FOI 200511
Document 1

DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT

To: Andrew McNee, Assistant Secretary, Assessments and Governance Branch (for decision)

Referral Decision Brief – Mahalo Development Area, 40 km north-east of Rolleston, Queensland (2019/8534)

Timing: As soon as possible – the statutory timeframe (7 November 2019) has passed

Recommended Decision	NCA ☒ NCA(pm) ☐ CA ☐
Person proposing the action	Australia Pacific LNG Pty Limited ABN: 68001646331
Controlling Provisions triggered or matters protected by particular manner	World Heritage (s12 & s15A) Yes ☐ No ☒ No if PM ☐ National Heritage (s15B & s15C) Yes ☐ No ☒ No if PM ☐ Ramsar wetland (s16 & s17B) Yes ☐ No ☒ No if PM ☐ Threatened Species & Communities (s18 & s18A) Yes ☐ No ☒ No if PM ☐ Migratory Species (s20 & s20A) Yes ☐ No ☒ No if PM ☐ C'wealth marine (s23 & 24A) Yes ☐ No ☒ No if PM ☐ Nuclear actions (s21 & 22A) Yes ☐ No ☒ No if PM ☐ C'wealth land (s26 & s27A) Yes ☐ No ☒ No if PM ☐ C'wealth actions (s28) Yes ☐ No ☒ No if PM ☐ GBRMP (s24B & s24C)* Yes ☐ No ☒ No if PM ☐ A water resource – large coal mines and CSG (s24D & s24E) Yes ☐ No ☒ No if PM ☐ C'wealth heritage o/s (s27B & 27C) Yes ☐ No ☒ No if PM ☐
Public Comments	Yes ☒ No ☐ Number: Four See Attachment E
Ministerial Comments	Yes ☒ No ☐ Who: See Attachment F

Recommendation/s:

1. Consider the information in this brief, the referral (Attachment A) and other attachments.

Considered / ~~Please discuss~~

2. Agree with the recommended decision.

Agreed / ~~Not agreed~~

3. Agree to the designated proponent.

Agreed / ~~Not agreed~~

4. If you agree to 2, indicate that you accept the reasoning in the departmental briefing package as the basis for your decision.

Accepted / Please discuss

5. Sign the notice at Attachment H (which will be published if you make the recommended decision).

Signed / Not signed

6. Sign the letters at Attachment I.

Signed / Not signed

Andrew McNee
Assistant Secretary
Assessments and Governance Branch

Date: 15 May 20

Comments:

KEY ISSUES:

- Australia Pacific LNG Pty Limited (APLNG) proposes to develop a coal seam gas field including 95 production wells and associated infrastructure and facilities. The project will have a maximum 500 ha disturbance footprint and a duration of 30 years.
- The Department considers that significant impacts on matters of national environmental significance are unlikely to arise as a result of the proposed action.

BACKGROUND:

Description of the referral

A valid referral was received on 9 October 2019 (Attachment A1-A26). The action was referred by APLNG, which has stated its belief that the proposal is not a controlled action for the purposes of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In response to discussions with the Department regarding the information provided in the referral, the potential impacts of the proposed action on protected matters and the proposed avoidance and mitigation measures, the proponent provided additional information to support the referral on 13 January 2020 (Attachment B1-B4) and on 8 April 2020 (Attachment B5-B6).

Description of the proposal (including location)

The proposed action is to develop a coal seam gas field subject to Petroleum Lease applications 1082 and 1083, located approximately 40 km north-east of Rolleston and 60 km east of Springsure in central Queensland.

The proposed action involves the construction, operation and rehabilitation of gas production wells and supporting infrastructure and facilities, including:

- 95 gas production wells;
- Gas and water pipelines;
- Gas compression facilities;
- Water management infrastructure;
- Access tracks;
- Power and communication lines; and
- Other facilities to support construction and operations.

The proposed action involves vertical and/or surface to in-seam gas wells, consisting of a vertical gas well intersecting a horizontal well section drilled within the coal seam. Hydraulic stimulation will not be required and is prohibited by the conditions of the proponent's Environmental Authority (EA) under the *Environmental Protection Act 1994* (Qld) (Attachment A23-A24). Each well site will be constructed in an operational area of 1.2 ha for the initial construction of the well. Following construction, well sites will be partially rehabilitated, leaving an area of 0.4 ha for operation, which will be fenced.

Below-ground pipelines will be constructed to transport gas and water from each production well. This will involve excavation of a trench, pipeline laying and backfilling. Power lines and communication lines will be co-located with pipelines, and an unsealed track will be maintained over the pipelines to provide access to production wells. Produced water will be transferred to water storage areas, including above-ground dams and/or tanks. Produced water will be used for irrigation, industrial, development and operational activities.

The project site is 46,900 ha. The project layout has not been finalised, however the proponent states that the disturbance footprint will be no more than 500 ha (Attachment B2) and that the *Mahalo Development Area Environmental Constraints Planning and Field Development Protocol* (hereafter Constraints Protocol) (Attachment B4) will be implemented to avoid and minimise impacts to protected matters. The duration of the proposed action is 30 years.

Description of the environment

Existing land use in the project area is predominantly cattle grazing, cropping and petroleum exploration activities. The referral states that approximately 93% of the proposed action area has been cleared, with some areas of remnant and regrowth woodland and open forest in association with watercourses and as isolated patches across the proposed action area. Broad terrestrial habitat types within the proposed action area include Brigalow community on alluvial plains, Brigalow community on non-alluvial surfaces, riparian woodland, open woodland to woodland on alluvial soils, grassland on non-alluvial soils and non-remnant cleared areas.

The proposed action area is located within the Comet River catchment in the Fitzroy Basin. Key watercourses within the vicinity of the proposed action include Comet River, Meteor Creek, Plant Creek, Humboldt Creek and Shotover Creek. These watercourses are largely ephemeral and typically only flow during and following significant rainfall events but may contain perennial waterholes isolated by dry river channels during dry periods.

The target gas-producing formation for the proposed action is the Bandanna Formation. Groundwater systems in the proposed action area include Cenozoic-age deposits comprising

alluvium associated with the Comet River, basalt and Cenozoic sediments, Triassic Rewan Group and Permian coal measures.

RECOMMENDED DECISION:

Under section 75 of the EPBC Act you must decide whether the action that is the subject of the proposal referred is a controlled action, and which provisions of Part 3 (if any) are controlling provisions for the action. In making your decision you must consider all adverse impacts the action has, will have, or is likely to have, on the matter protected by each provision of Part 3. You must not consider any beneficial impacts the action has, will have or is likely to have on the matter protected by each provision of Part 3.

The Department recommends that you decide that the proposal is not a controlled action, because there are not likely to be significant impacts on any controlling provisions. The reasons for this recommendation are detailed further below.

PROTECTED MATTERS THAT ARE NOT CONTROLLING PROVISIONS:

Listed threatened species and communities (s18 & 18A)

The Department's Environment Reporting Tool (ERT) identifies 24 threatened species and five threatened ecological communities (TECs) may occur within five km of the proposed action (Attachment C). Based on the location of the action, likely habitat in the area of the proposed action and nature and scale of the action, the Department considers that impacts may arise in relation to 15 threatened species and five TECs (Attachment D).

The Department considers that potential impacts associated with the proposed action may include altered surface hydrology, erosion and sedimentation, clearing and fragmentation, edge effects, introduction of weeds, and smothering by dust. The proponent states that the maximum footprint of the proposed action will be 500 ha (Attachment B2).

The proposed action may also result in potential impacts from groundwater drawdown. These impacts are discussed in relation to the water resource controlling provision below and in Attachment D.

The proponent has committed to implementing a Constraints Protocol (Attachment B4) to minimise impacts on listed threatened species and TECs. The Constraints Protocol provides a framework that requires the project footprint avoid threatened species habitat and TECs. This will be achieved by locating the wells in cleared areas and using existing infrastructure, undertaking pre-clearance surveys and establishing a buffer around all avoidance areas. The referral indicates that these commitments are feasible through the use of horizontal drilling technology in the construction of gas wells and direction drilling of pipelines under TECs.

In addition, the proponent has also committed to implementing a Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20), which detail mitigation measures to manage other potential impacts.

Based on information available to the Department, such as SPRAT and information from the referral documentation and additional supporting documentation, given the avoidance, minimisation and mitigation measures, and having considered the Department's Significant Impact Guidelines 1.1, the Department considers that significant impacts are not likely to arise in relation to listed threatened species and communities.

The Department considers sections 18 and 18A are not controlling provisions for the proposed action. See Attachment D for details.

Listed migratory species (s20 & 20A)

The Department's ERT identifies 11 migratory species may occur within five kilometres of the proposed action (see the ERT report dated 29 April 2020 at Attachment C).

An ecological assessment undertaken by the proponent (Attachment A4-A6) identified suitable habitat for the eight migratory species within the proposed action area.

The referral states that only one migratory species, Latham's Snipe, was recorded during the proponent's field surveys (Attachment A4). However, the proponent's field survey records (Attachment A5) indicate that the Fork-tailed Swift, White-throated Needletail and Satin Flycatcher were also observed within the proposed action area.

The proponent states that the maximum footprint of the proposed action will be 500 ha (Attachment B2). The referral notes that areas to be cleared are largely agricultural land that has been previously cleared for grazing. Furthermore, where possible wells will be located in cleared areas and existing infrastructure such as tracks will be utilised.

The Department considers that there is no evidence to indicate that the proposed action area is an area of important habitat for any of these species, or that the proposed action area contains an ecologically significant proportion of the population of any of these species.

In addition, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

Based on information available to the Department, such as SPRAT and information from the referral documentation and additional supporting documentation, given the avoidance, minimisation and mitigation measures, and having considered the Department's Significant Impact Guidelines 1.1, the Department considers that significant impacts are not likely to arise in relation to listed migratory species.

The Department considers sections 20 and 20A are not controlling provisions for the proposed action. See Attachment D for details.

A water resource, in relation to a large coal mining development or coal seam gas development (s24D & 24E)

The referral indicates the proposed action is unlikely to impact on water quality of surface water or groundwater and will not significantly impact on surface water regimes. The referral states that modelling predicted a groundwater level decline in several groundwater units as a result of gas production for the proposed action. This includes groundwater units in the area underlying potential ground water dependent ecosystems (GDEs).

On 28 October 2019 the Department's Office of Water Science (OWS) provided advice on the referral (Attachment E1), noting that OWS agrees with the proponent that there are unlikely to be impacts on spring complexes or known subterranean fauna, and that there are unlikely to be impacts from subsidence, drilling fluids and muds, construction activities, or interaction with drawdown between the proposed action and the nearby Rolleston and Blackwater mines.

The OWS advice (Attachment E1) raised concerns regarding limitations of the groundwater monitoring data and groundwater drawdown modelling provided by the proponent. The Department discussed these concerns with the proponent, noting that these issues reduce the certainty with which potential impacts on water resources could be determined.

On 13 January 2020 the proponent provided additional information to clarify the concerns raised by the Department and provided a technical memorandum to further support their conclusions

that the proposed action will not have a significant impact on water resources (Attachment B1-B4). OWS reviewed this additional information and provided advice on 17 January 2020 (Attachment E2) that indicated some concerns raised had not been adequately addressed. The Department communicated this to the proponent via email and teleconference discussions, highlighting that information relevant to possible impacts on GDEs was of particular concern.

On 8 April 2020 the proponent provided a supplementary report providing additional information and analysis around the potential impacts of the proposed action on GDEs as a result of drawdown (Attachment B5-B6). The report concludes that the proposed action will not have impacts on GDEs as the vegetation in the two areas where drawdown is predicted (Northern Drawdown Area and Shotover Creek) is unlikely to be groundwater dependent. OWS reviewed this report and provided advice on 28 April 2020 (Attachment E3), supporting the conclusion that the Northern Drawdown Area is unlikely to be groundwater dependent, but noting that the information provided is not sufficient to conclude that the vegetation around Shotover Creek is not groundwater dependent.

The Department supports the OWS' conclusions. However, noting that the area of riparian vegetation is of limited size and is likely to be in poor condition due to the prevalence of invasive species and impacts from cattle, and it is unlikely that groundwater is the main source of water for much of the riparian vegetation, and the magnitude of the drawdown is relatively small, the Department considers it is unlikely that groundwater drawdown resulting from the proposed action will result in reduced condition or loss of GDEs.

The Department notes that the proposed action is within the Surat Cumulative Management Area, and therefore the proponent will be required to prepare a groundwater monitoring program specific to the proposed action, which will be incorporated into future revisions of the Queensland Government's Underground Water Impact Report.

The Department notes that the proponent also has relevant obligations and conditions in relation to monitoring and managing environmental impacts under other legislation, including the *Environmental Protection Act 1994* (Qld), *Water Act 2000* (Qld), *Waste Reduction and Recycling Act 2014* (Qld), and relevant Australian Standards and regulatory requirements.

Based on information available to the Department, including the information from the referral documentation, additional supporting information and advice from the OWS, and considering the Department's Significant Impact Guidelines 1.3, the Department considers that significant impacts are not likely to arise in relation to a water resource in relation to a coal seam gas development.

The Department considers sections 24D and 24E are not controlling provisions for the proposed action. See Attachment D for details.

OTHER PROTECTED MATTERS THAT ARE NOT CONTROLLING PROVISIONS:

Ramsar Wetlands (s16 & 17B)	The ERT did not identify any Ramsar listed wetland of international importance within or adjacent to the proposed action area. Further, given the information contained in the referral documentation, the nature and scale of the proposed action and its potential impacts, and the distance to Ramsar listed wetlands of international importance, the proposed action is unlikely to have a significant impact on Ramsar listed wetlands of international importance. For these reasons the Department considers that sections 16 and 17B are not controlling provisions for the proposed action.

World Heritage properties (s12 & 15A)	The ERT did not identify any World Heritage properties located within or adjacent to the proposed action area. Further, given the information contained in the referral documentation, the nature and scale of the proposed action and its potential impacts, and the distance to World Heritage properties, the proposed action is unlikely to have a significant impact on World Heritage properties. For these reasons the Department considers that sections 12 and 15A are not controlling provisions for the proposed action.
National Heritage places (s15B & 15C)	The ERT did not identify any National Heritage places located within or adjacent to the proposed action area. Further, given the information contained in the referral documentation, the nature and scale of the proposed action and its potential impacts, and the distance to National Heritage places, the proposed action is unlikely to have a significant impact on National Heritage places. For these reasons the Department considers that sections 15B and 15C are not controlling provisions for the proposed action.
Commonwealth marine environment (s23 & 24A)	The proposed action does not occur in a Commonwealth marine area. Further, given the information contained in the referral documentation, the nature and scale of the proposed action and its potential impacts, and the distance to a Commonwealth marine area, the proposed action is unlikely to have a significant impact on the environment in a Commonwealth marine area. For these reasons the Department considers that sections 23 and 24A are not controlling provisions for the proposed action.
Commonwealth action (s28)	The referring party is not a Commonwealth agency. For this reason, the Department considers that section 28 is not a controlling provision for the proposed action.
Commonwealth land (s26 & 27A)	The proposed action is not being undertaken on Commonwealth land. Further, given the information contained in the referral documentation, the nature and scale of the proposed action and its potential impacts, and the distance to Commonwealth land, the proposed action is unlikely to have a significant impact on the environment on Commonwealth land. For these reasons the Department considers that sections 26 and 27A are not controlling provisions for the proposed action.
Nuclear action (s21 & 22A)	The proposed action does not meet the definition of a nuclear action as defined in the EPBC Act. For this reason, the Department considers that sections 21 and 22A are not controlling provisions for the proposed action.
Great Barrier Reef Marine Park (s24B & 24C)	The proposed action is not being undertaken in the Great Barrier Reef Marine Park. Further, given the information contained in the referral documentation, the nature and scale of the proposed action and its potential impacts, and the distance to the Great Barrier Reef Marine Park, the proposed action is unlikely to have a significant impact on the Great Barrier Reef Marine Park. For these reasons the Department considers that sections 24B and 24C are not controlling provisions for the proposed action.

Commonwealth Heritage places overseas (s27B & 27C)	The proposed action is not located overseas. For this reason, the Department considers that sections 27B and 27C are not controlling provisions for the proposed action.

SUBMISSIONS:

Public submissions

The proposal was published on the Department's website on 10 October 2019 and public comments were invited until 24 October 2019. Four public submissions were received on the referral (Attachment F1-F7). The submissions all raised concerns about the environmental impacts of the proposed action, including the following:

- The referral document did not provide sufficient information regarding fauna surveys or maps and plans of critical infrastructure for the project;
- Surveys were not undertaken in accordance with the Department's survey guidelines;
- The extent of Koala habitat has been underestimated by the proponent;
- The project will have significant impacts on listed threatened species and ecological communities;
- Potential impacts in relation to dust and erosion have not been adequately addressed;
- The proposed mitigation measures are inadequate;
- The modelling and assessment of impacts in relation to water resources are inadequate;
- The proposed action should be a controlled action and should be assessed by environmental impact statement;
- The project should be assessed in relation to its greenhouse gas emissions and their impacts through climate change on threatened species (including the Mountain Pygmy Possum (*Burramys parvus*), Northern Corroboree Frog (*Pseudophryne pengilleyi*) and Southern Corroboree Frog (*Pseudophryne corroboree*)) and the Great Barrier Reef; and
- The project should be assessed in relation to impacts of land clearing on local and regional rainfall and other weather patterns.

The Department's opinion regarding the issues raised in submissions is outlined below:

The information provided in the referral documentation (including the surveys, habitat assessment and avoidance and mitigation measures) and the potential impacts on listed threatened species and ecological communities and water resources have been considered by the Department in preparing this brief, and are discussed in relation to each controlling provision above.

Based on information available to the Department, nature of the project to locate wells and infrastructure to avoid impacts on MNES, and having considered the Department's Significant Impact Guidelines 1.1 and 1.3, the Department considers that significant impacts are not likely to arise in relation to listed threatened species, listed migratory species and water resources.

The EPBC Act does not regulate greenhouse gas emissions as a matter of national environmental significance. However, greenhouse gas emissions from the taking of an action may be considered where those emissions are likely to result in a 'significant impact' on a

protected matter (whether on their own, or in combination with other adverse environmental effects) having regard to the Department's Significant Impact Guidelines 1.1 (2013).

In the Department's view, it is not possible to establish that the greenhouse gas emissions associated with the proposed action will be a substantial cause of any adverse climate change related effects on relevant matters of national environmental significance, such as listed threatened species or communities, listed migratory species, water resources, the environment (in the Commonwealth marine area or on Commonwealth land), the environment in the Great Barrier Reef Marine Park, the world heritage values of World Heritage properties, the national heritage values of National Heritage places, or the ecological character of Ramsar wetlands.

However, the Department notes the proponent will need meet obligations under the National Greenhouse and Energy Reporting Act 2007 (Cwth) (NGER Act), including calculating and reporting greenhouse gas emissions from the operation of facilities for the proposed action as part of its wider activities. The Department notes that the proponent has previously reported annual Scope 1 and Scope 2 greenhouse gas emissions for its activities to the Australian Clean Energy Regulator in accordance with the NGER Act.

The Department also notes the concerns raised regarding changes to local and regional weather patterns, but considers it is not possible to sufficiently demonstrate a relationship between land clearing and weather patterns and a real chance or possibility of an identifiable significant impact on matters of national environmental significance.

Comments from Commonwealth Ministers

By letter dated 10 October 2019, the following ministers were invited to comment on the referral:

- Senator the Hon Bridget McKenzie, the former Minister for Agriculture;
- The Hon Angus Taylor MP, Minister for Energy and Emissions;
- The Hon Ken Wyatt AM MP, Minister for Indigenous Australians; and
- Senator the Hon Matt Canavan, the former Minister for Resources and Northern Australia.

No comments were received from the Minister for Energy and Emissions or the Minister for Indigenous Australians.

The delegate for the Minister for Agriculture responded on 28 October 2019 (Attachment G1) and noted that the Department of Agriculture had no comments from a portfolio perspective on whether the proposed action may have significant impacts on any matters of national environmental significance protected under the EPBC Act.

A representative from the Department of Industry, Innovation and Science responded on 25 October 2019 (Attachment G2) and noted that Department is supportive of the project. The representative also provided advice from Geoscience Australia (GA) (Attachment G3), which is summarised below.

Advice from Geoscience Australia

GA's advice (Attachment G3) states that the proponent has provided extensive information in support of their assessment but relies on the regional scale Surat Cumulative Management Area groundwater model developed by the Queensland Office of Groundwater Impact Assessment (OGIA) for predictions of area and scale of impact. GA states that local scale analysis and modelling is required to determine the significance of impacts from the proposed action on water resources.

GA states that the assessment does not adequately consider the potential impacts to the basalt groundwater resources to the west of the project area. GA also notes that, as the project is part of a larger staged development, it may be appropriate to consider the impacts from full scale development as part of a single process to ensure the cumulative impacts of the whole project are assessed.

The information provided in the referral documentation and the potential impacts on water resources have been considered by the Department in preparing this brief and are discussed in relation to water resources above. The Department notes that the concerns raised by GA were also raised by the OWS (Attachment E1). On 13 January 2020 the proponent provided additional information to clarify the concerns raised by the Department regarding the groundwater drawdown modelling and provided a technical memorandum to further support their conclusions that the proposed action will not have a significant impact on water resources (Attachment B1-B4).

The Department notes that the regional scale modelling is supported by local conceptual models and the uncertainty analysis undertaken by the proponent, which provide further confidence that local scale differences in hydraulic parameters have been considered when assessing groundwater impacts. The Department considers that the only likely impacts in relation to water resources could arise from groundwater drawdown in the shallow groundwater units under potential GDEs around Shotover Creek. Based on the additional information from the proponent and advice from the OWS, the Department considers significant impacts are unlikely to arise in relation to GDEs around Shotover Creek. See Attachment D for details.

Based on information available to the Department, including the information from the referral documentation, additional supporting information and advice from the OWS, and considering the Department's Significant Impact Guidelines 1.3, the Department considers that significant impacts are not likely to arise in relation to a water resource in relation to a coal seam gas development.

Noting GA's comment that the project is part of a larger staged development, the referral indicates that, while future related actions would utilise infrastructure of the referred action, there is currently no plan or vision for the larger action and the related action would not be undertaken for many years or even decades.

Comments from State/Territory Ministers

By letter dated 10 October 2019, s22 the delegated contact for the Queensland Minister for Environment and the Great Barrier Reef, Minister for Science and Minister for the Arts, the Hon Leeanne Enoch MP, was invited to comment on the referral.

A representative from the Queensland Government Department of Environment and Science (DES) responded on behalf of s22 on 23 October 2019 (Attachment G4) and noted that DES had not yet received a new EA application or an application to amend the existing EA for the project and the Department would be advised after an application was received and a decision made about the assessment approach. The representative also noted that based on the listed proposed activities it is not expected a disturbance area of 2,000 hectares will be reached, and so the proposed activities are unlikely to trigger the need for an Environmental Impact Statement in accordance with the guideline *Triggers for Environmental Impact Statements under the* Environmental Protection Act 1994 *for mining, petroleum and gas activities*.

s22 responded on 28 October 2019 on behalf of s22 (Attachment G5) and advised that the proposal will not be assessed using the environmental impact statement

process in Chapter 3 of the *Environmental Protection Act 1994*. s22 also noted that the Queensland Government Department of State Development, Manufacturing, Infrastructure and Planning has advised that the proposal is not currently being assessed as a coordinated project under Part 4 of the *State Development and Public Works Organisation Act 1971* and is not likely to be assessed under this process in the future.

OTHER MATTERS FOR DECISION-MAKING:

Significant impact guidelines

The Department has reviewed the information in the referral against the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (December 2013) and other relevant material. While this material is not binding or exhaustive, the factors identified are considered adequate for decision-making in the circumstances of this referral. Adequate information is available for decision-making for this proposal.

Precautionary principle

In making your decision under section 75, you are required to take account of the precautionary principle (section 391). The precautionary principle is that a lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.

Bioregional Plans

In accordance with section 176(5), you are required to have regard to a bioregional plan in making any decision under the Act to which the plan is relevant. There is no bioregional plan that is relevant to your decision.

Management Plans for Commonwealth Reserves

In accordance with section 362(2), the Commonwealth or a Commonwealth agency must not perform its functions or exercise its powers in relation to a Commonwealth reserve inconsistently with a management plan that is in operation for the reserve. There is no Commonwealth reserve management plan that is relevant to your decision.

s22
Director
Queensland Assessments North
Assessments & Governance Branch
Ph: 02 6274 s22

May 2020

s22
Queensland Assessments North
Ph: 02 6274 s22

ATTACHMENTS

A: Referral documentation

B: Additional information from the proponent

C: ERT Report dated 29 April 2020

D: Department's impact assessment

E: Advice from the Office of Water Science

F: Public comments

G: Minister comments

H: Decision notice FOR SIGNATURE

I: Letters to the proponent & Ministers FOR SIGNATURE

FOI 200511
Document 2

From: s47F @origin.com.au>
Sent: Monday, 13 January 2020 4:31 PM
To: Andrew McNee
Cc: s22 ; s22 ; s22 ; s22 @environmentgov.au; s47F s47F
Subject: RE: Mahalo Referral - follow-up quesons [SE C=OFFICIAL]
A achments: Origin Response to DoEE Referral Comments.pdf; A. achment 1 - Technical Memorandum.pdf; Attachment 2- Revised Environmental Constraints Planning and Field Development Protocol.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Andrew,

Happy new year!

Please find our response to the Department's follow-up quesons and those r aised during our 11 November teleconference. This has taken some me t o prepare as we sought addional da ta from other operators in the area and commissioned addional t echnical work to further support the findings of the assessment conducted for the referral. See attached for a consolidated response to these queries.

We understand that the informaon r equested below represents the extent of the Department's follow-up quesons; the attached should provide the Department with sufficient informaon t o proceed with making a decision on the referral. As previously discussed, we would prefer to collaborate on any addional manag ement measures for decisions made under Secon 77A of the EPBC Act.

As you may be aware, we made an FOI Act applicaon f or access to the standard decision making documents for the Atlas NCA decision (EPBC 2018/8329). We made this applicaon due t o the many similaries of the acons described in the Atlas and Mahalo referrals. The attached response references some of the informaon r elied upon for deciding the Atlas referral.

Please feel free to contact me if you require any further informaon.

Kind regards,

s47F

s47F

Exploraon & Ne w Ventures

Origin
m s47F

originenergy.com.au

From: Andrew McNee <Andrew.McNee@environment.gov.au>
Sent: Monday, November 4, 2019 7:57:26 AM
To: s47F @origin.com.au>
Cc: s22 @environment.gov.au>; s22 @environment.gov.au>; s22 s22 @environment.gov.au>; s22 @environment.gov.au>
Subject: Mahalo Referral - follow-up quesons [SE C=OFFICIAL]

Hi s47F

Thanks for your me on Thur sday and apologies for the delay in geng this email out t o you. As flagged, we are interested in further discussing several key areas relevant to our consideraon of the Mahalo r eferral.

At this stage, we are keen to ensure that there is adequate informaon t o resolve any uncertaines ar ound the nature and extent of potenal impacts on w ater resources and listed threatened species and communies.

In relaon t o water resources the areas we want to discuss are:

- informaon t o support the conclusion that there is no connecvity be tween the Bandanna Formaon and the overlying geological units, including:
    - clarificaon of diff erences between the conceptual models presented.
    - the role of the Inderi Fault and its influence on groundwater flow.
    - the effecv eness of the Rewan Formaon as an aquit ard, parcularly in ar eas where it is thin or not present.
    - monitoring of groundwater in the alluvium, basalt and Cenozoic sediments.
- Informaon and assessmen t of the nature and extent (if any) of groundwater dependent ecosystems (GDEs) in the project area.

In relaon t o listed threatened species and communies w e want to discuss:

- suitable avoidance buffers for the environmental constraints protocol to protect 'high constraint' areas.
- descripons of Squa tter Pigeon (southern) breeding and non-breeding habitat.
- the disturbance footprint of the project, both total and following rehabilitaon, t o inform our consideraon of potenal impacts on 'medium constraint' areas.

At this stage it looks like Friday this week would be the best me f or us due to the availability of the Office of Water Science. Let me know what may suit and we will lock something in.

Thanks, Andrew

Andrew McNee

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The Department acknowledges the tradional o wners of country throughout Australia and their connuing connecon t o land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

Agenda – Mahalo Development Area – Teleconference – 11 November 2019

Issue	Desired Outcome	Response
Water Resources		
The referral does not adequately demonstrate whether or not potential changes to hydrology will impact on third-party water users including groundwater dependent ecosystems (GDEs). This is needed for the Department's consideration of potential impacts on water resources.	Origin to provide additional information to adequately characterise hydrogeological conditions within the project area and immediate surrounds, how this will impact GDEs and any other third-party water users, and whether the impacts will be significant. This will include: – Further consideration of the fault and its influence on groundwater flow, including clarification of differences between conceptual models presented in the quantitative study and the water assessment report. This needs to include a resolution regarding the limitations with the OGIA geological modelling relating to the fault in the project area.	Section 8.5. of Appendix B describes how the model could potentially under-predict the propagation of drawdown within the Bandanna Formation within a localised area immediately east of the of Inderi Fault. However, this area is underlain by approximately 300m of the Rewan Formation aquitard. The model results shows that propagation of drawdown impacts to shallow aquifers only occurs in the absence of the Rewan Formation. Attachment 1 to this document provides additional evidence of how the hydrogeological conditions of the Mahalo Development Area are accurately represented in the UWIR model for the Surat CMA, including additional data showing the extent of the Rewan Formation and additional analysis of the hydrogeological characteristics of the Inderi fault. Regardless, the UWIR model for the Surat CMA will be revised to represent a greater thickness of the Bandanna Formation in this area. A UWIR is required to be in place under the *Water Act 2000* for production activities in the Mahalo Development Area. Appendix C provides a conceptual hydrogeological model to inform a transport model used in the Chemical Risk Assessment. Although used for very different purposes, the conceptual models are generally consistent. Tables 4-5 and 4-6 of Appendix C provide site-specific hydraulic parameters used in the chemical transport model. Appendix B describes the sensitivity analysis for the UWIR model.
	– Baseline groundwater monitoring in all geological units in the project area. This must include bores along Humboldt and Comet River to confirm the nature and extent of alluvium, and associated	Section 7.6 of Appendix B presents an analysis of groundwater level data from many bores within and surrounding the Mahalo Development Area including those accessing water from the following formations: • Alluvium (8 within project area) • Cenozoic sediments • Basalt

Issue	Desired Outcome	Response
	groundwater levels and quality.	• Rewan Formation • Bandanna Formation Section 7.8. Appendix B provides an ecohydrological model of the Comet River alluvium system based on site-specific groundwater monitoring data.
	– Demonstration of how each of the above will impact on water resources and hence water users including GDEs. This might include conducting site surveys to confirm the nature and extent of any GDEs within and nearby the project area.	For the purposes of the assessment, the low confidence potential GDEs are conservatively assumed to represent GDEs despite the groundwater data indicating depth to groundwater is greater the 30 metres below ground. Using the 2019 UWIR methodology for assessing potential impacts to terrestrial GDEs, the impacts are categorised as 'low risk' (greater than 0.2m but less than 1m). Coupled with the >30m depth to groundwater, it is considered that there is very limited potential for the low confidence potential GDEs to experience drawdown related impacts. The sensitivity analysis provides another layer of conservatism for the model by modifying relevant hydraulic parameters outside their known range. The groundwater model is further conservative in how it models the extraction of produced water from the Bandanna Formation with complete dewatering of the coal seam within the entirety of the Mahalo Development Area.
Listed threatened species and ecological communities and listed migratory species		
The environmental constraints protocol does not specify an avoidance buffer around 'high constraint' habitat/individuals. The Department considers this to be an important part of the proposed avoidance measures. Without appropriate buffers in the constraints protocol, the	Origin to provide an updated constraints protocol that includes appropriate 'no go' buffers that will be implemented. This could be a single buffer width for all 'high constraint' TECs, habitat and individuals, or different buffer widths appropriate to each.	Section 4.2 of the Environmental Constraints Planning and Field Development Protocol has been revised to include a 5m buffer around high constraint areas as follows: *A 5 metre 'buffer' will be established around all avoidance areas to exclude significant disturbance to land adjacent to high constraint areas.* The size of this buffer was derived in consideration of EA conditions that limit impacts from dust, noise, vibration and to address the

Issue	Desired Outcome	Response
Department has no certainty that the proposed avoidance of all high constraints will adequately mitigate impacts on these MNES. For example, there is no commitment that clearing or construction will not occur directly adjacent to an individual plant or fauna habitat, hence leading to impacts from dust, noise, vibration etc.		potential impacts described by the Department including localised transport of soil during construction activities adjacent to high constraint areas. The revised Environmental Constraints Planning and Field Development Protocol is provided in addition to the Significant Species Management Plan and includes species specific mitigation measures to manage off-site / indirect impacts. These mitigation measures are provided to directly address threats listed in the SPRAT listing for each species. The Environmental Management Plan also provides management measures for nuisance type emissions during construction including dust and noise. The action would not include significant vibration emissions as blasting activities are not proposed.
The referral does not include a disturbance footprint. This is a key requirement of all referrals as it is needed for the Department to consider potential impacts on MNES. In this case the Department needs information on the disturbance footprint for two reasons: – It will be a key factor in our consideration of potential impacts on MNES that fall into the 'medium constraints' category. This is because the amount of habitat disturbed is a key determinant of whether impacts will be significant. – All public submissions on the referral raised concerns regarding the extent of clearing, because the referral implies 46,900 ha will be disturbed. The	Origin to provide the disturbance area in hectares, including both total disturbance area and residual disturbance area after rehabilitation. These may be approximate figures, but should be the maximum potential disturbance area.	Of the 46,900 ha referral area, the project will occupy a footprint of up to approximately 500 ha inclusive of existing infrastructure and previously disturbed areas. As described in Appendix A, 93% of the referral area (43,620 ha) has been subject to extensive land disturbance as a result of historical broad-scale vegetation clearing and ongoing agricultural operations. The project's 500 ha footprint represents approximately 1% of the referral area and would be undertaken exclusively within existing disturbed areas. The residual footprint area after rehabilitation is estimated at <1ha due to the final rehabilitation acceptance criteria prescribed by Environmental Authority EPPG00872113. The proposed action can be undertaken without significantly impacting threatened fauna species habitat given the habitat avoidance commitments, significant existing disturbance, rehabilitation of disturbed areas, and implementation of the Significant Species Management Plan.
		The 'medium constraint' category represents disturbed areas and areas that represent low probability occurrence for MNES species, primarily Squatter pigeon, Tufted grass, Bluegrass and

<table>
<tr><th>Issue</th><th>Desired Outcome</th><th>Response</th></tr>
<tr><td>Department has a legal obligation to address these concerns, and to do so we need to know the area of disturbance.</td><td></td><td>
King Bluegrass. The medium constraints category does not contain any habitat critical to the survival of MNES species.

Temporary impacts to medium constraint habitat areas for the four species is possible but unlikely, prior to rehabilitation of disturbed areas. None of the four species have been recorded within the project area. Based on SPRAT profile descriptions (vegetation types, land zones, soils and water requirements) the maximum medium constraint disturbance area has been estimated based on the suitable habitat within the project area and the % likely intercept with the approximate 500 ha disturbance area. These calculations are shown in the table below.

<table>
<tr><th>Species</th><th>Hectares within referral area</th><th>% of project area</th><th>Potential max habitat disturbance (ha)</th></tr>
<tr><td>Squatter Pigeon (non breeding)</td><td>1672.1</td><td>3.57%</td><td>18</td></tr>
<tr><td>Tufted Grass</td><td>863.7</td><td>1.84%</td><td>9</td></tr>
<tr><td>Bluegrass</td><td>187.6</td><td>0.40%</td><td><5</td></tr>
<tr><td>King Bluegrass</td><td>236.7</td><td>0.50%</td><td><5</td></tr>
</table>
However, as presented in the referral and SPRAT profiles, the above species utilise disturbed areas as habitat, including disturbance / infrastructure types associated with the Project.

While all four species may well disperse or occur in cleared lightly grazed paddocks or roadsides, such areas do not directly conform to the SPRAT profiles and presence is considered unlikely. Any presence would be sporadic and potentially periodic dependent on existing land use. None of these areas would constitute habitat critical to the survival of the species.
</td></tr>
</table>

Issue	Desired Outcome	Response
Definition of breeding and non-breeding Squatter pigeon habitat - Squatter pigeon habitat is defined, however the definition is not separated into breeding and non-breeding habitat. Given the constraints on disturbance to habitat for this species are separated into breeding and non-breeding habitat, these two habitats need to be defined. - Without defining these two habitat types in writing in an appropriate document, the Department does not have any certainty that the constraints protocol will be implemented as described and hence that there will be no impacts to Squatter Pigeon breeding habitat.	Origin to provide an updated version of the documentation that includes habitat definitions for each Squatter Pigeon habitat type. The significant species management plan would be the most appropriate place for this.	Table 3-1 of the Environmental Constraints Planning and Field Development Protocol has been revised to include the following squatter pigeon habitat descriptions consistent with SPRAT: **General (non-breeding) habitat** of the squatter pigeon (southern) includes open forest to sparse open woodlands and scrubs that contain the following features (DoEE SPRAT, 2019): • an overstorey dominated by Eucalyptus, Corymbia, Acacia or Callitris species • ground covering vegetation patchy consisting of native, perennial tussock grasses or a mix of perennial tussock grasses and low shrubs or forbs; cover rarely exceeds 33%. • remnant, regrowth or relatively modified vegetation communities • a water source within 3 km. **Breeding habitat –** As for general (non-breeding habitat): • patchy, tussock-grassy understories of open-forest to woodland • Nests in shallow depressions in the ground and requires well draining soils (predominantly land zones 3, 5 and 7 in Qld) • within 1 km of a suitable, permanent waterbody. Effectively the defining feature for breeding and non-breeding is distance to water provided other features are present. This revised Environmental Constraints Planning and Field Development Protocol is provided at Attachment 2 to this document.

Additional Comments raised during teleconference

<table>
<tr><th>Issue</th><th>Response</th></tr>
<tr><td colspan="2">Water Resources</td></tr>
<tr><td>s22 suggested issues with using the regional scale UWIR groundwater model (cell size of 1.5km) to predict shallow groundwater drawdown and impacts on riparian vegetation</td><td>The UWIR groundwater model has been used to for these purposes for other similar referrals, including the EPBC referral 2018/8329 for Senex's Atlas Project. The Office of Water Science (OWS) provided the following relevant advice for the Atlas referral:

OGIA produced a regional groundwater flow model (Appendix 4 Pg. 120) to identify the likely cumulative impact of all projects in the Surat sub-basin with and without the Atlas project. OWS notes the limit of resolution for this model is 1.5 km by 1.5 km and that there is no reason to consider this inadequate (Appendix 4 Table 9.1 Pg. 115).

The 2016 UWIR groundwater model used for the Atlas referral did not include the uncertainty analysis described below.

Additional information and further discussion regarding the project specific characteristics of the Rewan Formation and the fault to the west of the project area is provided in the accompanying technical memorandum titled Response to DoEE's Queries on Appendix B.

Origin Energy notes the IESC explanatory note (http://www.iesc.environment.gov.au/system/files/resources/31feb114-2d09-4a98-8b3f-ad629dbe4b97/files/environmental-assessments-fact-sheet.pdf) confirming the use of the UWIR groundwater model for the purposes of the EPBC Act. Specifically, the IESC explanatory note provides the following information requirements to confirm the suitability of the UWIR for local scale predictions including potential drawdown impacts to riparian vegetation:

<table>
<tr><th>IESC Requirement</th><th>Referral Reference</th></tr>
<tr><td>additional data or information that is available in and around the project area pertaining to conceptualisation of groundwater system, current impacts from CSG and non-CSG development, GDEs</td><td>See accompanying technical memorandum for additional information regarding conceptualisation of the hydrogeological system at the Project area. This additional information further supports the interpreted impacts from the proposed development, as previously identified in the Mahalo Development Area Water Assessment</td></tr>
</table>
</td></tr>
</table>

Issue	Response	
	and surface-groundwater interaction	Report (Appendix B of the Mahalo Development Area *EPBC Act* Referral).
	an updated local scale conceptualisation and how this may differ from the conceptualisation used by OGIA in their assessments *how the updated conceptualisation might affect OGIA's modelling output in the project area*	See accompanying technical memorandum for additional information regarding the local conceptualisation of the hydrogeological system within the vicinity of the Project area. Based on the additional information regarding the local conceptualisation, and a comparison of this information with OGIA's numerical groundwater model, it is interpreted that the local hydrogeological system (system extent and thickness; and, the aquifer parameters) has been adequately captured in the numerical model.
	how specific impacts such as changes to surface water – groundwater interactions or riparian vegetation are assessed	Surface water – groundwater interactions are not predicted to be impacted by the proposed development as previously identified in the Mahalo Development Area Water Assessment Report (Appendix B of the Mahalo Development Area *EPBC Act* Referral).
	The primary purpose of OGIA's model is to predict impacts from CSG development which is typically in deeper parts of the system. The model is not therefore designed to explicitly simulate surface water – groundwater interaction in the surficial layers. Therefore, use of model outputs for that purpose must be supported by appropriate conceptualisation	The accompanying technical memorandum provides additional information regarding local conceptualisation of the hydrogeological system, including the conceptualisation of interaction between the surface water system and the groundwater system; and, hydraulic connection between the shallow aquifers and the underlying deeper systems. This local conceptualisation supports the predicted impact assessment from the OGIA numerical model.
	The IESC encourages the need to do an appropriate level of uncertainty analysis as part of the proponent's groundwater modelling to provide a range of likely impacts rather than just a simple deterministic	Uncertainty analysis results from the 2019 UWIR numerical model have been provided in the Mahalo Development Area Water Assessment Report (Appendix B of the Mahalo Development Area *EPBC Act* Referral).

Issue	Response
	result. The current OGIA groundwater model (2016) has not included an uncertainty analysis which was done for the 2012 version. OGIA is planning to undertake uncertainty analysis for the 2019 UWIR
s22 queried the geographic distribution of bore impacts	Four third-party groundwater bores are predicted to experience drawdown greater than 5 m as a result of the Project development (Figure 9.1, Appendix B of the Mahalo Development Area *EPBC Act* Referral). These bores source water from the Bandanna Formation (or other formations including the Bandanna Formation) and therefore have a source aquifer attribution as the Bandanna Formation, the formation with the greatest potential for drawdown to occur (i.e. producing formation). Other bores surrounding and adjacent to the triggered bores are predicted to not be triggered as a result of the proposed development due to these bores not sourcing water from the Bandanna Formation (i.e. have an aquifer attribution that is not the Bandanna Formation). Figure 7.32 from the Mahalo Development Area Water Assessment Report presents the aquifer attribution for all bores within a 50 km buffer of the Project area.
s22 queried the width of the Inderi fault	Additional information and further discussion regarding the project specific characteristics of the Rewan Formation and the Inderi Fault is provided in the accompanying technical memorandum (Attachment 1) titled Response to DoEE's Queries on Appendix B. Characterisation of the Inderi Fault has been undertaken based on seismic surveys across the alignment of the fault. Seismic survey results identifying the presence of the fault is presented in Figure 7.7 of the Mahalo Development Area Water Assessment Report. The seismic results indicate that the fault is steeply dipping (80^{o} from horizontal) and has resulted in an offset of approximately 500 m between the hanging wall and the footwall, causing a separation of the hydrostratigraphic units. Based on the discontinuity of the seismic results along the Inderi Fault plane, the width of the fault is interpreted to be approximately 200 m.

