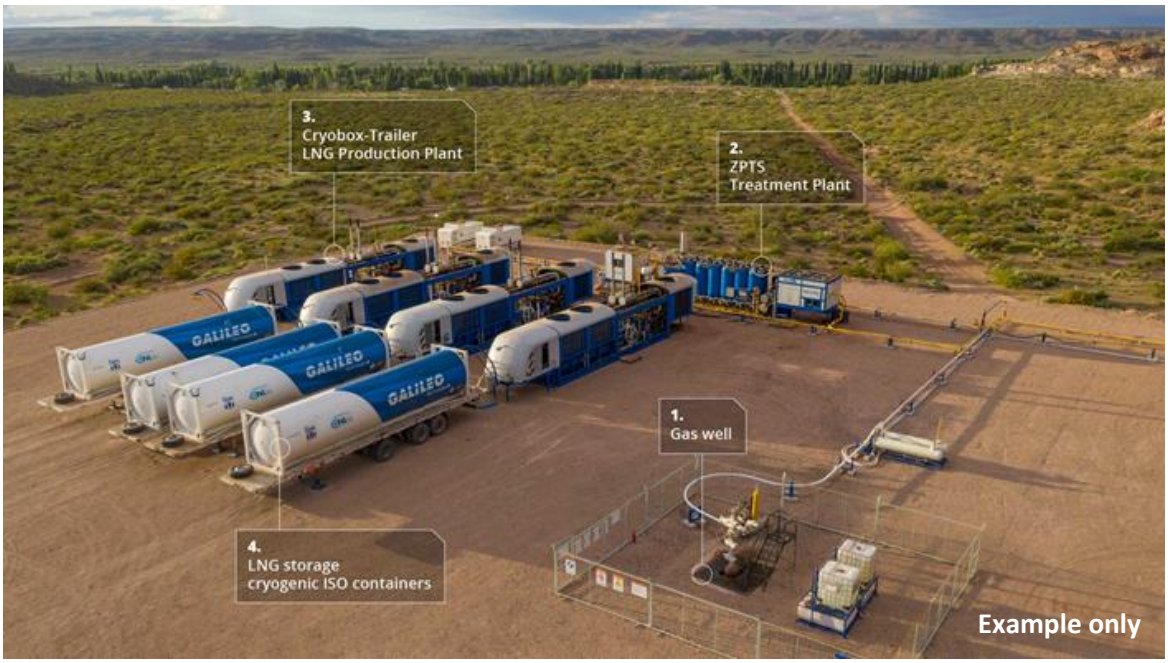
LILYVALE MICRO-LNG FACILITY

ENVIRONMENTAL AUTHORITY



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1 INTRODUCTION

Our Energy Group (Qld) Pty Ltd (OEG)) is proposing to construct, own and operate a Micro-LNG Facility approximately 32km north east of Emerald. The facility will be authorised via a Petroleum Facility Licence (PFL) issued under the *Petroleum and Gas (Production and Safety) Act 2004*. The "Lilyvale Micro-LNG Facility" will source gas from the underlying Kestrel Coal Mine for cryogenic production of Liquified Natural Gas (LNG), which will be exported via road tanker to industrial users in the region.

1.1 PURPOSE

The purpose of this document is to provide sufficient detail to support an application for a site-specific Environmental Authority (EA) to allow the construction and operation of the proposed Lilyvale Micro-LNG Facility (the Facility).

A PFL application for the Lilyvale Micro-LNG Facility was submitted to the Department of Natural Resources, Mines & Energy (DNRME) on 27th April 2020. The assessment of that application is pending.

1.2 SCOPE

The scope of this EA application covers the installation, operation and rehabilitation of the proposed Facility.

Requirements for EA applications are set out in Section 125 of the *Environmental Protection Act 1994*, and are referenced in Table 1 with an appropriate response from the proponent.

EPA Act Section	Requirement	Proponent Response
125	Requirements for applications generally	
(1)	An application for an environmental authority must—	
(a)	be made to the administering authority; and	Application made via Connect portal.
(b)	be made in the approved form; and	Application made via Connect portal.
(c)	describe all environmentally relevant activities for the application; and	Refer to Section 1.3
(d)	describe the land on which each activity will be carried out; and	Refer to Section 3.5
(e)	be accompanied by the fee prescribed under a regulation; and	Application made via Connect portal.
(f)	if 2 or more entities (*joint applicants*) jointly make the application—nominate 1 joint applicant as the principal applicant; and	Not applicable.
(g)	state whether the application is— (i) a standard application; or (ii) a variation application; or (iii) a site-specific application; and	This application is a site-specific application.
(h)	state whether the applicant is a registered suitable operator; and	The applicant is a registered suitable operator, Suitable Operator Reference number is: RSO003785
(i)	if a development permit under the *Planning Act*, or an SDA approval under the *State Development Act*, is required under either of those Acts for carrying out the environmentally relevant activities for the application—describe the permit or approval; and	No development permits or approvals are required.

EPA Act Section	Requirement	Proponent Response
(j)	if the application is a standard or variation application—include a declaration that each relevant activity complies with the eligibility criteria; and	Not applicable.
(k)	if the application is a variation application— (i) for a variation application under section 123(1)—state the standard conditions for the activity or authority the applicant seeks to change; or (ii) for a variation application under section 123(2)—state the standard conditions that are not the same as the Coordinator-General's conditions; and	Not applicable.
(l)	if the application is a variation or site-specific application—	
	(i) include an assessment of the likely impact of each relevant activity on the environmental values, including—	
	(A) a description of the environmental values likely to be affected by each relevant activity; and	Refer to Section 4.
	(B) details of any emissions or releases likely to be generated by each relevant activity; and	
	(C) a description of the risk and likely magnitude of impacts on the environmental values; and	
	(D) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and	
	(E) if paragraph (n) does not apply—details of how the land the subject of the application will be rehabilitated after each relevant activity ceases; and	Refer to Section 5.
	(ii) include a description of the proposed measures for minimising and managing waste generated by each relevant activity; and	Refer to Section 4.5
	(iii) include details of any site management plan that relates to the land the subject of the application; and	Not applicable.
(m)	if the application is for a prescribed ERA—state whether the applicant wants any environmental authority granted for the application to take effect on a day nominated by the applicant; and	Not applicable.
(n)	if the application is a site-specific application for a mining activity relating to a mining lease—be accompanied by a proposed PRC plan that complies with this division; and	Not applicable. The Facility overlies an existing underground coal mine, however does not involve any mining activity.
(o)	include any other document relating to the application prescribed under a regulation.	Not applicable.
(2)	Despite subsection (1)(l), if the application is a variation application under section 123(1), it need only include the matters mentioned in that subsection to the extent it seeks to change the standard conditions for the activity or authority.	Not applicable.
(3)	Subsection (1)(l) does not apply for an application if—	
(a)	either— (i) the EIS process for an EIS for each relevant activity the subject of the application has been completed; or (ii) the Coordinator-General has evaluated an EIS for each relevant activity the subject of the application and there are Coordinator-General's conditions that relate to each relevant activity; and	Not applicable. This project has not undergone an EIS process.

EPA Act Section	Requirement	Proponent Response
(b)	an assessment of the environmental risks of each relevant activity would be the same as the assessment in the EIS mentioned in paragraph (a)(i), or the evaluation mentioned in paragraph (a)(ii), if completed.	
(4)	Also, subsection (1)(l) does not apply for a variation application under section 123(2) if the application seeks only to apply the Coordinator-General's conditions.	Not applicable.
126	Requirements for site-specific applications—CSG activities	Not applicable. No CSG activities will be carried out.
126A	Requirements for site-specific applications—particular resource projects and resource activities	Not applicable. No activities relating to groundwater will be carried out.

Table 1: mandatory application requirement of the Environmental Protection Act 1994

1.3 ENVIRONMENTALLY RELEVANT ACTIVITIES

The Facility will operate under a Petroleum Facility Licence (PFL), which is a resource authority issued under the Qld *Petroleum and Gas (Production and Safety) Act 2004*.

Following discussion with Qld Department of Environment & Science (DES), the appropriate Environmentally Relevant Activities (ERA's), as defined by Schedule 2 and Schedule 3 of the *Environmental Protection Regulation 2019* (EP Reg), for the proposed Lilyvale Micro-LNG Facility are shown in Table 2, below.

EP Reg Schedule	Prescribed ERA	Threshold	Aggregate Environmental Score (AES)	Relevance to Project
Schedule 3	ERA 8: A petroleum activity or GHG storage activity	Includes 1 or more activities mentioned in schedule 2 for which an AES is stated. (see below)	126	The Facility is a petroleum activity.
Schedule 2	ERA 9: Hydrocarbon gas refining	(c) coal seam gas	64	The Facility will process incidental coal seam gas from an operating mine. Operation of the Facility will process the following volumes of natural gas: (i) Stage 1: 21.15 million m^3/yr (ii) Stage 2: 42.30 million m^3/yr

Table 2: prescribed ERAs for the Lilyvale Micro-LNG Facility

The proponent notes, however, that the Aggregate Environmental Score (AES) designated for the proposed Facility is disproportionally high given the minor scope of the Facility. For comparison, EP Reg Schedule 2: ERA 9(a) has no AES for processing up to 200 million m^3 of natural gas, more than 4 times the volume to be processed by the Facility. The Facility does not involve the extraction of coal seam gas (CSG) and simply converts existing incidental waste mine gas (traditionally flared) into LNG. The proponent recommends that issues around the ERA and AES for the Facility need further resolution.

2 GENERAL

The **Lilyvale Micro-LNG Facility** (the "Facility") considered under this application is part of a broader Project which will capture stranded and wasted gas resources for use in the domestic industrial energy market.

The Project is being developed to satisfy the following primary objectives:

1. Increase access to natural gas supplies for industrial users in North Queensland, particularly in the Moranbah and Townsville areas (currently serviced by a single CSG field)
2. Provide a locally produced alternative to diesel fuel for heavy horsepower applications
3. Reduce waste of a valuable energy resource that is currently flared
4. Reduce regional greenhouse gas emissions.

The Project will achieve these objectives by collecting waste methane from underground coal mining activities, liquifying that gas on-site in modular micro-LNG plant, and distribution of LNG to end users via road transport. The Facility is part of the initial phases of the Project, with subsequent liquification facilities to be installed in other locations.

The Project acts as a "virtual pipeline" to move energy from stranded gas production (underground coal pre-mine drainage & CSG appraisal fields) to new and existing gas customers in Moranbah and surrounds, and via existing pipeline (NQGP) to customers further north in Townsville.

The Project is the first of its kind in Queensland and offers a unique solution to capture waste energy resources and reduce Scope 1 and Scope 3 NGER emissions.

The Project (illustrated in Figure 1) works as follows, with only items 2-5 occurring within the Facility:

1. Gas produced by pre-mine drainage is collected from SIS wellheads by surface piping. This is conducted by the mine operator under existing and separate approvals and is entirely external to the proposed Facility.
2. Gas is transferred to a newly installed Micro-LNG Facility (the subject of this EA application), where it will be used to power the facility and provide feedstock for LNG production
3. Produced gas will be filtered to remove inert gases and heavier hydrocarbons (if present) by a specialised filtration skid
4. Conditioned gas (>95% CH_4) is liquified at very low temperature (<161°C) in specialised cryogenic modules to generate Liquified Natural Gas (LNG)
5. LNG is pumped into static cryogenic storage tanks
6. LNG is transported by road tanker to a newly installed LNG Regasification Plant located adjacent to the NQGP at Moranbah, approximately 220km by road to the north

7. LNG is transferred into cryogenic storage tanks located at the Regasification Plant
8. Stored LNG is then regasified at high pressure into the NQGP
9. Gas is supplied to customers in Townsville.

Where independent customers are serviced directly by the virtual pipeline:

5. LNG is transported by road tanker directly to client site
6. LNG is pumped into cryogenic storage tanks at the client site
7. Stored LNG is used on-demand to supply energy needs for the client
8. Further deliveries are made based on demand and storage levels.

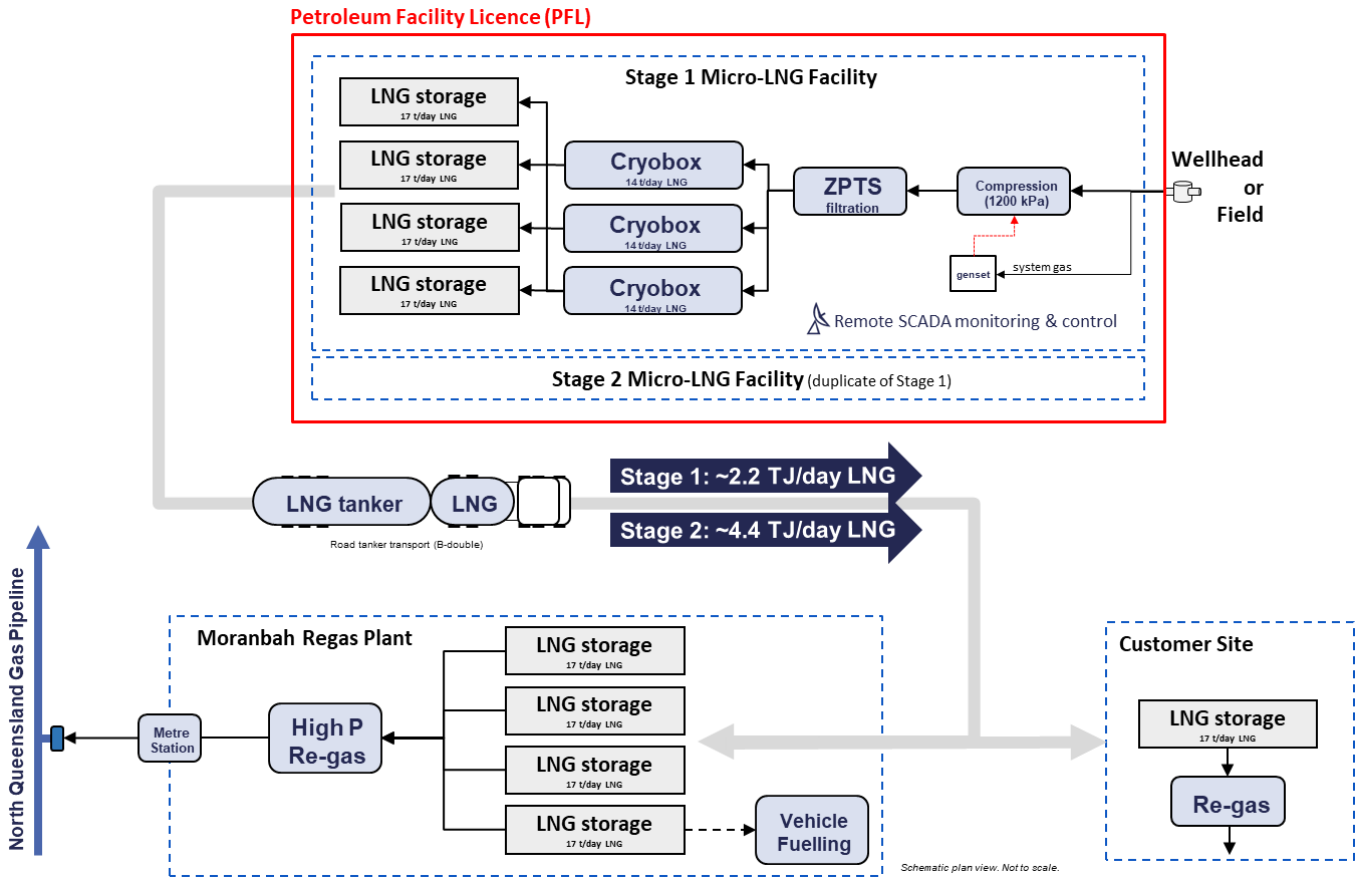

Figure 1: schematic overview of the North Queensland LNG Virtual Pipeline Project, including the PFL which is the subject of this EA

