Santos

Section 2.1 – Proposed PL1021 Activities

Issue 1 – Historical activities

In *Section 2.1 – Proposed PL1021 Activities* of the supporting information, Santos stated that the proposed activities are in addition to the pre-existing activities authorised by EA EPPG00651513 on authority to prospect (ATP) 889, the current EA for the underlying exploration activities, which is held by Senex Energy Limited. In *Table 1: GFD Project Activities*, Santos has proposed the activities to be undertaken on PL1021.

The administering authority considers that the historical activities present on the tenure should be included in *Table 1: GFD Project Activities*.

Please provide the scale and intensity of the activities undertaken on ATP889 that will be included in the disturbance undertaken on PL1021.

Santos Response:

Table 1 below provides a summary of the scale and intensity for existing and proposed activities on PL1021. Attachment 2 – Supporting Information to the EA application has been revised to include this table within Section 2.1 as Table 2: Scale and intensity for the activities.

Table 1: Scale and intensity for the activities - PL1021

Petroleum Activities and Infrastructure	Existing scale (number of activities)	Proposed scale (number of activities)	Intensity (maximum size in total)
Coal seam gas exploration, appraisal and development wellpads	5	175	224 ha
Sewage Treatment Plant(s) that discharge treated effluent to an infiltration trench or through an irrigation scheme, or to land for dust suppression, construction or operational purposes (21 to 1500 EP)	0	4	100 EP
Electrified compressor facility	0	1	30 ha
Accommodation	0	2	3.5 ha
Regulated structure	0	1	15 ha
Water treatment facility	0	1	< 10 ML/day

Santos

Issue 2 – Water Treatment Facility

In Table 1: GFD Project Activities of the supporting information, Santos has proposed that a water treatment facility be authorised on the EA. In Section 4.11 of the supporting information, Santos stated that at some time in the future, a water treatment facility may be required to assist with managing produced water volumes and/or facilitate water management activities such as beneficial reuse. However, Santos has not clearly identified the possible impacts associated with this activity or the management measures to be implemented to minimise any possible impacts.

As such, please provide further information on the impacts and management measures to be implemented in relation to a water treatment facility.

Santos Response:

Table 2 below provides a summary of the potential impacts and mitigation measures to be implemented on PL1021 with regards to water treatment operations. Attachment 2 – Supporting Information to the EA application has been revised to include Table 2 as Table 21: Potential Impacts and Mitigation Measures – water treatment operations within Section 4.11 Schedule E – Brine and salt management.

Table 2: Potential Impacts and Mitigation Measures - water treatment operations

Potential Impact	Mitigation Measure
Release of treated or untreated coal seam (CS) water to environment	• Locate plant away from surface water bodies. • Design of treatment plant in accordance with approved standards; • Implement an inspection and maintenance regime at the frequency prescribed by the operating and maintenance manual for the facility to minimise the likelihood of a release of CS water as a result of plant or equipment failure; • Monitor of flow volume in and out of the facility at a frequency designed to maintain plant efficiency and minimise the likelihood of a release of CS water; • In the unlikely event of a release of CS water, the following measures may be implemented: o Determine cause and release location within the facility and rectify the failure as soon as possible; o Divert water away from sensitive environments where practicable; o Clean up spill where practicable; o Conduct monitoring (soil and/or water) if necessary to determine impacts to the receiving environment; o Undertake remediation measures (soil and/or water) if deemed necessary; o Notify the administering authority where required by the CG stated conditions in Schedule K – Notification.
Construction related air emissions	• Conduct dust suppression of disturbed areas with water trucks where meteorological conditions cause the potential for nuisance impacts; • Maintain vehicles and machinery in good working order to minimise emissions; • Minimise the time vehicles and machinery are left to idle; • Progressively rehabilitate disturbed areas where they are no longer required for construction (i.e. minimise exposed areas); • Conduct routine inspections and maintenance on plant and equipment.
Construction and operation related noise emissions	• Plant will be located away from sensitive receptors to ensure compliance with prescribed noise limits. • Design and construction of treatment plant in accordance with approved standards;

Potential Impact	Mitigation Measure
	• Operation and maintenance of plant and equipment in good working order; • Minimising the amount of time that vehicles and machinery are left to idle.
Chemical/waste spills	• Chemicals and wastes stored in effective containment systems impervious to the materials stored; • Chemicals and wastes stored and handled in accordance with relevant Australian Standard (where applicable); • Chemicals and waste isolated from stormwater runoff; • Removal of chemicals and wastes by a licensed waste contractor for treatment and/or disposal to a licensed waste facility in accordance with legislative requirements.

Issue 3 – Stimulation

In *Section 2.1 – Proposed PL1021 Activities* of the supporting information, Santos stated that it will be seeking to undertake hydraulic stimulation.

Santos has not clearly identified the possible impacts associated with this activity or the management measures to be implemented to minimise any possible impacts.

As such, please provide further information on the impacts and management measures to be implemented in relation to stimulation activities. This should include a risk assessment to ensure that the activities are managed to prevent environmental harm and the proposed monitoring program to be undertaken to ensure that impacts are not occurring to environmental values.

Santos Response:

Section 4.12 Schedule I – Well construction, maintenance and stimulation activities has been included in Attachment 2 – Supporting Information to the EA application to address the possible impacts and management measures associated with hydraulic stimulation. Section 4.12 outlines the following:

- The Santos Upstream Hydraulic Fracturing Risk Assessment is attached as Appendix B to Attachment 2 – Supporting Information to the EA application. As outlined in section 1.1 of the risk assessment, *'the Hydraulic Fracturing Risk Assessment – Compendium of Assessed Fluid Systems Report addresses all regulatory requirements contained within the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) approval, CG conditions and EA, and synthesises the findings of all hydraulic fracturing risk assessments completed to date.'*
- The Santos Upstream Hydraulic Fracturing Risk Assessment synthesises the findings of all hydraulic risk assessments completed to date for Santos. The risk assessment documents the conditions in all of the Santos GLNG gas fields and describes the process by which hydraulic fracturing is conducted and monitored. As outlined in the Risk Assessment, the Roma Project Area incorporates the Roma East Project which has the same geological, hydrological and geomorphological characteristics. PL1021 is located directly adjacent to the existing Santos Roma and Roma East Project Areas and is considered to have the same geological, hydrological and geomorphological characteristics as the Roma and Roma East Project Areas. The risk assessment is therefore considered applicable to PL1021.
- The Santos Stimulation Impact Monitoring Program is attached as Appendix C to Attachment 2 – Supporting Information to the EA application. The program will be implemented for hydraulic stimulation activities undertaken on PL1021. This monitoring program has been developed to comply with Santos' upstream environmental authorities including the proposed EA conditions for PL1021.

Santos

Section 3.1.3 – Flora and Fauna

Issue 1 – Table 4: Regional Ecosystems

In *Table 4: Regional Ecosystems* of the supporting information, Santos provided details on the regional ecosystems present on PL1021 including the biodiversity status of the regional ecosystems under the *Environmental Protection Regulation 2008*. Santos has not provided the *Vegetation Management Act 1999* (VM Act) class for each of the regional ecosystems.

Further, Santos has discussed RE 11.9.7 and RE 11.3.17 in different sections of the supporting information, however, these REs are not included in Table 4.

Please provide the information on RE 11.9.7 and RE 11.3.17 in *Table 4: Regional Ecosystems*.

Santos Response:

The information presented in Table 4 was a replication of the information provided in DEHP's Regional Ecosystem Environmental Report. This data shows the mapped extent of regional ecosystems in PL 1021 using the Queensland Herbarium's regional ecosystem mapping / DEHP's regulated vegetation map.

The regulated vegetation management map and supporting map issued by DEHP contains areas of incorrect mapping. Detailed assessment and mapping has been completed by Santos across PL 1021. The full results of this assessment and mapping of regional ecosystems are shown in Table 3 below and within Table 5 of Section 3.1.3 of Attachment 2 – Supporting Information to the EA application.