ATTACHMENT 1: TECHNICAL MEMO FOR THE WATER ASSESSMENT REPORT (KCB, 2020)

ATTACHMENT 2: REVISED ENVIRONMENTAL CONSTRAINTS PLANNING AND FIELD DEVELOPMENT PROTOCOL

TECHNICAL MEMORANDUM

TO: APLNG **DATE:** January 2020

FROM: KCB **FILE NO:** D09620A79

SUBJECT: Response to DoEE's Queries on Appendix B

1 INTRODUCTION

This technical memorandum provides supplementary information to support APLNG's response to issues raised by the Department of Environment and Energy (DoEE) regarding the Mahalo Development Area Water Assessment Report; Appendix B of the Mahalo Development Area *EPBC Act* Referral. This memorandum is to be read in conjunction with APLNG's response to DoEE on issues regarding Water Resources, specifically to address the additional comments raised during the teleconference regarding the local conceptualisation of the Rewan Group.

2 REWAN GROUP DISCUSSION

This section provides multiple lines of evidence to support the hydrogeological characteristics of the Rewan Group within the vicinity of the project area, highlighting the occurrence of the Rewan Group as an aquitard, which is appropriately represented in the 2019 Surat Cumulative Management Area (CMA) Underground Water Impact Report (UWIR) Groundwater Model approved under the *Water Act 2000* on 12 November 2019. Key lines of evidence are provided in the following section, and include:

- Interpreted extent and characteristics of the Rewan Group within the Project area based on site-specific resource drilling and seismic surveys completed by APLNG;
- Interpreted hydraulic connection across the Rewan Group based on groundwater levels from paired monitoring bores screened within hydrostratigraphic units above and below the Rewan Group; and,
- Hydraulic conductivity values of the Rewan Group adopted from various approved development projects within the vicinity of the Project area.

2.1 Extent and Characteristics

Resource definition completed by APLNG within the Project area comprise drilling and seismic surveys, which intersected and provided an understanding of the extent of the Rewan Group. A summary of the results from these activities are as follows:

- Drilling

Production / Resource definition drilling completed across the Project area, where the Rewan Group was intersected is summarised in

Table 2.1. A summary of the Rewan Group thickness and depth to the top of the Bandanna Formation is also provided in the table.

Table 2.1 Mahalo Development Area Production Drilling – Rewan Group Wells

Well ID	Easting[1]	Northing[1]	Rewan Group Thickness (m)	Depth to Top of Bandanna Fm (mbGL[2])
TOG-NS32	672,465	7,334,816	~75	~100
MIR1	678,045	7,326,784	~145	~200
SCG2	682,094	7,323,188	~320	~385
KAT1	686,356	7,306,958	~325	~390
TCN1	661,207	7,331,151	~285	~310
MAH1	666,092	7,333,458	~145	~155
TOG-NS8	677,138	7,335,741	~165	~195
HUM103002	686,595	7,329,975	~195	~240
HUM103009	690,720	7,333,594	~355	~390

[1] coordinate provided in GDA4 datum, Zone 55
[2] mbGL = meters below ground level

A location map of these wells, along with interpreted geological cross-section alignments across the study area, on the solid geology map is presented in Figure 2-1; while a plan of the cross-section alignments plotted on the Rewan Group thickness isopach map is provided in Figure 2-2. Interpreted geological cross-sections through the project area are provided in Figure 2-3. The cross-sections (interpreted by APLNG) provided in Figure 2-3 are comparable to the interpreted OGIA Rewan Group thickness isopach (as captured in the 2019 UWIR numerical model) provided in Figure 2-2. This highlights that the local morphology of the Rewan Group within the project area is captured in the numerical model.

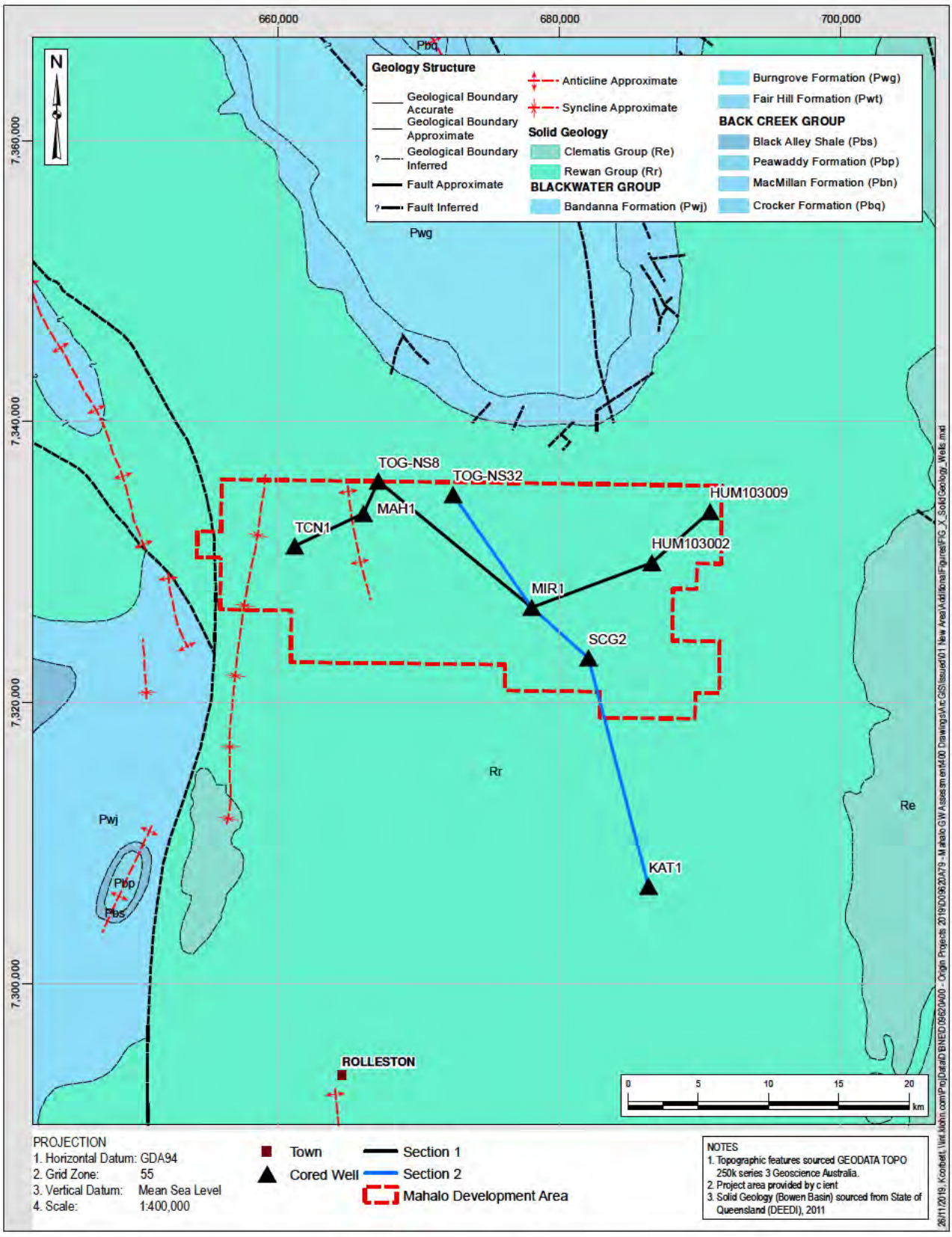

Figure 2-1 Solid Geology Map with Cross-section Alignments

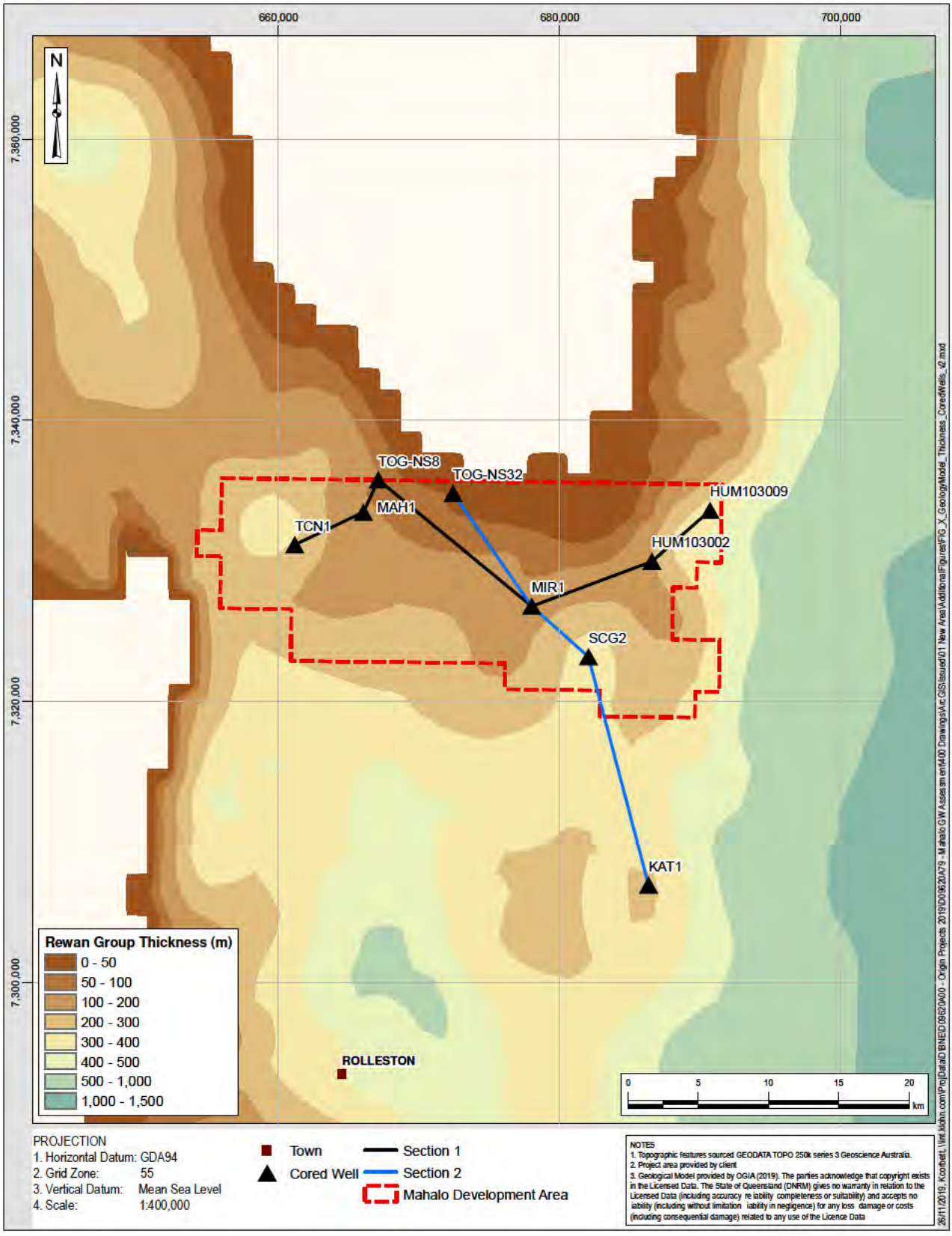

Figure 2-2 Rewan Group Thickness Isopach Map with Cross-section Alignments

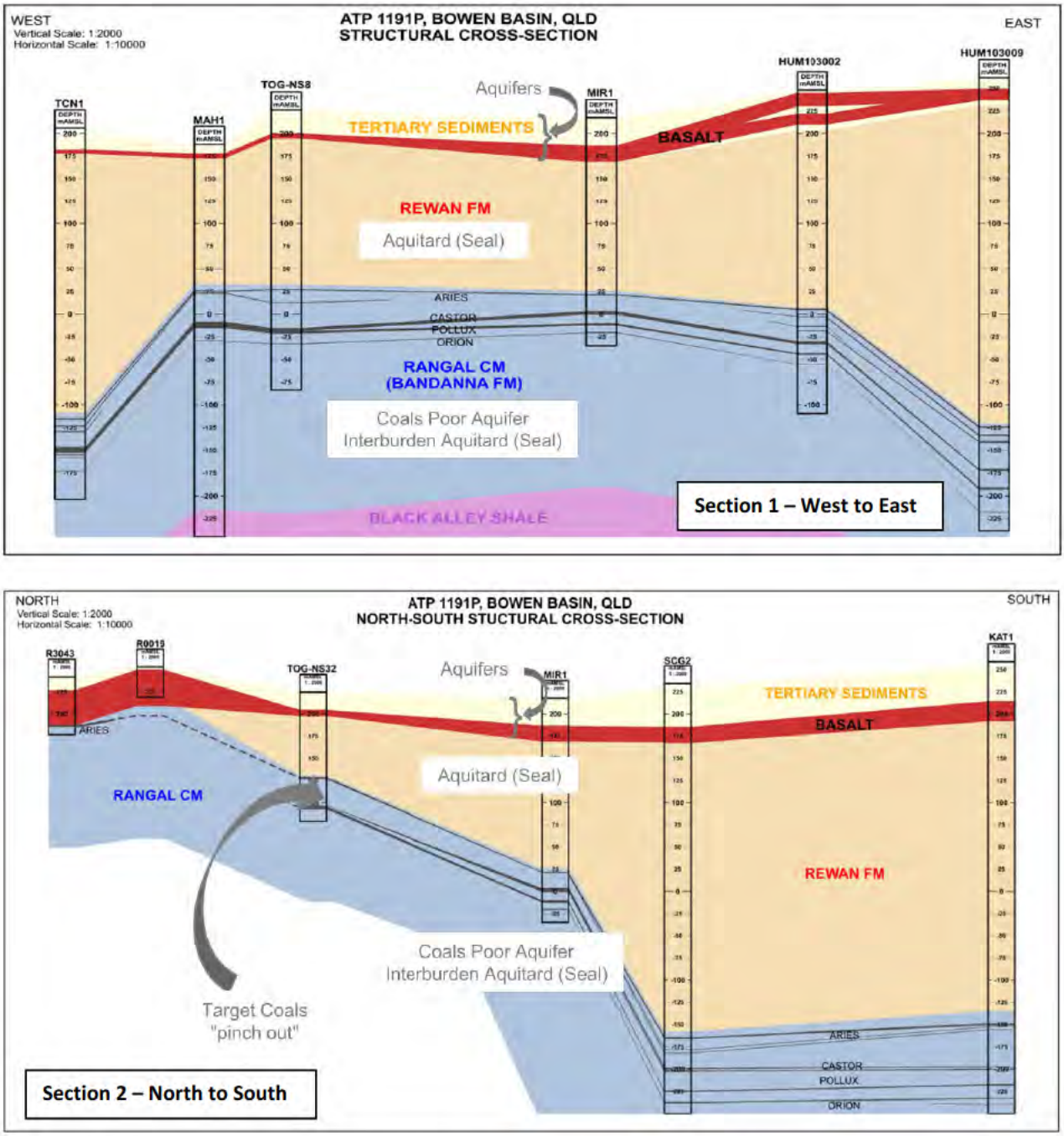

Figure 2-3 Interpreted Geological Cross-Sections through the Study Area

Drilling results, and the interpretation of the geology between drill hole locations indicate that the Rewan Group varies in thickness across the study area from ~145 m to ~355 m, except in the vicinity of where the Bandanna Formation, and the Rewan Group, "pinches out" to the north of the project area. A discussion regarding the Rewan Group extent to the west of the project area, in the vicinity of the fault structure, is provided in Section **Error! Reference source not found.**.

Drilling undertaken through the Rewan Group in the project area was predominantly completed using tri-cone bit wash-boring techniques, resulting in rock chip returns to the

surface. Coring of the Rewan Group was completed on one hole – MAH1. Lithological logging of the drill holes indicate that the Rewan Group comprises moderately hard to hard claystone with minor interbeds of fine-grained, hard sandstone. Detail logging of the core from MAH1 identified that the Rewan Group is massive and comprises minor fracturing. These fractures were consistently identified to be clay-filled, highlighting limited secondary porosity as a result of these fractures. Photographs of the MAH1 Rewan Group core are provided in Photo 2-1, Photo 2-2 and Photo 2-3; which support the massive and low permeability characteristics of the Rewan Group at the Project area.

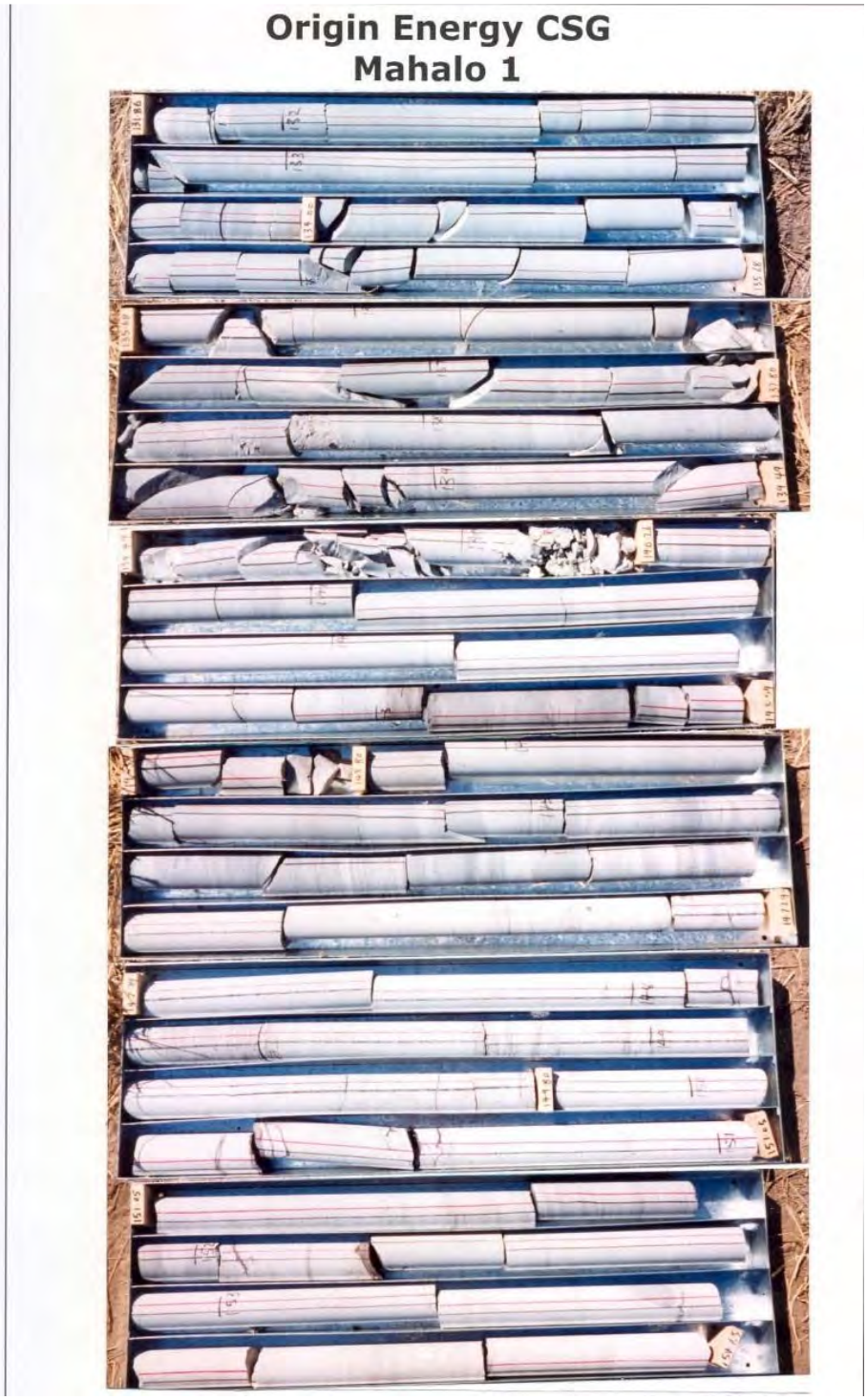

Photo 2-1 Core Photos from MAH1 – 131.6 mbGL to 154.65 mbGL (all Rewan Group)

Photo 2-2 Core Photos from MAH1 – 154.65 mbGL to 177.23 mbGL (all Rewan Group)

Photo 2-3 Core Photos from MAH1 – Rewan Group from 177.23 mbGL to 197.46 mbGL

- Seismic Surveys

  Seismic surveys have been completed through the Project area as part of the exploration campaign to characterise the Bandanna Formation. These surveys also highlight the thickness and consistency of cover, predominantly the Rewan Group, that is overlying the Bandanna Formation. Figure 2-4 presents the alignment of the seismic surveys across the

Project area, while Figure 2-5, Figure 2-6 and Figure 2-7 present the seismic survey results. Key points to note from the seismic results are:

- The Rewan Group is laterally extensive across the Project area, and across the northern, eastern and southern boundaries of the Project area. Adjacent to the western boundary of the Project area, a fault (Inderi Fault) truncates the Rewan Group resulting in the uplift and outcrop of Permian strata (Bandanna Formation, Back Creek Group).
- Minor faulting has been interpreted through the Bandanna Formation, however, these faults are localised to the coal-bearing formation.
- With the exception of the Inderi Fault located adjacent to the western boundary of the Project area, the seismic signature through the Rewan Group identifies a homogeneous characteristic of this strata, with limited deformation observed. This indicates that limited secondary structures of note (e.g. faults) are present within the Rewan Group across the Project area, therefore, the potential for hydraulic connection across the Rewan Group through secondary structures as a result of the Project development is not anticipated.

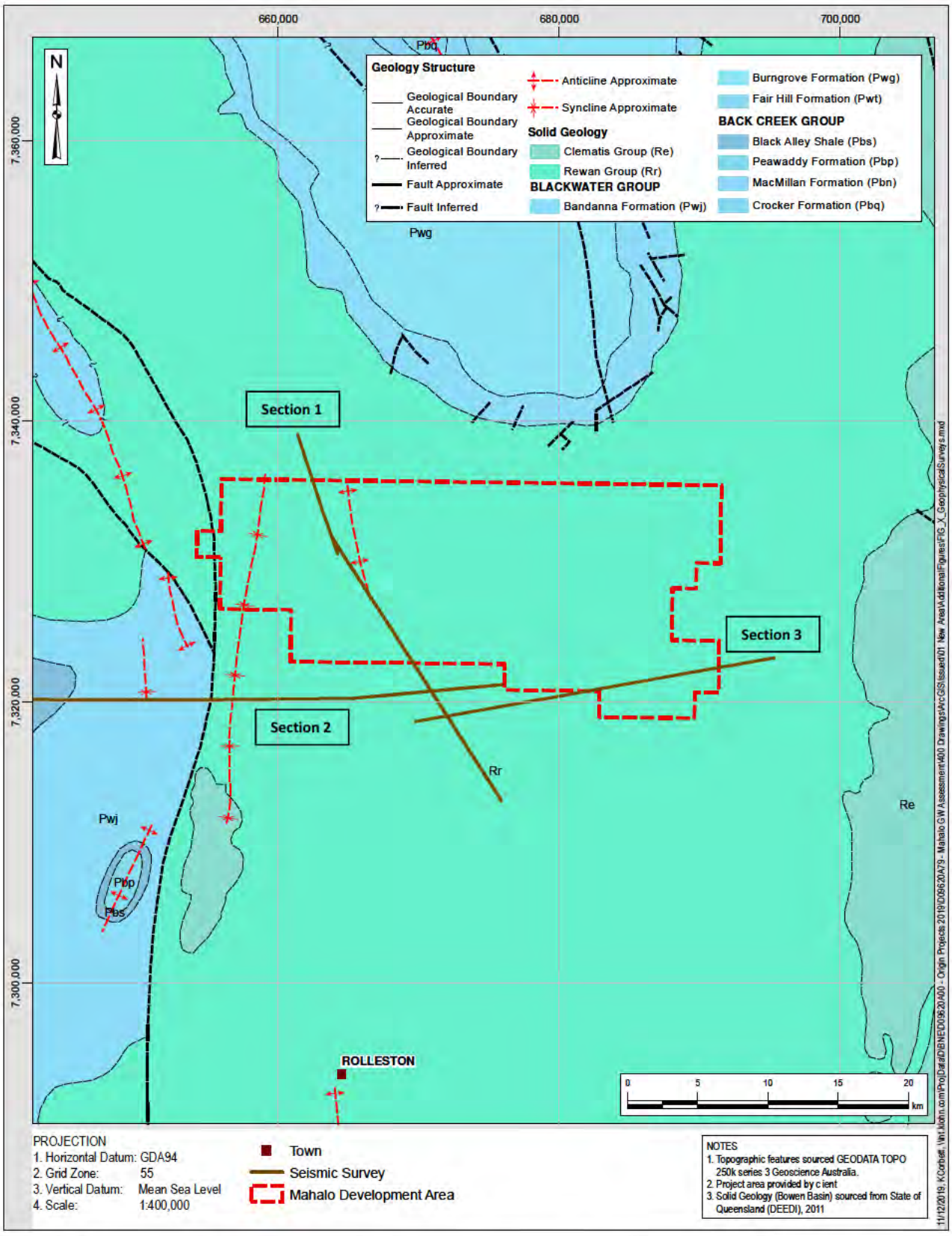

Figure 2-4 Location of Seismic Survey Alignments across the Project Area

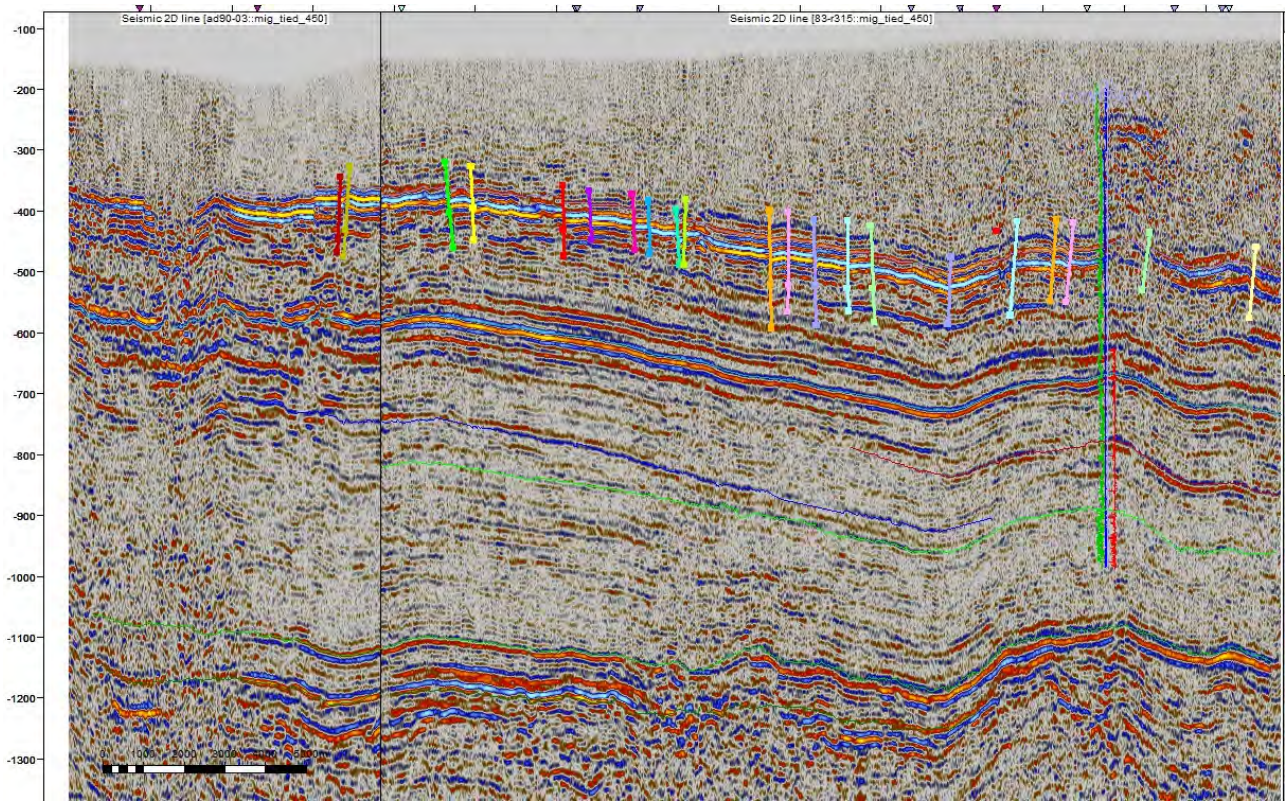

Figure 2-5 Section 1 Seismic Survey – Northwest to Southeast (Left to Right)

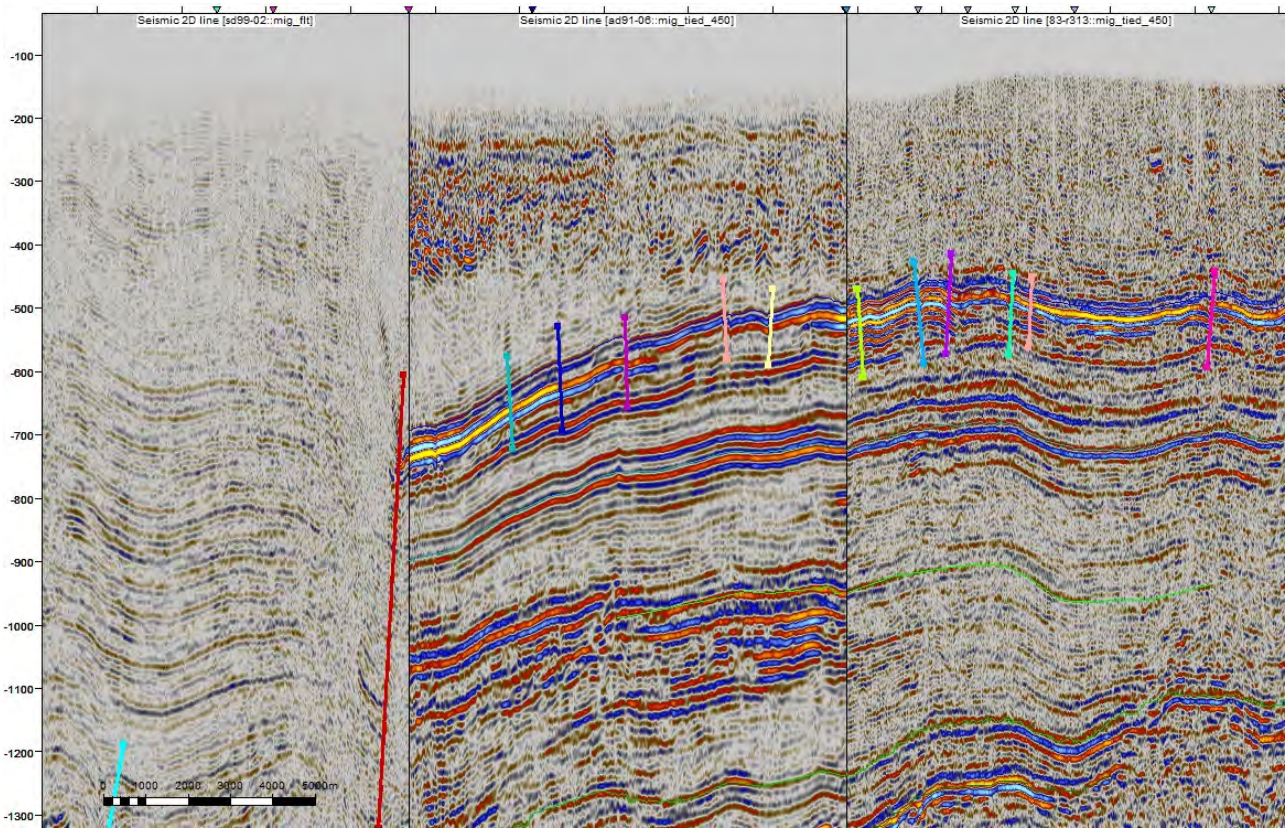

Figure 2-6 Section 2 Seismic Survey – West to East (Left to Right)

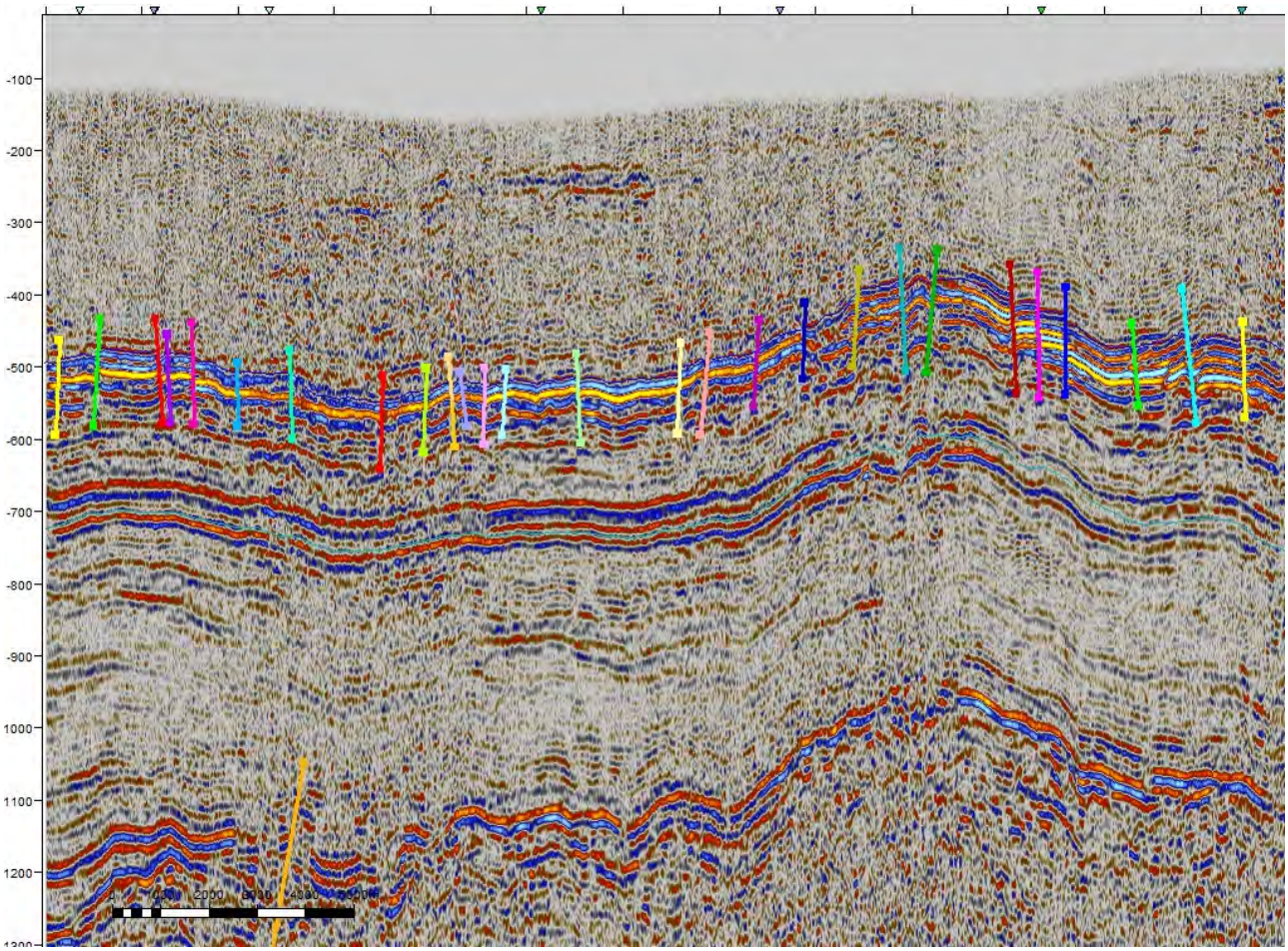

Figure 2-7 Section 3 Seismic Survey –West to East (Left to Right)

2.2 Groundwater Levels

Groundwater levels recorded from bores screened within the Rewan Group were presented as a hydrograph in Figure 7.16 of the Water Assessment Report (KCB, 2019) – bores RN132995, RN13050015 and RN13050018. These hydrographs indicate that groundwater levels in the Rewan Group are variable across the Project area and surrounds, ranging from approximately ~223 mAHD to the east of the Project area to ~190 mAHD and ~177 mAHD to the southeast and northwest of the Project area, respectively. The monitoring records from each of these bores, with the exception of RN132995 (only four monitoring records), indicate that limited variation in water levels is observed over time. In comparison, groundwater levels observed in the alluvium (Figure 7.10 of Water Assessment Report (KCB, 2019)) fluctuate with rainfall events indicating direct rainfall recharge to the alluvium and/or hydraulic connection with the associated water course during surface water flow events. Should hydraulic connection between the alluvium and Rewan Group exist, a similar trend in fluctuating water levels relative to rainfall events would be anticipated, however, this is not observed.

Located to the southwest of the Project area is a paired monitoring site comprises two bores screened within the alluvium (RN132756) and the Bandanna Formation (RN132757). Groundwater level hydrographs for these bores were presented in Figure 7.19 of the Water Assessment Report (KCB, 2019). A key point to note regarding this monitoring site is that the Rewan Group is absent

in the stratigraphic profile and the alluvium is directly overlying the Bandanna Formation. The groundwater levels for these bores identify a downward hydraulic gradient from the alluvium to the Bandanna Formation. Furthermore, the temporal groundwater level trend indicates a rapid response to rainfall events in the alluvium bore and a subdued/dulled response to rainfall events in the Bandanna Formation, further supporting the downward hydraulic gradient from the alluvium to the Bandanna Formation, as the subdued/dulled response is likely a function of leakage from the alluvium downwards. Therefore, even without the presence of a Rewan Group separating the alluvium and the Bandanna Formation, there is no observed upward hydraulic connection between the Bandanna and the overlying alluvium.

2.3 Permeability Data Summary – Surrounding Approved Projects

Permeability testing of the Rewan Group has been undertaken and cited for a number of projects within the vicinity of the Project area. These projects include:

- Springsure Creek Coal Mine Project (CDM Smith, 2013; NTEC, 2013) – EPBC 2010/5783
- Bowen Gas Project (URS, 2012; Ausenco-Norwest, 2012) – EPBC 2012/6377

A comparison of the Rewan Group permeability from the above projects with the permeability adopted by OGIA as part of the Surat CMA UWIR is provided in Table 2.2.

Table 2.2 Rewan Group Permeability Values

Project / Source	Kh (m/day)		Kv (m/day)	
	Min	Max	Min	Max
Springsure Creek Coal Mine Project	1×10^{-4}		1×10^{-6}	
Bowen Gas Project	5×10^{-4}	5×10^{-2}	1×10^{-5}	1×10^{-3}
Surat CMA UWIR[1]	2×10^{-3}		1×10^{-7}	

[1] Horizontal and vertical permeability values from the Surat CMA UWIR have been estimated from the Figures H1-26 and H3-26, which represent calibrated permeabilities from the model.

Horizontal permeability results from Table 2.2 indicate a good correlation of values across the various projects / sources; while the vertical permeability adopted in the Surat CMA UWIR numerical model is approximately one order-of-magnitude lower than the referenced value from the Springsure Creek Coal Mine Project.

Mahalo Development Area

Environmental Constraints Planning and Field Development Protocol

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1. Purpose

The Environmental Constraints Planning and Field Development Protocol (the Protocol) for the Mahalo Development Area (the Project) aims to ensure that infrastructure siting:

- considers Matters of National Environmental Significance (MNES), listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), when selecting the location of petroleum activities; and
- avoids, minimises, and rehabilitates disturbances to MNES.

The Protocol also recognises that, in addition to environmental constraints, landholder, engineering and cultural heritage constraints must be considered during infrastructure siting.

2. Scope

This Protocol applies to siting of petroleum activities for the Project, including:

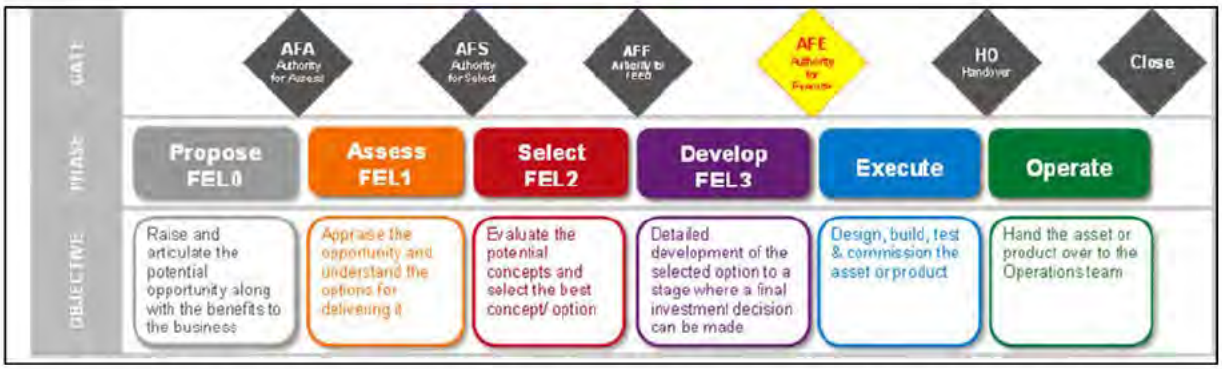
- well lease pads;
- access tracks, pipelines and other ancillary linear infrastructure;
- compression facilities;
- dams and water management facilities;
- seismic surveys;
- camps; and
- ancillary infrastructure and activities associated with the above.

The large majority of petroleum activities will be located on land previously cleared for agricultural activities and generally used for cattle grazing.

3. Protocol

The Protocol is triggered by the initiation of the Gated Design Process as shown on Figure 3-1. The process ensures thorough assessment of all relevant considerations (environmental, landholder, engineering) described in Section 3.1.

Figure 3-1: Gated Design Process



The following hierarchy of environmental management principles is used for planning the location of petroleum activities:

- **Avoidance** - avoid disturbance to MNES values.
- **Minimisation** - minimise disturbance to MNES values where disturbance cannot reasonably and practicably be avoided.
- **Rehabilitation** - actively rehabilitate all disturbed areas in accordance with the Mahalo environmental authority.

The following steps are iteratively followed in the final selection of the location of petroleum activities.

3.1. Environmental constraints analysis

A constraints analysis will be completed including review of GIS mapping layers relating to the proposed infrastructure locations and additional field assessments. The constraints GIS datasets considered for the Project have been compiled through targeted on-ground ecology survey data combined with Government datasets and Australia Pacific LNG GIS datasets. The constraints categories as detailed in the GIS layers represent requirements for constraints planning and field development for the Project. The group of constraints that make up the different GIS layers will be revised if new constraints are identified during additional field assessments.