The Project is being developed by **Our Energy Group (Qld) Pty Ltd**, which has been set up to leverage OEG's Australian oil and gas operational experience with Galileo Technology (the LNG plant OEM) depth of expertise in the field of remote micro-LNG production and plant operation. The proposed Facility configuration is a replication of installations that the OEM, Galileo Technologies, has installed and operated across the globe. Being specifically designed to be relocatable and scalable, Galileo LNG plant is modular and plug-and-play by design. These aspects greatly reduce the complexity of installation and commissioning, resulting in a simple mobilisation to a gravel pad and connection of integrated units.

Central to the Facility is the Galileo Cryobox (Figure 2), which operates an LNG liquification cycle at high pressure for small scale LNG production. This technology allows highly efficient LNG production of up to 16,000

Nm^3 per day per Cryobox unit with very low OPEX and CAPEX, significantly lower than those of conventional fixed LNG production facilities available in the market.

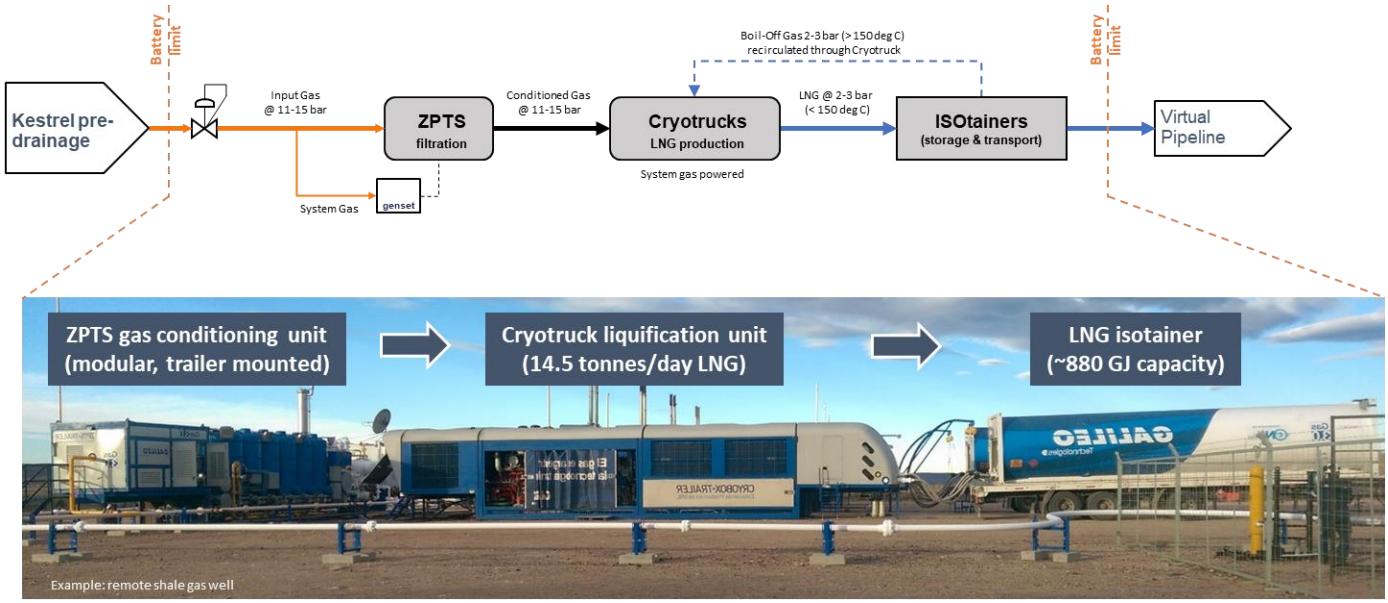

Figure 2: Micro-LNG Facility process overview

During operations, Project staff will supervise the Facility during regular LNG transfers. In between on-site supervision, the plant operates autonomously with 24/7 remote monitoring and control via Galileo's in-house SCADA system, which is maintained on a 24/7/365 basis.

The following videos provide a good overview of the plant simplicity of installation, commissioning and operation:

- www.youtube.com/watch?v=Pfs2zMxm9gk
- www.youtube.com/watch?v=kq0CQdeNqTw
- www.youtube.com/watch?v=qsf96FdjB_s

2.1 PURPOSE OF THE FACILITY

The Facility will generate Liquified Natural Gas (LNG) from waste gas produced by pre-mine gas drainage at Kestrel Coal Mine. Generated LNG will then be trucked off-site for consumption by energy users in north Queensland.

The Facility will process Incidental Coal Seam Gas (ICSG) produced from gas drainage activities at Kestrel Coal Mine, predominantly from pre-mine surface-in-seam (SIS) wells. ICSG is gathered from SIS wells via surface piping and transferred by the mine operator to the battery limit of the proposed Micro-LNG Facility, where it will be used to power the facility and provide feedstock for LNG production.

At the Micro-LNG Facility (the subject of this EA), ICSG will be compressed, conditioned and filtered and then cryogenically converted into LNG which will be stored temporally on site. At regular intervals, a tanker will collect LNG from the facility for distribution via road train to industrial customers in the region.

External to the petroleum facility licence, LNG will be delivered by truck directly to industrial customers or regasified into the North Qld Gas Pipeline (NQGP) at a dedicated inlet in Moranbah.

2.2 FACILITY ACTIVITIES

The activities to be carried out under the proposed Lilyvale Micro-LNG Facility are listed in Table 3.

Activity	Description
Civil Works	Preparation of hardstand, rehabilitation and general maintenance.
Receival and metering of inlet gas	Custody transfer from mine
Gas compression	Booster compressor from inlet to ZPTS (~1200kPa)
Electrical power generation	Required for plant operation
Gas conditioning	Filter out heavy hydrocarbons, carbon dioxide, hydrogen sulphide, particulates, water vapour
Cryogenics	Gas refrigeration and compression to generate LNG
LNG storage	Sufficient static LNG storage capacity for around 2 days of LNG generation (4-8 TJ)
LNG transfer	Pump LNG from static storage to road tanker
Servicing and Maintenance	Preventative maintenance and unscheduled maintenance on all equipment
Mobilisation/de-mobilisation	Modular equipment will be transported to and from site
Rehabilitation	Hardstand will be rehabilitated to meet landholder requirements at the end of the Project

Table 3: description of activities carried out under the proposed Facility

The Facility is anticipated to operate for as long as incidental mine gas is available. Due to the changing nature of mine operations, the exact duration of gas availability is presently unknown. An indicative project timeframe is presented in Table 4, below.

Phase	Description	Estimated Duration
1	Civil works: construct gravel hardstand & improve road access	1 month
2	Facility Stage 1: installation of first stage of Facility	1 month
3	Facility Stage 2: installation of second stage of Facility	1 month
4	Facility operation: operate Stage 1 for ~1 year, then operate Stage 2	7 – 10 years
5	Rehabilitation	1 – 1.5 months

Table 4: planned project life and phases of work

2.3 PERMIT DESCRIPTION

The proposed Lilyvale Micro-LNG Facility is:

- to be operated under a Petroleum Facility Licence (PFL) issued under the *Petroleum and Gas (Production and Safety) Act 2004*
- located adjacent to Kestrel Coal Mine, approximately 32km NE of Emerald in central Queensland
- located on freehold land (parcel 10/TT71) owned by Kestrel Coal Pty Ltd, the owner/operator of Kestrel Coal Mine
- located on an existing mining lease (ML70481) with no overlapping petroleum tenure
- situated on previously cleared land that is currently being used for underground coal mining purposes and cattle grazing
- situated on elevated terrain, outside any areas of Matters of State Environmental Significance (MSES) and outside 1% AEP flooding events
- Adjacent to existing gazetted roads currently in use by farming and mine operations vehicles (Figure 3)
- within the Central Highlands Regional Council, the County of Talbot and Parish of Yamala

- located in the north-eastern corner of an existing grazing paddock. Figure 3, below, shows the proposed location in relation to property parcels and planned underground roadways of Kestrel Coal Mine.

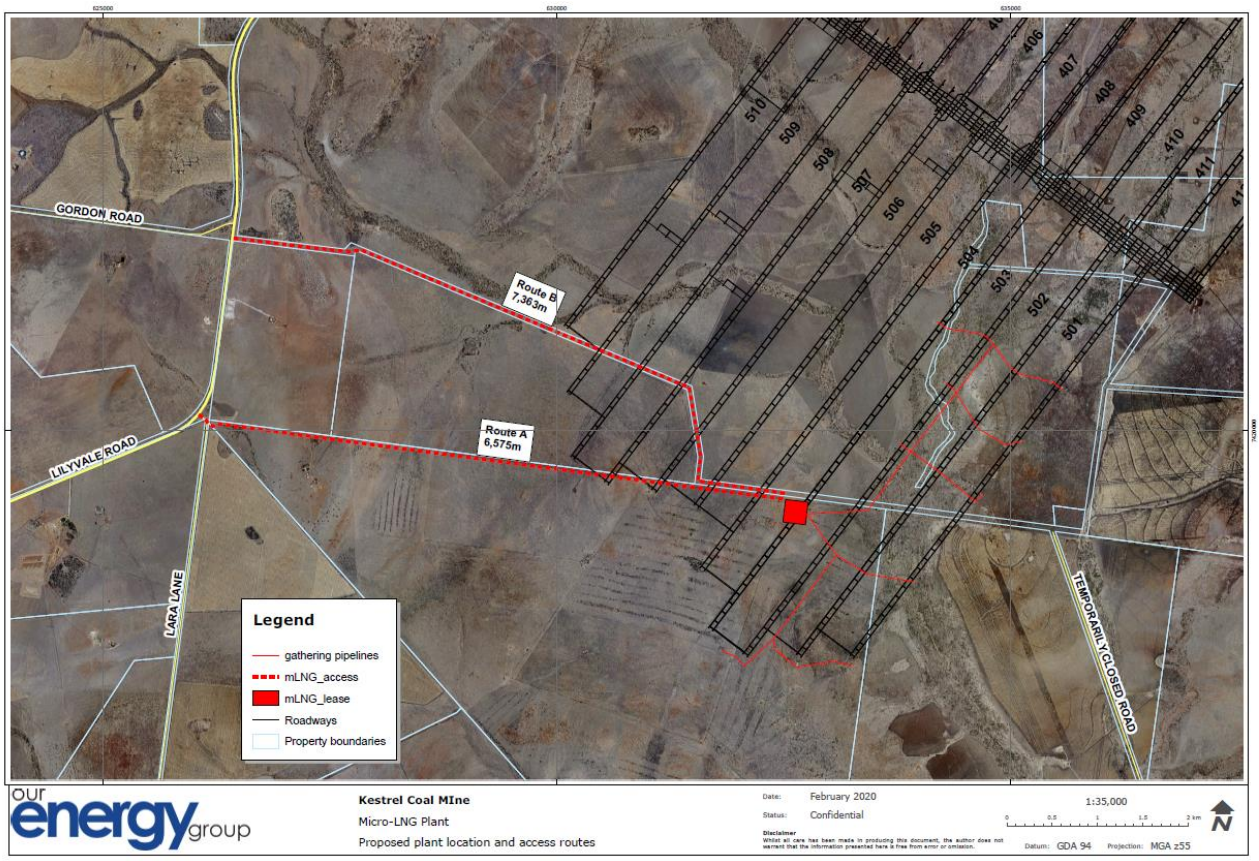

Figure 3: location of proposed Micro-LNG Facility

2.4 CONFIGURATION, DESIGN AND CONSTRUCTION METHODS

The Facility is comprised of modular, "off-the-shelf" equipment manufactured by Galileo Technologies referred to as the Gas 3.0 System. This system consists of an integrated set of pre-fabricated units in a "plug-and-play" configuration which lends itself to a scalable, modular and easily mobilised facility (Figure 4).

Due to the pre-fabricated and flexible nature of the individual Facility components, the system and does not require any special installation. The proposed Facility requires only a level hardstand pad and vehicle access for its installation. All pre-fabricated Facility components are based on a 40 feet shipping container or trailer chassis, which facilitates its delivery in a single trailer and flexibility to allow simple scalability. The proposed Facility is similar to other micro-LNG plants that Galileo has installed around the world.

Due to the modular and mobile design of the equipment used for the Facility, the hardstand area will be constructed from a simple level gravel pad, approximately 60 x 70m in size, surrounded by appropriate security fencing. Existing vegetation (comprised predominantly of native grasses) will be removed and the topsoil set aside for future rehabilitation purposes. No trees or substantial vegetation will be removed.

All equipment will be skid mounted and connections made with AGA certified flexible pipework. Other than civils and fencing, the setup and commissioning of the plant is largely a process of mobilisation and inter-connection between the "plug-and-play' modules.

