Arckaringa Basin Exploration Activities

Environmental Impact Report

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1. Introduction

Australian Carbon Vault (ACV) is the holder of Gas Storage Exploration Licences (GSELs) 794, 795, 796, 797, 798, 799, 800 and 801 under the Energy Resources Act 2000 (ER Act).

There is a portion of GSEL 795 located to the west of the Licence Area, NW of Coober Pedy, which is excluded from the Licence Area and for the purposes of this Environmental Impact Report (EIR).

D3 Energy Limited (D3) through its 100% owned company Unleash Energy Pty Ltd is the holder of Petroleum Exploration Licences (PELs) 121 and 122 (which cover the same area as GSELs 794-798) under the ER Act.

The GSELs and PELs are all located in the Arckaringa Basin in northern South Australia (Figure 1-1) and collectively will be referred to as the Licence Area throughout this document.

ACV and D3 are planning to undertake exploration activities under the ER Act in the Licence Area. ACV plans to undertake drilling and an extended Carbon Dioxide (CO_2) injectivity pilot program. D3 plans to initially undertake 2D seismic survey to assess the potential for hydrogen and helium resources and will then undertake subsequent exploration drilling. ACV and D3's activities are referred to as 'proposed activities' throughout this document.

This Environmental Impact Report (EIR) has been prepared as a requirement of the ER Act to provide information on the proposed activities, the potential environmental impacts and their management.

1.1 Location

The Arckaringa Basin is located 800 km northwest of Adelaide in South Australia and covers an area of approximately 80,000 km^2 (Figure 1-1).

The Arckaringa Basin contains early Permian–age sediments that are analogous to the Cooper Basin oil and gas productive areas but at shallower depths. The main formations that have historically been of interest for exploration activities (for petroleum) are the Mt Toondina (source, reservoir and seal), the Stuart Range (source and seal) and Boorthanna (source, reservoir and some seal). These formations are underlain by Proterozoic basement rocks within the Gawler Craton, which are recognised as potential sources for hydrogen and helium.

The Boorthanna Formation sandstones and the Mt Toondina Formation coals are the key formations of interest for CO_2 injection to evaluate future storage potential due to their high permeability and the presence of overlying seals.

The basement rocks underlying the Arckaringa basin are part of the Gawler craton, composed of three domains each of which could be sources of helium and hydrogen. Hydrogen (H_2) is formed by the serpentinization of ultramafic rocks rich in iron and magnesium (Mg^{2+}). The ferrous iron (Fe^{2+}) comes in contact with water and oxidises to ferric iron (Fe^{3+}) which releases H_2. Also, Mg^{2+} comes in contact with water to make Mg^{3+} which also releases H_2. The process requires a significant volume of water (fractured basement) plus ultramafic rocks (such as olivine $(Mg,Fe)_2SiO_4$) or amphiboles typically high in iron and magnesium for serpentinization to occur.

Helium and hydrogen can also be produced by naturally occurring radiolysis of water by radiation released in the radioactive decay of uranium, thorium and other radioactive rocks such as granite. The granitic and pegmatitic nature of the Mt Woods domain appears to be a good candidate for this process. The presence of the Olympic Dam Uranium mine to the south indicates there is an abundance of radioactive minerals in the area.

Previous exploration has been undertaken in the Arckaringa Basin between 2009 and 2015, targeting conventional and unconventional petroleum resources. SAPEX Pty Ltd initially assessed the coal seam gas potential of the Mount Toondina Formation coal measures. While extensive coal deposits exist in the area, gas saturation of the coals was generally found to be low. This is likely due to their low rank or other geological processes such as water flushing. Conventional petroleum exploration was also completed targeting structures within the Boorthanna Trough. These wells however were plugged and decommissioned due to the lack of valid pay within the target reservoir sections. The unconventional petroleum potential of the Stuart Range Shale in the Boorthanna Trough was also evaluated. While oil shows were recorded in the target rocks, the shales were not mature enough to form an unconventional reservoir.

1.2 Project Proponents

ACV is a South Australian-based company specialising in carbon dioxide removal and permanent geological storage. ACV is developing scalable, low-cost CO_2 injection solutions underpinned by innovative technology, strong governance, and a commitment to sustainability. The company's operations are designed to provide a permanent, economic solution to carbon emissions, contributing to both national and global climate change mitigation efforts.

ACV holds eight Gas Storage Exploration Licences (GSELs) located in the Arckaringa Basin in northern South Australia.

D3 Energy is an Australian-listed energy proponent engaged in the exploration and development of helium, hydrogen, and natural gas resources. With a flagship project in South Africa and newly acquired tenements in South Australia, the company is strategically positioned to supply critical gases to global markets. Its operations are guided by principles of sustainability, efficient resource development, and strong corporate governance, making D3 Energy a credible and forward-looking participant in the clean energy and industrial gas sectors.

1.3 About this Document

This document has been prepared to fulfil the requirements of an EIR in accordance with current legislative requirements, in particular Section 97 of the ER Act and *Energy Regulatory Guidelines PGRG015 Environmental Impact Assessment Criteria*.

This document is an update and revision of the previous EIRs developed for exploration drilling and geophysical activities in the Arckaringa Basin (SAPEX, 2020 and SAPEX, 2013). It also draws information from similar documents developed for the Cooper Basin, particularly Santos (2018).

A Statement of Environmental Objectives (SEO) has also been developed in conjunction with this document. The SEO outlines the environmental objectives for the Licence Area required to achieve and the criteria on which the objectives are to be assessed.

This document relates to the proposed activities to be carried out in the Licence Area (Figure 1-1).

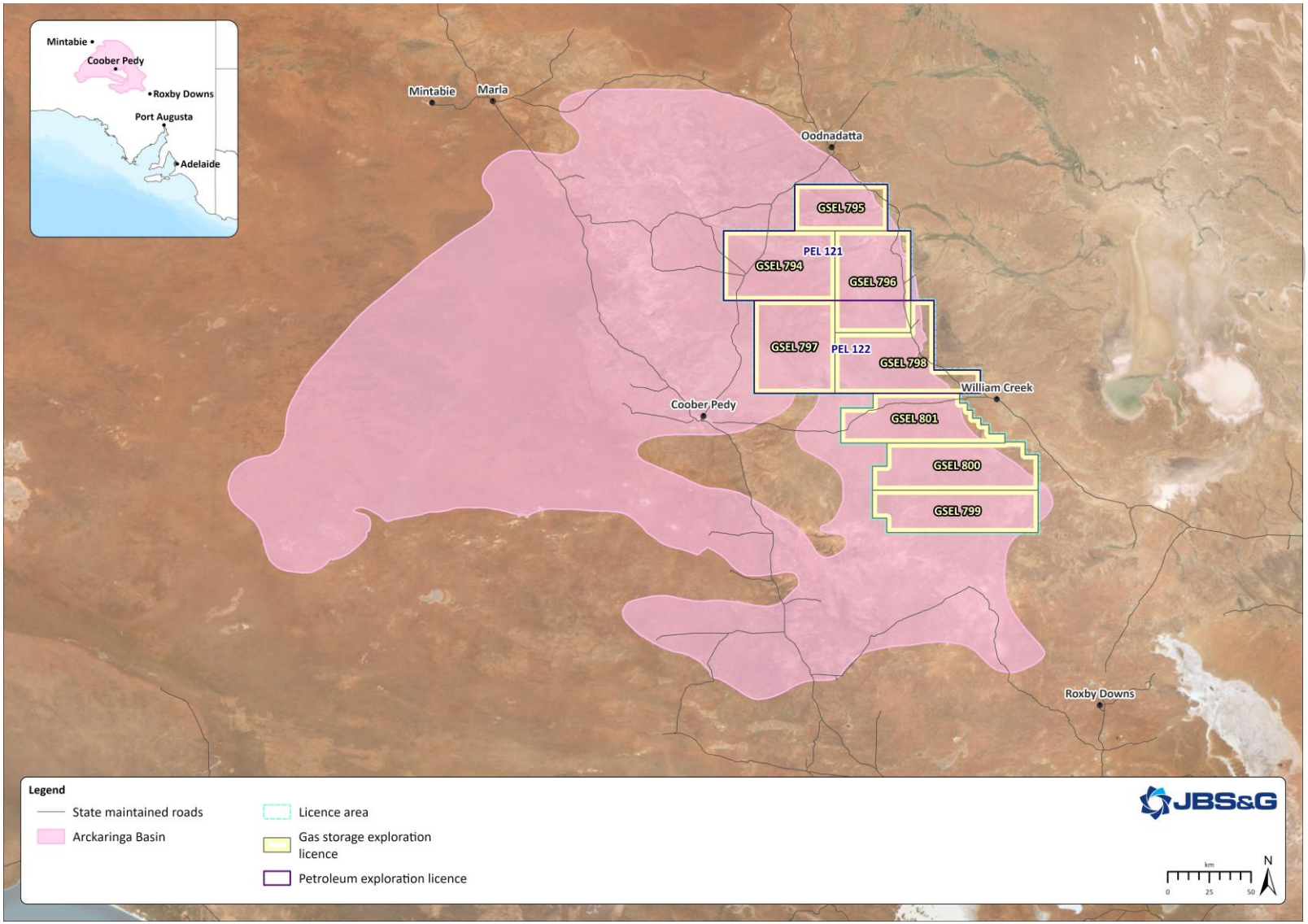


Figure 1-1: Arckaringa Basin and Licence Area

2. Legislative Framework

This section briefly describes the legislative framework that currently applies to activities regulated under the ER Act and *Energy Resources Regulations 2013* (ER Regulations) in South Australia. The legislation is administered by the Department for Energy and Mining (DEM), to ensure all activities under the ER Act occur in an environmentally, technical and economically responsible manner and align with leading practice.

2.1 Energy Resources Act

The ER Act was enacted on 11 April 2024, following amendments and a change in name, superseding the *Petroleum and Geothermal Energy Act 2000*.

The ER Act regulates exploration, production, transmission, and storage of energy resources. It establishes licensing requirements, environmental safeguards, and Crown ownership rights, ensuring that emerging energy activities are managed responsibly under South Australia's legislative framework.

Key objectives of the ER Act include:

- establishing an effective, efficient and flexible regulatory scheme to enable the exploration for, and the recovery, production, transmission, storage and management of energy resources that encourages and maintains an appropriate level of competition
- ensuring that energy rights and resources are managed for the benefit of the State
- ensuring that the exploration for, and the recovery, production, transmission, storage and management of, energy resources is carried out safely and is ecologically sustainable
- ensuring that regulated activities that may have adverse effects on the environment
    - are properly managed to reduce environmental damage
    - are carried out in a way that eliminates or limits the risk of significant long term environmental damage; and to ensure as far as reasonably practicable, security of supply for users of natural gas
- ensuring that land adversely affected by regulated activities is properly rehabilitated
- establishing appropriate consultative processes with people directly affected by regulated activities including Aboriginal people and the public generally
- protecting the public from risks inherent in regulated activities.

The ER Act and ER Regulations are objective-based rather than prescriptive. An objective-based regulatory approach principally seeks to ensure that industry effectively manages its activities by complying with performance standards that are cooperatively developed by the licensee, the regulatory authority and the community. This contrasts with prescriptive regulation where detailed management strategies for particular risks are stipulated in legislation.

The regulated resources, substances and activities to which the ER Act applies are defined within the ER Act.

- Regulated resources as defined in Part 1 of the Act include 'a naturally occurring underground accumulation of a regulated substance' and 'a natural reservoir'

- Regulated substances as defined in Part 1 of the Act includes petroleum, hydrogen (and hydrogen compounds or by-products of the creation of hydrogen), helium and carbon dioxide
- Regulated activities relevant for the purposes of this EIR are defined in section 10(1) as
    - exploring for a regulated resource
    - operations to establish the nature and extent of a discovery of a regulated resource, and to establish the commercial feasibility of production and the appropriate production techniques
    - producing or processing a regulated substance
    - utilising a natural reservoir to store a regulated substance
    - activities for the rehabilitation of land on account of the impact of regulated activities.

2.1.1 Statement of Environmental Objectives

As a requirement of Part 12 of the ER Act, a regulated activity can only be conducted if an approved SEO is in force for the relevant activity. The SEO must set out environmental objectives to be achieved, assessment criteria, leading performance criteria and immediately reportable and reportable incidents, in accordance with section 100 of the ER Act.

A SEO is based on the information provided in the Environmental Impact Report (EIR).

2.1.2 Environmental Impact Report

Under Section 97 of the ER Act, an EIR must be prepared for proposed regulated activities. This document addresses the potential impacts to the environment and outlines the extent to which these impacts can be managed. The EIR must:

- take into account cultural, amenity and other values of Aboriginal and other Australians insofar as those values are relevant to the assessment
- take into account risks to the health and safety of the public inherent in the regulated activities
- contain sufficient information to make possible an informed assessment of the likely impact of the activities on the environment
- include an assessment of the environmental impact of regulated activities to which the report applies against the environmental impact assessment criteria.

Section 4(1) of the ER Act defines the environment as including:

- land, air, water (including both surface and underground water and sea water), organisms, ecosystems, flora, fauna
- buildings, structures and other forms of infrastructure, and cultural artefacts
- existing and potential land use
- public health, safety or amenity
- the heritage, aesthetic, or cultural values of an area
- the economic or social impact on an area.

As per ER Regulation 10, for the purposes of an EIR, a licensee must provide:

- a description of the regulated activities to be carried out under the licence (including their location)
- a description of the specific features of the environment that can reasonably be expected to be affected by the activities, with particular reference to the environment and existing land uses
- an assessment of the cultural and heritage values of Aboriginal and other Australians which could reasonably be foreseen to be affected by the activities in the area of the licence, and the public health and safety risks inherent in those activities (insofar as these matters are relevant in the particular circumstances)
- if required by the Minister – a prudential assessment of the security of natural gas supply
- information on any consultation that has occurred with the owner of the relevant land, any Aboriginal groups or representatives, any agency or instrumentality of the Crown, or any other relevant stakeholders, including specific details about relevant issues that have been raised and any response to those issues, but not including confidential information.

2.1.2.1 Environmental Impact Assessment Criteria

Under section 96A of the Act, the Minister is required to determine the criteria against which the environmental impact of an authorised operation is to be assessed. An impact assessment against these environmental impact assessment criteria must be prepared by the licensee and be included as part of the EIR submitted by the licensee.

The Environmental Impact Assessment Criteria[1], to be addressed in the EIR are:

- Criteria 1 – Elements of the environment
- Criteria 2 – Potential impact events
- Criteria 3 – Confirmation of impact events
- Criteria 4 – Control and management strategies and uncertainty assessment
- Criteria 5 – Environmental significance assessment
- Criteria 6 – Statement of environmental objectives.

2.1.3 Consultation on the EIR and SEO

Under sections 97 (6) and 99 (3) of the ER Act and Regulation 11, a licensee is required to undertake consultation on an EIR and SEO in accordance with an approved consultation plan prepared and implemented as required by ER Regulations. An EIR and SEO consultation plan must be submitted to DEM for approval prior to undertaking mandatory consultation on the EIR and SEO.

Following consultation by the licensee, the EIR and SEO are formally submitted to DEM and an assessment is undertaken to ensure the documents meet the requirements of the ER Act, ER Regulations and the Environmental Impact Assessment Criteria as required under section 97(4). Once satisfied the documents are compliant, DEM undertakes its own public consultation process, inviting written submissions on the EIR and SEO for a period of at least 30 business days period in accordance with Regulation 14.

[1] The environmental impact assessment criteria can be accessed at https://www.energymining.sa.gov.au/industry/energy-resources/regulation/environmental-register#eia

Any submissions received during the DEM consultation process are provided to the licensee. The licensee is required to address all relevant comments received and, where appropriate, incorporate those into the EIR and / or SEO.

Once the approval process is complete, all documentation—including the EIR and its associated SEO—must be entered on the public Environmental Register maintained by DEM. The Environmental Register is accessible to the community via the DEM website, ensuring transparency and accountability.

2.1.4 Activity Notification / Approval Process

Prior to commencing a regulated activity, Section 74(3) of the ER Act provides that:

- The Minister's prior written approval is required for activities requiring high-level official surveillance (as per Regulation 19), and
- Notice of activities requiring low-level official surveillance is to be given at least 21 days in advance (as per Regulation 18).

The proposed activities would fall in the high-level official surveillance category (all licensees are initially high-level official surveillance operators for all activities).

In order to obtain written approval for activities requiring high-level official surveillance, an application and notification of activities (in accordance with Regulation 20) must be submitted to the Minister at least 35 days prior to the commencement of activities. The notification of activities must include:

- specific technical and environmental information on the proposed activity
- an assessment to demonstrate that the activity is covered by an existing and approved SEO.

This activity notification and approval process is often referred to as Stage 3 of the approval process under the ER Act, as it follows licensing (Stage 1) and the EIR and SEO approval process (Stage 2). The Stage 3 activity notification and approval process provides an additional opportunity for DEM to ensure that the proposed activities and their impacts can be effectively managed and are consistent with the approvals obtained in the EIR and SEO approval process.

The site-specific detail provided would include an environmental assessment report (EAR), which must include the following site-specific detail:

- An assessment of the environment at the proposed location
- Investigation of specific issues such as the likelihood of threatened species occurrence, presence of mound springs, or areas of sensitive landscape
- Proposed measures to minimise impacts to key issues (e.g. low-impact survey techniques in sensitive areas, avoidance of sensitive locations)

On-ground environmental investigations are typically required as part of this assessment, particularly where potential issues are significant or the operation is in a new area.

2.2 Other Legislation

A variety of legislation is potentially application to the proposed activities and is listed below. This is not a comprehensive list of all applicable legislation. Further detail on key legislation is provided following the list.

Commonwealth

Aboriginal and Torrens Strait Islander Heritage Protection Act 1984

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Native Title Act 1993

South Australia

Aboriginal Heritage Act 1988

Crown Land Management Act 2009

Dangerous Substances Act 1979

Environment Protection Act 1993

Fire and Emergency Services Act 2005

Heritage Places Act 1993

Landscape South Australia Act 2019

National Parks and Wildlife Act 1972

Native Title (South Australia) Act 1994

Native Vegetation Act 1991

South Australian Public Health Act 2011

Work Health and Safety Act 2012

2.2.1 Commonwealth Environment Protection and Biodiversity Conversation Act 1999

Approval under the *Environment Protection an Biodiversity Conservation Act 1999* (EPBC Act) is required for activities that are likely to impact matters of national environmental significance (MNES) including World Heritage properties, National Heritage places, wetlands of international importance (listed under the Ramsar Convention), listed threatened species and ecological communities, migratory species and a water resource in relation to a coal seam gas development and large coal mining development.

With regard to the proposed activities in the License Area, issues that may trigger approval requirements under the EPBC Act can typically be mitigated by site selection and implementation of field procedures (e.g. avoiding impacts to surface drainage and significant wetland areas or flagging and avoiding significant sites). The proposed activities will be reviewed against the MNES, and a referral will be submitted to the Department of Climate Change, Energy, the Environment and Water if necessary. Based on current knowledge, it is unlikely that a requirement for approval under the EPBC Act would be triggered.

2.2.2 Landscape South Australia Act 2019

The *Landscape South Australia Act 2019* (Landscape SA Act) provides a framework for the sustainable and integrated management of the state's water resources including surface water and groundwater. It provides the mechanism to prescribe a watercourse or underground waters and establish a water allocation plan for the prescribed area.

The project is located within the South Australian Arid Lands landscape management region.

The Landscape SA Act and the South Australian Arid Lands Water Affecting Activities Control Policy (SAAL, 2021) also set out a number of water affecting activities that must not be undertaken without a permit. A permit to drain or discharge water into a well, pursuant to section 112 of the Act, may be required for injectivity testing activities.

The Landscape SA Act also governs the control of declared pest plants and animals.

2.2.3 Native Vegetation Act 1991

Exploration activities that are approved under the ER Act do not require approval under the *Native Vegetation Act 1991* for the clearance of native vegetation, provided that such activities are undertaken in accordance with industry standards endorsed by the Native Vegetation Council (NVC) that are directed towards minimising environmental impact and encouraging the regrowth of any native vegetation that is cleared (see Regulation 15 of the Native Vegetation Regulations 2017).

If there are no applicable industry standards, or if it is not possible to undertake the operations in accordance with applicable industry standards, the clearance is permitted if undertaken in accordance with a management plan, approved by the NVC, that results in a significant environmental benefit, or if the person undertaking the operations makes a payment into the Native Vegetation Fund of an amount considered by the Council to be sufficient to achieve a significant environmental benefit.

2.2.4 National Parks & Wildlife Act 1972

The *National Parks and Wildlife Act 1972* (NPW Act) provides for the establishment and management of parks reserves and the conservation of wildlife in a natural environment.

There are no Conservation Parks or Reserves within the Licence area.

2.2.5 Aboriginal Heritage Act 1988

The *Aboriginal Heritage Act 1988* provides protection for all Aboriginal sites, objects and remains across the state, whether known or unknown. The Act applies to all land and bodies of water and vests the powers to protect and preserve Aboriginal heritage to the Minister for Aboriginal Affairs, who is required to take such measures as are practicable for protecting and preserving Aboriginal sites, objects and remains.

It is an offence to damage, disturb or interfere with Aboriginal sites, objects or remains unless prior written authorisation has been obtained from the Minister for Aboriginal Affairs under the relevant section of the Act. Penalties apply for failure to comply.

2.2.6 Environment Protection Act 1993

The *Environment Protection Act 1993* imposes a general duty of care not to undertake an activity that pollutes or might pollute the environment unless all reasonable and practicable measures have been taken to prevent or minimise any resulting environmental harm. The Act's framework includes Environment Protection Policies that cover aspects including air quality, water quality, noise and waste. Environmental authorisations are required to undertake activities prescribed under the Act.

The Environment Protection Act does not apply to 'petroleum exploration activity undertaken under the *Petroleum Act 2000'* (noting that this is the original name of the ER Act) or to wastes produced in the course of an activity (not being a prescribed activity of environmental significance) authorised by a lease or licence under the ER Act when produced and disposed of

to land and contained within the area of the lease or licence (pursuant to Section 7(4) of the Environment Protection Act).

3. Proposed Activities

The following section provides an overview of the proposed activities, namely seismic survey and exploration drilling and injectivity testing of CO_2.

3.1 Seismic Survey

3.1.1 Overview

Geophysical data acquisition allows resource explorers to gather information about the location and characteristics of geological structures located beneath the earth's surface. This information is used to assist in identifying areas where hydrocarbons (and other natural resources) may be present.

Onshore geophysical surveys (seismic surveys) for petroleum hydrocarbon exploration predominantly utilise the principles of reflection seismology to collect geophysical data. The methods are largely based around how acoustic / sound waves change their speed (velocity) and direction (reflection and refraction) as they pass through different types of soil and rock. Interpretation of changes in velocity and direction of sound waves as they pass through soil and rock enables geophysicists to determine geological conditions and structures in a given survey area.

Seismic surveys require an energy source to create a sound wave on or near the earth's surface, and receivers to record the reflected waves (Plate 3-1). Prior to the 1970s, seismic surveys in Australia used small explosive charges placed in or on the surface or buried in shallow holes as the energy source to generate sound waves. Other systems to create a controlled seismic 'source point' have been developed over the years including 'vibroseis', which uses a vibrator on the surface to generate sound waves, and weight drop (or thumper) which uses a heavy weight dropped from a height as the energy source. Source point types are discussed further in Section 3.1.2.1.

The generated acoustic waves travel into the earth where they reflect off subsurface geological formations back to the surface. The returning acoustic waves are recorded by a series of sensors commonly referred to as 'receiver points'. These sensors include receivers such as geophones, accelerometers and fibre optic cables. Receiver point types are discussed in Section 3.1.2.2.

Source and receiver points are typically laid out in relatively straight lines or multi-line grids (commonly referred to as 'seismic lines'), however survey designs will vary with survey requirements. Source and receiver points may be located on the surface, buried in trenches or placed in drilled holes, or used in combination depending on survey requirements, the surface environment and the nature of the geology in the survey area. All source and receiver points are numbered, and the position of each point is accurately mapped. The number of source points and their positions are carefully designed to improve the downward-going sound energy, minimise the energy going in other directions, and minimise impacts to surface and subsurface environments. The different types and methods of seismic survey are described further in Section 3.1.3.

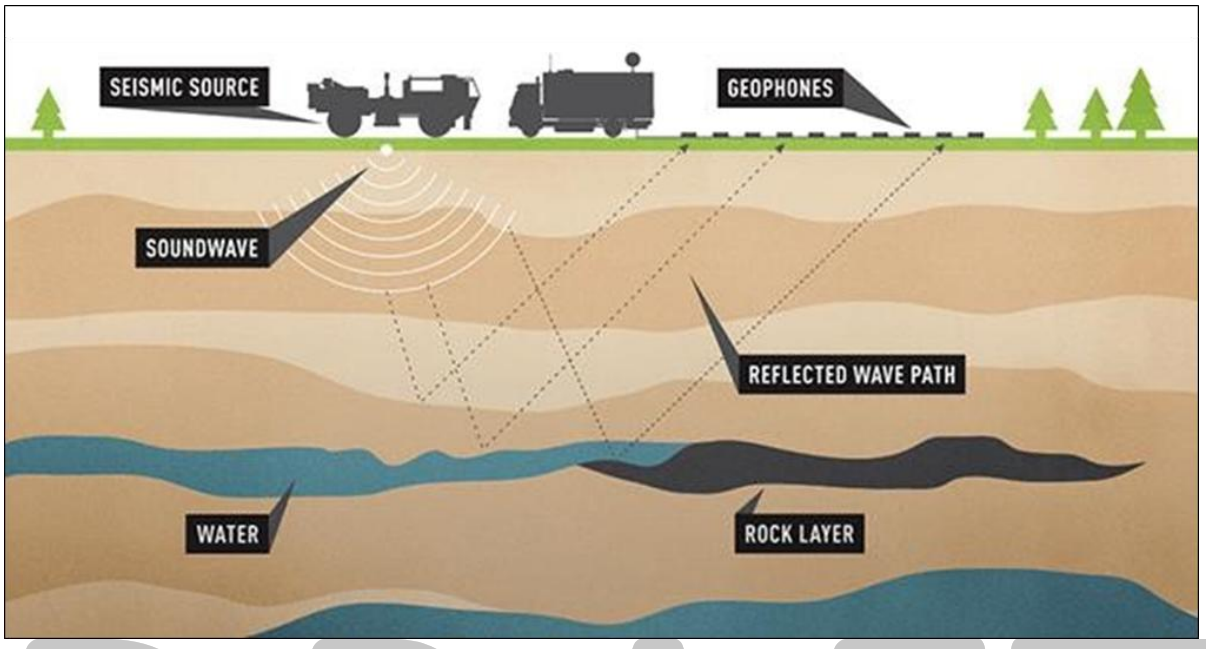


Plate 3-1: Typical onshore seismic survey outline (Source: APPEA, 2019)

3.1.2 Seismic Survey Energy Sources and Receivers

3.1.2.1 Energy Source Types

Seismic surveys can utilise a range of energy sources to generate sound waves. Modern onshore seismic surveys typically utilise either a 'vibroseis' system, weight drop system or small buried explosive charges (buried source).