A full list of constraints, constraint categories and restrictions for field development activities are detailed in Table 3-1.

Table 3-1: Mahalo Development Area Constraint Categories

Constraint Categories	EPBC Act Constraint	Mitigation Measure
High constraint area ('no go' area)	**TECs** • Brigalow • Weeping Myall Woodlands • Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions • Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin • Poplar Box grassy woodlands on alluvial plains **Threatened flora** • Tufted Grass (*Aristida annua*) individuals • Ooline (*Cadelia pentastylis*) individuals and habitat • Bluegrass (*Dichanthium setosum*) individuals • King Bluegrass (*Dichanthium queenslandicum*) individuals • Marsdenia (*Marsdenia brevifolia*) individuals and habitat **Threatened fauna** • Koala (*Phascolarctos cinereus*) habitat • Ornamental snake (*Denisonia maculata)* habitat • Yakka Skink (*Egernia rugosa*) habitat • Dunmall's Snake (*Furina dunmalli*) habitat • Squatter pidgeon (*Geophaps scripta scripta*) breeding habitat[1] • Painted Honeyeater (*Grantiella picta)* habitat • Corben's Long-eared Bat (*Nyctophilus corbeni)* habitat • Greater Glider (*Petauroides volans)* habitat	Avoidance
Medium constraint area	**Threatened flora** • Tufted Grass (*Aristida annua*) habitat • Bluegrass (*Dichanthium setosum*) habitat • King Bluegrass (*Dichanthium queenslandicum*) habitat **Threatened fauna** • Squatter Pidgeon (*Geophaps scripta scripta*) non-breeding habitat[2] **Migratory species**	Minimisation Rehabilitation

Constraint Categories	EPBC Act Constraint	Mitigation Measure
	• Common Sandpiper (*Actitis hypoleucos*) habitat • Fork-tailed Swift (*Apus pacificus*) habitat • Sharp-tailed Sandpiper (*Calidris acuminate*) habitat • Pectoral Sandpiper (*Calidris melanotos*) habitat • Oriental Cuckoo (*Cuculus optatus*) habitat • Latham's Snipe (*Gallinago hardwickii*) habitat • Yellow Wagtail (*Motacilla flava*) habitat • Satin Flycatcher (*Myiagra cyanoleuca*) habitat	
Low constraint areas	• All other environment constraints (non MNES)	Rehabilitation

Note 1: General (non-breeding) habitat of the squatter pigeon (southern) includes open forest to sparse open woodlands and scrubs that contain the following features (DoEE SPRAT, 2019):

- an overstorey dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species;
- ground covering vegetation patchy consisting of native, perennial tussock grasses or a mix of perennial tussock grasses and low shrubs or forbs; cover rarely exceeds 33%;
- remnant, regrowth or relatively modified vegetation communities; and
- a water source within 3 km.

Note 2: Breeding habitat of the squatter pigeon (southern) is as for general (non-breeding habitat) with:

- patchy, tussock-grassy understories of open-forest to woodland;
- nests in shallow depressions in the ground and requires well draining soils (predominantly land zones 3, 5 and 7 in Qld); and
- within 1 km of a suitable, permanent waterbody.

4. Mitigation measures

4.1. Additional ecological assessments

Additional ecological assessments would be undertaken prior to disturbance to confirm the presence, and further refine the location, of TECs, threatened flora, threatened fauna habitat, and migratory fauna habitat. The results of these assessments would be used to determine the location of petroleum activities through the avoidance of, and minimisation of disturbance to, MNES values as described below.

4.2. Avoidance

Proposed infrastructure locations will be relocated or modified to avoid disturbance, including the following avoidance measures:

- Re-design / relocation of proposed infrastructure.
- Construction of gas wells using horizontal drilling technology.
- Direction drilling of pipelines under TECs, threatened flora, threatened fauna habitat, and migratory fauna habitat.
- Utilising existing cleared areas and existing infrastructure (e.g. access tracks).

A 5 metre 'buffer' will be established around all avoidance areas to exclude significant disturbance to land adjacent to high constraint areas.

4.3. Minimisation

Disturbances will be minimised within habitat for species with a very broad 'general' habitat extent within the Mahalo Development Area, including the Squatter Pidgeon and 'flyover' migratory species. Disturbance minimisation will include a combination of the following:

- Pipeline right-of-way widths limited to 18 metres.
- Gas well pads limited to 1.2 hectares.
- Use of minimal disturbance well pads and access tracks.

- Non-linear infrastructure will be excluded from watercourses.

4.4. Rehabilitation

All disturbances would be rehabilitated in accordance with the Mahalo Development Area Rehabilitation Management Plan and the Mahalo EA, including the following prescribed rehabilitation conditions:

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) 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.

5. Environmental constraints reporting

An Environmental Constraints Report is prepared following the site survey and finalisation of location of the proposed petroleum activities to formally document:

- That infrastructure siting complies with relevant environmental approval conditions including planning considerations; and
- Site-specific or construction-related environmental considerations.

The report includes a list of site-specific environmental requirements and associated maps, issued to relevant staff and contractors prior to commencing construction. The Environmental Constraints Report is used to demonstrate compliance with approvals, as part of the overarching Australia Pacific LNG Compliance Management System.

FOI 200511
Document 6

From: s22
Sent: Wednesday, 8 April 2020 1:30 PM
To: s47F
Cc: s47F ; s47F ; Andrew McNee; s22
Subject: RE: Mahalo Referral 2019/8534: Proposal For Addional R eferral Informaon [SEC=OFFICIAL]

Hi s47F

Thanks for this. We'll review and seek OWS advice on this report and get in touch if we have any quesons.

Otherwise we'll proceed with preparing briefing for the delegate to make a decision on whether or not it is a controlled acon. I'll tr y to keep you updated on me frames as we progress this.

As always, don't hesitate to get in touch if you have any quesons. W e're pretty much all working remotely now so emailing is the easiest way of getting onto us.

Cheers
s22

From: s47F @upstream.originenergy.com.au>
Sent: Wednesday, 8 April 2020 12:51 PM
To: s22 @environment.gov.au>; s22 @awe.gov.au>; Andrew McNee <Andrew.McNee@awe.gov.au>
Cc: s47F @origin.com.au>; s47F @klohn.com>
Subject: RE: Mahalo Referral 2019/8534: Proposal For Addional R eferral Informaon

Hi s22, s22 , and Andrew,

Following our calls on 10 March and 19 March, we agreed to undertake further analysis of the interacon be tween predicted groundwater drawdown and potenal t errestrial groundwater dependent ecosystems (TGDEs) as detailed in my email below.

See a. ached for this extra work which clearly demonstrates that groundwater drawdown is unlikely to impact potenal T GDEs. This extra work confirms that:

- **For potenal T GDEs north of the referral area**: Groundwater levels are too deep for potenal T GDEs to be reliant/dependent on this groundwater.
- **For potenal T GDEs along Shotover Creek:** This riparian vegetaon is unlik ely to be dependent on groundwater.

As the scope of this extra work was agreed with s22 on 19 March, we ask that further OWS advice be limited to this extra work / agreed scope.

While we're more than willing to parcipa te in addional t eleconferences to discuss this addional w ork, we feel that it removes any residual uncertainty of impacts to water resources and allows the Department to proceed with deciding whether the acon is a c ontrolled acon.

Cheers,

s47F

From: s47F
Sent: Wednesday, 11 March 2020 4:18 PM
To: s22 @awe.gov.au>
Subject: Mahalo Referral 2019/8534: Proposal For Addional R eferral Informaon

Hi s22 ,

Thank you for reaching out this morning and your suggeson f or me to document my proposal discussed on the phone yesterday with the Department.

Site-Specific Eco-Hydrological Model

We are proposing to prepare a site-specific eco-hydrological model for select potenal t errestrial groundwater dependent ecosystems (TGDEs). We are proposing to focus on the potenal T GDEs located within the area of drawdown predicted within shallower groundwater units as vegetaon has a mor e obvious potenal t o interact with shallow groundwater. This drawdown area is shown on the first / upper le fr ame of Figure 8.3 of the Water Assessment Report (Appendix B of the referral) (I've attached this figure for ease of reference). Note that the UWIR groundwater model ulised f or the referral combines the alluvium, cenozoic, and basalt units as a single layer for modelling purposes.

To create the site-specific eco-hydrological model, we are proposing to combine the groundwater model for the referral with exisng c onceptual GDE models that the QLD government has developed for all potenal T GDEs in QLD. Detail of the QLD government's GDE mapping and conceptual GDE models can be found here:

hp s://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/gde-background/
hp s://wetlandinfo.des.qld.gov.au/wetlands/ecology/aquac-ec osystems-natural/groundwater-dependent/

Creang this sit e-specific eco-hydrological model will better demonstrate the degree of interacon be tween the deeper rooted vegetaon c omprising the potenal T GDEs (mostly *Eucalyptus populnea*, *E. melanophloia*, and *Corymbia clarksoniana* in this case), and the predicted drawdown for the acon. W e are also proposing to undertake a literature review of the likely roong dep th for this vegetaon t o inform an assessment of the groundwater interacon.

Potenal T GDE Significance Assessment

We are further proposing to use the results of the site-specific eco-hydrological model to inform a TGDE significance assessment using a variaon of the GDE risk assessmen t methodology adopted by the QLD Office of Groundwater Impact Assessment (OGIA) for the 2019 UWIR for the Surat CMA. This risk assessment methodology considers the following:

- Biodiversity status (e.g. what's the inherent habitat value of the TGDE);
- Groundwater drawdown predicons; and
- Geological outcrop mapping.

OGIA's risk assessment methodology is described in Secon 10 of the UWIR (hp s://www.dnrme.qld.gov.au/ data/assets/pdf file/0019/1461241/uwir-full-report.pdf).

For the TGDE significance assessment, we propose to 'convert' the above QLD matters (e.g. biodiversity status under the *Vegetaon Managemen t Act 1999*) to Commonwealth matters (e.g. community & species lisngs and habit at value for MNES species).

Pending the results of this exercise, I feel like the above is a pracc al and achievable way to reduce impact assessment uncertainty and provide the Department with addional in formaon needed t o make a not a controlled acon decision.

If you have any queries about the above give me a call at your leisure (I have your number in my phone now).

Cheers,

s47F

s47F
Strategic Approvals | Exploration & New Ventures

Origin
Level 29, 180 Ann Street, Brisbane QLD 4000
m s47F
s47F @upstream.originenergy.com.au
I pay my respect to the Traditional Owners whose land we live and work on. I acknowledge their Elders - past, present and emerging.

From: s22 @awe.gov.au>
Sent: Wednesday, 11 March 2020 10:05 AM
To: s47F @upstream.originenergy.com.au>
Subject: [SEC=UNOFFICIAL]

s22
Assistant Director
Assessments and Governance Branch
Department of Agriculture, Water and the Environment
P: 02 6274 s22
E: s22

Klohn Crippen Berger

FOI 200511
Document 7

8 April 2020

APLNG Pty Ltd
Email Delivery: s47F @upstream.originenergy.com.au

s47F
Strategic Approvals – Exploration & New Ventures

Dear s47F :

Mahalo Development Area
TGDE Drawdown Impact Supplementary Information

1 INTRODUCTION & BACKGROUND

Predicted groundwater level drawdown, as a result of proposed gas development at Australian Pacific LNG Pty Ltd's (APLNG) Mahalo Development Area (the Project), was completed by the Office of Groundwater Impact Assessment (OGIA). Simulation of the Project development was completed using OGIA's Surat Cumulative Management Area (CMA) groundwater model, with results comprising the base case drawdown prediction and uncertainty analysis results. These results were provided in the Mahalo Development Area Water Assessment Report (KCB, 2019), along with the interpretation of potential impacts to terrestrial groundwater dependent ecosystems (TGDE) as a result of the predicted drawdown. The water assessment report was provided to the Department of Agriculture, Water and the Environment (DAWE), formerly the Department of Environment and Energy (DoEE), in September 2019.

Following a review of the water assessment report DAWE requested additional information regarding potential impacts to potential TGDEs as a result of the Project development. This supplementary letter provides additional localised information regarding the predicted groundwater level drawdown within the vicinity of mapped TGDEs.

2 OGIA MODEL RESULTS

The predicted groundwater level drawdown results provided by OGIA for the Project development comprised a "Base Case" groundwater level drawdown, which are predictive results based on the calibrated parameters for the model domain; and, uncertainty analysis groundwater level drawdowns based on a null space Monte Carlo (NSMC) approach for uncertainty analysis. The water assessment report presented potential drawdown impacts based on the "Base Case" groundwater level drawdown, however, the potential drawdown impacts discussed in this document are based on the 95th percentile drawdown results from the uncertainty analysis. It is important to note that the 95th percentile drawdown represents the 95th percentile of a statistical analysis of groundwater levels from 450 realisations of groundwater model parameter variations. Therefore, the drawdown extent presented as the 95th percentile would capture 95% of the drawdown extent from the 450 realisations. The remaining 5% of realisation results, beyond the

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95th percentile are considered outliers. Therefore, the 95th percentile drawdown extent presented in the figures of this document represents the statistical upper-bound of predicted drawdown extent for the project development.

The drawdown results across the Project area, based on the 95th percentile uncertainty analysis from the model, is presented in Figure 2-1. The drawdown results indicate that the maximum 95th percentile drawdown within Layer 1 of the model ranges from 0.2 m to 1.6 m; with the 0.2 m drawdown contour extending approximately 10 km to the north of the Project area. In relation to areas of mapped TGDEs, there are two areas where the predicted 95th percentile drawdown coincides with mapped TGDEs, and these are located to the north of the Project area (Northern Drawdown Area) and along Shotover Creek, within the Project area. Further discussions on these mapped TGDEs and the potential impacts on them as a result of the predicted 95th percentile drawdown is provided in the following sections.

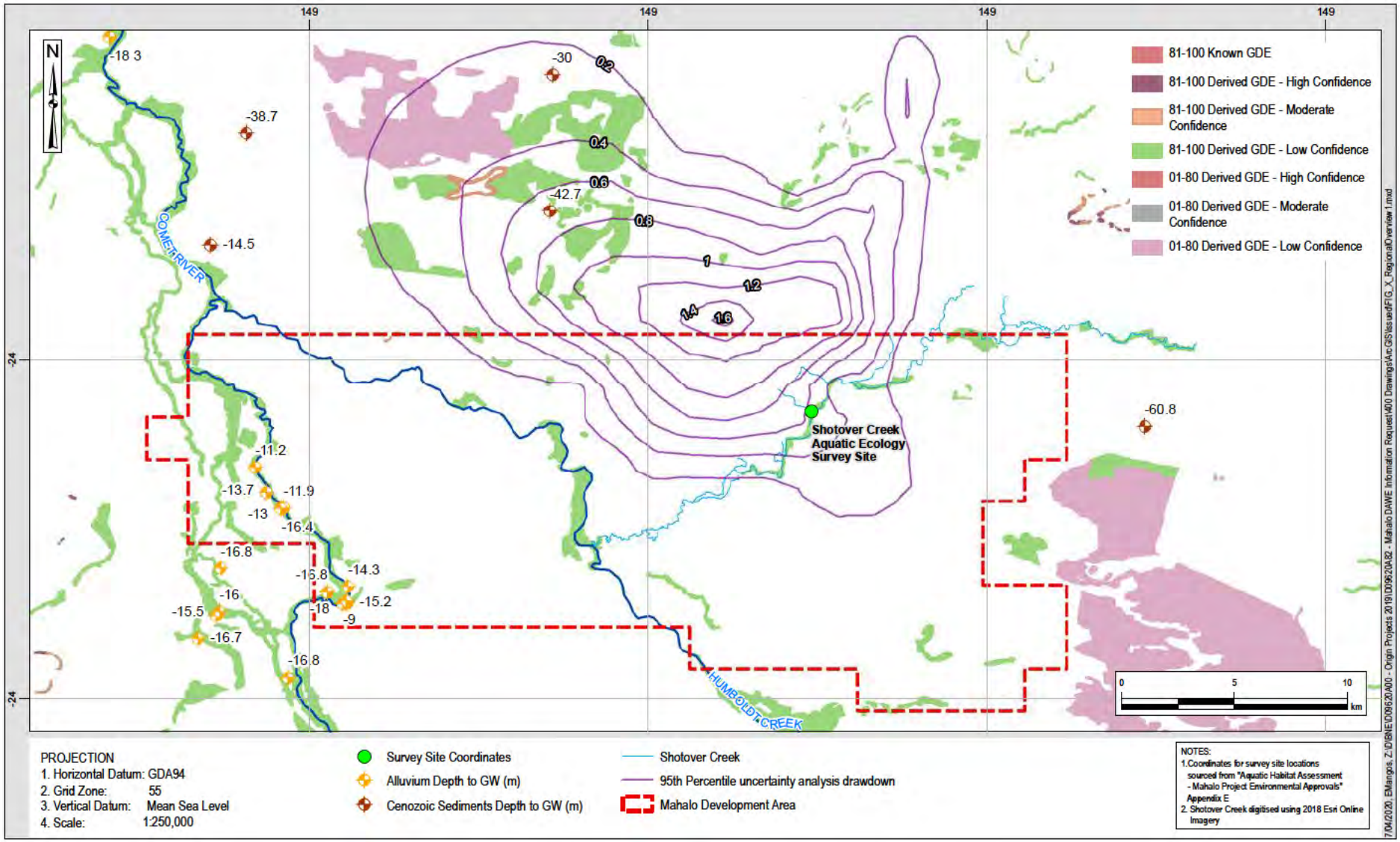


Figure 2-1: Predicted 95th Percentile Uncertainty Analysis Groundwater Level Drawdown (Layer 1) – Mahalo Development Area

3 TGDE IMPACT ASSESSMENT

The discussion surrounding potential impacts to the mapped TGDEs in the Northern Drawdown Area and along Shotover Creek, as a result of the predicted 95th percentile drawdown is provided in the following sections.

3.1 Northern Drawdown Area

Maximum predicted groundwater level drawdown (95th percentile) within the vicinity of the Northern Drawdown Area, and across the mapped TGDE within this area, ranges from approximately 0.2 m to 1 m (Figure 3-1). The Regional Ecosystem (RE), comprising both remnant and non-remnant ecosystems, mapped within the vicinity of the Northern Drawdown area comprise RE 11.4.8 (with dominant tree species *Eucalyptus cambageana, Acacia harpophylla, Acacia argyrodendron, Eremophila mitchellii*) and RE 11.5.3 (with dominant tree species *Eucalyptus populnea, Eucalyptus melanophloia, Eucalyptus cambageana, Eucalyptus brownii Corymbia clarksoniana, Corymbia dallachiana*). Based on these dominant tree species within the vicinity of the mapped potential TGDE area, the maximum rooting depth for this potential TGDE is limited to a depth of ~20 m (Eamus et. al. 2006).

The geology within the vicinity of the Northern Drawdown Area comprises Cenozoic Sediments from the surface to ~60 m below ground surface, followed by ~20 m of low permeability Rewan Formation, which is underlain by the Bandanna Formation. Groundwater in the Northern Drawdown Area is observed in the Cenozoic Sediments, with third-party groundwater bores installed and screened within the Cenozoic Sediments (bore locations provided in Figure 3-1). Monitoring of groundwater from these bores indicate that groundwater levels across the Northern Drawdown Area ranges from 30 m to 42.7 m below the ground surface.

The information provided above is summarised in Figure 3-2 as a stratigraphic column, which conceptualises the localised hydrogeological system. This figure highlights the vertical separation / offset between the maximum rooting depth of the identified dominant tree species and the observed groundwater level in the area; with the groundwater level occurring ~22 m below the maximum rooting depth of the identified tree species. As a result, the TGDE identified within the Northern Drawdown Area are not considered to be dependent upon the regional groundwater system, and therefore, are not considered to be impacted by the predicted 95th percentile drawdown resulting from the Project development.

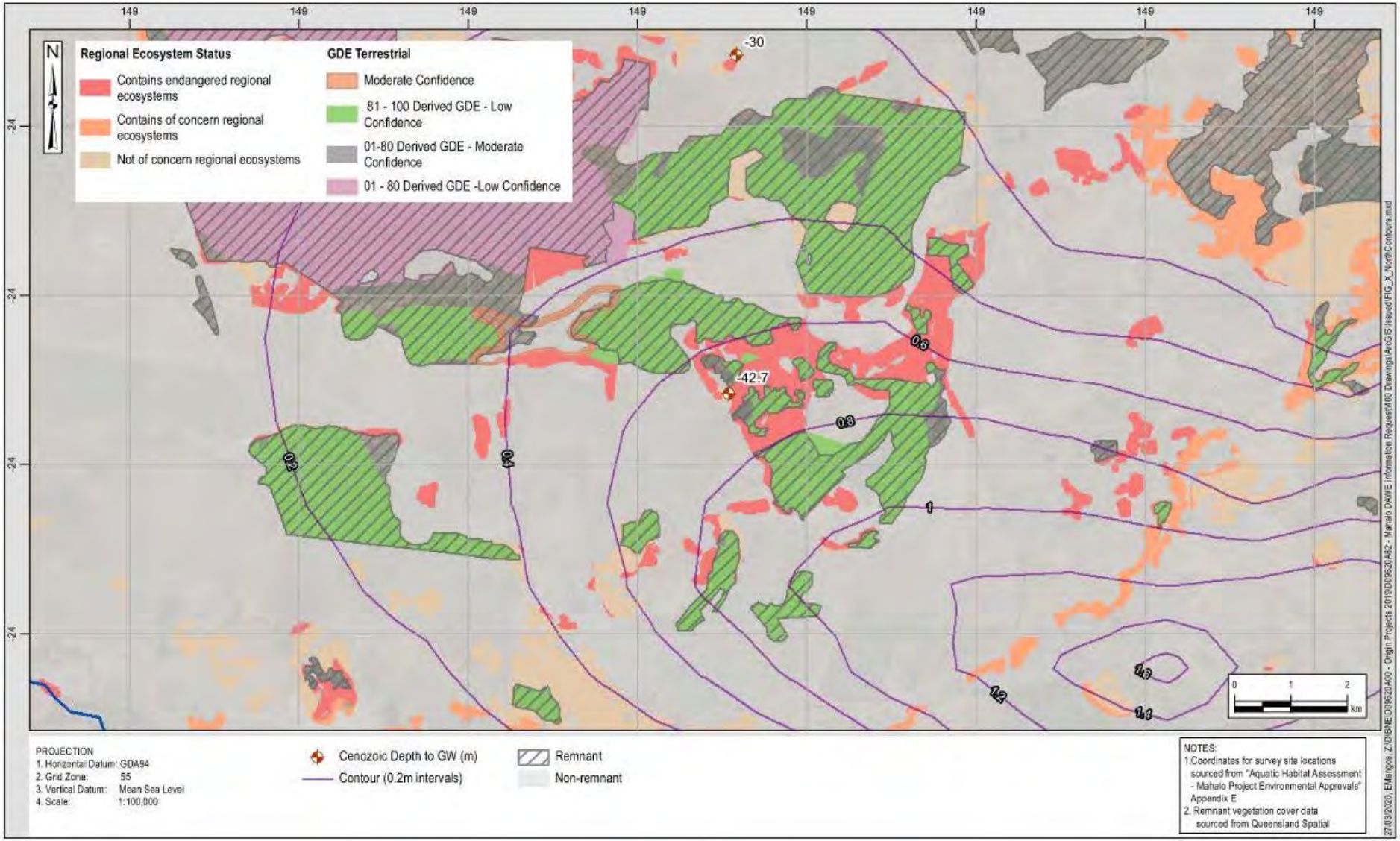


Figure 3-1: Predicted 95th Percentile Uncertainty Analysis Groundwater Level Drawdown (Layer 1) – Northern Drawdown Area

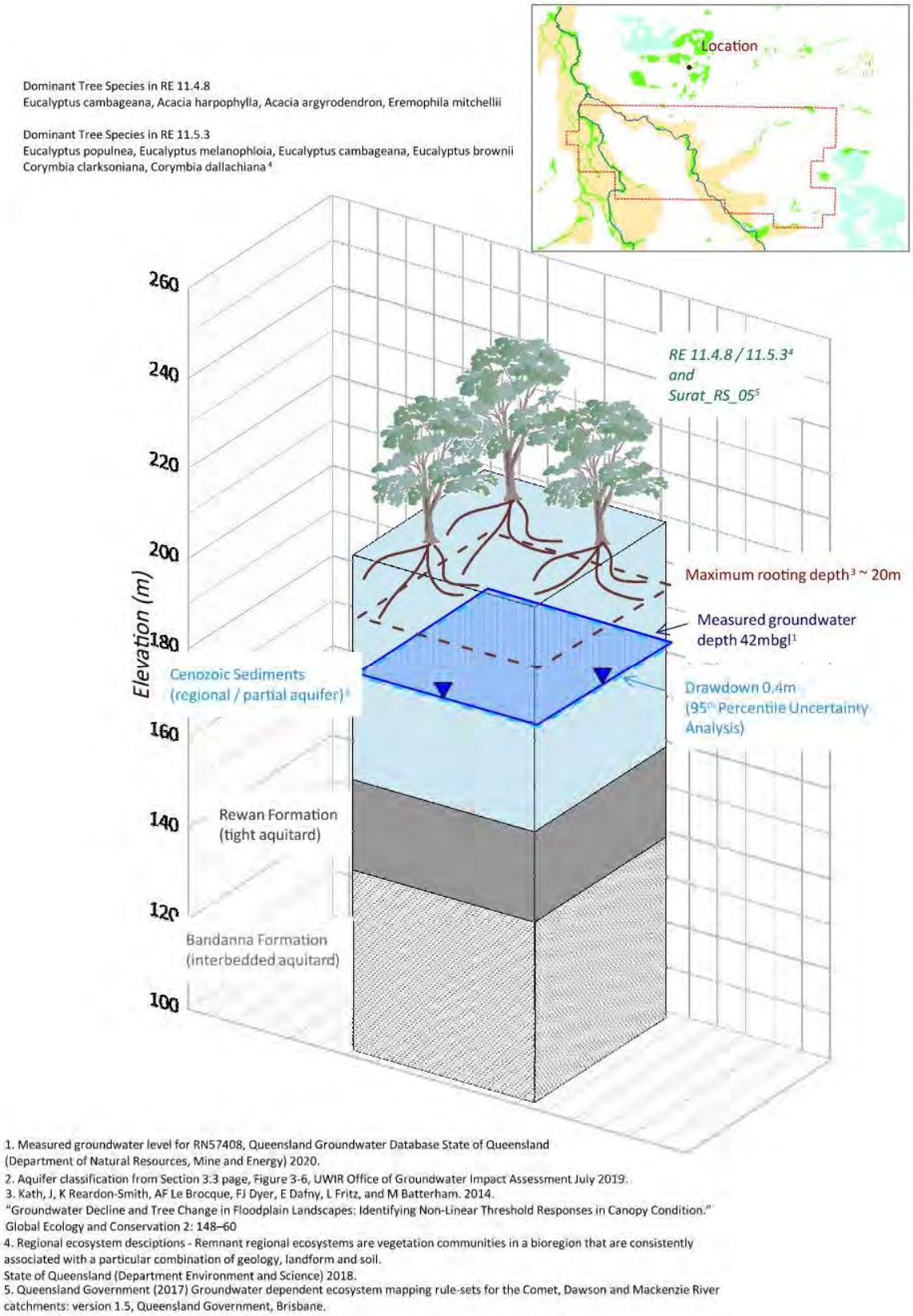


Figure 3-2: Conceptual Hydrogeological Stratigraphic Column

3.2 Shotover Creek

Maximum groundwater level drawdown (95th percentile) within the vicinity of the Shotover Creek area ranges from 0.4 m to 0.6 m (Figure 3-3). An ecological survey along Shotover Creek, and within the area of the predicted drawdown, has been previously undertaken. The results from this survey are presented in a summary table in Figure 3-3, however, the dominant RE that has been identified in this area is RE 11.3.25, with *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines being verified as the most dominant vegetation type.

The geology within the vicinity of Shotover Creek is similar to what is observed at the Northern Drawdown Area, with a profile comprising Cenozoic Sediment, Rewan Formation and Bandanna Formation, however, the Rewan Formation is thicker in this area (~200 m thick). In addition to these geological units, Quaternary alluvium (Qa) has also been mapped within, and adjacent to, the drainage line of Shotover Creek. The extent of this alluvium is mapped from the confluence of Shotover Creek and Humboldt Creek to ~10 km upstream in Shotover Creek.

The closest groundwater level monitoring points to Shotover Creek is ~10 km to the northwest and ~10 km to the east, with groundwater levels of 42.7 m and 60 m below the ground surface, respectively (Figure 2-1). These observed groundwater levels are well below the maximum rooting depths (~20 m below ground surface) for the identified dominant tree species, *Eucalyptus tereticornis,* within the Shotover Creek area. Furthermore, field verification of the RE along Shotover Creek confirms that the riparian vegetation present along Shotover Creek represents RE 11.3.25 and not RE 11.3.2 as indicated by Government mapping. Attachment A provides confirmation of the RE for riparian vegetation along Shotover Creek contrasting against the mapped RE 11.3.2, as shown in Table 3.1.

Table 3.1: Shotover Creek RE Comparison (Field Verified vs. Mapped)

RE Code	Short Description	Dominant Tree Species	Landform Association	Wetland Association	Relevant Comments	Mapped GDE?
11.3.25[1] (field verified)	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	*Eucalyptus tereticornis* (observed)	Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region.	Riverine wetland or fringing riverine wetland.	Often associated with RE 11.3.2 which may occur on adjacent alluvial plains. In highly cleared subregions a narrow fringe of riparian vegetation is often the only surviving woody vegetation	No
11.3.2[2] (QLD Govt mapping)	*Eucalyptus populnea* woodland on alluvial plains	*Eucalyptus populnea*	Occurs on Cainozoic alluvial plains.	Palustrine wetlands (non-riverine or non-channel systems)	N/A	Yes

As shown in Table 3.1, RE 11.3.25 only occurs along drainage lines which indicates species dependence more on surface water than groundwater. Based on the observed regional groundwater levels, the field verified RE 11.3.25 surface water dependence, and the predicted 95th percentile groundwater level drawdown of less than 0.6m, the Project is not considered likely to impact the riparian vegetation (mapped as a potential TGDE) associated with Shotover Creek.

[1] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=11.3.25
[2] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=11.3.2

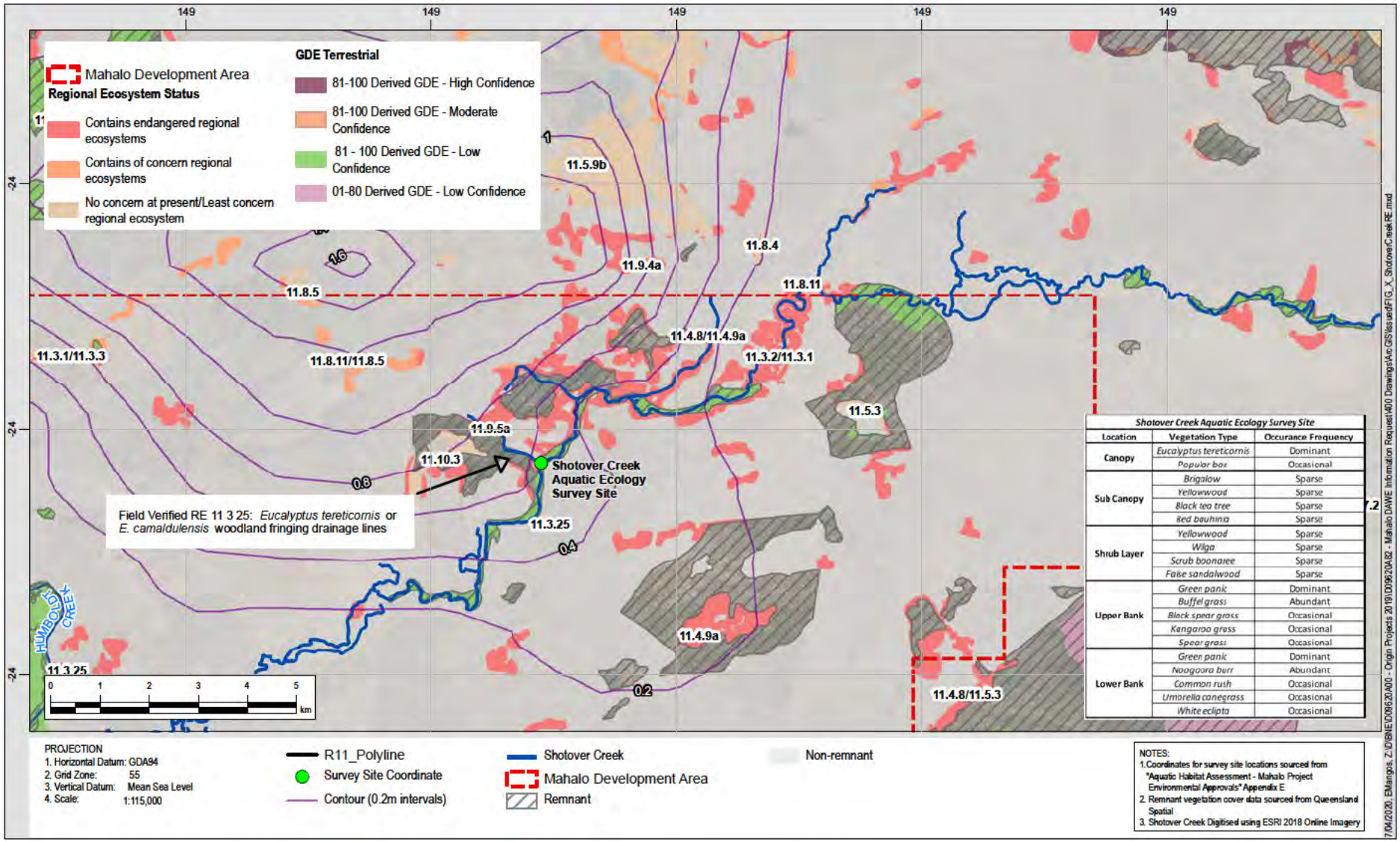


Figure 3-3: Predicted 95th Percentile Uncertainty Analysis Groundwater Level Drawdown (Layer 1) – Shotover Creek

4 DOCUMENT CLOSURE

KCB is pleased to provide this supplementary information regarding the potential drawdown impacts to TGDEs as a result of the Mahalo Development Area. Should you have any queries regarding this document, please do not hesitate to contact the undersigned on +61 s47F or s47F @klohn.com.

Yours truly,

KCB AUSTRALIA PTY LTD.

s47F
Principal Hydrogeologist

CS:DK

REFERENCES

Eamus D, Froend R, Loomes R, Hose G and Murray B (2006). A functional methodology for determining the groundwater regime needed to maintain the health of groundwater dependent vegetation. Australian Journal of Botany 54: 97-114.

ATTACHMENT A

Shotover Creek Aquatic Habitat Assessment

Site Code: R11 **Location:** Shotover Creek, Humboldt **Stream order:** 4 **Latitude:** -24.1017 **Longitude:** 148.8137 **Date:** 20/02/2018 **Season:** Wet

Upstream

Left Bank

Downstream

Right Bank

General Site Description

Site attributes

Fourth order watercourse; well defined bed and banks; no local catchment erosion detected; bankfull width approximately 15 m and bankfull height approximately 3 m; isolated deep (>0.5 m) pool at the time of assessment; in-stream habitat included shallow pool, deep pool, large woody debris and fringing macrophytes; bed substrates comprised approximately 20% cobble (64-256 mm), 10% pebble (4-64 mm), 5% gravel (2-4 mm), 20% sand (0.05-2 mm) and 45% silt/clay (<0.05 mm); substrates in the edge habitat comprised approximately 20% cobble (64-256 mm), 10% pebble (4-64 mm), 5% gravel (2-4 mm), 15% sand (0.05-2 mm) and 50% silt/clay (<0.05 mm); clay loam banks; upstream and adjacent land use includes moderate cattle grazing on a mix of cleared land and remnant vegetation.

Aquatic and riparian vegetation

Study reach positioned within remnant vegetation state mapped as RE 11.3.2/11.3.1, but reflective of RE 11.3.25 – '*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines'; riparian vegetation included woodland dominated by Queensland blue gum (*Eucalyptus tereticornis*), with occasional poplar box (*E. populnea*); sparse sub-canopy of brigalow (*Acacia harpophylla*), yellowwood (*Terminalia oblongata*), black tea tree (*Melaleuca bracteata*) and red bauhinia (*Lysiphyllum carronii*); sparse shrub layer of yellowwood, wilga (*Geijera parviflora*), scrub boonaree (*Alectryon diversifolius*), false sandalwood (*Eremophila mitchellii*) and *Acacia* spp.; ground layer of the upper bank dominated by green panic (*Megathyrsus maximus*)*, with abundant buffel grass (*Cenchrus ciliaris*)*, occasional black spear grass (*Heteropogon contortus*) and kangaroo grass (*Themeda triandra*); ground layer of the lower bank dominated by green panic*, with abundant forest bluegrass (*Bothriochloa bladhii*) and Noogoora burr (*Xanthium occidentale*)*. Occasional fringing semi-aquatic macrophytes, including common rush (*Juncus usitatus*) (little), umbrella canegrass (*Leptochloa digitata*) (little) and white eclipta (*Eclipta prostrata*) (little).

Erosion risk

Low – banks appeared to be moderately stable, and 50-79% of surfaces covered by vegetation, gravel or larger material.

Aquatic fauna, including breeding habitat

The waterway provides seasonal, opportunistic habitat for waterfowl and wader birds, fish and turtles. Unlikely habitat for platypus.

Endangered, Vulnerable, Near Threatened (EVNT), Special Least Concern (SLC), or Priority flora and fauna

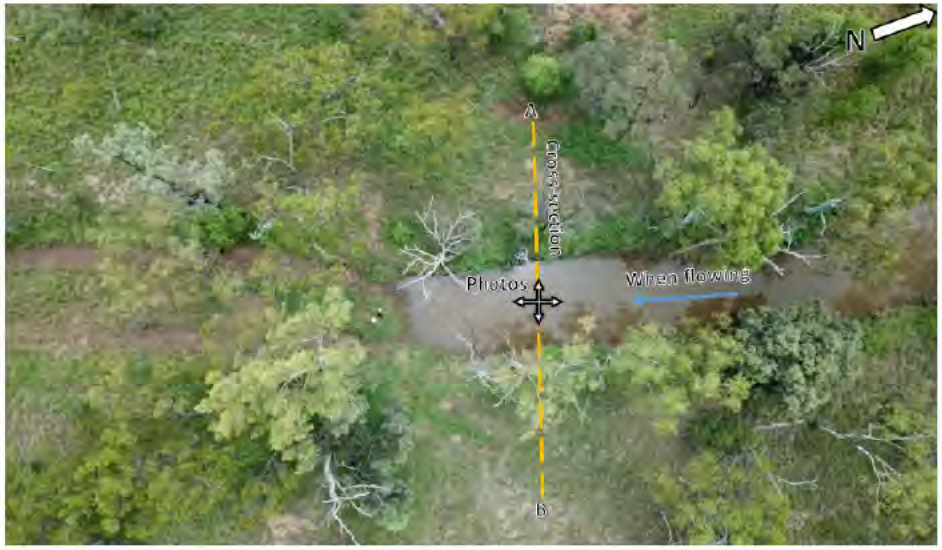
No EVNT, SLC or Priority aquatic flora or fauna species were detected at the time of the site visit (although no fauna survey effort undertaken). The Critically Endangered (EPBC Act) southern snapping turtle (*Elseya albagula*) and Vulnerable Fitzroy River turtle (*Rheodytes leukops*) are recorded from the Comet River drainage sub-basin (DES 2018). The waterway lacks habitat features suitable for these species.

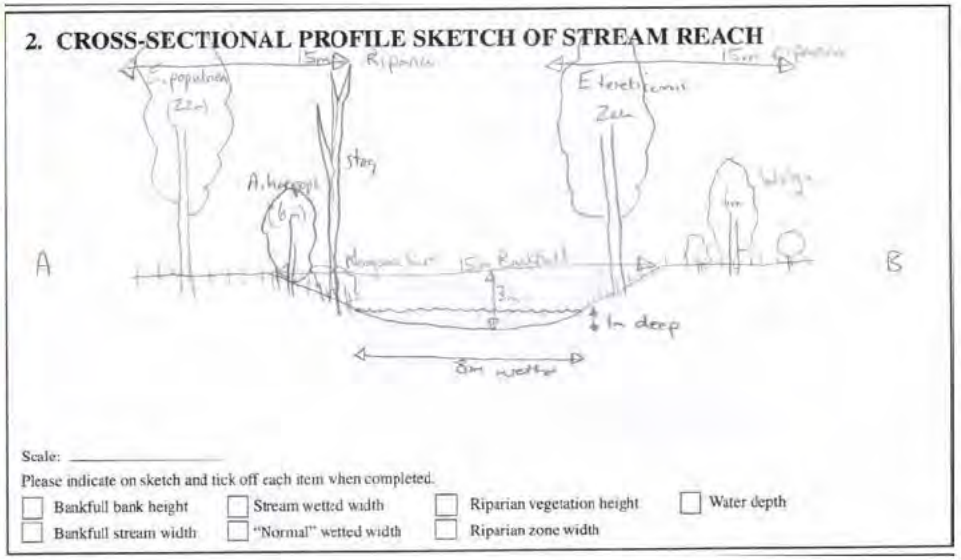
Physico-chemical water quality

Collection time: 11:30 EST; water temp.: 29.4˚C; specific conductivity: 130 µS/cm (fresh); turbidity: 87 NTU (moderate to poor clarity); dissolved oxygen: 62.7%, 4.79 (low); pH 7.01 (neutral). Summary: Normal (low DO likely influenced by a combination of shading, time of day, poor light penetration into turbid water, lack of flow, and oxygen consumption by aerobic bacteria).

Overall aquatic values

Low.