The Facility will accommodate the following infrastructure (Figure 4):

- Hardstand area sufficient for the full plant (approximately 60x70m in size, or 4,200m^2)
- Stage 1 and Stage 2 plant, including electrical generation
- Static LNG storage for both Stage 1 and Stage 2
- Flare for maintenance and safety bleed down of plant, including exclusion zone
- Bunded topsoil for use in future rehabilitation of the hardstand area
- Vehicle turning area sufficient for A-double trailer turning
- External buffer zone and stock-proof fencing
- Light vehicle parking, control room, communications equipment, fire protection equipment

The layout of the Facility is presented in Figure 4. Major components are listed in Table 5.

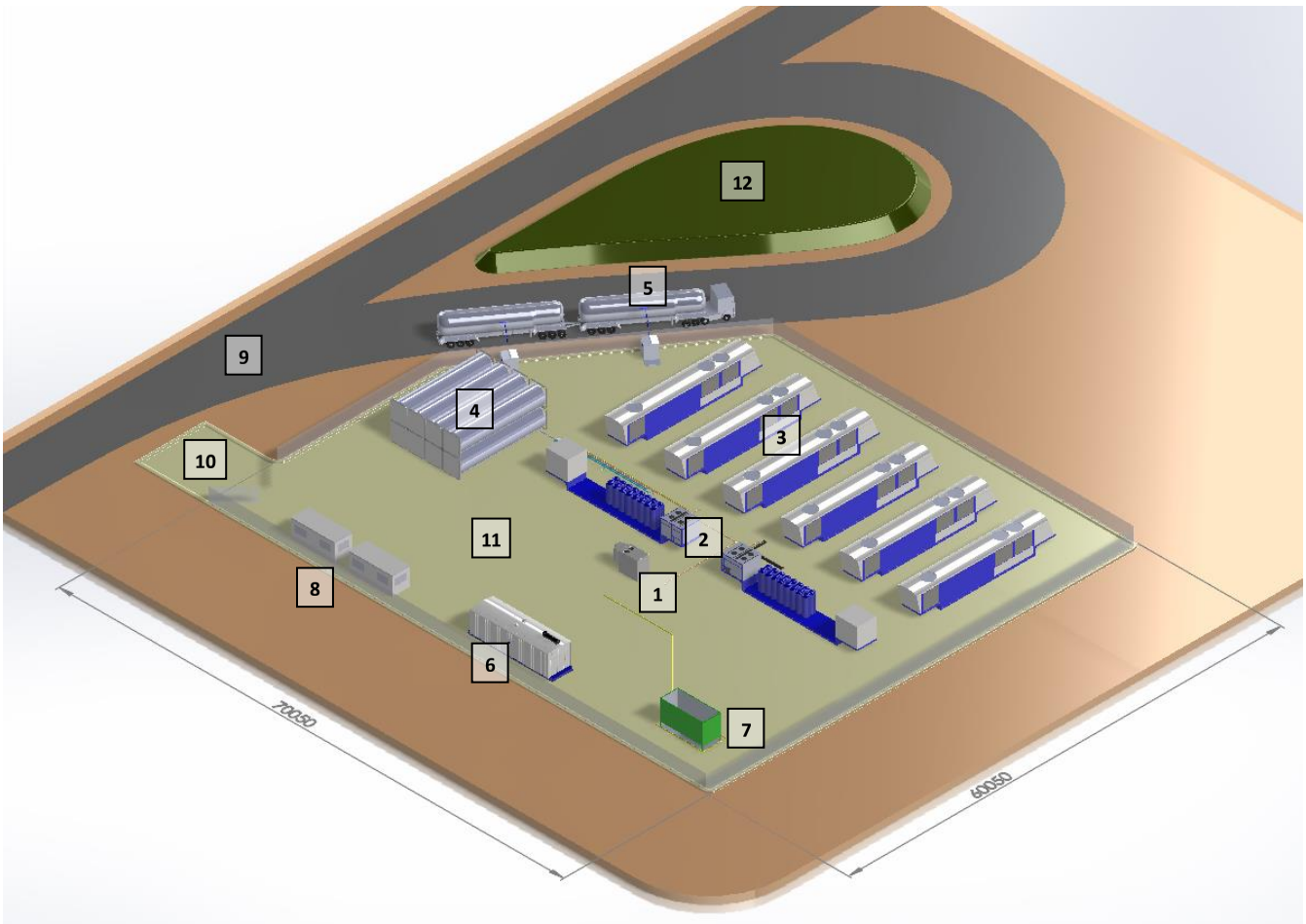

Figure 4: layout of the proposed Micro-LNG Facility

Item (Figure 4)	Item Description
1	Inlet booster compressor
2	ZPTS (gas filtration skid). Stage 1 n=1. Stage 2 n=2.
3	Cryobox (cryogenic skid). Stage 1 n=3. Stage 2 n=6.
4	LNG storage tanks
5	Road tanker & prime mover
6	Electrical generator
7	Horizontal flare
8	Workshop, store, control room
9	Access road & turning loop
10	Facility access & light vehicle parking
11	Gravel pad = approximately 60x70m in size
12	Stockpiled topsoil = approximately 1,000m^3 (if required)

Table 5: components of the proposed Micro-LNG Facility

Gravel Hardstand and Vehicle Loop Construction Methods

The gravel hardstand, including access and vehicle turning loop, is the most substantial built aspect of the Facility. Two options are considered for its construction, with the final configuration dependant on ground conditions (see Section 3.4) and engineering assessment:

1. **Traditional hardstand**: topsoil excavated (stockpiled for rehabilitation) and a thick (500mm) layer of gravel imported to site and compacted. A geofabric base may be used and drainage installed.

2. **Geosynthetic reinforced floating hardstand**: grass slashed, a geofabric base laid down, coarse gravel substrate bought in and overlain by a geosynthetic mesh (geogrid), finally a 200mm top course of gravel will be laid and compacted.

Option 2 is subject to final design, however, is preferred at this stage as it provides a flexible and durable hardstand suitable for heavy machinery due to the increased tensile strength of the aggregate. Additionally, a reinforced floating hardstand:

- will require up to 60% less gravel fill being bought onto site
- provides internal drainage and lateral structure
- is less susceptible to sinking in mobile black clay soils
- is better suited to heavy machinery in soft soils
- will have far less impact on the long term integrity of the soil profile as no excavation is required

Concrete footings may be installed to accommodate the cryogenic storage tanks.

2.5 PUBLIC INTEREST

The proponent's firm belief is that the proposed Facility, and related outcomes, is in the public interest.

A Micro-LNG Facility installed and operational as proposed will satisfy key objectives:

1. Increase access to natural gas supplies for industrial users in North Queensland, particularly in the Moranbah and Townsville areas, and increase security to energy
2. Reduce waste of a natural resource that is otherwise flared
3. Reduce needless greenhouse gas emissions
4. Demonstrate to other coal mine operators in the region the viability of ICSG commercialisation via LNG, hopefully resulting in similar projects being developed and further enhancing benefits to north Queensland.

The Micro-LNG Facility will achieve these objectives by converting the bulk of flared SIS-related emissions at the mine to saleable LNG. Kestrel Coal Mine currently flares large volumes of methane from its SIS pre-drainage program. The mine predicts that gas flaring will increase over the next five years as underground mining moves to deeper and gassier domains. Stage 1 of the proposed Micro-LNG Facility will convert 2.2 TJ/day of the ICSG into LNG, ramping up to 4.4 TJ/day when Stage 2 is completed.

The proposed Micro-LNG Facility and related activities are expected to deliver tangible and significant benefits to Northern QLD in economic, employment and environmental terms (Table 6). The Project will deliver improved outcomes for existing business and has the potential to foster new enterprise and economic development in the region.

Table 6 below, presents a summary of the potential benefits flowing from the Project, most of which will be felt in this part of North QLD.

	Aspect	Benefits to Northern Queensland
Direct Project Related Benefits		
1.	**Employment**	• The Project will generate a small number of direct new jobs. • The number of Project jobs will increase with subsequent expansion phases.
2.	**Investment**	• The Project will directly invest in new infrastructure. • Local business will benefit from direct Project-related expenditure. These would likely include civil contractors, crane operators, transport companies, equipment suppliers, mechanical services, motels, food outlets, laundry services, etc.
3.	**Environment**	• The Project will directly reduce the amount of gas currently flared at the mine. • This will significantly reduce greenhouse gas emissions from the mine. • Reduction in flaring at the mine will minimise flare-related visual pollution and fire risks.
4.	**Resource utilisation**	• The Project will directly improve gas resource utilisation by reducing the waste of commercially viable coal mine waste gas.
5.	**Government revenue**	• The Project will generate totally new tax revenue and new gas-related royalties for the Queensland Government.
Associated Benefits		
6.	**Customer economics**	• Increased gas supplies and diversity of gas supplies will create more competitive gas pricing for customers. • Diversity of supply, from the current single source (Moranbah Gas Field), will enhance customers energy security. • Switching from diesel to LNG for high-horsepower off-road applications will result in a direct ~20% saving in fuel costs and a ~30% reduction in GHG emissions.

	Aspect	Benefits to Northern Queensland
7.	**Customer local expansion**	• With additional gas supplies being available from the Project, product end-users may have more incentive to expand their own operations, resulting in more local investment and associated local job opportunities. This is particularly apparent at Dyno Nobel Moranbah for example, where the owner is considering a large uprate to their facility which must be underpinned by additional gas supply.
8.	**New enterprise (LNG fuels)**	• LNG is a value-added product and can substitute diesel as a fuel for transport and electrical generation. Real potential exists for the Project to directly supply fuels to existing and new transport fleets, particularly for back-to-base and mining operations. • LNG fuel is around 30% lower cost than diesel on an energy content basis. • LNG fuel produces less nitrous oxides, sulphur dioxide and almost no particulates compared to diesel, resulting in comparatively better air quality and lower greenhouse gas emissions. • LNG fuel provides better long-term driver outcomes due to less engine vibration.
9.	**Electrical generation in Townsville**	• The rapid and large development of solar farms near Townsville place increased demand on gas-fired generators to cover peaks after the sun sets. Whilst the Facility will not produce sufficient gas to supply base load generation, Townsville has two peaking generators which may benefit from additional supply: • Townsville Power Station (244 MW, leased by Arrow/AGL) relies on existing gas supplies from the NQGP. • Mt Stuart Power Station (423 MW, operated by Origin) currently uses high-cost aviation fuel and have expressed interest of switching to gas if additional supply becomes available.
10.	**Heavy industry in Townsville**	• The Project supports existing Government initiatives for industrial development in Townsville, which will require increased volumes of competitively priced gas. • Townsville hosts three existing, and two planned, metal refineries. These are high energy users and would clearly benefit from additional energy supplies to Townsville. • Yabulu Nickel Refinery (Qld Nickel) has announced plans to reopen the facility in 2020, at which point around 13 TJ/day of additional gas supplies will be required. • The proposed Battery Gigafactory (by Imperium3) and other new industrial energy users would also clearly benefit from additional energy supplies to Townsville.
Indirect Benefits		
11.	**Local business**	• Increase local spending directly by the Project, and by increased customer activity will improve turnover of local business.
12.	**Improved competitiveness**	• Additional and competitive energy supplies will ensure that local business and industry are more commercially competitive.
13.	**Sustainable population**	• Increased local spending, new job creation and improved energy supply will encourage people to remain in or migrate to the region.
14.	**Air quality**	• Regional air quality would benefit due to reduced gas flaring at mine sites, improved emissions from LNG-fuelled vehicles and cleaner burning electrical power generation.

Table 6: direct, associated and indirect project benefits

3 EXISTING ENVIRONMENT

The following section describes the existing environment in and around the vicinity of the proposed Facility.

3.1 STAKEHOLDERS

Stakeholders relevant to the proposed Facility have been identified and are presented in Table 7, below.

Stakeholder	Description
Department of Natural Resources, Mines & Energy (DNRME)	Administering authority of the Petroleum Facility Licence (PFL)
Department of Environment & Science (DES)	Administering authority of the Environmental Authority (EA)
Central Highlands Regional Council	Local government authority
Kestrel Coal	Landowner of the Facility land and operator of Kestrel Coal Mine
Adjacent landholders	Landholders and residents within proximity of the Facility
Western Kangoulu People & Lumburra Bimbi	Native title claimants & local aboriginal corporation

Table 7: stakeholders relevant to the Facility

3.2 CLIMATE

The proposed Facility is located around 32km north east of Emerald in central Queensland. The area is subject to a humid subtropical climate with warm to hot summers and mild, dry winters. Maximum temperatures range from 34°C in January to 22°C in July, while minimum temperatures range from 22°C to 7°C. Extremes of recorded temperature have ranged from 48.6°C to −5.6°C

The average annual rainfall is 641mm. The wettest year on record was 1407mm in 1956., while the wettest 24 hours on record was 182mm on 25 February 1975.

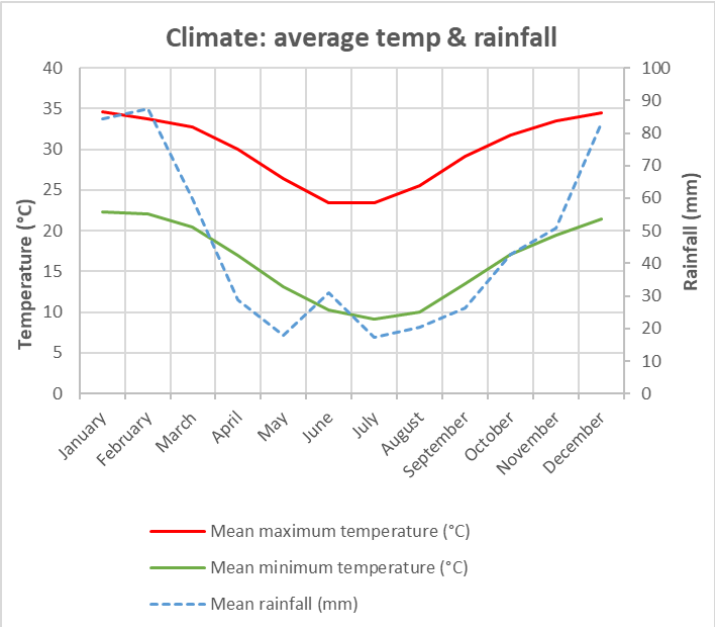

Figure 5: Average temperature and rainfall 1992 - 2020 (source: Bureau of Meteorology)

3.3 SENSITIVE RECEIVERS

Potential receivers were identified within a 12km radius of the proposed Facility (Figure 6 and Table 8). In total, 30 dwellings were identified and are classified as "sensitive" for the purpose of visual and noise assessments (see Section 4). The closest dwelling is located 5.1km from the Facility and therefore has a high degree of sensitivity than the furthest dwelling from the Facility (12.8km). Additionally, a single mine site was identified, however is classified as not sensitive due to its industrial nature and 24/7 operations.