Vibroseis

Vibroseis is the most common energy source used for modern 2D and 3D seismic surveys. The vibroseis system is a truck-mounted system that uses a large oscillating mass (vibrator) to generate acoustic waves of varying frequencies. The vibrator is typically in the form of a large retractable baseplate (mounted to the underside of a truck) that can be lowered to the ground with pressure applied (Plate 3-2). The plate is applied to the ground for each vibration (source point) and then raised up as the truck moves to the next source point. Small vibrator pad marks (i.e. shallow indentations on the soil surface) may be left on soil where the vibrator pad was pressed against the ground surface. These indentions are temporary, and they typically naturally rehabilitate within a short period of time.

Vibroseis produces a low energy density, which allows it to be used in sensitive environments, cities and other built-up areas without damaging buildings or the environment in close proximity to the energy source (APPEA, 2019). Vibroseis trucks typically use large balloon type tyres (or tracks less typically), to lower their surface pressure and footprint (Plate 3-2).

Plate 3-2: Vibroseis truck and baseplate (Source: M.Kneipp, 2026)

Weight Drop (or Thumper)

The weight drop system is a simple method used to generate a sound wave. A heavy weight is dropped from a height of several metres onto a base plate located on the ground. When the weight makes contact with the base plate it generates a 'thump', which imparts a sound energy source into the ground. Weight drop units are commonly mounted to a small posi-track or tractor type vehicle (Plate 3-3). As with vibroseis, this method can result in shallow indentations on the ground surface, which are temporary, and typically naturally rehabilitate within a short period of time.

Plate 3-3: Weight drop unit mounted to a tractor and Posi-track (Source: M.Kneipp, 2026)

3.1.2.2 Receiver Source Types

There are many types of seismic sensors (receivers), such as geophones, accelerometers and fibre optic cables. These sensors convert the extremely small returning sound waves into data that can interpreted by geophysicists. Many thousands of sensor locations are required to record the returning acoustic waves and sensors are installed temporarily on the surface. Sensors are typically arranged in linear patterns along seismic lines, but arrangements vary with survey requirements (refer to Section 3.1.3).

Geophones

Geophones located on the surface are typically pushed into the soil surface using small metal spikes to ensure a firm connection with the ground. A range of geophone types and their installation are shown in Plate 3-4 and Plate 3-5.

Plate 3-4: Example Geophone and Accelerometer node types (Source: M.Kneipp, 2026)

Plate 3-5: Installed Geophone and Accelerometer nodes (Source: M.Kneipp, 2026)

3.1.3 Types of Seismic Survey

3.1.3.1 2D and 3D Seismic Surveys

Until the early 1980s, onshore seismic surveys were typically conducted along single seismic survey lines with source and receiver points located along the same line. The resulting data creates a simplistic two-dimensional (2D) image representative of a slice through the subsurface structures beneath a particular seismic line (Plate 3-6). 2D seismic surveys typically involve a series of seismic lines in the order of 10 km to 50 km in length, with spacing between lines of approximately 0.25 km to 5 km (Plate 3-6). Spacing between shot and receiver points along the seismic lines for 2D surveys is typically in the range of 5 m to 50 m. The seismic line itself is usually 3 m – 5 m wide.

While 2D seismic is still undertaken, the majority of modern seismic surveying uses the three-dimensional (3D) survey method. The 3D methodology is similar to 2D, but instead of a single line of source and receiver points, the source and receiver points are located on dedicated source lines and receiver lines laid out in a grid pattern across a survey area (Plate 3-6). Receiver

points are laid down in parallel 'receiver lines', and the source points are laid out in perpendicular parallel 'source lines' to form a cross-hatched grid.

3D seismic surveys can range in size from several km^2 to several thousand km^2, and spacing between seismic lines is typically in the order of 100 m to 400 m. Spacing between source and receiver points typically ranges from 5 m to 50 m. The grid arrangement means that source and receiver points are spread across the entire survey area, which allows each receiver point to collect seismic reflections from multiple directions across the survey area (Plate 3-7). This data can then be analysed to create a 3D image of the survey area subsurface (Plate 3-7).

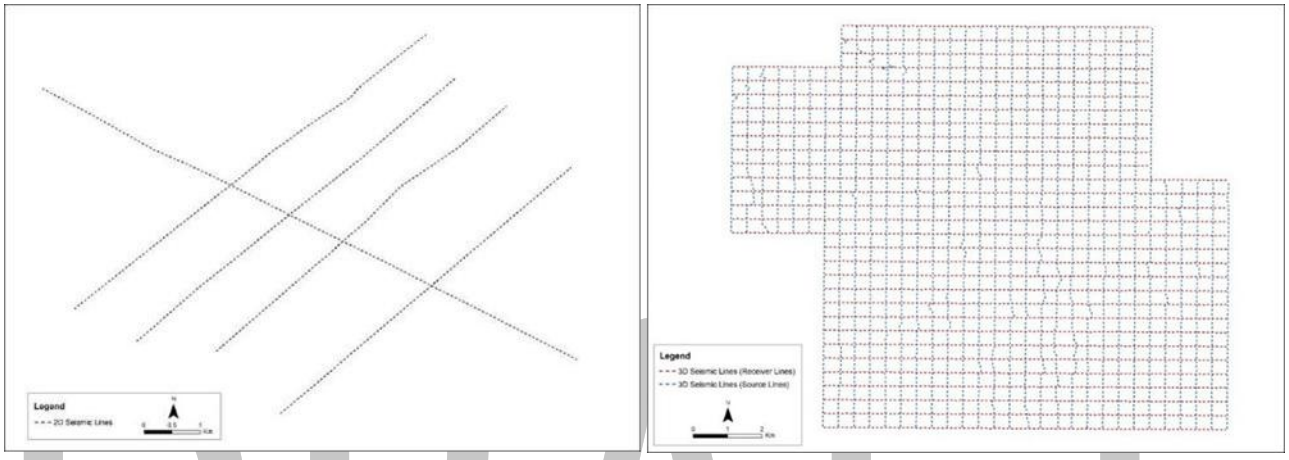


Plate 3-6: Comparison of 2D and 3D seismic survey design

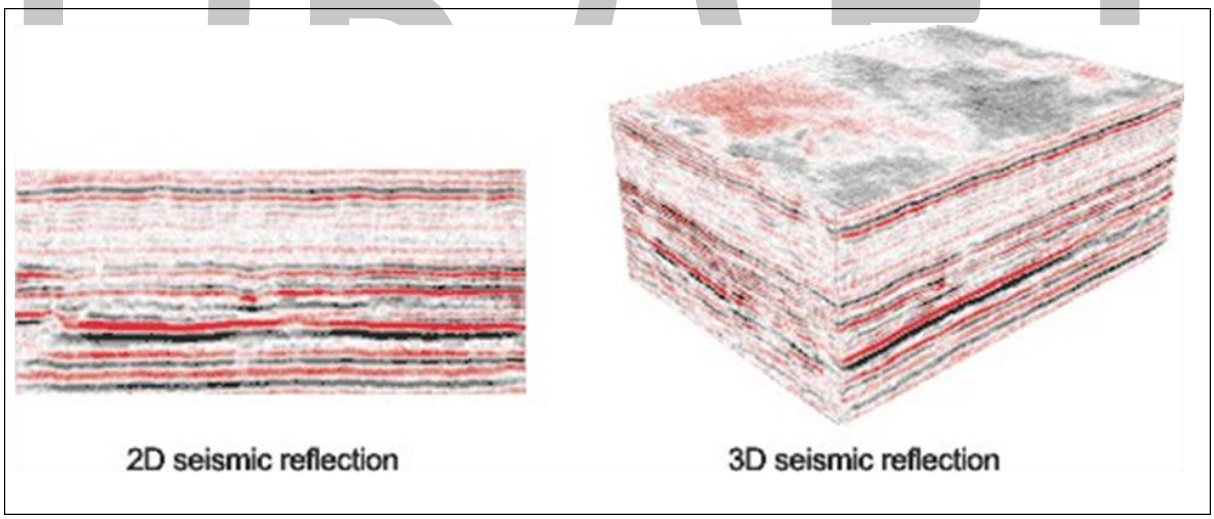


Plate 3-7: Comparison of 2D and 3D seismic survey images. (Mari and Chapellier, 1999)

3.1.4 Planning

Once the company has decided to plan a seismic program, existing subsurface information such as aerial imagery, seismic data, well data and other types of geophysical survey data such as gravity and magnetic survey data are reviewed and incorporated into a seismic design that is best suited to meet the subsurface imaging requirements of the company.

The preliminary seismic design is then reviewed against known environmental, heritage and landowner constraints and the seismic design is modified to meet these, as well as health, safety, and operational considerations. Once the preliminary design has been reviewed, a site "scouting" survey is undertaken to confirm the accuracy of the previous data and identify any on-ground constraints not identified earlier.

As part of project planning, regulatory approval, environmental and safety requirements are identified and planned, stakeholders are notified of the planned activities, cultural heritage surveys are requested, and procurement of a seismic service provider is undertaken.

3.1.5 Cultural Heritage Clearance

Cultural Heritage surveys conducted by Native Title holders or Native Title Claimants on Native Title land are not activities regulated under the Petroleum and Geothermal Energy Act 2000 and are not considered within the scope of this EIR and the SEO. However, Petroleum Tenement Holders uphold relevant heritage legislation and their agreements with different Native Title groups by ensuring that all new project areas are the subject of a Work Area Clearance (WAC).

New projects in areas that have not previously been culturally cleared for works, for example seismic projects, will be assessed by a WAC team in order to provide the tenement holder with a 'Work Area Clearance'.

A WAC team comprises representatives of the Native Title group, a company representative and specialists who might be an anthropologist or archaeologist. Together they conduct a detailed field survey of the proposed works area, identify and record sites, define Exclusion Zones, and provide the tenement holder with a 'Conditions of Clearance' table and GIS (Geographic Information System) mapping data.

This data defines areas cleared for works requested and any Exclusion Zones. These conditions must be strictly adhered to. This table and data, along with a final report, comprise a Work Area Clearance.

Typically, a WAC team consists of up to 12 personnel travelling in up to four light 4WD vehicles. Usually, the vehicles pass only once over a given section of ground, although in the vicinity of identified sites and detours, some backtracking may occur. Existing tracks or old seismic lines are used when possible, to gain access into the program areas.

3.1.6 Access Track and Seismic Survey Preparation Activities

Planning is undertaken to minimise new disturbance and prioritise use of pre-disturbed areas wherever practicable. However, areas with limited access for vehicles or lacking other development (e.g. petroleum wells or production facilities) may require at least minor access track and seismic survey preparation activities to be undertaken (dependent on the proposed survey method). Following cultural heritage surveys, access track and seismic survey preparation activities can commence.

3.1.6.1 Access Tracks

Seismic surveys utilise existing roads and tracks for access where possible. Where required, access tracks are typically 4 m wide, except on bends and at entry and exit points to a camp site where the width may be as wide as 8 m. If grass adjacent to access tracks is dry, a graded or ploughed firebreak along each side of the access track may also be constructed. Where particular access tracks may experience increased traffic loads (e.g. main access tracks leading into the survey area or a camp site), it may be necessary to lightly pave these tracks with gravel to prevent significant soil disturbance. Paving materials are usually removed during rehabilitation (unless the landholder requests they are retained) and stockpiled topsoil is re-spread over the site.

3.1.6.2 Seismic Survey Line Preparation

Light vehicles (e.g. 4WD vehicles), vibroseis / thumper trucks generally require access along seismic lines in order to lay out geophones and input sound energy at source points. Vehicle access is less important for laying out receiver points (geophones) as walk-in methods can be

utilised. Seismic lines are generally surveyed on the ground using GPS technology, and some surveys are also marked out using small pin flags or water-based paint so the 'grid' can be easily navigated.

Seismic lines are generally 3 m to 5 m wide, and in many environments they typically do not require any line preparation. In areas of particularly tall or dense pasture grass, an agricultural slasher, vegetation mulcher (Plate 3-9) may be used to remove the top layer of vegetation (retaining rootstock and groundcover, and minimising disturbance to soil (Plate 3-10). This process may also be required to mitigate potential bushfire risk i.e. fire risk associated with vehicle exhausts.

In rough or highly vegetated terrain, seismic lines may require light preparation by earthmoving or vegetation slashing machinery to enable safe and efficient vehicle and equipment access. Large tree limbs overhanging existing access roads and tracks may need to be trimmed (using a chainsaw) to allow safe vehicle access. Appropriate impact management strategies will also be implemented as detailed below.

Disturbance to areas of remnant or significant vegetation, fauna habitat, cultural heritage sites, watercourses and waterbodies is avoided wherever practicable. Where sensitive areas such as remnant vegetation, swamps and lakes cannot be avoided, small low impact vehicles (e.g. quad bikes or off-road buggies) and hand carrying (walk-in) by field personnel can be used to transport and install geophones to avoid traversing the area with large vehicles. Where disturbance to native vegetation is unavoidable, ecological surveys and appropriate clearance permitting processes will be undertaken.

Seismic lines do not need to be perfectly straight and are regularly 'offset' and 'weaved' around environmental sensitivities such as large trees and areas of intact vegetation wherever practicable. This process also reduces the visual impact (linearity) of seismic lines (Plate 3-9). The location of seismic lines (including tolerances for weaving around sensitivities) is typically pre-programmed into a GPS linked computer display located in the cabin (this will generally be a tracked bobcat or similar machine (Plate 3-9). In this manner, the vehicle operator can weave seismic lines within set tolerances to avoid obstacles and maintain compliance with cultural heritage conditions. In areas where visual impact is an issue, seismic lines may also be weaved every 75 m to 100 m to reduce the linearity of seismic lines where appropriate (however, weaving may be avoided on steep, fragile or wet soils as it may increase rutting and soil disturbance).

Preparation of seismic lines is undertaken to minimise ground and vegetation disturbance and allow natural processes and rainfall to rehabilitate the area in a short timeframe following completion of survey activities. In some cases, minor re-spreading of soil and vegetation following the completion of the activities may be required. D3 respects the rights and requirements of all landholders and will engage directly with landholders regarding the preparation and remediation of survey lines.

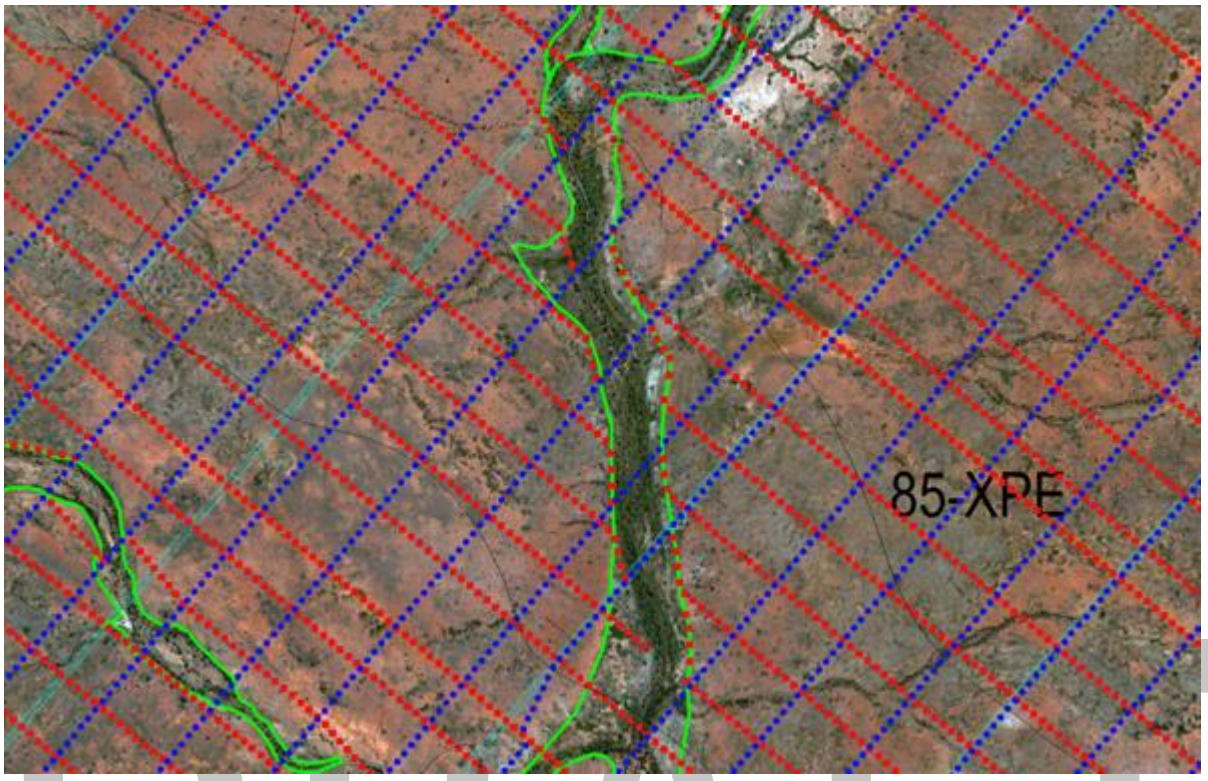


Plate 3-8: Example of deviation of seismic line offsetting to avoid sensitive areas

Plate 3-9: Prepared seismic line following use of Bobcat mounted vegetation mulcher in tall / dense pasture grass (Source: M.Kneipp, 2026)


Plate 3-10: Preparing a seismic line using a grader and dozer, with the blade just skimming the surface to remove hazards but leaving rootstock (Source: M.Kneipp, 2026)

3.1.7 Impact Mitigation / Management Strategies

Where disturbance to native vegetation is unavoidable, ecological surveys and management strategies will be implemented to mitigate impacts to priority areas, species and / or habitat. Appropriate clearance permits will also be obtained. Management strategies may include (but are not limited to) the following:

- extensive line weaving
- reduced seismic line disturbance width
- use of smaller and/or tracked source machines
- use of walk-in methods or small low-impact off-road vehicles to install receiver points
- tree limbs trimmed on existing access roads / tracks (using a chainsaw) rather than clearing trees
- use of handheld or bobcat mounted vegetation mulching / slashing equipment and techniques
- vegetation rolling / flattening equipment and techniques.

Using these methods, vegetation clearance is reduced, topsoil and groundcover is generally not disturbed, and vegetation rootstock is retained (Plate 3-10). These methods have been shown to facilitate rapid natural vegetation rehabilitation / regeneration rates compared with standard vegetation clearing methods (Williams et al, 1993). It should be noted that in sensitive areas, low impact vehicles (e.g. quad bikes and off-road buggies) and hand carrying by field personnel can be used to transport and install geophones on receiver lines with limited to no line preparation required. Walk-in methods are commonly used to lay out geophones in sensitive areas such as swamps and dense remnant vegetation.

Furthermore, all machine operators are required to undertake cultural heritage and environmental inductions prior to starting work on a particular seismic survey project. Line preparation machinery operators are also required to maintain vigilance for the presence of cultural heritage sites not identified during cultural heritage surveys. Any new site discoveries must be reported immediately to the Seismic Field Supervisor and work must stop in that area.

Following completion of seismic survey operations, evidence of operations is typically limited to weaved lines of lower height vegetation, some localised disturbance at drilling sites, and minor

wheel tracks. These disturbances generally naturally rehabilitate within a short period of time following natural processes e.g. rainfall and regrowth vegetation.

Further detail on reinstatement and rehabilitation processes is provided in Section 3.1.11.

3.1.8 Surveying Operations

Surveying typically commences shortly before the start of seismic line preparation. Surveying is required to ensure all source and receiver point locations are accurately recorded.

Surveying typically involves a team of field surveyors recording the location of all source and receiver points using high accuracy GPS technology. Source and receiver points are commonly referred to as 'stations'. The location of stations may also be marked on the ground using biodegradable paint, pin flags or wooden pegs. Line detours may also be marked with biodegradable flagging tape, which is removed on completion of recording. However, mark-less systems using GPS technology are also commonly used. If pins or pegs are used, these are removed on completion of recording.

Each survey team (one to two surveyors in a 4WD light vehicle, quad bike or off-road buggy) typically makes one pass over any given section of seismic line or source / receiver station area. Field surveyors may also need to walk into sensitive areas to survey and mark stations. Field survey crews may also use this period to construct temporary gates and fence crossings at property and paddock boundaries along seismic lines (where required or requested by the landholder). Pre-existing gates are used if possible.

3.1.9 Recording Operations / Data Acquisition

The commencement of recording activities (data acquisition) varies with seismic survey type. For 2D / 3D surveys using vibroseis or weight drop, recording typically commences 1-3 weeks after the start of seismic line preparation. The recording phase is the largest part of a seismic survey program in terms of personnel and vehicles required. A recording team will typically consist of:

- 2D surveys: 10-20 personnel and 5-10 vehicles
- 3D surveys: 15 to 40 personnel and up to 20 vehicles.

These figures will vary with survey size, recording technique, terrain, season and amount of access. Vibroseis / weight drop surveys require drivers and mechanics to support 1 to 6 vibroseis / weight drop trucks.

2D / 3D seismic operations commence with deployment of geophones. The geophones are installed into the ground by personnel on foot. In areas with harder soils, geophones may be installed using hand tools or small motorised augers to dig small holes to place geophones. As discussed above, geophone placement is typically a very low impact activity, and geophones can typically be placed in sensitive areas on foot, or with use of low impact vehicles. Seismic field crews are inducted and fully informed of all environmental requirements, and the need to respect the rights and interests of landholders and land users.

Recording for 2D and 3D surveys would normally commence when sufficient geophones have been laid out in accordance with the arrangements described in Section 3.1.2.2. This layout is termed 'the spread' and a pre-selected 'live' section of the spread will record energy reflected from subsurface layers while source energy is being input to that area. Prior to the start of data recording, the spread and all recording systems are tested. Once the spread is live, the chosen source energy will begin to be input to the ground.

An array of one (1) to four (4) source trucks are typically used for the energy source. The trucks are electronically synchronised to vibrate or drop in phase with each other. The trucks line up

along a source line separated by a few metres and centred on a source point. Each unit inputs one or more frequency sweeps or drops into the ground at each source point. Each sweep/drop lasts for only a few seconds. On completion of each source point the source trucks move to the next source point.

The live spread is the only part of the survey area where data is recorded for any given source position. The live spread is moved as the vibroseis trucks or shot firers move across the survey area. As sections of the spread become redundant, geophones are picked up and transported to the front end of the line. This cycle continues until the line is completed.

Data recorded during this process is typically stored on internal memory modules within each geophone.

All operational vehicles stay on seismic lines. Non-operational vehicles are required to park off-line to avoid causing interference with collected data. Non-operational vehicles include 4WD vehicles for personnel access / transport, spare source trucks, service truck and a recording truck (if required).

Along any single seismic line, the following vehicle passes can be expected to occur during normal operations:

- source trucks and service truck, 1 pass per truck
- recording truck, 1 pass (if required)
- light vehicles, 4-20 passes in total.

Source trucks and associated equipment may use 3D receiver lines for access from one source line to the next, and so traffic on 3D receiver lines will be very similar to a 2D seismic line. However, 3D source lines carry limited traffic in comparison to a 2D line i.e. traffic is limited to source trucks, potentially a service truck as required, and minor light vehicle traffic. All operational vehicles stay on existing access tracks and roads during recording operations. Non-operational vehicles are required to park away from geophones to avoid causing interference with collected data. Non-operational vehicles may include a small number of 4WD vehicles for personnel access / transport.

3.1.10 Camp Sites and Associated Activities

Depending on the size and location of a seismic survey program, temporary camp sites may be required to house seismic survey personnel, and they may be used to locate a site office and store equipment and vehicles. Smaller seismic survey operations may utilise existing local private accommodation.

Temporary camps typically accommodate 10 to 40 personnel and require an area of up to 80 m x 50 m for locating self-contained re-locatable buildings equipped with wastewater processing facilities. Camps are typically established in pre-existing areas of disturbance (e.g. existing laydown areas) or on cleared agricultural land located as close as possible to existing access tracks / roads (see Plate 3-11: Seismic survey camp (Source: M.Kneipp, 2026) for an example of a typical camp). Disturbance to the soil surface will be kept to a minimum. It may be necessary to lightly pave the camp area and access track with gravel to prevent significant soil disturbance. Appropriate council permits / approvals will be attained for temporary camps (and for associated waste management requirements).

Aside from housing survey personnel, the camps may also act as a laydown / depot to store equipment, vehicles, site offices, and a rendezvous point for the crew each morning prior to commencing works. Equipment stored at camps may include vehicles, diesel fuel and lubricants (minor storage), vehicle maintenance equipment, star pickets / droppers and wooden stakes, plant and equipment components and materials. Where local private accommodation is

used rather than an onsite camp, a lightly paved laydown area / depot will typically be required to be located near the survey area to store equipment, diesel fuel and a site office (as described above). For larger seismic surveys, two to three temporary camp sites may be required to be in operation at any one time. These camps may include a line preparation / survey crew camp and recording camp.

Spill and drip trays are provided to address minor drips and spills resulting from re-fuelling operations. Storage and handling of fuel and chemicals is undertaken in accordance with Safety Data Sheets (SDS), and relevant standards and guidelines such as the EPA Bunding Guidelines and Australian Standard 1940. Potential spill containment practices include containment of fuel drums within portable bunding. The storage of fuel at camp sites is contained within tankers utilising safety features such as double-skins, safety cut-off valves, top accessing etc. to minimise or eliminate the potential for spills.