EPBC Act Protected Matters Report

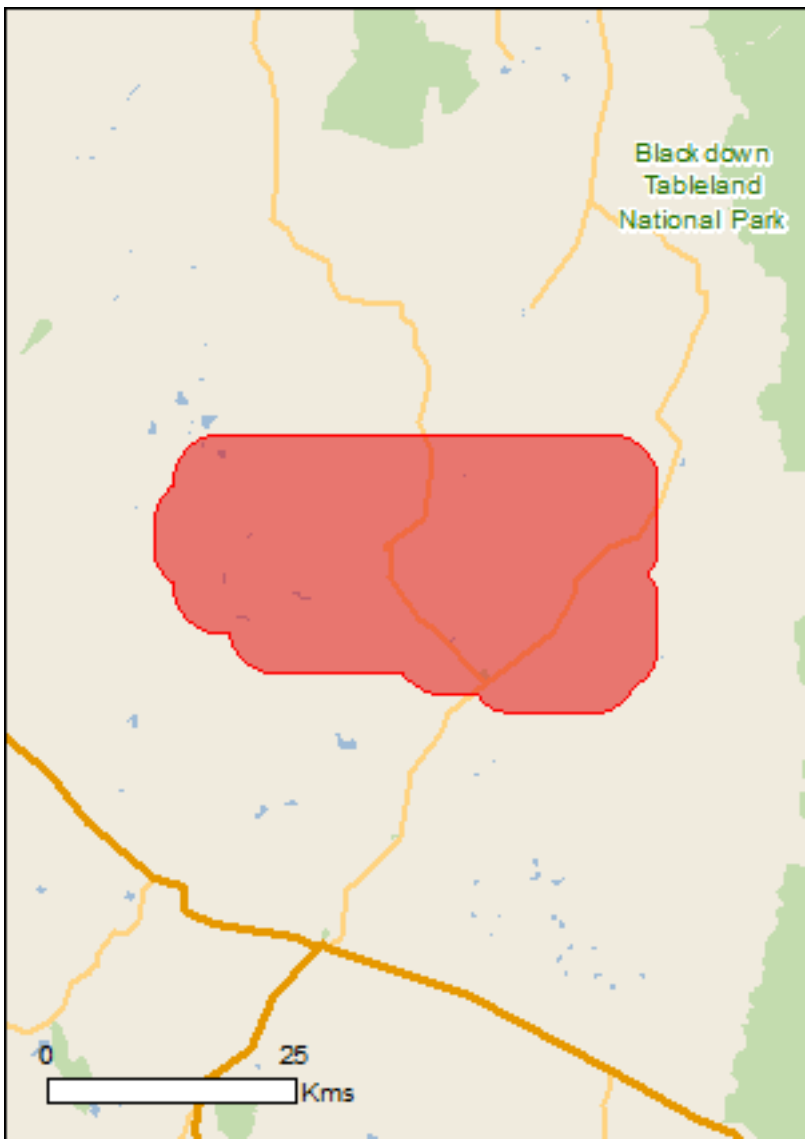
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

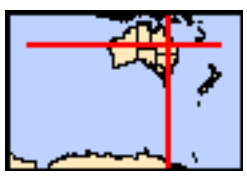
2019/8534 ERT 5 km 29/04/2020

Report created: 29/04/2020 06:09:27

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

Caveat
Acknowledgements





Summary

Matters of National Environment Significance

World Heritage Properties:	None
National Heritage Places:	None
Ramsar Wetlands:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Threatened Ecological Communities:	5
Threatened Species:	24
Migratory Species:	11

Other Matters Protected by the EPBC Act

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	17
Nationally Important Wetlands:	None
EPBC Act Referrals:	11
Key Ecological Features (Marine):	None

Details

Matters of National Environmental Significance

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.

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

Threatened Species [Resource Information]

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

Current Scientific Name	Status	Type of Presence
BIRD		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
MAMMAL		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within 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]	Vulnerable	Species or species habitat known to occur within area
PLANT		

Current Scientific Name	Status	Type of Presence
Aristida annua [17906]	Vulnerable	Species or species habitat may occur within area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat may occur within area
Marsdenia brevifolia [64585]	Vulnerable	Species or species habitat may occur within area
Solanum dissectum [75720]	Endangered	Species or species habitat may occur within area
REPTILE		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat likely to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat likely to occur within area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area

Migratory Species	[Resource Information]

Current Scientific Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion cristatus as Pandion haliaetus Eastern Osprey [82411]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Current Scientific Name	Threatened	Type of Presence
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area overfly marine area
Ardea modesta as Ardea alba Eastern Great Egret [82410]		Species or species habitat likely to occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area

Current Scientific Name	Threatened	Type of Presence
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area overfly marine area
Pandion cristatus as Pandion haliaetus Eastern Osprey [82411]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Humboldt National Park	QLD

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Bird		

Name	Status	Type of Presence
[Acridotheres tristis](#) Common Myna, Indian Myna [387]	Feral	Species or species habitat likely to occur within area
[Columba livia](#) Rock Pigeon, Rock Dove, Domestic Pigeon [803]	Feral	Species or species habitat likely to occur within area
[Passer domesticus](#) House Sparrow [405]	Feral	Species or species habitat likely to occur within area
Frog		
[Rhinella marina](#) Cane Toad [83218]	Feral	Species or species habitat known to occur within area
Mammal		
[Bos taurus](#) Domestic Cattle [16]	Feral	Species or species habitat likely to occur within area
[Canis familiaris listed as Canis lupus familiaris](#) Domestic Dog, Dingo [17]	Feral	Species or species habitat likely to occur within area
[Felis catus](#) Cat, House Cat, Domestic Cat [19]	Feral	Species or species habitat likely to occur within area
[Lepus capensis](#) Brown Hare [127]	Feral	Species or species habitat likely to occur within area
[Mus musculus](#) House Mouse [120]	Feral	Species or species habitat likely to occur within area
[Oryctolagus cuniculus](#) Rabbit, European Rabbit [128]	Feral	Species or species habitat likely to occur within area
[Sus scrofa](#) Pig [6]	Feral	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Vulpes vulpes Red Fox, Fox [18]	Feral	Species or species habitat likely to occur within area

Plant		
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]	WoNS	Species or species habitat likely to occur within area
Jatropha gossypiifolia listed as Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [89505]	WoNS	Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]	WoNS	Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]	WoNS	Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]	WoNS	Species or species habitat likely to occur within area

EPBC Act Referrals [Resource Information]

Further details about the referral is available in the Environmental Impact Assessment System (EIAS); click on the title to access.

Referral			
Title	Reference	Referral Outcome	Assessment Status
Arcturus Coal Project; A combined open cut and underground longwall coal mine	2010/5783	Controlled Action	Completed
Blackwater to Rolleston 132 kV transmission line	2002/880	Not Controlled Action (Particular Manner)	Post-Approval
Clearing of regrowth Brigalow	2003/962	Not Controlled Action (Particular Manner)	Post-Approval
Coal Seam Gas Field Development for Natural Gas Liquefaction Park, Curtis Island	2008/4059	Controlled Action	Post-Approval
Future Gas Supply Area Project	2012/6357	Controlled Action	Completed

Referral			
Title	Reference	Referral Outcome	Assessment Status
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Mahalo Development Area CSG Project	2019/8534	Referral Decision	Referral Publication
rail track to link the proposed MIM Rolleston coal mine to existing rail network	2002/637	Controlled Action	Post-Approval
Santos GLNG Gas Field Development Project, QLD	2012/6615	Controlled Action	Post-Approval
Springsure Creek Coal Project	2010/5782	Controlled Action	Post-Approval
ZeroGen Integrated Gasification Combined Cycle Power Plant and CO2 Capture, Transport and Storage	2009/5195	Controlled Action	Completed

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

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, Energy and Science, New South Wales
-Department of Environment, Land, Water and Planning, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Government of South Australia, Department for Environment and Water, South Australia
-Department of Environment and Natural Resources, Northern Territory
-Department of Environment and Science, Queensland
-Department of Biodiversity, Conservation and Attractions, Western Australia
-Environment, Planning and Sustainable Development Directorate, ACT
-Birdlife Australia
-Department of Environment and Energy, Australian Bird and Bat Banding Scheme
-CSIRO, Australian National Wildlife Collection
-Natural history museums of Australia
-Australian Museum
-Museums Victoria
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-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 of 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.

ATTACHMENT D

Listed threatened species and communities (s18 & 18A)

The Department's Environment Reporting Tool (ERT) identifies 24 threatened species and five threatened ecological communities (TECs) may occur within 5 km of the proposed action (see the ERT report dated 29 April 2020 at Attachment C). The ecological assessment undertaken by the proponent (Attachment A4-A6) identified a further three threatened species that may occur within the proposed action area. Based on the location of the action, likely habitat in the area of the proposed action and nature and scale of the action, the Department considers that impacts may arise in relation to the following:

Threatened ecological communities: Brigalow (Acacia harpophylla dominant and co-dominant) – Endangered; Natural grassland of the Queensland central highlands and northern Fitzroy Basin – Endangered; Poplar Box grassy woodland on alluvial plains – Endangered; Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions – Endangered; Weeping Myall woodlands – Endangered

Information about these TECs can be found in the Department's Species Profile and Threats database (SPRAT):

- Brigalow (*Acacia harpophylla* dominant and co-dominant): http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/showcommunity.pl?id=28
- Natural grassland of the Queensland central highlands and northern Fitzroy Basin: http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/showcommunity.pl?id=99
- Poplar Box grassy woodland on alluvial plains: http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/showcommunity.pl?id=141
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions: http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/showcommunity.pl?id=24
- Weeping Myall woodlands: http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/showcommunity.pl?id=98

Proposed action area

The ERT (Attachment C) identifies Brigalow (*Acacia harpophylla* dominant and co-dominant) as known to occur in the proposed action area, and the other four TECs as likely to occur in the proposed action area.

The proponent notes that Queensland regional ecosystem (RE) mapping indicates all five TECs as occurring within the proposed action area. The proponent undertook an ecological assessment of the proposed action area (Attachment A4), which confirmed the presence of three TECs within the proposed action area. Due to access issues, the proponent was not able to ground-truth mapped areas of the other two TECs, and therefore was not able to confirm their presence.

The proponent mapped areas of the five TECs within the proposed action area based on a combination of Queensland RE mapping and ground-truthing during ecological surveys (see Figure 8 of Attachment A4).

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments undertaken prior to disturbance to confirm and further refine the location of the TECs.

Potential impacts

The referral indicates that the proposed action does not involve clearing of TECs.

The Department considers that potential impacts resulting from the proposed action may include altered surface hydrology, erosion and sedimentation, introduction of weeds, and smothering by dust.

Potential impacts resulting from groundwater drawdown are discussed in relation to the water resource controlling provision below.

The proponent considers the proposed action will not impact on these TECs given the proposed avoidance, minimisation and mitigation measures discussed below.

Avoidance and mitigation measures

The proponent has committed to implementing a Constraints Protocol (Attachment B4), which outlines avoidance, minimisation and rehabilitation requirements. The Constraints Protocol (Attachment B4) requires the wells and infrastructure to be sited to avoid all direct disturbance to all TECs. This will be achieved through the following:

- Existing cleared areas and existing infrastructure such as access tracks will be utilised;
- Additional ecological assessments will be undertaken prior to disturbance to confirm and further refine the location of TECs;
- Proposed infrastructure locations will be relocated or modified to avoid disturbance to TECs;
- A five metre ‘buffer’ will be established around all avoidance areas to exclude significant disturbance to land adjacent to high constraint areas.

The referral indicates that these commitments are feasible through the use of horizontal drilling technology in the construction of gas wells and direction drilling of pipelines under TECs.

The proponent has also committed to implementing a Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20), which detail mitigation measures to manage other potential impacts. Relevant to the five TECs, the management plans include commitments to:

- Minimise and progressively reinstate disturbed land as soon as practicable following construction, minimise activities with potential to generate dust during windy periods and undertake dust suppression as required;
- Install and maintain noise attenuating devices on all equipment during construction to reduce noise;

- Use directional lighting and/or shroud lights to reduce light spillage;
- Implement a weed, pest and biosecurity management plan including compliance with obligations under the QLD Biosecurity Act 2014;
- Implement an erosion and sediment control plan during construction; and
- Maintain internal roads so that natural drainage patterns and catchments are changed as little as possible.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these TECs.

Threatened flora species: *Aristida annua* – Vulnerable; King Blue-grass (*Dichanthium queenslandicum*) – Endangered; Bluegrass (*Dichanthium setosum*) – Vulnerable; Ooline (*Cadellia pentastylis*) – Vulnerable; *Marsdenia brevifolia* – Vulnerable

Information about these species can be found in SPRAT:

- *Aristida annua*: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=17906
- King Blue-grass: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=5481
- Bluegrass: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14159
- Ooline: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=9828
- *Marsdenia brevifolia*: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64585

Proposed action area

The ERT (Attachment C) identifies that *Aristida annua*, King Blue-grass and Bluegrass or their habitat are likely to occur in the proposed action area and that Ooline and *Marsdenia brevifolia* or their habitat may occur in the proposed action area.

These species were not recorded during the proponent's ecological surveys, however the proponent's ecological assessment identified that the proposed action area supports areas of habitat for all five species' (Attachment A4).

The Department considers the proponent's definitions of habitat for these species align with the habitat descriptions in SPRAT.

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments prior to disturbance to confirm and further refine the location of the species' habitat and identify any individuals.

Potential impacts

The referral indicates that the proposed action does not involve clearing of Ooline and *Marsdenia brevifolia* habitat and does not involve clearing of *Aristida annua*, King Blue-grass and Bluegrass individuals.

The Department considers that potential impacts resulting from the proposed action may include altered surface hydrology, erosion and sedimentation, habitat clearing and fragmentation, edge effects, introduction of weeds, and smothering by dust.

Potential impacts of habitat degradation or loss resulting from groundwater drawdown are discussed in relation to the water resource controlling provision below.

The proponent states that the maximum footprint of the proposed action will be 500 ha (Attachment B2), that most of the proposed action will be undertaken in land previously cleared for agricultural activities and used for grazing, and that existing cleared areas and infrastructure such as tracks will be utilised (Attachment B4).

The referral indicates that the proposed action will disturb habitat for *Aristida annua*, King Blue-grass and Bluegrass but considers the impacts will not be significant given the vast local and regional extent of habitat for the species and the species' utilisation of disturbed areas as habitat.

The proponent considers the proposed action will not impact on Ooline and *Marsdenia brevifolia* given the proposed avoidance, minimisation and mitigation measures discussed below.

Avoidance and mitigation measures

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires the wells and infrastructure to be sited to avoid all direct disturbance to all Ooline and *Marsdenia brevifolia* habitat and all *Aristida annua*, King Blue-grass and Bluegrass individuals.

The Constraints Protocol requires that disturbance is minimised in all areas of *Aristida annua*, King Blue-grass and Bluegrass habitat. This is because these three species have a broad habitat extent within the proposed action area.

The Department considers the management measures outlined above in relation to TECs are relevant to mitigating other impacts to these species. In addition, the management plans include specific commitments for these species, including:

- Progressive rehabilitation including reinstatement of soils; and
- Preclearance surveys will be undertaken for populations of Ooline and *Marsdenia brevifolia* and project infrastructure will avoid disturbance to identified populations.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these species.

Squatter Pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable

Information about the species can be found in SPRAT at:
http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440

Proposed action area

The ERT (Attachment C) identifies that the Squatter Pigeon or its habitat is likely to occur in the proposed action area.

The species was not recorded during the proponent's ecological surveys, however the proponent's ecological assessment identified that the proposed action area supports large areas of breeding and non-breeding habitat for the species' (Attachment A4).

The Department considers the proponent's definition of habitat for this species aligns with the habitat descriptions in SPRAT.

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments prior to disturbance to confirm and further refine the location of the species' habitat.

Potential impacts

The referral indicates that the proposed action does not involve clearing of Squatter Pigeon breeding habitat.

The Department considers that potential impacts resulting from the proposed action may include non-breeding habitat clearing and fragmentation, edge effects, introduction of weeds and feral predators, noise and dust disturbance and individual mortality from vehicle strike.

The referral indicates that the proposed action will disturb non-breeding habitat for the Squatter Pigeon but considers the impacts will not be significant given the vast local and regional extent of habitat for the species and the species' utilisation of disturbed areas as habitat.

Avoidance and mitigation measures

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires the wells and infrastructure to be sited to avoid all direct disturbance to all Squatter Pigeon breeding habitat, and that disturbance is minimised in all areas of Squatter Pigeon non-breeding habitat. This is because of the broad extent of non-breeding habitat within the proposed action area.

The Department considers the management measures outlined above in relation to other listed threatened species and communities are relevant to mitigating other impacts to the Squatter Pigeon.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on this species.

Southern Black-throated Finch (*Poephila cincta cincta*) – Endangered; Star Finch (*Neochmia ruficauda*) – Endangered

Information about the species can be found in SPRAT:

- Southern Black-throated Finch: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64447

- Star Finch: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26027

Proposed action area

Both species were identified by the proponent as unlikely to occur within the proposed action area due to a lack of suitable habitat (Attachment A5). However, the Department notes that the proposed action area as described in the referral (Attachment A1) and ecological assessment (Attachment A4-A6) includes vegetation types that align with the description of the species' habitats in SPRAT. Noting this and given the large area of the project site and limitations of the proponent's field surveys (as outlined in Attachment A4 and Attachment A6), the Department considers that these species or their habitat may occur within the proposed action area.

Potential impacts

The Department considers that potential impacts resulting from the proposed action may include habitat degradation or loss from groundwater drawdown, habitat clearing and fragmentation, edge effects, introduction of weeds and feral predators, noise and dust disturbance and individual mortality from vehicle strike.

Avoidance and mitigation measures

These species are not included in the Constraints Protocol, and hence no commitments have been made by the proponent to avoid or minimise impacts to the species' habitat.

However, the Department considers the management measures outlined in the Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20) are relevant to managing impacts to the Southern Black-throated Finch and Star Finch.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these species.

Painted Honeyeater (*Grantiella picta*) – Vulnerable

Information about the species can be found in SPRAT at:
https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=470

Proposed action area

The ERT (Attachment C) identifies that the Painted Honeyeater or its habitat may occur in the proposed action area.

This species was not recorded during the proponent's ecological surveys, however the proponent's ecological assessment identified that the proposed action area supports areas of habitat for the species (Attachment A4).

The Department considers the proponent's definition of habitat for this species aligns with the habitat descriptions in SPRAT.

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments prior to disturbance to confirm and further refine the location of the species' habitat.

Potential impacts

The referral indicates that the proposed action does not involve clearing of Painted Honeyeater habitat.

The Department considers that potential impacts resulting from the proposed action may include introduction of weeds and feral predators, noise and dust disturbance and individual mortality from vehicle strike.

Potential impacts of habitat degradation or loss resulting from groundwater drawdown are discussed in relation to the water resource controlling provision below.

The proponent considers the proposed action will not impact on the Painted Honeyeater given the proposed avoidance, minimisation and mitigation measures discussed below.

Avoidance and mitigation measures

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires the wells and infrastructure to be sited to avoid all direct disturbance to all Painted Honeyeater habitat.

The Department considers the management measures outlined above in relation to other listed threatened species and communities are relevant to mitigating other impacts to the Painted Honeyeater. In addition, the management plans include a commitment to undertake regular and ongoing monitoring to ensure the effectiveness of mitigation measures to avoid impacts to the species.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these species.

Brigalow belt reptiles: Ornamental Snake (*Denisonia maculata*) – Vulnerable; Dunmall's Snake (*Furina dunmalli*) – Vulnerable; Yakka Skink (*Egernia rugosa*) – Vulnerable; Collared Delma (*Delma torquata*) – Vulnerable

Information about the species can be found in SPRAT:

- Ornamental Snake: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1193
- Dunmall's Snake: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254
- Yakka Skink: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420
- Collared Delma: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656

Proposed action area

The ERT (Attachment C) identifies that the Ornamental Snake and Yakka Skink or their habitats are likely to occur in the proposed action area and the Collared Delma or its habitat

may occur in the proposed action area. The ERT did not identify the Dunmall's Snake as potentially occurring in the proposed action area, however the proponent identified potential habitat for the species within the proposed action area (Attachment A4).

Twelve Ornamental Snakes were recorded during targeted field surveys undertaken by the proponent at 15 locations within areas identified as suitable habitat for the Ornamental Snake across the proposed action area over three days and nights in March 2018. The proponent used aerial imagery and gilgai mapping from the Queensland Government Department of Environment and Science (DES) to map areas of gilgai in the proposed action area.

The Dunmall's Snake, Yakka Skink and Collared Delma were not recorded during the proponent's ecological surveys but the ecological assessment identified that the proposed action area contains Dunmall's Snake and Yakka Skink habitat (Attachment A4).

The Collared Delma was identified as unlikely to occur within the proposed action area due to a lack of suitable habitat (Attachment A5). However, the Department notes that the proposed action area as described in the referral (Attachment A1) and ecological assessment (Attachment A4-A6) includes vegetation types that align with the description of the species' habitat in SPRAT. Noting this and given the large area of the project site and limitations of the proponent's field surveys (as outlined in Attachment A4 and Attachment A6), the Department considers that the Collared Delma species or its habitat may occur within the proposed action area.

The Department considers the proponent's definitions of habitat for these species align with the habitat descriptions in SPRAT.

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments prior to disturbance to confirm and further refine the location of the species' habitat.

Potential impacts

The referral indicates that the proposed action does not involve clearing of Ornamental Snake, Dunmall's Snake and Yakka Skink habitat.

The Department considers that potential impacts resulting from the proposed action may include habitat degradation or loss from groundwater drawdown, altered surface hydrology, habitat clearing and fragmentation, edge effects, introduction of weeds and feral predators, noise and dust disturbance and individual mortality from trench construction activities and vehicle strike.

Potential impacts of habitat degradation or loss resulting from groundwater drawdown are discussed in relation to the water resource controlling provision below.

The proponent considers the proposed action will not impact on these species given the proposed avoidance, minimisation and mitigation measures discussed below.

Avoidance and mitigation measures

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires the wells and infrastructure to be sited to avoid all direct disturbance to all Ornamental Snake, Dunmall's Snake and Yakka Skink habitat. The Collared Delma is not included in the Constraints Protocol, and hence no specific commitments have been made by the proponent to avoid or minimise impacts to the species' habitat. However, the Department notes that there is considerable overlap between Collared Delma habitat and other listed threatened species that are covered by the constraints protocol, and therefore considers that impacts to habitat for the species, if it occurs, are likely to be avoided or minimised.

The Department considers the management measures outlined above in relation to other listed threatened species and communities are relevant to mitigating other impacts to these reptile species. In addition, the management plans include specific commitments for these species, including:

- Manage potential mortality during construction activities by:
    - Minimising the length of open pipeline trench and progressively backfilling following pipeline construction;
    - Installing fauna egress devices in all excavations left open overnight;
    - Inspecting excavations and trenches daily and prior to backfilling, and relocating any fauna;
    - Plugging open ends of pipeline sections at the end of each day to prevent the ingress of fauna; and
    - Laying out pipeline sections with gaps to allow for fauna movement;
- Undertake regular and ongoing monitoring to ensure the effectiveness of mitigation measures to avoid impacts to the Ornamental Snake, Dunmall's Snake and Yakka Skink.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these species.

Corben's Long-eared Bat (*Nycotophilus corbeni*) – Vulnerable

Information about the species can be found in SPRAT at:
http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83395

Proposed action area

The ERT (Attachment C) identifies that the species or its habitat may occur in the proposed action area.

This species was not recorded during the proponent's ecological surveys, however the proponent's ecological assessment identified that the proposed action area supports areas of habitat for the species (Attachment A4).

The Department considers the proponent's definition of habitat for this species aligns with the habitat description in SPRAT.

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments prior to disturbance to confirm and further refine the location of the species' habitat.

Potential impacts

The referral indicates that the proposed action does not involve clearing of Corben's Long-eared bat habitat.

The Department considers that potential impacts resulting from the proposed action may include introduction of weeds and feral predators, noise and dust disturbance.

The proponent considers the proposed action will not impact on the Corben's Long-eared Bat given the proposed avoidance, minimisation and mitigation measures discussed below.

Avoidance and mitigation measures

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires the wells and infrastructure to be sited to avoid all direct disturbance to all Corben's Long-eared Bat habitat. The Department considers the management measures outlined above in relation to other listed threatened species and communities are relevant to mitigating other impacts to the Corben's Long-eared Bat. In addition, the management plans include a commitment to undertake regular and ongoing monitoring to ensure the effectiveness of mitigation measures to avoid impacts to the species.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these species.

Greater Glider (*Petauroides volans*) – Vulnerable; Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (*Phascolarctos cinereus*) – Vulnerable

Information about the species can be found in SPRAT:

- Greater Glider: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=254
- Koala: http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/showspecies.pl?taxon_id=85104

Proposed action area

The Department's ERT (Attachment C) identifies that the Greater Glider or its habitat may occur in the proposed action area and that the Koala or its habitat is known to occur in the proposed action area.

The Greater Glider was not recorded during the proponent's ecological surveys, however the proponent's ecological assessment identified that the proposed action area supports areas of habitat for the species (Attachment A4).

The proponent's ecological assessment (Attachment A4) confirmed that Koalas occur in the proposed action area through scats and anecdotal evidence, as well as from historical records within the proposed action area. The proponent's ecological assessment identified that the proposed action area supports areas of habitat for the species, including habitat

critical to the survival of the species as described in the Department's Referral Guidelines for the Koala.

The Department considers the proponent's definitions of habitat for these species align with the habitat descriptions in SPRAT.

The Department notes that the Constraints Protocol (Attachment B4) includes a commitment to undertake additional ecological assessments prior to disturbance to confirm and further refine the location of the species' habitat.

Potential impacts

The referral indicates that the proposed action does not involve clearing of Greater Glider or Koala habitat.

The Department considers that potential impacts resulting from the proposed action may include habitat degradation or loss from groundwater drawdown, introduction of weeds and feral predators, noise and dust disturbance and individual mortality from vehicle strike.

Potential impacts of habitat degradation or loss resulting from groundwater drawdown are discussed in relation to the water resource controlling provision below.

The proponent considers the proposed action will not impact on the Greater Glider or Koala given the proposed avoidance, minimisation and mitigation measures discussed below.

Avoidance and mitigation measures

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires the wells and infrastructure to be sited to avoid all direct disturbance to all Greater Glider and Koala habitat. The Department considers the management measures outlined above in relation to other listed threatened species and communities are relevant to mitigating other impacts to the Greater Glider and Koala. In addition, the management plans include specific commitments for these species, including:

- Prohibition of keeping domestic animals within the proposed action area and surrounds by personnel employed for the proposed action;
- Manage potential mortality from vehicle strike by:
    - Implementing enforceable operational speed limits shall be set to 60 km/h at all times, especially on access tracks;
    - Vehicle movements predominantly during daylight hours; and
    - Installation of road signage to alert drivers to the fact that Koalas may cross the roadway in the area;
- Specific measures for the Greater Glider:
    - Avoid using barbed wire when fencing project infrastructure;
    - Preferentially position infrastructure in areas of non-remnant vegetation to avoid a significant increase in tree hollow competition from Cockatoos and Powerful Owls;

- Undertake regular and ongoing monitoring to ensure the effectiveness of mitigation measures to avoid impacts to the Greater Glider and Koala.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on these species.

Other listed species

The Department's ERT identifies the potential presence of additional threatened species and communities within five kilometres of the proposed action area (Attachment C). Based on the location of the action, likely habitat in the area of the proposed action and nature and scale of the action, the Department considers that the proposed action is unlikely to have significant impacts on other species and communities.

Conclusion

Based on information available to the Department, such as SPRAT and information from the referral documentation, given the avoidance, minimisation and mitigation measures the proponent has committed to implementing, and having considered the Department's Significant Impact Guidelines 1.1, the Department considers that significant impacts are not likely to arise in relation to listed threatened species and communities.

For these reasons the Department considers sections 18 and 18A are not controlling provisions for the proposed action.

Listed migratory species (s20 & 20A)

The Department's ERT identifies 11 migratory species may occur within five kilometres of the proposed action (see the ERT report dated 29 April 2020 at Attachment C).

An ecological assessment undertaken by the proponent (Attachment A4-A6) identified suitable habitat for the following species within the proposed action area:

- Common Sandpiper (*Actitis hypoleucos*);
- Fork-tailed Swift (*Apus pacificus*);
- Sharp-tailed Sandpiper (*Calidris acuminata*);
- Pectoral Sandpiper (*Calidris melanotos*);
- Oriental Cuckoo (*Cuculus optatus*);
- Latham's Snipe (*Gallinago hardwickii*);
- Yellow Wagtail (*Motacilla flava*); and
- Satin Flycatcher (*Myiagra cyanoleuca*).

The referral states that only migratory species was recorded during the proponent's field surveys (identified as the Latham's Snipe in the proponent's ecological assessment report at Attachment A4). However, the proponent's field survey records (Attachment A5) indicate that the Fork-tailed Swift, White-throated Needletail and Satin Flycatcher were also observed within the proposed action area.

Given the availability of suitable habitats as described in the ecological assessment (Attachment A4-A6), the large extent of the proposed action area and the widespread nature

of these species, the Department considers that other migratory bird species including those identified above may also occasionally occur within the proposed action area.

The proponent states that the maximum footprint of the proposed action will be 500 ha (Attachment B2), that most of the proposed action will be undertaken in land previously cleared for agricultural activities and used for grazing, and that existing cleared areas and infrastructure such as tracks will be utilised.

As discussed above, the proponent has committed to implementing a Constraints Protocol (Attachment B4), Significant Species Management Plan (Attachment A18), Rehabilitation Management Plan (Attachment A19) and Environmental Management Plan (Attachment A20).

The Constraints Protocol requires that disturbance is minimised in all areas of habitat for species with a very broad 'general' habitat extent within the proposed action area, including the listed migratory bird species identified above. Relevant to these species, this will include minimising the disturbance footprint of the proposed action and excluding non-linear infrastructure from watercourses.

The Department considers that the proposed avoidance, minimisation and mitigation measures, as well as the proponent's obligations under other legislation, will be sufficient to manage the potential impacts of the proposed action on listed migratory bird species and habitat that may occur within the proposed action area. In addition, the Department considers that there is no evidence to indicate that the proposed action area is an area of important habitat for any of these species, or that the proposed action area contains an ecologically significant proportion of the population of any of these species.

Conclusion

Based on information available to the Department, such as SPRAT and information from the referral documentation, given the avoidance, minimisation and mitigation measures the proponent has committed to implementing, and having considered the Department's Significant Impact Guidelines 1.1, the Department considers that significant impacts are not likely to arise in relation to listed migratory species.

For these reasons the Department considers sections 20 and 20A are not controlling provisions for the proposed action.

A water resource, in relation to a large coal mining development or coal seam gas development (s24D & 24E)

Information provided in the referral

Water quality

The referral states that the proposed action will not impact surface water quality as it does not include abstraction from or discharges to surface waters. The referral states the proposed action would not impact local groundwater quality as hydraulic stimulation does not form part of the action, and all production wells will be designed, constructed and abandoned in accordance with the Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland.

The referral states that the proposed action will not cause chemicals or other potentially harmful substances to accumulate in the environment as:

- Any water treatment by-products generated by the proposed action will be removed from the proposed action area and sent to a facility licenced to receive the waste under the *Environmental Protection Act 1994* (Qld).
- Fuel and chemicals used during drilling and operations will be stored and handled in accordance with the relevant Australian Standards and regulatory requirements.
- Produced water would be exclusively beneficially used in accordance with the Mahalo Environmental Authority and the approvals under the *Waste Reduction and Recycling Act 2014* (Qld) including irrigation water quality limits in accordance with the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines.

Surface water

The referral states that the proposed action will not significantly change the existing flow regime within the proposed action area or surrounds as the proposed action does not include any abstraction of surface water or discharges to surface waters, is not predicted to reduce the baseflow of any watercourses or springs, and does not include significant diversion or interception of existing surface water runoff contributing to streamflow.

Groundwater

The referral states that produced water extraction for the proposed action is limited to the coal seams of the Bandanna Formation. In order to produce gas, the formation pressure must be reduced, which as a result may induce groundwater flow into the coal formation from overlying or underlying formations.

The referral states that the drawdown impacts of produced water extraction from the Bandanna Formation within the proposed action area was modelled by the Office of Groundwater Impact Assessment (OGIA) using their numerical groundwater model for the 2019 Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area (CMA), and that the results of this modelling were used to determine the extent and magnitude of potential groundwater drawdown impacts resulting from the proposed action. The referral states that local scale conceptualisation and uncertainty analysis was undertaken to validate the OGIA model.

The referral states that modelling predicted a groundwater level decline in the Bandanna Formation, Rewan Group and underlying Permian units as a result of gas production for the proposed action.

The referral states that four groundwater bores will experience drawdown in exceedance of the *Water Act 2000* (Qld) bore impact thresholds. The referral notes that any impacts on these bores would be subject to ‘make good’ arrangements under the Water Act 2000 (Qld).

The referral states that groundwater and surface water interactions are unlikely to be affected as the watercourses in the proposed action area are not considered to receive baseflow from groundwater. The referral also states that no exceedance of the *Water Act 2000* (Qld) impact threshold for spring complexes and watercourse springs is predicted within the proposed action area.

Groundwater dependent ecosystems (GDEs)

The referral states that it is unlikely that subterranean fauna will be impacted by the proposed action as no drawdown is predicted in the alluvium or basalt aquifers and the predicted drawdown within the Cenozoic sediments is negligible.

The referral states that potential terrestrial GDEs are mapped within the proposed action area as occurring adjacent to select watercourses, which are potentially reliant on groundwater within the alluvium and in areas where Cenozoic sediments are present. The referral states that groundwater modelling predicts a maximum of 0.3 m drawdown within these shallow groundwater units in the area underlying the potential GDEs. The referral states that based on groundwater level records for this area as well as the potential GDEs classified as 'low confidence', the water table is considered too deep (greater than ~30 m) for the vegetation roots to reach and therefore has very limited potential to be impacted.

Advice from the Office of Water Science

On 28 October 2019 the Department's Office of Water Science (OWS) provided advice on the referral (Attachment E1), noting that:

- OWS agrees with the proponent that there are unlikely to be impacts:
    - On spring complexes located 12 km and 50 km away;
    - On known subterranean fauna (however OWS notes that without further information no conclusive determination can be made);
    - From subsidence;
    - From from drilling fluids and muds.
- If standard operational procedures are maintained there is little risk to water resources from the construction activities.
- It is highly unlikely that there will be any interaction with drawdown between the proposed action and the nearby Rolleston and Blackwater mines.
- The OGIA groundwater model is a regional scale model, hence it is limited in its ability to predict impacts at the local scale. However, this limitation is more for the level of impact (i.e. the amount of drawdown) than for the area where impacts will occur.
- As part of the groundwater modelling OGIA ran a series of uncertainty analysis scenarios. While not replacing the need for local scale data or modelling, conducting an uncertainty analysis does provide a level of confidence that local scale differences in hydraulic parameters have been considered when assessing groundwater impacts.
- There is a lack of groundwater monitoring for any geological unit in the project area. There are large variations in groundwater levels in the various alluvial units and Cenozoic sediments and this data is intermittent, spread over a number of years and cannot be considered to provide a time series.
- The groundwater modelling indicates a small area of drawdown in the surficial layers, particularly in the area of Humboldt Creek. The predicted groundwater drawdown in the Alluvium, Cenozoic and Basalt indicates up to 1 m of drawdown in the central

north of the project area. The 95th percentile uncertainty analysis scenario indicates that drawdown may increase to 2 m.

Additional information

The Department discussed with the proponent the concerns raised by the OWS regarding limitations of the groundwater monitoring and modelling, and that these issues reduce the certainty with which potential impacts on water resources could be determined.

On 13 January 2020 the proponent provided additional information to clarify the questions raised by the Department and a technical memorandum to further support their conclusions that the proposed action will not have a significant impact on water resources (Attachment B1-B4). The OWS reviewed this additional information and provided advice on 17 January 2020 (Attachment E2) that indicated some concerns raised had not been adequately addressed. The Department communicated this to the proponent via email and teleconference discussions, highlighting that information relevant to possible impacts on GDEs was of particular concern.

On 8 April 2020 the proponent provided a supplementary report providing additional information and analysis around the potential impacts of the proposed action on GDEs as a result of drawdown (Attachment B5-B6). The report concludes that the proposed action will not have impacts on GDEs as the vegetation in the two areas where drawdown is predicted (Northern Drawdown Area and Shotover Creek) is unlikely to be groundwater dependent. This is based on the proponent's conclusion that the watertable in the Northern Drawdown Area and Shotover Creek area is deeper than the rooting depth of the vegetation within those areas.

The OWS reviewed this report and provided advice on 28 April 2020 (Attachment E3), which indicates that while the information provided suggests that the Northern Drawdown Area is unlikely to be a GDE, the information is not sufficient to support the proponent's assertion that the vegetation around Shotover Creek is not a GDE.

The OWS advice indicates that based on the available information, the watertable in the Shotover Creek area could be approximately 15 m deep. In this case the groundwater would likely only be available to some vegetation and the watertable may be close to the limit of the rooting depth of that vegetation. However, the OWS notes that should this be the case then the predicted drawdown may result in groundwater becoming inaccessible to that vegetation.

The OWS advice (Attachment E3) indicates that if the vegetation around Shotover Creek is groundwater dependent possible impacts could include reduced condition and potential loss of vegetation which utilises groundwater. If bank vegetation were lost, erosion could occur or increase. In addition, the OWS notes that if the pool identified on Shotover Creek is at least partially sustained by groundwater discharge then persistence of this pool could be reduced and potential refuge habitat for aquatic fauna lost due to drawdown.

Conclusion on impacts on GDEs

The Department considers that the additional information provided by the proponent (Attachment B1-B6) clarifies many of the concerns raised by the OWS regarding the limitations of the groundwater monitoring and modelling, and that this reduces the uncertainty around the potential impacts on water resources.

The Department notes the potential extent of the impact is limited to the riparian vegetation around Shotover Creek. However, this area of riparian vegetation is spatially limited and is likely to be in poor condition due to the prevalence of invasive species and impacts from cattle.

The referral indicates that Shotover Creek is ephemeral with flow only occurring for brief periods following rainfall. The Department notes this flow regime is consistent with limited discharge of groundwater to the creek.

The Department notes that this area of riparian vegetation includes vegetation mapped by the proponent as Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC and Weeping Myall woodlands TEC as well as Koala, Greater Glider, Yakka Skink, Painted Honeyeater and Ooline habitat. Under the Constraints Protocol (Attachment B4) this vegetation will not be directly impacted through disturbance.

The Department notes that no changes to the surface water regime are predicted as a result of the proposed action, so any changes to water availability for the riparian vegetation would result from groundwater drawdown alone.

The Department notes that the magnitude of the impact is relatively small (<1 m drawdown at the 95th percentile and no impact at the 50th percentile).

Based on the information available, the Department considers that the depth to the water table at Shotover Creek is likely to be greater than 15 m, however this cannot be confirmed without site specific data. If the water table is 15 m below ground level or greater, only a limited number of trees would be able to access and use the groundwater.

Therefore, the Department considers the only impact to the riparian vegetation that may occur is through a small amount of groundwater drawdown. While this drawdown could reduce water availability for some large trees in the area of riparian vegetation around Shotover Creek, it is unlikely that groundwater is the main source of water for much of the riparian vegetation and potentially impacted riparian vegetation is likely to be able to adapt to the small possible changes.

Given this, the Department considers it is unlikely that groundwater drawdown resulting from the proposed action will result in reduced condition or loss of GDEs.

Conclusion

Based on information available to the Department, including the information from the referral documentation, additional supporting information and advice from the OWS, and considering the Department's Significant Impact Guidelines 1.3, the Department considers that significant impacts are not likely to arise in relation to a water resource in relation to a coal seam gas development.

For these reasons the Department considers sections 24D and 24E are not controlling provisions for the proposed action.

OFFICE OF WATER SCIENCE ADVICE
MAHALO DEVELOPMENT AREA

FOI 200511
Document 10

Requesting section	Queensland Assessments North	**Requesting officer**	s22
Date of request	10/10/2019		
EPBC reference	EPBC 2019-8534	**OWS reference**	OWS 2019-052
Project assessment stage	Referral		
OWS contact officer	s22		
Cleared by	s22 Director / Senior Principal Research Scientist	**Date of Advice**	28/10/2019

The OWS provides technical advice for internal Departmental decision making and briefing purposes only. OWS advice should not be forwarded directly to external parties in the format provided. Please contact the OWS before providing the advice directly to an external source. The OWS does not speak for, and our response has not been endorsed by, the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development.

This document, prepared at the request of the Environmental Assessments Division outlines the Office of Water Science's (OWS) technical advice on the Mahalo Development Area project.

The project is located approximately 30km north of the township of Rolleston. The gas target for the project is within the Bandanna Formation part of the Permo-Triassic Bowen Basin.

Gas production activities are planned to commence in 2021. The project will involve the progressive development of gas infrastructure including:

- 95 gas production wells;
- ancillary linear infrastructure including gas and water pipelines, access tracks, power lines, and communication lines;
- gas compression facilities;
- water management infrastructure; and
- other ancillary activities and facilities to support gas field development.

OWS has not considered potential cumulative impacts from any further developments in this region as the scale and nature of those extensions is unknown.

Q1. What does the OWS consider are the likely nature and extent of impacts on water resources posed by the proposed action?

1. It is predicted that the cumulative project water production, after 25 years, is 3.4 GL with peak production in Year 3 (2024) of 772 ML or approximately 2 ML/day (KCB 2019 Appendix B1, p. 26 and Figures 3.1 and 3.2).

    a. The groundwater modelling was done by the Queensland Office of Groundwater Impact Assessment (OGIA) with the water production calculated by comparing with and without Mahalo development scenarios (KCB 2019, p. 106).

        i. This project was **not** included in the 2019 OGIA Underground Water Impact Report (UWIR), OGIA completed additional modelling specifically for this project (KCB 2019, p. 106).

    b. Over the last 3 years CSG water production in the Surat Cumulative Management Area has been approximately 60,000 ML/year (OGIA 2019). The addition of this project would increase water production by approximately 1.3% by Year 3 (2024) with a significant decline in Year 4 – to approximately 0.8%.

        i. It is important to note that this water production does not come from the aquifers of the Great Artesian Basin as the Bandanna Formation is part of the Bowen Basin.

        ii. Groundwater from the Bandanna Formation is considered brackish with a median Total Dissolved Solids (TDS) of 1577 parts per million (ppm) for the formation generally and 4437 ppm for the coal seams (KCB 2019, Table 7.4). *Please note the TDS is assumed to be ppm, which is standard, as no units are presented*.

    c. The known groundwater users are shown in Figure 7.32 (KCB 2019). Within the project areas the primary aquifers utilised are from the Comet River alluvium and the basalt.

        i. It is important to note that the OGIA groundwater model is a regional scale model hence it is limited in its ability to predict impacts at the local scale. However this limitation is more so for the level of impact (i.e. the amount of drawdown) and not so much for the area where impacts will occur. The uncertainty analysis that was conducted also assists with this regional versus local impact issue to some degree.

        ii. The predicted groundwater drawdown in Layer 1 (Alluvium, Cenozoic and Basalt) indicates up to 1 m of drawdown in the central north of the project area. There is one bore in the alluvium (though this seems unlikely given its location) and one in the basalt with drawdown predicted to occur from 2051. The 95th percentile uncertainty analysis scenario (KCB 2019, Appendix VI, Figure VI-1) indicates that drawdown may increase to 2 m but this would still be below any 'make good' provisions.

        iii. No impacts are predicted in the Moolayember Formation and Clematis Sandstone (KCB 2019, Figure III-2 and III-3).

    d. It is predicted that the impact to four landholder stock and domestic bores will be above the trigger threshold of 5 m. These are all screened in the Bandanna Formation (KCB 2019, Appendix B1, p. 113). From the uncertainty analysis this increases to seven bores under the 95th percentile scenario, presumably in the Bandanna

Formation as well. The impacts to these bores will be addressed through 'make-good' provisions.

   i. Figure 9.1 (KCB 2019, Appendix B1, p. 114) shows the four impacted bores. The distribution of these impacted bores is interesting and no explanation is provided as to why the other bores completed in the Bandanna Formation, and in close proximity, are not impacted.