Table 3: Regional ecosystems of PL1021

RE Code	VM Act Class	Bio Status	Short Description (DEHP 2015)	Extent – remnant (ha)	Extent – regrowth (ha)	Total (ha)	% of PL 1021
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains	60.33	3.49	63.82	0.83
11.3.2 / 11.3.25	OC / LC	OC / OC	*Eucalyptus populnea* woodland on alluvial plains / *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	34.85	Not detected	34.85	0.45
11.3.17	OC	E	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	0.9	Not detected	0.9	0.01
11.3.25	LC	OC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	91.62	Not detected	91.62	1.19
11.7.2	LC	NCAP	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	161.42	22.79	184.21	2.40
11.7.2 / 11.7.6	LC / LC	NCAP / NCAP	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone / *Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	277.54	Not detected	277.54	3.62
11.7.6	LC	NCAP	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	193.99	52.82	246.81	3.22
11.9.5	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	27.33	131.91	159.24	2.08
11.9.7	OC	OC	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	67.34	81.34	148.68	1.94

RE Code	VM Act Class	Bio Status	Short Description (DEHP 2015)	Extent – remnant (ha)	Extent – regrowth (ha)	Total (ha)	% of PL 1021
11.9.10	OC	E	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	46.88	173.7	220.58	2.87
Non-Remnant	None	None	Non-Remnant	6244.75			81.39

Issue 2 – Species present on PL1021

In *Section 3.1.3 – Flora and Fauna* of the supporting information, Santos stated that the Government Wildlife Online database search for PL1021 yielded a total of six species recorded from 1980. None of the species are listed as threatened under the *Nature Conservation Act 1992.*

However, to allow the administering authority to fully understand the species present on the tenure, please provide the six species that have been recorded as being present on PL1021.

Santos Response:

This information has been updated to reflect the work done in the ecological assessment report. The updated supporting information document now states the following.

> A targeted terrestrial ecology assessment was undertaken by Boobook in March and April 2017 (Appendix A of Attachment 2 – Supporting Information to the EA application). The purpose of this assessment was to provide baseline ecological data for the GFD Project generally and to inform future offset obligations. Microhabitat assessments were undertaken in conjunction with vegetation community surveys at each survey plot, or as required where significant variation in the type and abundance of habitat features occurred. The results of these assessments, combined with ecologist knowledge, were used to identify the 16 NC Act and/or EPBC Act protected wildlife species with potential to occur within PL1021 (See below). In addition, habitat suitability mapping was completed for these 16 species.
>
> - South-eastern Long-eared Bat (Nyctophilus corbeni)
> - Greater glider (Petauroides volans)
> - Koala (Phascolarctos cinereus)
> - Glossy Black-Cockatoo (Calyptorhynchus lathami)
> - Painted Honeyeater (Grantiella picta)
> - Australian Painted Snipe (*Rostratula australis*)
> - Common Death Adder (Acanthophis antarcticus)
> - Woma (Aspidites ramsayi)
> - Collared Delma (Delma torquata)
> - Yakka Skink (Egernia rugosa)
> - Dunmall's Snake (Furina dunmalli)
> - Grey Snake (Hemiaspis damelii)
> - Golden-tailed Gecko (Strophurus taenicauda)
> - Pale Imperial Hairstreak (Jalmenus eubulus)
> - Belson's Panic (Homopholis belsonii)

- Hawkweed (Picris barbarorum)

The results of this of this assessment are discussed in more detail below and the full ecological assessment report is provided as Appendix A to the Supporting Information Report.

Section 4.3 – CG Condition - Schedule D, Table 2 – Authorised disturbances

In *Section 4.3 – CG Condition – Schedule D, Table 2 – Authorised disturbances* of the supporting information, Santos stated that there are no new ESA disturbance authorisations proposed as part of the application and that no planned development at the time of the application will disturb ESAs outside of the authorisation provided for in the proposed EA conditions in *Section 4.2 – Flora and Fauna.*

To allow the administering authority to understand the disturbance already undertaken within ESAs on the underlying ATP889, please provide the following information for each disturbance:

- Authorised activity
- The identifier of the infrastructure
- The latitude and longitude (GDA 94) of the location of the disturbance area
- The area of disturbance for the activity (in length (m) and area (ha), where applicable)
- The ESA that has been disturbed

Santos Response:

Historical disturbances on PL1021 are limited to the five petroleum exploration wells drilled by QGC Pty Ltd in 2013. The disturbance associated with each well is approximately 1 ha. The name of the well and the location (latitude and longitude) is shown in Table 4 below and within Table 11 of Section 4.3 of Attachment 2 – Supporting Information to the EA application.

Table 4: Existing well details

Well Name	Latitude	Longitude
Maisey 40	-26.430133	149.221169
Maisey 116	-26.482991	149.225380
Maisey 123	-26.482705	149.232616
Maisey 17M	-26.489864	149.226205
Maisey 137	-26.489211	149.233147

Two new access tracks were constructed to access these five wells. The disturbance areas for each access track is provided in Table 5 below and within Table 12 of Section 4.3 of Attachment 2 – Supporting Information to the EA application.

Table 5: Existing well access track details

Access Track	Approximate Disturbance Area (ha)
Northern Track	1.57
Southern Track	1.58

A review of historic aerial photography indicates these wells and associated access tracks were located in areas historically cleared for grazing. No ESA was disturbed during the construction of these wells.

Section 4.4 – CG Condition D13 – Maximum disturbance to ecological receptors

In *Table 7: Maximum disturbance limits to ecological receptors* of the supporting information, Santos has provided details of the requested disturbances to specified ecological receptors. Santos proposed 25 hectares of disturbance to endangered regulated vegetation and 17 hectares for of concern regulated vegetation. However, Santos has not indicated if this proposed amount of disturbance includes historical disturbance.

Please provide the historical disturbance to ecological receptors that was undertaken on ATP889 and that will be included in the disturbance authorised on PL1021.

Santos Response:

Historical disturbances on PL1021 are limited to the five petroleum exploration wells listed above. A review of historic aerial photography indicates these wells and associated access tracks were located in areas historically cleared for grazing. These areas were likely to be dominated by pasture grasses and no disturbance to any ecological receptor was required.

Section 4.5 – Matters of State Environmental Significance

Issue 1 – Regulated Vegetation

In the Regulated Vegetation part of *Section 4.5 – Matters of State Environmental Significance* of the supporting information, Santos stated that detailed assessment and mapping has identified only 237.63 ha of remnant endangered and of concern REs on PL1021, as opposed to the administering authority's regulated vegetation management map, which identifies 633.98 hectares of endangered / of concern REs and 85.7 km of regulated vegetation intersecting a watercourse.

To allow the administering authority to undertake a full assessment of the impacts to regulated vegetation, please provide the ecological assessment and mapping that was used to determine that only 237.63 hectares of endangered and of concern REs are present on PL1021.

Santos Response:

There has been a substantial reduction in remnant endangered REs present between the mapping of Santos and the State. This is mostly due to the incorrect identification of a large patch of vegetation in the North East of PL1021. The State mapping identifies this patch as endangered RE 11.9.5 when in reality, it is mostly least concern vegetation (RE 11.7.2). The assessment report, including mapping, is attached to Attachment 2 – Supporting Information to the EA application.

Issue 2 – Table 8: Remnant Endangered and Of Concern Vegetation in PL1021 and Table 9: Proposed Stage 1 Impacts to all Remnant Regional Ecosystems

Former Tables 8 and 9 of the supporting information detail the remnant endangered and of concern vegetation present on PL1021 and the proposed Stage 1 impacts to all remnant regional ecosystems, respectively. The issues relating to these tables are as follows:

- REs 11.7.6 and 11.7.2 are included in Table 9 but are not included in Table 8.
- Table 8 states that the VM Act class has been used to identify the REs. However, the biodiversity status under the EP Act has been used.
- Table 9 states that the VM Act class for some of the REs is 'no concern at present'. However, this is not a VM Act status, but is a biodiversity status under the EP Act.
- A number of other REs listed in Table 9 have the incorrect VM Act class.