Potable water for use at camps and operational sites may be obtained from commercial suppliers, landholders or appropriately licensed water bores. Sewage wastes are handled using septic tanks or self-contained on-site treatment systems that are approved and managed under the South Australian Public Health (Wastewater) Regulations 2013 and in compliance with the South Australian Health On-site Wastewater Systems Code. Toilet facilities with wastewater processing units and septic tanks will be provided at camp sites. Where septic tanks are used to contain wastewater (black water and grey water), they will be pumped out by licensed contractors as required for disposal at a licensed facility consistent with the requirements of the Environment Protection (Water Quality) Policy 2015. Small pits may be constructed to house the tanks which will be removed after operations are completed. Any necessary approvals (e.g. local council) for the installation of the septic tanks will be obtained.

Following completion of survey activities, all camp buildings, laydowns and fuel and equipment stores will be removed. Hardstand areas will either be rehabilitated as described in Section 3.1.11or handed over the landholder if requested.

Plate 3-11: Seismic survey camp (Source: M.Kneipp, 2026)

3.1.11 Rehabilitation / Restoration

The majority of seismic lines, access tracks and campsites do not require rehabilitation work as one of the main objectives is to prepare and utilise them in a way that will facilitate rapid natural recovery. However, instances that can require restoration are:

- wheel ruts caused after wet periods
- windrows (e.g. in crab-hole floodplains if not fully removed by grader 'rill kill' devices attached to the edge of the blade)
- windrows that have been created at intersection of lines and public tracks
- compaction of topsoil at campsites
- compaction of shoulders on public access tracks
- heavily trafficked routes between camp sites and nearest public track
- access tracks that have turned to bulldust due to extensive seismic traffic
- water course channel infill and or natural flow restriction.

Normally a single dozer or grader or one of each is all that is required to carry out the rehabilitation work. Methods used for rehabilitation include:

- ripping of compacted areas with bulldozer or grader rear tynes
- windrow material pushed onto line and smoothed
- public road shoulders reinstated
- wheel rut material used to infill affected areas
- affected water course channels and creek banks reinstated.

Restoration and rehabilitation activities will be undertaken in consultation with, and to the satisfaction of the relevant landholder. Seismic lines, access tracks and campsites will be restored and rehabilitated to attain the highest achievable Goal Attainment Scaling (GAS) rating, as defined in the SEO and, where relevant, in DEM's *Field guide for the environmental assessment of recently completed seismic lines in the Cooper Basin and arid regions, South Australia* (Energy Information Sheet, 008, 2024c).

3.2 Drilling and Injectivity Testing

The following section provides an overview of drilling and CO_2 injectivity testing activities. A detailed description of exploration drilling activities is contained in the Cooper Basin Drilling and Well Operations EIR (Santos 2021)[2].

3.2.1 Drill Site

The objective of constructing a well lease is to create a stable working platform suitable for safely undertaking drilling, completions and well operations. In addition, construction should provide a defined (and where possible, low permeability) surface that provides temporary containment for minor releases, should they occur.

The lease incorporates areas for the drilling rig, generators, fuels, chemicals, casing and pipe storage, and associated portable buildings. A well lease generally incorporates the following standard features:

[2] Available at https://energymining.sa.gov.au/industry/energy-resources/regulation/environmental-register

- a compacted and stable drilling rig hard stand area
- a mud sump for the disposal of drill cuttings and the recirculation of water into the mud system (in the order of 20-30 m by 30-40 m and 2 m deep for petroleum (or equivalent) drilling, depending on the particular rig)
- a flare pit for well control and testing operations if required
- a lined 'turkey's nest' for the storage of clean water required for drilling operations (lined with plastic (HDPE) to prevent loss of water through seepage)
- an access road with clear entry and exit points for vehicles, which could include a loop or turnaround
- mobile wastewater treatment systems for the disposal of ablutions waste from well site offices and accommodation
- water storage tanks or ponds for drilling and / or completion fluids (if required for the particular well).

The size and layout of the well leases will vary depending on a number of factors such as the number of wells to be drilled (multi-well pads), the size and type of drilling rig, the program for completion of the well(s) and the surrounding environment. Smaller rigs typically require a well lease in the order of 100 m x 120 m. Wells drilled by larger rigs, or that require additional space on the well's lease for storage or laydown (e.g. water storage tanks or ponds for stimulation activities), may require a lease in the order of 200 m by 200 m. An example of a typical well lease layout is provided in Plate 3-12.

Plate 3-12: Petroleum exploration drilling showing typical layout of well lease (Source: Santos 2003)

Well lease construction methods vary depending upon the land system on which the well is to be drilled. Typically, topsoil with rootstock and vegetation is cleared and stockpiled for use in restoration. Material sourced from borrow pits is imported where required to construct the lease

pad, access roads and associated infrastructure. Borrow material is watered and rolled to achieve adequate compaction and provide a stable and trafficable surface.

In areas such as gibber plains and tablelands, it is necessary to control risk of environmental harm caused by erosion. Considerations for siting and constructing well leases and associated infrastructure include:

- The selection of non-sloping well leases is preferable (to minimise the requirements for large cut and fill)
- Greater level of control employed in sensitive areas such as floodplains and watercourses where required
- Constructing erosion control measures where appropriate (i.e. diversion banks or berms)
- Rolling of gibber terrain where possible
- Capping of sensitive terrain to preserve the underlying soils where required
- Avoiding disturbance of important native vegetation and fauna habitat where possible.

Well lease construction methods specific to particular land systems are outlined in Table 3-1.

Table 3-1: Well lease construction methods for landforms in the Licence Area (Adapted from Santos 2021)

Construction Method	Land System						
	Wetlands (GAB springs)	Drainage Lines & Floodplains	Moon Plains	Breakaways & Stony Hills	Stony Plains	Dunefields & Sand plains	Salt Lakes
Avoid construction	✓						✓
Utilise naturally cleared areas		✓	✓	✓	✓	✓	
Avoid steep slopes				✓	✓		
Avoid trees & large shrubs		✓	✓	✓	✓	✓	
Clear & grade		✓	✓			✓	
Stockpile topsoil & cleared vegetation		✓	✓			✓	
Roll				✓	✓		
Cap surface		✓	✓		✓	✓	
Build up drill site (only on slopes to provide flat surface)				✓	✓		
Cut & fill (steep slopes)		✓				✓	

3.2.2 Well Site, Access and Camp

3.2.2.1 Access track

Drilling operations are accessed using existing station tracks and public roads where possible. Purpose-built access tracks are usually required to connect the site to an existing track or road.

The method used for access track construction is dependent upon the terrain in which it is being built and the expected level of use or traffic. In most cases, the access track is cleared and graded or rolled. Table 3-2 provides information on the appropriate road construction methods that would be applied to landforms found in the Licence Area. These landforms are discussed in Section 4.

Access tracks are typically less than 6 m wide, except on bends and at entry and exit points to the camp and pad where width is 8 m. There will generally be a ring road built for safety and for keeping trucks to the designated areas preventing wheel ruts in undisturbed lease areas. If adjacent grass is dry, a graded or ploughed firebreak along each side of the access track will be constructed.

3.2.2.2 Access tracks in gibber terrain

In sensitive environments (e.g. for rig roads in gibber plains) it is essential that surfaces have the stone cover layer maintained to control erosion. The following methods are considered to minimise disturbance and control erosion risk:

- Roll gibber where surface is naturally smooth, stable and trafficable
- Remove gibber mantle to windrows, grade underlying surface smooth, replace gibber mantle, water and roll
- Leave existing natural surface, over-cap large rocks and wearing areas with borrow material that contains clay and stone
- Construct erosion control berms, banks and drains where required
- Undertake ongoing maintenance to prevent wheel rutting and water channelling.

Erosion controls are implemented during and after construction, with particular attention given to flood and water flow areas. Culverts or other structures may be installed, where required, to ensure that surface water flows are not impeded by the road. In some circumstances, structures such as raised roads or bridges may be installed to support exploration or production activities.

Table 3-2: Road construction methods for landforms in the Licence Area (Adapted from Santos 2021)

Construction Method	Land System						
	Wetlands (GAB springs)	Drainage Lines & Floodplains	Moon Plains	Breakaways & Stony Hills	Stony Plains	Dunefields & Sand plains	Salt Lakes
Avoid construction	✓						✓
Utilise naturally cleared areas		✓	✓	✓	✓	✓	
Avoid steep slopes				✓	✓		

Construction Method	Land System						
	Wetlands (GAB springs)	Drainage Lines & Floodplains	Moon Plains	Breakaways & Stony Hills	Stony Plains	Dunefields & Sand plains	Salt Lakes
Weave between trees		✓	✓	✓	✓	✓	
Clear & grade		✓	✓			✓	
Roll				✓	✓		
Cap surface		✓	✓			✓	
Culverts or similar installed on drainage		✓	✓	✓	✓	✓	

3.2.3 Borrow Material

Soil types in some project areas will not support operational requirements. Borrow pits are used to provide the material required to construct a stable and supportive surface for well leases, roads, floodways and ponds. Generally, clay borrow material is sourced from borrow pits located on plains or swales, usually along roadsides and adjacent to well sites. Borrow pits vary in size depending upon the quality and quantity of material contained within them.

In 2014, a study into the impacts of Cooper Basin borrow pits was undertaken by the Department of State Development (DSD - now DEM) to evaluate compliance requirements for siting, construction, management and rehabilitation of borrow pits. The results of the study enabled targeted review and update of the 2003/2009 Goal Attainment Scale (GAS) for Borrow Pit Construction and Rehabilitation. The 2014 GAS criteria table has been incorporated into the SEO.

3.2.4 Campsite

A temporary campsite is usually required to provide accommodation for drilling operations personnel, due to the remote location of most drill sites. Campsites for exploration drilling are usually designed to accommodate approximately 30-40 people. Campsites are usually located near the well site and, where possible, existing campsites are utilised. Campsite construction methods are similar to these for drill pads, with the exception that the location of the campsite is flexible and site clearance or compaction is often not required.

Campsites are usually constructed on naturally clear, flat areas, where disturbance of vegetation and surface drainage and the importation of borrow material can be avoided or minimised. Wastewater (sewage and grey water) at temporary camp sites is typically treated using transportable aerated wastewater treatment systems that have been approved under the *South Australian Public Health (Wastewater) Regulations 2013*. Other options are available with approval of the Department of Health. Removal of any septage will be completed in compliance with the EPA's Septage Management Guidelines. Waste will be segregated, and recyclables disposed of at recycling facilities where possible. Putrescible wastes (e.g. food scraps, cardboard) will be collected (may be compacted) for disposal to approved landfill.

3.2.5 Drilling Operations

Drilling will be undertaken in accordance with accepted industry practice, the *Energy Resources Act 2000*, the *Energy Resources Regulations 2006*, DEM regulatory guidance, and relevant guidance issued by the South Australian Department for Energy and Mining (DEM).

Detailed well design, drilling methods, and specific parameters for each well will be provided to DEM through the activity notification process prior to drilling.

The drilling activity will require a 220,000 lb fit-for-purpose super single drilling rig. The selected rig will require an approximately 100 m x 120 m low disturbance lease to perform drilling operations. As mentioned above under groundworks, there will be pre-works on the lease to level the lease and perform any earth works including conductor casing installation and a cellar if required. A drilling sump (typically in the order of up to 10 m x 20 m x 2 m deep) would be excavated to handle drill cuttings and waste drilling muds.-Along with a suitable rig being selected, high-end logging, cementing, mud logging, mud engineering, various consumables and other support services and suppliers have been identified and are in process of being contracted and/or procured.

All wells will be constructed in line with good oilfield practices and will follow API design codes where applicable for exploration well design and construction, plus any additional requirements identified for service in a hydrogen environment. The 12 1/4” surface hole will be drilled to approximately 600mMD +/- 50m within the Boothana formation with known formation strength to provide suitable shoe integrity. It will then be cased with 9 5/8” casing and cemented back to surface. A 9” 5M A-section will then be installed with a BOP (size determined by supply from drilling contractor) with the BOP having a 5,000psi pressure rating.

The surface casing shoe track will be drilled out and an FIT will be performed to approximately 19ppg to confirm the surface hole shoe strength and the kick tolerance should a kick be encountered whilst drilling. The production hole will then be drilled ahead in 8 1/2” hole size to approx. 2,600mMD +/- 100m, based on geological prognosis from offset well data reviewed.

For the target 8 ½” hole section, Drill Stem Tests may be conducted either off bottom or at selected intervals whilst drilling and/or post section TD via straddle test depending on formation pressure conditions.

The well will then have series of wireline logs conducted to help identify potential hydrocarbon, helium or hydrogen bearing zones. Upon completion of this stage of logging and testing the well, 7” casing will be conveyed and cemented back to surface. Once well TD has been reached and the well has been cased, cemented per program and wellbore conditioned, the wellhead B-section will be installed and the well suspended for future intervention such as well testing.

3.2.5.1 Drilling Methods and Well Construction

Exploration wells will be drilled to planned total depths, typically in the order of 2,000 m to 3,000 m as defined by geological targets and subsurface conditions.

The rig drills the well by rotating a drill bit while exerting downward force on a drill pipe. The well is drilled deeper by adding lengths of drill pipe until the total planned depth is reached.

A well is typically drilled in several sections, with the diameter of deeper sections smaller than the sections above. After each section of the well is drilled, casing (steel pipe) slightly smaller than the hole diameter is lowered into the hole and cemented into place. As a result, the shallow portions of the well have several concentric layers of steel casing installed. Plate 3-13 presents a schematic layout of the well design. Final well design and specifications will be provided prior to construction for regulatory approval.

Drilling will employ water-based drilling fluids that are non-toxic or of low toxicity. Fluid selection, handling, containment, and disposal will be managed to maintain well control, protect groundwater quality, and prevent off-site impacts.

Where shallow groundwater is present (generally less than 30 m below ground level), a lined drilling sump will be constructed to contain drilling fluids and cuttings. Sump design, operation, and closure will comply with DEM requirements and approved environmental controls.

Wells may be drilled vertically or deviated depending on geological and exploration objectives. Limited horizontal drilling may be used where required to improve intersection with target formations, subject to regulatory notification and approval.

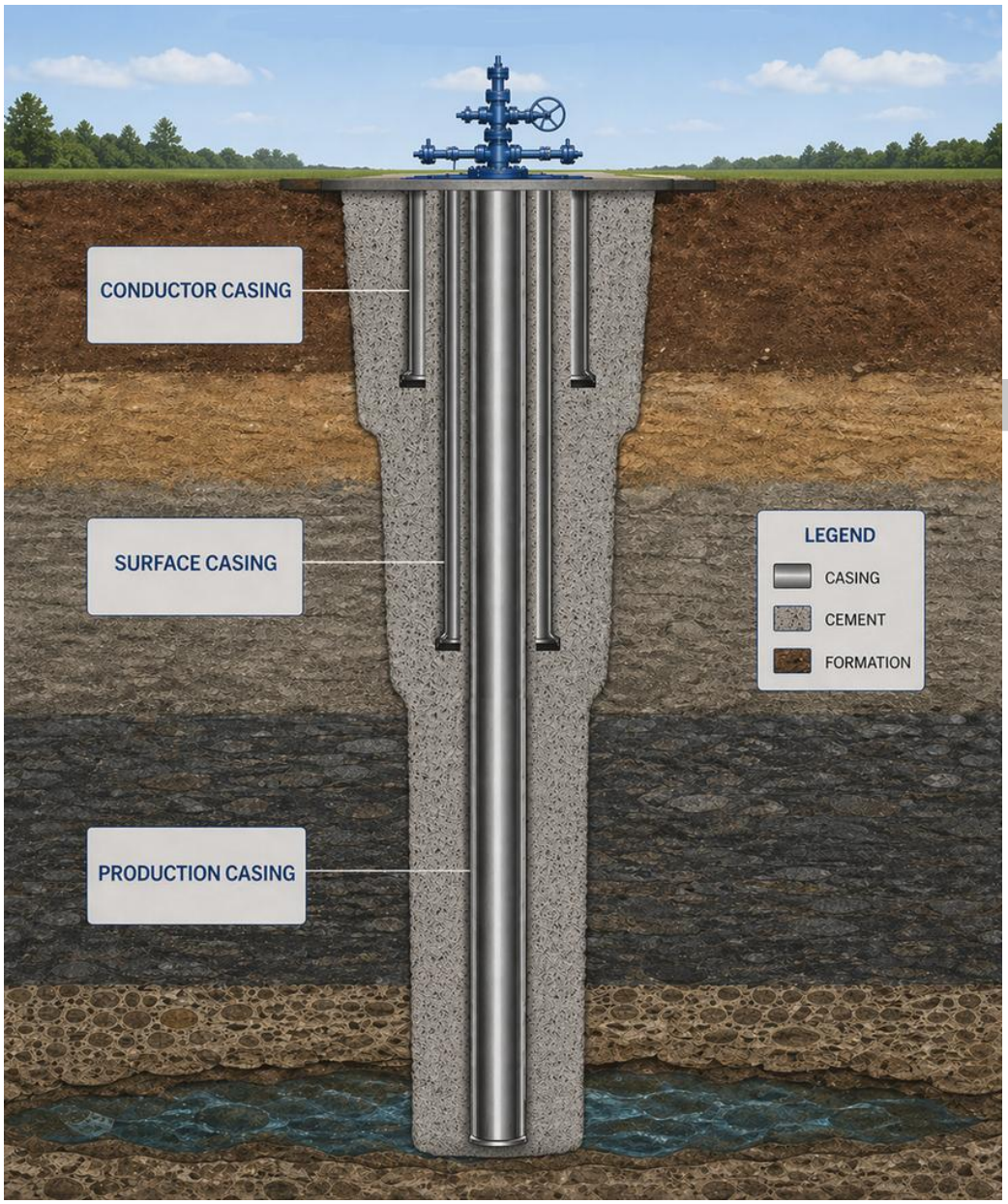


Plate 3-13: Well construction schematic

3.2.5.2 Casing, Cementing and Well Integrity

Wells will be constructed with appropriately sequenced surface, intermediate, and production casing strings, each cemented to provide zonal isolation and long-term well integrity in accordance with DEM well construction standards. Casing and cementing practices will be designed to isolate groundwater aquifers, prevent fluid migration, and support safe evaluation and testing.

Equipment and materials used in drilling operations will be selected to ensure safe operations, with particular consideration given to the interface with hydrogen gas or CO_2 as relevant to the particular well. This would include drill pipe, casing pipe, cement, the wellhead tree and surface materials that would interface with liquids and gases that may flow to surface.

3.2.5.3 Formation Evaluation and Testing

Formation evaluation will include:

- Sidewall coring or conventional coring for lithological and geochemical analysis
- Open-hole and cased-hole logging to assess key formation properties relevant to hydrogen and helium prospectivity
- Formation testing (e.g., drill stem tests or comparable methods) to evaluate pressure, permeability, gas occurrence, and composition. Test intervals will be isolated across zones of interest. Where gas flows to surface, gas volumes and composition will be measured using equipment appropriate to the gas type.

Formation water or associated fluid recovered during testing will be managed in accordance with approved drilling fluid and sump management procedures.

Hydraulic fracture stimulation is not proposed as part of the exploration drilling activities and is not included within the scope of this EIR.

3.2.5.4 Well Completion and Appraisal

Where exploration drilling identifies potentially commercial concentrations of hydrocarbon and/or hydrogen and/or helium, additional activities may be undertaken, subject to further regulatory approval. These activities may include:

- Installing additional casing and wellhead equipment designed for controlled evaluation and monitoring
- Well completion and short-duration flow testing, including clean-out, selective perforation, pressure monitoring, and acquisition of logging data to characterise reservoir properties.

3.2.5.5 Well Production Testing

If there is a discovery during drilling further flow testing will be required and a production test will be carried out. The production test will normally take place over a 2–4 week period and is used to evaluate the well's deliverability and reservoir characteristics under sustained flow conditions. To enable the production test to be undertaken the well will need to be completed with a tubing string. The results of the testing undertaken will determine the equipment needed but it can consist of separators, gas metering and tanks to measure and contain fluids.

3.2.5.6 Plugging and Abandonment

If a well does not identify commercially viable resources, it will be plugged and abandoned according to DEM requirements and industry best practice, ensuring permanent isolation of formations and protection of groundwater resources.

3.2.5.7 Duration of Activities

The typical period required for drilling a single exploration well, including mobilisation and demobilisation, is approximately 30-45 days, subject to site-specific conditions.

3.2.5.8 Workovers

Workover activities may be undertaken where necessary. These may include well clean-out, repair or replacement of casing or liners, pressure testing, drilling deeper, re-perforating, re-testing existing zones, or plugging and abandonment. Workovers may involve wireline tools or the mobilisation of a workover rig. Pumps and fluid management systems will be used as required, with containment and disposal in accordance with approved procedures.

3.3 CO_2 Injectivity Testing

Following the completion of drilling and well construction, Carbon Dioxide (CO_2) injectivity testing will be undertaken to demonstrate that CO_2 can be safely and permanently injected and stored into specifically targeted storage reservoirs in the Licence Area.

ACV refers to the targeted injection reservoirs as Carbon Vaults. There are two carbon vaults being targeted in the initial pilot program:

- Carbon Vault 1 – the Permian aged Boorthanna Formation Sandstones
- Carbon Vault 2 – the Permian aged Mt Toondina Formation Coals

Small amounts of CO_2 (less than 200 tonnes) are planned to be injected into each Carbon Vault. Post injection monitoring and data gathering will be used to prove the CO_2 can be permanently sequestered under the earth in the Licence Area.

Carbon dioxide injectivity testing will generally involve the activities described below that are currently planned for the initial pilot program.

3.3.1 Pilot Plan and Objective

The current plan for the Southern Cross Pilot Drilling and Injection Program is as follows:

Carbon Vault 1 Boorthanna Sandstones

The Carbon Vault 1 program targeting the Boorthanna Sandstones will involve drilling a single well to a depth of less than 2,000 m. The well will be cased and cemented to just above the reservoir before the injection phase begins. Up to 200 t of CO_2 will then be injected into the reservoir as a liquid in a supercritical phase. The movement and behaviour of the CO_2 within the injection reservoir will be monitored through a temporal (repeated) wireline logging program to track its distribution and containment. Throughout the project, comprehensive technical data and operational information will be collected to demonstrate that CO_2 can be permanently sequestered within the Boorthanna Formation of the Arckaringa Basin.

The entire program is expected to be completed within a period of less than six months.

Carbon Vault 2 Mt Toondina Coals

The proposed program will involve drilling up to three wells to a depth of less than 500 m within the Mt Toondina Formation of the Arckaringa Basin. Up to 200 t of carbon dioxide–saturated water will be circulated into coal fractures and cleats through an injection well, with the water recovered via one or more production wells. The saturated water will then be recirculated repeatedly until the carbon dioxide becomes chemically adsorbed onto the coal.

Throughout the process, temporal logging programs will be conducted to monitor the system and ensure that the carbon dioxide is securely entrapped. All technical data and operational information will be collected and analysed to comprehensively demonstrate that carbon dioxide can be permanently sequestered within the formation.

The entire program is expected to be completed in less than nine months.

3.3.2 Post Injection and Monitoring

In each Carbon Vault test, less than 200 t of CO_2 will be injected into the base of the target formation. In the Boorthanna Carbon Vault, the CO_2 will be injected as a liquid in a supercritical phase, whereas in the Mt Toondina Coals Carbon Vault it will be injected in water saturated with CO_2.

The movement of the CO_2 within the reservoir will be monitored using wireline logging techniques, such as resistivity and density logs, to observe its behaviour and distribution. Due to the relatively small volume of carbon dioxide being injected, the response detected by these logging methods is expected to be minimal and potentially difficult to trace.

In preparation for future development, ACV has also undertaken modelling of larger-scale injection scenarios. The modelling indicates that injecting 500,000 t of CO_2 over a 25-year period into a single wellbore could result in the plume extending approximately 7 km from the wellbore in the Boorthanna case. By comparison, an injection volume of 200 t would be negligible and would not be expected to produce any meaningful plume migration.

3.3.3 Pressure Fall-off and Formation Response Monitoring

Following the cessation of CO_2 injection, a pressure fall-off period will be undertaken to evaluate reservoir permeability and pressure dissipation characteristics. Additional logging or well interventions, such as production logging tools, fibre-optic surveys, or downhole gauges, may also be conducted to further assess injectivity, identify potential flow pathways, and confirm zonal isolation within the well. Throughout the program, all monitored parameters—including injected volumes, pressures, temperature variations, and any produced fluids—will be carefully recorded and compiled for detailed post-operation analysis. These data will support the evaluation of reservoir performance and the overall effectiveness of the injection program.

3.3.4 Surface Operations and Management of Materials

Carbon dioxide (CO_2) will be supplied either via portable storage vessels or generated on-site, depending on logistical considerations, with all storage, handling, and transport conducted in accordance with relevant safety regulations. Temporary pipework and pumps will be installed on hardstands within the well pad to support the injection and circulation process, and all equipment will be removed following completion of the test.

Direct Air Capture (DAC) may be used to supply a limited quantity of carbon dioxide for injection and testing purposes. DAC is a technology that removes CO_2 directly from ambient air using chemical processes that bind CO_2 to solid sorbents or liquid solvents. The captured CO_2 is then concentrated, compressed, and transported for permanent storage in suitable underground geological formations. Incorporating DAC into the pilot would allow the project to test the full carbon removal chain from atmospheric capture through to subsurface storage, at a small demonstration scale.

Testing of the Mt Toondina coals may require two wells located several hundred metres apart to be connected by a temporary flowline to allow circulation between the injection and production wells. Any produced fluids, such as minor volumes of formation water, will be collected, managed, and disposed of in accordance with applicable regulatory requirements. Emissions associated with site equipment, including pumps and generators, are expected to be comparable to those generated during standard well-testing operations.

3.3.5 Decommissioning of Test Equipment

Upon completion of the injectivity program, all temporary injection and monitoring equipment will be demobilised from the site. If the well is to be retained for potential future injection or monitoring activities, it will be suspended in accordance with applicable regulatory standards

and well integrity requirements. Alternatively, if the well is not required for any further data acquisition or operational purposes, it will be decommissioned and permanently abandoned in accordance with approved well abandonment procedures (refer to Section 3.3.6).

3.3.6 Well Decommissioning

Well decommissioning activities are designed to achieve the following outcomes:

- preventing the uncontrolled migration of formation fluids or gases, including CO_2, between stratigraphic units
- isolating tested injection intervals and any permeable formations intersected by the well
- protecting groundwater resources, land users, infrastructure, livestock, and wildlife from potential impacts associated with subsurface fluid or gas migration.