2. As part of the groundwater modelling OGIA ran a series of uncertainty analysis scenarios. While not replacing the need for local scale data or modelling, conducting an uncertainty analysis does provide a level of confidence that local scale differences in hydraulic parameters have been considered when assessing groundwater impacts.

   a. Site-specific data is presented for the Bandanna Formation (KCB 2019, Table 7.2) and OGIA as part of their overall assessment and analytic processes have compiled local-scale data for the project area (KCB 2019, Table 7.3).

3. OWS notes the lack of groundwater monitoring, for any geological unit, in the project area. Given this is a new area the proponent will need to comply with the obligations of the Surat CMA Water Monitoring Strategy (WMS) (APLNG 2019?).

   a. While this situation is not ideal i.e. it would be preferable to have current monitoring of all geological units in place to establish a baseline, the WMS will stipulate the type of monitoring bore (e.g. nested or stand-alone), target aquifers, frequency and type of measurement (level and chemistry).

4. The project does not include any discharge of co-produced water, abstraction of surface water or any diversions (KCB 2019, Appendix B1, p. 112).

   a. The co-produced water will be used for operational purposes or for beneficial use after treatment. If standard operational procedures are maintained there is little risk to water resources from the use of co-produced water.

   b. However, as identified by the IESC on numerous occasions, there is still no co-ordinated plan for the long term storage of the brine resulting from the treatment of the co-produced water. This remains an ongoing, unresolved, long-term environmental legacy and as such a persistent risk to water resources.

5. OWS agrees with the proponent that there will be no impact on spring complexes located 12 and 50km away.

   a. The Springwood complex, 12km to the southwest is sourced from the basalt (KCB 2019, p. 88). There are no predicted impacts to the basalt in this area, including under the uncertainty analysis scenarios.

   b. The spring complexes to the east are sourced from the Clematis Sandstone (KCB 2019, p. 88). The groundwater modelling predicts no impacts to the Clematis Sandstone.

6. In terms of impacts on surface water-groundwater connectivity, as discussed in paragraph 1cii, the groundwater modelling does indicate a small area of drawdown in the surficial layers (KCB 2019, Figure 8.3), particularly in the area of Humboldt Creek. OWS notes that the proponent is using the 2019 UWIR methodology (KCB 2019, p. 115) and categorising the risks as low. While OWS tends to agree with this assessment it is not clear from the

monitoring strategy how any changes to these predictions will be identified and any mitigation, if required, will be applied.

a. OWS also notes the large variations in groundwater levels in the various alluvial units and that this data is intermittent, spread over a number of years and cannot in anyway be considered to provide a time series. There are similar issues with the Cenozoic sediments (no monitoring in project area). The groundwater level data in the basalts is quite good though again there is no monitoring bores in the project area (KCB 2019, pp. 72-77).

    i. Confirmation of alluvial and Cenozoic groundwater levels is required as it is probable that any riparian vegetation (which is part of the 'water trigger') is dependent, at least partially, on groundwater.

    ii. Monitoring of groundwater levels (and chemistry) is required in these geological units, within the project area, as soon as practical.

7. OWS tends to agree with the proponent that there will be no impact on known subterranean fauna (KCB 2019, p. 115), however without the information noted in paragraph 6 no conclusive determination can be made.

8. The proponent identifies a fault to the west of the project area (KCB 2019, p. 67). This fault is represented in the OGIA groundwater model and, as such, any control on groundwater drawdown from this fault would be included in the modelling results.

    a. OWS, however, notes the guidance from OGIA (KCB 2019, p. 110) that there are some limitations with the OGIA geological modelling in the Mahalo project area but that this 'does not impact the predictions presented in the UWIR 2019' and, by implication, the groundwater modelling done for this project.

        i. These limitations should be resolved as soon as possible.

9. OWS agrees with the proponent that there will be no material impact from subsidence (KCB 2019, p. 116).

10. The 2019 UWIR modelling does not include coal mines (KCB 2019, p. 106) – this will be addressed in the next iteration of the UWIR. Consequently the cumulative impacts from the Rolleston and Blackwater mines cannot be determined using the OGIA modelling – agricultural groundwater use is included in the current OGIA modelling.

    a. Given the distances involved ~ 30km to the Rolleston mine and ~ 10km to the Blackwater mine it is highly unlikely that there will be any interaction with drawdown between these mines and the CSG production.

11. The proponent commissioned a quantitative study on the potential impacts from drilling fluids and muds (EHS Support 2019). While at a theoretical level there may be very localised impacts from some of these additives at a practical level the risk is extremely low.

    a. It is important to note that the same, or similar, drilling fluids and muds would be used for any bores drilled for agricultural purposes due to the potential for artesian conditions.

    b. There are some differences between the conceptual models, particularly in regards to the distribution of the basalt, in EHS (2019 pp. 13 and 14) and KCB (2019 pp. 100 and

101). While these differences are unlikely to make any material differences to the predictions from the different quantitative and numerical modelling (respectively), greater confidence would be gained if the same conceptual model was used.

12. If standard operational procedures are maintained there is little risk to water resources from the construction activities.

Water Assessment Information Portal (WAIP): for more information on water-related environmental impacts, please see the WAIP (accessible on the intranet via Home ⇨ Themes ⇨ Water ⇨ Water Assessment Information Portal).

References

Australia Pacific LNG (APLNG) 2019?. Mahalo Development Area – Groundwater Monitoring and Management Plan.

EHS Support 2019. Appendix A – Hydrogeological Assessment.

Klohn Crippen Berger (KCB) 2019. Australia Pacific LNG – Mahalo Development Area, Water Assessment Report.

OGIA 2019. Underground Water Impact Report for the Surat Cumulative Management Area – Consultation draft.

Other documentation reviewed

Golder 2019. Produced Water Management Plan – Mahalo Development Area.

OWS advice on adequacy of response 17/01/20.

FOI 200511
Document 11

Issue	Desired Outcome	Response	OWS comment
Water Resources			
The referral does not adequately demonstrate whether or not potential changes to hydrology will impact on third-party water users including groundwater dependent ecosystems (GDEs). This is needed for the Department's consideration of potential impacts on water resources.	Origin to provide additional information to adequately characterise hydrogeological conditions within the project area and immediate surrounds, how this will impact GDEs and any other third-party water users, and whether the impacts will be significant. This will include: − Further consideration of the fault and its influence on groundwater flow, including clarification of differences between conceptual models presented in the quantitative study and the water assessment report. This needs to include a resolution regarding the limitations with the OGIA geological modelling relating to the fault in the project area.	Section 8.5. of Appendix B describes how the model could potentially under-predict the propagation of drawdown within the Bandanna Formation within a localised area immediately east of the of Inderi Fault. However, this area is underlain by approximately 300m of the Rewan Formation aquitard. The model results shows that propagation of drawdown impacts to shallow aquifers only occurs in the absence of the Rewan Formation. Attachment 1 to this document provides additional evidence of how the hydrogeological conditions of the Mahalo Development Area are accurately represented in the UWIR model for the Surat CMA, including additional data showing the extent of the Rewan Formation and additional analysis of the hydrogeological characteristics of the Inderi fault. Regardless, the UWIR model for the Surat CMA will be revised to represent a greater thickness of the Bandanna Formation in this area. A UWIR is required to be in place under the Water Act 2000 for production activities in the Mahalo Development Area. Appendix C provides a conceptual hydrogeological model to inform a transport model used in the Chemical Risk Assessment. Although used for very different purposes, the conceptual models are generally consistent. Tables 4-5 and 4-6 of Appendix C provide site specific hydraulic parameters	**Not addressed** 1. OWS is unclear why the response is limited to the area near the Inderi Fault. In its previous advice (OWS-2019-052) OWS noted the lack of groundwater information particularly in the alluvial and Cenozoic sediments. This is compounded by the results of the uncertainty analysis modelling done by OGIA e.g. the 95th percentile result (KCB Groundwater modelling report Appendix VI). Figure VI-2 indicates a potential drawdown of 50-100m in the north-central area. From the new information presented in the technical memorandum the thickness of the Rewan Formation in this area is reported to be approximately 75m thick (Bore TOG-NS32) – that is drawdown will propagate through the Rewan Formation. This area coincides with a drawdown in Alluvium, Cenozic and Basalt (layer 1) of 1-2m. This area contains at least

		used in the chemical transport model. Appendix B describes the sensitivity analysis for the UWIR model.	one major tributary and some small tributaries of the Humboldt Creek. Figure 3 (Golder 2019) shows the sites of terrestrial and aquatic surveys and there does not appear to be any surveys over much of this impacted zone. As noted in previous advice (OWS-2019-052) There are some differences between the conceptual models, particularly in regards to the distribution of the basalt, in EHS (2019 pp. 13 and 14) and KCB (2019 pp. 100 and 101). It is noted known whether these differences make a material difference to the predicted impacts.
	− Baseline groundwater monitoring in all geological units in the project area. This must include bores along Humboldt and Comet River to confirm the nature and extent of alluvium, and associated groundwater levels and quality.	Section 7.6 of Appendix B presents an analysis of groundwater level data from many bores within and surrounding the Mahalo Development Area including those accessing water from the following formations: Alluvium (8 within project area) Cenozoic sediments Basalt Rewan Formation Bandanna Formation Section 7.8. Appendix B provides an ecohydrological model of the Comet River alluvium system based on site-specific groundwater monitoring data.	**Not addressed** 1. There are no monitoring bores in the Humboldt Creek alluvium (Figure 7.11). 2. There are no monitoring bores in the Cenozoic Sediments in the Humboldt Creek area (Figure 7.12). 3. There are two monitoring bores in the Basalt in the Humboldt Creek area

			but these are outside the project area (Figure 7.15). 4. There are no monitoring bores in the Rewan or Bandanna Formations in the Humboldt Creek area (Figure 7.12).
	− Demonstration of how each of the above will impact on water resources and hence water users including GDEs. This might include conducting site surveys to confirm the nature and extent of any GDEs within and nearby the project area.	For the purposes of the assessment, the low confidence potential GDEs are conservatively assumed to represent GDEs despite the groundwater data indicating depth to groundwater is greater the 30 metres below ground. Using the 2019 UWIR methodology for assessing potential impacts to terrestrial GDEs, the impacts are categorised as 'low risk' (greater than 0.2m but less than 1m). Coupled with the >30m depth to groundwater, it is considered that there is very limited potential for the low confidence potential GDEs to experience drawdown related impacts. The sensitivity analysis provides another layer of conservatism for the model by modifying relevant hydraulic parameters outside their known range. The groundwater model is further conservative in how it models the extraction of produced water from the Bandanna Formation with complete dewatering of the coal seam within the entirety of the Mahalo Development Area.	**Not addressed** 1. Based on the lack of shallow groundwater level data (and monitoring bores generally), the lack of ecological surveys in much of the Humboldt Creek area and the uncertainty analysis modelling showing the potential for impacts to the surface in the Humboldt Creek area this argument cannot be sustained.
s22 suggested issues with using the regional scale UWIR groundwater model (cell size of 1.5km) to predict shallow groundwater		The UWIR groundwater model has been used to for these purposes for other similar referrals, including the EPBC referral 2018/8329 for Senex's Atlas Project. The Office of Water Science (OWS) provided the following relevant advice for the Atlas referral: *OGIA produced a regional groundwater flow model (Appendix 4 Pg. 120) to identify the likely cumulative impact of all*	**Partially addressed.** 1. The quotation for the Senex Atlas project referral is taken out of context and refers to the adequacy for cumulative impacts and that, as such, a 1.5 x 1.5km grid is appropriate. It

drawdown and impacts on riparian vegetation		*projects in the Surat sub-basin with and without the Atlas project. OWS notes the limit of resolution for this model is 1.5 km by 1.5 km and that there is no reason to consider this inadequate (Appendix 4 Table 9.1 Pg.115).* The 2016 UWIR groundwater model used for the Atlas referral did not include the uncertainty analysis described below. Additional information and further discussion regarding the project specific characteristics of the Rewan Formation and the fault to the west of the project area is provided in the accompanying technical memorandum titled Response to DoEE's Queries on Appendix B. Origin Energy notes the IESC explanatory note (http://www.iesc.environment.gov.au/system/files/resources/31feb114-2d09-4a98-8b3fad629dbe4b97/files/environmental-assessments-fact-sheet.pdf) confirming the use of the UWIR groundwater model for the purposes of the EPBC Act. Specifically, the IESC explanatory note provides the following information requirements to confirm the suitability of the UWIR for local scale predictions including potential drawdown impacts to riparian vegetation:	does not state that the model is suitable *to predict shallow groundwater drawdown and impacts on riparian vegetation* as is implied.
	IESC Requirement	**Referral Reference**	
	additional data or information that is available in and around the project area pertaining to	See accompanying technical memorandum for additional information regarding conceptualisation of the hydrogeological system at the Project area. This additional information further supports the interpreted impacts from the proposed development, as previously identified in the Mahalo	**Partially addressed** 1. OWS agrees that additional information has been provided in the technical memorandum particularly in

	conceptualisation of groundwater system, current impacts from CSG and non-CSG development, GDEs and surface-groundwater interaction	Development Area Water Assessment Report (Appendix B of the Mahalo Development Area EPBC Act Referral).	regards to the Rewan Formation and additional seismic lines.
	an updated local scale conceptualisation and how this may differ from the conceptualisation used by OGIA in their assessments how the updated conceptualisation might affect OGIA's modelling output in the project area	See accompanying technical memorandum for additional information regarding the local conceptualisation of the hydrogeological system within the vicinity of the Project area. Based on the additional information regarding the local conceptualisation, and a comparison of this information with OGIA's numerical groundwater model, it is interpreted that the local hydrogeological system (system extent and thickness; and, the aquifer parameters) has been adequately captured in the numerical model.	2. OWS agrees that the Rewan Formation is an effective aquitard however the uncertainty analysis modelling shows there is potential for drawdown through the Rewan Formation impacting on the surficial layers in the Humboldt Creek area. 3. In the technical memorandum (pg. 9) it is stated that there is minor faulting in the Bandanna Formation and that it is localised to this formation. OWS notes that the quality of the seismic in the shallower sections is poor (this is not a criticism as it was not the focus of the survey hence the configuration of the survey did not allow for high resolution in the shallower sediments). However this makes it difficult to tell whether there is any upward propagation of these faults into the shallower sequence though OWS notes on Figure 2-5 there does seem to be a major fault

			(green, red and blue vertical lines) that extends from deeper sediments through the Bandanna Formation with a possible 'flower structure' in the shallower sequence. While this fault appears to be to the south of the project area it demonstrates that there may be faulting into the shallower sequence which may, locally, increase impacts. 4. Section 2.2 in the technical memorandum discusses groundwater levels and hydraulic gradient. OWS agrees, based on the very limited data (most of which is outside the project area), that the hydraulic gradient is downwards i.e. the Bandanna Formation is not providing groundwater to the surficial layers or baseflow to streams. However the uncertainty analysis indicates the potential for impacts in the Humboldt Creek area which may result in an increase in the downwards hydraulic gradient in this area resulting in a lower residence time of groundwater in alluvial sediments and in any refugial pools that may exist.
	how specific impacts such as changes to surface	Surface water – groundwater interactions are not predicted to be impacted by the proposed development as previously	**Not addressed**

	water – groundwater interactions or riparian vegetation are assessed	identified in the Mahalo Development Area Water Assessment Report (Appendix B of the Mahalo Development Area EPBC Act Referral).	1. As previously noted the uncertainty analysis shows the potential for impacts in the surficial layers in the Humboldt Creek area where no surveying has been conducted and therefore impacts on surface water – groundwater interactions have not been assessed.
	The primary purpose of OGIA's model is to predict impacts from CSG development which is typically in deeper parts of the system. The model is not therefore designed to explicitly simulate surface water – groundwater interaction in the surficial layers. Therefore, use of model outputs for that purpose must be supported by appropriate conceptualisation	The accompanying technical memorandum provides additional information regarding local conceptualisation of the hydrogeological system, including the conceptualisation of interaction between the surface water system and the groundwater system; and, hydraulic connection between the shallow aquifers and the underlying deeper systems. This local conceptualisation supports the predicted impact assessment from the OGIA numerical model.	**Partially addressed** 1. The technical memorandum as noted provides additional information but it does not address the potential interaction identified in the uncertainty analysis between CSG production in the Bandanna Formation resulting in drawdown in the surficial layers and hence surface water systems. 2. A basic conceptual model is presented for the Comet River alluvium (Figure 7.26 Water Assessment report vol. 2) and a broader one for the project area (Figure 7.33). Neither are to scale nor do they show the amount of direction of flux between geological units. OWS notes that Figure 7.33 indicates baseflow contribution from Cenozoic sediments into Humboldt Creek which, based on the uncertainty

			analysis modelling, may experience drawdown and hence baseflow reduction.
	The IESC encourages the need to do an appropriate level of uncertainty analysis as part of the proponent's groundwater modelling to provide a range of likely impacts rather than just a simple deterministic result. The current OGIA groundwater model (2016) has not included an uncertainty analysis which was done for the 2012 version. OGIA is planning to undertake uncertainty analysis for the 2019 UWIR	Uncertainty analysis results from the 2019 UWIR numerical model have been provided in the Mahalo Development Area Water Assessment Report (Appendix B of the Mahalo Development Area EPBC Act Referral).	**Addressed** 1. Noting this is the regional scale OGIA model.
s22 queried the geographic distribution of bore impacts		Four third-party groundwater bores are predicted to experience drawdown greater than 5 m as a result of the Project development (Figure 9.1, Appendix B of the Mahalo Development Area EPBC Act Referral). These bores source water from the Bandanna Formation (or other formations including the Bandanna Formation) and therefore have a source aquifer attribution as the Bandanna Formation, the formation with the greatest potential for drawdown to occur (i.e. producing formation). Other bores surrounding and adjacent to the triggered bores are predicted to not be triggered as a result of the proposed development due to these bores not sourcing water from the Bandanna Formation (i.e. have an aquifer attribution that is not the Bandanna Formation). Figure 7.32 from the Mahalo Development Area	**Addressed** 1. Noting this is poor documentation as Table 9.1 shows these bores to be in the Upper or Lower Bandanna Formation with no other formation attributed but OWS acknowledges that in the text on pg. 113 it does say '*four bores assumed to be screened across the Bandanna Formation*'.

		Water Assessment Report presents the aquifer attribution for all bores within a 50 km buffer of the Project area.	
s22 queried the width of the Inderi fault		Additional information and further discussion regarding the project specific characteristics of the Rewan Formation and the Inderi Fault is provided in the accompanying technical memorandum (Attachment 1) titled Response to DoEE's Queries on Appendix B. Characterisation of the Inderi Fault has been undertaken based on seismic surveys across the alignment of the fault. Seismic survey results identifying the presence of the fault is presented in Figure 7.7 of the Mahalo Development Area Water Assessment Report. The seismic results indicate that the fault is steeply dipping (80o from horizontal) and has resulted in an offset of approximately 500 m between the hanging wall and the footwall, causing a separation of the hydrostratigraphic units. Based on the discontinuity of the seismic results along the Inderi Fault plane, the width of the fault is interpreted to be approximately 200 m.	**Partially addressed** 1. The primary issue in regards to the Inderi Fault is the thickness of the damaged zone and whether this provides an increased risk of propagation. Given that the fault is on the western edge of the project area OWS acknowledges that the risk is very low but it is not discussed and is not possible to assess as now details on production wells are provided.

OFFICE OF WATER SCIENCE ADVICE
MAHALO DEVELOPMENT AREA

Requesting section	Queensland Assessments North	**Requesting officer**	s22
Date of request	15 April 2020		
EPBC reference	EPBC 2019/8534	**OWS reference**	OWS 2020-024
Project assessment stage	Referral		
OWS contact officer	s22		
Cleared by	s22 A/g Director Office of Water Science	**Date**	28/04/2020

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This document, prepared at the request of the Environment Approvals Division, outlines the Office of Water Science's (OWS) technical advice on the Mahalo Development Area Coal Seam Gas (CSG) Project. This advice specifically relates to the additional information provided by the proponent on 8 April 2020 in a memo titled *"Mahalo Development Area TGDE Drawdown Impact Supplementary Information"* (KCB 2020) in relation to whether two previously identified areas of potential groundwater drawdown contain groundwater-dependent ecosystems (GDEs). Given time constraints this advice has not considered the full documentation previously provided by the proponent to the Department. That documentation has been previously reviewed by the OWS for the advices OWS-2020-002 and OWS-2019-052.

Question 1: Given the additional information provided by the proponent on 8 April 2020, what does the OWS consider are the likely nature and extent of impacts of drawdown on GDEs posed by the proposed project?

1. The information provided in KCB (2020) focuses on two areas of potential GDEs that occur within the predicted area of drawdown in the surface aquifer. These areas are identified on the map provided at **Attachment A** (KCB 2020, Figure 2-1, p. 3):

    a. Northern Drawdown Area; and,

    b. Shotover Creek.

2. OWS notes that the information provided suggests that the Northern Drawdown Area is unlikely to be a GDE. However, the information is insufficient to support the proponent's assertion that Shotover Creek is not a GDE.

3. Potential impacts to GDEs along Shotover Creek may occur as a result of the predicted drawdown. The likely extent and nature of these impacts are unclear as it remains uncertain if the riparian vegetation of Shotover Creek is groundwater-dependent. Possible impacts could include reduced condition and potential loss of vegetation which utilises groundwater. Erosion could occur/increase if bank vegetation is lost. If the pool identified on Shotover Creek is at least partially sustained by groundwater discharge then persistence of this pool could be reduced and potential refuge habitat for aquatic fauna lost due to drawdown.

<u>Shotover Creek</u>

4. **Attachment A** shows that some areas of Shotover Creek are classified as having a low potential for being GDEs. The proponent has determined that this vegetation is not a GDE. Their reasoning and OWS assessment are outlined below.

5. The proponent has stated that the closest groundwater bores show that the watertable is between 42.7 m to 60 m below ground level meaning this groundwater would be too deep for the local vegetation to utilise (KCB 2020, p. 7).

    a. OWS agrees that if groundwater was more than 40 m below ground level along Shotover Creek that it would be highly unlikely that the riparian vegetation would be groundwater-dependent.

    b. OWS, however, does not consider that this assessment of the depth to groundwater at Shotover Creek is supported by the information provided in **Attachment A**.

        i. The closest bores to Shotover Creek are too distant from Shotover Creek to be used to estimate the groundwater levels.

        ii. Additionally, the two bores used appear to be located distant from surface water systems, possibly in higher-elevation areas and would not be within the alluvium that the proponent has stated occurs up to 10 km upstream of the confluence of Shotover Creek with Humboldt Creek (KCB 2020, p. 7).

        iii. It is generally accepted that the watertable is a subdued version of surface topography. This means that in higher-elevation areas the watertable is commonly deeper than it is beneath creeks.

        iv. Thus, the two bores being used to predict the depth to the watertable in the vicinity of Shotover Creek are likely to be over-estimating the depth to the watertable.

        v. The only way the depth to the watertable in the vicinity of Shotover Creek can be accurately determined would be to install at least one monitoring bore at this location. Without site-specific data on the depth to the watertable it is difficult to conclusively prove that the riparian vegetation along Shotover Creek is not, at least periodically, utilising groundwater.

    c. The proponent has identified that the dominant riparian vegetation along Shotover Creek is *Ecalyptus tereticornis* or *E. camaldulensis* (KCB 2020, p. 7). While they note in Table 3.1 (KCB 2020, p. 3) that the corresponding Regional Ecosystem

(RE 11.3.25) is not a mapped GDE OWS notes that this does not mean that the RE would not utilise groundwater if it were available. If streamflow is ephemeral and/or highly intermittent within Shotover Creek then this would make it more likely that the riparian vegetation is at least partially sustained by shallow groundwater.

d. In the absence of site-specific data for the depth to the watertable at Shotover Creek, OWS considers that the information provided in **Attachment A** could mean that the watertable in this area is likely to be approximately 15 m deep.

    i. This number is an approximation and is based on the trends in water level depths provided in **Attachment A**.

    ii. It is apparent that in Comet River where observations of watertable depths within the alluvium (noting that this is likely to be a different alluvial system to that which occurs at Shotover Creek) are provided that the watertable is generally between 11-17 m below ground level.

    iii. A Cenozoic bore (14.5 m below ground level) located north of the confluence of Humboldt Creek with Comet River also suggests that the depth to groundwater may rapidly decrease near surface water features. At other Cenozoic bores located to the east of this bore (likely to be upgradient in the shallow groundwater system) the depth to the watertable is much greater.

    iv. This information suggests that the depth to groundwater could be approximately 15 m along Shotover Creek. OWS notes, however, that this is an approximation. The depth to groundwater could be greater or less. As discussed in Paragraph 4bv site-specific data would be needed to accurately determine the depth.

    v. If groundwater was approximately 15 m below ground level near Shotover Creek then it is likely that the groundwater would only be available to some vegetation. At this depth, the watertable may be close to the limit of the rooting depth of that vegetation. Should this be the case then the relatively small predicted drawdown (approximately 0.6 m at the 95th percentile) may result in groundwater becoming inaccessible to that vegetation.

    vi. OWS notes again that limited monitoring data appears to be available for the project site, therefore, it is difficult to make robust conclusions about the groundwater system and the availability of groundwater to vegetation.

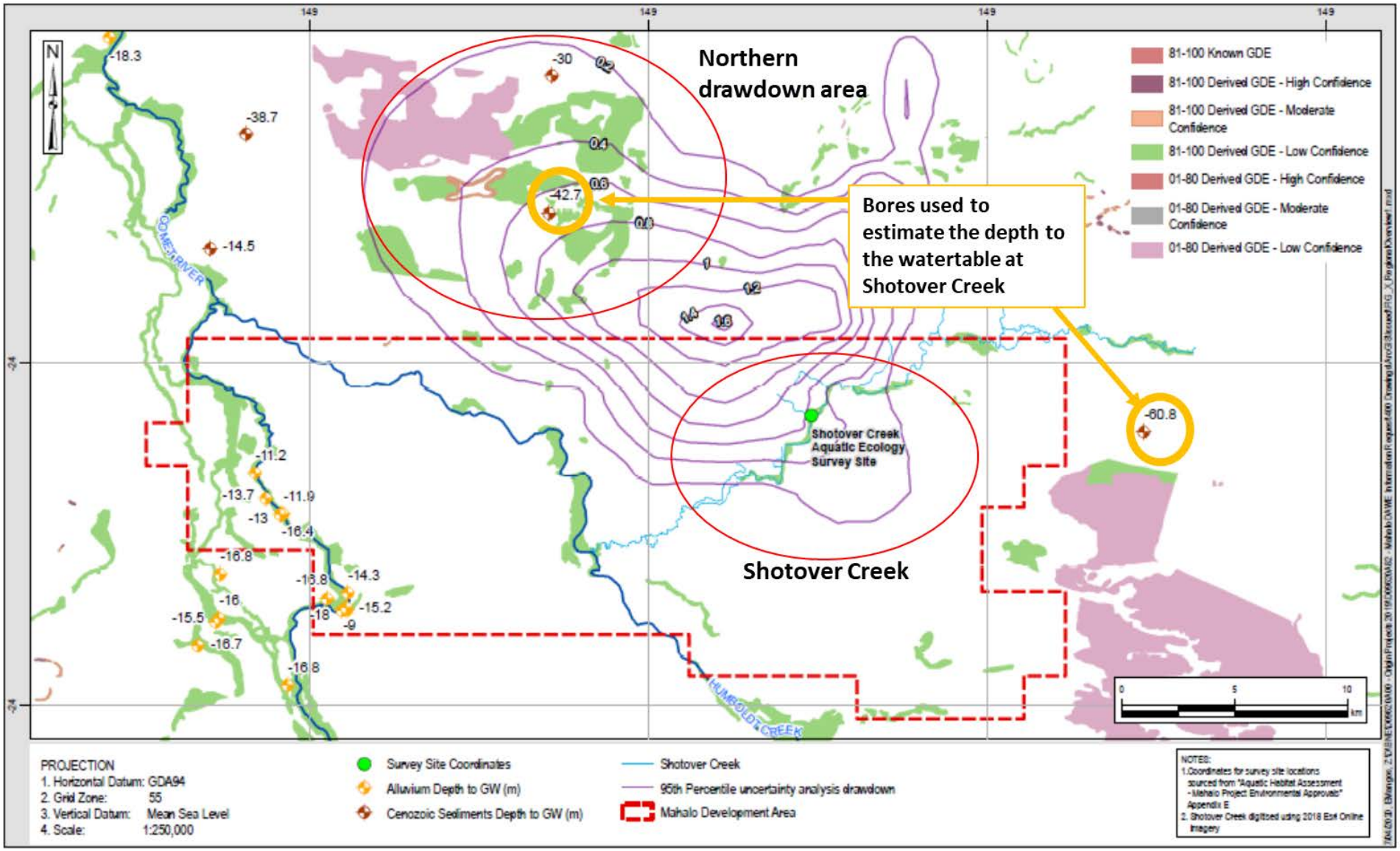
6. OWS notes that a large pool is described on Shotover Creek (KCB 2020, Att. A, pp. 11-12). The dimensions of this pool are not provided but the aerial photograph and cross-sectional profile (KCB 2020, Att. A, p. 12) suggest the dimensions could be 8 m wide by 30 m long. This is a sizeable pool and it is possible that groundwater discharge could sustain this pool. However, given the observations occurred during the wet season, that considerable rainfall had occurred at the site (closest BoM Station Somerby 35063 based on the coordinates provided) around the time of sampling and that there is very limited imagery of the site on Google Earth, OWS cannot determine if groundwater discharge is a likely source of water to the pool.

Water Assessment Information Portal (WAIP): for more information on water-related environmental impacts, please see the WAIP (accessible on the intranet via Home ⇨ Themes ⇨ Water ⇨ Water Assessment Information Portal).

References

KCB 2020. *Mahalo Development Area TGDE Drawdown Impact Supplementary Information.* Memo date 8 April 2020.

Attachment A – Location map based on Figure 2-1 (KCB 2020, p. 3) with key features highlighted by OWS.



Referrals Gateway
Assessment & Governance Branch
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

Email: epbc.comments@environment.gov.au

Dear Minister,

Submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

I am writing in relation to the CSG project proposed by Australia Pacific LNG (APLNG) in the Mahalo Development Area.

It has come to my attention that APLNG has stated that the project will have no significant impact to matters protected under the EPBC Act and therefore should not be found to be a "controlled action" under the Act and subject to an environmental assessment process.

In my view, the clearance of 46,900 hectares of vegetation, including critical habitat for the koalas without any fauna surveys or maps and plans provided by APLNG of critical infrastructure for the project is completely unacceptable.

I believe that the project will have a significant impact on matters of national environmental significance including the:

a. Endangered Brigalow (Acacia harpophylla dominant and co- dominant);

b. Endangered Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin;

c. Endangered Poplar Box Grassy Woodland on Alluvial Plains;

d. Endangered Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;

e. Endangered Weeping Myall Woodlands;

f. *Calidris ferruginea,* Critically Endangered Curlew Sandpiper;

g. *Neochmia ruficauda ruficauda,* Star Finch (eastern), Endangered Star Finch (southern);

h. *Poephila cincta cincta;* Endangered Southern Black-throated Finch;

i. *Rostratula australis;* Endangered Australian Painted-snipe, Australian Painted Snipe;

j. Dasyurus hallucatus, Endangered Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu];

k. Elseya albagula, Critically Endangered Southern Snapping Turtle, White-throated Snapping Turtle; and

l. Rheodytes leukops, Endangered Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver.

I also believe that any CSG project on this scale should be assessed in relation to its emissions of greenhouse gases and an environmental impact and its effects on threatened species in Australia and the Great Barrier Reef. The current concerns about the disappearing Bogong moth (which breeds in Victoria, NSW and Queensland) and Victoria s Mountain Pygmy Possum show how environmental impacts in one state can lead to extinctions in other states.

Also, I believe that land clearing projects should be assessed for the impact on local and regional rainfall and other weather patterns.

Based on the complete lack of information of threatened species on site, project impacts, mitigation actions and climate change effects, I submit that the project should be assessed by full environmental impact assessment.

Yours sincerely,

s47F

FOI 200511
Document 14

From: EPBC.comments
Sent: Tuesday, 22 October 2019 12:15 PM
To: s22
Cc: s22 ; s22
Subject: FW: Mahalo Development Area CSG Project [SEC=OFFICIAL]

Hi s22

Please see a comment regarding the 2019/8534 Mahalo project. Note that the comment has not yet been saved to SPIRE.

Kind regards

Referrals Gateway | Assessments and Governance Branch
Department of the Environment and Energy
GPO Box 787, CANBERRA ACT 2601
Email: EPBC.Referrals@environment.gov.au | Web: www.environment.gov.au

From: s47F
Sent: Monday, 21 October 2019 9:26 AM
To: EPBC.comments
Subject: Mahalo Development Area CSG Project

Referrals Gateway
Assessment & Governance Branch
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

Dear Minister,

Submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

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a. Endangered Poplar Box Grassy Woodland on Alluvial Plains;

a. Endangered Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;

a. Endangered Weeping Myall Woodlands;

a. *Calidris ferruginea,* Critically Endangered Curlew Sandpiper;

a. *Neochmia ruficauda ruficauda,* Star Finch (eastern), Endangered Star Finch (southern);

a. *Poephila cincta cincta;* Endangered Southern Black-throated Finch;

a. *Rostratula australis;* Endangered Australian Painted-snipe, Australian Painted Snipe;

a. Dasyurus hallucatus, Endangered Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu];

a. Elseya albagula, Critically Endangered Southern Snapping Turtle, White-throated Snapping Turtle; and

a. Rheodytes leukops, Endangered Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver.

I also believe that any CSG project on this scale should be assessed in relation to its emissions of greenhouse gases and an environmental impact and its effects on threatened species in Australia and the Great Barrier Reef.

Based on the complete lack of information of threatened species on site, project impacts, mitigation actions and climate change effects, I submit that the project should be assessed by full environmental impact assessment.

Yours sincerely,
s47F

FOI 200511
Document 15

From: EPBC.comments
Sent: Tuesday, 22 October 2019 12:15 PM
To: s22
Cc: s22 ; s22
Subject: FW: Submissionon 2019/8534 AUSTRALIA PACIFIC LN [SEC=OFFICIAL]

Hi s22

Please see a comment regarding the 2019/8534 Mahalo project. Note that the comment has not yet been saved to SPIRE.

Kind regards

Referrals Gateway | Assessments and Governance Branch
Department of the Environment and Energy
GPO Box 787, CANBERRA ACT 2601
Email: EPBC.Referrals@environment.gov.au | Web: www.environment.gov.au

From: s47F
Sent: Monday, 21 October 2019 11:43 AM
To: EPBC.comments
Subject: Submissionon 2019/8534 AUSTRALIA PACIFIC LN

Referrals Gateway
Assessment & Governance Branch
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

Email: epbc.comments@environment.gov.au

Dear Minister,

Submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

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c. Endangered Poplar Box Grassy Woodland on Alluvial Plains;

d. Endangered Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;

e. Endangered Weeping Myall Woodlands;

f. *Calidris ferruginea,* Critically Endangered Curlew Sandpiper;

g. *Neochmia ruficauda ruficauda,* Star Finch (eastern), Endangered Star Finch (southern);

h. *Poephila cincta cincta;* Endangered Southern Black-throated Finch;

As a lifelong resident of Queensland I expect every possible consideration be given to the potential environmental effects without hesitation and all examinations be enforced.

In this age of warnings and eyes on Queensland from international forums on our treatment of the environment in light of scientific advice, this will become an election issue and must be addressed with the full scrutiny of science under the law and better judgement of our elected officials.

Sincerely,

s47F

FOI 200511
Document 16

From: s22
Sent: Thursday, 24 October 2019 1:04 PM
To: s22
Subject: FW: 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generaon and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project [SEC=OFFICIAL]
A achments: Mahalo CSG Supplementary Submission Final and Cover.pdf; Mahalo CSG Submission Final and Cover.pdf

FYI

From: EPBC.comments
Sent: Thursday, 24 October 2019 12:31 PM
To: s22 ; s22
Cc: s22
Subject: FW: 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generaon and Supply (non-r enewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project [SEC=OFFICIAL]

Good a. ernoon QNA Team

Please see below and a ached an addional c omment on 2019/8534 Mahalo Development Area. Note that there are two a ached comment documents. Note that neither this email nor the a achments have been saved to SPIRE.

Kind regards

Referrals Gateway | Assessments and Governance Branch
Department of the Environment and Energy
GPO Box 787, CANBERRA ACT 2601
Email: EPBC.Referrals@environment.gov.au | Web: www.environment.gov.au

From: s11C(1)(a)
Sent: Thursday, 24 October 2019 11:51 AM
To: EPBC.comments <EPBC.comments@environment.gov.au>
Subject: 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generaon and Supply (non-r enewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

Dear Sir/Madam

I attach a submission and supplementary submission in relation to 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project.

Kind regards

s11C(1)(a)

FOI 200511
Document 17

Submission Cover Sheet

Supplementary Submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

Submission made by:

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

Referrals Gateway
Assessment & Governance Branch
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

Email: epbc.comments@environment.gov.au

24 October 2019

Dear Sir/Madam

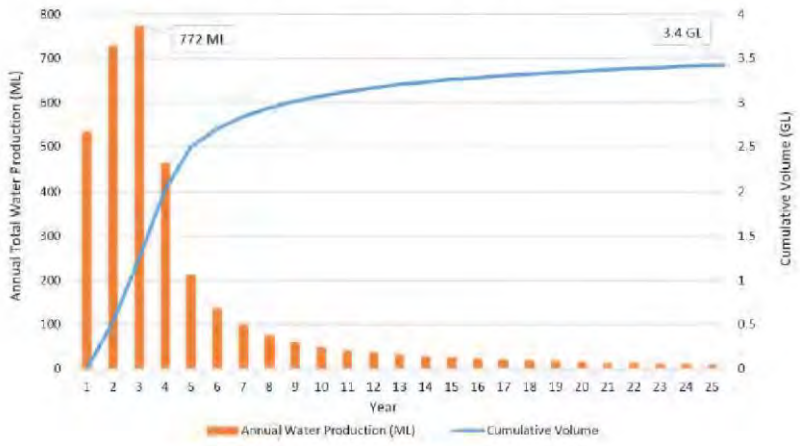
Supplementary submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

This Supplementary Submission focuses on the whether the Mahalo Development Area CSG Project (**Proposed Action**) is likely to have a significant impact on a water resource.

Background

1. The Proposed Action will involve the construction and operation of infrastructure that proposes to extract significant volumes of water between 500 million to 772 million litres of water per year in the early stages of development (see Figure 1 below).[1] The total volume of groundwater that has been projected to be extracted for the duration of the project is estimated at 3.4 gigalitres of water.[2]

Figure 3.1 Predicted Water Production Rate (Golder 2019)



[1] Klohn Crippen Berger "Mahalo Water Report"(September 2019) 27.
[2] Klohn Crippen Berger, above n1, 26.

2. In the documents submitted to the Minister for the purposes of the Referral, Australia Pacific LNG (**APLNG**) described the project as follows:

   "Groundwater abstraction is required as part of the gas production process. Groundwater is abstracted (pumped) from production wells to depressurize target production coal seams. Depressurisation generates gas flow and sustains groundwater from the well to maintain the target producing operational pressure for each production well."[3]

Statutory Context

3. Any action involving coal seam gas or large coal mining development with a significant impact on water resources must not be taken unless that action has been referred and approved under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**).

4. Sections 24D and 24E are found within Subdivision FB, *Protection of water resources from coal seam gas development and large coal mining development*, within Part 3 of Chapter 2, *Protecting the environment*. Section 24D of the Act provides, relevantly:

   24D Requirement for approval of developments with a significant impact on water resources

   (1) A constitutional corporation, the Commonwealth or a Commonwealth agency must not take an action if:
   (a) the action involves:
   (i) coal seam gas development; or
   (ii) large coal mining development; and
   (b) the action:
   (i) has or will have a significant impact on a water resource; or
   (ii) is likely to have a significant impact on a water resource.

   Civil penalty:
   (a) for an individual—5,000 penalty units;
   (b) for a body corporate—50,000 penalty units.

   …

   (4) Subsections (1) to (3) do not apply to an action if:
   (c) there is in force a decision of the Minister under Division 2 of Part 7 that this section is not a controlling provision for the action and, if the decision was made because the Minister believed the action would be taken in a manner specified in the notice of the decision under section 77, the action is taken in that manner…"

[3] Klohn Crippen Berger, above n1, 26.

5. Section 24D(1)(a) contains what is subsequently referred to hererin as “the first limb” of the water trigger, while section 24D(1)(b) is referred to as the “second limb”.

6. Significant Impact Guidelines 1.1 “Matters of National Environmental Significance provide the following guidance on the interpretation on the assessment of “significant impact” in s 24D(1):

   “**What is a significant impact?**

   A ‘significant impact’ is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance.”

   When is a significant impact likely?
   To be ‘likely’, it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility.