Please provide:

- Information on REs 11.7.6 and 11.7.2 in Table 8; and
- The correct VM Act class and the correct biodiversity status for each of the REs in both Table 8 and Table 9.

Santos Response:

The remnant and regrowth vegetation in PL1021 table (formerly Table 8) and Proposed Stage 1 Impacts to all remnant regional ecosystems (formerly Table 9) have been updated to include the above REs and also the VM Act class and Biodiversity class have been correctly applied. Table 8 has been replaced by Table 14: Remnant and Regrowth Vegetation in PL1021 and Table 9 has been replaced by Table 15: Proposed Stage 1 Impacts to all Remnant Regional Ecosystems within section 4.5.1 of Attachment 2 – Supporting Information to the EA Application. These tables are presented as Tables 6 and 7 below.

Table 6: Remnant and Regrowth Vegetation in PL1021

RE Code	VM Act Class	Bio Status	Short Description (DEHP 2015)	Extent – remnant (ha)	Extent – regrowth (ha)	Total (ha)
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains	60.33	3.49	63.82
11.3.2 / 11.3.25	OC / LC	OC / OC	*Eucalyptus populnea* woodland on alluvial plains / *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	34.85	Not detected	34.85
11.3.17	OC	E	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	0.9	Not detected	0.9
11.3.25	LC	OC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	91.62	Not detected	91.62
11.7.2	LC	NCAP	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	161.42	22.79	184.21
11.7.2 / 11.7.6	LC / LC	NCAP / NCAP	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone / *Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	277.54	Not detected	277.54
11.7.6	LC	NCAP	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	193.99	52.82	246.81
11.9.5	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	27.33	131.91	159.24
11.9.7	OC	OC	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	67.34	81.34	148.68
11.9.10	OC	E	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	46.88	173.7	220.58

Table 7: Proposed Stage 1 Impacts to all Remnant Regional Ecosystems

RE Code	VM Act Class	Bio Status	Short Description (DEHP 2015)	Impact – remnant (ha)	Impact – regrowth (ha)	Total Impact (ha)
11.3.2	OC	OC	*Eucalyptus populnea* woodland on alluvial plains	0.20	None	0.20
11.3.25	LC	OC	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	0.80	None	0.80
11.7.2	LC	NCAP	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	3.93	0.51	4.43
11.7.2 / 11.7.6	LC / LC	NCAP / NCAP	*Acacia* spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone / *Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	1.41	None	1.41
11.7.6	LC	NCAP	*Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust	8.04	0.52	8.56
11.9.5	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	0.75	1.35	2.10
11.9.7	OC	OC	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	2.55	3.36	5.90
11.9.10	OC	E	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	4.00	13.65	17.66

Issue 3 – Significant residual impact from stage 1 impacts to all remnant REs

As outlined above, *Table 9: Proposed Stage 1 Impacts to all Remnant Regional Ecosystems* detailed the proposed stage 1 impacts to all remnant REs. The administering authority considers that this table shows the significant residual impact to be had on REs.

Santos has listed RE 11.7.2, RE 11.7.2/11.7.6 and RE 11.7.6 in this table. The administering authority notes that these REs are 'least concern' under the VM Act. However, Santos has not indicated that RE 11.7.2, RE 11.7.2/11.7.6 and 11.7.6 are REs within the defined distance from the defining banks of a watercourse. Therefore, unless these REs are within the defined distance from the defining banks of a watercourse, under the Environmental Offset Regulation 2014, they are not deemed to be matters of State environmental significance.

As such, please provide additional clarity around the inclusion of RE 11.7.2, RE 11.7.2/11.7.7 and RE 11.7.6 in Table 9.

Santos Response:

REs 11.7.2, RE 11.7.2/11.7.7 and RE 11.7.6, all belong to Land Zone 7. Throughout the Roma region, Land Zone 7 is generally associated with Ironstone jump-ups with high elevation (see the figure below). Given the topography, watercourses are generally not associated with Land Zone 7.

There is only one occurrence where Proposed Stage 1 impacts occur within a Least Concern RE that is also located within the defined distance from the defining banks of a watercourse. This disturbance is restricted to 0.26 ha of RE 11.7.2 shown in the new version of the supporting information report. Remnant and regrowth areas of RE 11.7.2 are included as habitat for a number of threatened fauna species listed under the EPBC Act. These species are:

- Collared Delma

- Yakka Skink
- Dunmall's Snake
- South-eastern Long-eared Bat

Therefore any significant impact to habitat (including all areas of Remnant RE 11.7.2 - Regulated Vegetation) for the above listed species will be offset in accordance with EPBC Act Approval 2012/6615.

Issue 4 – Connectivity

In the Connectivity part of *Section 4.5 – Matters of State Environmental Significance,* Santos discusses the impact on connectivity areas within PL1021. Santos has not provided the results.

As such, please provide the Landscape Fragmentation and Connectivity Tool results.

Santos Response:

The Landscape Fragmentation and Connectivity Tool Results are attached as Appendix 1 to this response.

Issue 5 – Terrestrial ecology assessment

In the Protected Wildlife Habitat part of *Section 4.5 – Matters of State Environmental Significance*, Santos has stated that a targeted terrestrial ecology assessment was undertaken by Boobook in March and April 2017. The purpose of the assessment was to provide baseline ecological data for the project and to inform future offset obligations. Santos has not provided this assessment.

To allow the administering authority to understand the ecological assessment that was undertaken, please provide the terrestrial ecology assessment.

Santos Response:

The terrestrial ecology assessment is provided as Appendix A to Attachment 2 – Supporting Information to the EA application.

Issue 6 - Protected wildlife habitat

In the Protected Wildlife Habitat part of *Section 4.5 – Matters of State Environmental Significance*, Santos has detailed a number of species that have suitable habitat present on PL1021. However, the administering authority does not consider there is enough information included in the application regarding the appropriate habitat requirements for each of the species.

As such, please provide the following information:

- The classification of the species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *Nature Conservation Act 1992*;
- A full description of the habitat requirements for each species identified in Table 10;
- How each of the REs identified in Table 10 meet the habitat requirements for each of the species; and
- Confirmation of significant residual impact (in hectares) proposed to be made to protected wildlife habitat as it relates to each of the suitable habitats of the species outlined in Table 10.

Santos Response:

An assessment of the likelihood of occurrence of EPBC Act and/or NC Act listed threatened flora and fauna and NC Act listed Special Least Concern fauna potentially occurring in the Site, including a full description of habitat details is found in Table 6 of the Broad-scale Ecological Assessment Report for PL 1021. This report is provided as Appendix A to Attachment 2 – Supporting Information to the EA application.

Issue 7 – Offset delivery for Regulated Vegetation

In the Offset Delivery Mechanism part of *Section 4.5 – Matters of State Environmental Significance*, Santos has proposed an offset delivery mechanism for the significant residual impacts to regulated vegetation on PL1021. Santos has stated that all regulated vegetation impacted by the development of PL1021 is analogous with a threatened ecological community and/or threatened species habitat for species listed under the EPBC Act. Therefore, all significant residual impacts will be offset in accordance with EPBC Act Approval 2012/6615.

Under section 15 of the *Environmental Offset Act 2014,* an offset condition can only be imposed on an EA if the same, or substantially the same, impact and the same, or substantially the same, prescribed environmental matter has not been the subject of an assessment under the EPBC Act.