The "Gordon Downs" property is owned by Kestrel Coal. Whilst the homestead is identified as a potential receiver, the homestead is not occupied due to mining-related activity and is therefore classified as having low sensitivity.

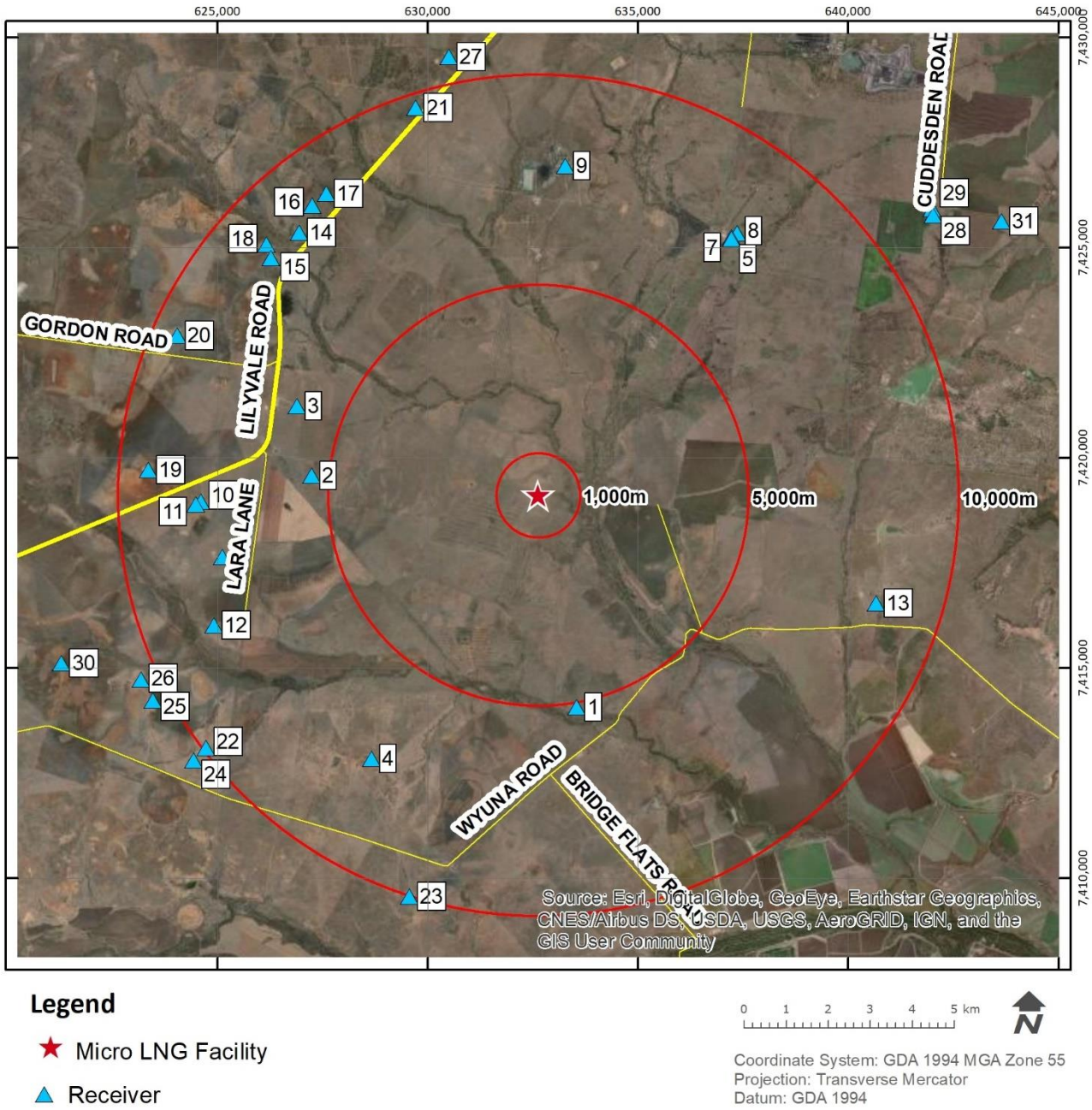

Figure 6: location of receivers within 12km of the proposed Facility

Receiver #	Property Reference	Receiver Type	Line of Sight to Facility	Potential Sensitivity	Distance from Facility (m)
1	Langley Downs	Dwelling	None	Highest	5,113
2	Larundel	Dwelling	Partial	High	5,409
3		Dwelling	Partial	High	6,117
4		Dwelling	None	Moderate	7,403
5	Gordon Downs	Workers cottage	Full	Low	7,639
6	Chellinlee	Dwelling	None	Moderate	7,653
7	Gordon Downs	Workers cottage	Full	Low	7,676
8	Gordon Downs	Dwelling	Full	Low	7,825
9	*Kestrel Coal Mine*	*mine buildings*	Full	*Not sensitive*	*7,868*
10	Kalarah	Dwelling	None	Low	8,031
11	Kalarah	Workers cottage	None	Low	8,150
12	Oasis	Dwelling	None	Low	8,312
13	Yapunya	Dwelling	None	Low	8,436
14	Banyula	Dwelling	None	Low	8,454
15		Dwelling	Partial	Moderate	8,507
16	Melaleuca	Dwelling	Partial	Moderate	8,739
17	Kelam	Dwelling	Full	Moderate	8,774
18		Dwelling	None	Low	8,800
19	Wilgavale	Dwelling	None	Low	9,293
20	Werrina Downs	Dwelling	None	Low	9,395
21	Yellowwood Park	Dwelling	Full	Low	9,678
22		Dwelling	None	Low	9,924
23		Dwelling	None	Low	10,014
24	Karcalamb	Dwelling	None	Low	10,339
25		Dwelling	None	Low	10,379
26		Dwelling	None	Low	10,412
27	Kevricia	Dwelling	Full	Low	10,646
28	Wanditta	Workers cottage	None	Low	11,524
29	Wanditta	Workers cottage	None	Low	11,593
30	Lara	Dwelling	None	Low	12,018
31	Wanditta	Dwelling	None	Lowest	12,804

Table 8: receivers within 12km of the proposed Facility

3.4 TOPOGRAPHY AND SOILS

The proposed Facility is located on gently undulating grasslands comprised of black cracking clays largely cleared of vegetation. Particulars of the land are provided below:

Drainage basin: Fitzroy

Bioregion: Brigalow Belt bioregion, Basalt Downs subregion

Soil type: black self-mulching cracking clays (Kd6) described as uniform fine cracking, smooth faced peds, dark clay horizon underlain by brown/mottled clay.[1]

Land system: Kinsale (Kn) which is described as Brigalow scrub on rolling basalt country with cracking clay soils within the Tertiary weathered zone.[2]

Agricultural land class: A1 defined as "Crop Land - Broadacre and Horticulture"

Elevation: around 173m (AHD)

Slope: the location slopes approximately 0.5° to the NNE

Coordinates: the proposed Facility is located within the following bounding coordinates:

Corner	Longitude (GDA 94)	Latitude (GDA 94)
A	148° 17' 46.361" E	23° 19' 51.548" S
B	148° 17' 55.102" E	23° 19' 52.484" S
C	148° 17' 54.116" E	23° 20' 00.560" S
D	148° 17' 45.365" E	23° 19' 59.688" S

A contaminated land register search for the land parcel impacted by the Facility has been undertaken and was not found to be listed.

The proposed Facility is located on land subject to potential impacts from mining operations.

The existing condition of the land is presented in Figure 7 to Figure 10, below.

[1] Source: Atlas of Australian Soils
[2] Source: Land systems of the Nogoa-Belyando area – Queensland CSIRO Land Research Series No. 18 (SALI project code ZCQ2) by Gunn *et al* 1967

Figure 7: proposed Facility location, looking north (April 2020)

Figure 8: proposed Facility location, looking east (April 2020)

Figure 9: proposed Facility location, looking south (April 2020)

Figure 10: proposed Facility location, looking west (April 2020)

Figure 11: topography around the proposed Facility

3.5 LAND TENURE

The following comments describe the existing land tenure in the area of the proposed Facility:

- The Facility will be operated under a **Petroleum Facility Licence** (PFL) currently being assessed by DNRME.
- The Facility is located on private land (parcel **10/TT71**) owned by the operator of Kestrel Coal Mine.
- The Facility is located on land subject to **Mining Lease 70481** (ML70481) held by Kestrel Coal Resources Pty Ltd ("Kestrel Coal").

- The Proponent and Kestrel Coal have agreed to enter into a **Conduct and Compensation Agreement** (CCA) for the installation and operation of the Facility.
- The Facility is located on land designated as **Strategic Cropping Land** (SCL) under the *Regional Planning Interest Act 2014* (RPI Act). However, the construction and operation of the proposed Facility is classified as an "*exempt resource activity*" under Clause 22(2)[3] of the RPI Act as:
    a) the proponent has entered into a voluntary conduct and compensation agreement with the landholder; and
    b) due to its small size (4,200m^2) and non-permanent nature, the Facility is not likely to have significant impact on the SCL; and
    c) the Facility is not likely to impact on land owned another landholder.

  The Facility being an "*exempt resource activity*" is taken to mean that a Regional Interest Development Approval is not required for the proposed Facility (Clause 19(4) of the RPI Act).

3.6 LAND USE

The primary current land use is surface operations related to underground longwall mining at Kestrel Coal Mine. This includes ventilation and service shafts, mine gas drainage boreholes, surface gas gathering and flaring infrastructure, water and environmental monitoring stations, and associated access roads. The main mine portal, administrative buildings and coal handling yard are located around 7.5km to the north of the proposed Facility. Within the immediate vicinity of the proposed Facility, the mine undertakes gas drainage activities including drilling, operation of gas wells, installation and operation of gas gathering pipelines, gas flaring and associated activities.

Ancillary land use of the site is cattle grazing. The mine operator leases part of the land for cattle grazing depending on the extent and nature of surface mine-related activities at the time.

3.7 MATTERS OF ENVIRONMENTAL SIGNIFICANCE

3.7.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

A search was made of matters of national environmental significance or other matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may occur within 2km of the proposed Facility.

Results of the search are presented in **Appendix 1: EPBC Act Protected Matters Report** and summarised in Table 9, below.

Matters of National Environmental Significance	Occurrences
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	None
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	3

[3] Clause 22(2) of the Regional Planning Interest Act 2014 (RPI Act) - link

Listed Threatened Species	20
Listed Migratory Species	10
Other Matters Protected by the EPBC Act	**Occurrences**
Commonwealth Land	None
Commonwealth Heritage Places	None
Listed Marine Species	16
Whales and Other Cetaceans	None
Critical Habitats	None
Commonwealth Reserves Terrestrial	None
Australian Marine Parks	None

Table 9: summary of Matters of National Environmental Significance (MNES)

3.7.2 MATTERS OF STATE ENVIRONMENTAL SIGNIFICANCE (MSES)

A search was made of matters of state environmental significance which are part of the biodiversity state interest that is defined under the *State Planning Policy* (SPP) and defined under the *Environmental Offsets Regulation 2014* that may occur within 2km of the proposed Facility.

Results of the search are presented in **Appendix 2: MSES Report** and summarised in Table 10, below.

Matters of State Environmental Significance		**Occurrence**
1a	Protected Areas - estates	None
1b	Protected Areas - nature refuges	None
2	State Marine Parks - highly protected zones	None
3	Fish habitat areas (A and B areas)	None
4	Strategic Environmental Areas (SEA)	None
5	High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values	None
6a	Wetlands in High Ecological Value (HEV) waters	None
6b	Waterways in High Ecological Value (HEV) waters	None
7a	Threatened (endangered or vulnerable) wildlife	Values are present
7b	Special least concern animals	Not applicable
7ci	Koala habitat area - core (SEQ)	Not applicable
7cii	Koala habitat area - locally refined (SEQ)	Not applicable
8a	Regulated Vegetation - Endangered/Of concern in Category B (remnant)	Values are present
8b	Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	Values are present
8c	Regulated Vegetation - Category R (GBR riverine regrowth)	Values are present
8d	Regulated Vegetation - Essential habitat	Values are present
8e	Regulated Vegetation - intersecting a watercourse	Values are present
8f	Regulated Vegetation - within 100m of a Vegetation Management wetland	Not applicable
9a	Legally secured offset areas - offset register areas	None
9b	Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation	None

Table 10: summary of Matters of State Environmental Significance (MSES)

3.7.3 MATTERS OF LOCAL ENVIRONMENTAL SIGNIFICANCE (MLES)

No matters of local environmental significance were found in the Central Highlands Regional Council in relation to the proposed Facility location.

3.8 TERRESTRIAL ECOLOGY

Existing vegetation at the proposed Facility location is grasslands comprised of Mitchell Grass (Astrebla spp.) (see Figure 8).

No remnant vegetation occurs within the Facility area (Figure 12). Populations of remnant vegetation within 2km of the proposed Facility are listed in Table 11, including their closest distance from the Facility.