   If there is scientific uncertainty about the impacts of your action and potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.”[4]

Significant Impact Criteria – the nature of impacts

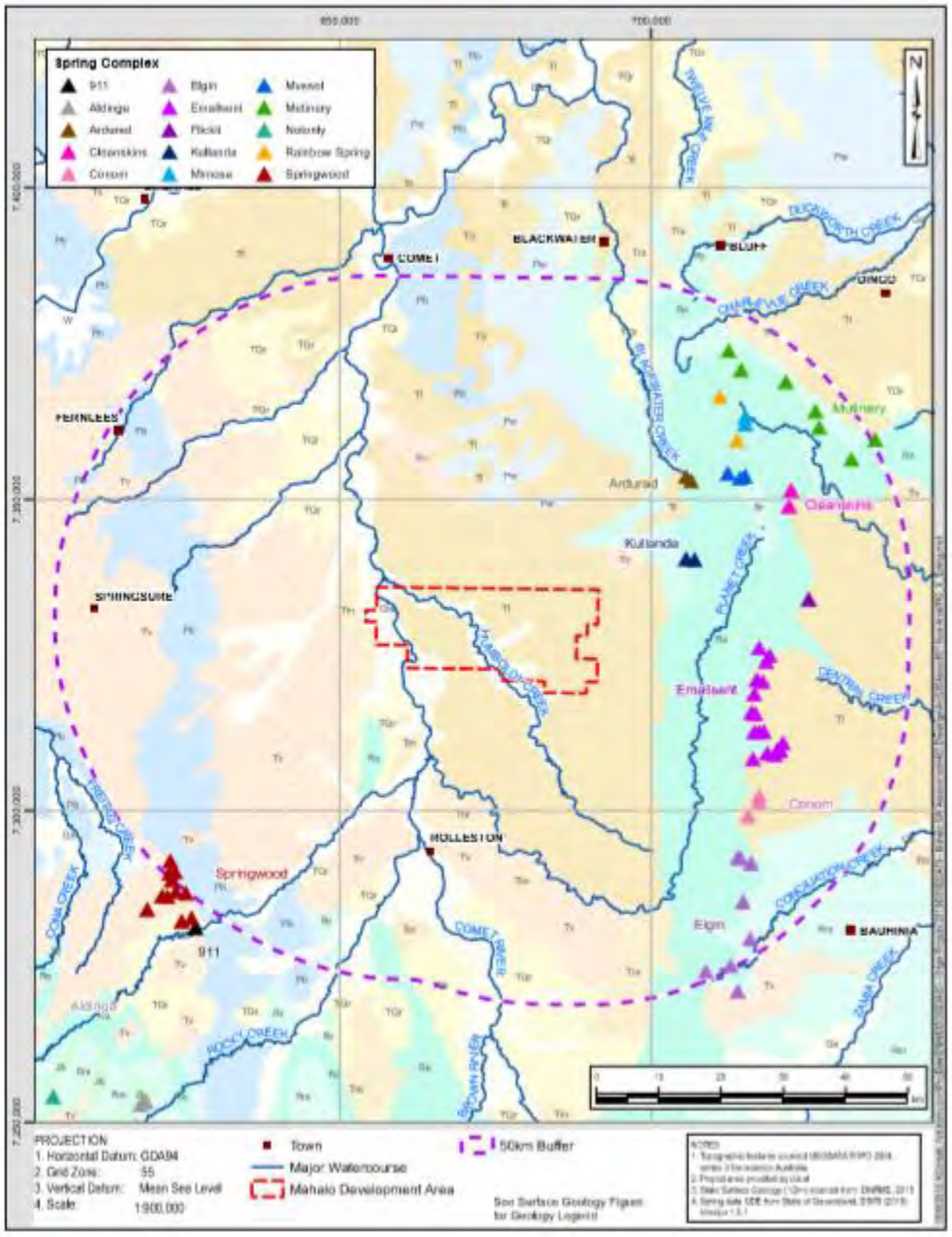
7. In September 2019, Klohn Crippen Berger (**KCB**) issued a Water Assessment Report (**WA Report**) for the Proposed Action. In the Report, KCB identified the key potential impacts upon water resources for the project in relation to groundwater and surface water.

8. The key groundwater impacts identified by KCB are as follows:

   a. Impacts to source acquifers for groundwater dependent ecosystems (GDEs) and spring complexes. These included complexes to the east and southwest of the Mahalo Development Area, with the nearest spring complex (Kullanda) sourcing located approximately 12 km northeast from the Mahalo Development Area[5] (See Figure 2 below).

[4] Commonwealth of Australia, “Significant Impact Guidelines 1.1 Matters of National Environmental Significance” (2013) 2-3.
[5] Water Assessment Report Page 115

Figure 2: Location of Springs Vent/Complexes in the Vicinity of the Mahalo Development Area[6]



b. Impacts to terrestrial GDEs, which have been mapped as occurring adjacent to watercourses. These GDEs are potentially reliant on groundwater within the

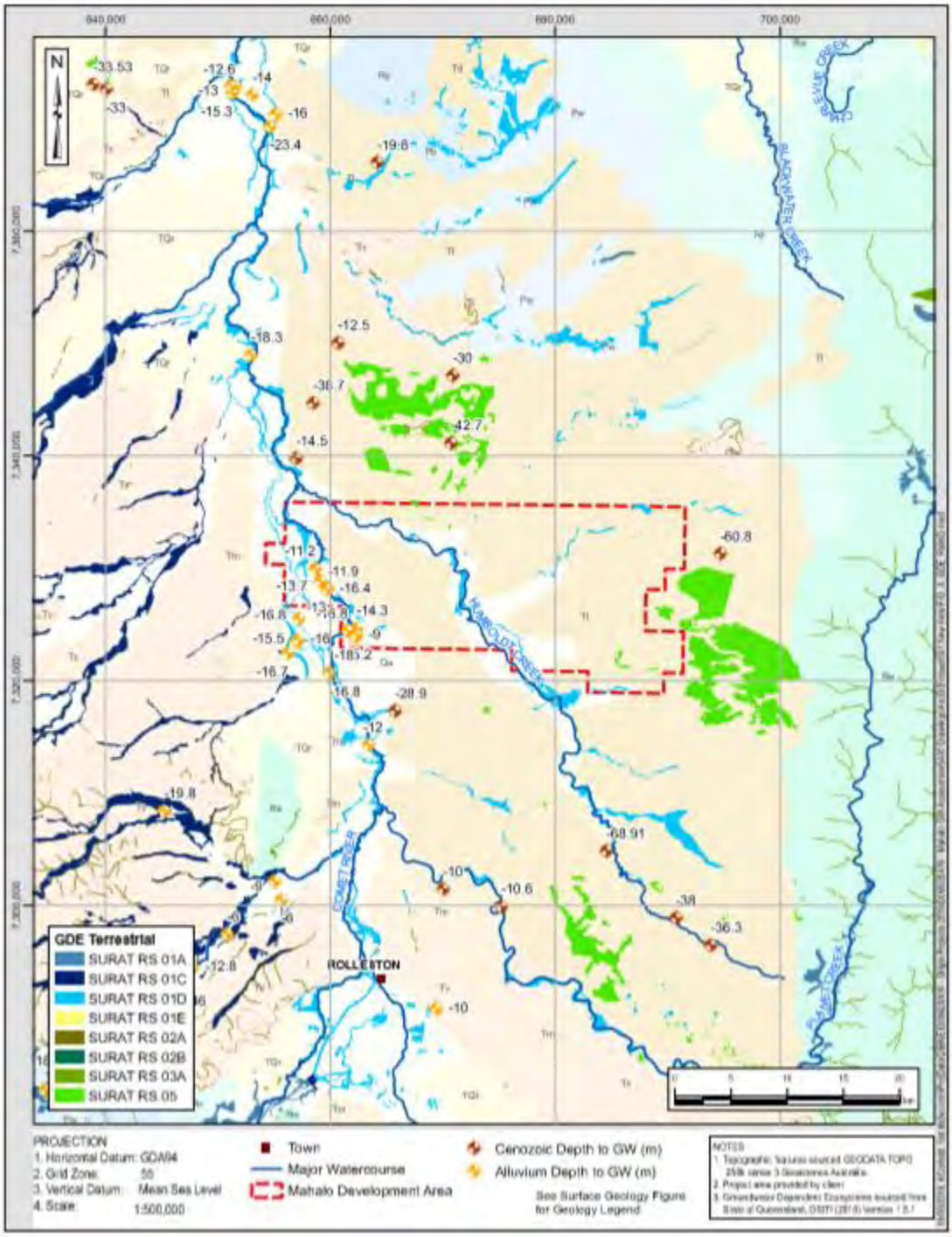
[6] Water Assessment Report Page 89

alluvium and were mapped by KCB in areas where Cenozoic levels were present (see Figures 3 and 4 below).

Figure 3: Location of Potential Terrestrial GDEs in the Vicinity of the Mahalo Development Area[7]

7

Figure 4 Potential Terrestrial GDEs by Rule Set and Depth to Groundwater[8]



[8] Water Assessment Report page 93

d. Impacts to subterranean fauna. These are predominantly crustaceans that are between 0.3mm and 15 mm in length. They are predominantly found in aquifers with large pore spaces, with pore space a key determinant of suitale habitat.[9] The WA Report provided that "potential habitat for stygofauna exists within the alluvium, Cenozoic sediments and basalt units, which are shallower in depth and exhibit relatively fresh EC.[10]

e. Impacts to existing groundwater users. There are currently a large number of registered groundwater bores that could potentially be impacted by the project (within the Authority to Prospect and a 50 km buffer). The WA Report states that there were 1,747 registered groundwater bores recorded in the Groundwater Database (**GWDB**) as of July 2019.

9. It is submitted that the above impacts are "important, notable, or of consequence, having regard to … context and intensity" because of long term consequences to local GDEs and fauna, which are dependent on groundwater, the sensitivity of impacts on spring water complexes and groundwater users, and severity of possible impacts given the large volumes of water that will be withdrawn and the scale of the Proposed Action.

Significant Impact Criteria – likelihood of impacts

10. In the WA Report, KCB concluded that impacts to source aquifers, terrestrial GDEs, subterranean fauna and existing groundwater users would not be significant. This conclusion was primarily based on drawdown predictions in locations where environmental receivers were located.[11]

11. We attach preliminary assessment made by s11C(1)(a) s11C(1)(a) regarding the WA Report (**Preliminary Assessment**). s11C(1)(a) s11C(1)(a) has expertise in the field of hydrogeology and geochemistry and has substantial experience working with the water industry and environmental regulators.

[9] Water Assessment Report Page 94
[10] Water Assessment Report Page 94
[11] Water Assessment Report pages 112-116.

12. In his Preliminary Assessment, s11C(1)(a) states that it is critical that investigation and modelling is done in accordance with the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development information guidelines (**IESC Guidelines**) when assessing significant impacts on water resources. He states:

    "There must be sufficient data and a sufficient level of confidence in the predicted impacts in order to determine whether or not there is a reasonable likelihood of significant impact on water resources."[12]

13. One of the key issues identified by s11C(1)(a) is that the WA Report is based on numerical modelling used by the Surat CMA Underground Water Impact Report (**UWIR**), which has been prepared by the Office of Groundwater Impact Assessment (**OGIA**). The Preliminary Assessment provides:

    "Much of the groundwater modelling work/impact prediction is based on numerical modelling conducted by OGIA using the Surat CMA underground water impact model – a regional-scale model being used to assess CSG impacts on groundwater within the wider area. While this is indeed an appropriate tool to be used in the assessment of impacts in the project area, a significant amount of additional local-scale data, including baseline groundwater levels and quality, information about geological structures, interaquifer connectivity and ground-surface water interaction are needed within and around the project area to make a more targeted and confident local-scale assessment of impacts, in accordance with the IESC information guidelines…"[13]

Inadequate data

14. In his Preliminary Assessment, s11C(1)(a) identified four deficiencies with KCB's modelling and analysis compared to the IESC Guidelines. These are:

    a. Lack of groundwater monitoring bores within the project area to assess baseline conditions and inter-aquifer connectivity.

       "As shown in Figure 7.9, no dedicated active monitoring bores currently occur within the project area. A small number of groundwater database records/bores occur in the west of the project area (Fig 7.11), and water level records from these and other bores in the surrounding area are presented in the report. However, the coverage of monitoring bores and historic groundwater level monitoring data, and the hydrochemical data presented from the project area are not adequate to characterise baseline groundwater elevation ranges, the

[12] s11C(1)(a), "Comments Regarding Water Assessment: Mahalo Coal Seam Gas Project (APLNG)" (22 October 2019) 1

[13] s11C(1)(a) above n12, 2.

groundwater flow regime, recharge and discharge and/or inter-aquifer connectivity;"[14]

b. Inadequate information on a significant geological fault in the region.

"A significant geological fault has been identified in the region. This fault appears to cause significant offset to deep geological units in the basin, creating a possibility of enhanced connectivity between deep and shallow aquifers (Figure 7.7). The fault may also be an important control on the occurrence of springs in the region (e.g. providing a conduit for flow from confined aquifers to the surface). The information and analysis regarding this fault and its possible hydrogeological effects is inadequate to meet the following IESC checklist item…

The location of the fault is not clearly shown on a map in relation to the project area. A statement is made that seismic data (Fig 7.7) indicates a "~1 km zone of fault rubble, resulting in limited connectivity between the coal seams on the east and west of the fault". The nature of the material in the fault zone appears only to have been assessed based on seismic profiles (rather than analysis of geological samples) and the conclusion about connectivity is highly speculative without any analysis of water level data either side of the fault, direct sampling of geologic material or hydrochemical analysis of groundwater in its vicinity. As a result, the hydrogeological effects of this major structure remain unclear, with implications for the impact predictions and the level of confidence with which these can be made."[15]

c. Inadequate data and analysis on the ground-surface interaction

"The report includes a conceptual model of ground-surface water interaction for the Comet River and alluvial aquifer (Fig 7.26). It is stated that due to the depth of the water table in the alluvium being below the base of the river in monitoring data, no baseflow is anticipated to occur. While this may be the case, the possibility of enhanced leakage or capture of surface water due to increased vertical hydraulic gradients should be examined, and differences in the relationship between water table height and stream base (along the length of the river) further examined. A greater amount of observation data and analysis is needed to verify the relationship between surface water levels, alluvial groundwater levels, and stream base elevation both spatially and temporally, in accordance with the following IESC checklist item…"

[14] s11C(1)(a) above n12, 2.
[15] s11C(1)(a) above n12, 3.

d. Inadequate modelling and assessment of impacts to existing bores and users

"Based on the numerical modelling, the project predicts drawdowns of greater than 0.2m in certain parts of the upper layers (alluvium and Basalt) as well as the Rewan Group, and Upper/Lower Bandanna Formation (see page 107), Fig 8.3, Table 9.1 and Fig. 9.1.

These model results indicate that some level of drawdown propagation will probably occur in aquifers in which significant numbers of landholder bores occur (although most bores are not predicted to be impacted by drawdowns above the 2m threshold level in the Water Act). While the model-predicted drawdown levels are below threshold levels in the upper layers, including Basalt (the layer with the highest number of bores) and alluvium, the occurrence of drawdown in these layers within the model indicates some probable level of impact. Larger drawdown effects may be possible in these units, for example, depending on local-scale hydrostratigraphy, aquifer parameters and geological structures (for which the current set of field data provide insufficient local-scale detail).

The same applies in the Rewan Group. Impacts to Rewan Group bores surrounding the project include predicted drawdowns of up to 3.3m. There are also a significant number of bores in the Rewan Formation near the town Springsure, to the west of the project area, where the drawdown predictions in the model do not appear to extend (Figure 8.3). Given the reasonably high predicted drawdowns in the Rewan elsewhere in the modelled area, further local scale hydrogeological investigations and/or modelling would help better understand the possibility of significant impacts to these bores.

There are four bores in the Bandanna Formation, where the model predicts drawdown to be greater than threshold levels in the Water Act (north of the project area). Again, given the model is a regional-scale tool, the magnitude and extent of the drawdown should be further investigated and informed by local-scale studies of inter-aquifer connectivity, aquifer and aquitard hydraulic properties and geological structure, as further bores in the area may be similarly affected."[16]

[16] s11C(1)(a) above n12, 4.

Precautionary Principle

15. KCB's lack of adequate modelling and assessment of impacts for the Proposed Action invokes the precautionary principle.

16. The Minister is required to precautionary principle when making decisions pursuant to section 391 of the EPBC Act when there is a lack of full scientific certainty regarding the potential for serious or irreversible environmental damage.

17. Section 391 of the EPBC Act provides:

> "(2) The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage."

18. Significant Impact Guidelines 1.1 provide:

> "When deciding whether or not a proposed action is likely to have a significant impact on a matter of national environmental significance, the precautionary principle is relevant. Accordingly, where there is a risk of serious or irreversible damage, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on a matter of national environmental significance."

19. The Hon. Justice Preston, Chief Justice of the Land and Environment Court of New South Wales provides guidance on the interpretation and application of the precautionary principle in Ministerial decision making. His Honour states that "an assessment must be made that a serious threat exists and that there is considerable scientific uncertainty about that threat for the principle to operate."[17]

20. In particular, the Proposed Action is:

    a. located in an environmentally sensitive area with threatened ecological communities and listed threatened species;
    b. over a large geographical area (development footprint of 46,900 ha);
    c. proposing to withdraw significant quantities of groundwater;
    d. near other CSG projects, which are already impacting the environment; and
    e. inconclusive as to the significant direct and indirect impacts over time due to inadequate modelling, data and analysis.

---

[17] The Honourable Justice Preston, Chief Justice of the Land and Environment Court of New South Wales, "The Judicial Development of the Precautionary Principle" to the Queensland Government, Environmental Management of Firefighting Foam Policy Implementation Seminar, 21 February 2017, Brisbane, Page 18. Accessed on 9 January 2019 < http://www.lec.justice.nsw.gov.au/Documents/Speeches%20and%20Papers/PrestonCJ/Justice%20Brian%20J%20Preston%20SC%20Keynote%20Address%20-%20Precautionary%20Principle%20%20delivered%2021.02.17.pdf>

21. These factors contribute to the potential for irreversible and irreparable changes and damage to the location of the proposed action. Accordingly, the precautionary principle should be invoked, at the very least, to determine whether there is a serious and irreversible threat of environmental damage based on a process of analysis inclusive of, inter alia, technical, methodological and/or epistemological measures.[18]

Conclusion

22. For the reasons above, we submit that the proposed action is a controlled action with meaning of s 67 of the EPBC Act. We request the Minister to decide under s 75(1) that the Proposed Action requires her approval, that the controlling provision is s 24D and to obtain advice from the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development.

23. We further submit that a full environment assessment process should be required.

[18] As above at page 11 citing Telstra Corp Ltd v Hornsby Shire Council [2006] NSWLEC 133; (2006) 67 NSWLR 256, 27 [41]; cited in Environment East Gippsland Inc v VicForests [2010] VSC 335; (2010) 30 VR 1, 48 [195].

FOI 200511
Document 18

Submission Cover Sheet

Submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

Submission made by:

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

s11C(1)(a)

Referrals Gateway
Assessment & Governance Branch
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

Email: epbc.comments@environment.gov.au

24 October 2019

Dear Sir/Madam

Submission on 2019/8534 AUSTRALIA PACIFIC LNG PTY LIMITED/Energy Generation and Supply (non-renewable)/Surat Basin/Queensland/Mahalo Development Area CSG Project

1. We would like to thank the Department of Environment and Energy for consulting the public on the Referral by Australia Pacific LNG (**APLNG**) of for the construction, operation and rehabilitation of the following:

    a. 95 gas production wells;

    b. ancillary linear infrastructure including gas and water pipelines, access tracks, power lines, and communication lines;

    c. gas compression facilities;

    d. water management infrastructure; and

    e. ancillary activities and facilities to support construction and operations

    within the Mahalo Development Area (**Proposed Action**).

2. We submit that the Minister for the Environment should decide that the proposed action is a controlled action under s 75(1) of the Environment Protection and Biodiversity Act 1999 (Cth) (**EPBC Act**) and relevant controlling provisions for the purposes of s 75(2) are:

    a. Section 18, which prohibits actions with significant impact on listed threatened species or endangered community;

    b. Section 20, which prohibits actions with a significant impact on a listed migratory species; and

    c. Section 24(b)(2), which prohibits actions with a significant impact on the environment in the Great Barrier Reef.

3. We further submit that the appropriate level assessment for this project, given the potential for serious environmental degradation and impact to

Matters of National Environment Signifiicance (**MNES**), in particular with regard to impacts on koalas and greenhouse gas emissions (**GHG**s) from the project, to be that of a full environmental assessment process.

4. This submission makes the following key points:

   a. APLNG failed to assess the likely presence of several endangered and critically endangered species in the environment that may be affected (**EMBA**).

   b. Once APLNG was aware of the known, likely, or potential presence of threatened species in the EMBA, it had an obligation to carry out targeted surveys, in accordance with best practice standards and DoEE survey guidelines before making its referral application and to support its assessment of significant impact. APLNG completely failed to fulfill this requirement.

   c. APLNG's failure as set out in paragraph 3(b) above, should be grounds for the DoEE to apply the precautionary principle in determining whether MNEs are present in the EMBA.

   d. Although APLNG has asserted that there will be no significant impacts to listed threatened species by designating habitat as "no go zones", there has been a complete failure by APLNG to disclose maps and locations of key infrastructure components of the project, the specific nature and condition of vegetation to be cleared for such infrastructure and likely impacts on threatened species.

   e. APLNG's failure, as set out in paragraph 3(d) above, significantly increases the likelihood of significant impacts from the Proposed Action on MNES with regard to habitat loss, dust emissions and erosion.

   f. The Proposed Action is likely to have a significant impact on the following MNEs:

      i. Endangered Brigalow (Acacia harpophylla dominant and co-dominant);

      ii. Endangered Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin;

      iii. Endangered Poplar Box Grassy Woodland on Alluvial Plains;

      iv. Endangered Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;

      v. Endangered Weeping Myall Woodlands;

      vi. *Calidris ferruginea,* Critically Endangered Curlew Sandpiper;

vii. *Geophaps scripta scripta,* Squatter Pigeon (southern);

viii. *Neochmia ruficauda ruficauda,* Star Finch (eastern), Endangered Star Finch (southern);

ix. *Poephila cincta cincta;* Endangered Southern Black-throated Finch;

x. *Rostratula australis;* Endangered Australian Painted-snipe, Australian Painted Snipe;

xi. *Dasyurus hallucatus,* Endangered Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu];

xii. *Elseya albagula,* Critically Endangered Southern Snapping Turtle, White-throated Snapping Turtle; and

xiii. *Rheodytes leukops,* Endangered Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver.

g. The Proposed Action is likely to have a significant impact on koalas because of APLNG's failure to conduct koala surveys and develop an appropriate mitigation strategy.

h. The Proposed Action is likely to have a significant impact on MNES due to climate change impacts.[1] It is submitted that the international scientific consensus on the impacts of climate change and recent Australian case law[2] require consideration of climate change impacts when applying Significant Impact Guidelines 1.1 to the impacts of the Proposed Action.

i. The following list of threatened species have been identified in relevant Recovery Plans, Conservation Advices and scientific research as being particularly vulnerable to climate change impacts. It is submitted that the Proposed Action is likely to have a significant impact on the recovery of these species:

i. *Burramys parvus,* Endangered Mountain Pygmy Possum;

ii. *Pseudophryne pengilleyi,* Critically Endangered Northern Corroboree Frog; and

iii. *Pseudophryne corroboree,* Critically Endangered Southern Corroboree Frog.

j. The Proposed Action is likely to have a significant impact on the Great Barrier Reef.

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[1] Lee JR, Maggini R, Taylor MFJ, Fuller RA (2015) Mapping the Drivers of Climate Change Vulnerability for Australia's Threatened Species. PLoS ONE 10(5): e0124766. <https://doi.org/10.1371/journal.pone.0124766>.

[2] *Gloucester Resources Limited v Minister for Planning* [2019] NSWLEC 7

APLNG failed to assess the likely presence of several endangered and critically endangered species in the EMBA.

5. The Mahalo Development Area Ecology Assessment Report for Impacts to Matters of National Environmental Significance (**EA**) was submitted to the DoEE in support of APLNG's Referral. It asserted that there would be no significant impact to listed threatened species and other protected matters under the EPBC Act.

6. It is submitted that APLNG completely failed to assess the likely presence of the following endangered and critically endangered species in the EMBA, which were identified by the Protected Matters Search Tool.

    i. *Calidris ferruginea,* Critically Endangered and Migratory Curlew Sandpiper;

    ii. *Neochmia ruficauda ruficauda,* Star Finch (eastern), Endangered Star Finch (southern);

    iii. *Poephila cincta cincta,* Endangered Southern Black-throated Finch;

    iv. *Rostratula australis,* Endangered Australian Painted-snipe, Australian Painted Snipe;

    v. *Dasyurus hallucatus,* Endangered Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu];

    vi. *Elseya albagula,* Critically Endangered Southern Snapping Turtle, White-throated Snapping Turtle; and

    vii. *Rheodytes leukops,* Endangered Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver.

7. Assessments of the likely presence of the above critically endangered and endangered species in the EMBA are set out in Table 1 below.

Table 1: Likely presence of MNES in the EMBA

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
Threatened Ecological Communities					
1.	Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	Brigalow TEC confirmed as present. Regrowth Brigalow TEC confirmed as present.[3]	Agreed.
2.	Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area	Mapped as present. Grassland communities were inferred from State Regional Ecosystem mapping v11 (DNRME, 2019).[4]	The TEC is likely to occur within the area for the following reasons: • The State Regional Ecosystem maps the TEC as present; and • Protected Matters Search Tool report indicates that the TEC is likely to occur within the area.
3.	Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area	Confirmed as present. Poplar Box communities were identified through a combination of formal vegetation quadrats as well as State Regional Ecosystem mapping v11 (DNRME, 2019).[5]	Agreed.

[3] Golder Associates, 'Mahalo Development Area Ecology Assessment Report for Impacts to Matters of National Environmental Significance' (2019) 43.
[4] Ibid 44.
[5] Ibid 44.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
4.	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	Mapped as present. Vine Thicket communities were inferred from State Regional Ecosystem mapping v11 (DNRME, 2019).[6]	TEC is likely to occur within the area for the following reasons: • The State Regional Ecosystem maps the TEC as present; and • The PMST report indicates that the TEC is likely to occur within the area.
5.	Weeping Myall Woodlands	Endangered	Community likely to occur within area	Weeping Myall communities were identified through a combination of formal vegetation quadrats as well as State Regional Ecosystem mapping v11 (DNRME, 2019). It is noted the Weeping Myall communities can occur as a sub-community within the Poplar Box communities. Although, none were confirmed within the Mahalo Development Area, there is a high likelihood they could occur.[7]	Agreed that TEC is likely to occur within the area for the following reasons: • The State Regional Ecosystem maps the TEC as present; and • The PMST report indicates that the TEC is likely to occur within the area.
Birds					

[6] Ibid 44.
[7] Ibid 44.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
6.	*Calidris ferruginea* Curlew Sandpiper	Critically endangered, Migratory wetland	Species or species habitat **may** occur within area	**No significant impact assessment was made. No surveys were conducted.**	The Curlew Sandpiper is likely to occur within the area for the following reasons: • The Conservation Advice for the Curlew Sandpiper provides: "In Australia, curlew sandpipers 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 (Higgins & Davies, 1996)."[8] • The EMBA contains large areas of wetlands that are suitable habitat for curlew sandpipers.[9] Examples include Palustrine Wetland, Struan, which has been assessed as providing "marginal breeding and foraging habitat for waterfowl and wader birds

[8] Conservation Advice for the Curlew Sandpiper (2015) 3.

[9] Golder Associates, 'Mahalo Development Area Ecology Assessment Report for Impacts to Matters of National Environmental Significance' (2019) Appendix E.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					(terrestrial fauna) during wetter periods", Lacustrine Wetland, Somerby (Site Code L1), which has been as providing "marginal breeding and foraging habitat for waterfowl and wader birds (terrestrial fauna) during wetter periods", Lacustrine Wetland Somerby (Site Code L2), which has been assessed to provide "foraging and potential breeding habitat for waterfowl and wader birds" and Hummboldt Creek, Straun, which has been assessed to include "seasonal, opportunistic habitat for waterfowl and wader birds, fish and turtles".[10] • The area is within the SPRAT distribution map for the Curlew Sandpiper.[11]
7.	*Geophaps scripta scripta* Squatter Pigeon (southern)	Vulnerable	Species or species habitat **likely** to occur within area	Although not recorded during surveys for the Project, Appendix B provides the rationale for the potential occurrence of this MNES within the Mahalo Development Area. The Mahalo Development Area is within the known distribution of this species with	

[10] Ibid.
[11] Department of the Environment (2019). *Calidris ferruginea* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
				known records occurring approximately 20 km to the west-south-west of the site (ALA, 2019). The Mahalo Development Area intercepts potential habitat modelling for the Squatter Pigeon (DES, 2015). The Squatter Pigeon (southern) habitat is generally defined as open-forests to sparse, open- woodlands and scrub that are, mostly dominated in the overstorey by Eucalyptus, Corymbia, Acacia or Callitris species remnant, regrowth or partly modified vegetation communities, and within 3 km of water bodies or courses (DoEE, 2018n). The species often moves into adjacent natural grasslands and/or highly modified or degraded habitats, such as pastures, stockyards, road reserves, railway easements and settlements, to forage for seed on the ground, drink from stock troughs or dams with	

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
				gently sloping banks, and dust-bathe on bare, dusty ground (DoEE, 2018n).	
8.	*Neochmia ruficauda ruficauda* Star Finch (eastern), Star Finch (southern)	Endangered	Species or species habitat **likely** to occur within area	**No significant impact assessment was made. No surveys were conducted.**	The Star Finch (eastern) is likely to occur within the area for the following reasons: • The Conservation Advice for the Star Finch states that the distribution of the Star Finch is likely to overlap with the EPBC Act Listed TECs comprising of Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions and the Brigalow (Acacia harpophylla dominant and co-dominant). Both of these TECs are present within the EMBA; • The PMST report indicates that the community is likely to occur within area; and • The area is within the SPRAT distribution map for the Star Finch (eastern).[12]
9.	*Poephila cincta cincta*	Endangered	Species or species habitat	**No significant impact assessment was made. No surveys were conducted.**	The Southern Black-Throated Finch is likely to occur within the area for the following reasons:

[12] Department of the Environment (2019). *Neochmia ruficauda ruficauda* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
	Southern Black-throated Finch		**may** occur within area		• The Recovery Plan for the Southern Black-Throated Finch states that: "The southern subspecies of the black-throated finch historically occurred from north-east NSW to Queensland's Atherton Tablelands and west to central Queensland, with the northern subspecies found from the Atherton Tablelands, north to Cape York Peninsula, and west to the Gulf of Carpentaria (Schodde and Mason 1999). The black-throated finch inhabits grassy woodland dominated by eucalypts, paperbarks or acacias, where there is access to seeding grasses and water (Zann 1976)."[13] • The EMBA contains suitable habitat for the black-throated finch such as 355.2 ha of RE 11.3.25 River Red Gum woodland fringing drainage lines, RE 11.4.8; 863.7 ha of Dawson Gum/Brigalow woodland on remnant surfaces, 93.4 ha of RE 11.9.5 Brigalow and/or Belah open forest on fine-grained sedimentary rocks and 49.4 ha of

[13] Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service. 2007. *National recovery plan for the black-throated finch southern subspecies* Poephila cincta cincta . Report to the Department of the Environment and Water Resources, Canberra. Department of Environment and Climate Change (NSW), Hurstville and Queensland Parks and Wildlife Service, Brisbane, 8-9.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					RE 11.10.3 Bendee (Acacia catenulata) or Lancewood (A. shirleyi) open forest on coarse-grained sedimentary rocks. Crests and scarps;[14] and • The area is within the SPRAT distribution map for the Southern Black-throated Finch.[15]
10.	*Rostratula australis* Australian Painted-snipe, Australian Painted Snipe	Endangered	Species or species habitat **may** occur within area	**No significant impact assessment was made. No surveys were conducted.**	The Australian Painted Snipe is likely to occur within the area for the following reasons: • The EMBA is within the geographical range of the Australian Painted Snipe. In particular, the Conservation Advice for the Australian Painted Snipe provides: "The Australian painted snipe occurs in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams, rice crops, sewage farms and bore drains, generally with a good cover of grasses, rushes and reeds, low scrub, Muehlenbeckia spp. (lignum), open timber or samphire (Reader's Digest, 1997; Marchant and

[14] Golder Associates, above n1, 20-22.
[15] Department of the Environment (2019). *Poephila cincta cincta* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					Higgins, 2003). It has been recorded at wetlands in all states and territories (Barrett et al, 2003; Blakers et al., 1984) and is most common in eastern Australia. Important areas for this species in the past have included the Murray-Darling Basin (particularly the Riverina of Victoria and New South Wales), Queensland Channel Country, Fitzroy Basin of Central Queensland, south-eastern South Australia and adjacent parts of Victoria (Rogers et al., 2005)."[16] • The EMBA is within an important area for the species as it is within the Comet River drainage sub-basin of the Fitzroy Basin.[17] • The EMBA contains large areas of wetlands that are suitable habitat for the Australian Painted Snipe, including breeding habitat.[18] Examples include Palustrine Wetland, Struan, which has been assessed as providing "the marginal breeding and foraging habitat for waterfowl and wader birds (terrestrial fauna) during wetter periods", Lacustrine Wetland, Somerby (Site

[16] Conservation Advice for the Australian Painted Snipe (2013) 2.
[17] Golder Associates, above n1, 7, 40.
[18] Golder Associates, above n9.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					Code L1), which has been as providing "marginal breeding and foraging habitat for waterfowl and wader birds (terrestrial fauna) during wetter periods", Lacustrine Wetland Somerby (Site Code L2), which has been assessed to provide "foraging and potential breeding habitat for waterfowl and wader birds" and Hummboldt Creek, Straun, which has been assessed to include "seasonal, opportunistic habitat for waterfowl and wader birds, fish and turtles";[19]
Mammals					
11.	*Dasyurus hallucatus* Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu]	Endangered	Species or species habitat **may** occur within area	**No significant impact assessment was made. No surveys were conducted.**	The Northern Quoll is likely to occur within the area for the following reasons: • The EMBA is within the known distribution of the Northern Quoll in Central Queensland;[20] • The area is within the SPRAT distribution map for the Northern Quoll;[21] and • There is suitable habitat for the Northern Quoll within the EMBA. The SPRAT

[19] Ibid.
[20] Hill B.M. and Ward S.J. (2010). National Recovery Plan for the Northern Quoll *Dasyurus hallucatus*. Department of Natural Resources, Environment, The Arts and Sport, Darwin.
[21] Department of the Environment (2019). *Dasyurus hallucatus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					database states that suitable habitat includes "rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Threatened Species Scientific Committee 2005aq)."[22]
12.	*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)* Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	Vulnerable	Species or species habitat **likely** to occur within area	Koala presence was confirmed through the presence of secondary and anecdotal evidence (that is, scats, and sightings by landholders) during formal vegetation quadrats and habitat assessments, as well as historical records within the Mahalo Development Area. The Mahalo Development Area contains habitat critical to the survival of the Koala, as defined by the Koala Referral Guidelines (DoE, 2014). This species may be present in suitable remnant and regrowth vegetation communities within the Mahalo Development Area where preferred habitat and feed trees are prevalent (that is, within REs 11.3.1, 11.3.1b,	Agreed that koalas are known to occur within the area.

[22] Ibid.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
				11.3.2, 11.3.4, 11.3.4a, 11.3.25, 11.4.8, 11.5.3, 11.5.5, 11.5.13, 11.8.4, and 11.8.5).	
Reptiles					
13.	*Elseya albagula* Southern Snapping Turtle, White-throated Snapping Turtle	Critically Endangered	Species or species habitat likely to occur within area	**No significant impact assessment was made. No surveys were conducted.**	The Southern Snapping Turtle is likely to occur in the area for the following reasons: • The Conservation Advice for the Southern Snapping Turtle states that it is: "Found only in Queensland in the Fitzroy, Mary and Burnett Rivers and associated smaller drainages in south eastern Queensland."[23] • The Comet River flows through the EMBA. It is a tributary of the Mackenzie River, which is a tributary of the Fitzroy River. • The EMBA contains 100 watercourses that are suitable habitat for the Southern Snapping Turtle.[24] • The EMBA contains large areas of wetlands that are suitable habitat for the Southern

[23] Conservation Advice for the Southern Snapping Turtle (2014) 1.

[24] Golder Associates, above n1, 35.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					Snapping Turtle.[25] Examples include Palustrine Wetland, Struan, which has been assessed as potentially "providing foraging habitat for Least Concern turtles during the wetter months of the year for highly mobile species such as eastern snake-necked turtle (*Chelodina longicollis*)," Lacustrine Wetland Somerby (Site Code L2), which has been assessed to provide "foraging and potential breeding habitat for waterfowl and wader birds. Likely habitat for fish and turtles" and Hummboldt Creek, Straun, which has been assessed to include "seasonal, opportunistic habitat for waterfowl and wader birds, fish and turtles";[26] • The PMST Report indicates that the species or species habitat is likely to occur within the area.
14. "	*Rheodytes leukops* Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver	Endangered	Species or species habitat likely to occur within area	**No significant impact assessment was made. No surveys were conducted.**	• The Conservation Advice for the Fitzroy River Turtle states: "*Rheodytes leukops* is only found in the Fitzroy River and its tributaries (EPA, 2007). Known sites include Boolburra, Gainsford, Glenroy Crossing, Theodore, Baralba, the Mackenzie River, the Connors River,

[25] Golder Associates, above n9.
[26] Golder Associates, above n9.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					Duaringa, Marlborough Ck, and Gogango (Cogger et al., 1993; Covacevich et al., 1996; Tucker et al., 2001; Venz, 2001). *Rheodytes leukops* occurs in flowing rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles (Cogger et al., 1993; EPA, 2007; Latta & Latta, 2005)." • The Comet River flows through the EMBA. It is a tributary of the Mackenzie River, which is a tributary of the Fitzroy River. • The EMBA contains large areas of wetlands that are suitable habitat for curlew sandpipers.[27] Examples include Palustrine Wetland, Struan, which has been assessed as potentially "providing foraging habitat for Least Concern turtles during the wetter months of the year for highly mobile species such as eastern snake-necked turtle (*Chelodina longicollis*)," Lacustrine Wetland Somerby (Site Code L2), which has been assessed to provide "foraging and potential breeding habitat for waterfowl and wader birds. Likely habitat for fish and turtles" and Hummboldt Creek, Straun, which has been assessed to include "seasonal, opportunistic

[27] Golder Associates, above n9.

	Scientific and Common name	EPBC Act Status	Type of Presence (Protected Matters Report)	Golder Assessment	Response
					habitat for waterfowl and wader birds, fish and turtles";[28]

[28] Golder Associates, above n9.

APLNG has an obligation to ensure that surveys for critically endangered and endangered species were carried out accordance with best practice standards and DoEE survey guidelines. Based on information provided in the EA, APLNG completely failed to fulfill these basic requirements.

8. The following DoEE survey guidelines are critical for determining species presence/absence in the EMBA:

   i. Survey Guidelines for Australia's Threatened Birds;[29]

   ii. Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebirds;[30]

   iii. Survey Guidelines for Australia's Threatened Mammals;[31]

   iv. Survey Guidelines for Australia's Threatened Reptiles.

   (collectively referred to as DoEE Survey Guidelines).

9. APLNG has failed to fulfill baseline requirements and, as such, its desktop and habitat surveys cannot be relied upon as evidence of the absence of threatened species in the EMBA. Particulars of the failure of APLNG to comply with the DoEE Survey Guidelines in relation to threatened mammals, birds and reptiles are set out in Table 2 below.

10. The DoEE Survey Guidelines provide that "biological surveys are usually an essential component of significant impact assessment, and should be conducted on the site of the proposed action prior to referral."[32] A proponent may depart from the DoEE Survey Guidelines if "an evidence-based rationale for an alternative approach has been provided."[33] In the present matter, APLNG has failed to provide any justification for the lack of any fauna surveys being conducted in the EMBA in support of its Referral application.

[29] Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Birds* (2010).
[30] Commonwealth of Australia, *EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (2017).
[31] Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Mammals* (2011).
[32] Ibid 1.
[33] Ibid.

Table 2:

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
Birds			
1.	*Calidris ferruginea* Curlew Sandpiper	The Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebirds requires the following minimal survey effort: • 4 roosting surveys when the majority of migratory shorebirds are present in the area; • 4 foraging surveys; • Survey during non-breeding period; • Survey replication – 1 survey in December, 2 surveys in January and 1 survey in February.	No searches were undertaken for the Curlew Sandpiper.
2.	*Neochmia ruficauda ruficauda* Star Finch (eastern), Star Finch (southern)	The Survey Guidelines for Australia's Threatened Birds provides: **Recommended methods** The Survey Guidelines for Australia's Threatened Birds provides: Area searches or transect-point surveys in suitable habitat, such as rank grasses in riparian areas with pandanus or corypha palm. Also check within flocks of other finches. Detection by calls and sighting. Broadcast (playback) surveys may be useful, especially in the morning and evening. Targeted searches and subsequent watches of waterholes may also be useful in the dry season.	No searches were undertaken for Star Finch (eastern).

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
		Survey Effort: • Area searches or transect-point surveys (in areas less than 50 ha) – 15 hours, 5 days; • Broadcast surveys (in areas less than 50 ha) – 15 hours 3 days; • Targeted surveys (targeting waterholes especially in dry season) – 10 hours, 4 days.[34]	
3.	*Poephila cincta cincta* Southern Black-throated Finch	The Survey Guidelines for Australia's Threatened Birds provides: **Recommended methods** In the tropics, locate and watch suitable waterholes late in the dry season and conduct area searches of savanna woodland. Also check around breeding black-faced woodswallow *Artamus cinereus* flocks in the early wet season (S. Garnett pers. comm.). Elsewhere use area searches of suitable habitat for sightings and checking flocks of other finch species. **Survey effort** Land based area searches (areas less than 50 hectares)– 10 hours, 5 days Targeted searches (targeting waterholes and woodswallow nests) – 6 hours 2 days.	No searches were undertaken for the Southern Black-throated Finch.
4.	*Rostratula australis*	The Survey Guidelines for Australia's Threatened Birds provides: **Detectability**	No searches were undertaken for the Australian Painted Snipe.

[34]Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Birds* (2010), 199-200.

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
	Australian Painted-snipe, Australian Painted Snipe	Difficult to detect even when present. Thought to be mainly crepuscular but can be detected during the day. Secretive but conspicuous when in the open (rare) (Marchant & Higgins 1993; C. Tzaros pers. comm.). Intensive vigilance is required to detect flushed birds (C. Tzaros pers. comm.). **Recommended methods** • Area searches or transects through suitable wetlands; detection by sighting and flushing. • Targeted stationary observations at dawn and dusk of suitable foraging locations within wetlands; detection by sighting. Also a brief spotlight search shortly after dusk may detect birds. To date, trials of broadcast (playback) have not been successful (C. Tzaros pers. comm.). **Survey Effort** • Targeted stationary observations – 10 hours, 5 days; • Land-based area searches or line transects (for areas less than 50 hectares when wetland holds water but is not flooded) – 10 hours, 3 days.[35]	

[35] Commonwealth of Australia, above n29, 34-35.

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
Mammals			
5.	*Dasyurus hallucatus* Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu]	**The Survey Guidelines for Australia's Threatened Mammals provides:** • In large areas, Elliott traps are suitable, in particular large Elliot traps. • Trapping is best conducted between May and August to minimise disturbance to reproductive period. **The following survey method and minimum survey effort is recommended:** • 20 Elliott A, B or E traps (see species profiles for details) placed at each sampling site; • Traps placed 10 metres apart in two parallel straight lines (transects) separated by 25 metres (a greater distance between traps is recommended in some species profiles); • One sampling site per representative habitat, with a minimum of two sampling sites required per 5 hectares (replication across habitat types in areas greater than 5 hectares); • Set traps for four consecutive nights; • Check traps early in the morning and close during the day; • Bait traps with a species-specific mixture (see species profiles); • Rebait and open traps in the late afternoon;	No searches were undertaken for the Northern Quoll.

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
		• Consider placing two traps at each trap station to saturate trapping effort if common species are likely to limit the detection of listed mammals; • Provide a small amount of nesting material for shelter (for example, shade and warmth); and • In places where populations are low or where it is difficult logistically to deploy cage traps, additional or complementary techniques may be used. [36]	
6.	*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)* Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory	The EPBC Act Referral Guidelines for the Vulnerable Koala provide that the following constitute methods of surveying for koalas: • Direct observation methods including strip transects, nocturnal spotlighting, call playback, remote sensor activated cameras and mark-resight or mark-recapture. • Direct observation surveys should be undertaken between August and January. This is the period when koala activity is generally at a peak, and resident breeding females with back-young are most easily observed. Direct observation surveys conducted outside of this period must take into account the potential for lower koala activity (reduced detectability) and other relevant seasonal considerations. • Indirect survey methods including scratchings, Scats – Spot Assessment Technique, Scats – Regularised Grid Based Spot Assessment Technique (RGB-SAT), Scats – Koala optimized Rapid	• No searches were undertaken for the Koala. • Vegetation surveys were conducted in 14 to 21 February 2018 and from 27 to 30 March 2018, which would are outside the August – January window recommended by the Referral Guidelines for the Vulnerable Koala.