The administering authority understands this legislative position. However, it does not consider that Santos has provided sufficient detail on how the ecological communities listed in Annex 1 of EPBC Act Approval 2012/6615 and the proposed impacts to these ecological communities can be deemed the same, or substantially the same, prescribed environmental matter and the same, or substantially the same, impact, as the regulated vegetation to be impacted by the proposed activities on PL1021.

As such, please provide further detail to allow the administering authority to determine that the ecological communities listed in Annex 1 of EPBC Act Approval 2012/6615 and the proposed impacts to these ecological communities can be deemed the same, or substantially the same, prescribed environmental matter and the same, or substantially the same, impact, as the regulated vegetation to be impacted by the proposed activities on PL1021.

Santos Response:

The project impacts in PL 1021 assessed for offsets under EPBC Act approval 2012/6615 are the same impacts associated with this EA application.

All regulated vegetation, as defined by Schedule 2 of the *Environmental Offsets Regulation 2014*, impacted by the project, is analogous with habitat for at least one EPBC listed threatened flora and fauna species and / or threatened ecological community included in Annex 1 of the approval (2012/6615). Therefore offset will be undertaken in accordance with EPBC Act. For clarity a list of all proposed Stage 1 impacts to all regional ecosystems and their same or substantially the same EPBC Act listed species and / or community is provided in the table below.

It is important to note this table includes impacts to REs that are not regulated vegetation (least concern vegetation not associated with a wetland or watercourse). It is also important to note that the table below includes NC Act species that are not listed under the EPBC Act, the species in bold are the species listed in Annex 1 of EPBC approval (2012/6615). This has been done to show the species with the same or substantially the same habitat requirements.

RE	RE Description	VM Act Status	Bio Status	Disturbance Estimate	EPBC Act TEC	Associated Species Habitat (Bold species are listed in Annex 1 of EPBC Act approval (2012/6615))
11.3.25	*Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines*	LC*	OC	0.8	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Greater glider (*Petauroides volans*) • **Koala (*Phascolarctos cinereus*)** • Painted Honeyeater (*Grantiella picta*) • **Australian Painted Snipe (*Rostratula australis*)** • **Collared Delma (*Delma torquata*)** • **Dunmall's Snake (*Furina dunmalli*)** • Grey Snake (*Hemiaspis damelii*) • Golden-tailed Gecko (*Strophurus taenicauda*)
11.7.2	*Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone*	LC	NCAP	3.93	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Common Death Adder *(Acanthophis antarcticus)* • Woma (*Aspidites ramsayi*) • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugosa*)** • **Dunmall's Snake (*Furina dunmalli*)** • Golden-tailed Gecko (*Strophurus taenicauda*)
11.7.2 / 11.7.6	*Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone / Corymbia citriodora or Eucalyptus crebra woodland on Cainozoic lateritic duricrust*	LC	NCAP	1.41	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Greater glider (*Petauroides volans*) • **Koala (*Phascolarctos cinereus*)** • Painted Honeyeater (*Grantiella picta*) • Common Death Adder *(Acanthophis antarcticus)* • Woma (*Aspidites ramsayi*) • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugosa*)** • **Dunmall's Snake (*Furina dunmalli*)** • Golden-tailed Gecko (*Strophurus taenicauda*)
11.7.6	*Corymbia citriodora or Eucalyptus crebra woodland on Cainozoic lateritic duricrust*	LC	NCAP	8.04	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Greater glider (*Petauroides volans*) • **Koala (*Phascolarctos cinereus*)** • Painted Honeyeater (*Grantiella picta*) • Common Death Adder *(Acanthophis antarcticus)* • Woma (*Aspidites ramsayi*) • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugose*)** • **Dunmall's Snake (*Furina dunmalli*)** • Golden-tailed Gecko (*Strophurus taenicauda*)

RE	RE Description	VM Act Status	Bio Status	Disturbance Estimate	EPBC Act TEC	Associated Species Habitat (Bold species are listed in Annex 1 of EPBC Act approval (2012/6615))
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	OC**	OC	0.2	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Greater glider (*Petauroides volans*) • **Koala (*Phascolarctos cinereus*)** • Painted Honeyeater (*Grantiella picta*) • **Australian Painted Snipe (*Rostratula australis*)** • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugosa*)** • **Dunmall's Snake (*Furina dunmalli*)** • Grey Snake (*Hemiaspis damelii*) • Golden-tailed Gecko (*Strophurus taenicauda*)
11.9.7	*Eucalyptus populnea, Eremophila mitchellii shrubby woodland on fine-grained sedimentary rocks*	OC**	OC	2.55	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Greater glider (*Petauroides volans*) • **Koala (*Phascolarctos cinereus*)** • Painted Honeyeater (*Grantiella picta*) • Common Death Adder *(Acanthophis antarcticus)* • Woma (*Aspidites ramsayi*) • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugosa*)** • **Dunmall's Snake (*Furina dunmalli*)** • Golden-tailed Gecko (*Strophurus taenicauda*) • **Belson's Panic (*Homopholis belsonii*)** • Hawkweed (*Picris barbarorum*)
11.9.10	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks	OC**	E	4.0	No	• **South-eastern Long-eared Bat (*Nyctophilus corbeni*)** • Greater glider (*Petauroides volans*) • **Koala (*Phascolarctos cinereus*)** • Glossy Black-Cockatoo (*Calyptorhynchus lathami*) • Painted Honeyeater (*Grantiella picta*) • Common Death Adder *(Acanthophis antarcticus)* • Woma (*Aspidites ramsayi*) • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugosa*)** • **Dunmall's Snake (*Furina dunmalli*)** • Golden-tailed Gecko (*Strophurus taenicauda*) • Pale Imperial Hairstreak (*Jalmenus eubulus*) • **Belson's Panic (*Homopholis belsonii*)** • Hawkweed (*Picris barbarorum*)

RE	RE Description	VM Act Status	Bio Status	Disturbance Estimate	EPBC Act TEC	Associated Species Habitat (Bold species are listed in Annex 1 of EPBC Act approval (2012/6615))
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	E**	E	0.75	Yes - Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC	• **South-eastern Long-eared Bat (*Nyctophilus corbeni)*** • Glossy Black-Cockatoo (*Calyptorhynchus lathami*) • Painted Honeyeater (*Grantiella picta*) • Common Death Adder *(Acanthophis antarcticus)* • Woma (*Aspidites ramsayi*) • **Collared Delma (*Delma torquata*)** • **Yakka Skink (*Egernia rugosa*)** • **Dunmall's Snake (*Furina dunmalli*)** • Grey Snake (*Hemiaspis damelii*) • Golden-tailed Gecko (*Strophurus taenicauda*) • Pale Imperial Hairstreak (*Jalmenus eubulus*) • **Belson's Panic (*Homopholis belsonii*)**

Issue 8 – Offset delivery for Protected Wildlife Habitat

In the Offset Delivery Mechanism part of *Section 4.5 – Matters of State Environmental Significance*, Santos has proposed an offset delivery mechanism for the significant residual impacts to protected wildlife habitat on PL1021. Santos has stated that all significant impacts to EPBC Act threatened species habitats will be offset in accordance with EPBC Act Approval 2012/6615.

As outlined above in Issue 7, offset conditions can only be imposed on an EA under certain circumstances, However, Santos has stated that the impact to the protected wildlife habitat of each of the species listed in *Table 10: Threatened Species Habitat Mapping Rules* will be offset in accordance with the EPBC Act Approval 2012/6615. However, the following species are not included in Annex 1 of the approval:

- *Petauroides Volans (*Greater Glider)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Grantiella picta* (Painted Honeyeater)
- *Acanthophis antarcticus* (Common Death Adder)
- *Aspidites ramsayi* (Woma)
- *Hemiaspis damelii* (Grey Snake)
- *Strophurus taenicauda* (Golden-tailed Gecko)
- *Picris barbarorum* (Hawkweed)

This means that, for the species above, their habitat is not covered by the EPBC Act Approval.