Regional Ecosystem	Short Description	Biodiversity Status	Broad Vegetation Group (BVG 1:1m)	Distance from Facility
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	17a	950m
11.3.3	Eucalyptus coolabah woodland on alluvial plains	Of concern	16c	950m
11.3.37	Eucalyptus coolabah fringing woodland on alluvial plains	No concern at present	16a	950m
11.8.11	Dichanthium sericeum grassland on Cainozoic igneous rocks	Of concern	30b	1,690m
11.8.4	Eucalyptus melanophloia open woodland on Cainozoic igneous rocks	No concern at present	11a	1,030m
11.8.5	Eucalyptus orgadophila open woodland on Cainozoic igneous rocks	No concern at present	11a	1,030m

Table 11: remnant vegetation regional ecosystems identified within 2km of the Facility (source: DES Regional Ecosystems)

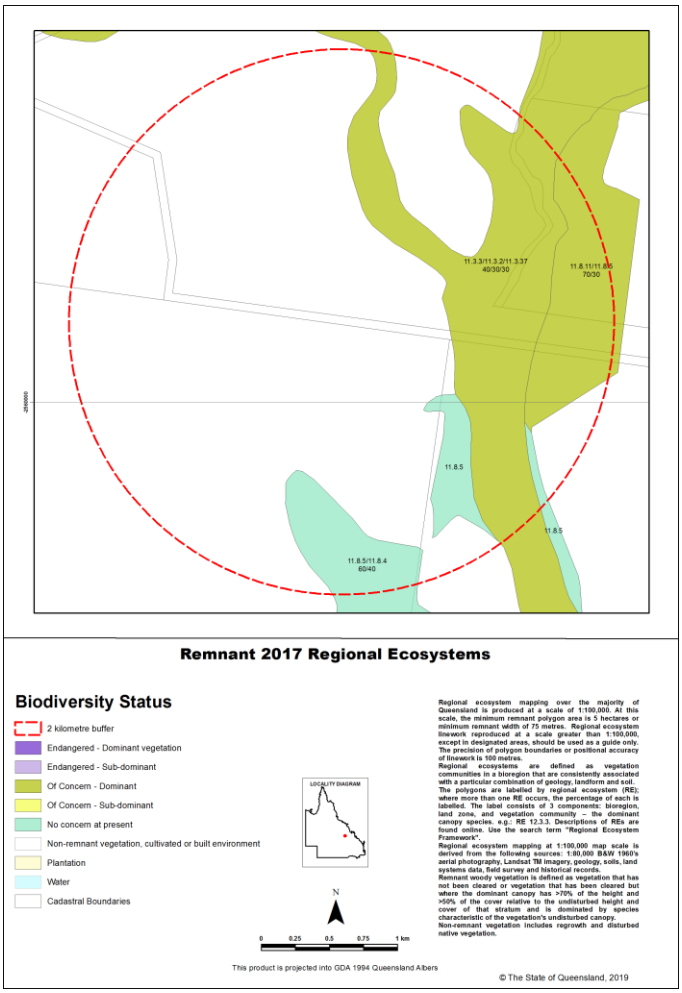

Figure 12: map of remnant vegetation in proximity to the Facility

3.9 WATER

The following describes water features within the area of the proposed Facility:

- The Facility is located within the Fitzroy drainage basin and within the Nogoa River Sub-basin.
- There are no water features within the proposed disturbance area of the Facility.
- The closest watercourse is located 220m northeast of the Facility boundary, and is an un-named, ephemeral, non-perennial tributary to Crinum Creek.
- The closest significant non-perennial watercourse is the junction between Crinum Creek (a tributary to the Nogoa River) and Belcong Creek, which lies approximately 1.2km to the east of the Facility.
- No springs, waterholes, high quality aquatic habitat or wetland areas were identified or are mapped within the Facility footprint or immediate surrounds.
- Groundwater on the site is expected to be over 10m deep and will not be encountered during construction or operation of the Facility.
- The closest groundwater bores include: RN 103310 (420m SE of Facility) and RN 158051 (660m west of the Facility). RN 158051 is a groundwater monitoring bore installed by Kestrel Mine.

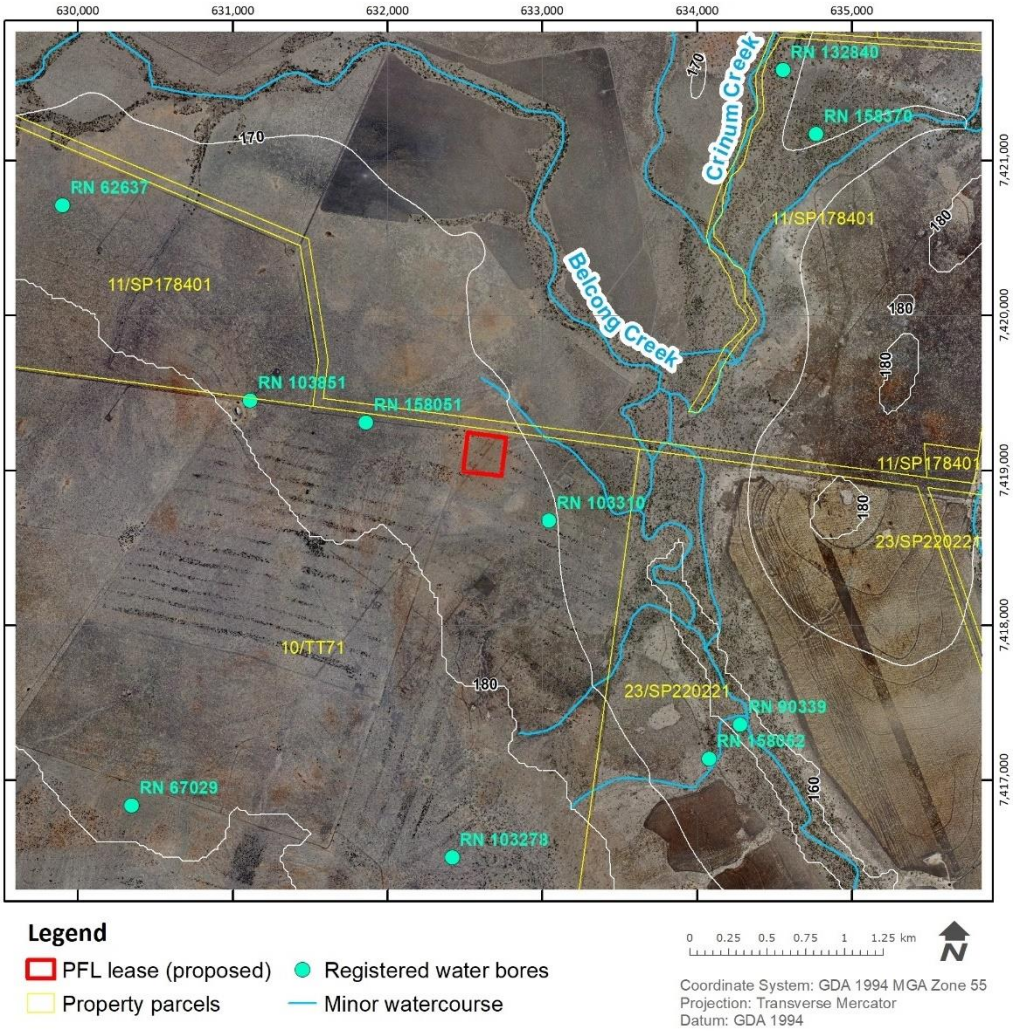

Figure 13: water features within proximity to the proposed Facility

3.10 GREENHOUSE GAS EMISSIONS

Kestrel Coal routinely flares large volumes of methane gas from its pre-mine gas drainage activities. Flares are located adjacent to surface-in-seam (SIS) boreholes and operate on a continuous basis. Flaring is an approved activity for underground coal mining.

The proposed Facility will convert the bulk of flared emissions related to mine pre-drainage at the mine to LNG for commercial export from the Facility.

4 ASSESSMENT OF ENVIRONMENTAL IMPACTS

The following section describes the environmental values potentially affected by the Facility, provides details of emissions or releases likely to be generated, describes the risk and likely magnitude of impacts on environmental values, and outlines mitigation measures to prevent or minimise adverse impacts.

4.1 WATER

4.1.1 ENVIRONMENTAL VALUES

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water) defines environmental values and water quality objectives for the surface water environment in Queensland. These are defined further by the *Nogoa River Sub-basin Environmental Values and Water Quality Objectives* (2011) and the *WQ1303 - Lower Nogoa River / Theresa Creek Sub-basin Plan.*

Environmental values to be to be protected or enhanced in the "Lower Nogoa/Theresa Creek—undeveloped areas" are:

- Aquatic ecosystems
- Stock water
- Human consumer
- Primary recreation
- Secondary recreation
- Visual recreation
- Drinking water
- Cultural and spiritual values

Water quality objectives of the "Lower Nogoa/Theresa Creek" area relating to the Facility as identified in Table 12, below.

Water area	Management intent (level of protection)	Water quality objectives to protect aquatic ecosystem

Lower Nogoa/ Theresa Creek Sub-basin waters (WQ1303)	Aquatic ecosystem—moderately disturbed	• ammonia N: <10 µg/L
		• oxidised N: <60 µg/L
		• organic N: <420 µg/L
		• total nitrogen: <500 µg/L
		• filterable reactive phosphorus (FRP): <20 µg/L
		• total phosphorus: <50 µg/L
		• chlorophyll a: <5.0 µg/L
		• dissolved oxygen: 85%–110% saturation
		• turbidity: <50 NTU
		• suspended solids: <10mg/L
		• pH: 6.5–8.5
		• conductivity (EC) baseflow:
		  ○ Lower Nogoa: < 340µS/cm
		  ○ Theresa Creek: < 720µS/cm
		• conductivity (EC) high flow (Lower Nogoa, Theresa Creek): <250 µS/cm

Water area	Management intent (level of protection)	Water quality objectives to protect aquatic ecosystem

		• sulfate: <25 mg/L
		• Macroinvertebrates:
		  ○ Taxa richness (composite): 12–21
		  ○ Taxa richness (edge habitat): 23–33
		  ○ PET taxa richness (composite): 2–5
		  ○ PET taxa richness (edge habitat): 2–5
		  ○ SIGNAL index (composite): 3.33–3.85
		  ○ SIGNAL index (edge habitat): 3.31–4.20
		  ○ % tolerant taxa (composite): 25–50%
		  ○ % tolerant taxa (edge habitat): 44–56%

Table 12: water quality objectives of the Lower Nogoa/Theresa Creek area

4.1.2 EMISSIONS & RELEASES

The activities to be carried out for the Facility do not involve any planned emissions or releases to either surface or ground waters.

The highest risk water feature is an un-named, ephemeral minor tributary to Crinum Creek located around 220m from the PFL boundary. Mitigation measures to avoid transport of sediment and contaminants into watercourses will focus heavily on this water feature.

Surface water
The Facility gravel pad, which occupies and area of 4,200m^2, will be subject to surface runoff during rainfall events. Surface runoff will be allowed to free-flow from the pad into surrounding grassland where it will be absorbed by the native soils.

The volume of runoff waters is expected to be minor. During peak recorded rainfall events (7mm/hr) a total runoff volume of around 30m^3 could be released from the entire Facility site. This is expected to be a worst-case scenario.

Groundwater
Works relating to the Facility will not penetrate beneath the soil horizon and will have no releases to, or extraction from, the groundwater environment. Facility activities do not penetrate the subsurface by greater than 0.5m and therefore are expected to have no effect on groundwater resources, water quality or aquifer connectivity. No emission of groundwater and no release into aquifers will occur during construction or operation of the Facility.

Wetlands
The Facility site was chosen in part to its elevated position and distance from watercourses, including wetlands. The Facility will make no releases to wetlands.

4.1.3 POTENTIAL IMPACTS, RISK & MITIGATION MEASURES

Details of potential impacts, their risk to the water environment and measures to further minimise impacts are presented below.

Potential impact:	**Transport of suspended sediment to waters**
Risk & magnitude of impacts: Construction: LOW Operation: VERY LOW	During both construction and operation, runoff from rainfall events may entrain sediment from disturbed land, land yet to be rehabilitated and the gravel pad. Runoff will travel 220m downslope from the Facility before entering an un-named tributary to Crinum Creek. It is highly unlikely for sediment to remain suspended in surface runoff over that distance. Potential impacts are only likely to occur during rain event induced flows and are therefore short in duration and extent. Any potential impacts to aquatic habitats, downstream water users and waterway bed and banks from proposed activities will be unlikely, localised, short term and have only minor recoverable impact on water users and biota during the construction and operational phases of the Facility. The risk of environmental harm to aquatic habitats, downstream water users and waterway bed and banks of Crinum Creek is assessed as being very low.
Mitigation measures:	• Works will not commence until any relevant erosion and sediment control procedures have been approved by the Site Supervisor and are installed as required on significantly disturbed land • Clean stormwater to be diverted around disturbed land wherever practical • Erosion and sediment control structures will be inspected periodically as required and after rain events and maintenance carried out where required • The duration that disturbed soils are exposed to the erosive forces of wind rain and flowing water will be minimised • Progressive rehabilitation will be undertaken where appropriate

Potential impact:	**Transport of contaminants to waters**
Risk & magnitude of impacts: Construction: VERY LOW Operation: LOW	Runoff during rainfall events may entrain chemicals or oils used in Facility operation if they have been spilled onto the gravel pad or escape containment. The small volume of potential contaminants stored on site and the relatively small volume of surface runoff waters anticipated at any one time demonstrate a low level of risk of contamination of waters.
Mitigation measures:	• All fuel, oil and chemicals are to be stored, transported and handled in accordance appropriate standards including AS 1940:2004 – The storage and handling of flammable and combustible liquids, AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers • Store limited volumes of chemicals and oils on site • Immediately clean up any spills and dispose of contaminated material at a suitable waste facility • Facility storage tanks will be self-bunded or contained within bunded areas of sufficient size to hold 120% of largest vessel storage capacity

	• Appropriate spill response equipment must be available on site and/or with vehicles, and regularly maintained • Containment bunds and/or sumps will be drained periodically of accumulated rainwater to prevent overflow and subsequent pollution of the surrounding land and watercourses. • In the event of a chemical, oil or fuel spill, the spill will be contained and cleaned up.

4.2 LAND

4.2.1 ENVIRONMENTAL VALUES

No prescribed environmental values have been identified relating to land for the Facility.

Based on the assessment of the existing environment, the environmental values of the land to be protected or enhanced are:

- the integrity of undisturbed land
- the stability of disturbed land ensuring it is non-polluting
- soil health, function and stability
- visual landscape
- the suitability of the land for continued agricultural use post-closure

4.2.2 EMISSIONS & RELEASES

Visual Assessment
Visibility modelling was undertaken based on Qld Government digital elevation model (25m grid), an observer height of 1.7m at the receiver and a Facility structure height of 3.6m. Modelling does not accommodate reduced visibility due to the presence of vegetation, nor does it accommodate impacts of small scale topographic features and man-made structures.