Wells to be decommissioned will be subject to site-specific technical evaluation prior to determine the most appropriate plugging and abandonment methodology. This evaluation will consider well construction, geological conditions, pressure regimes, and the potential for natural hydraulic communication between formations to ensure long-term containment and compliance with regulatory requirements.

Further detail on specific decommissioning scenarios is provided below.

3.3.6.1 Decommissioning following drilling

Following the drilling of a well and testing and evaluation of its potential, a decision is made on whether to proceed with completion of the well (e.g.by installing production casing) or to decommission it. If a decision is made to decommission the well, the following steps are undertaken:

- Plugs are set to isolate all formations that have petroleum shows
- Plugs are set across separate aquifers
- Plugs are set across the surface casing shoe and intermediate casing shoe (if present)
- A plug (typically 15 m) is set at the surface prior to cutting off the surface casing bowl.

The well site is then cleaned-up and reinstated as described in Section 3.3.7.

3.3.6.2 Decommissioning following testing

Once any well is completed a decision is made on whether to decommission the cased well bore or leave it in a suspended state until it can be decommissioned. Each well would be evaluated individually to design the decommissioning program.

The decommissioning program typically involves the following:

- All perforated zones are isolated from other perforated zones with cement plugs and/or bridge plugs.
- The bond logs are evaluated to ensure that the cement behind the production casing is adequate to avoid crossflow of aquifers with other aquifers or reservoir/storage/ producing zones. A decision may be made to perforate and squeeze off the aquifer to ensure that there is no crossflow.
- An additional cement plug is placed in the surface casing prior to cutting off the well head below ground level.

The well site is then cleaned up and reinstated as described in Section 3.6 below.

3.3.7 Site Clean-up and Reinstatement

The restoration of well sites and associated access tracks is normally undertaken in stages following the completion of drilling operations.

3.3.7.1 Initial Restoration

Irrespective of the outcome of the drilling operation, initial well lease clean-up involves:

- fencing the drilling mud sump immediately following the completion of drilling to prevent stock access and discourage wildlife access
- pumping any additional water from the turkey's nest into the mud sump and removing the turkey's nest liner.

The drilling mud sump will remain fenced until the contents have dried sufficiently to allow the sump to be backfilled without displacing drilling muds and fluids to the soil surface. The time required for the sump contents to dry is dependent upon the size of the sump and seasonal weather conditions, but for a petroleum well usually takes between 6 and 12 months.

3.3.7.2 Partial Restoration

When the drilling sump has dried, full or partial restoration of the well site will be undertaken, depending upon the outcome of the drilling operations. Partial restoration will be undertaken at well sites that have verified successful injection as subsequent operations, such as workover and completion activities, require less space than that which was required for drilling operations. Partial restoration involves:

- backfilling the drilling sump to achieve at least 1 m cover over mud contents (following drilling operations sufficient freeboard is left to allow for this without creating a raised surface upon restoration)
- partial ripping and respreading of topsoil on excess lease areas to promote revegetation and stabilisation of the lease edges
- backfilling the turkey's nest
- backfilling any additional pits used for loading and offloading earthmoving equipment as well as vent pits (flare pits may be left open for subsequent operations)
- ripping excess loop roads used for road train turnaround
- ripping the campsite and camp access track (unless required for future drilling operations).

3.3.7.3 Final Restoration

Complete well site, access track and borrow pit restoration will be undertaken following decommissioning of the well.

Final surface restoration of all well sites will involve:

- backfilling all pits including the drilling mud sump, turkey's nest, flare pits and vent pits
- ripping and recontouring (where appropriate, note ripping will not be undertaken on unsuitable soils – i.e. stony plains) of well sites, campsites and the respreading of stockpiled topsoil and
- cleared vegetation to promote revegetation
- ripping the access track to relieve compaction and promote revegetation

- removing any windrows to ensure that water flows are not impeded.

Final restoration of borrow pits will involve:

- returning any overburden to the pit
- battering slopes to prevent collapse
- ripping the floor and sides of the pit
- spreading stockpiled topsoil and vegetation
- ripping (where appropriate) haul roads and tracks to relieve compaction.

Restoration and rehabilitation activities will be undertaken in consultation with, and to the satisfaction of the relevant landholder. Transfer of certain infrastructure may occur with the landholder if compliance with all other relevant acts can be demonstrated (e.g. *Pastoral Land Management and Conservation Act 1989*).

Drill and well sites, access tracks and campsites will be restored and rehabilitated to attain the highest achievable Goal Attainment Scaling (GAS) rating, as defined in the SEO and, where relevant, in DEM's *Field guide for the environmental assessment of decommissioned petroleum well sites in the Cooper Basin, South Australia* (Energy Information Sheet, 006, 2024d).

3.3.8 Associated Activities

3.3.8.1 Water Supply

Water will be required for both domestic and industrial purposes for drilling operations. The quality of the water required is dependent upon the intended use.

3.3.8.2 Domestic water supply

Potable water will be required to supply kitchen and ablutions facilities on the drill site and at the camp. The source of potable water will depend on the well location, but may it be sourced from the water supply of a nearby town or station and transported to site in a bulk water tanker.

3.3.8.3 Drilling water supply

The amount of water required for drilling operations depends principally upon the depth of the well that is being drilled. Water use for drilling of an 1800 m deep exploration well would typically range from 7,500 – 11,500 barrels (800 to 1,200 kL) depending on casing diameter.

Water for drilling operations is likely to be sourced from existing artesian and sub-artesian bores located in the region. Supply bores for a drill site will be chosen on the basis of minimising the distance for the water haul and minimising impacts on pastoral activities. However, the water quality (particularly the calcium content) of the water is also considered.

The installation and construction of new groundwater extraction bores will be undertaken in accordance with the Far North Prescribed Wells Area Water Allocation Plan (FNPWA WAP) and DEW by a licensed Class 2 (sub-artesian) or Class 3 (artesian) water bore driller. Prior to any drilling works, a search of the government registered bores within a 5 km vicinity of the proposed location will be undertaken. Where registered bores are identified within this area, consultation with the well owner will be undertaken to ensure that the potential for impacts due to drawdown can be managed.

Where proposed groundwater bores are in an area adjacent to, and / or in the vicinity of, a surface water system that is dependent on base flow, an impact assessment will be undertaken and the bore moved to an alternative location where required.

The management strategies and control measures described above ensure that potential for loss of aquifer pressure and subsequent aquifer impacts is low.

3.3.9 Waste Management

A range of wastes are generated during drilling and well operations. Typical wastes are summarised in Table 3-3.

Table 3-3: Typical drilling wastes and disposal methods (Adapted from Santos 2021)

Waste	Disposal Method
Sewage and grey water	Onsite treatment with portable treatment systems prior to
Putrescibles	Collected at camp and rig site for disposal to a licensed waste
Plastic, glass, cans, cardboard and paper	Collected at camp and rig site (may be compacted) for recycling and/or disposal to a licensed waste management
Oily Waste	Collected for disposal to a licensed waste management facility
Industrial Bulky Container (IBC)	Collected for disposal/recycle at a licensed waste management facility
200L Drums	Collected in designated skip for recycling
Scrap metals	Collected in designated skip for recycling
Chemical wastes	Disposal to licensed waste management facility or return to supplier
Timber pallets (skids)	Recycled or to a licensed waste management facility
Vehicle tyres	Collected in designated skip for recycling
Completions Fluids	Collected in lined pits or tanks for offsite treatment or disposal to an appropriate facility
Completions flowback solids (proppant) and contaminated soil	Management on-site or at an appropriate facility (e.g. lined evaporation ponds, land farm or licensed waste management facility)
Used liner (e.g. from lined pits if used)	Removed from site for disposal at a licensed waste management facility

Campsites require the provision of systems for the management of sewage wastes, which must be managed in accordance with the *South Australian Public Health (Wastewater) Regulations 2013*. The method of disposal for wastewater must comply with the SA Health On-site Wastewater Systems Code or be to the satisfaction of the Department for Health.

Putrescible domestic wastes will be stored on site along with other domestic wastes (such as plastics, cans and glass) prior to their transportation to a licensed waste disposal facility. The presence of waste attracts wildlife, most commonly crows, black kites and dingoes. Litter may also be scattered by the wind and scavenging wildlife. Storage methods will take these issues into account to avoid litter scattering and impacts on wildlife (e.g. rubbish bins or skips will be covered.

All industrial solid wastes created during drilling and well operations will be collected in designated skips for eventual recycling or disposal to an appropriately licensed facility. Other wastes associated with drilling and well operations, including drilling fluids, drilling muds and drill cuttings are generally disposed to the excavated drilling sump. The contents of the drill sump are allowed to dry before being covered with fill (with at least at least one metre of cover for petroleum exploration drilling sumps).

3.3.10 Fuel and Chemical Storage

A variety of fuels and chemicals are required for drilling operations. These include fuel, lubes, oils, solvents, and drilling mud. The volumes and types of chemicals used will be dependent upon the type of operation.

Drilling mud may include the following chemicals:

- polymers e.g. PHPA (partially-hydrolysed polyacrylamide)
- barites
- biocide
- bentonite
- caustic soda
- LCM (lost circulation material)
- salt (typically sodium chloride and/or potassium chloride)
- sodium carbonate
- sodium sulphite.

All fuel, oil and chemical storage, handling and secondary containment will be undertaken in accordance with appropriate standards and guidelines e.g. Australian Standard AS 1940, EPA guideline 080/16 Bunding and Spill Management, the Australian Dangerous Goods Code (ADG) and product Safety Data Sheets (SDSs). Typically fuel and chemicals are stored in approved containers in appropriately lined bunded areas or on bunded pallets, and well leases are constructed to provide a suitable working platform and containment for minor spills.

Diesel storage volumes will vary depending upon the operation. Diesel storage volumes are usually greatest for drilling operations.

4. Existing Environment

4.1 Climate

The climate in the Arckaringa Basin region is classified as arid and has a typical desert climate of hot to extremely hot, dry summers and mild, dry winters, with low and erratic rainfall. Average annual rainfall Coober Pedy Airport (1995-2026), in the centre of the region, is 144.1 mm. Median annual rainfall, which is a more appropriate measure where rainfall is erratic, is 144 mm.

Rainfall can occur at any time of year, but rainfall events often occur in summer, when moist tropical air from the northern monsoon penetrates the region. Record daily falls of between 100 mm and 200 mm have been recorded across the region (Marla-Oodnadatta SCB 2002). A summary of climate records for Coober Pedy Airport 1994 - 2026 (Station #016090) is provided in Table 4-1 (Bureau of Meteorology, 2026).

The prevailing winds in the summer are from the south or southeast and the winter winds are more variable and come from either the north or the south to southwest quadrants (Bureau of Meteorology, 2025).

Climate can be an important consideration when scheduling operations, particularly the likelihood of heavy or prolonged rainfall. However, due to the unpredictable and erratic rainfall (which may or may not occur any time of the year) and the predominantly dry conditions experienced in the region, seasonal rainfall is not a significant factor in scheduling activities in this region.

Table 4-1: Temperature and Rainfall Records for Coober Pedy Airport (Station #016090)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Daily Max (^{O}C)*	36.9	35.6	32.2	27.3	22.1	18.4	18.7	21.3	25.8	29.1	32.1	34.8	27.9
Mean Daily Min (^{O}C)*	22.3	21.5	18.7	14.5	9.9	6.9	6.3	7.7	11.2	14.3	17.6	20.1	14.2
Mean Rainfall (mm)**	13.1	13.9	13.1	13.4	9.1	13.1	5.1	6.8	7.9	12.9	16.0	18.8	144.1
Median Rainfall (mm)	6.6	5.9	2.6	3.0	3.2	4.8	2.4	2.2	4.6	5.4	12.0	13.7	144.0

4.2 Biophysical Environment

The Licence Area includes two biogeographical regions[3] (or bioregions), as defined by the Interim Biogeographic Regionalisation for Australia (IBRA). These bioregions, which are broad landscape units based on major geomorphic features, are:

- Stony Plains
- Simpson Strzelecki Dunefields.

[3] Biogeographic regions (bioregions) are broad landscape units based on major geomorphic features and are defined by the Interim Biogeographic Regionalisation for Australia (IBRA) Version 7.0. They are continental scale ecosystems, ranging in size from one to 20 million hectares and may include more than 30 landforms and 50 vegetation associations (DEH 2009).

The following sections of this EIR describe the environment within the Licence Area in each of these bioregions (Figure 4-1: IBRA regions of the Licence Area).

Each bioregion is divided into subregions under the IBRA classification and can be further divided into land systems, which are regional scale ecosystems with a recurring pattern of geology, topography, soils and vegetation (Marla-Oodnadatta SCB 2002, DEH 2009). A number of identified land systems have been mapped across the Licence Area region as part of broader land system mapping, which is used in natural resources management and soil conservation planning in pastoral areas of South Australia. The land systems occurring in the Licence Area and their soil and vegetation characteristics are summarised in Appendix A.

To assist in the discussion of potential impacts and environmental management measures in subsequent sections of this EIR, the major landforms encountered within each bioregion are also identified and discussed in the following sections.

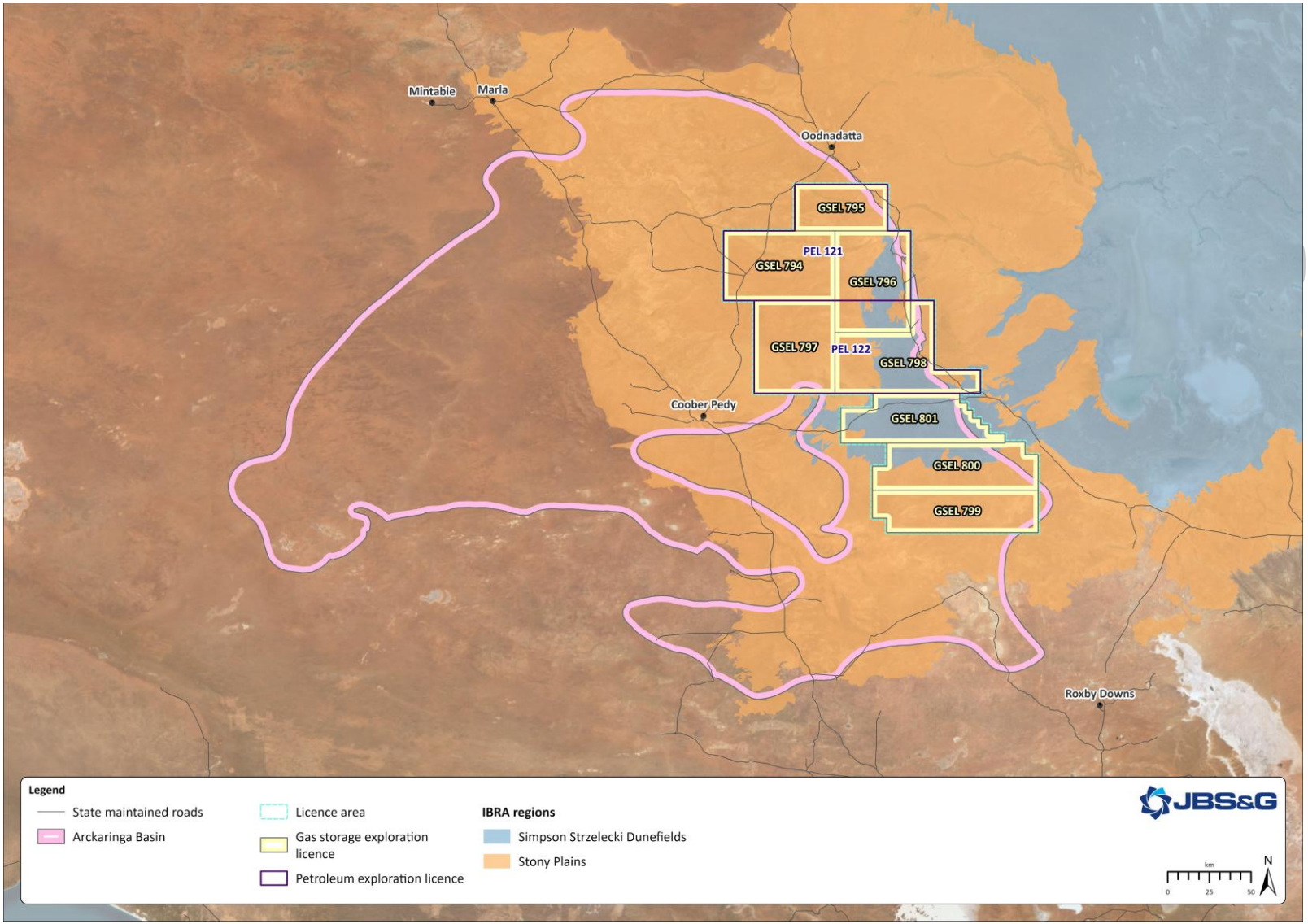


Figure 4-1: IBRA regions of the Licence Area

4.2.1 Stony Plains

The entire Stony Plains bioregion covers an area of 129,240km^2 and represents 24.8% of the South Australian Arid Lands and 13.2% of the state (Bastin 2008a). It stretches in an arc from the Northern Territory through to south of Lake Eyre and east to the edges of the Strzelecki Desert and Flinders Ranges.

The Stony Plains bioregion is the dominant bioregion in the Licence Area with a coverage of approximately 73%.

The main land systems present in the Stony Plains bioregion covered by the Licence Areas include Baltana, Breakaway, Mount Margaret and Oodnadatta. A full description these land systems in provided in Appendix A.

4.2.1.1 Geology, soils & landform

The Stony Plains bioregion can be generally described as a series of arid stony silcrete tablelands and gibber and gypsum plains with duplex soils and calcareous earths. The dominant undulating gibber and gypsum plains are dotted with occasional lakes, claypans, low hills and ephemeral watercourses and floodplains which typically drain into Lake Eyre (Miles et al. 2015).

The northwest of the region is interspersed by dissected silcrete-capped tablelands and mesas with extensive gibber covered footslopes on deeply weathered shales (Neagle 2003). These tablelands include the 'Breakaways' landform which typically occurs west of the Licence Area.

Some watercourses form major drainage systems featuring deep channels and occasional permanent waterholes (Neagle 2003). Wetlands occur throughout this bioregion with the Great Artesian Basin (GAB) springs being the most significant wetland feature.

The Licence Area is a representative subset of the Stony Plans bioregion. They contain a variety of plains and tablelands interspersed with dunefields, hills and plateaus. Seven major landforms occur within the Licence Area based on the landform groupings in DEH (2009):

- Stony plains and tablelands
- Moon plains
- Breakaways and stony hills
- Dunefields and sand plains
- Drainage lines and flood plains
- Great Artesian Basin springs
- Salt lakes.

These are discussed further below and photographic examples are provided in Plate 4-1 to Plate 4-6.

Stony Plains and Tablelands

This landform is typified by gently sloping plains with a cover of small to large gibber stones. Gilgai are typically present, which are stone-free, often circular depressions with clay soils that receive much of the runoff from the adjacent gibber. Gibber stones are typically derived from silcrete, but in the Coongra land system the stone cover is comprised of sandstone and shale.

The surface stones generally form a stable pavement that protects the underlying soil from erosion. Grading or removal of the stone cover can result in significant erosion (Marree SCB 2004, Santos 2006).

Stony plains occur in the Oodnadatta, Baltana, Buckshot, Coongra, Lookout and Paisley land systems.

Moon Plains

Plains with clay soils but without significant stone cover occur in the Moon Plain land system. The Moon Plain (located northeast of Coober Pedy) is an undulating plain with soft grey gypseous cracking clay soils and limited drainage.

Breakaways and Stony Hills

This landform includes dissected tablelands and other residual habitats forming mesas or tabletops with a capping of silcrete overlaying various shales (DEH 2009). It is typified by the steep escarpments and mesas of the Breakaway land system, but also includes the stony hills found in a number of land systems and the more rugged ranges such as the Mount Margaret land system.

Breakaways and stony hills occur in the Breakaway, Coongra, Lookout, Paisley (the Stuart Range) and Mount Margaret land systems, with limited occurrences in other land systems including Oodnadatta, Christie and Baltana.

Dunefields and Sand Plains

Dunefields and sand plains occur in limited areas, where they overlie the gibber surface or surround rocky outcrops or hills (DEH 2009). Dune soils are typically deep red sands, while soils of plains and interdune swales range from sandy clays to calcareous and siliceous sands.

Land systems with dunefields and sandplains include a small area of Wattiwarriganna (with its extensive dunefields), Woolridge and Paisley (which contain some sand dunes) and Buckshot, Christie and Glendambo.

Drainage Lines and Flood Plains

This landform is typified by ephemeral watercourses, generally draining towards Lake Eyre. In places these form major drainage systems featuring broad flood plains. Large, braided creeks occur throughout the region (e.g. Neales and Arckaringa creeks).

Drainage lines occur in most land systems; even the less well-drained land systems (such as Moon Plain) tend to be traversed by major drainage lines.

Drainage lines running out of the breakaways country are particularly sensitive areas where gidgee and mulga leaf-litter provides refuge habitat for several rare species, including the Bronze-backed Legless lizard.

Great Artesian Basin Springs

These high conservation value wetlands are found on the margins of the Great Artesian Basin (GAB). They can take a wide variety of geological forms from large carbonate mounds to sandy seeps (DEH 2009). Typical spring structure includes a vent where it emerges from the ground, a tail which flows from the vent and terminates in the wetland around the base of the spring (if the flow is great enough) and saline spring margins surrounding the spring. GAB springs are discussed further in Section 4.3.1.

GAB Springs in the Licence Area occur predominantly in the Wattiwarriganna and Oodnadatta land systems

Salt lakes

Salt lakes and salt pans are formed when excess evaporation in interior basins leads to the concentration of soluble salts as a surface crust. Salt lakes occur in limited areas within the

Licence Area, including scattered occurrences in the Moon Plain land system. The largest salt lake in the area is Lake Cadibarrawirracanna (on the boundary of PEL122 & 123). Most other salt lakes in the PELs are relatively small.

Plate 4-1: Stony Plains, (Source: Linc Energy)

Plate 4-2: Moon Plains (Source: Linc Energy)

Plate 4-3: Breakaways and Stony Hills (Source: JBS&G)

Plate 4-4: Dunefields and Sand Plains (Source: Linc Energy)

Plate 4-5: Drainage Lines and Flood Plains (in Oodnadatta land system) (Source: Linc Energy)

Plate 4-6: Great Artesian Basin Springs (in Oodnadatta land system) (Source: Linc Energy: Strangways Spring located outside of the Licence Area 5.5km east of PEL123.)

4.2.1.2 Flora

The following information has been taken from Brandle (1998), as cited in Neagle (2003).

The stony desert tablelands and gibber plains feature low open shrublands variously dominated by Saltbush (*Atriplex* spp.), Bluebush (*Maireana* spp.) or Samphire (*Sclerostegia medullosa*), short-lived Bindyi (*Sclerolaena* spp.), Thyme Sea-heath (*Frankenia serpyllifolia*) or Bonefruit (*Osteocarpum* spp.) Low Open Shrublands, and Barley Mitchell-grass (*Astrebla pectinata*) or Love-grass (*Eragrostis* spp.) Open Tussock Grasslands.

These plant associations are also present in the breakaways and rocky hills though often with the addition of medium shrubs, such as Wattle (*Acacia* spp.), Emubush (*Eremophila* spp.) and occasionally Silver Needlewood (*Hakea leucoptera* ssp. *leucoptera*). Also present is Mulga (*Acacia aneura* var. *aneura*) Low Woodland, as well as Beaked Red Mallee (*Eucalyptus socialis*).

Drainage channels in the upper catchments tend to have a denser version of the vegetation of the surrounding hills and breakaways with low woodlands of Wattle including Gidgee (*Acacia cambagei*), Coolibah (*Eucalyptus coolabah* ssp. *arida*) and possibly Northern River Red Gum (*E. camaldulensis* var. *obtusa*).

Floodplains and swamps are a mix of low open shrublands variously dominated by Old-man Saltbush (*Atriplex nummularia* var. *nummularia*), Lignum (*Duma florulenta*), Cottonbush (*Maireana aphylla*) or Samphires, as well as Cane-grass (*Eragrostis australasica*) Tussock Grasslands in swamps, and Mitchell-grass, Love-grass or Bindyi Open Tussock Grasslands. Salt pans are usually bare and salt crusted but often have a halo of Cane-grass Tussock Grassland or Grey Samphire (*Tecticornia halocnemoides*), Slender Samphire (*Sclerostegia tenuis*) Low Open Shrubland.

Where dunefields and sand plains overlay gibber surfaces several other plant associations are prominent. Sandhill Cane-grass (*Zygochloa paradoxa*) Open Hummock Grassland dominates deep sands, especially on dunes, but Umbrella Bush (*Acacia ligulata*) Tall Shrublands and Mulga Tall Shrublands are also common. Sand plains support Nitre-bush (*Nitraria billardierei*) Low Open Shrublands or Sturt's Pigface (*Gunniopsis quadrifida*), Bladder Saltbush (*Atriplex vesicaria*) Low Open Shrublands. Small areas of calcareous loams and clays in the western Lake Eyre Basin support Low Bluebush (*Maireana astrotricha*), Bladder Saltbush, Twinleaf (*Zygophyllum* spp.) and/or Balcarra Spear-grass (*Austrostipa nitida*) Low Open Shrublands.

The Moon Plain has very little plant cover in most years, with only a few perennial species present. Mitchell grasses (*Astrebla* spp.) and Neverfail (*Eragrostis setifolia*) are two of the few perennial grasses found on the Plain, together with Annual Saltbush (*Atriplex muelleri*.) and Pop Saltbush (*Atriplex spongiosa/holocarpa*), Mulka Grass (*Eragrostis dielsii* var. *dielsi*i), Poverty-bushes (*Sclerolaena* spp.) and Buckbush (*Salsola kali*). Several species of Samphire (*Tecticornia* spp.) are common in the drainage lines, along with Prickly Wattle *(Acacia victoriae* ssp. *victoriae*) Old-man Saltbush (*Atriplex nummularia* ssp. *nummularia*), Lignum (*Muehlenbeckia florulenta*), Swamp Canegrass (*Eragrostis australasica*) and a few stunted Coolibahs *(Eucalyptus coolabah* ssp. *arida*) (Marla-Oodnadatta SCB 2002).