[36]Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Mammals* (2011) 45.

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
		Assessment Methodology (KRAM) and Faecal standing crop assessment.[37]	
Reptiles			
7.	*Elseya albagula* Southern Snapping Turtle, White-throated Snapping Turtle	The Survey Guidelines for Australia's Threatened Reptiles provide: Survey techniques typically applied to the detection of freshwater turtles include diving with a face mask and snorkel and/or baited traps.[38] Trapping also effectively samples some species. Commercially available 'yabby' traps (60 centimetres x 45 centimetres x 25 centimetres) are sufficient to capture moderately large turtles such as the Namoi River elseya *Elseya belli*, the Bellinger River emydura *Emydura macquarii signata*, and the Fitzroy tortoise *Rheodytes leukops*.[39] Placement of traps is critical. These should be suspended from branches overhanging the water (depending on the incline of the bank) with the top 3–5 centimetres of the trap out of the water to allow the turtles to breathe between trap checks. Alternatively, the traps can be suspended from floats that are anchored to the bank by a rope. Traps should be checked several times within the first hour or two of being set, to ensure that turtle densities are not so great as to cause large numbers to enter the traps, causing them to sink and drown their captures.	No searches were made for the Southern Snapping Turtle.[40]

[37]Commonwealth of Australia, *EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (2014) 21, 23-24.
[38] Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Reptiles* (2011) 12.
[39] Ibid 14.
[40] Golder Associates, 'Mahalo Development Area Ecology Assessment Report for Impacts to Matters of National Environmental Significance' (2019) Appendix E.

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
		After this, traps need to be checked several times during the day and then several hours after sunset before being inspected again early in the morning. Where there is a risk of trapping excessive numbers of individuals, if traps cannot be checked every hour they should be removed from the water until regular checking can be resumed. Seining has also been used with success in capturing many species of chelid turtles in lagoons, streams and lakes where there are relatively few snags and other obstacles. The use of nets usually requires special authorisation by the relevant fishing authority. The use of traps, seines or snorkelling may be impractical in waterbodies in northern Australia occupied by saltwater crocodiles *Crocodylus porosus*.	
8.	*Rheodytes leukops* Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver	Survey techniques typically applied to the detection of freshwater turtles include diving with a face mask and snorkel and/or baited traps.[41] Trapping also effectively samples some species. Commercially available 'yabby' traps (60 centimetres x 45 centimetres x 25 centimetres) are sufficient to capture moderately large turtles such as the Namoi River elseya *Elseya belli*, the Bellinger River emydura *Emydura macquarii signata*, and the Fitzroy tortoise *Rheodytes leukops*.[42] Placement of traps is critical. These should be suspended from branches overhanging the water (depending on the incline of the bank) with the top 3–5 centimetres of the trap out of the water to allow the turtles to breathe between trap checks. Alternatively, the traps can be suspended from floats that are anchored to the bank by a rope.	No searches were made for the Fitzroy River Turtle.

[41] Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Reptiles* (2011) 12.
[42] Ibid 14.

	Species	DoEE Guidelines	Was EBS methodology/survey effort in accordance with the DoEE Guidelines?
		Traps should be checked several times within the first hour or two of being set, to ensure that turtle densities are not so great as to cause large numbers to enter the traps, causing them to sink and drown their captures. After this, traps need to be checked several times during the day and then several hours after sunset before being inspected again early in the morning. Where there is a risk of trapping excessive numbers of individuals, if traps cannot be checked every hour they should be removed from the water until regular checking can be resumed. Seining has also been used with success in capturing many species of chelid turtles in lagoons, streams and lakes where there are relatively few snags and other obstacles. The use of nets usually requires special authorisation by the relevant fishing authority. The use of traps, seines or snorkelling may be impractical in waterbodies in northern Australia occupied by saltwater crocodiles *Crocodylus porosus*.	

The failure by APLNG to conduct appropriate surveys as set out in paragraphs 8-10 above should be grounds for the Minister to apply the precautionary principle in determining whether MNEs are present in the EMBA.

11. The DoEE Survey Guidelines in relation to threatened birds and mammals provide that in the absence of appropriate surveys being conducted, the precautionary principle may apply.

12. Relevantly, the DoEE Survey Guidelines for Australia's Threatened Mammals provides:

> "Failing to survey appropriately for threatened species that may be present at a site could result in the department applying the precautionary principle with regard to significant impact determinations. That is, if no supporting evidence (such as survey results) is presented to support the claim of species absence, then the department may assume that the species is in fact present. The department will not accept claimed species absence without effective validation such as through these survey guidelines, other survey techniques (for example, a state guideline or an accepted industry guideline), or relevant expertise. Where a claim of absence is made, proposals should provide a robust evaluation of species absence."[43]

Similar application of the precautionary principle is recommended by the DoEE Survey Guideline for Australia's Threatened Birds.[44]

13. It is submitted that the failure by APLNG to conduct appropriate surveys as set out in paragraphs 8-10 above should lead to the precautionary principle being applied and species presence to be assumed for the following MNES:

viii. *Calidris ferruginea,* Critically Endangered Curlew Sandpiper;

ix. *Neochmia ruficauda ruficauda,* Star Finch (eastern), Endangered Star Finch (southern);

x. *Poephila cincta cincta;* Endangered Southern Black-throated Finch;

xi. *Rostratula australis;* Endangered Australian Painted-snipe, Australian Painted Snipe;

xii. *Dasyurus hallucatus,* Endangered Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu];

xiii. *Phascolarctos cinereus (combined populations of Qld, NSW and the ACT),* Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory);

[43] Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Mammals* (2011) 1.
[44] Commonwealth of Australia, *Survey Guidelines for Australia's Threatened Birds* (2010) 1.

xiv. *Elseya albagula,* Critically Endangered Southern Snapping Turtle, White-throated Snapping Turtle; and

xv. *Rheodytes leukops,* Endangered Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver.

Habitat degradation and loss from construction of the gas production wells, gas compression facilities and water treatment infrastructure

14. Construction of the gas production wells, gas compression facilities and water treatment infrastructure will involve the following activities:

    a. Construction, design and decommissioning of 95 vertical production wells intersecting with horizontal well sections within the coal seam. Each well will be constructed in an operational area of up to approximately 1.2 ha for the initial construction of the well;[45]

    b. Construction of a gas compression facility to gather and pressurise gas. Equipment within the facility will include instrumentation and control systems, tanks, gas compressor units, gas dehydration/ separation units, safety systems, flare, offices, workshops, and other infrastructure;[46]

    c. Water storage(s) including above-ground dams and/or tanks to store produced water. Infrastructure may include a water treatment facility to treat produced water at a nominal treatment rate of up to approximately 2 ML/day; and

    d. Water storage(s) including dams and/or tanks to store waste generated from desalination process.

15. The activities set out in paragraph 14 above (**Major Infrastructure Construction and Operation Activities**) are all, individually, major projects. In the EA, APLNG states that the total area of habitat vegetation that will be cleared by the Proposed Action will be 46,900 ha.[47] This will result in extensive vegetation clearing and habitat loss for MNES present in the EMBA.

16. Despite the extensive vegetation clearing that will result from the Proposed Action, APLNG has completely failed to disclose maps and locations of key infrastructure components of the project, the specific nature and condition of vegetation to be cleared for such infrastructure and likely impacts on threatened species. APLNG has also failed to disclose even basic details such as the disturbance footprint of each component of the Proposed Action.

[45] APLNG, Mahalo Development Area CSG Project Referral 2019/8534 (Mahalo Referral) 1.2.
[46] Ibid.
[47] CDM Smith 127-128

17. Without an assessment of where each infrastructure component will be located in the context of the environment that will be affected, APLNG's assertion there will be no significant impact to MNES in the EMBA is unsubstantiated.

Habitat degradation and loss from construction of the gas and water pipelines

18. Construction of below-ground pipelines to collect gas and water from each production well will involve the following activities:

    a. A construction right-of-way (**RoW**) between approximately 10 to 18m wide for standard pipeline construction;

    b. RoW works will include excavation of trenches, pipeline laying, backfilling of trenches and reinstatement of the RoW;

    c. Installation of power and communication lines (e.g. fibre optic cable) co-located with pipelines; and

    d. an unsealed 4WD track will be maintained along the RoW to provide access to production wells.[48]

19. Significant habitat degradation and loss is likely to result from the construction of the gas and water pipelines. Despite the likely presence of listed threatened species in the EMBA, there has been a complete failure by APLNG to disclose:

    a. the water and gas pipeline routes;

    b. the RoW route and ancillary works;

    c. the development footprint of the water and gas pipelines, RoW and power and communication lines; and

    d. the nature and condition of native vegetation that will be cleared.

20. Without an assessment of where the water and gas pipelines will be located in the context of the environment that will be affected, APLNG assertion there will be no significant impact to MNES in the EMBA is unsubstantiated.

Dust emissions from construction activities

21. Construction activities for the extensive infrastructure required by the project will generate dust emissions. The main sources of dust will be:

    a. Dust lift-off from exposed surfaces;

[48] Ibid.

b. Construction of the embankments, including moving, dumping and shaping material;

c. Vegetation and soil clearing of the land; and

d. Wheel-generated dust from haul roads for the construction phase.

22. Excessive deposition of dust on leaves of plants can suppress growth and photosynthesis and result in reduced habitat quality for fauna. High levels of airborne dust particles can irritate the respiratory systems of fauna and potential result in ingestion of dust-coated seeds and other foods. Excessive deposition of dust on open water bodies may also degrade water quality, and overall habitat quality for fauna.

23. No risk assessment has been conducted and no mitigation measures have been proposed with regard to dust emissions by APLNG. In particular, no provision has been made for:

a. All significant earthworks to avoided where practicable during unfavourable meteorological conditions (high winds etc.);

b. Watering of haul roads to minimise wheel-generated dust;

c. Watering of exposed areas including cleared areas and stockpiles to minimise dust lift-off;

d. Progressive clearing to minimise the area of exposed/open soil;

e. Appropriate maximum speed limits to be determined and signposted during construction;

f. Physical barriers such as bunds and/or wind breaks around stockpiles; and

g. Water spraying of nearby sensitive vegetation will occur if visible dust sedimentation is occurring and arborist assessment determines that it is likely to cause harm to vegetation.

24. For the reasons stated above, it is submitted that <u>without a risk assessment and appropriate mitigation measures, the residual risk of significant impact from dust emissions on MNES in the EMBA remain high.</u>

Erosion from construction activities

25. Erosion of soil, and the potential sedimentation of waterways can occur when vegetation is cleared and soil is exposed to overland flow. Large areas of exposed soil are anticipated due to works. APLNG has stated that it will develop an erosion plan, but has failed to disclose any details of such a plan. As such, the risk of significant impact to vegetation and aquatic habitats remains high.

Significant Impact on Koalas

26. It is submitted that the Proposed Action is likely to have a significant impact on koalas for the following reasons:

    a. The mapping by Golder Associates in the EA does not accurately represent koala habitat present on site;

    b. APLNG failed to conduct baseline monitoring of koala presence on site;

    c. There has been no evidence provided regarding key infrastructure components of the Proposed Action in support of APLNG's assertion that there will be no "direct disturbance" to "important koala habitat"; and

    d. APLNG's proposed mitigation actions are inadequate.

27. The EA has confirmed that koalas are present in the EMBA. It provides:

    "Koalas were detected via scats in critical habitat areas containing preferred food and habitat trees, that is, habitat dominated by Eucalyptus species. Koala scats were detected on the Brooklee property in a remnant riparian community adjacent to Humboldt Creek (site T25a, Figure 3) (***Plate 3***). Further anecdotal evidence of Koalas was provided by the landholders of the Sirius property who have seen koalas within their property along the Comet River. "[49]

28. The EMBA contains significant riparian areas, which are important for the interim recovery objectives identified in the Koala Referral Guidelines, which include to "protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility."[50] Figure 1 below provides mapping of koala habitat as assessed by APLNG's environmental consultant, Golder Associates. Figure 2 provides mapping of koala habitat provided by the Australian Koala Foundation (**AKF**).

[50] Commonwealth of Australia, above n37, 17

Figure 1: Koala habitat mapping by Golder Associates[51]

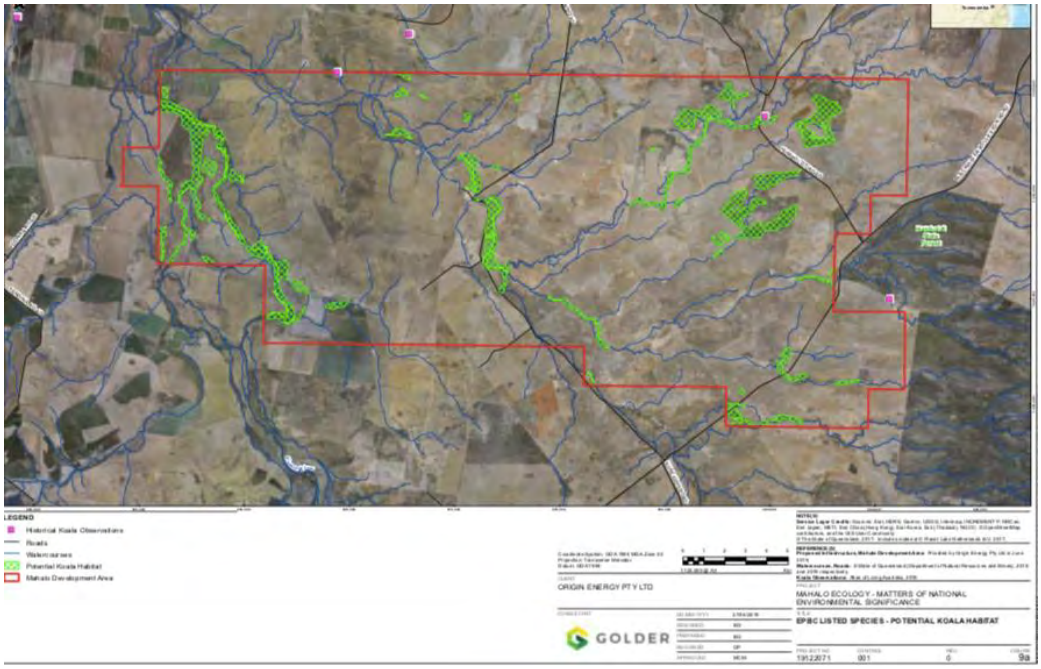
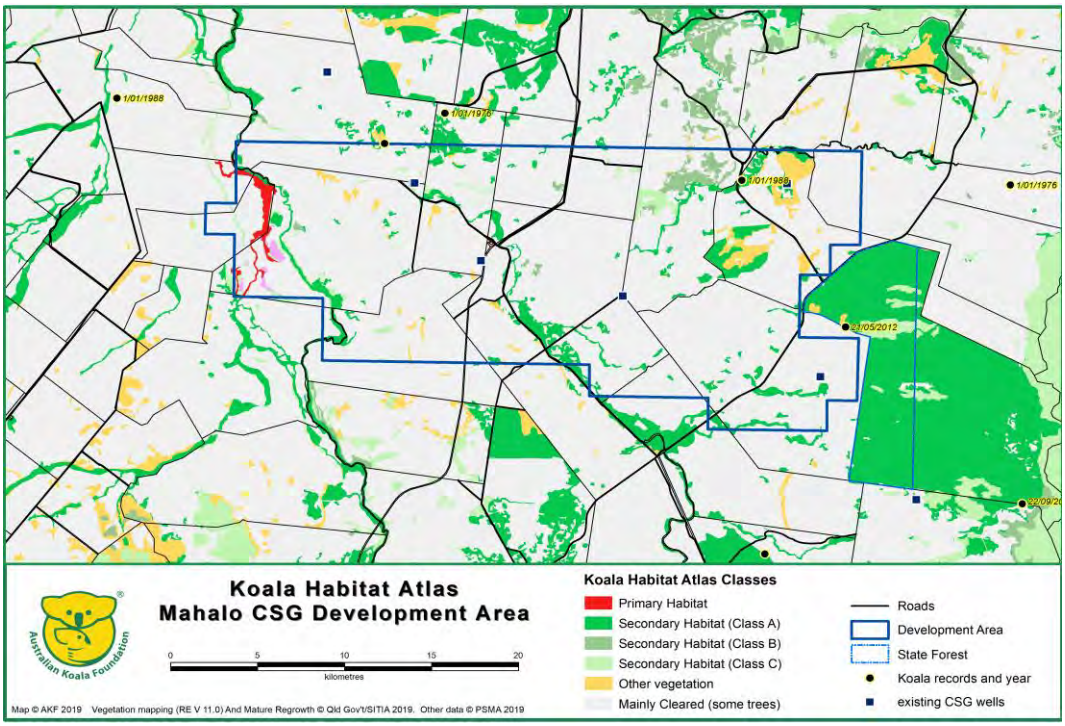


Figure 2: Koala Habitat Atlas Extract for the Mahalo CSG Development Area[52]



29. Both of the above maps were prepared using Regional Ecosystem (RE) mapping Version 11.0. However, the AKF map also includes the Mature

[51] Golder Associates, above n1.

[52] Australia Koala Foundation, 'Koala Habitat Atlas: Mahalo CSG Development Area" (15 October 2019).

Regrowth layer. This is regrowth vegetation that is almost Remnant, but has shown some degree of disturbance or clearing.

30. AKF, the principal Australian non-profit and non-governmental organization in relation to koala conservation, considers Mature Regrowth to be just as important to koalas as Remnant vegetation. It is submitted that AKF's assessment approach is to be preferred to that of Golder Associates because it is consistent with the Koala Referral Guidelines. The Guidelines define "koala habitat" in the inland context as including "small patchy and sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes or in and around rural towns."[53]

31. APLNG has asserted that there will be no significant impact to koalas because "No direct disturbance to important Koala habitat is proposed for the project. Important Koala habitat has been identified as 'no-go' areas in the Protocol."[54]

32. The Koala Referral Guidelines provide:

    "For actions with a large footprint, or landscape-scale impacts, baseline monitoring which evaluates koala abundance, movement and habitat preferences in the area proposed to be affected by the project will be necessary. This may involve a combination of direct and indirect survey methods in the study area, particularly if there is limited desktop data available. The surveys will be important for effective design and implementation of mitigation measures to minimize the action's impacts."[55]

33. It is submitted that APLNG does not have a basis upon which to base its assessment that no "important Koala habitat" will be "directly disturbed" given the deficiencies in its mapping (see para 30 above), its failure to conduct any surveys for koalas in the EMBA and the lack of information provided regarding the location of key infrastructure components of the Proposed Action.

34. APLNG has also identified the following mitigation measures:

    a. Enforceable operational speed limits shall be set to 60 km/h at all times, especially on access tracks;

    b. Vehicles movement will be predominantly during daylight hours;

    c. koala cross the roadway in the area;

    d. Implement a weed, pest and biosecurity management plan including compliance with obligations under the QLD Biosecurity Act 2014,

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[53] *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*, Commonwealth of Australia, 2014, 17.

[54] Golder Associates, above n1, 56-57.

[55] Commonwealth of Australia, above n53, 20.

including hygiene procedures to manage unintentional introduction and spread of Phytophthora cinnamomi and Myrtle Rust. Management measures will be put in place to minimise waste and to reduce potential attraction of predatory fauna and pest species; and

e. Undertake regular and ongoing monitoring to ensure the effectiveness of mitigation measures to avoid impacts to the Koalas. Environmental training for all workers and contractors that highlights conservation issues and species-specific sensitivities. Prohibition of keeping domestic animals (e.g., dogs or cats) within the Mahalo Development Area and surrounds by personnel employed for the Project.

35. It is unlikely that APLNG's proposed mitigation measures will substantially reduce the impact of the Proposed Action on koalas because no surveys have been carried out of koalas to assess the impact of the project on koala habitat including connectivity of habitat and access to habitat refuges in riparian areas.

a. No objectives have been defined as a framework to mitigate and manage the effects of the Proposed Action on the koala such as retention remnant Regional Ecosystems that are identified as essential habitat for Koala; retention of the vast majority of remnant regrowth vegetation of higher value to Koala and retention of habitat which has consistently yielded the highest concentrations of fresh evidence of koala presence, detected through surveys which account for potential seasonal variation in habitat use;

b. No spatially suitable buffers to achieve the to the above objectives have been defined or proposed;

c. No corridor network template which that achieves the above objectives abovementioned values has been proposed (e.g. layout, dimensions, etc.) which is consistent with the requirements of policy and best practice guidelines;

d. No consideration has been given to measures to increase the site's carrying capacity for koalas in the medium to long term and to achieve the Interim Recovery Objectives for the koala as defined by the EPBC Act Referral Guidelines for the Vulnerable Koala;

e. No provisions have been made for sequential clearing, such as: 1. ensuring that clearing is carried out in a way that ensures koalas on the area being cleared have enough time to move out of the clearing site without human intervention and, for sites with an area of more than three hectares, involves: minimum clearing areas for each stage and ensuring a minimum period of time between each stage where no trees are cleared from site 2. maintaining habitat links between the clearing site and its adjacent areas to allow koalas to move out of site during clearing 3. ensuring that no tree in which a koala is present or a tree with a crown

overlapping a tree in which a koala is present, is cleared until the tree is vacated by the koala;

f. Ensuring that any sequential clearing is away through threatening processes or hostile vegetation and towards retained vegetation and habitat links;

g. Constructing dedicated road crossing treatments to minimise koala habitat fragmentation, facilitate koala movements and reduce vehicle related koala injury and mortality such as underpasses and grade separated crossings; and

h. Using directional fencing considering local conditions for each road or section of road with minimum height requirements, koala exclusion metal strips of minimum width, fence bracing/supports, timber poles on non-exclusion sides of the fence and maintenance of vegetation adjacent to fencing to ensure fence effectiveness.

36. The mitigation measures proposed by APLNG are not only inadequate, but also without any factual basis from on-ground surveys. As such, it is submitted that a high residual risk remains to koalas in the EMBA.

Significant Impact on Squatter Pigeons

37. It is submitted that the Proposed Action will have a significant impact on Squatter Pigeons for the following reasons:

a. Squatter Pigeons are likely to occur in the EMBA;

b. Proposed Action will clear Squatter Pigeon habitat; and

c. The mitigation actions proposed are inadequate.

38. Desktop search results in the EA have indicated the likely presence of Squatter Pigeons in the EMBA. The EA states:

"The Mahalo Development Area is within the known distribution of this species with known records occurring approximately 20 km to the west-sout-west of the site (ALA, 2019) The Mahalo Development Area intercepts potential habitat modelling for the Squatter Pigeon."[56]

39. Birddata and eBird mapping confirm the likely presence of Squatter Pigeons in the area.[57] Birdlife Capricornia, the local chapter of Birdlife Australia, has also indicated that Squatter Pigeons are likely to be found in the area.

[56] Golder Associates, above n1, 47.
[57] < https://ebird.org/home> and <https://birdata.birdlife.org.au/>

40. In the EA, Golder Associates states:

> "While this species is known to utilize disturbed areas as habitat, including disturbance types associated with the Project, and given the widespread occurrence of foraging and non-breeding habitat, disturbance to these habitat types will be minimized as described by the Constraints Protocol. All disturbed areas will be progressively rehabilitated in accordance with the Mahalo EA and Rehabilitation Management Plan following construction and decommissioning."[58]

41. The Constraints Protocol lists mitigation actions in relation to Squatter Pigeon non-breeding habitat as "minimization". This is specified as:

    a. Pipeline right-of-way widths limited to 18 meters;

    b. Gas well pads limited to 1.2 hectares;

    c. Use of minimal disturbance well pads and access tracks; and

    d. Non-linear infrastructure will be excluded from watercourses.

42. No analysis has been conducted of the likely impact of the project on Squatter Pigeons, the total amount of Squatter Pigeon habitat that will be directly and indirectly affected by the proposal. No analysis has been conducted on the residual impacts to Squatter Pigeon habitat and whether these impacts are significant. An impact can be minimised but still constitute a significant impact to a threatened species.

43. The Precautionary Principle should apply in circumstances where there is a high level of uncertainty of the impacts of the Proposed Action because no surveys have been conducted of Squatter Pigeons, no mapping of major infrastructure as it relates to Squatter Pigeon habitat has been provided and no significant impact analysis has been conducted of residual impact to Squatter Pigeons.

The proposed action is likely to have a significant impact on the critically endangered and endangered MNES in the EMBA.

	Species	EPBC Act Conservation Status	Impact
1.	Brigalow (Acacia harpophylla dominant and co- dominant)	Endangered	• Reduction in the area of occupancy of the species. • Adversely affecting habitat critical to the survival of a species. The uncertainty of the impacts of the Proposed Action on TEC areas given the lack of information from APLNG

[58] Golder Associates, above n9.

	Species	EPBC Act Conservation Status	Impact
			should be grounds for applying the Precautionary Principle. • Interfering with the recovery of the species as set out in the Conservation Advice for the Brigalow. In particular, the Recovery Plan lists clearing of brigalow as one of the key threats to the recovery of the species.[59]
2.	Endangered Natural Grasslands of the Queensland Central Highlands and Northern Fitzroy Basin	Endangered	• Reduction in the area of occupancy of the species. • Adversely affecting habitat critical to the survival of a species. The uncertainty of the impacts of the Proposed Action on TEC areas given the lack of information from APLNG should be grounds for applying the Precautionary Principle.
3.	Poplar Box Grassy Woodland on Alluvial Plains	Endangered	• Reduction in the area of occupancy of the species. • Adversely affecting habitat critical to the survival of a species. The undertainty of the impacts of the Proposed Action on TEC areas given the lack of information from APLNG should be grounds for applying the Precautionary Principle. • Interfering with the recovery of the species as set out in the Recovery Plan for the Poplar Box. In particular, the Recovery Plan states that the highest priority actions for the species include "prevent further clearance, fragmentation or detrimental modification of remnants of the ecological community and of surrounding native vegetation."[60] The Highest Priority Actions also include "Prevent impacts to native vegetation, native fauna, hydrology or soil structure from any developments and activities adjacent to or near patches of the ecological community by

[59] *Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community (2013)* 12.
[60] *Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains* (2019) 32.

	Species	EPBC Act Conservation Status	Impact
			planning for and appropriately avoiding or mitigating off-site effects. For instance, apply recommended buffers of at least 30 m (native vegetation buffers are preferred) around patches of the ecological community and avoid activities that could cause significant hydrological change. Wider buffers may be required where there is larger scale landscape change, for example hydrological modifications."[61]
4.	Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	• Reduction in the area of occupancy of the species. • Adversely affecting habitat critical to the survival of a species. The uncertainty of the impacts of the Proposed Action on TEC areas given the lack of information from APLNG should be grounds for applying the Precautionary Principle.
5.	*Calidris ferruginea*, Curlew Sandpiper	Critically endangered	• Reduction in the area of occupancy of the species. • Interfering with the recovery of the species as set out in the Conservation Advice for the Curlew Sandpiper. In particular, the Conservation Advice states that loss of habitat and changes to water regimes are key threats to the species.[62]
6.	*Poephila cincta cincta* Southern Black-throated Finch	Endangered	• Reduction in the area of occupancy of the species. • Interfering with the recovery of the species as set out in the Conservation Advice for the Southern Black-throated Finch, which states that habitat loss and degradation is a key threat to the species.[63]
7.	*Neochmia ruficauda ruficauda* Star Finch (eastern), Star Finch (southern)	Endangered	• Reduction in the area of occupancy of the species. • Interfering with the recovery of the species as set out in the Conservation Advice for the Star Finch (eastern). In particular, the Conservation Advice

[61] Ibid.
[62] *Conservation Advice for Calidris ferruginea (Curlew sandpiper)* (2015) 6.
[63] *Conservation Advice for Southern Black-throated Finch (Poephila cincta cincta)*(2005).

	Species	EPBC Act Conservation Status	Impact
			states that loss of habitat and disruptions to water flows are key threats to the species, given that it requires seasonally inundated or damp habitat near permanent waterholes.[64]
8.	*Rostratula australis* Australian Painted-snipe, Australian Painted Snipe	Endangered	• Reduction in the area of occupancy of the species.
9.	*Dasyurus hallucatus* Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu].	Endangered	• Reduction in the area of occupancy of the species.
10.	*Elseya albagula,* Southern Snapping Turtle, White-throated Snapping Turtle	Critically Endangered	• Reduction in the area of occupancy of the species. • Adversely affecting habitat critical to the survival of a species.
11.	*Rheodytes leukops,* Endangered Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver.	Endangered	• Reduction in the area of occupancy of the species. • Adversely affecting habitat critical to the survival of a species.

[64] *Conservation Advice for Neochmia ruficauda ruficauda (Star Finch (eastern))* (2008) 2.

The Proposed Action is likely to have a significant impact on MNES due to climate change impacts.[65] It is submitted that the international scientific consensus on the impacts of climate change and recent Australian case law[66] require consideration of climate change impacts in applying Significant Impact Guidelines 1.1.

44. Significant Impact Guidelines 1.1 provide:

> "**Considering the proposed action at its broadest scope, is there potential for impacts on matters of national environmental significance?**
>
> If there are matters of national environmental significance in the vicinity of your proposed action, you need to consider whether there is potential for your proposed action to impact upon those matters.
>
> The proposed action should be considered at its broadest possible scope. This includes all stages and components of the action, all related activities, and all related infrastructure such as roads and powerlines, if applicable.
>
> If the action consists of a series of activities or a number of related activities, you should consider the impacts of each activity, and then consider the combined impacts of those activities.
>
> It is also necessary and important to consider off-site and indirect impacts of your proposed action on matters of national environmental significance …"
>
> **Indirect and offsite impacts**
>
> When considering whether or not an action is likely to have a significant impact on a matter of national environmental significance it is relevant to consider all adverse impacts which result from the action, including indirect and offsite impacts.
>
> Indirect and offsite impacts include:
>
> - 'downstream' or 'downwind' impacts, such as impacts on wetlands or ocean reefs from sediment, fertilisers or chemicals which are washed or discharged into river systems;
>
> - 'upstream impacts' such as impacts associated with the extraction of raw materials and other inputs which are used to undertake the action; and

[65] Lee JR, Maggini R, Taylor MFJ, Fuller RA (2015) Mapping the Drivers of Climate Change Vulnerability for Australia's Threatened Species. PLoS ONE 10(5): e0124766. <https://doi.org/10.1371/journal.pone.0124766>.
[66] *Gloucester Resources Limited v Minister for Planning* [2019] NSWLEC 7.

- ‘facilitated impacts’ which result from further actions (including actions by third parties) which are made possible or facilitated by the action. For example, the construction of a dam for irrigation water facilitates the use of that water by irrigators with associated impacts. Likewise, the construction of basic infrastructure in a previously undeveloped area may, in certain circumstances, facilitate the urban or commercial development of that area..[67]

Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action.

It may be helpful to consider the following:

- ‘But for’ the proposed action would the indirect impacts occur?

- Is the proposed action a ‘material and substantial’ cause of the indirect impacts?

- Are the potential impacts of any subsequent or third party actions known, or would they be expected to be known, by the person proposing to take the action (particularly where the subsequent or third party actions are an intended outcome of the proposed action)? If the answer to these questions is ‘yes’, then it is necessary to consider whether these impacts are likely to occur, and whether they are likely to have a significant impact on a matter of national environmental significance. If so, as much information as possible should be provided to assist the minister in determining whether the impacts are relevant, and whether approval under the EPBC Act is required. “

45. Applying the above sections of the Significant Impact Guidelines 1.1, consideration of the impacts of the Proposed Action requires consideration of “the action at its broadest scope” and “all adverse impacts which result from the action including indirect and offsite impacts.”

46. In the Referral, APLNG stated that the Proposed Action was intended to produce, compress and transport gas for export to domestic and international markets (Referral s 1.2). The adverse impacts that could

[67] Note that consideration of the impacts of ‘facilitated actions’ during the assessment and approval of the original action has no effect on the requirement of the proponent of the facilitated action to make a referral when that action eventuates, if that action will have, or is likely to have, a significant impact on a matter of national environmental significance.

reasonably be predicted to follow from the Proposed Action include impacts within and outside the control of APLNG.

47. A report by the Commonwealth Scientific and Industrial Research Organisation (**CSIRO**) published earlier this year examined the whole of life GHG emissions from coal seam gas (**CSG**) in the Surat Basin. It found that GHG emissions from CSG projects comprised of:

    a. Scope 1 - emissions directly due to activities within the company during production of CSG and LNG;

    b. Scope 2 - all indirect emissions associated with generation and transmission of electricity used by the company to produce CSG and LNG; and

    c. Scope 3 - emissions are also indirect and external to the company, and they refer to emissions associated with production of goods and services that the company has purchased.[68]

48. The CSIRO Report found that emissions from CSG projects were in the range of 4.77 kt CO2-e/PJ of CSG (Scope 1)[69] and 2.58 kt CO2-e/PJ of CSG[70] and 7.63 kt CO2-e/PJ of CSG (Scope 3)[71]. Further, the production of CSG results in methane emissions, which are 80 times more potent than CO_2 according to the Intergovernmental Panel on Climate Change.[72]

49. In relation to Scope 3 emissions, the applicable test is whether they are sufficiently close to the Proposed Action to be said to be a consequence of the action and whether they could reasonably be within the contemplation of APLNG.

50. In determining the answer to the above question, the Significant Impact Guidelines 1.1 provides several questions to be considered. These are answered below.

    a. **'But for' the proposed action would the indirect impacts occur?**

       Yes, CSG supplied by the Proposed Action, the indirect impact of GHG emissions would not occur.

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[68] Heinz Schandl, Tim Baynes, Nawshad Haque, Damian Barrett and Arne Geschke (2019). Final Report for Final Report for GISERA Project G2 - Whole of Life Greenhouse Gas Emissions Assessment of a Coal Seam Gas to Liquefied Natural Gas Project in the Surat Basin, Queensland, Australia. CSIRO, Australia.

[69] Ibid 16.

[70] Ibid 17.

[71] Ibid 19.

[72] 'Stephen Leahy, 'Fracking Boom Tied to Methane Spike in Earth's Atmosphere,' National Geographic (15 August 2019) <https://www.nationalgeographic.com/environment/2019/08/fracking-boom-tied-to-methane-spike-in-earths-atmosphere/>.

b. **Is the proposed action a 'material and substantial' cause of the indirect impacts?**

   Yes. Downstream emissions from LNG produced and sold from the operations of the Proposed Action can be proved to be a "material and substantial cause" of climate change and indirect impacts to MNES. Support for this position from recent case law is further discussed in paragraph 51 below.

c. **Are the potential impacts of any subsequent or third party actions known, or would they be expected to be known, by the person proposing to take the action (particularly where the subsequent or third party actions are an intended outcome of the proposed action)?**

   Greenhouse gas (GHG) emissions from CSG projects have been under intense public scrutiny for years. APLNG is, without doubt, aware of potential climate change impacts from GHG emissions that will result from Proposed Action. APLNG is also likely to be aware of the impacts of climate change from CSG because GHG emissions have been accepted by Australian courts as a relevant consideration in determining applications for activities involving fossil fuel extraction and combustion.[73]

d. **If the answer to these questions is 'yes', then it is necessary to consider whether these impacts are likely to occur, and whether they are likely to have a significant impact on a matter of national environmental significance. If so, as much information as possible should be provided to assist the minister in determining whether the impacts are relevant, and whether approval under the EPBC Act is required.**

   This question relates to the certainty of climate change impacts is further discussed in paragraph 37 below.

51. In *Gloucester Resources Limited v Minister for Planning* [2019] NSWLEC 7, Chief Justice Preston found that all GHG emissions from the Rocky Hill Coal Mine would contribute to climate change. His Honour held in [514]-[516]:

"All GHG emissions contribute to climate change

514. All of the direct and indirect GHG emissions of the Rocky Hill Coal Project will impact on the environment. All anthropogenic GHG emissions contribute to climate change. As the IPCC found, most of the observed increase in global average temperatures is due to the observed increase in anthropogenic GHG concentrations in the

[73] See *Australian Conservation Foundation v Latrobe City Council* (2004) 140 LGERA 100; [2004] VCAT 2029, *Coast and Country Association Queensland Inc v Smith* [2016] QCA 242, *Wollar Property Progress Association Inc v Wilpinjong Coal Pty Ltd* [2018] NSWLEC 92 and Gloucester Resources Limited v Minister for Planning [2019] NSWLEC 7.

atmosphere. The increased GHG concentrations in the atmosphere have already affected, and will continue to affect, the climate system. The current and future impacts of climate change were summarised by Professor Steffen and have been set out earlier in the judgment.

515. The direct and indirect GHG emissions of the Rocky Hill Coal Project will contribute cumulatively to the global total GHG emissions. In aggregate, the Scope 1, 2 and 3 emissions over the life of the Project will be at least 37.8Mt CO2-e, a sizeable individual source of GHG emissions. It matters not that this aggregate of the Project's GHG emissions may represent a small fraction of the global total of GHG emissions. The global problem of climate change needs to be addressed by multiple local actions to mitigate emissions by sources and remove GHGs by sinks. As Professor Steffen pointed out, "global greenhouse gas emissions are made up of millions, and probably hundreds of millions, of individual emissions around the globe. All emissions are important because cumulatively they constitute the global total of greenhouse gas emissions, which are destabilising the global climate system at a rapid rate. Just as many emitters are contributing to the problem, so many emission reduction activities are required to solve the problem" (Steffen report, [57]).

516. Many courts have recognised this point that climate change is caused by cumulative emissions from a myriad of individual sources, each proportionally small relative to the global total of GHG emissions, and will be solved by abatement of the GHG emissions from these myriad of individual sources.

517. In *Australian Conservation Foundation v Latrobe City Council,* the Victorian Civil and Administrative Tribunal found that there was a sufficient nexus between the planning scheme amendment to facilitate coal mining and the environmental effect of greenhouse gases that were likely to be produced by the use of the coal burnt by the Hazelwood power station (at [46]).

518. In *Gray v Minister for Planning,* Pain J held:

"Climate change/global warming is widely recognised as a significant environmental impact to which there are many contributors worldwide but the extent of the change is not yet certain and is a matter of dispute. The fact there are many contributors globally does not mean the contribution from a single large source such as the Anvil Hill Project in the context of NSW should be ignored in the environmental assessment process. The coal intended to be mined is clearly a potential major single contributor to GHG emissions deriving from NSW given the large size of the proposed mine. That the impact from burning the coal will be experienced globally as well as in NSW, but in a way that is currently not able to be accurately measured, does not suggest that the link to causation of an environmental impact is insufficient." (at [98])."

52. Applying the decisions in *Gloucester Resources Limited v Minister for Planning* and *Gray v Minister for Planning* (2006) 152 LGERA 258; [2006] NSWLEC 720, it is submitted that the GHG emissions from the Proposed Action will contribute to climate change.

53. In 2015, the CSIRO and the Bureau of Meteorology published "Climate Change in Australia: A Technical Report"[74] (**Technical Report**), which analysed expected climate change impacts in regions in Australia. The Technical Report made the following findings:

i. There is *very high confidence* in continued increases of mean, daily minimum and daily maximum temperatures throughout this century for all regions in Australia. [75]

ii. In Southern Australia, there is a high confidence that cool season (winter and spring) rainfall is projected to decrease (*high confidence*), though little change or increases in Tasmania in winter are projected (*medium confidence*). The winter decline may be as great as 50 % in south-western Australia in the highest emission scenario (RCP8.5) by 2090.[76]

iii. Extreme rainfall events (wettest day of the year and wettest day in 20 years) are projected to increase in intensity with *high confidence*.[77]

iv. There is *high confidence* in decreasing soil moisture in the southern regions (particularly in winter and spring) driven by the projected decrease in rainfall and higher evaporative demand. There is *medium confidence* in decreasing soil moisture elsewhere in Australia where evaporative demand is projected to increase but the direction of rainfall change is uncertain.[78]

v. Decreases in runoff are projected with *high confidence* in south-western Western Australia and southern South Australia, and with *medium confidence* in far south- eastern Australia, where future rainfall is projected to decrease."[79]

54. Specifically, the conservation advices and advices of the Threatened Species Scientific Community regarding the following critically endangered and endangered species include climate change impacts as interfering with recovery of the species, which is a significant impact criterion under the Significant Impact Guidelines 1.1. Details of these impacts are set out in Table 5 below.

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[74] CSIRO and Bureau of Meteorology 2015, *Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report*, CSIRO and Bureau of Meteorology, Australia
[75] Ibid 91.
[76] Ibid 99.
[77] Ibid 118.
[78] Ibid 136.
[79] Ibid 136.

Table 5: Significant impacts on Critically Endangered and Endangered Species from facilitated climate change impacts from the Water Storage and Stage A Pipeline Construction and Operation Activities

	Species	EPBC Act Protected Status	Significant Impact from Climate Change
1.	*Burramys parvus* Mountain Pygmy Possum	Endangered	Consequence rating: Catastrophic The Conservation Advice for *Burramys parvus* states: "The species' entire range is likely to be substantially affected by a predicted rise in temperature, with likely impacts on hibernation cover, predator abundance, abundance of key dietary items, and fire regimes (Broome et al., 2012a). The species is highly sensitive to extreme temperatures (Shi et al., 2015). Snow depth and duration has been decreasing in the Australian Alps over the past 40 years, with more severe reductions and increasing early spring snow-melt predicted to occur by 2050- 2070 (Whetton et all., 1996; Hennessey et al., 2003). "[80]
2.	*Pseudophryne pengilleyi* Northern Corroboree Frog	Critically Endangered	The Threatened Species Scientific Community's advice to the Minister for *Pseudophryne pengilleyi* states: "Climate change is expected to have a significant impact on corroboree frogs (Osborne and Davis, 1997). Climate change modelling suggests that higher elevation areas of the Australian Alps, including the Brindabellas, will experience warmer temperatures and a decrease in precipitation (both as rainfall and snow) (Hennessey et al., 2003). This will reduce the water table during late spring and early summer, and result in earlier pool drying. Given the strong tendency for corroboree frogs to breed in highly ephemeral pools (Osborne, 1990; Hunter et al., 2009b), the most immediate and direct impact of climate change will result from increased rates of pool drying prior to metamorphosis.

[80] *Conservation Advice for Burramys parvus (Mountain Pygmy-Possum)* (2018) 3.