Results of the visibility modelling are shown in Table 13 and Figure 14, below.

The modelling identified areas of the Facility viewshed which have full, partial or no likely visibility of the proposed Facility. Results of the modelling demonstrate that:

- the full structure of the Facility may be visibility from 3 dwellings, the closest being 8.7km from the Facility (receiver # 17). Other receivers with full Facility visibility are owned by Kestrel Coal and are not inhabited.
- the Facility may be partially visible from 7 dwellings in the study area, the closest being 5.4km from the Facility

Receiver	Property Reference	Receiver Type	Distance from Facility (m)	Facility Visibility		
				None	Partial	Full
1	Langley Downs	dwelling	5,113	•		
2	Larundel	dwelling	5,409		•	
3		dwelling	6,117		•	
4		dwelling	7,403	•		
5	Gordon Downs	workers cottage	7,639			•
6	Chellinlee	dwelling	7,653	•		
7	Gordon Downs	workers cottage	7,676			•
8	Gordon Downs	dwelling	7,825			•
9	*Kestrel Mine*	*mine buildings*	*7,868*			•
10	Kalarah	dwelling	8,031	•		
11	Kalarah	workers cottage	8,150	•		
12	Oasis	dwelling	8,312	•		
13	Yapunya	dwelling	8,436	•		
14	Banyula	dwelling	8,454	•		
15		dwelling	8,507		•	
16	Melaleuca	dwelling	8,739		•	
17	Kelam	dwelling	8,774			•
18		dwelling	8,800	•		
19	Wilgavale	dwelling	9,293	•		
20	Werrina Downs	dwelling	9,395	•		
21	Yellowwood Park	dwelling	9,678			•
22		dwelling	9,924	•		
23		dwelling	10,014	•		
24	Karcalamb	dwelling	10,339	•		
25		dwelling	10,379	•		
26		dwelling	10,412	•		
27	Kevricia	dwelling	10,646			•
28	Wanditta	workers cottage	11,524	•		
29	Wanditta	workers cottage	11,593	•		
30	Lara	dwelling	12,018	•		
31	Wanditta	dwelling	12,804	•		

Table 13: Facility distance and visibility from identified receivers

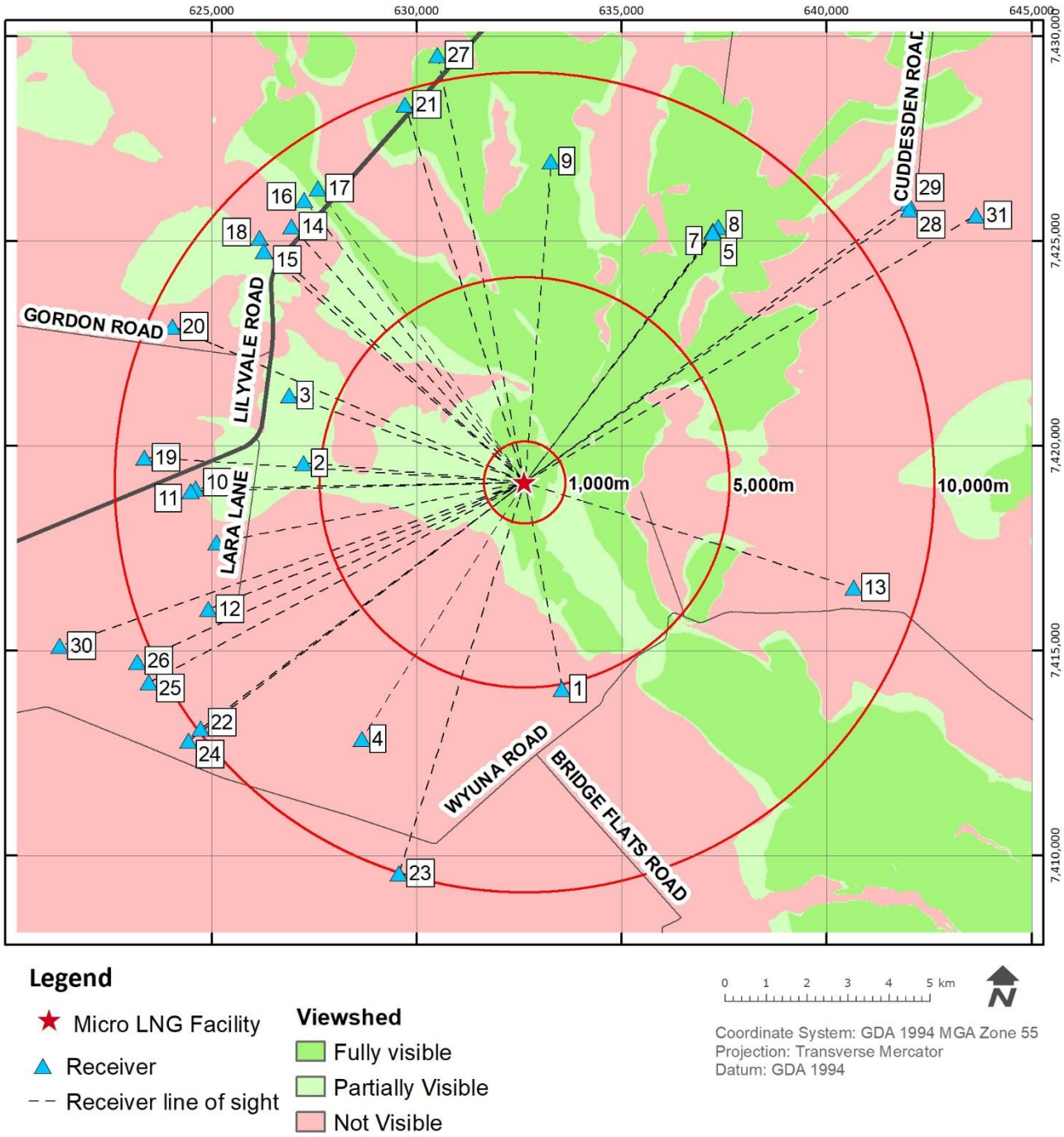

Figure 14: visibility analysis of the Facility (3.6m high) from potential receivers (1.7m high)

4.2.3 POTENTIAL IMPACTS, RISK & MITIGATION MEASURES

Details of potential impacts, their risk to the land environment and measures to further minimise impacts are presented below.

Potential impact:	**Disturbing visual amenity**
Risk & magnitude of impacts: Construction: LOW Operation: LOW-MOD	The Facility may impact on the visual amenity of the landscape. The Facility comprises modular equipment which may be visible at a distance. The overall risk of visual impacts is relatively low due to the remote location of the Facility, which is located 5.4km from the nearest dwelling with line of sight to at least part of the Facility and 6.7km from the nearest public road with line of sight to at least part of the Facility. The Facility is also small in size (70x60m area), reducing its visibility over long distance. During construction, impacts on visual amenity will be low due to the short duration of works and the long distance from potential receivers. The risk of impacts during operation is assessed as low to moderate, with the slight increase due to the 7+ year tenure of the site and frequency tanker truck movements (1-2 per day) over that time period.
Mitigation measures:	Due to the relatively low impact and risk, no measures are proposed to mitigate potential impacts on visual amenity at this time.

Potential impact:	**Use of strategic cropping land**
Risk & magnitude of impacts: Construction: LOW Operation: LOW	The Facility is located on land classified as "Strategic Cropping Land" currently used for ancillary coal mining operations and cattle grazing, and therefore has potential to impact on the future use of land. Construction and operation of the Facility will impact around 5,200m^2 of land and will remove this area from agricultural purposes (mainly grazing) during the 7+ year tenure of the Facility. The small area of the Facility in the local land context and its non-permanent nature ensure that the risk and magnitude of any impact is low.
Mitigation measures:	• Minimise Facility footprint where possible to reduce the area of land impacted • Avoid interference with the soil profile where possible (eg use of a reinforced floating gravel hardstand – see Section 2.4) • Ensure that rehabilitation of the site includes ripping up areas subject to potential soil compaction • Return Facility site to a condition suitable for future agricultural use and in consultation with the landholder

Potential impact:	**Integrity and stability of land**
Risk & magnitude of impacts: Construction: LOW-MODERATE	Installation of the Facility has potential to impact the stability and structural integrity of the land, particularly in areas disturbed by excavation or frequent heavy vehicle traffic.

Operation: LOW	Construction of the gravel hardstand and vehicle turning loop is the main period during which impacts to land integrity and stability may occur. The short duration of construction works and preferred hardstand construction methods will ensure that the risk and duration of impacts is low. Allowing for wet ground conditions, the risk of impacts may be low to moderate. During operation of the Facility, no further ground disturbing activities are planned and therefore the risk of impacts to land integrity and stability are low.
Mitigation measures:	• Avoid interference with the soil profile where possible (eg use of a reinforced floating gravel hardstand – see Section 2.4) • Avoid unnecessary works during, or immediately after, periods of heavy rainfall • The duration that disturbed soils are exposed to the erosive forces of wind rain and flowing water will be minimised • Progressive rehabilitation will be undertaken where appropriate • Works will not commence until any relevant erosion and sediment control procedures have been approved by the Site Supervisor and are installed as required on significantly disturbed land

4.3 AIR

4.3.1 ENVIRONMENTAL VALUES

The environmental values of the air environment for the Facility that are to be enhanced or protected as required by the *Environmental Protection (Air) Policy 2019* (EPP Air) are prescribed as follows:

- the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems
- the qualities of the air environment that are conducive to human health and wellbeing
- the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property
- the qualities of the air environment that are conducive to protecting agricultural use of the environment

Air quality goals as described in Schedule 1 of the EPP Air for air pollutants relevant to the proposed Facility are shown in Table 14, below.

Indicator	Environmental Value	Air Quality Objective	Averaging Period	Allowable Exceedances
NO_2	Health & wellbeing	250 µg/m^3	1 hour	1 day/year
		62 µg/m^3	1 year	-
	Health & biodiversity of ecosystems	33 µg/m^3	1 year	-
CO	Health & wellbeing	11 mg/m^3	8 hours	1 day/tear

Table 14: relevant air quality goals of the Environmental Protection (Air) Policy 2019

4.3.2 EMISSIONS & RELEASES

Short-term construction activities have the potential to result in the generation of fugitive dust emissions and combustion-related pollutants due to emissions from diesel fuelled construction equipment and vehicles.

Point Source Emissions

Field gas will be used to power plant and equipment installed at the Facility. Table 15 describes the induvial point emission sources and estimated cumulative total emissions for Stage 1 and Stage 2 of the Facility operating at 100% load on a 24/7/365 basis. Emissions parameters for each key plant unit is presented in Table 16.

Estimated facility emissions are calculated based on the installation of Oxidation Catalyst installed in line with the exhaust system of each plant unit and helps lower engine emissions through chemical reactions that convert carbon monoxide, hydrocarbons and aldehydes into carbon dioxide and water.

Pollutant	Point emissions per unit (t/annum)			Estimated Facility emissions	
	Inlet booster (MicroBox)	Electrical Generator	Cryogenics (CryoBox)	Stage 1 emissions (t/annum)	Stage 1+2 emissions (t/annum)
Oxides of Nitrogen (NO_X)	0.60	2.10	1.05	5.85	10.65
Carbon Monoxide (CO)	0.89	2.10	1.58	7.73	14.40
VOC	0.30	1.31	0.53	3.19	5.72
Sulphur Dioxide (SO_2)	0.01	0.01	0.01	0.05	0.10
PM_{10}	0.10	0.22	0.18	0.86	1.62
$PM_{2.5}$	0.10	0.22	0.18	0.86	1.62
Methane	12.75	27.83	22.50	108.07	202.22
Carbon Dioxide (CO_2)	1,328.37	2,449.08	2,344.18	10,809.98	20,395.41
Total CO_2-e/annum	*1,647.74*	*3,146.30*	*2,907.78*	*13,517.38*	*25,461.61*

Table 15: Facility point source emissions

Source	Number of Units		Stack height (m)	Stack diameter (m)	Exhaust velocity (m/s)	Exhaust temp (°C)	Fuel use rate (m^3/hr)	Specific emissions per unit (g/s)	
	Stage 1	Stage 1+2						NOx (µg/s)	CO (mg/s)
Inlet booster	1	1	3.6	0.1	20	350	72.5	19000	28
Electrical generator	1	1	3.6	0.1	25	350	158.3	67000	67
Cryobox	3	6	3.6	0.1	25	350	128.0	33000	50
Flare (upset only)	1	1	3.6	2.4x6.0	15	1,200			

Table 16: Facility units stack & emission data (specific emissions after Oxidation Catalyst installed)

Exhaust pollutant concentrations at a receptor located 5km from the Facility were estimated using a Gaussian plume model at stable atmospheric conditions. The calculated NOx and CO concentrations at a receptor located 5km from the Facility (Table 17) are well below the EPP Air quality objectives (Table 14).

Exhaust plume dispersion calculations (Table 17) suggest that the full sized Facility (Stage 1 + Stage 2) is likely to result in the following NOx and CO concentrations at the closest receptor:

- total NOx concentration of 0.6700 µg/m^3 (well below the EPP Air objectives of 33 µg/m^3)
- total CO concentration of 0.0009 mg/m^3 (well below the EPP Air objective of 11 mg/m^3)

	Cumulative facility emission rates	
Stage	**NOx (µg/s)**	**CO (mg/s)**
Stage 1	185,000	245
Stage 1+2	284,000	395

	Receptor concentration @ 5km	
Stage	**NOx (µg/m³)**	**CO (mg/m³)**
Stage 1	0.4364	0.0006
Stage 1+2	0.6700	0.0009

Model Parameters		
Wind speed:	5.0	m/s
Receptor distance:	5,000	m
Cross-wind dispersion parameter:	300	m
Vertical dispersion parameter:	90	m
Atmospheric stability:	Neutral (D)	

Table 17: exhaust dispersion calculation

Fugitive Greenhouse Gas Emissions

Incidental mine gas (IMG) will be delivered by the mine operator to the Facility battery limit. Fugitive emissions upstream of the battery limit are part of mine operations and are not part of the proposed Facility operations.

Fugitive emissions relating to the Facility may be generated from two potential sources. Estimates of the volume of fugitive emissions (in tonnes CO2-e/annum) are provided in Table 18. These are considered to be an upper estimate.