The Stony Plains bioregion supports 13 endemic plant species, including Barkers Mulla Mulla (*Ptilotus barkeri*), Johnston's Slipper Plant (*Embadium johnstonii*), Gypsum Groundsel (*Othonna gypsicola*) and Haegi's Stemodia (*Stemodia haegii*) and provides a habitat for five nationally threatened species including Salt Pipewort (*Eriocaulon carsonii*) and Sea-heath (*Frankenia plicata*) (Neagle 2003). Many of these species have been recorded, or may occur, in the in Licence Area.

One threatened ecological community listed under the EPBC Act is present in the region – *The community of native species dependent on natural discharge of groundwater from the Great*

Artesian Basin. This community is associated with the GAB spring wetlands that occur in the region along the margins of the GAB.

More than ten declared plant species (declared weeds) have been recorded on DEW databases as occurring in the Stony Plain region (specifically Breakaways, Baltana and Oodnadatta IBRA subregions) (DEW accessed January 2026). Two weeds of national significance have been recorded in the same region: Athel Pine and Devil's Rope Pear.

4.2.1.3 Significant Fauna

The diversity of habitats within the Stony Plains bioregion has led to the occurrence of a wide variety and number of species in the region. Over one hundred and fifty bird species and thirty mammal species have been recorded at biological survey sites (Brandle 1998). More than 100 species of reptile have been recorded in the region including four endemic species – the Gibber Dragon (*Ctenophorous gibba*), Ochre Dragon (C. *tjantjalka*), Bronze-back Legless-lizard (*Ophidiocephalus taeniatus*) and Woomera Slider (*Lerista elongata*).

The Stony Plains bioregion is known to support 11 nationally threatened fauna species (DCCEEW accessed January 2026b):

- Five Critically Endangered species
- Six Vulnerable species.

The bioregion provides primary habitat for the Thick-billed Grasswren (*Amytornis textillis modestus*), Plains Rat (*Pseudomys australis*) and the Bronze-back Legless-lizard (Neagle 2003).

Rare or threatened flora and fauna species that have been recorded in the Licence Area are listed in Appendix B.

4.2.2 Simpson-Strzelecki Dunefields

The Simpson-Strzelecki Dunefields bioregion covers an area of 277,920km^2 and extends across South Australia and the Northern Territory, with some overlap into Queensland and New South Wales. The Licence Area lies to the west of the bulk of this bioregion and intersect an outlying tongue that constitutes its western-most extent. Approximately 27% of the area of the Licence Area occurs within this bioregion.

The portion of the Simpson-Strzelecki Dunefields bioregion covered by the Licence Area is comprised of the Wattiwarriganna land system. A full description of this land system is provided in Appendix A.

4.2.2.1 Geology, Soils & Landform

The Simpson-Strzelecki Dunefields are characterised by the vast aeolian sand dune systems of the Simpson and Strzelecki Deserts. They contain comprises long parallel sand dunes, fringing dunefields, extensive sand plains, dry watercourses and saltpans. Vegetation is predominantly spinifex hummock grasslands with sparse acacia shrublands and some narrow river red gum and coolibah riverine woodlands (Bastin 2008b). In places they are interrupted by large clay pans that grade into a large playa complex of salt lakes and gypsum dunes. The main lakes in this system are located outside the Licence Area to the east and include Lake Eyre and a chain of interconnected lakes in the southeast.

Throughout the bioregion, the dune systems are generally orientated on a north-northwest to south- southeast longitudinal plane. The orientation varies across the Licence Area, and the longitudinal orientation of dunes is east-northeast to west-southwest in the southern part of the bioregion and north-northeast to south-southwest in the northern part.

The bioregion also includes the lower reaches of two of Australia's major inland river systems, Warburton and Cooper creeks and three wetlands of national significance, Lake Eyre, Inland Salt Lakes and the Strzelecki Creek (Neagle 2003). However, all of these features are located in the eastern portion of the bioregion, outside the area covered by the Licence Area.

The Licence Area intersects the Warriner IBRA subregion. The Warriner IBRA subregion is characterised by arid to semi-arid landscapes, with generally low relief and vegetation communities adapted to low and variable rainfall.

The Wattiwarriganna land system (which is the only Simpson-Strzelecki Dunefields land system in the Licence Area) is comprised of an extensive dune field of long parallel dunes and broad inter-dunal corridors which include sandy flats and claypans. Numerous large watercourses dissect the land system and there are several mound springs present. Soils in the region range from deep red sandy soils on the dunes to sandy-clay soils in the swales (Marla-Oodnadatta SCB 2002).

The main types of landforms encountered in the bioregion include:

- Dunefields and sand plains
- Salt lakes
- GAB springs.

4.2.2.2 Flora

Vegetation of the dunes is dominated by a hummock grassland of Sandhill Canegrass (*Zygochloa paradoxa*) or a tall shrubland of Horse Mulga (*Acacia ramulosa*). Umbrella Bush (*A. ligulata*) occurs in isolated stands and Narrow-leaved Hopbush (*Dodonaea viscosa ssp. angustissima*) is also moderately common. Few understorey species grow under or near these two shrubs. Silver Needlebush (*Hakea leucoptera ssp. leucoptera*) also occurs as scattered plants and mulga occurs on some dune footslopes. The understorey includes Tall Kerosene Grass (*Aristida holathera*), Buckbush (*Salsola kali*) and Cattle Bush (*Trichodesma zeylanicum*) (Marla-Oodnadatta SCB 2002).

Interdune corridors include both sandy flats and claypans. Sandy flats support low shrublands of Sturts pigface (*Gunniopsis quadrifida*), Cottonbush (*Maireana aphylla*), Low Bluebush (*Maireana astrotricha*), Bladder Saltbush (*Atriplex vesicaria*), Emubushes (*Eremophila* sp.), Sennas (*Senna* sp.) and Neverfail (*Eragrostis setifolia*), with Mulga grass (*Aristida contorta*) dominant in the understorey. Some claypans support Swamp Canegrass (*Eragrostis australasica*), Old Man Saltbush (*Atriplex nummularia* ssp. *nummularia*), Cottonbush, Neverfail and Lignum (*Duma florulenta*). Blue rod (*Stemodia florulenta*) is common at claypan margins (Marla-Oodnadatta SCB 2002).

Larger watercourses are usually lined with Coolibah (*E. coolabah*), with Sandhill Wattle, Old Man Saltbush, Cottonbush, Sennas, Samphire (*Tecticornia* sp.), Neverfail, Cupgrasses (*Eriochloa* sp.), Silky Browntop (*Eulalia aurea*) and Swamp Canegrass all present in the understorey (Marla-Oodnadatta SCB 2002).

GAB springs support their characteristic vegetation including Common Reed (*Phragmites australis*), Bore-drain Sedge (*Cyperus laevigatus*), Cutting Grass (*Ghania trifida*), Bare Twig Rush (*Baumea juncea*), Sea Rush (*Juncus kraussii*) and Salt Couch (*Sporobolus virginicus*) (Marla-Oodnadatta SCB 2002).

Four proclaimed (weed) plant species have been recorded on DEW databases as occurring in the Warriner IBRA subregion: African Boxthorn (*Lycium ferocissimum*), Buffel Grass (*Cenchrus ciliaris/pennisetiformis*), Caltrop (*Tribulus terrestris*) and Gian Reed (*Arundo donax*). African Boxthorn is a weed of national significance.

4.2.2.3 Significant Fauna

At least ten State rare or threatened fauna species have been recorded in the Licence Area of the Warriner subregion and are bird species with the exception of the State-listed (Rare) Woma (*Aspidites ramsayi*) (DEW accessed January 2026b).

The Dusky Hopping-mouse occurs in the far eastern part of the bioregion and has not been recorded (and is not likely to occur) in the Licence Area.

The Warriner subregion within the Licence Area is known to support Three vulnerable EPBC listed fauna species: Grey Falcon (*Falco hypoleucos*), Southern Whiteface (*Aphelocephala leucopsis*) and Thick-billed Grasswren (*Amytornis modestus*).

Rare or threatened flora and fauna species that have been recorded in the Licence Area are listed in Appendix B.

4.3 Water Resources

Surface water features in the region include rivers, creeks, associated flood plains, salt lakes, internally draining dunefield clay pans and Great Artesian Basin (GAB) springs. The majority of the major rivers in the north of the region drain into Lake Eyre, while rivers and creeks in the southern portion terminate in salt lakes or clay pans.

Surface water in the region is generally ephemeral and is only present following localised rainfall. Several of the rivers and creeks in the region, including the Neales River, Arckaringa Creek, Peake Creek and Margaret Creek, contain semi-permanent and permanent waterholes (DEH 2005). Water in these waterholes may persist for six months or more, some lasting over 12 months (Marla-Oodnadatta SCB 2002).

Permanent surface water can be found at points where artesian water flows to the surface, such as pastoral bores or the GAB springs.

4.3.1 GAB Springs

The most northeastern portion of the Licence Area overlies the western edge of the Great Artesian Basin (GAB) and is within the South Australian groundwater provinces of the Lake Eyre Basin and the Eromanga Basin (Figure 4-2). The GAB aquifer outcrops at the surface to the west of Coober Pedy and deepens in a northeasterly direction to around 250m at Lake Eyre (Marla-Oodnadatta SCB 2002). Vertical leakage from the GAB occurs via a series of springs (known as GAB springs or mound springs) which appear around the southern and southwestern margins of the basin (Armstrong 1990).

GAB springs have been described as “oases in the desert” and are foci for plant, animal and human life. They have very high biological and cultural significance (Boyd 1990). They support unique flora and fauna, some of which is endemic to the springs and is considered threatened on a national level. As indicated in Section 2.2.1, the ecological community associated with GAB springs is protected under the EPBC Act. Many of the springs are significant Aboriginal places with abundant archaeological material (Boyd 1990).

GAB spring structure is highly variable but typically includes a vent where it emerges from the ground, a tail which flows from the vent and terminates in the wetland around the base of the spring (if the flow is great enough) and saline spring margins surrounding the spring (DEH 2005). Mounds can develop at the spring vent by the deposition of carbonate or trapping of windblown material by spring vegetation (Marree SCB 2004).

Work by DEWNR (2015/03) has identified potential for some springs to be sourced from deeper aquifers beneath the GAB including the Boorthanna Formation and pre-Permian basement. Evidence comes from the southern region of the Arckaringa Basin where uplift has caused

erosion of the Mount Toondina and Stuart Range Formation (aquitards) leaving the GAB in direct contact with the formations mentioned above.

DEWNR (2016/02) completed a detailed study of GAB Springs within the northern parts of the Arckaringa Basin to inform the Bioregional Assessment Programme in the Lake Eyre Basin. The aim of the project was to improve data knowledge through field investigations to inform future decision making and management for the South Australian portion of the Lake Eyre Basin and areas overlying the Arckaringa and Pedirka Coal Basins. The report concludes springs on the western margin of the Great Artesian Basin are currently impacted by low flows, high grazing pressure and high nutrient loads.

There are a number of GAB springs present in the Licence Area, mostly in the eastern portion (Figure 4-2). Many of these have been identified as features of high biological and cultural significance.

4.3.2 Lake Eyre Basin

DEWNR (2015/43) describes the Lake Eyre Basin (LEB) is an internally-draining basin that takes up almost one sixth of Australia's land mass in the arid and semi-arid interior (Figure 4-3). It is unique in being one of the only unregulated dryland river systems in the world and having the most variable flows in the world. The first assessment of the health of LEB rivers found them to be in near-natural condition. The LEB contains wetlands of national and international importance for supporting Australia's waterbird populations and nationally threatened and endemic species are found in the SA LEB. The ecology is driven by the flow regime and cycles from 'boom' periods following large floods through to 'bust' periods with little to no flow.

The Basin surface gradient is very flat (less than 1% slope), except at the outer margins where it is fringed by low ranges (mostly around 300 to 400 m above sea level). Kati Thanda-Lake Eyre (North and South) is the terminus for most catchments in the Basin, however, under current climatic conditions, thirty-two percent of the Basin area does not contribute run-off to Kati Thanda-Lake Eyre. Much of the Basin experiences long periods of little to no flow, punctuated by small to medium floods and the occasional large flood where entire floodplains of catchments are inundated.

The Licence Area is in the southwestern corner of the basin with PEL122 being 55km west of Lake Eyre South (Figure 4-3).

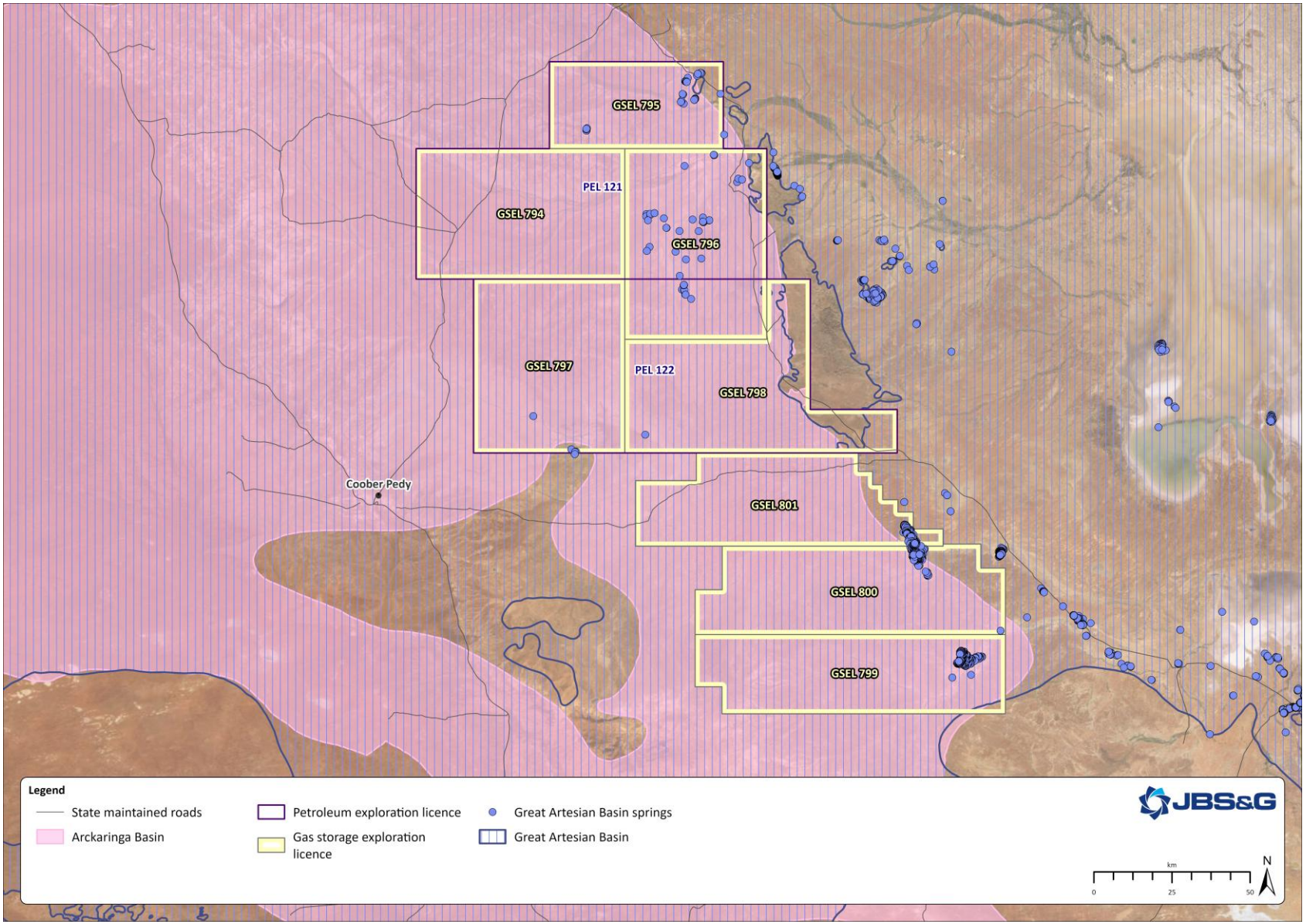


Figure 4-2: Licence Area and GAB spring locations

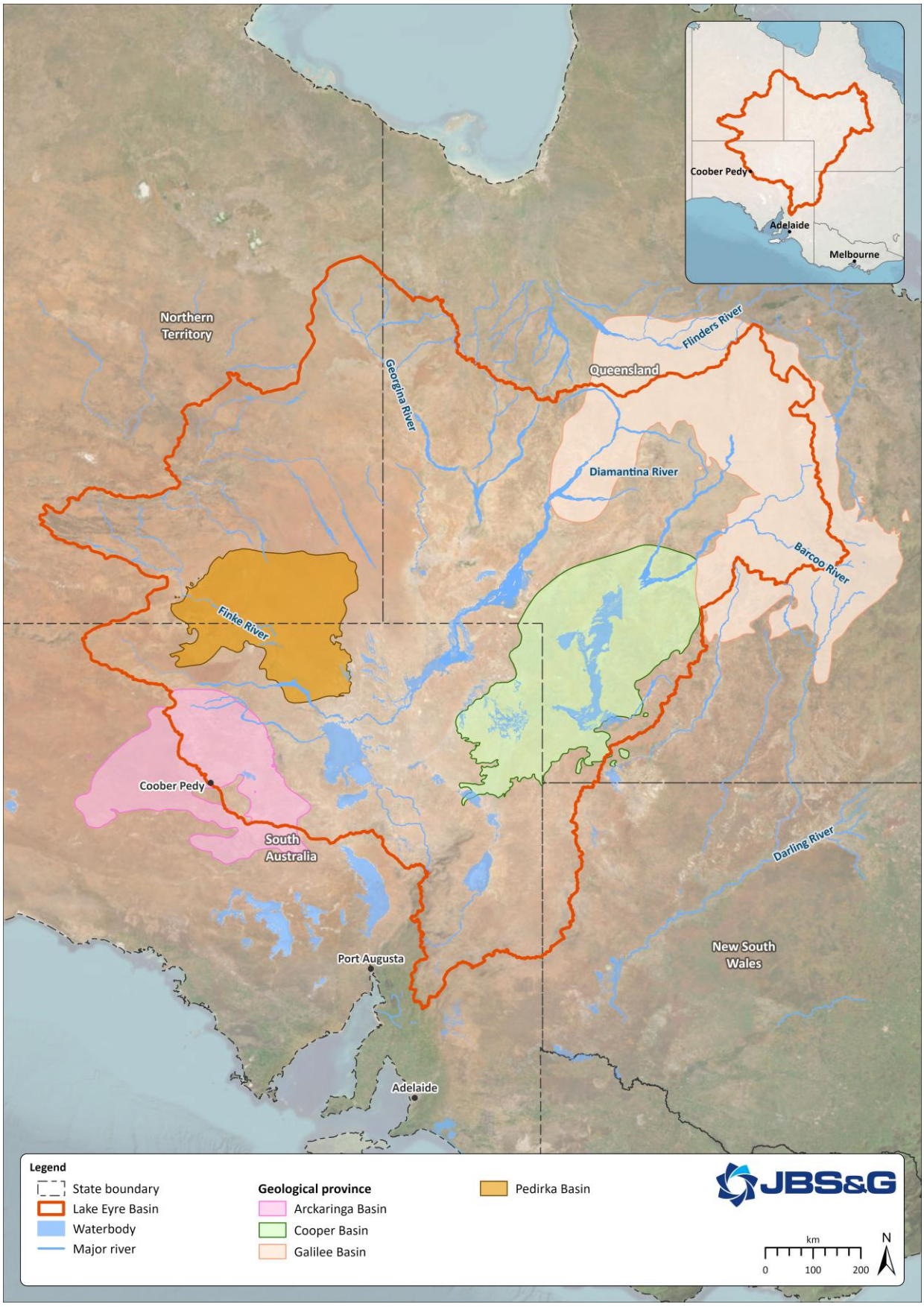


Figure 4-3: Lake Eyre Basin, showing the major waterbodies and location of Permian basins

4.4 Arckaringa Basin Geology

4.4.1 Structural Setting

The Arckaringa Basin is an intra–cratonic basin, which contains sediments of mainly early Permian age. The main regional tectonic features are shown in Figure 4-4. These are the age equivalent of petroleum productive Permian intervals in the Cooper Basin. The Arckaringa Basin covers an area of about 80,000 km^2 in the northern South Australia.

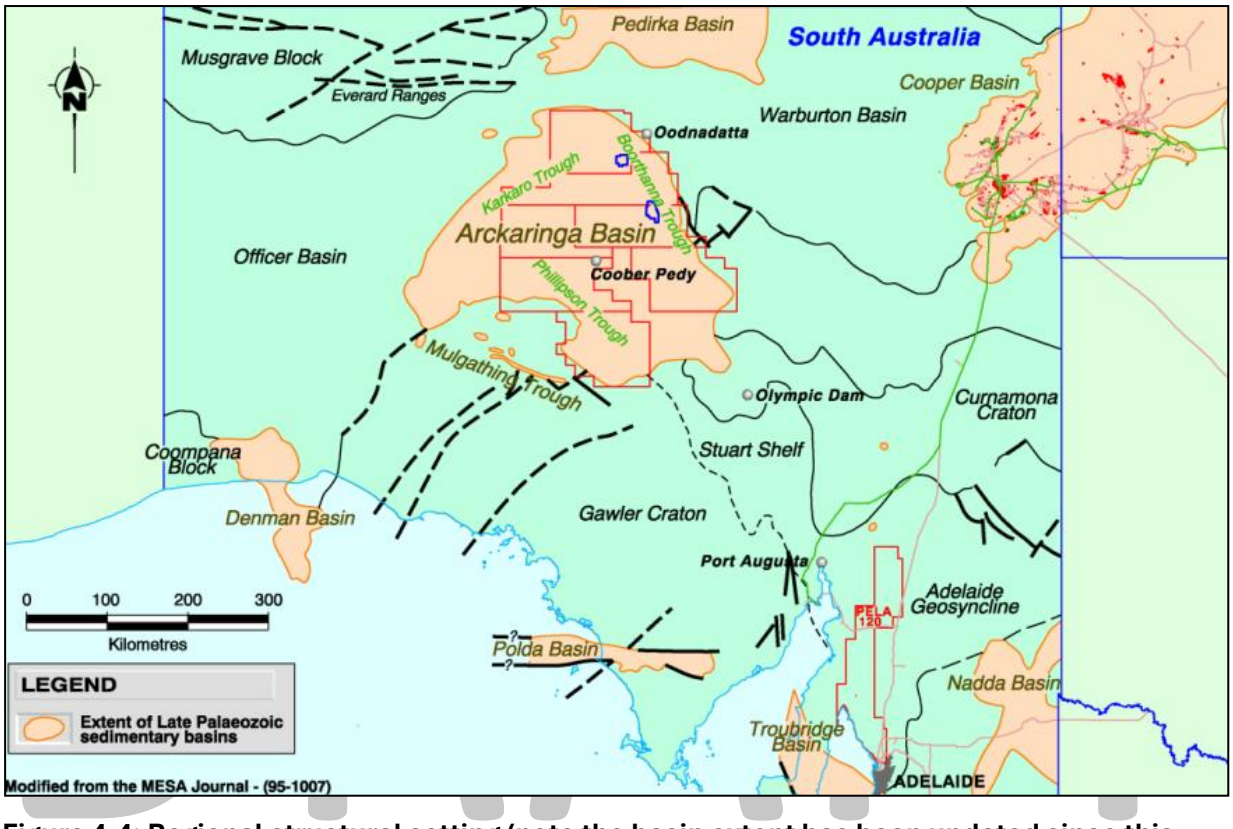


Figure 4-4: Regional structural setting (note the basin extent has been updated since this map was published)

It is composed of a central platform area of gently undulating shallow crystalline basement surrounded by peripheral depressions. The basin was formed by faulting of the marginal depressions, oriented in a northwest to southeast direction, such as the Boorthanna and Phillipson Troughs. The Permian sediments are underlain unconformably by thick pre-Permian (Adelaidean to Cambrian) sequence. Mesozoic Eromanga sediments (Middle Jurassic to Early Cretaceous) are spread as a thin veneer (up to 300 m) over most of the Arckaringa region, thickening to the north and north-east. It is generally less than 10 m of Tertiary cover over the basin area (Drexel and Preiss 1995).

The Arckaringa Basin is bounded by the Early Proterozoic Gawler Craton in the south, late Proterozoic to early Palaeozoic eastern Officer Basin in the west and to the east it is fault bounded against the Peak and Denison Inliers. These ranges comprise the Precambrian crystalline rocks, overlain by folded and metamorphosed sediments of the Adelaide Geosyncline and are intruded by Early Palaeozoic granites. The north and north-eastern margin are not readily defined due to lack of outcrop and subsurface data (Hibburt 1984).

4.4.2 Stratigraphy

Composite generalised stratigraphy of the Arckaringa Basin is presented in Figure 4-5.