	Species	EPBC Act Protected Status	Significant Impact from Climate Change
			Higher temperatures might also be expected to result in a contraction of the lower altitudinal limit for this species, whereas higher temperatures and less precipitation, combined with an expected higher fire frequency, might result in a change in the hydrological functioning of wetlands and a reduction of suitable breeding habitat (such as sphagnum moss communities becoming wet sedgeland, grassland or heathland). This process appears to have already occurred across many sites occupied by the northern corroboree frog, as many sites previously occupied by the northern corroboree frog no longer appear to contain suitable pools (Scheele, 2010)."[81]
3.	*Pseudophryne corroboree* Critically Endangered Southern Corroboree Frog	Critically Endangered	The Threatened Species Scientific Community's advice to the Minister for *Pseudophryne corroboree* states: "Climate change is expected to have a significant impact on corroboree frogs (Osborne and Davis, 1997). Climate change modelling suggests that higher elevation areas of the Australian Alps will experience warmer temperatures and a decrease in precipitation (both as rainfall and snow) (Hennessey et al., 2003). This will reduce the water table during late spring and early summer, and result in earlier pool drying. Given the strong tendency for corroboree frogs to breed in highly ephemeral pools (Osborne, 1990; Hunter et al., 2009b), the most immediate and direct impact of climate change will result from increased rates of pool drying prior to metamorphosis.

[81] *Advice to the Minister for Sustainability, Environment, Water, Population and Communities from the Threatened Species Scientific Committee on Amendment to the list of Threatened Species under the Environment Protection and Biodiversity Conservation Act 1999 on Pseudophryne pengilleyi* (2013) 6.

	Species	EPBC Act Protected Status	Significant Impact from Climate Change
			Higher temperatures might also be expected to result in a contraction of the lower altitudinal limit for this species, whereas higher temperatures and less precipitation, combined with an expected higher fire frequency, might result in a change in the hydrological functioning of wetlands and a reduction of suitable breeding habitat (such as sphagnum moss communities becoming wet sedgeland, grassland or heathland) (Scheele, 2010). While pre-decline corroboree frog populations would have been robust to failed recruitment during El Ni□o events (Hunter, 2000), an increase in the frequency of droughts will only further compromise the capacity for this species to recover from its current low population size. Moreover, the impact of the chytrid fungus, through decreasing adult survival (Scherer et al., 2005), will increase population susceptibility to failed recruitment. This is because failed recruitment in some years is compensated by the adults being able to live longer and breed over consecutive years. The most immediate effect on the species is likely to be less reliable annual recruitment to the population due to less frequent 'favourable' breeding seasons. The long development times for corroboree frogs as eggs and tadpoles (several months) means that both species of corroboree frog are particularly susceptible to low precipitation that results in ephemeral pools not forming (loss of eggs) or pools drying before tadpoles reach metamorphosis (Osborne, 1990; Hunter et al., 2009b)."[82]

[82] *Advice to the Minister for Sustainability, Environment, Water, Population and Communities from the Threatened Species Scientific Committee on Amendment to the list of Threatened Species under the Environment Protection and Biodiversity Conservation Act 1999 on Pseudophryne corroboree* (2013) 5-6.

Significant Impacts to the Great Barrier Reef

55. Significant Impact Guidelines 1.1 provide that:

"An action will require approval if:

- the action is taken in the Great Barrier Reef Marine Park and the action has, will have, or is likely to have a significant impact on the environment, or

- the action is taken outside the Great Barrier Reef Marine Park and the action has, will have, or is likely to have a significant impact on the environment in the Great Barrier Reef Marine Park."

What is the Environment?

'Environment' is defined in the EPBC Act as:

a. ecosystems and their constituent parts including people and communities ('ecosystem' is defined in the EPBC Act as 'a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functioning unit'

b. natural and physical resources

c. qualities and characteristics of locations, place and areas

d. heritage values of places ('heritage value' is defined in the EPBC Act as including 'the place's natural and cultural environment having aesthetic, historic, scientific or social significance, or other significance, for current and future generations of Australians.' 'Indigenous heritage value' is defined as meaning ' a heritage value of the place that is of significance to Indigenous persons in accordance with their practices, observances, customs, traditions, beliefs or history'), and

e. the social, economic and cultural aspects of a thing mentioned in paragraphs (a), (b) or (c).

Significant impact criteria An action is likely to have a significant impact on the environment of the Great Barrier Reef Marine Park if there is a real chance or possibility that the action will:

a. modify, destroy, fragment, isolate or disturb an important, substantial, sensitive or vulnerable area of habitat or ecosystem component such that an adverse impact on marine ecosystem health, functioning or integrity in the Great Barrier Reef Marine Park results;

b. have a substantial adverse effect on a population of a species or cetacean including its life cycle (for example, breeding, feeding, migration behaviour, life expectancy) and spatial distribution;

c. result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological health or integrity or social amenity or human health;

d. result in a known or potential pest species being introduced or becoming established in the Great Barrier Reef Marine Park;

e. result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, or social amenity or human health may be adversely affected, or

f. have a substantial adverse impact on heritage values of the Great Barrier Reef Marine Park, including damage or destruction of an historic shipwreck."

56. Earlier this year, the Great Barrier Reef Marine Park Authority (**GBRMPA**) released a position statement on the effects of climate change on the Great Barrier Reef. It stated:

"Climate change is the greatest threat to the Great Barrier Reef. Only the strongest and fastest possible actions to decrease global greenhouse gas emissions will reduce the risks and limit the impacts of climate change on the Reef. Further impacts can be minimised by limiting global temperature increase to the maximum extent possible and fast-tracking actions to build Reef resilience."[83]

57. The GBRMPA Position Statement has unequivocally stated that climate change is currently causing the following effects on the Great Barrier Reef:

a. Marine heatwaves - "Global emissions of greenhouse gases such as carbon dioxide fromhuman activities are estimated to have caused approximately a 1.0°C increase in global average temperature above pre-industrial levels. This continuing and rapid increase in global temperature is causing sea temperature to increase, which also increases the likelihood of marine heatwaves.**"**

b. Increased coral mortality – "Coral reef ecosystems are particularly sensitive to changes in sea temperature. Their existence hinges on the health of reef-building coral species, which have limited capacity to endure heat stress. Increased sea temperature can directly cause mass bleaching and mortality."

[83] Great Barrier Marine Park Authority, 'Position Statement: Climate Change" (25 June 2019).

c. Severe cyclones – “Increasing sea temperature is likely to increase the proportion of severe tropical cyclones and the frequency and severity of heavy rainfall events. Multiple severe tropical cyclones and floods have had cumulative impacts on the Reef’s ecosystem, including seagrass meadows, coral reefs, and dugong and turtle populations.”

d. Other effects on species – “Other impacts, such as rising sea level, are projected to result in increased coastal erosion and inundation of critical nesting habitats, while changes in the patterns of ocean circulation can lead to shifts in the distribution and abundance of species.”

58. It is submitted that the climate change effects from the GHG emissions as stated in paragraph 43 above from the Proposed Action fulfill the Significant Impact Criteria due to modification and disturbance of the Great Barrier Reef Marine Park habitat and ecosystem.

Relevant Assessment Approach

59. Under the EPBC Act, one of six assessment processes must be used if the proposed action is deemed a controlled action. The Department’s Environment Assessment Manual advises that in identifying the appropriate assessment approach the following points should be considered:

a. Number of matters of national environmental significance affected;

b. Scale and nature of impacts (including complexity of issues);

c. Degree of confidence with which these impacts can be predicted;

d. The adequacy and completeness of the information;

e. The extent to which potential relevant impacts have already been assessed under state legislation; and

f. The degree of public concern associated with the proposal. [84]

60. For the following reasons, the most appropriate assessment process is assessment by environmental impact statement:

- At a minimum, two controlling provisions should be applied to the proposed action;

- The scale of the impacts in relation to the proposed development footprint of 46,900 hectares is significant. Further, the nature of the impacts are complex and range from dust, erosion, sedimentation, habitat loss, habitat fragmentation and GHG emissions;

[84] Commonwealth of Australia, *Environment Protection and Biodiversity Conservation Act 1999 – Environment Assessment Manual – Implementing Chapter 4, EPBC Act* (May 2012) <http://www.environment.gov.au/system/files/resources/0b0cfb1e- 6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf> 2H-2.

- The assessment of impacts upon MNES requires detailed and independent analysis as well as project specific design and planning;

- The EPBC Act assessment provided by APLNG cannot be relied upon to predict, with high confidence, the nature of the impacts of the Proposed Action on MNES; and

- The adequacy and completeness of impacts on MNES provided by APLNG is low. In addition, the assessment of impacts on listed threatened species and communities is low given the complete absence of fauna surveys.

Conclusion

61. For the reasons above, we submit that the proposed action is a controlled action with meaning of s 67 of the EPBC Act and request the Minister to decide under s 75(1) that the proposed action requires her approval.

62. We further submit that the appropriate level of assessment for the Proposed Action should be that of a full environmental assessment.

Comments regarding Water Assessment: Mahalo Coal Seam Gas project (APLNG)

s11C(1)(a)

School of Engineering, RMIT University

22nd October 2019

The Mahalo project proposes to develop coal seam gas through drilling and operation of approximately 95 wells, targeting coal seams in the Bandanna Formation, in the Bowen Basin, Queensland. This would be the first CSG project in the immediate area. The other main existing mining activity nearby is the Rolleston Open Cut coal mine, located approximately 30km to the south.

Significant volumes of water (exceeding 500 ML/year during early stages of development) would be extracted as produced/associated water during coal seam gas development. This is anticipated to result in drawdown of groundwater levels in certain layers in parts of the basin, and require appropriate methods to manage the associated water.

The Water Assessment Report (in 3 volumes) completed by Klohn Crippen Berger was developed in order to consider whether the project should be considered at controlled action under the EPBC Act, according to the Water Trigger and DOEE's Significant Impact Guidelines.

Major impacts of the project for water resources, which may be of significance include:

a) drawdown of groundwater in certain aquifer units, affecting water levels in bores, flow rates and area of springs and spring complexes, and reduction in surface water flows;

b) water quality impacts (e.g. contamination) affecting groundwater in aquifers, springs, streams and wetlands.

Key receptors which may be affected by these impacts include:

- A wetland of high ecological significance within the project area, associated with the Comet River floodplain (see Figure 6.4).

- A large number of groundwater users - e.g., over 1000 registered bores within 50km of the project area, mostly located to the west of the project area, with the majority in the Tertiary Volcanics (Basalt) aquifer (see Fig 7.32), as well as bores in the alluvium, Rewan Formation and Bandana Formation.

-Spring complexes located to the east and southwest of the project area (see Figure 7.27).

-Surface water bodies – e.g. Comet River, Humboldt Creek.

In order to assess whether the project is likely to have a significant impact on water resources, investigation and modelling work must be done in accordance with the IESC guideline for CSG proponents (IESC, 2018). There must be sufficient data, and a sufficient level of confidence in predicted impacts in order to determine whether or not there is a reasonable likelihood of significant impacts on water resources. The DOEE's Significant Impact Guidelines state that:

> "To be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on a water resource is a real or not remote chance or possibility."

And,

> "Under section 391 of the EPBC Act, the Minister must take into consideration the precautionary principle when deciding whether an action is a controlled action. This principle states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation."

The Executive Summary of the Water Assessment Report states that overall:

> "It is concluded that the proposed development of the Mahalo Development Area will not have a significant impact on water resources" (p. iii)

However, as discussed below, there are data and evidence not included in the report which would be needed (in my view) to fully substantiate this conclusion with a high level of confidence, i.e., in consistent with the statement above regarding the Precautionary Principle. Much of the groundwater modelling work/impact prediction is based on numerical modelling conducted by OGIA using the Surat CMA underground water impact model – a regional-scale model being used to assess CSG impacts on groundwater within the wider area. While this is indeed an appropriate tool to be used in the assessment of impacts in the project area, a significant amount of additional local-scale data, including baseline groundwater levels and quality, information about geological structures, inter-aquifer connectivity and ground-surface water interaction are needed within and around the project area to make a more targeted and confident local-scale assessment of impacts, in accordance with the IESC information guidelines, as discussed below.

The checklist within the IESC's 2018 Information Guidelines is presented at the beginning of the Water Assessment Report. This checklist provides a means to examine whether a proponent has included sufficient data, analysis and information for an independent assessor to verify that a CSG proposal has assessed:

"the processes of cause and effect between the project and water resources, and

the magnitude of the impacts on water resources." – IESC, 2018

Based on a reading of this checklist and the report, it appears there are many areas where the proponent has not adequately collected data or investigated key issues which are likely to have a bearing on the likely level of impact on water resources in the region and the level of confidence with which conclusions about an impact (or lack of impact) can be made. Notably:

1. There are very few groundwater monitoring bores located within the project area with which to assess baseline conditions in key aquifers and/or examine the possibility of inter-aquifer connectivity. As shown in Figure 7.9, no dedicated active monitoring bores currently occur within the project area. A small number of groundwater database records/bores occur in the west of the project area (Fig 7.11), and water level records from these and other bores in the surrounding area are presented in the report. However, the coverage of monitoring bores and historic groundwater level monitoring data, and the hydrochemical data presented from the project area are not adequate to characterise baseline groundwater elevation ranges, the groundwater flow regime, recharge and discharge and/or inter-aquifer connectivity, as per the following items in the IESC Checklist:

"*Provide data to demonstrate the varying depths to the hydrogeological units and associated standing water levels or potentiometric heads, including direction of groundwater flow, contour maps, and hydrographs. All boreholes used to provide this data should have been surveyed*"

"Provide sufficient data on physical aquifer parameters and hydrogeochemistry to establish pre-development conditions, including fluctuations in groundwater levels at time intervals relevant to aquifer processes"

"Provide hydrochemical (e.g. acidity/alkalinity, electrical conductivity, metals, and major ions) and environmental tracer (e.g. stable isotopes of water, tritium, helium, strontium isotopes, etc.) characterisation to identify sources of water, recharge rates, transit times in aquifers, connectivity between geological units and groundwater discharge locations."

Only two locations have 'paired' (nested) groundwater monitoring bore records, and both are near the Rolleston coal mine. The data from these bores provide insufficient information to properly assess the likely degree of inter-aquifer connectivity in the project area, which in turn is important for assessing the likelihood of drawdown propagation between units, landholder bores and GDEs.

2. A significant geological fault has been identified in the region. This fault appears to cause significant offset to deep geological units in the basin, creating a possibility of enhanced connectivity between deep and shallow aquifers (Figure 7.7). The fault may also be an important control on the occurrence of springs in the region (e.g. providing a conduit for flow from confined aquifers to the surface). The information and analysis regarding this fault and its possible hydrogeological effects is inadequate to meet the following IESC checklist item:

> "Define and describe or characterise significant geological structures (e.g. faults, folds, intrusives) and associated fracturing in the area and their influence on groundwater – particularly groundwater flow, discharge or recharge.
> –Site-specific studies (e.g. geophysical, coring/wireline logging etc.) should give consideration to characterising and detailing the local stress regime and fault structure (e.g. damage zone size, open/closed along fault plane, presence of clay/shale smear, fault jogs or splays).
> –Discussion on how this fits into the fault's potential influence on regional-scale groundwater conditions should also be included.

The location of the fault is not clearly shown on a map in relation to the project area. A statement is made that seismic data (Fig 7.7) indicates a "~1 km zone of fault rubble, resulting in limited connectivity between the coal seams on the east and west of the fault". The nature of the material in the fault zone appears only to have been assessed based on seismic profiles (rather than analysis of geological samples) and the conclusion about connectivity is highly speculative without any analysis of water level data either side of the fault, direct sampling of geologic material or hydrochemical analysis of groundwater in its vicinity. As a result, the hydrogeological effects of this major structure remain unclear, with implications for the impact predictions and the level of confidence with which these can be made.

3. Ground-surface water interaction.

The report includes a conceptual model of ground-surface water interaction for the Comet River and alluvial aquifer (Fig 7.26). It is stated that due to the depth of the water table in the alluvium being below the base of the river in monitoring data, no baseflow is anticipated to occur. While this may be the case, the possibility of enhanced leakage or capture of surface water due to increased vertical hydraulic gradients should be examined, and differences in the relationship between water table height and stream base (along the length of the river) further examined. A greater amount of observation data and analysis is needed to verify the relationship between surface water levels, alluvial groundwater levels, and stream base elevation both spatially and temporally, in accordance with the following IESC checklist item:

"Provide an assessment of the frequency, volume, seasonal variability and direction of interactions between water resources, including surface water/groundwater connectivity.."

4. Impacts to existing bores/users

   Based on the numerical modelling, the project predicts drawdowns of greater than 0.2m in certain parts of the upper layers (alluvium and Basalt) as well as the Rewan Group, and Upper/Lower Bandanna Formation (see page 107), Fig 8.3, Table 9.1 and Fig. 9.1.

   These model results indicate that some level of drawdown propagation will probably occur in aquifers in which significant numbers of landholder bores occur (although most bores are not predicted to be impacted by drawdowns above the 2m threshold level in the Water Act). While the model-predicted drawdown levels are below threshold levels in the upper layers, including Basalt (the layer with the highest number of bores) and alluvium, the occurrence of drawdown in these layers within the model indicates some probable level of impact. Larger drawdown effects may be possible in these units, for example, depending on local-scale hydrostratigraphy, aquifer parameters and geological structures (for which the current set of field data provide insufficient local-scale detail).

   The same applies in the Rewan Group. Impacts to Rewan Group bores surrounding the project include predicted drawdowns of up to 3.3m. There are also a significant number of bores in the Rewan Formation near the town Springsure, to the west of the project area, where the drawdown predictions in the model do not appear to extend (Figure 8.3). Given the reasonably high predicted drawdowns in the Rewan elsewhere in the modelled area, further local scale hydrogeological investigations and/or modelling would help better understand the possibility of significant impacts to these bores.

   There are four bores in the Bandanna Formation, where the model predicts drawdown to be greater than threshold levels in the Water Act (north of the project area). Again, given the model is a regional-scale tool, the magnitude and extent of the drawdown should be further investigated and informed by local-scale studies of inter-aquifer connectivity, aquifer and aquitard hydraulic properties and geological structure, as further bores in the area may be similarly affected.

References

Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), 2018. Information guidelines for proponents preparing coal seam gas and large coal mining

proposals. May 2018, 30pp. Available at:
<http://www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-may-2018.pdf>

Australian Government
Department of Agriculture

FOI 200511
Document 20

s22
Queensland North Assessments Section
Assessments & Governance Branch
Department of the Environment and Energy
GPO Box 787
CANBERRA ACT 2601

Dear s22

I refer to the letter of 10 October 2019 from s22 (Director, Referrals Gateway, Department of the Environment and Energy) to Senator the Hon. Bridget McKenzie, Minister for Agriculture, inviting comment on referral 2019/8534 Mahalo Development Area CSG project, Surat Basin, Queensland, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Minister for Agriculture has asked me to reply on her behalf.

This referral relates to Australia Pacific LNG Pty Ltd's proposal to produce gas at the Mahalo Development Area approximately 40 kilometres (km) north-northeast of Rolleston, Central Queensland. The department notes the referral states that the proposal includes construction, operation and rehabilitation of 95 gas production wells and associated infrastructure including gas and water pipelines and water storage.

The referral describes the project area as approximately 470 km^2 of which approximately 93 percent is used for cattle grazing and limited cropping. Much of the area is impacted by the presence of invasive animals and plants. The majority of the project area is privately owned freehold land associated with larger agricultural properties. The remainder of the land tenure is a combination of lands lease, road reserves, easements, and unallocated state land.

The department has no comments from a portfolio perspective on whether the proposed action may have significant impact(s) on any matters of national environmental significance protected under the EPBC Act.

Thank you for the opportunity to comment on referral EPBC 2019/8534.

Yours sincerely

s22
Courtney Bryant
A/g Assistant Secretary
Climate & Resilience Policy Branch

28 October 2019

T +61 2 6272 3933
F +61 2 6272 5161
18 Marcus Clarke Street
Canberra City ACT 2601
GPO Box 858
Canberra ACT 2601
agriculture.gov.au
ABN 24 113 085 695

From: EPBC Referrals
Sent: Friday, 25 October 2019 12:10 PM
To: s22
Cc: s22
Subject: FW: Invitation to comment on Referral - (EPBC 2019/8534) - Mahalo Development Area CSG project, Surat Basin, Qld [SEC=OFFICIAL]
Attachments: GA comments on the EPBC referral - Mahalo Development Area CSG Project (....pdf

FOI 200511
Document 21

Hi s22

This was just sent to s22 and the RG.
Passing it on to you in case it is needed for today's meeting. Pass onto Andrew if appropriate.

Cheers

S.

From: EPBC [mailto:EPBC@industry.gov.au]
Sent: Friday, 25 October 2019 12:01 PM
To: EPBC Referrals ; EPBC ; s22
Cc: 'epbc@ga.gov.au'
Subject: RE: Invitation to comment on Referral - (EPBC 2019/8534) - Mahalo Development Area CSG project, Surat Basin, Qld [DLM=For-Official-Use-Only]

Good afternoon s22 ,

Sorry for the delay in returning this one to you. Please find our comments below.

The Department of Industry, Innovation and Science is supportive of the project.

Geoscience Australia has reviewed the referral and provided comments. Please find them attached.

Warm regards,

s22
Policy Officer, Environment and Resources Stewardship
Resources Strategy| Resources Division
02 6213 s22 | s22 @industry.gov.au

Department of Industry, Innovation and Science

For Official Use Only

From: EPBC Referrals [mailto:EPBC.Referrals@environment.gov.au]
Sent: Thursday, 10 October 2019 4:52 PM
To: EPBC <EPBC@industry.gov.au>
Cc: 'epbc@ga.gov.au' <epbc@ga.gov.au>; EPBC Referrals <EPBC.Referrals@environment.gov.au>
Subject: Invitation to comment on Referral - (EPBC 2019/8534) - Mahalo Development Area CSG project, Surat Basin, Qld [SEC=OFFICIAL]

Good afternoon

We are sending you the attached link to a referral received for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for your comments, as it falls within your area of interest:
http://epbcnotices.environment.gov.au/invitations/

Formal notification of this referral is attached to this email.

Any comment should be sent by 24 October 2019 via:

by letter s22
Queensland North Assessments Section
Assessments & Governance Branch
Department of the Environment and Energy
GPO Box 787
CANBERRA ACT 2601

by email s22 @environment.gov.au

Regards

Referrals Gateway
Governance and Business Support Section

Cnr Jerrabomberra Avenue
and Hindmarsh Drive,
Symonston ACT 2609
GPO Box 378,
Canberra, ACT 2601 Australia
Phone: +61 2 6249 9111
Facsimile: +61 2 6249 9999
Web: www.ga.gov.au
ABN 80 091 799 039

Resource Stewardship and Environment Section
Resources Strategy
Resources Division
Department of Industry, Innovation and Science

23 October 2019

Attn: s22

Re: Invitation to comment on EPBC Referral – Mahalo Development Area CSG Project (EPBC 2019/8534), Qld

I refer to the request for comments dated 10 October 2019 on an EPBC referral for the Mahalo Development Area Coal Seam Gas project (the Project), Surat Basin, Queensland, by Australia Pacific LNG Pty Limited (the Proponent). Geoscience Australia (GA) has reviewed the referral information, particularly as it relates to sections 24D and 24E (the water trigger) of the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), with attention to potential impacts to groundwater resources and other technical geoscience or geotechnical factors.

Summary

The Project proposes to install 95 gas production wells, targeting the Bandanna Formation within the Bowen Basin, as the first part of a staged development. The Project will also include associated infrastructure.

The Proponent has self-assessed that the Project will not have a significant impact on water resources and the water trigger should not be a controlling provision. The Proponent has provided extensive information in support of their assessment and relies on the regional scale Surat Cumulative Management Area groundwater model developed by the Queensland Office of Groundwater Impact Assessment for predictions of area and scale of impact.

GA considers that local scale analysis and modelling is required to determine the significance of the Project Impacts on water resources. The assessment provided does not adequately consider the potential impacts to the basalt groundwater resources to the west of the Project Area.

GA also notes that, as the Project is part of a larger staged development, it may be appropriate to consider the impacts from full scale development as part of a single process to ensure the cumulative impacts of the whole project are assessed, and appropriate monitoring and management strategies are implemented. Assessing the full project as a whole would also potentially serve to reduce the regulatory burden on the Proponent.

Background

The Project area is approximately 470 km^2 located in the northern part of the Surat Cumulative Management Area, 40 km north of Rolleston. The operating life of individual CSG production wells is anticipated to be between 20 and 30 years. Gas production is planned to cease by approximately 2050.

The Project will be operated by Australia Pacific LNG Pty Limited, on behalf of the Joint Venture Parties, which consists of Comet Ridge Ltd (40%), Santos QNT Pty Ltd (30%), and Australia Pacific LNG Pty Limited (30%).

The Project would involve the construction, operation, and rehabilitation of:

- 95 gas production wells;
- Associated infrastructure including gas and water pipelines, access tracks, power lines, and communication lines;
- Gas compression facilities;
- Water management infrastructure; and
- Other ancillary activities and facilities to support construction and operations.

Treated 'produced water' will be beneficially used, for example to support irrigation and industrial activities. Water treatment by-products from any desalination process (such as brine) will be stored in dams or tanks constructed and operated in accordance with relevant guidelines, from where it may be further concentrated via solar or mechanical evaporation. This waste will be disposed off-site at a Regulated Waste Facility.

An existing Environmental Authority (EA EPPG00872113), issued by the Queensland Government, authorises the proposed petroleum activities within the Mahalo Development Area. The Proponent notes that this EA will be amended to seek authorisation for the full scope of the proposed action. It is not clear from the referral documentation what elements of the Project are not covered by the existing EA and would be the subject of the proposed amendment.

Total 'produced' groundwater that will be abstracted for the duration of the Project is estimated at approximately 3.4 GL with a peak rate of up to approximately 2.2 ML/day.

Coal Seam Gas Resources

The Mahalo CSG project is located in the Denison Trough area of the Bowen Basin near Rolleston, and covers an area of 911 km^2. Resource figures are provided in the table below.

Early petroleum exploration in the region had focussed on conventional resources in Permian sandstone reservoirs, resulting in the discovery of several gas fields. Arcturus and Yandina conventional gas fields are located just to the west of the permit area.

The area is prospective for coal seam gas and coal extraction in the Permian Bandanna Coal Measures. Coal seam gas exploration commenced in the Mahalo JV Project Area in 2004.

Twenty four wells have been drilled as part of the project to-date.

Category	Gas Reserve (PJ)			Gas Contingent Resource (PJ)		
	1P	2P	3P	1C	2C	3C
5 March 2018 certification: Mahalo Gas Project (ATP 1191)	18	172	374	224	385	389

Comments

Staged Development

The Proponent has indicated that the Project is part of a larger staged development. The Proponent stated that there is no overall plan for the larger development and that due to the significant timeframe associated with development of additional stages, the Project should be assessed as a 'split referral' (as defined in the EPBC Act). GA notes that the draft UWIR, 2019[1] indicates that a development plan for the larger Mahalo Project has been used to inform the OGIA groundwater model, and shows a total production area of 4000 km^2 and 3000 wells.

As the Proponent has a clear and stated intention to develop additional stages of the Mahalo Project GA recommends that planning groundwater monitoring and management for the full scale of the development commence now. Project-scale groundwater modelling of the full development would be an appropriate assessment and management tool.

Project-Scale Modelling

The Proponent has provided extensive information in support of their referral and relies on the regional scale Surat Cumulative Management Area (CMA) 2019 groundwater model developed by the Queensland Office of Groundwater Impact Assessment (OGIA) for predictions of area and scale of impact. On request from the Proponent, OGIA ran their model to predict the impacts associated with the Project, based on Project specific development information provided by the Proponent. The Proponent notes that the OGIA model does not include the coal mines in the vicinity of the Project area.

The OGIA model is a best practice tool for assessing cumulative groundwater impacts in the Surat CMA however OGIA noted, with reference to the 2016 Surat CMA groundwater model, that "The model is not designed to be used to directly predict water pressure or water level variations at a local scale" (OGIA, 2016[2]). The Groundwater modelling report for the 2019 model has not yet been publically released, but the scale of the model has not changed, with the cell size remaining at 1.5 km x 1.5 km, as such it is unlikely that the 2019 OGIA groundwater model will be any more suitable for predicting local-scale impacts.

Impacts to Basalt Aquifer

The Project will target the Bandanna Formation. Across the majority of the Project area the Bandanna formation underlies the Rewan Group, a regional aquitard. However, in the west of the project area the Rewan Group is absent. In this location the Bandanna is overlain directly by Basalt. As shown in Figure 7.2 of Appendix B this area of Bandanna subcrop is mapped approximately 1 to 2 km to the

[1] Underground Water Impact Report for the Surat Cumulative Management Area Consultation draft, OGIA, May 2019 https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0003/1445547/uwir-2019.pdf

[2] Groundwater modelling report for the Surat Cumulative Management Area, OGIA, September 2016 https://drive.google.com/open?id=0B5u2TKAmnh_iRlo4T0ZMOTB3WE0

west of the project area, and within the area of 2 to 5 m drawdown impact for the Rewan Formation predicted by the OGIA model.

GA notes that approximately 65% of the groundwater bores within a 50 km radius of the Project area target the Basalt, making it a key local groundwater resource.

Due to the local scale of the subcrop, and the importance of the Basalt as a local water resource, GA considers that project-scale analysis and modelling is required to determine the significance of the Project Impacts on water resources. The assessment provided with the referral does not adequately consider the potential impacts to the Basalt groundwater resources to the west of the Project Area.

Surface Water – Groundwater Connectivity

The Project Area is located within the Comet River catchment, consisting of a network of watercourses that typically only flow during and immediately after significant rainfall events. GA notes that the watercourses and associated alluvium in the region are a potentially significant source of recharge to the regional aquifers, including the Basalt. GA considers that the connections between these formations and surface water features should be further investigated, as the Project has been predicted to impact on the alluvium and these impacts may have the potential to alter the recharge rates to the Basalt.

Groundwater Monitoring

A brief groundwater monitoring and management plan (Appendix F) is presented with the referral. It indicates the project may be subject to obligations set by OGIA relating to the Surat Cumulative Management Area Underground Water Impacts Report Water Monitoring Strategy, however no information is provided about the nature of these obligations. Little other information is provided in the plan regarding the management and monitoring of groundwater resources impacted by the Project.

No baseline groundwater monitoring sites are identified within the Project Area. Five Queensland government groundwater monitoring bores, with time series data, are located within a 25 km radius of the Project boundary, and these were used to inform the impact assessment in the referral. None of these bores target the Bandanna Formation or the alluvium.

GA notes that baseline and ongoing groundwater monitoring data are key to calibration of groundwater models and ensuring measured impacts do not unexpectedly exceed predictions. It is important that any groundwater monitoring network is designed to achieve the intended aims, for example early warning of unexpected impacts, model validation and investigation of areas of uncertainty.

If you have any queries on this, please contact me on 6249 s22 or s22

Kind regards,

s22

A/g Director - Groundwater Advice, Groundwater Branch
Environmental Geoscience Division
Geoscience Australia

FOI 200511
Document 23

From: s22 @des.qld.gov.au>
Sent: Wednesday, 23 October 2019 5:01 PM
To: s22
Cc: s22 ;s22 ;s22 ;s22
Subject: RE: EPBC 2019/8534 - Mahalo Development Area CSG project, Surat Basin QLD [SEC=OFFICIAL]

Hi s22

Thank you.

I would like to clarify with item 4 that that this will be confirmed by DES upon receiving an application from APLNG. It does not appear that the disturbance footprint of the project has been specified (only the area of the development area) and this would confirm whether an EIS would be triggered. However, based on the listed proposed activities it is not expected a disturbance area of 2,000 hectares will be reached.

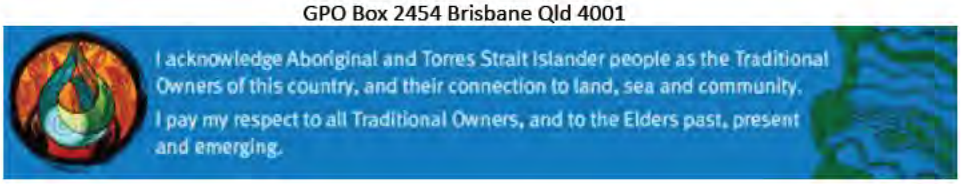
Happy to keep in communication regarding this project.

Kind regards,

Queensland Government

s22
Senior Environmental Officer (Assessment)
Energy & Extractive Resources
Environmental Services & Regulation
Department of Environment and Science

Ph: 07 3330 s22
s22
Lvl 7, 400 George St Brisbane
GPO Box 2454 Brisbane Qld 4001



From: s22
Sent: Wednesday, 23 October 2019 3:30 PM
To: s22
Cc: s22 ;s22 ;s22 ;s22
Subject: RE: EPBC 2019/8534 - Mahalo Development Area CSG project, Surat Basin QLD [SEC=OFFICIAL]

Hi s22

Thank you very much for your comments. Please let us know if you receive a request for a new EA or an amendment to the existing EA. We'll also keep in touch regarding our consideration of the referral.

Thanks
s22

s22
Acting Director
Queensland North Assessments | Assessments and Governance Branch
Environment Approvals Division | Department of the Environment and Energy
PO Box 787, Canberra, ACT, 2601
Tel: 02 6274 s22 | Mob: s22
Part time – Tuesday to Thursday

The Department acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

From: s22 @des.qld.gov.au]
Sent: Wednesday, 23 October 2019 4:04 PM
To: s22 @environment.gov.au>
Cc: s22 @des.qld.gov.au>; s22 @des.qld.gov.au>
Subject: EPBC 2019/8534 - Mahalo Development Area CSG project, Surat Basin QLD

Good afternoon s22

Re: Invitation to comment on referral: Mahalo Development Area CSG project, Surat Basin QLD - EPBC 2019/8534

Thank you for your letter to the Department of Environment and Science (DES) received on 10 October 2019.

DES has reviewed your request and have considered the following:

1. Australia Pacific LNG Pty Limited (APLNG) currently hold an environmental authority (EA) for an Authority to Prospect (ATP) tenure for exploration purposes.
2. APLNG have applied to the Department of Natural Resources, Mines and Energy (DNMRE) for Petroleum Leases (PLs) 1082 and 1083 to replace the ATP and allow for extraction activities.
3. DES have not yet received either a new EA application or an application to amend the existing EA to change the conditions, activities and locations to authorise extraction. Therefore, DES do not have the information to determine the appropriate assessment approach for the impacts of the project.
4. The proposed activities do not trigger the need for an Environmental Impact Statement (EIS) in accordance with the guideline *Triggers for Environmental Impact Statements under the* Environmental Protection Act 1994 *for mining, petroleum and gas activities.*
5. DES will require a site-specific assessment of the proposed activities and impacts to Matters of State Environmental Significance (MSES) which will be undertaken through either a new EA application process or an amendment to the existing EA.
6. Considering the extent of potential impacts to Matters of National Environmental Significance (MNES), it seems appropriate to DES that an assessment is carried out under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) by the Department of Environment and Energy.
7. DES can consider the federal authority in the assessment and conditioning of the EA upon receiving an application to amend their EA.

Please feel free to contact me to discuss this further if required.

Kind regards,

Queensland Government

s22
Senior Environmental Officer (Assessment)
Energy & Extractive Resources
Environmental Services & Regulation
Department of Environment and Science

Ph: 07 3330 s22
s22
Lvl 7, 400 George St Brisbane
GPO Box 2454 Brisbane Qld 4001

Queensland Government

Department of
Environment and Science

Ref 101/0003868-007

25 October 2019

s22
Queensland North Assessments Section
Assessments and Governance Branch
Department of the Environment and Energy
GPO Box 787
CANBERRA ACT 2601

Dear s22

Invitation to comment on referral EPBC 2019/8534 – Mahalo Development Area CSG project, Surat Basin, Qld

Thank you for your letter dated 10 October 2019 requesting advice on whether the above action will be assessed in a manner described in Schedule 1 of the Agreement between the Commonwealth of Australia and the State of Queensland (the Bilateral Agreement) developed under Section 45 of the *Environment Protection and Biodiversity Conservation Act 1999*.

I advise the proposal will not be assessed using the environmental impact statement process in Chapter 3 of the *Environmental Protection Act 1994*.

The Department of State Development, Manufacturing, Infrastructure and Planning has advised that the proposal is not currently being assessed as a coordinated project under Part 4 of the *State Development and Public Works Organisation Act 1971* and is not likely to be assessed under this process in the future.

Should you have any further enquiries, please contact me on telephone (07) 3330 5598.

Yours sincerely

s22

A/Director, Operational Support

Level 9
400 George Street Brisbane
GPO Box 2454 Brisbane
Queensland 4001 Australia
Telephone + 61 7 3330 5598
Facsimile + 61 7 3330 5875
Website www.des.qld.gov.au
ABN 46 640 294 485

Australian Government
Department of Agriculture, Water and the Environment

FOI 200511
Document 25

EPBC Ref: 2019/8534

Ms Nicole Buchanski
Strategic Approvals Manager
Australia Pacific LNG PTY Limited
GPO Box 148
Brisbane QLD 4001

Dear Ms Buchanski

Decision on referral
Mahalo Development Area CSG Project (EPBC 2019/8534)

Thank you for submitting a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This is to advise you of my decision about the proposed action to construct and operate 95 gas production wells and supporting infrastructure and facilities, approximately 40 km north-east of Rolleston, Queensland.

As a delegate of the Minister for the Environment, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the Department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act. This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

The Department has an active audit program for proposals that have been referred under the EPBC Act. The audit program aims to ensure that proposals are implemented as planned. Please note that your project may be selected for audit by the Department at any time and all related records and documents may be subject to scrutiny. Information about the Department's compliance monitoring and auditing program is enclosed.

If you have any questions about the referral process or this decision, please contact the project manager, s22 , by email to s22 @environment.gov.au or phone 02 6274 s22 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Andrew McNee
Assistant Secretary
Assessments and Governance Branch
15 May 2020

Australian Government
Department of Agriculture, Water and the Environment

FOI 200511
Document 26

EPBC Ref: 2019/8534

The Hon David Littleproud MP
Minister for Agriculture, Drought and Emergency Management
PO Box 6022
Parliament House
CANBERRA ACT 2600

Dear Minister

Decision on referral
Mahalo Development Area CSG Project (EPBC 2019/8534)

This is to advise you of my decision about the proposed action to construct and operate 95 gas production wells and supporting infrastructure and facilities, approximately 40 km north-east of Rolleston, Queensland.

As a delegate of the Minister for the Environment, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the Department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act. This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

If you have any questions about the referral process or this decision, please contact the project manager, s22 , by email to s22 @environment.gov.au, or telephone 02 6274 s22 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Andrew McNee
Assistant Secretary
Assessments and Governance Branch
15 May 2020

Australian Government
Department of Agriculture, Water and the Environment

FOI 200511
Document 27

EPBC Ref: 2019/8534

The Hon Keith Pitt MP

Minister for Resources, Water and Northern Australia
Parliament House
CANBERRA ACT 2600

Dear Minister

Decision on referral
Mahalo Development Area CSG Project (EPBC 2019/8534)

This is to advise you of my decision about the proposed action to construct and operate 95 gas production wells and supporting infrastructure and facilities, approximately 40 km north-east of Rolleston, Queensland.

As a delegate of the Minister for the Environment, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the Department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act. This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

If you have any questions about the referral process or this decision, please contact the project manager, s22 , by email to s22 @environment.gov.au, or telephone 02 6274 s22 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Andrew McNee
Assistant Secretary
Assessments and Governance Branch
15 May 2020

EPBC Ref: 2019/8534

s22
Director
Impact Assessment and Operational Support
Department of Environment and Science
GPO Box 2454
BRISBANE QLD 4001

Dear s22

Decision on referral
Mahalo Development Area CSG Project (EPBC 2019/8534)

This is to advise you of my decision about the proposed action to construct and operate 95 gas production wells and supporting infrastructure and facilities, approximately 40 km north-east of Rolleston, Queensland.

As a delegate of the Minister for the Environment, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the Department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act. This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

If you have any questions about the referral process or this decision, please contact the project manager, s22 by email to s22 @environment.gov.au, or telephone 02 6274 s22 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Andrew McNee
Assistant Secretary
Assessments and Governance Branch
15 May 2020

/Quality Assurance Checklist – Referral Brief

FOI 200511
Document 29

Reviewing Officer (may be assessment officer, clearing officer or peer reviewer)

Name: s22 Signature: s22 Date: 13/5/2020

Note: Assessment officer to fill out sections shaded YELLOW. Reviewing officer to complete all other sections.

Project: Mahalo Development Area CSG Project							
EPBC No: 2019/8534	**Assessment officer:** s22	**Due Date: Statutory timeframe was 7 Nov 2019**					
General requirements		**Brief**		**Decision Notice**		**Letters**	
		(tick or circle)					
Correct templates used		☒		☒		☒	
Template version numbers: (assessment officer to insert version numbers)		4.3					
EPBC reference number correct and used consistently		☒		☒		☒	
Title of the action consistent		☒		☒		☒	
The ACN (or ABN if no ACN) is listed and correct		☒		☒			
The designated proponent (CA)/person proposing the action (NCA or NCA-PM) is correct. Needs to be a 'person' for the purposes of the EPBC Act.		☒		☒			
Description of the proposal is an accurate reflection of what is in the referral and encompasses all proposed activities		☒		☒		☒	
Statutory deadline consistent with database record		☒					
Signature blocks and dates are correct		☒		☒		☒	
List of attachments is correct		☒					
All dates mentioned accord with records		☒		☒		☒	
All species references use SPRAT scientific names (first time that they are used)		☒	N/A	☐	**N/A**	☐	**N/A**
Material used to prepare briefing is listed		☒	N/A				
Public comments are included and issues raised in public comments are addressed (s75(1A))		☒	N/A				
Legal advice is included (if advice has been sought)		☐	**N/A**				
Line area advice is included (if advice has been sought)		☒	N/A				
All line areas consulted are clearly identified		☒	N/A				
Comments from Commonwealth and State/Territory Ministers are included and addressed		☒	N/A				
Additional information requests (stop clocks) are discussed and briefing package and additional information attached		☐	**N/A**				
Current ERT Report included		☒		Date of ERT Report: 29/04/2020			

Compliance, monitoring and auditing fact sheet is attached (for NCA and NCA-PM)	n/a			To be sent with letter
Identifies the protected matters potentially impacted by the proposed action and provides clear reasons why significant impacts are likely/not likely	☒			
Recommendations on significance are based on *EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (2013) and relevant referral guidelines	☒			
Considers all adverse impacts the action has, will have or is likely to have on matters protected by each provision of Part 3 ((s.75)(2)(a))	☒			
Does not consider any beneficial impacts the action has, will have or is likely to have on matter protected by each provision of Part 3 ((s.75)(2)(b))	☒			
States that the decision maker must take account of the precautionary principle, and the precautionary principle is discussed as appropriate to recommendations of significance	☒			
Bioregional plans are included and discussed (where relevant)	☐	**N/A**		
Check listing status of all listed species potentially significantly impacted by the proposed action. Ensure correct listing statuses are used in the brief	☒	N/A	Date of check against SPRAT: 29/04/2020	
BCD (Species Listing Information & Policy Section) weekly report is consulted to confirm imminent listing events or delistings (if required)	☒	N/A	Date of weekly report: 01/05/2020	
BCD (Species Listing Information & Policy Section) line area advice included on recent and pending listing decisions (if required)	☐	**N/A**	Date of advice received:	