As such, please provide further information on how the EPBC Act Approval 2012/6615 provides for the offset delivery for the habitat of the above species.

Santos Response:

As demonstrated in the table above, habitat for all the NC Act species above coexists with at least one EPBC Act listed species and / or community. The habitat requirements for these species are the same or substantially the same as habitat requirements for other similar EPBC Act listed species.

Section 4.6 – Air

In *Section 4.6 – Air* of the supporting information, Santos has stated that the proposed compressor station will be electrically powered rather than fuel/gas powered and that it would not impact air environmental values. However, the administering authority does not consider that Santos has provided adequate information on how this conclusion was reached. Additional information that may be provided could include details on the operation of the compressor station, any possible pollutants that may be released and any sensitive receptors present onsite.

As such, please provide additional information in relation to the compressor station and any sensitive receptors onsite.

Santos Response:

The design of the compression infrastructure has not yet been undertaken. However, it is anticipated the compression infrastructure will be electrified / grid-connected, with the design of the facility incorporating low noise emission equipment and no air emissions (including exhaust emissions, given the grid connection (electricity driven)). The compressor station is likely to be comprised of all equipment similar to other electric / grid connected compressor facilities used by Santos including: a compressor package (Howden screw compressor), compressor motor (electric driven and coolers – electric driven), flaring equipment, metering equipment, system monitoring and safety control facilities.

The Howden screw compressor is the dominant unit in the QLD CSG acreage and current unit used by Santos for intermediate compression at Roma Hub (R-HCS), Fairview (FV-HCS 04 & 05) and proposed for Roma Backbone (R-NCS-01).

The operation of this facility does not constitute fuel burning.

The compressor facility will incorporate a flare system. The flare system allows gas in the gathering system and the compressor station to be combusted (flared) in the event of an emergency that requires evacuation of the gas from the system or during plant shutdown for equipment maintenance. The frequency of maintenance flaring is generally once per year. During normal operation, a small pilot flare is continuously lit for immediate use in emergencies as well as routine depressurisation of process units for maintenance. Emissions to air from the pilot flare are negligible.

The environmental values for Air; air quality objectives, potential impacts and mitigation measures are provided in sections 3.1.1 and 4.6 of Attachment 2 – Supporting Information to the EA application, along with the information provided in this response to Section 4.6 – Air.

Section 4.8 – CG Condition – Schedule H – Regulated Structures

In *Section 4.12 – Land resources and rehabilitation* and *Section 4.14 – Surface Water* of the supporting information, Santos has stated that the proposed impact to environmental values from regulated structures is unintentional leakage from the walls or floor of the regulated structure. The administering authority considers that Santos should also discuss the possibility of overtopping or dam wall breaks.

Santos has stated that the management measures outlined in *Section 4.8 CG Condition – Schedule H – Regulated Structures* will be undertaken in accordance with the *Guideline – Structures which are dams or levees constructed as part of environmentally relevant activities.* This section outlines the outcome focussed conditions that Santos is seeking to regulate the activity. However, the administering authority considers that more specific management measures are required to be outlined to ensure that the proposed conditions are met.

Further, Santos discussed the management measures to be implemented to monitor the impact of the proposed activities on groundwater. However, Santos has not discussed seepage monitoring requirements to monitor impacts from containment facilities (such as regulated structures).

As such, please provide additional information on the impacts and management and monitoring measures for regulated structures.

Santos Response:

Table 8 below provides a summary of the potential impacts and mitigation measures to be implemented on PL1021 with regards to the regulated structures. Attachment 2 – Supporting Information to the EA application has been revised to include Table 8 as Table 19: Potential Impacts and Mitigation Measures – regulated structures within Section 4.8 CG Condition – Schedule H – Regulated structures.

Table 8: Potential Impacts and Mitigation Measures – regulated structures

Potential Impact	Mitigation Measure
• Unintentional leakage from the walls or floor of the regulated structure	• Dam construction will be undertaken in accordance with the requirements of the DEHP *Manual for assessing hazard categories and hydraulic performance of dams* (EHP 2012). Design and construction activities can involve the following: o Placement and testing of clay and/or liner materials to achieve the required hydraulic performance o Leak detection sump and pipe work o Transfer pump and associated pipework o Escape areas for animals on dam slopes o Emergency spillways lined with geotextile

Potential Impact	Mitigation Measure
	o Erosion control blanket over topsoil on batters • Compliance with Section 4.8 CG Condition – Schedule H – Regulated Structures will be undertaken in accordance with the Guideline – Structures which are dams or levees constructed as part of environmentally relevant activities. • Implementation of a Seepage Monitoring Program to detect seepage to groundwater as a result of storing contaminants in a regulated structure(s) such as a dam • The Seepage Monitoring Program will be consistent with relevant Guidelines and Standards such that the Program design has: o a sufficient number seepage monitoring points and / or wells to obtain representative groundwater samples from the uppermost aquifer upgradient and down-gradient of the potential influence; o if a salt monocell is constructed then a sufficient number of seepage monitoring bores are to be installed and located not more than 150 m from the monocell or the boundary of the monocell facility, whichever is the closer; o sufficient regularity and spatial and temporal replication to make statistically valid conclusions about the presence or absence of contaminants; o procedures to determine the quality of groundwater down gradient of potential sources of contaminants including groundwater passing the relevant seepage monitoring bore(s); o procedures to allow an assessment of whether there has been any statistically significant adverse change in groundwater quality at locations hydraulically down gradient of the containment activities. • A Seepage trigger action response procedure will be developed and implemented, which include but not be limited to the following: o trigger levels for the relevant trigger parameter(s); • trigger and action response measures at which investigations will be undertaken; o action levels for the relevant possible contaminants of concern at which additional investigation into the potential for environmental harm, including the validation and verification of the source, cause and extent of impact.
• Overtopping or dam wall breaks and subsequent overland flow	• All regulated structures will be designed and constructed using the principles and guidelines provided in the Manual for Assessing consequence Categories and Hydraulic Performance of Structures, as amended from time to time. • Santos will mark the mandatory reporting level on each regulated dams in such a way that it is clearly observable during routine inspections of each dam. If Santos becomes aware that the mandatory reporting level has been reached, action will be taken to prevent, or if unable to prevent, to minimise any actual or potential environmental harm. • Further, on 1 November of each year, Santos GLNG will ensure that there is available storage in each regulated structure to meet the design storage allowance. If Santos GLNG becomes

Potential Impact	Mitigation Measure
	aware that the design storage allowance cannot be achieved on 1 November of each year, action will be taken to prevent, or if unable to prevent, to minimise any actual or potential environmental harm. • Ponds are designed not to received overland flow so as to only contain CS water • Annual inspections will be conducted by qualified REPQ to verify statutory reporting and management responses for mandatory reporting levels and maximum allowable storage levels will be identified. • Should an MRL be reached, the administering authority will be notified and actions taken to lower the water level in the dam. • Spillways designed to manage risks to downgradient receptors. • Santos will maintain information relating to surrounding land use and watercourses; environmentally sensitive areas, watercourses and groundwater aquifers; and the specifications of the dam in accordance with the fundamental consequence evaluation data as prescribed by Appendix B of the Manual for assessing consequence categories and hydraulic performance of structures.

Section 4.10 – Waste

In *Section 1 – Introduction* of the supporting material, Santos stated that it is seeking consistent conditions for its development on PL1021 through the inclusion of the stated conditions contained in Appendix 1 of the Coordinator-General's evaluation report (CG's report) on the Gas Field Development Environmental Impact Statement.

The disposal of residual drilling material on-site is included in these stated conditions. However, Santos has not provided any details regarding this activity.

As such, please provide information on the possible impacts from the disposal of residual drilling materials on-site and the associated management measures. Please note, if Santos does not propose to use the mix-bury-cover method and the residual drilling material does not meet the approved quality criteria (as defined in the stated conditions), Santos will need to provide additional information on the proposed method to ensure that environmental harm does not result from the alternative disposal method.