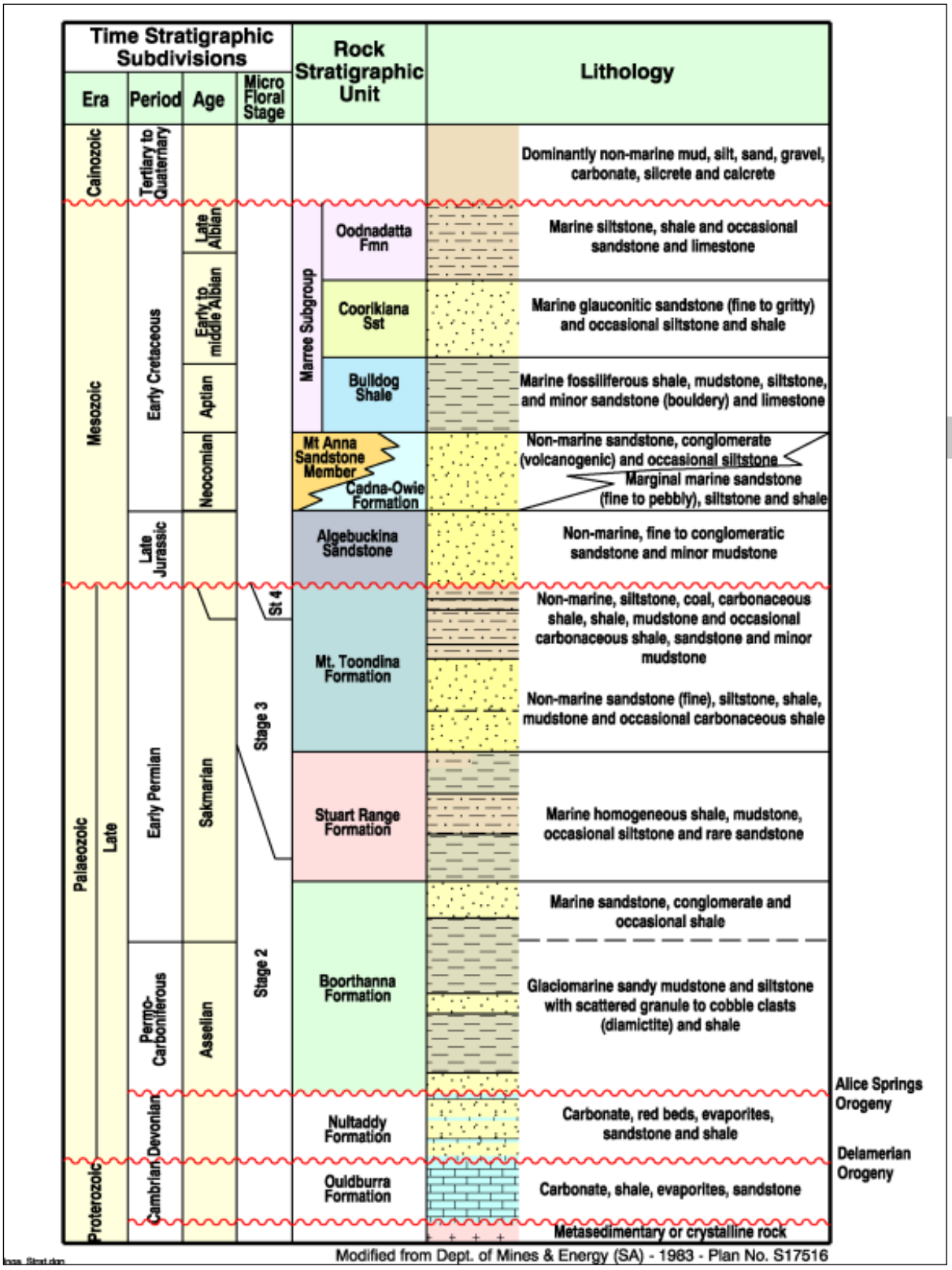


Figure 4-5: General stratigraphic column of the Arckaringa Basin

4.4.2.1 Mesozoic Sediments (Eromanga Basin)

The early Permian sediments are overlain by an abbreviated Eromanga Basin succession which consists of Algebuckina Sandstone, Cadna-owie Formation and Bulldog Shale. The Jurassic Algebuckina Sandstone is sand-dominated deposited in the braided fluvial system with typical lithology of white kaolinitic quartz sandstone and conglomerate composed of well-rounded quartz pebbles. The early Cretaceous Cadna-Owie Formation has been deposited in the marginally marine to non-marine environment.

Its lithology is typically fine to medium grained brownish sandstone, silty and micaceous and it may also contain quartz pebbles. The Bulldog Shale is a shelf mud deposited from suspension in an epicontinental sea and it consists of dark grey, bioturbated and fossiliferous shaly mudstone. The Bulldog Shale could provide a top seal for the Cadna-owie Formation and Algebuckina Sandstone. The total Eromanga Basin sequence, in the Arckaringa Basin, is up to 300m thick. Following this phase of rapid deposition, erosion and deep weathering occurred during the Late Cretaceous to Paleocene (Alexander and Hibburt 1996).

The Algebuckina Sandstone and Cadna-Owie Formation collectively form the Great Artesian Basin within the Arckaringa area.

4.4.2.2 Permian Sediments (Arckaringa Basin)

The Arckaringa Basin sediments have been deposited during late Carboniferous to early Permian. Three major sedimentary units (Boorthanna, Stuart Range and Mount Toondina formations) have been defined from the seismic, drilling and mapping in the area (Figure 4-6).

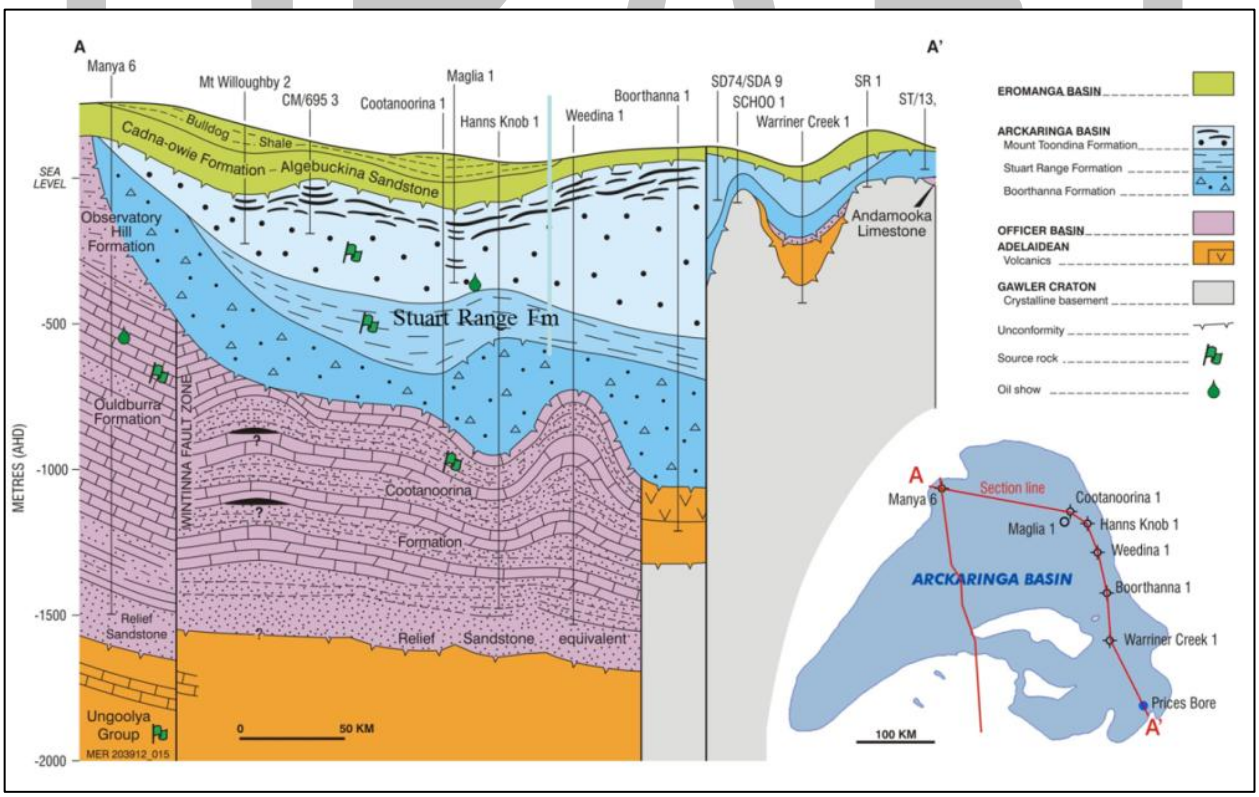


Figure 4-6: Schematic cross-section of the Arckaringa Basin

Mount Toondina Formation

The Mount Toondina Formation overlies, usually conformably but occasionally disconformably, the Stuart Range Formation. Three units have been recognised from seismic and wells. The basal unit has

only been intersected in the south (Boorthanna 1 and Arkeeta 1)[4] and it consists of anoxic marine shale with interbedded limestone indicating a restricted marine environment. The overlying middle unit comprises fluvio-deltaic sands prograding from the east with interbedded siltstones. Termination of marine deposition was brought about by crustal isostatic recovery or eustatic fall bringing about a return to freshwater conditions. The age of the Lower Mount Toondina Formation has been determined by palynology to be Kungurian 276-270 Ma (Purcell 2012).

The upper unit is deposited in a predominantly lacustrine environment with coals deposited during phases of swamp development, and sandstones representing fluvial incursions. The coals have seams, which are up to 8m thick, with cumulative thicknesses up to 30 m. The Mount Toondina Formation is lithologically similar to the time equivalent Purni Formation in Pedirka Basin and the Patchawarra Formation in the Cooper Basin (Moore 1982).

Sedimentation ceased as a consequence of positive epeirogenic movements at the end of Early Permian. Apart from some erosion in the eastern side of the basin no other deposition records are preserved in the Arckaringa Basin from Late Permian and Triassic.

Stuart Range Formation

Following glaciation, marine transgressive conditions prevailed with eustatic rise in sea level and flooding of glacio-isostatically depressed lowlands resulting in deposition of the Stuart Range Formation, which usually conformably overlies the Boorthanna Formation, but it is mainly unconformable in the Boorthanna Trough).

The Stuart Range Formation is blanket marine shale of Early Permian (Sakmarian to Artinskian) and consists of dark grey to black shales and siltstones with some minor interbedded sandstone. It is predominantly deposited in quiet, restricted marine conditions but with occasional lacustrine intervals. It provides a top seal and potential source rock that could charge sandstones within the upper part of the Boorthanna Formation.

The total thickness estimated from seismic is between 70-300 m, however the thickest intersection reported is 49 m in Lake Phillipson Bore 1 (Moore 1982; Hibburt 1984). Thick organic rich black shales and siltstones with excellent source rock potential have been intersected in Arck 1, Wirrangula Hill 1A and Pata 1, all located in the central Boorthanna Trough (Figure 4-6).

Boorthanna Formation

The Boorthanna Formation comprises a basal glaciogenic sequence and upper marine unit with rhythmically bedded sandstone. The earliest sedimentation commenced with a period of glaciation and is dominated by glaciogenic sediments including diamictites, which were transported by glaciers and deposited in the marine environment interbedded with laminated mudstone and minor sandstones and carbonates. It is assumed the sea had access from the southwest. The faulting which was particularly active during the Early Permian ice age continued into the post glacial period and resulted in a number of turbidity currents, which provided transport of the coarse clastics forming the upper unit of the Boorthanna Formation. This sequence, which consists of medium to coarse grained sandstones, has demonstrated reservoir potential in a number of wells.

The maximum thickness intersected is 646 m at Pata 1. The age of the Boorthanna Formation has been determined by palynology to be Asselian to Sakmarian (299-284 Ma), Purcell 2012).

4.4.2.3 Pre-Permian Sediments (Officer Basin)

The stratigraphy of the pre-Permian sequence is poorly known due mainly to poor stratigraphic control and only few well intersections. Precambrian crystalline basement of the Gawler Craton, together with the varying thickness of Adelaidean to Cambrian sediments underlie most of the Permian in the basin

[4] Note: Petroleum wells previously drilled in the region are shown in **Error! Reference source not found.**.

(Priddle 1983). Based on the available seismic interpretation and limited well data it appears that pre-Permian sequence is present and up to 4km thick in the BoorthannaTrough and south-eastern part of the basin. The Pre-Permian sequence is very thin or absent in the central and south-western parts of the basin. No stratigraphic date has been determined through palynological analyses. Numerous oil and gas shows have been recorded in the pre-Permian sequence in the Officer Basin to the west.

The earliest preserved sedimentation in the area probably occurred during Adelaidean to Cambrian in a fault–bounded trough. Following uplift and erosion of the Ordovician Delamerian Cambrian, sedimentation recommenced with the possible deposition of a Siluro-Devonian sequence of shaly carbonates and terrigenous sediments, mainly red beds. Deposition of these rocks ceased with the onset of the Carboniferous Alice Springs Orogeny.

The lithologies intersected to date comprise mainly carbonates (dolomites) interbedded with anhydrite, dolomitic shales and minor sandstone indicating a predominantly quiet-water restricted marine environment including evaporitic tidal flats and sabkhas (Cootanoorina 1 and 2, William Creek 1 and Weedina 1) or red beds with a dolomite matrix and minor anhydrite (Eba 1), together with interbedded siltstones affected by multiple diagenesis (Hanns Knob 1 and Haystack 1). The effect of diagenesis found in these sediments appears to be spatially irregular. The basal part of the pre-Permian sequence in the Boorthanna Trough consists of metamorphics intersected in Birribiana 1, Weedina 1 and Boorthanna 1.

4.5 Hydrogeology

The following general summary of the hydrogeology of the Arckaringa Basin is based on information from the 2020 SAPEX EIR and Coffey (2007).

The Arckaringa Basin lies under the southwest edge of the Great Artesian Basin (GAB) and appears hydrogeologically partially separated from the central aquifer at basin scale by the Peak & Denison Inlier, an area of outcropping basement rocks.

Similarly, to other parts of the GAB, the Mesozoic Sandstones (Cretaceous Cadna-Owie Formation and Jurassic Algebuckina Sandstone) are the most important water yielding rocks. These formations appear to be hydrogeologically interconnected at a regional scale and would act as a single aquifer system.

The Algebuckina Sandstone forms the main aquifer and has been extensively developed for pastoral usage. It thickens from the sub-crop, in a north easterly direction across the GAB. This confined aquifer is known to be artesian in parts of the Arckaringa Basin in areas where the potentiometric surface lies above ground level, individual wells in the artesian zone may produce in excess of 4.3 ML/day.

In some areas the overlying Cretaceous Cadna-Owie Formation is of sufficient thickness and areal extent to be hydrogeologically significant. Since no continuous aquifer is known in the lower part of the Cretaceous it is likely that sandy horizons in this formation are isolated lenses.

The Cretaceous Bulldog Shale forms a confining layer over the Mesozoic Sandstones. Permian-age rocks extensively underlie the Sandstones of the GAB including the Mount Toondina, The Stuart Range and Boorthanna Formations. These rocks are relatively impermeable and usually form the hydrogeological base of the basin.

The major groundwater intake areas are the elevated eastern margin of New South Wales and Queensland. The general groundwater flow direction appears to be to the south-west towards South Australia. The flow pattern has not been accurately defined, and the general direction of flow is probably valid on a regional scale but may vary in local detail. Within the Arckaringa Basin there are minor subsidiary intake areas along the western rim of the margin and along the eastern range where the Algebuckina Sandstone crops out along the Peake – Denison Inlier. It is probable that there is direct rainfall recharge to the Mesozoic aquifers in their outcrop areas along the flanks of the Peak - Denison Ranges.

Groundwater discharge, in the artesian areas, occurs in the form of natural upward movement into overlying sediments, springs, free-flowing artesian bores and, where the potentiometric surface lies below ground level, pumped sub-artesian bores.

Groundwater hydrochemistry is described in DEWNR (2015/03) where an investigation was completed using bores on the flanks of the Arckaringa Basin and in the South towards the Billa Kalina Sub Basin (Figure 4-7). DEWNR (2015/03) noted similarities in major ion chemistry of groundwater from different aquifers as shown in Figure 4-7. Although trends in major ion hydrochemistry are evident, the high degree of overlap between groundwater sample-groupings based on aquifer provenance indicates that such trends may be more closely related to spatial distribution rather than hydro-stratigraphy.

DEWNR (2015/03) concludes that most samples are primarily dominated by Na+-Cl- chemistry, although a clear evolutionary trend that displays a change in anionic composition from proportionally high concentrations of HCO3 - to proportionally low concentration can be observed in some GAB aquifer and spring samples (Figure 4-7). These same samples also contain a proportional Na+ + K+ concentration of <10%.

Table 4-3 provides a summary of the regional hydrogeology.

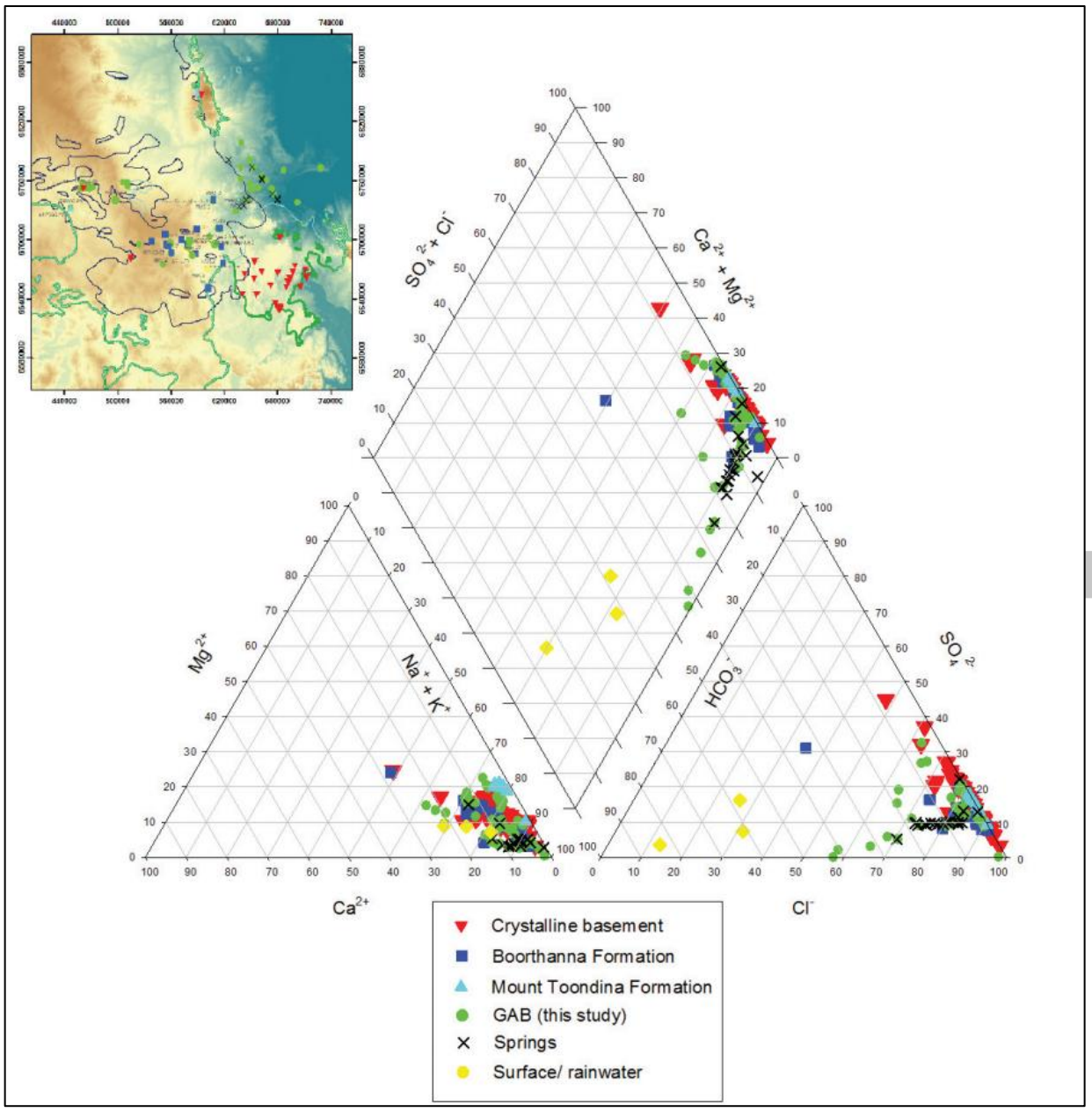


Figure 4-7: Piper plot displaying major ion data coloured according to aquifer provenance. Inset shows distribution of sample sites

4.5.1.1 Mesozoic Aquifers (Great Artesian Basin)

Coffey (2007) provides a review of the hydrogeology within the Mesozoic Eromanga Basin overlying the Arckaringa Basin. A cross section is provided in Figure 4-7 for reference, note the area highlighted by the red square approximates the target area for this EIR. The report identifies one regional aquifer system over multiple formations including the Cadna-Owie Formation and the Algebuckina Sandstone:

- The Cadna-Owie Formation and the Algebuckina Formation combine to form the Great Artesian Basin. This Cadna-Owie Formation is described as a uniform fine – medium sandstone with some silt, rare gravel and occasional thin lenses of siltstone/claystone. The upper section can contain hard sandstone bands with siliceous and/or sideritic cement.
- The Algebuckina Sandstone consists of a uniform, fine – medium – coarse poorly consolidated sandstone. Carbonaceous lenses on bedding planes are common and occasional lenses of silty

sandstone hard bands. Poorly lithified coarse sandstone and pebbles are common throughout, particularly in the lower Algebuckina Sandstone at the Permian unconformity.

- Existing data indicates water quality (based on Coffey 2007) within the GAB formations is fresh to brackish (600 – 4,000 mg/l TDS) with salinity increasing to the southwest. The dominant anion is chloride with variable sulphate and bicarbonate. Because grain size increases and percentage fines decrease with depth, the permeability may be expected to also increase with depth.
- During 2013 – 2014, Linc Energy completed a baseline groundwater monitoring program on existing bores and mound springs focussing on the eastern Boorthanna Trough (Figure 4-8 - most developed in GAB sediments). The monitoring was completed by Linc Energy in 2013 over three separate timeframes (September 2013, June 2014 & December 2014). In line with conclusions above, the cation and anion concentrations indicate the water is saline, this is further supported by the total dissolved solids ranging from 2,110 mg/l – 10,900mg/l with the average being 4,160mg/l. Overall, salinity tends to increase from PEL122 to PEL123 as shown in Figure 4-9: Average TDS values in the Eromanga Basin monitoring bores and springs (Source Linc 2016). Interpretation of the results concluded:
    - Cation and anion piper diagrams illustrate close groupings of all samples as show in Figure 4-10 similar to Figure 4-7: Piper plot displaying major ion data coloured according to aquifer provenance. Inset shows distribution of sample sites indicating samples are likely from the same origin or source rock
    - Comparison between total and dissolved metals as shown in Figure 4-11 indicate majority of metals are dissolved consistent with the low suspended solids report above.
    - Phenolic, PAH & BTEXN compound results were all below the limits of reporting
    - Total petroleum hydrocarbons (TPH) results are below the limit of reporting. (It is noted two samples from Johns Bore and South Well spring contained anomalous TPH compounds in isolation from all other data including subsequent samples from the same bores. These results were likely due to cross contamination during sampling).
    - Surfactants were detected in all samples collected in September 2013 in isolation from other samples collected in subsequent dates, these results were attributed to decontamination solution used to clean sampling equipment not being adequately rinsed of between samples.

The southern portion of PEL122 and PEL123, the Algebuckina Sandstone pinches out with only the Cadna-Owie Formation remaining. Here the GAB outcrops at surface notable by the surface topography changing from stony plains to sand dune country. Existing drill hole data indicates the GAB formation can be weathered in part/full with common clayey bands formed causing isolated aquifer lenses. Water is generally sub artesian and saline (up to 12,000mg/L TDS). Water quality improves towards Lake Eyre on the eastern side of the mound spring network along with artesian pressure.

The early Cretaceous Bulldog Shale forms the confining aquitard to the GAB aquifers. Minor, sporadic, laterally discontinuous perched aquifers are known to exist at shallow depths within or at the base of the weathered zone (8 – 15m) however this isn't common. Water quality is saline with a measured salinity of approximately 25,600 mg/l TDS.