Fugitive Emission Source	Estimated Annual Fugitive Emissions ($t\ CO_2$-e/annum)		Description
	Stage 1	Stage 1+2	
Leakage from pipe fittings:	131	219	Estimate based on the number and type of connections, valves and seals in accordance with the *Protocol for Equipment Leak Emission Estimates* (US EPA)
Discharge of CO_2 filtered out of the inlet gas stream:	1,512	3,024	Estimate based on the upper limit of forecast CO_2 concentration in inlet gas. During gas filtration in the ZPTS unit, CO_2 is removed from gas stream. This CO2 waste is either vented or injected into the engine fuel line.
Total annual fugitive emissions (upper estimate):	1,643	3,242	

Table 18: estimated fugitive emissions from the Facility

Boil-off of stored LNG generally occurs at a rate of around 0.2% after 52 days in the cryogenic storage tanks proposed. Any LNG boil-off produced is recycled through the cryogenic units by design to minimise fugitive emissions. Frequent export of LNG from site (every 1-2 days) will further reduce the likelihood of boil-off occurring.

Net Greenhouse Gas

Overall, the Facility is expected to deliver a tangible reduction in net greenhouse gas emissions. Whilst the Facility will produce its own generation and fugitive emissions, reductions are expected to be felt both at the mine site and at end user facilities (depending on the end use of LNG).

Due to overall reduction in emissions, the Proponent will seek to register the Facility as a carbon abatement project under the *Emissions Reduction Fund* (Federal).

There are three main types of emissions related to the Project:

1. **Emissions created by the Project**. Emissions generated by the Facility are (a) through the use of electrical energy required to refrigerate and compress feedstock gas; and (b) fugitive CO2 emissions which is filtered from the inlet gas stream. These GHG emissions are referred to as **Project Scope 2 Emissions** and will be incurred by OEG.

LNG Production Emissions	Stage 1	Stage 1+2	
LNG Production	15,225	30,450	t LNG/annum
(350 days operation per annum)	833,681	1,667,363	GJ/annum
Energy used in LNG production	100,042	200,084	GJ/annum
Project Scope 2 Emissions CREATED (a) emissions generated by LNG production	**10,809**	**20,395**	**t CO_2-e/annum**
Project Scope 2 Emissions CREATED (b) fugitive emissions of CO_2	**1,512**	**3,024**	**t CO_2-e/annum**

2. **Emissions avoided by the mine site**. As a large proportion of the mines gas is converted to LNG, thereby removing those related emissions from the **Mine Scope 1 Emissions** inventory. The mine has emissions from three main sources: pre-drainage, post-drainage, and ventilation. The Project uses pre-drainage gas from SIS wells and will remove around 42% of flared SIS emissions in Stage 1, and 83% in Stage 2.

Mine Site Emissions Saving	Stage 1	Stage 1+2	
Current emissions from SIS	106,658		t CO_2-e/annum
Mine Scope 1 Emissions AVOIDED (emissions avoided by LNG production)	**44,293**	**88,587**	t CO_2-e/annum
% reduction in SIS Pre-Drainage emissions	**42%**	**83%**	
Note: the mine has other emission sources in addition to the SIS Pre-Drainage			

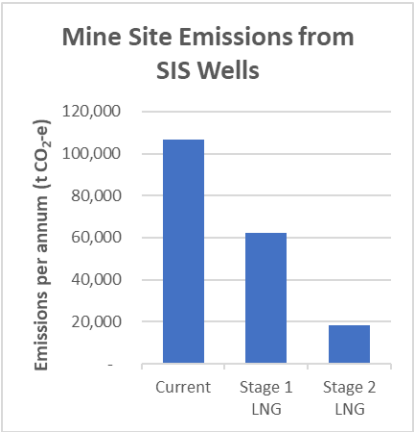

Figure 15: reduction in pre-drainage SIS related emissions from staged LNG project

3. **Emissions avoided by end-users**. Using LNG to displace higher-emitting traditional fuels (such as diesel, LPG, kerosene) has potential to deliver reduced **Client Scope 2 Emissions** depending on the

application. By displacing other fuels with LNG, end users (clients) can achieve up to a 26% reduction in fuel-based GHG emissions.

End-User Emissions Saving	Stage 1	Stage 1+2		
Energy used (ie total LNG produced)	833,681	1,667,363	GJ/annum LNG replacing other fuels	
Client Scope 2 Emissions (emissions generated by the consumption of LNG by end users)	42,851	85,702	t CO_2-e/annum	
Emissions generated by equivalent consumption of traditional fuels				**Reduction in emissions when using LNG**
Diesel	58,274	116,549	t CO_2-e/annum	**26%**
Client Scope 2 Emissions **AVOIDED**	**15,423**	**30,846**	t CO_2-e/annum	
LPG	50,188	100,375	t CO_2-e/annum	**15%**
Client Scope 2 Emissions **AVOIDED**	**7,336**	**14,673**	t CO_2-e/annum	
Kerosene	57,441	114,881	t CO_2-e/annum	**25%**
Client Scope 2 Emissions **AVOIDED**	**14,589**	**29,179**	t CO_2-e/annum	
Note: emissions calculated from NGER Emissions Factors (2008)				

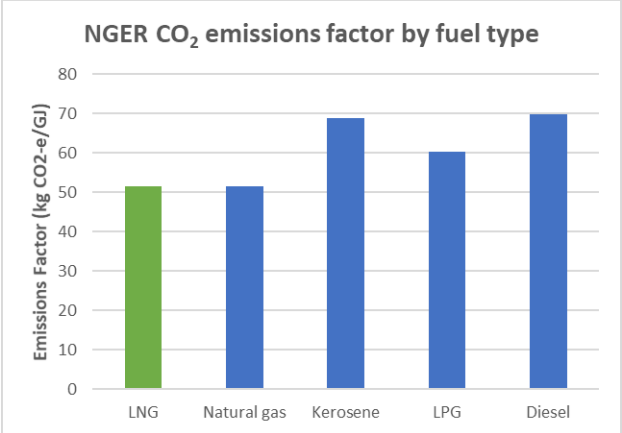

Figure 16: CO_2 emissions factor by fuel type (NGER, 2008)

4.3.3 POTENTIAL IMPACTS, RISK & MITIGATION MEASURES

Details of potential impacts, their risk to the air environment and measures to further minimise impacts are presented below.

Potential impact:	**Dust generation during construction & operation**
Risk & magnitude of impacts: Construction: LOW Operation: LOW	The Facility generates no dust from its operations, however the access road is unsealed and could be expected to generate dust from the passage of vehicles accessing the Facility during both construction and operation during dry conditions. Due to the limited duration of construction activities (<1 month per stage), impacts associated with dust during construction are anticipated to be low. Due to the small number of heavy vehicle movements (1 tanker per day per stage) the impacts associated with dust during operations on the air environment are

	expected to be low throughout the term of the operation if the following mitigation measures are taken.
Mitigation measures:	• Staff and contractors to be made aware through general site induction and training of the potential to generate dust emissions and mitigation and management measures that should be implemented. • Vehicles, plant and machinery must comply with site-specific speed limits to minimise dust generation. • During operations, disturbed areas and access roads may be watered using a water cart/truck on an as-required basis to minimise the potential for environmental nuisance due to dust.

Potential impact:	**Exhaust emissions during construction & operation**
Risk & magnitude of impacts: Construction: LOW Operation: LOW-MODERATE	Equipment used during contraction and installation of the Facility produce exhaust emissions from diesel engines which have potential to impact the quality of the air environment. Due to the short duration of construction/installation activities, the risk of exhaust emissions on the air environment is considered low. During operation, on-board gas engines on Facility plant will produce exhaust emissions (see Table 15 and Table 16). Installation of oxidising catalytic converters on engine exhaust has a control efficiency of 97-98% for NOx and CO emissions and ensure that emissions to the air environment are greatly minimised. The intensity of exhaust emissions in low, however since the Facility will operate for a +7 year period, the risk of impacts from exhaust emissions on the air environment is considered to be low to moderate.
Mitigation measures:	• Regular vehicle, plant and equipment maintenance to ensure all machinery is in good working order and does not generate excessive air emissions. Plant and equipment operated in their proper and effective condition. • Operate machinery in a fuel-efficient manner and not be left idling longer than required. • Install oxidising catalysts on gas engine exhaust • Subject to feasibility, the Proponent may employ LNG-fuelled prime movers to deliver LNG tankers to end users. This has potential to reduce GHG content of related exhaust emissions by 30% as well as reducing particulate and NOx emissions.

Potential impact:	**Fugitive GHG emissions to atmosphere**
Risk & magnitude of impacts: Construction: NIL Commissioning: LOW-MOD Operation: LOW	No natural gas will be used during construction phase, resulting in no risk of potential impacts. Commissioning of the Facility will use natural gas feedstock to test generators, engines and LNG compression plant. Whilst there may be some fugitive emissions generated during this phase, the very short duration (<24 hours per unit) of commissioning ensures that the magnitude of emissions is considered low to moderate. Normal operation of the Facility will result in some greenhouse gas emissions, mainly from the venting of CO_2 filtered from the inlet gas stream (Table 18). Since this CO_2 would have previously been vented as Incidental Mine Gas from the mine, these

	fugitive emissions are not new emissions. The objective of the Facility is to reduce both resource waste and GHG emissions, and by design results in net negative emissions. As such the risk of the Facility contributing to fugitive emissions to the air environment is low (or arguably, negative).
Mitigation measures:	• The Proponent will investigate engineering options to route gas filtration (ZPTS) exhaust into the gas engine fuel line to further reduce the emissions intensity of the filtration exhaust. • The Proponent will investigate engineering solutions to capture high CO_2 exhaust from the ZPTS plant as a by-product to LNG. This may be installed pending technical feasibility.

Potential impact:	**Visual amenity from operation of flares**
Risk & magnitude of impacts: Construction: NIL Operation: LOW	Flaring of natural gas produces flames which can be a visual nuisance on the environment, particularly at night. The flare will be used only during upset operations to provide a safe and lower emissions means to dispose of methane gas in the event of a system purge. This event is expected to occur infrequently over the project life, resulting in low risk of impacts on visual amenity. Since the Facility consumes incidental mine gas that would usually be flared by the coal mine operator, the operation of the Facility will actually reduce the amount of flaring and therefore the amount of flare-related visual pollution.
Mitigation measures:	• A horizontal enclosed flare will be used. The flare manifold is horizontal (like a BBQ), resulting in hundreds of low-level flames rather a single large flame. Flames are hidden from external observation by the container, thereby reducing or eliminating the likelihood of visible flames. An example of the Proponents existing flares is shown. 

Potential impact:	**Light emissions from the Facility**
Risk & magnitude of impacts: Construction: VERY LOW Operation: LOW	Construction activities are planned to be conducted during daylight hours resulting in little to no potential light pollution during this phase of work. The Facility may generate low levels of light during night-time operations for safety reasons. However, the Facility operated mostly autonomously and attended operations (such as LNG truck shipments and maintenance) occur during daylight hours. As such, the need for bright flood lighting at the Facility is low. As described in section 4.2.2, sensitive receivers with line of sight to the Facility are few in number and at large distance from the Facility. Whist there may be some unmitigated light pollution during operations, we have assessed the risk of nuisance light pollution on nearby receivers as low.
Mitigation measures:	In the event that mitigation of light sources is required, the following may be implemented: • Orient light sources away from receivers.

	• Install light shielding or shrouds where necessary.

Potential impact:	**Odour emissions from the Facility**
Risk & magnitude of impacts: Construction: LOW Operation: VERY LOW	Potential sources of odour during construction are limited to the combustion of diesel by machinery to be used. Due to the limited duration of construction activities (<1 month per stage), impacts associated with exhaust-related odour during construction are anticipated to be low. Odour-related nuisance from operation the Facility is highly unlikely due to the lack of odour causing substances. The risk of odour nuisance from Facility operation is very low. Inlet gas contains no measurable hydrogen sulphide (H_2S). Mercaptan gas, used as a deliberate odorant additive to natural gas, will not be used in the Facility due to its impact on cryogenic efficiency.
Mitigation measures:	• Monitor hydrogen sulphide concentration of inlet gas on an ongoing basis.

4.4 ACOUSTIC

4.4.1 ENVIRONMENTAL VALUES

The noise environmental values for the Facility that are to be enhanced or protected as required by the *Environmental Protection (Noise) Policy 2019* (EPP Noise) comprise:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems
- The qualities of the acoustic environment that are conducive to human health and wellbeing, including the individual's opportunity to have sleep, relaxation, and conversation without unreasonable interference from intrusive noise
- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Acoustic quality objectives relevant to the proposed Facility are described in Schedule 1 of the EPP Noise.

Acoustic quality objectives as described in Schedule 1 of the EPP Noise relevant to the proposed Facility are shown in Table 19, below.

Sensitive receptor	**Time of day**	**Acoustic quality objectives (dBA)**			**Environmental value**
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Residence (for outdoors)	Daytime & evening	50	55	65	Health & wellbeing

Table 19: relevant acoustic quality objectives of the *Environmental Protection (Noise) Policy 2019*

The following acoustic descriptors define the acoustic quality objectives (Table 19) at the receiver:

- $L_{Aeq,adj,1hr}$ means an A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within a 1 hour period has the same mean square sound pressure of a sound that varies with time.
- $L_{A10,adj,1hr}$ means the A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 10% of a 1 hour period when measured using a fast standardised response time.
- $L_{A1,adj,1hr}$ means the A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 1% of a 1 hour period when measured using a fast standardised response time.

4.4.2 EMISSIONS & RELEASES

Noise will be generated during both construction and operational phases of the Facility. Noise can be constant or occur intermittently over the short or long term.

Noise Generated During Construction
During site construction and installation of the Facility components, noise will be generated from machinery used in the preparation of the gravel pad and access road and from machinery used to deliver and place pre-fabricated Facility plant. Hand tools may be used to complete the installation.

The following observations are made regarding the timing and duration of noise generating construction activities:

- Noise generating machinery are listed in Table 20
- Construction/installation activities will occur during daylight hours, unless specifically agreed in writing by the landholder
- Duration of works for the construction of the gravel pad is approximately 8 days depending on ground conditions.
- Duration of installation works for each Facility stage (similar scope of work for each stage) is approximately 2 weeks.