Santos Response:

Table 9 provides a summary of the potential impacts and mitigation measures to be implemented on PL1021 with regards to the disposal of residual drilling material via mix-bury-cover. The impacts and mitigation measures presented are those which were described in the EA amendment applications for the Santos Upstream project areas, including Roma and Roma East which border PL1021. The impacts and mitigation measures are those which are described in the Department's Petroleum Production Risk Assessment and which were accepted by the department in the EA amendment applications for Roma and Roma East to obtain the streamlined model conditions (Waste 15, 16 and 17) for mix-bury-cover. Streamlined model conditions Waste 15, 16 and 17 are the same as the CG conditions E5, 6 and 7 which is sought in the PL1021 EA application.

Attachment 2 – Supporting Information to the EA application has been revised to include Table 9 as Table 20: Potential Impacts and Mitigation Measures – mix-bury-cover within Section 4.10 Waste.

Table 9: Potential Impacts and Mitigation Measures – mix-bury-cover

Potential Impact	Mitigation Measure
Item 83 of Risk assessment for petroleum lease: • Contamination of land or waters • Environmental nuisance	• No general waste disposal at well sites; • Mix bury cover operations will comply with the quality criteria for residual drilling solids, waste and burial methods (CG condition E6); • Sumps and pits to be temporary and small for safe containment of drilling fluids;
Item 85 of Risk assessment for petroleum lease: • Land contamination • Soil degradation (loss of soil quality and soil structure • Loss of productive soils • Loss of future land use	• Contain the wetting front and/or use a liner; • Store chemicals and fuels in accordance with Australian Standards where relevant;
Items 93 and 95 of Risk assessment for petroleum lease: • As per item 85; and vegetation die back	• Cement returns may be stored in cement bins, allowed to harden and then crushed up for mix bury cover, disposal to landfill, or sent to landfill; • Drilling fluids may be permitted to evaporate, or treated and reused for drilling, or if tested and meets general waste conditions disposed of at a suitable facility (CG condition E6).

Section 4.13 - Noise

Issue 1 – Compressor station

In *Section 4.13 – Noise* of the supporting information, Santos has stated that the proposed compressor stated is electrically powered rather than fuel/gas powered and that this results in lower noise emissions. Santos has stated that it will use site selection relative to sensitive receptors and/or noise mitigation measures (such as acoustic enclosures). However, the administering authority does not consider that Santos has provided adequate information on the management measures to mitigate noise impacts. Additional information that may be provided could include details on the operation of the compressor station, the potential noise that may be emitted and any sensitive receptors present onsite.

As such, please provide additional information in relation to the compressor station and any sensitive receptors onsite.

Santos Response:

As outlined in the response to 4.6 – Air, the design of the compression infrastructure has not yet been undertaken. The compression infrastructure is likely to be electrified / grid-connected with the design of the facility incorporating low noise emission equipment and no air emissions (including exhaust emissions, given the grid connection (electricity driven)). The compressor station will be comprised of all equipment similar to other electric / grid connected compressor facilities used by Santos: a compressor package (Howden screw compressor), compressor motor (electric driven and coolers – electric driven), flaring equipment, metering equipment, system monitoring and safety control facilities.

The Howden screw compressor is the dominant unit in the QLD CSG acreage and current unit used by Santos for intermediate compression at Roma Hub (R-HCS), Fairview (FV-HCS 04 & 05) and proposed at Roma Backbone (R-NCS-01).

The location of the proposed compressor station is not currently known. As such, a detailed assessment of the potential impacts to sensitive receptors cannot be undertaken at this time. Once a decision is made to proceed with a compression facility, an appropriate assessment will be undertaken in relation to possible noise impacts to identified sensitive receptors. The plant will be designed to meet the prescribed noise criteria in the approved environmental authority for PL1021. This may require the installation the appropriate noise mitigation measures as described above.

Furthermore, if the compression infrastructure is to be electrified/grid connected as proposed, it is considered the operation of the facility will comply with the noise conditions proposed in the CG stated conditions and that sought by the EA application. The CG stated conditions reflect those in the Roma and Roma East Project Area EA's and the departments Guideline – *Prescribing noise conditions for petroleum activities*. As such, it is unlikely that the operation of the facility will impact sensitive receptors.

The environmental values for Noise; acoustic quality objectives, potential impacts and mitigation measures are provided in sections 3.1.2 and 4.14 of Attachment 2 – Supporting Information to the EA application respectively.

Issue 2 – Proposed noise conditions

In *Section 4.13 – Noise* of the supporting information, Santos discussed the quality objectives prescribed by the Environmental Protection (Noise) Policy 2008. However, these are different to the conditions proposed in the stated conditions of the CG's report.

As such, please discuss the impacts and management measures for the activities in the context of the proposed conditions, as well as the *Environmental Protection (Noise) Policy 2008*.

Santos Response:

As has been discussed with the department on several occasions in the past, Santos considers the quality objectives prescribed by the *Environmental Protection (Noise) Policy 2008*, are those which Santos considers should be applied to the EA's under which it operates.

However, it is acknowledged the conditions prescribed by the CG are those currently in place for the Roma Shallow Gas and Roma Shallow Gas Project Area East EA's and by the departments Guideline – *Prescribing noise conditions for petroleum activities*. Santos will ensure any noise impacts meet the limits prescribed on the EA.

The potential impacts and mitigation measures from the conduct of the petroleum activities on PL1021 will not differ from that prescribed by Attachment 2 – Supporting Information to the EA application which states:

'Prior to construction, potentially significant noise generating activities are modelled to achieve compliance with acoustic quality objectives. Where these acoustic quality objectives are predicted to not be met, the activity is either relocated or modified (e.g. re-orientated), or the predicted noise impact is mitigated (e.g. with implementation of an acoustic enclosure or sound wall). Alternatively, an alternative arrangement is entered into with the owner of the potentially affected sensitive receptor.'

In addition, as outlined in the response to Section 4.13 – Noise, Issue 1 of the departments Notice-Information Request, the compression infrastructure is likely to be electrified / grid-connected with the design of the facility incorporating low noise emission equipment and no air emissions.

Section 4.14 – Surface Water

In *Section 1 – Introduction* of the supporting material, Santos stated that it is seeking consistent conditions for its development on PL1021 through the inclusion of the stated conditions contained in Appendix 1 of the CG's report

Construction of linear infrastructure within watercourses and wetlands is included in these stated conditions. However, Santos has not provided any details regarding this activity.

As such, please provide information on the possible impacts from the construction of linear infrastructure in watercourses and wetlands and the associated management measures. This should include monitoring of the impacts.