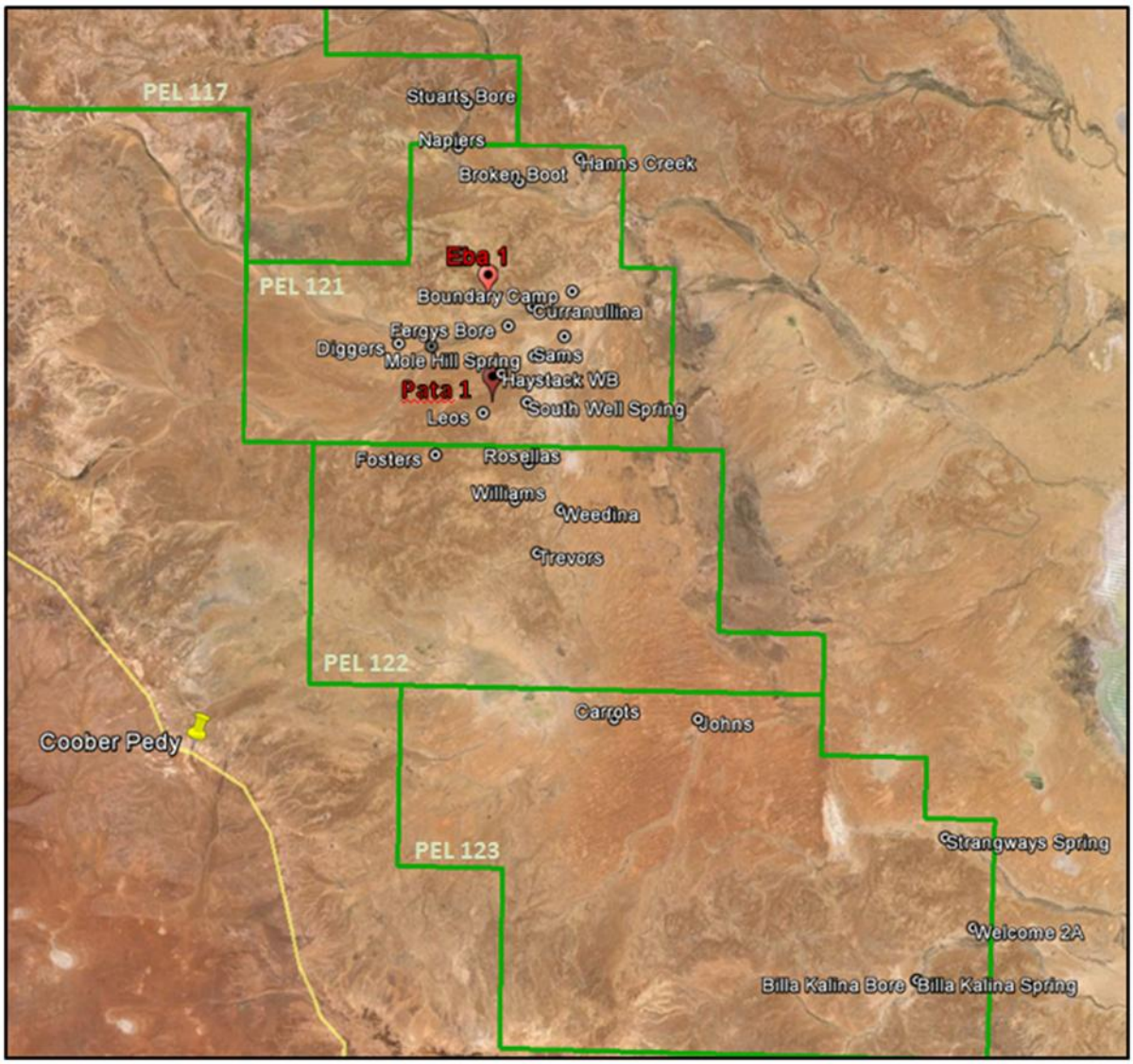


Figure 4-8: Map of groundwater bore and spring sampling locations

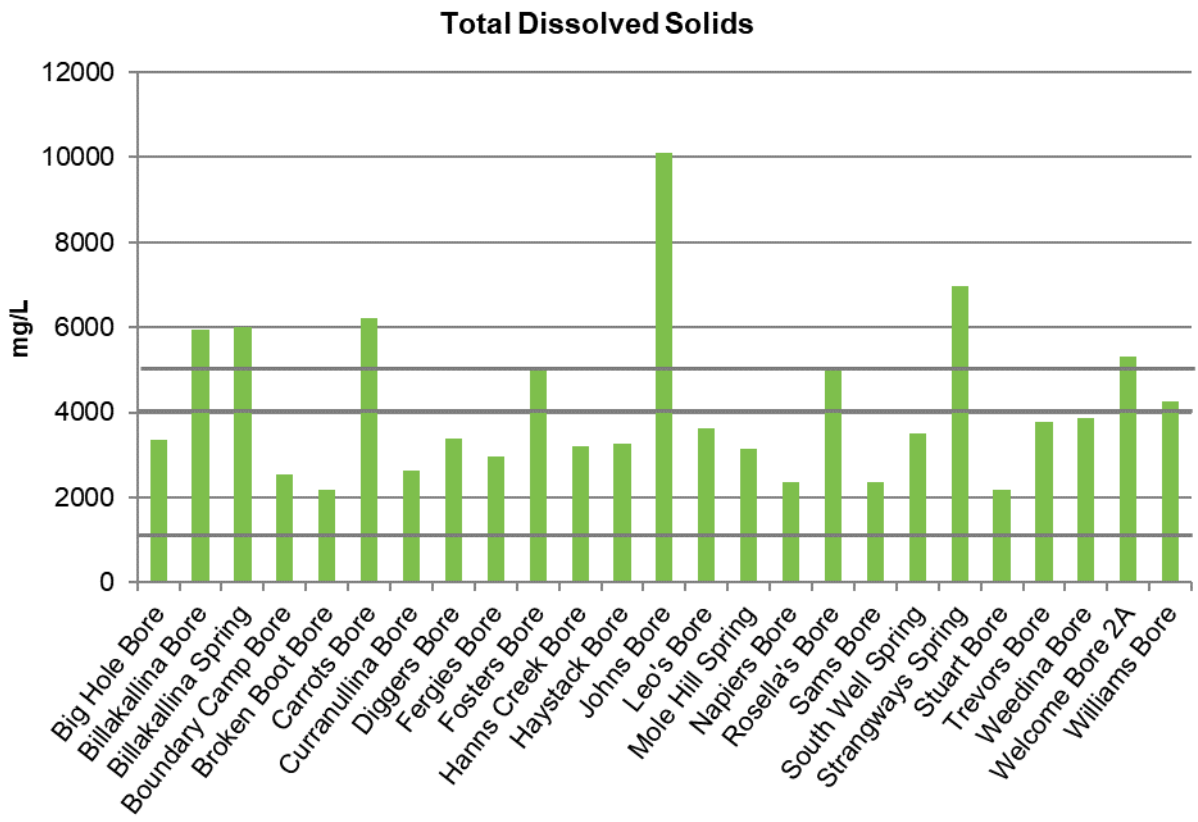
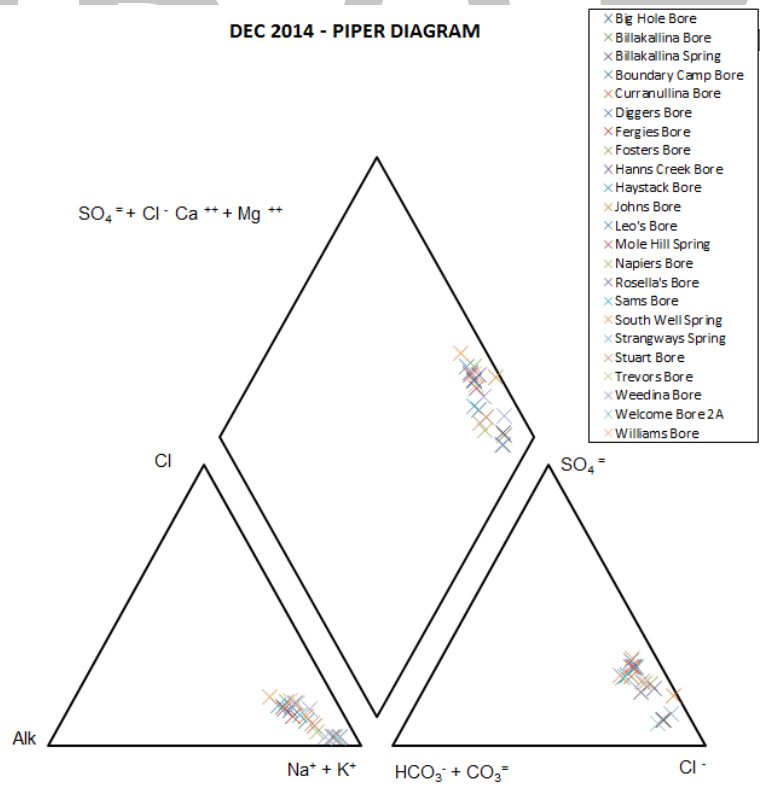


Figure 4-9: Average TDS values in the Eromanga Basin monitoring bores and springs (Source Linc 2016)



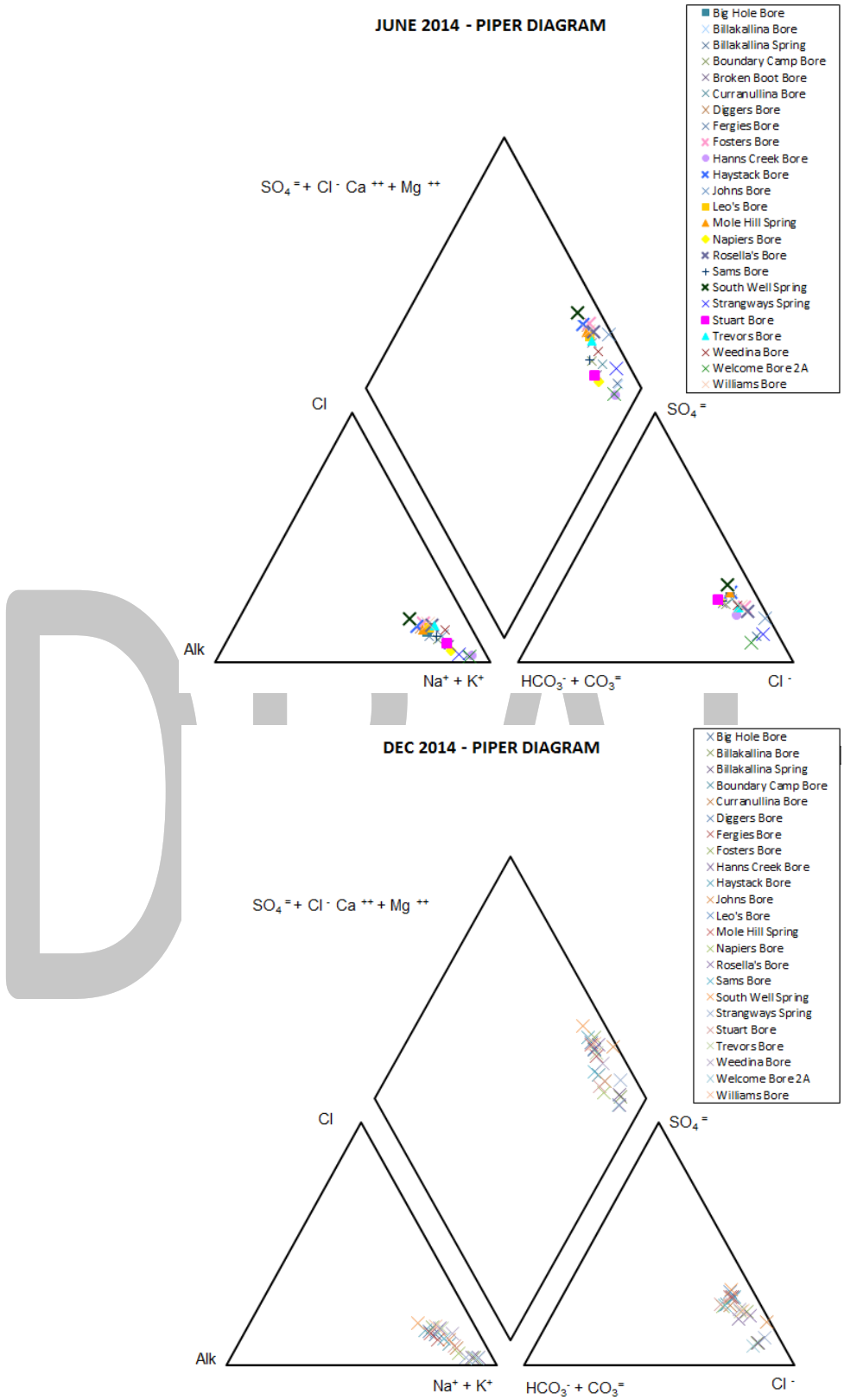


Figure 4-10: Piper plot displaying major ion data collected from the Eromanga Basin monitoring bores and springs (Source Linc Energy 2016)

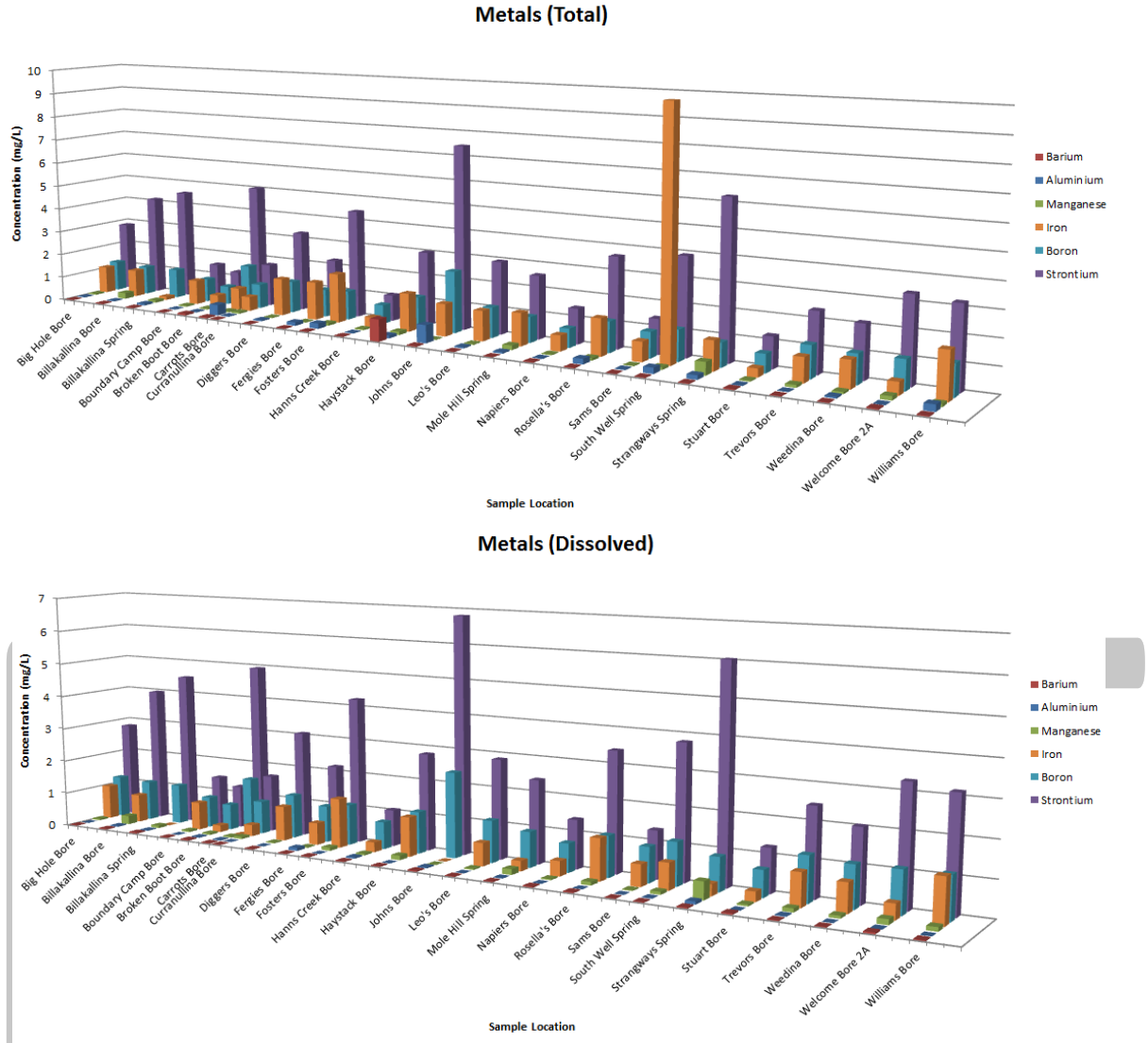


Figure 4-11: Total and dissolved metals (6 major metals) in the Eromanga Basin monitoring bores and springs (Source Linc 2016)

4.5.1.2 Permian Aquifers

DEWNR (2013/11) provides the most recent review of the Hydrogeology within the Permian Arckaringa Formation sediments. DEWNR (2013/11) identifies two regional aquifers systems:

- The **Mount Toondina Formation** which is described as comprising an upper section consisting of grey carbonaceous shales, coals and interbedded grey sandstones, siltstones and sandy shales. The sandstones and coals in the upper section are described as aquifers that are potentially interconnected with the overlying GAB although this is contrary to the conclusion in Coffey (2007). The lower section of the Mount Toondina Formation is described as less carbonaceous and slightly sandier forming a potential aquitard.
- Existing data indicates water quality within the Mount Toondina Formation is saline to ultra-saline (73,198 – 155,065 mg/l TDS), extremely hard (13,862 – 24,125 mg/L $CaCO_3$) and slightly acidic (pH 6.5 – 7.0). Hydraulic connectivity ranges from 0.9 – 9x10^{-3} m/d in coal seams and 9 x 10^{-4} – 9 x 10^{-5} in stony interbeds. Permeability ranges from 1.48 x 10^{-12} – 4.5 x 10^{-3} cm^2. Porosity ranges from 4 – 36.6%.
- The **Boorthanna Formation** is described as two units. The upper unit consists of interbedded marine clastics, with grain size ranging from silt to boulders, while the lower unit is comprised of glaciogenic sandy to bouldary claystone diamictite and shale intercalations. The lower unit is restricted to deeper parts of the basin including the southern Boorthanna

Trough. The sandstone and conglomerate layers are potential aquifers and have been targeted in earlier exploration as reservoirs. The shales, siltstone and diamictite layers are potential aquitards.

Most information concerning the hydrogeological characteristics of the Boorthanna Formation is sourced from the southeastern Arckaringa Basin in the Billa Kalina sub-basin. This area is approximately 10km south of PEL123 (Figure 13) and is a water source for major mining complexes including Prominent Hill and Peculiar Knob. Here, the Boorthanna Formation is described as heterogenous at a local scale with multiple isolated sandstone aquifers capable of supplying brackish to moderately saline water (7,000 – 50,000 mg/L TDS). This heterogeneity is reflected in stated lateral hydraulic conductivity figures in the Boorthanna Formation which vary from 0.02 – 5 m/d. It is thought the relatively isolated semi-discontinuous aquifers are related to sporadic turbidity flows within an otherwise quiescent glacio-marine environment and that further discontinuity may arise from syn and post depositional faults.

Permeability ranges from 2.96×10^{-9} – 1.97×10^{-9} cm^2 and porosity ranges from 3.6 – 25%.

The Stuart Range Formation is stratigraphically located between the Mount Toondina and the Boorthanna Formation. No aquifers of any significance are known to occur within the Stuart Range Formation. Hydraulic conductivity of core samples indicates a hydraulic conductivity of 1×10^{-4} m/d.

4.5.1.3 Arckaringa Basin Aquifer Connectivity

The Department for Environment, Water and Natural Resources (DEWNR) (now DEW) completed a number of projects between 2013 and 2015 consisting of reports, maps and models on the hydrogeology of the Arckaringa Basin. These were completed to support bioregional assessments completed by the Australian Government to better understand the potential impacts of coal seam gas and large coal mining development on water resources and water dependant assets. Project information produced by DEWNR includes:

- Arckaringa Basin and Pedirka Basin Groundwater Assessment Report (DEWNR 2013/11)
- A Hydrogeological Characterisation of the Arckaringa Basin (DEWNR 2015/03)
- Arckaringa Basin Aquifer Connectivity (DEWNR 2015/14)

DEWNR (2015/03) concluded the complexity of the Arckaringa Basin geology stems from fluvioglacial activity during the Permo-Carboniferous time rather than faulting. This architectural complexity may have resulted in sub-basinal hydrogeological systems that are isolated from regional systems evident by differing hydrochemical evolution and radiocarbon distributions of groundwater. Aquifer communication is generally controlled by thickness of Permian sediments and lithology at the Great Artesian Basin unconformity.

From a regional perspective, connectivity is most important where the GAB aquifer is in contact with sandier units of the Mount Toondina Formation. In such areas, similarities in hydrogeological properties between differing basinal strata will be conducive to inter basinal groundwater flow. This connectivity can be amplified by the presence of paleochannels within the unconformity between the Eromanga Basin and the Arckaringa Basin increasing the potential for both cross-formational flow and recharge to Permian aquifers. This connectivity will generally affect coarser sands and coals of the Upper Mount Toondina Formation where porosity and permeability are highest. Within the deeper areas of the basin such as the Boorthanna Trough, fine siltstones and shales are present within the middle to lower Mount Toondina Formation and would act as an aquitard.

For deeper aquifers such as those within the Boorthanna Formation, the removal of younger sedimentary horizons on the basin margins (in particular the Stuart Range Formation) by erosion prior to the deposition of the GAB or younger sedimentary units, provides potential for interconnectivity between the Boorthanna Formation and overlying aquifer units. This is largely evident in the south-eastern margins of the basin in the Billa Kalina sub basin where the Mt Toondina and Stuart Range Formation are absent (DEWNR 2015/03).

In areas where the Stuart Range Formation is thicker and better developed such as in the deeper sections of the Boorthanna Trough, it acts as a regional aquitard isolating the Boorthanna Formation from overlying aquifers. DEWNR (2015/14) tested this by drilling a continuous core hole in the south of the basin through the GAB sediments and into the Arckaringa Basin to provide an assessment of vertical flow via hydraulic, hydrogeological and hydrochemical analysis. At the location, all formations were relatively thin (compared to deeper areas of the Boorthanna trough) with the Bulldog Shale being 18m thick, the GAB aquifer being 29m thick and the Stuart Range Formation being 57.5m thick. The Mount Toondina Formation was absent. The investigation concluded there is a low degree of connectivity between the Arckaringa Basin and overlying GAB aquifer. It was determined that flow (flux) through the Stuart Range Formation aquitard is small, in the order of millimetres per 1,000 years. Where the Stuart Range Formation is thicker, and the lower Mount Toondina Formation aquitard present, flux is expected to be significantly lower.

The CSIRO (2012) regional hydrogeological assessments concluded the Cretaceous and Jurassic sequence overlying the Arckaringa Basin forms an independent yet hydrogeologically partially interconnected sub basin of the Great Artesian Basin referred to as the *'Western Eromanga Region'*. This region refers to the area of Eromanga Basin west of the Birdsville Track Ridge.

4.5.2 Groundwater use

Table 4-2 presents the environmental values assigned to two key hydrogeological (groundwater) units — the Great Artesian Basin (GAB) and the Boorthanna aquifer — as defined under the South Australia Environmental Protection (Water Quality) Policy 2015. These values indicate what each aquifer is considered suitable (or not suitable) for in terms of human use and ecological function within the Licence Area.

The environmental values define the baseline protection obligations for each aquifer. The GAB holds value for irrigation and general water use and livestock drinking water. The Boorthanna aquifer is recognised for livestock drinking water,

Table 4-2: Environmental Values of Different Hydrogeological Units in accordance with the Environmental Protection (Water Quality) Policy 2015.

Aquifer	Aquatic Ecosystem	Recreation and Aesthetics	Drinking Water for human consumption	Primary Industries – irrigation and general water use	Primary Industries – Livestock drinking water	Primary Industries – aquaculture and human consumption of aquatic foods
GAB	N/A	N/A	N/A	✓	✓	✓ – N/A
Boorthanna	N/A	N/A	N/A		✓	✓ – N/A

Existing groundwater use within the Licence Area is for pastoral activities with most bores developed within the Great Artesian Basin sediments. While water quality in parts of the GAB appears suitable for irrigation, weather conditions are too hot for cropping.

To the west of PEL122, a number of production bores have been developed in the GAB to supply water to the township of Coober Pedy. These bores are located approximately 13km west of the PEL122 boundary.

West of PEL123, numerous production and monitoring bores haves been developed to support major mining operations at Prominent Hill, Cairn Hill and Peculiar Knob. These bores extract water from the Great Artesian Basin (Cairn Hill) and the Boorthanna Formation (Prominent Hill and Peculiar Knob) within the Billa Kalina Sub Basin – see (Figure 4-11) (DEWNR 2013/11). A number of monitoring bores drilled by Prominent Hill are located within PEL123.

DEW maintain a state monitoring bore network for the Far North PWA, further information can be found on the DEW Groundwater Data Website[5].

[5] https://www.waterconnect.sa.gov.au/Systems/GD/Pages/Default.aspx

Table 4-3: Summary of regional hydrogeology

Formation	Use	Extent	Salinity	Pressure System	Permeability
Eromanga Basin					
Bulldog Shale	Aquitard	Basin wide	<1,000 - >20,000 ppm	Main confining bed to GAB. Minor sporadic, laterally discontinuous perched aquifers occur at shallow depths	1.78×10^{-8} – 4.3×10^{-8} cm^2
Cadna-Owie Formation	Aquifer	Basin wide	600 – 12,000 ppm	Main GAB Aquifer – Generally sub artesian to artesian. Lower unit may contain isolated sandy lenses. Formation subcrops in the south of the basin evident by presence of sand dunes at surface	Average artesian flow 0.5 – 1 ML/day but can be as high as 13ML/day in the borefields near Lake Eyre South
Algebuckina Sandstone	Aquifer	Basin wide		Main GAB Aquifer – Generally sub artesian to artesian – formation pinches out towards the south of the Arckaringa basin	
Arckaringa Basin					
Upper Mount Toondina Formation	Aquifer	Basin wide with higher connectivity within coals	73,198 – 155,065ppm	Potential connectivity with overly GAB aquifer, particularly in the north of the basin where coals sub-crop into base of Algebuckina Sandstone	1.48×10^{-12} – 4.5×10^{-3} cm^2
Lower Mount Toondina Formation	Aquitard	Basin wide	Unknown	Variable – may be the same or greater or less the GAB	
Stuart Range Formation	Aquitard	Basin wide	Unknown	Variable - Potential for over pressured zones in deeper section of the Boorthanna Trough. Confining bed to Boorthanna Formation	Very low - Tight
Boorthanna Formation	Potential aquifers and aquitards	Isolated semi discontinuous aquifers	7,000 – 50,000ppm	Variable – aquifers occur in isolated semi discontinues pods. Potential connectivity with GAB on basin edges where formations are in direct contact	2.96×10^{-9} – 1.97×10^{-8} cm^2

Formation	Use	Extent	Salinity	Pressure System	Permeability
Pre Permian	Potential aquifers and aquitards	Basin Wide	Unknown	Potential for over pressured zones in centre of Boorthanna Trough. may be the same or greater or less the GAB	Highly variable, may include natural fractures

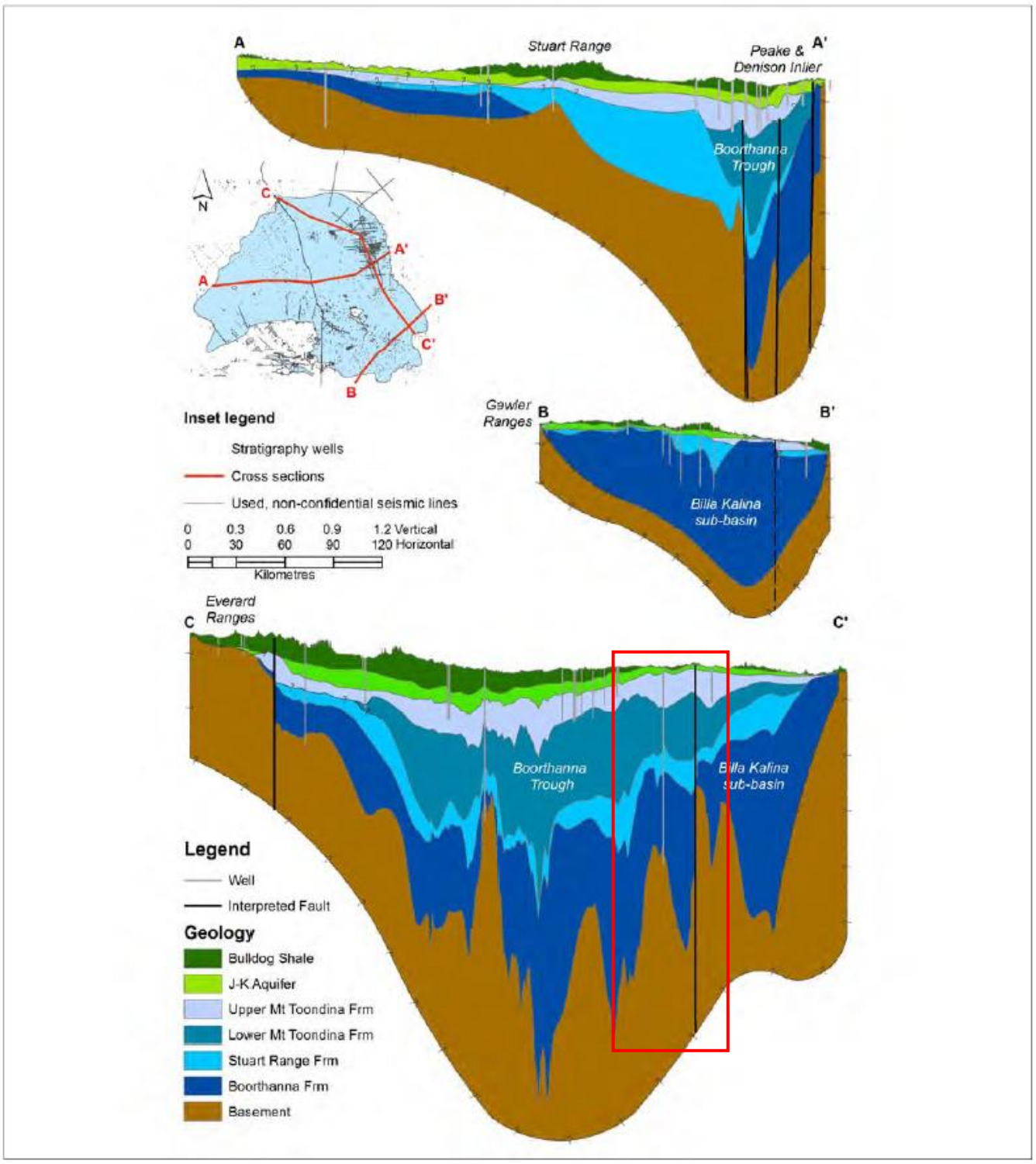


Figure 4-12: Interpreted cross-sections based on surfaces from seismic and well data. Source (DEWNR 2013/11)