Earthworks/Civil works	
Plant	**Individual Sound Power Level (dBA)**
Grader	106
D7 Dozer	105
Tipper	106
Bobcat	98

Construction/Installation	
Plant	**Individual Sound Power Level (dBA)**
Semi-trailers (delivery)	108
Crane	102
Hand tools	90

Table 20: noise emission sources during construction

Noise Generated During Operation
Noise generated during the operational phase of the Facility was considered a potential environmental risk factor. Accordingly, a Noise Assessment was carried out by Behrens & Associates Inc. for the proposed Facility using noise data from a similar operational site located in Pennsylvania, USA.

The noise assessment undertaken by Behrens & Associates is presented in **Appendix 3: Noise Assessment by Behrens & Associates.**

The noise modelling results (Table 21) indicate that the calculated $L_{Aeq,adj,1hr}$, $L_{A10,adj,1hr}$ and $L_{A1,adj,1hr}$ sound levels comply with the *Environmental Protection (Noise) Policy 2019* noise limits for Stage 1 as well as Stage 1 and 2 Facility operations. No adjustments were made for tonality as no tonal characteristics were identified. The predicted noise levels represent only the contribution of the Facility and do not include ambient noise or noise from other operations in the area.

Receiver	Distance from Facility (m)	Line of Sight to Facility	Stage 1: Predicted Sound Pressure Level			Stage 1 and 2: Predicted Sound Pressure Level		
			$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$
1	5,113	None	29.7	31.2	32.5	31.7	33.2	34.5
2	5,409	Partial	29.9	31.4	32.7	32.3	33.8	35.1
3	6,117	Partial	27.4	28.9	30.2	29.7	31.2	32.5
4	7,403	None	23.8	25.3	26.6	25.6	27.1	28.4
5	7,639	Full	23.7	25.2	26.5	25.5	27.0	28.3
6	7,653	None	23.8	25.3	26.6	26.1	27.6	28.9
7	7,676	Full	23.6	25.1	26.4	25.4	26.9	28.2
8	7,825	Full	23.4	24.9	26.2	25.2	26.7	28.0
9	7,868	Full	24.9	26.4	27.7	26.8	28.3	29.6
10	8,031	None	23.6	25.1	26.4	26.0	27.5	28.8
11	8,150	None	23.3	24.8	26.1	25.7	27.2	28.5
12	8,312	None	22.4	23.9	25.2	24.6	26.1	27.4
13	8,436	None	22.0	23.5	24.8	24.1	25.6	26.9
14	8,454	None	21.7	23.2	24.5	23.8	25.3	26.6
15	8,507	Partial	21.6	23.1	24.4	23.8	25.3	26.6
16	8,739	Partial	21.3	22.8	24.1	23.3	24.8	26.1
17	8,774	Full	21.2	22.7	24.0	23.2	24.7	26.0
18	8,800	None	21.0	22.5	23.8	23.2	24.7	26.0
19	9,293	None	21.1	22.6	23.9	23.5	25.0	26.3
20	9,395	None	20.4	21.9	23.2	22.7	24.2	25.5
21	9,678	Full	19.7	21.2	22.5	21.6	23.1	24.4
22	9,924	None	19.2	20.7	22.0	21.3	22.8	24.1
23	10,014	None	18.8	20.3	21.6	20.8	22.3	23.6
24	10,339	None	18.5	20.0	21.3	20.6	22.1	23.4
25	10,379	None	18.7	20.2	21.5	20.9	22.4	23.7
26	10,412	None	18.6	20.1	21.4	20.9	22.4	23.7
27	10,646	Full	18.1	19.6	20.9	20.0	21.5	22.8
28	11,524	None	16.9	18.4	19.7	18.7	20.2	21.5
29	11,593	None	16.8	18.3	19.6	18.6	20.1	21.4
30	12,018	None	16.2	17.7	19.0	18.5	20.0	21.3
31	12,804	None	15.1	16.6	17.9	17.0	18.5	19.8
Residential Night-time Noise Limits (EPP Noise, Schedule 1)			$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$
			45.0	50.0	55.0	45.0	50.0	55.0

Table 21: A-weighted noise modelling results (dBA)

4.4.3 POTENTIAL IMPACTS, RISK & MITIGATION MEASURES

The Facility will be operated in a way that protects the environmental values of the acoustic environment. In general, the release of sound to the environment from the Facility will be managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

Details of potential impacts, their risk to the acoustic environment and measures to further minimise impacts are presented below.

Potential impact:	**Excessive noise levels at sensitive receivers**
Risk & magnitude of impacts: Construction: VERY LOW Operation: MODERATE	Noise generated during construction is limited to heavy machinery involved in hardstand/access construction and the delivery/installation of plant. Due to the daylight hours of operation during construction and the short duration of construction activities, the risk of excessive noise at sensitive receivers is considered low. During operations, plant at the proposed Facility generate noise, primarily from on-board gas engines and will operate on a nominal 24/7 basis. Noise level modelling at receivers suggests that unless some noise attenuating measures are taken, levels of 30dBA may be recorded during operation. However, these levels are considered by the proponent to be the upper limit of noise each receiver may experience before topographic and mitigation measures are considered. The risk of excessing noise at receivers is considered moderate during operations.
Mitigation measures:	• Orientation: noise generating components will be orientated to reduce directional noise emitted toward nearby receivers. • Attenuation: additional noise attenuation components, such as enclosures and exhaust silencers, will be installed on the equipment where possible. • Barriers: in the event that further noise mitigation measures are required, external barriers may be installed. • Monitor: if complaints or consultation with nearby stakeholders present an issue with noise relating to Facility, receiver noise monitoring will be conducted.

4.5 WASTE MANAGEMENT

4.5.1 ENVIRONMENTAL VALUES

Although there are currently no prescribed environmental values for waste management, those previously prescribed under the *Environmental Protection (Waste Management) Policy 2000* (repealed) provide some guidance on the matter. The former environmental values for waste were:

- the life, health and wellbeing of people
- soil, air, and surface and groundwater quality
- land use capability, having regard to economic considerations.

4.5.2 EMISSIONS & RELEASES

The Facility will make no release of waste to the surrounding environment.

4.5.3 POTENTIAL IMPACTS, RISK & MANAGEMENT PRACTICES

It is not envisaged that the proposed activities will generate significant quantities of waste. Measures will be implemented so that waste is minimised and managed in accordance with general waste and resource management principles, including the Waste and Resource Management Hierarchy set out in section 9 of the *Waste Reduction and Recycling Act 2011*.

The proponent has considered the types of waste that will be generated by the proposed Facility during both Stage 1 and Stage 2. These are presented in Table 22, below.

Waste Stream	Description	Annual Volume	Management Practice
General waste	Domestic rubbish	Minor	Recycled where practical otherwise disposed to landfill.
Mechanical consumables	Engine filters, oil filters, spark plugs, oily rags, O-rings, gaskets	~130 filters ~85 spark plugs ~60 seals/gaskets	
Engine oils	Oils replaced during maintenance	~12,000 L	Transported by appropriately licensed transporter to an appropriately licensed recovery/recycling/disposal facility
Chemical & oil containers	Containers including plastic fuel, and lubricant containers		
Contaminated soil & spill kits	Where spills of hydrocarbons or other contaminants occur	None during normal operations	

Table 22: types, volumes and management practices of waste generated by the Facility

Prior to transport offsite, waste generated by the Facility will be appropriately stored in weather-proof containment to mitigate against potential contamination of the environment. Most waste will be generated during routine monthly and quarterly servicing of equipment within the Facility and will generally be removed from site at the end of each maintenance service. Records will be kept of all contaminants bought to site and waste removed from site. Disposal of engine oils will be prioritised to ensure that as much oil is recycled or recovered as practicable. No land is anticipated to be contaminated during operation of the Facility.

4.6 MATTERS OF STATE ENVIRONMENTAL SIGNIFICANCE

The *Significant Residual Impact Guidelines* (DEHP, 2014) provides criteria (and thresholds) to determine if the proposed activities will likely cause a significant residual impact. Relevant criteria and outcomes of an assessment of residual impact are summarised in Table 23, below.

MSES	Relevance to Facility	Significant Residual Assessment
REGULATED VEGETATION		
Prescribed regional ecosystems (endangered)	No regional ecosystems will be disturbed by the facility	N/A Not impacted by facility
Prescribed regional ecosystems (of concern)	No regional ecosystems will be disturbed by the facility	N/A Not impacted by facility
Prescribed regional ecosystems that intersect a wetland on the vegetation management wetlands map	No regional ecosystems will be disturbed by the facility	N/A Not impacted by facility

MSES	Relevance to Facility	Significant Residual Assessment
Prescribed regional ecosystems that intersect an area of essential habitat on the essential habitat map for an animal or plant that is endangered or vulnerable wildlife	No regional ecosystems will be disturbed by the facility	N/A Not impacted by facility
Prescribed regional ecosystems within the defined distance from the defining banks of a relevant watercourse on the vegetation management watercourse map	No regional ecosystems will be disturbed by the facility	N/A Not impacted by facility
CONNECTIVITY AREAS		
Prescribed regional ecosystem that is a connectivity area	No regional ecosystems will be disturbed by the facility	N/A Not impacted by facility
WETLANDS AND WATERCOURSES		
A wetland in a wetland protection area or of high ecological significance shown on the Map of referable wetlands	No wetlands will be impacted by the facility	N/A Not impacted by facility
A wetland or watercourse in high ecological value waters	No wetlands or watercourses will be impacted by the facility	N/A Not impacted by facility
DESIGNATED PRESCINCTS IN STRATEGIC ENVIRONMENTAL AREA		
Designated precinct in a strategic environmental area	No designated precinct in a strategic environmental area will be impacted by the facility	N/A Not impacted by facility
PROTECTED WILDLIFE HABITAT		
An area of essential habitat on the essential habitat map for an animal or plant that is endangered or vulnerable wildlife	The facility will not impact on essential habitat	N/A Not impacted by facility
An area shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife	No plants that are endangered or vulnerable wildlife have been identified at the facility site	N/A Not impacted by facility
An area not shown as a high risk area on the flora survey trigger map that contains plants that are endangered or vulnerable wildlife	No plants that are endangered or vulnerable wildlife have been identified at the facility site	N/A Not impacted by facility
Habitat for an animal that is endangered wildlife, vulnerable wildlife or special least concern animal	The facility does not impact on habitat for an animal that is endangered wildlife, vulnerable wildlife or special least concern animal	N/A Not impacted by facility
KOALA HABITAT IN SEQ		
An area of essential habitat as identified on the essential habitat map	The facility does not impact on essential koala habitat areas	N/A Not impacted by facility
An area that is not mapped as habitat, but which contains, or is known to contain koalas	The facility does not impact on known koala habitat areas	N/A Not impacted by facility
PROTECTED AREAS		
National park	The facility does not impact on protected areas	N/A Not impacted by facility
Regional park		
Nature refuge		
HIGHLY PROTECTED ZONES OF STATE MARINE PARKS		
Conservation park zone	The facility does not impact on a marine park	N/A Not impacted by facility
Marine national park zone		
Preservation zone		
Other zones (eg buffer, scientific research)		
FISH HABITAT AREAS		
A declared fish habitat area	The facility does not impact on a fish habitat area	N/A Not impacted by facility
WATERWAY PROVIDING FOR FISH PASSAGE		

MSES	Relevance to Facility	Significant Residual Assessment
Any part of a waterway providing for passage of fish if the construction, installation or modification of waterway barrier works carried out under an authority will limit the passage of fish along the waterway	The facility does not impact on a waterway or create a waterway barrier	N/A Not impacted by facility
MARINE PLANTS		
Marine plant (not in an urban area)	The facility does not impact on marine plants	N/A Not impacted by facility
OFFSET AREAS		
Legally secured offset area	The facility does not impact on a legally secured offset area	N/A Not impacted by facility

Table 23: MSES impact criteria in relation to the proposed Facility

5 REHABILITATION

5.1 POST CONSTRUCTION

Upon completion of construction works, temporary infrastructure, equipment and waste will be removed from the site. Waste will be disposed of at the appropriate class landfill facility.

Rehabilitation work of areas disturbed during construction, and not required for the Facility operation, will aim to:

- reinstate contours
- minimise the potential for erosion
- minimise any impact on drainage patterns
- minimise weed establishment
- minimise the visual impact of the Facility
- assist vegetative regrowth
- minimise adverse impacts of the facility on the existing environment and land users.

Erosion and sediment control structures (diversion berms, sediment traps) may be installed or left in place to divert run-off away from potentially unstable areas.

Revegetation of disturbed areas will be subject to weed monitoring following construction as a part of ongoing operations. Weed control measures will be undertaken if required.

Temporary access tracks no longer required for ongoing operational activities will be reinstated to a condition compatible with the surrounding land use. This will generally involve ripping to remove compaction, re-spreading stockpiled topsoil and revegetating if required. Access tracks required to support the Facility operation will be maintained and rehabilitated in conjunction with rehabilitation of the Facility.

5.2 POST FACILITY DECOMMISSIONING

Following the decommissioning of the Facility, all infrastructure, plant and equipment will be removed from site except where it is to remain with the written agreement of the landholder.

Rehabilitation works will be undertaken following Facility decommissioning to achieve a landform that is:

- Compatible with the landholders written requirements
- As close as possible to the pre-construction state of the land (see Figure 7 to Figure 10)
- Safe to humans, livestock and wildlife
- Non-polluting
- Stable
- Able to sustain an appropriate land use after restoration.

Decommissioning of the Facility and rehabilitation of the land will be undertaken in accordance with the relevant provisions of the Petroleum Legislation and EA conditions.

The following activities will be conducted during rehabilitation:

1. Removal of all plant & equipment
2. Removal of all fencing and other barriers
3. Rip up the gravel pad, vehicle turning circle and any other affected area
4. Replace retained topsoil across the disturbed area in layers to match the soil profile
5. Area seeded with a species mix determined by the post-disturbance land use
6. Temporary runoff and sediment control measures will be installed if necessary during vegetation regrowth
7. Removal of all temporary rehabilitation-related fixtures.

Post rehabilitation monitoring will be undertaken in consultation with the landholder.

REPORT ENDS

6 APPENDIX 1: EPBC ACT PROTECTED MATTERS REPORT

7 APPENDIX 2: MSES REPORT

8 APPENDIX 3: NOISE ASSESSMENT BY BEHRENS & ASSOCIATES