Santos Response:

The construction of linear infrastructure within a watercourse or wetland within PL1021 will be conducted in the same manner as the construction of linear infrastructure within a watercourse and wetland undertaken within all of the Santos Coal Seam Gas Fields as described in the Table 10 below. Table 10 has been included within section 4.15 Surface Water of Attachment 2 – Supporting Information to the EA application as Table 24:

Table 10: Summary of Potential Impacts and Mitigation Measures – construction of linear infrastructure within a watercourse and wetland

Potential Impact	Mitigation Measure
Increased sedimentation (adverse impacts on water quality and geomorphology) Erosion of stream banks Altered surface water flow regime (risk to overland flow paths, infrastructure, riparian vegetation, terrestrial ecosystems, baseflow from aquifers and environmental flow regime) Altered geomorphic character (e.g. increased lateral instability; significant alteration of geomorphic units)	• Works will be preferentially carried out in periods of low or no flow; • Watercourse crossings will be selected at locations where the least impact to flora and fauna will occur (i.e. clearing of vegetation and at narrowest and shallowest locations); • Implementation an erosion and sediment control management plan to minimise sediment release to waters; • Water quality monitoring (turbidity and hydrocarbons) will be undertaken at upstream (background) and downstream (20m from watercourse crossing works) locations to determine downstream turbidity levels are no more than 10% above upstream turbidity levels; • the use and placement of silt curtains for works carried out in watercourses where required; • maintaining spill kits (including marine spill kits) on site in the event of hydrocarbon spills; • Following the completion of all works conducted in a watercourse, the bed and banks of the watercourse will be returned to their original profile, stabilised and revegetated at the required densities where vegetation has been removed • Diverting the flow through a pipe to prevent siltation problems that may be created during trenching, lowering in and backfilling (flume method). The flume is designed to accommodate flow and allow fish passage. The flume pipe is installed before the minor dam is erected and remains in place for the full duration of construction. This technique is not suitable for watercourses with broad channels, low gradients or permeable substrates; • Pumping of water around the work area. This is appropriate for low gradient streams, with discharges less than 1,000 litres per second during construction. Barrier dykes or head

Potential Impact	Mitigation Measure
	walls are constructed above and below the trenched area and the work area pumped dry; and • Controlling water running into the creek from the surrounding catchment by contour banks to protect the creek banks from erosion. • Ensuring adequate fish movement as required by the Fisheries Act 1994.

Section 5.1.2 - Requirements for Site Specific Applications – CSG Activities

Issue 1 – Water Quality

In part (c) of *Table 8: CSG Water Management* of the supporting information, Santos has provided the mean and median average quality from the water extracted from the Walloon Coal Measures. However, Santos has only provided a mean and median range for pH, conductivity, iron and manganese. The administering authority notes that these are the parameters that appear in the Gas Fields Development Project Environmental Impact Statement. The administering authority considers that additional parameters should be provided, which include:

- Alkalinity (bicarbonate)
- Boron
- Calcium
- Chloride
- Copper
- Fluoride
- Hardness
- Lead
- Magnesium
- Nitrate (as N)
- Nitrite (as N)
- Potassium
- Sodium
- Sulphate
- Total dissolved solids
- Zinc

As such, please provide information on the above parameters as well as the median range for each parameter to show the possible fluctuations in water quality that could be reasonably expected in the water extracted from the Walloons Coal Measures.

Santos Response:

Table 11 depicts the water chemistry of Roma East. Roma East borders PL1021 to the east and is considered to be comparable produced water quality for PL1021. Appendix E has been included within Attachment 2 – Supporting Information to the EA application presenting the data within Table 11 below.

Santos

Table 11: Produced water chemistry for Roma Shallow Gas Project Area East

Component	Unit	PFW Roma East		Roma West permeate (AWBP1)	
		Weighted Median (Note 1)	Standard Deviation (Note 2)	Median	Standard Deviation (Note 3)
Aluminium					
- Total	mg/L	1.54	13.14	0.45	0.00
- Dissolved	mg/L	0.01	0.20	0.02	0.00
Ammonia as N	mg/L	1.49	0.53	0.09	0.00
Arsenic					
- Total	mg/L	0.001	0.01	0.001	0.00
- Dissolved	mg/L	0.001	0.00	0.001	0.00
Barium					
- Total	mg/L	1.60	0.67	0.2925	0.03
- Dissolved	mg/L	1.42	0.48	0.234	0.03
Beryllium					
- Total	mg/L	0.001	0.00	0.001	0.00
- Dissolved	mg/L	0.001	0.00	0.001	0.00
Bicarbonate Alkalinity as $CaCO_3$	mg/L	818	160.12	760	92.17
Boron					
- Total	mg/L	0.67	0.13	0.51	0.06
- Dissolved	mg/L	0.66	0.11	0.46	0.05
Cadmium					
- Total	mg/L	0.0001	0.00	0.0001	0.00
- Dissolved	mg/L	0.0001	0.00	0.0001	0.00
Calcium - Dissolved	mg/L	11	8.19	5	1.78
Carbonate Alkalinity as $CaCO_3$	mg/L	1	11.79	118	49.60
Chloride	mg/L	2338	755.16	790	45.91
Chromium					
- Total	mg/L	0.008	0.06	0.013	0.01
- Dissolved	mg/L	0.001	0.00	0.001	0.00
Cobalt					
- Total	mg/L	0.001	0.01	0.001	0.00
- Dissolved	mg/L	0.001	0.00	0.001	0.00
Copper					
- Total	mg/L	0.007	0.06	0.003	0.00
- Dissolved	mg/L	0.001	0.00	0.001	0.00
Dissolved Organic Carbon	mg/L	7	15.97	4	0.00
Electrical Conductivity @ 25°C	µS/cm	8012	1967.84	3935	119.31
Fluoride	mg/L	1.6	0.64	2.9	0.47
Iron					

Component	Unit	PFW Roma East		Roma West permeate (AWBP1)	
		Weighted Median (Note 1)	Standard Deviation (Note 2)	Median	Standard Deviation (Note 3)
- Total	mg/L	7.00	34.85	1.41	0.00
- Dissolved	mg/L	0.09	1.02	0.05	0.00
Lead					
- Total	mg/L	0.004	0.03	0.001	0.00
- Dissolved	mg/L	0.001	0.00	0.001	0.00
Magnesium - Dissolved	mg/L	3	1.54	1	0.00
Manganese					
- Total	mg/L	0.096	0.44	0.049	0.02
- Dissolved	mg/L	0.037	0.04	0.011	0.00
Mercury					
- Total	mg/L	0.0001	0.00	0.0001	0.00
- Dissolved	mg/L	0.0001	0.00	0.0001	0.00
Molybdenum					
- Total	mg/L	0.002	0.01	0.006	0.00
- Dissolved	mg/L	0.001	0.00	0.004	0.00
Nickel					
- Total	mg/L	0.002	0.02	0.003	0.00
- Dissolved	mg/L	0.001	0.00	0.001	0.00
pH - Lab	-	8.12	0.17	8.74	0.18
Potassium - Dissolved	mg/L	23	132.22	38	16.01
Selenium					
- Total	mg/L	0.01	0.00	0.01	0.00
- Dissolved	mg/L	0.01	0.00	0.01	0.00
Silicon as SiO_2	mg/L	23.6	3.73	18.2	0.00
Sodium - Dissolved	mg/L	1797	389.65	860	70.11
Strontium					
- Total	mg/L	3.322	1.81	0.919	0.00
- Dissolved	mg/L	3.042	1.56	0.785	0.00
Sulphate as SO_4 (2-) - Dissolved	mg/L	1	4.50	19	7.15
Total Alkalinity as $CaCO_3$	mg/L	826	159.18	881	100.72
Total Dissolved Solids @180°C	mg/L	4573	1107.19	2090	0.00
Total Organic Carbon	mg/L	9	19.58	4	0.00
Vanadium					
- Total	mg/L	0.01	0.03	0.01	0.00
- Dissolved	mg/L	0.01	0.00	0.01	0.00
Zinc					
- Total	mg/L	0.018	0.14	0.007	0.01

Component	Unit	PFW Roma East		Roma West permeate (AWBP1)	
		Weighted Median (Note 1)	Standard Deviation (Note 2)	Median	Standard Deviation (Note 3)
- Dissolved	mg/L	0.005	0.01	0.005	0.00

Issue 2 – Proposed management of CGS water

In part (d) of *Table 8: CSG Water Management* of the supporting information, Santos has stated that the proposed management of water includes storage in above-ground tanks, treatment to facilitate irrigation and beneficial uses such as dust suppression, construction, operational use and irrigation. Santos is not proposing disposal of CSG water as all water will be beneficially used. The administering authority does not consider that adequate information has been provided on the management measures to be utilised.

As such, please provide additional information on the management measures to be undertaken in the storage, treatment and beneficial uses of CSG water.

Santos Response:

The Santos GLNG Gas Field Development Project Coal Seam Water Management Strategy (CSWMS) is attached as Appendix C. The CSWMS outlines how Santos proposes to manage CS water within the Gas Field Development Project. This approach will similarly apply to water management on PL1021.

Section 5 of the CSWMS describes the water management options. As outlined in the EA application, disposal of CS water to surface waters is not proposed by this application. As such, all sections which relate to disposal are not applicable to this application.

Table 12 below outlines the management measures to be implemented for the storage, treatment and beneficial use of CS water. Section 4.15 of Attachment 2 – Supporting Information to the EA application has been updated to include Table 12 as Table 22.

Table 12: Management measures for the storage, treatment and beneficial use of CS water

CS Water Management Option	Management Measure
Above-ground tanks	• CS water may be stored temporarily in tanks prior to reuse on site, treatment or transfer off-tenure. • Tanks will be located away from watercourses and sensitive areas to minimise risk of water reaching watercourses in the event of a release. • Tanks will be designed in accordance with approved standards, including leak detection, and water level sensors. • Tanks will be regularly inspected to ensure integrity and sufficient capacity. • In the unlikely event of a release, the following measures may be implemented: o Determination of cause and release location and rectify the failure; o Conducting monitoring (soil and/or water) where required to determine impacts to the receiving environment; o Undertake remediation measures (soil and/or water) where required;

CS Water Management Option	Management Measure
	o Notification to the administering authority in accordance with the requirements of CG stated conditions in Schedule K – Notification where required.
Treatment to facilitate irrigation	Water may be treated to achieve a water quality that is fit for purpose for an identified beneficial reuse. Refer to the response provided in Table 2 for further management measures.
Beneficial use such as: • dust suppression • construction and operational uses	CS water may be used for dust suppression, in construction and for operational purposes (ie drilling, compaction etc) To manage this risk, Santos will not undertake dust suppression activities within or adjacent to watercourses or wetlands. . Water volumes will be commensurate to the activity requirements and the surface (eg engineered) and will be applied to avoid: • Pooling and ponding • Run-off from the target areas; • deep-drainage; • Drift to surrounding areas (ie avoid vegetation damage). Early warning, trigger thresholds and limits for detecting impact on surface water (and shallow groundwater) due to the suppression of dust on roads will be determined and implemented.
Irrigation	• Criteria for irrigation water quality will be determined through the application of the General Beneficial Use Approval – Irrigation of Associated Water (including coal seam gas water) (EHP, 2014), or the proposed CG conditions contained in Schedule C. These criteria are adopted or derived in accordance with ANZECC (2000). • Where a generic standard for a particular water quality parameter cannot be met, a Variation Report will be completed which is: o certified by an independent and suitably qualified person o states the extent to which the water quality does not meet the generic required standard o states the varied water quality parameters (for the parameters that do not meet the required standards) that ensures: - soil structure, stability and productive capacity can be maintained or improved; - toxic effects to crops do not result; and - yields and produce quality are maintained or improved - No adverse environmental impact outside of the irrigation area o includes a water monitoring plan that ensures these outcomes are achieved over the life of the project. • Predictive hydraulic modelling for irrigation will be undertaken to determine appropriate water volumes and application rates of water are applied to minimise the potential for environmental harm. • An assessment of risk of deep drainage will be undertaken to identify and manage the risk of subsurface migration of irrigation water to sensitive receptors.

CS Water Management Option	Management Measure
	• A monitoring program will be developed to demonstrate environmental outcomes and to inform adaptive management, if required, including developing early warning and trigger thresholds. • Irrigation will be undertaken in accordance with ANZECC 2000 (irrigation) guidelines including: o specifically designed equipment and application methodologies; o avoidance of water ponding or pooling upon application; o water quality and quantity monitoring in accordance with General BUA or variation report or EA conditions; o rainfall monitoring; o soil monitoring.

Issue 3 – Action proposed to be taken if the management criteria are not complied with

In part (f) of *Table 8: CSG Water Management* of the supporting information, Santos has stated that Table 17-5 in Appendix Y of the Gas Fields Development Project Environmental Impact Statement provides the monitoring and management task for the proposed beneficial uses of CSG water. However, the administering authority does not consider this adequately outlines the actions proposed to be taken if any management criteria is not complied with in relation to PL1021.

Please provided additional information on the actions to be taken if the management criteria are not complied with in relation to PL1021.

Santos Response:

Table 13: CSG Water Management (formerly Table 8: CSG Water Management) has been expanded below to include a new column outlining actions in the event management criteria are not met. Section 4.15 of Attachment 2 – Supporting Information to the EA application has been updated to include Table 13 as Table 23.

In addition, Santos will comply with the notification requirements of Schedule K – Notification, of the Coordinator Generals stated conditions for PL1021.

Santos

Table 13: CSG Water Management

Preferred use option	Location	Environmental values	Monitoring or management tasks	Performance indicators	Actions
Operational use, OR Provision to/use by third parties, OR Irrigation to land	On-tenure	• Maintain groundwater quality for protection of groundwater dependent ecosystems • Use of groundwater for drinking supply; stock watering; irrigation (downstream users) • Maintain surface water quality and hydrological regime for protection of aquatic ecosystem (i.e. consider issues such as hydraulically overloading a natural system; degrading soil structures, or allowing exceed water to run-off into surrounding catchments) • Use of surface water for drinking supply; stock watering; irrigation (downstream users) • Protect the environment and maximise the productive use of coal seam water as a valuable resource	• Seepage monitoring program: — Seepage monitoring bore locations: o Baseline/hydraulically up-gradient o Within aquifers potentially affected by a regulated structure — Geodetic survey of all seepage monitoring bores, showing groundwater potentiometric surface • Contaminants are not directly or indirectly released to any waters except as permitted under the relevant EA. • Compliance with conditions of general BUA (as for off-site use below)	• Detection of seepage to groundwater as a result of storing coal seam water in a regulated structure. • Procedures allow an assessment of whether there has been a statistically significant adverse change in groundwater quality at locations hydraulically down-gradient of the containment activity (e.g. regulated structure). • Identification of the trigger contaminant of concern in the event of seepage; initiate Seepage Trigger Action Response Procedure (parameters for analyse will be scheduled in the EA) • Performance indicators associated with general BUA, as outlined for off-tenure use below	• Reduce volume of fluid in containment system to safe levels • Confirm fluid in leak detection system is from containment structure via sampling and lab analysis. • Recirculate fluid where possible from leak detection systems to minimise pressure and rate of infiltration beneath the containment structure • Investigate the seep passage / cause • Undertake liner repair / remedial actions to reinstate or liner integrity. OR • Implement adaptive management and remedial actions in irrigation areas • Investigate and identify most likely causal factor/s • Assess need to implement contingency irrigation areas to reduce irrigation volumes at affected location • Increase extent and/or frequency of monitoring if required to assess management effectiveness OR • Cease application of water or continue application at a reduced rate

Preferred use option	Location	Environmental values	Monitoring or management tasks	Performance indicators	Actions
					• Assess need for and execute remediation, if required
	Off-tenure		• Compliance with conditions set out in general BUA : — General conditions — Standard water quality conditions (including fortnightly sampling for SAR, pH and EC; and initial monthly monitoring for other parameters. Six-monthly monitoring after three consecutive detects which are less than 50% of the prescribed water quality objectives) — Variation to standard water quality conditions (site-specific objectives derived in accordance with BUA) — General monitoring and operating conditions • Compliance with conditions set out in specific BUA	• Site-specific water quality objectives derived in accordance with the BUA are met at point of supply • All plant and equipment necessary for compliance with the BUA are installed, maintained and operated in proper and effective condition	• Cease application or provision of water until water is of appropriate quality. • Investigate and implement remedial actions if required. • Implement adaptive management. Cease operation of affected plant or equipment until effective operation is achieved.

Santos

Appendix 1 - Landscape Fragmentation and Connectivity Tool Results