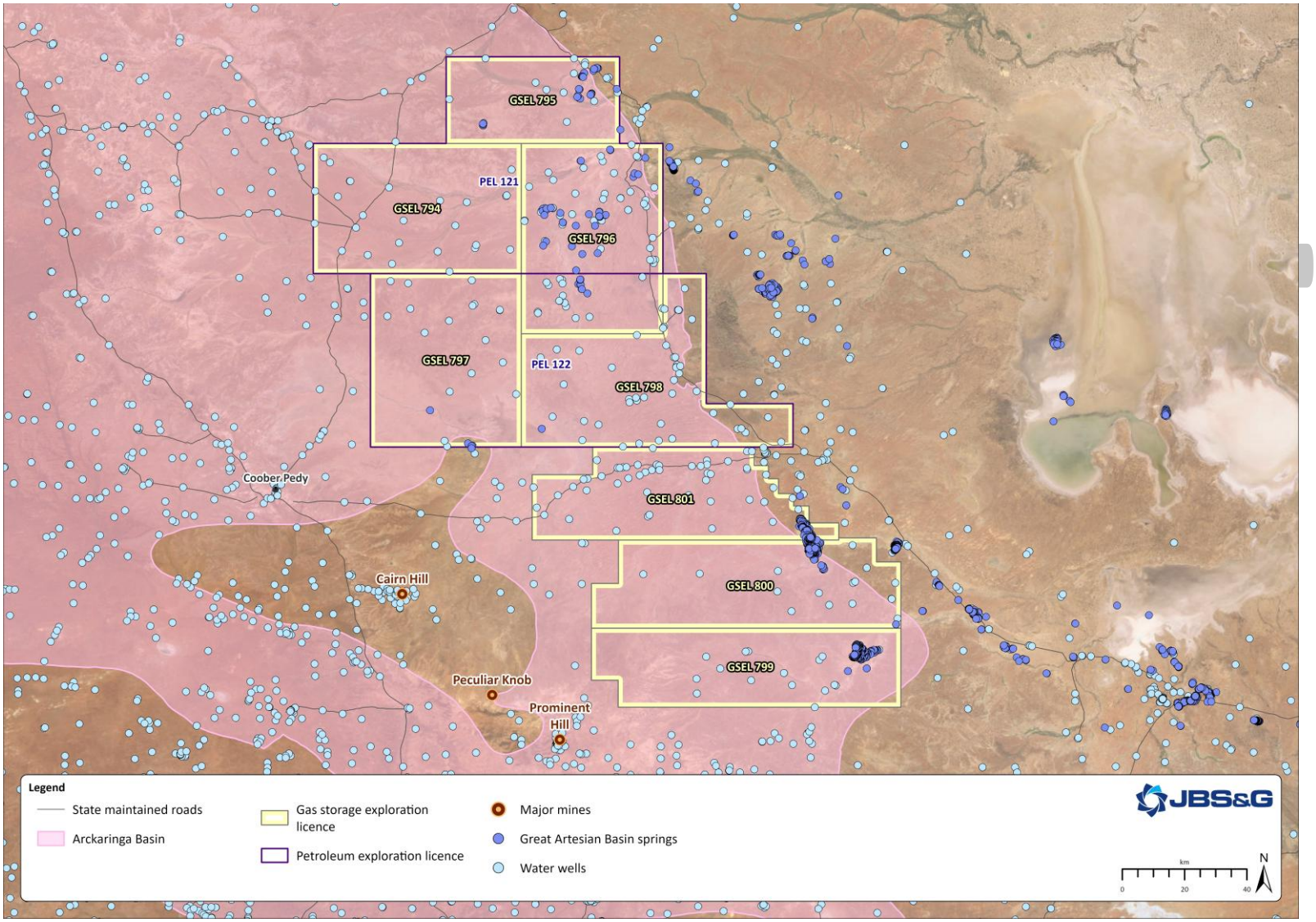


Figure 4-13: Major mining operations in the region

4.6 Heritage

A search of the National and State heritage registers has indicated that a number of heritage sites occur near to and within the Licence Area. A summary of these sites is provided in Table 4-4. Further information on these sites is provided in the sections following the table.

Table 4-4: Registered heritage sites in the Licence Area

Register Source	Site Type	Name	Location
Register of the National Estate (RNE)[6]	Indigenous	The Breakaways Reserve	PEL122
RNE	Indigenous	Ngampayiwalhuku	PEL121
RNE, State Heritage Register (SHR)	Historic	Edward Creek Railway Siding Complex	PEL121
RNE	Historic	Stony Creek Rail Bridge	5.5km SSE of Oodnadatta
RNE, SHR	Historic	Strangways Springs Site	PEL123
SHR	Historic	Marree to Alice Springs Railway	Extends from Marree to Oodnadatta PEL121, PEL122, PEL123
RNE	Natural	*Swainsona minutiflora*-Coorikanna Site	Between PEL 121 and Marla
RNE	Natural	Big Cadna-owie Spring	PEL121
RNE	Natural	Moon Plains	PEL122, PEL123
RNE	Natural	*Hemichroa mesembryanthena* Site	PEL123
RNE	Natural	Billa Kalina Spring	PEL123

4.6.1 Indigenous Heritage

There are numerous indigenous heritage sites located throughout the Arckaringa Basin. Many of these sites are of cultural significance and reflect Aboriginal occupation of the region. The more prominent sites include The Breakaways formation to the north of Coober Pedy and the Lake Phillipson area to the southwest of Coober Pedy. Many of the GAB Springs in the region are also an important component of Aboriginal culture. Much of the history of Aboriginal occupation of the land is also evident throughout the landscape in the form of middens, quarries, worksites, campsites and burial sites.

The Mount Willoughby Indigenous Protected Area (discussed in Section 4.7.3) is outside of the Licence Area. The protected area has a number of identified sites of importance to Aboriginal cultural heritage which are being recorded and preserved. The Pitjantjatjara and Maralinga Tjarutja Aboriginal Lands are located along the western and south-western edges of the region, outside the Licence Area.

[6] Note: The Register of the National Estate is a non-statutory archive.

4.6.2 Historical Heritage

Non-indigenous heritage in the region dates back to early exploration of the region in the mid to late 1800's and the expansion of pastoralism. The GAB springs along the southwest margin of the Great Artesian Basin were influential in this expansion, particularly in providing access to permanent water. The overland telegraph line and the Marree to Alice Springs railway line also passed through region of the GAB springs. Other heritage sites in the region are associated with early mineral exploration and the discovery of opal in Coober Pedy in the Stuart Ranges in 1915.

Many of the historical heritage sites in the region are associated with the exploration and development of the region by Europeans in the past 160 years. Prominent historical heritage includes the 'Old Ghan' or Marree to Alice Springs Railway and associated settlements, settlements associated with the Overland Telegraph Line (e.g. Strangways Spring site, The Peake Group), and settlements associated with early pastoral expansion and mining developments (e.g. housing in Coober Pedy, The Peake Group).

4.6.3 Natural Heritage

Natural heritage sites in the region identified in Section 4.6 include the geologically significant Arckaringa Hills (130 km north of Coober Pedy), the Moon Plains (10 km northeast of Coober Pedy) which supports a high diversity of rare species, a number of GAB Spring complexes along the western edge of the Great Artesian Basin (e.g. Big Cadna-owie Spring and Billa Kalina Spring) which provide important habitat for a number of indigenous plant and animal species, and sites providing habitat for listed vulnerable flora (e.g. *Swainsona minutiflora, Hemichroa mesembryanthena* sites).

4.7 Land Use

The current land uses in the project area include pastoralism, mining, conservation, tourism and defence.

4.7.1 Pastoralism

The main land use in the Licence Area is pastoralism with sheep and cattle grazing having been carried out over the past century. Cattle are grazed throughout the north of the region on large pastoral leases, while sheep are restricted to leases south of the Dog Fence, which is located outside of the Licence Area (generally west of the Licence Area). A limited number of properties are certified for organic production.

Pastoral leases in the Licence Area include:

- Allandale (including Toondina, Toondina East)
- Mount Willoughby
- Mount Barry
- Nilpinna
- The Peake
- Anna Creek (including The Peake).

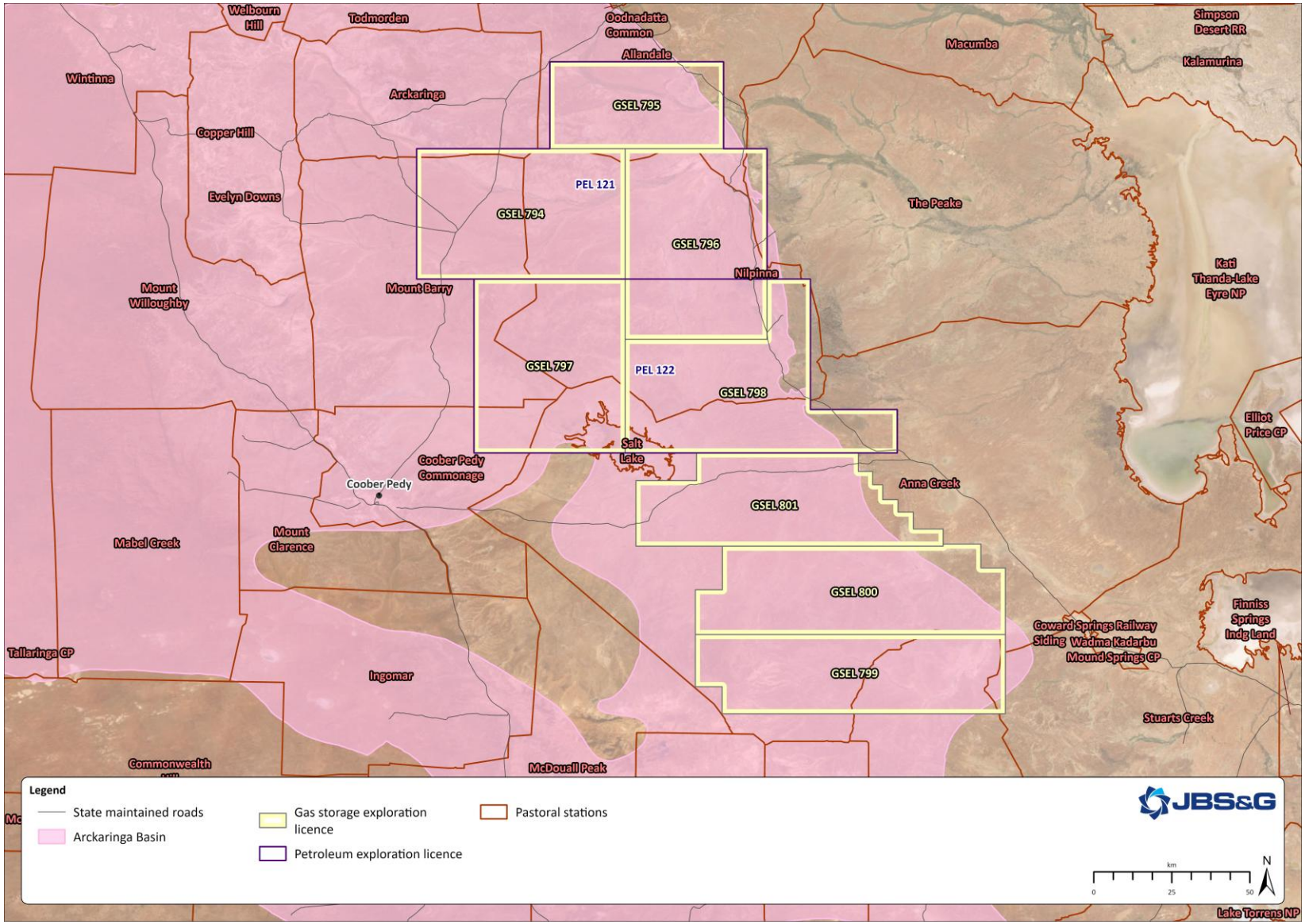


Figure 4-14: Pastoral stations within the Licence Area

4.7.2 Mining

Currently the most significant mining activities in the Arckaringa Basin are opal mining at Coober Pedy and the copper gold Prominent Hill mining operation established 130 km southeast of Coober Pedy outside the Licence Area (Figure 4-13).

Petroleum and mineral exploration also occur across the region, although these activities are campaign based. Petroleum exploration wells that have previously been drilled in the region are shown in Figure 4-15.

4.7.3 Conservation

The broader Arckaringa Basin region intersects four areas formally designated for conservation, all of which are outside the Licence Area (Figure 4-16):

- Kanku-Breakaways Conservation Park
- Wabma Kadarbu Mound Springs Conservation Park
- Tallaringa Conservation Park
- Mount Willoughby Indigenous Protected Area.

4.7.4 Tourism

Significant tourist attractions within the region include Coober Pedy and its opal mining, the Breakaways, the Painted Desert, GAB springs, Lake Eyre (to the east) and historical infrastructure associated with the Old Ghan Railway and the Overland Telegraph Line. Nature tourism, bush walking, wildlife, 4WD experiences, camping and indigenous tourism all occur throughout the region across all land tenures.

Tourism visitation in the region is largely restricted to townships, parks and the main network of sealed and unsealed roads connecting them including the Stuart Highway and the Oodnadatta Track.

4.7.5 Defence

The southern part of Licence Area lies within the Woomera Prohibited Area (Figure 4-16). There is limited Defence activity across most of this area but entry to the Prohibited Area (except on main road corridors) requires permission from the Commonwealth Department of Defence, in accordance with Regulation 35 of the *Defence Force Regulations 1952*.

The Woomera Prohibited Area intersects PELs122 and 123 / GSELs 797, 798, 799, 800 and 801.

4.7.6 Native Title

There is one Native Title determination across the Licence Area (Figure 4-16):

- SCD2012/002 – The Arabana People

The exploration licences have an associated agreement with the native title group that covers cultural heritage clearance requirements. Agreements were signed by the Minister on 03 October 2006. Under the requirements of the agreement, heritage clearances for any field work will be undertaken prior to the commencement of field activities.

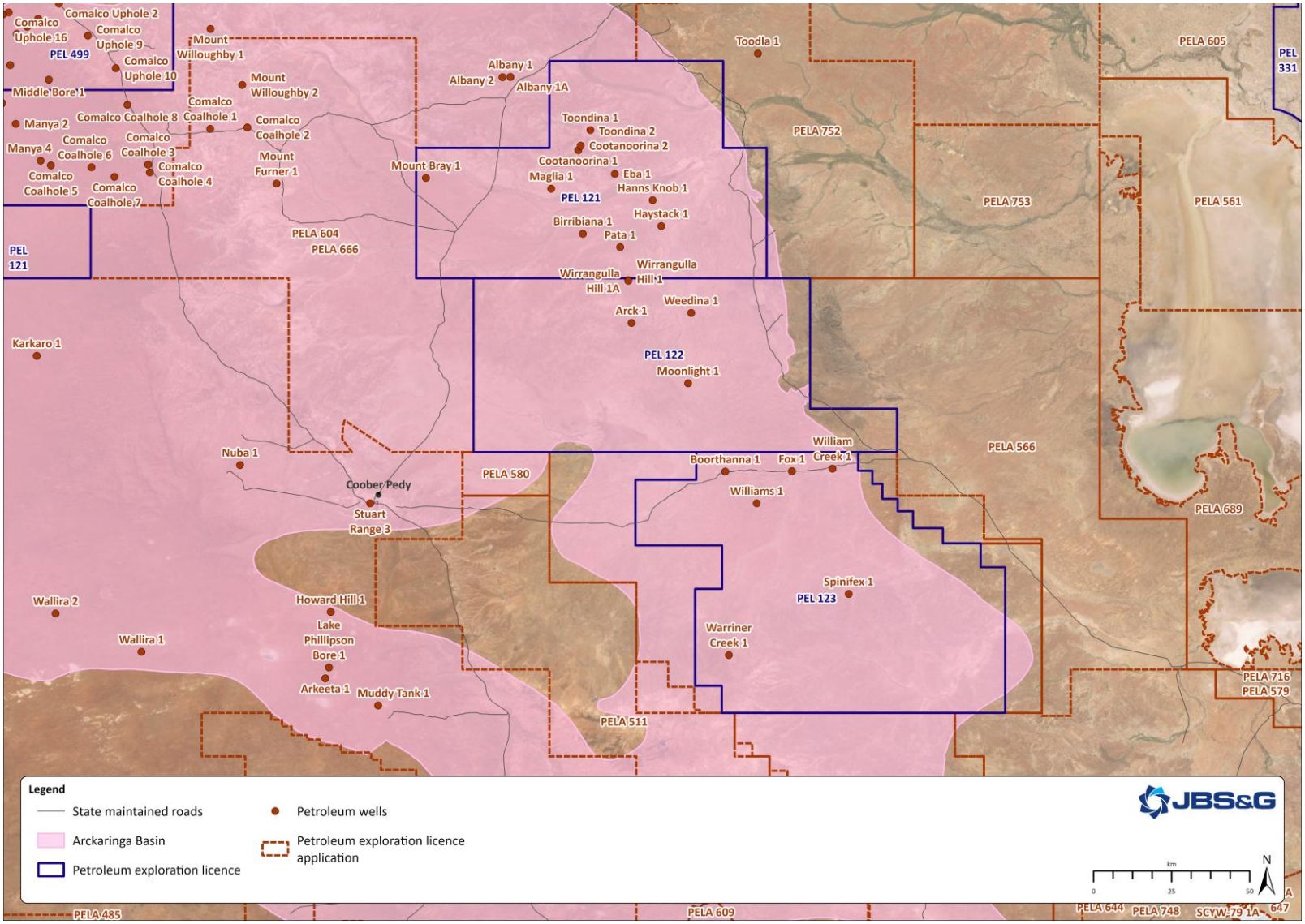


Figure 4-15: Location of historical petroleum exploration wells

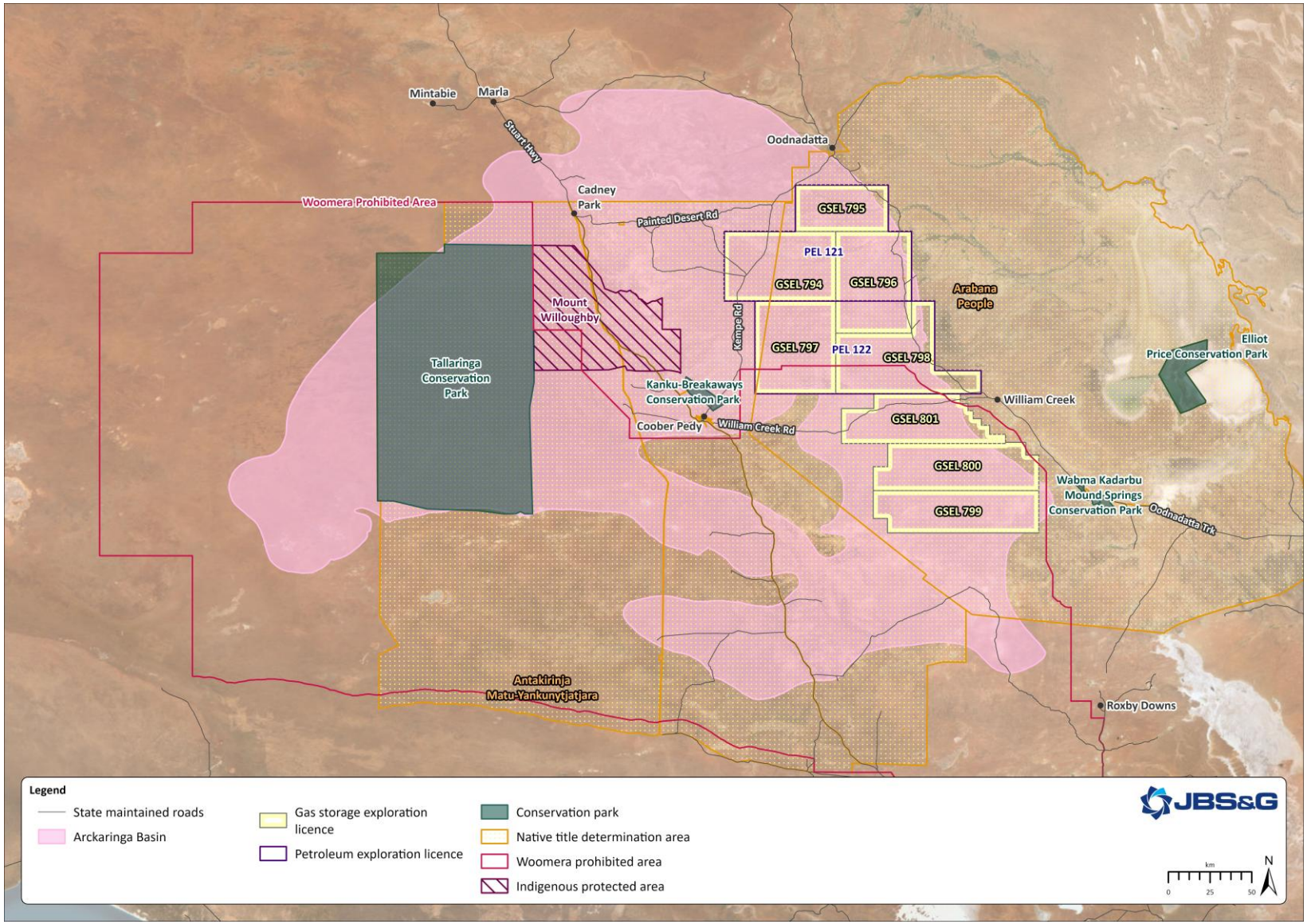


Figure 4-16: Land use within the Licence Area

4.8 Socio-Economic

4.8.1 Population Centres

The major town in the region is Coober Pedy, which is located 30 km west of the Licence Area. Coober Pedy is approximately 800 km northwest of Adelaide and has a population of approximately 1,566 people (ABS 2025).

Regional townships or population centres in the region (all of which are outside the Licence Area) include:

- Marla (230 km north-northwest of Coober Pedy)
- William Creek (165km east of Coober Pedy)
- Glendambo (250km south-southeast of Coober Pedy)
- Cadney Park Roadhouse (80km north-northwest of Coober Pedy).

4.8.2 Infrastructure

There is extensive transport infrastructure present in the region including the Stuart Highway (part of the national highway network) and the Adelaide-Darwin Railway, both of which are primary transport routes between South Australia and the Northern Territory. There are also a number of unsealed public roads. Major roads within or near the Licence Area include:

- Stuart Highway (sealed)
- Oodnadatta Track (Marla-Oodnadatta – unsealed)
- Painted Desert Road (Cadney Park-Oodnadatta - unsealed)
- The Kempe Road (Coober Pedy-Oodnadatta - unsealed)
- William Creek Road (Coober Pedy-William Creek - unsealed)
- Oodnadatta-Marree Track (unsealed).

The major roads in the region are multiple use roads. These roads carry a relatively high traffic volume that is predominantly a mix of heavy vehicles, light industrial/pastoral vehicles and tourist vehicles. Station access roads and internal tracks are generally restricted to pastoral use or occasional tourist traffic and carry a low of volume traffic.

The Dog Fence, constructed to allow sheep grazing in the southern portion of the state is located outside of the Licence Area (generally west of the Licence Area).

5. Environmental Impact Assessment

This section provides a general discussion of key activities and impacts associated with the proposed operations, then summarises the methodology and results of the environmental impact assessment for the seismic, drilling and injectivity testing activities.

5.1 Overview of Key Activities and Impacts

5.1.1 Seismic and Drilling

5.1.1.1 Earthworks

The type and severity of the potential impacts of preparation of survey lines, access tracks and well sites are dependent to a certain extent on the land system in which the activities are being carried out. Disturbance to soils (e.g. by grading) in some land systems, such as gibber plains and tablelands, can lead to substantial erosion by water while other systems, such as dune fields, are generally more resilient and less likely to suffer any long-term impacts from soil disturbance.

Wetlands

Wetlands, including the GAB Springs, are highly sensitive environments that can easily be damaged as a result of vegetation clearing, alteration of drainage patterns, spills of oil, fuel or chemicals or fire. Wetlands are avoided under most circumstances as they are generally of high ecological value and sensitivity. If sensitive environmental features such as wetlands or salt lakes cannot be avoided by seismic lines, they are usually traversed/surveyed without the use of heavy machinery.

Drainage Lines and Flood Plains

Drainage line and flood plains experience periodic natural disturbance and soil erosion as a result of rainfall and flood events. However, the movement of soil, alteration of surface profiles or the removal of vegetation associated with drainage lines and flood areas can lead to the accelerated erosion of soil or the alteration of surface flows if not appropriately located and managed.

Moon Plains

The light gypsiferous and saline soils of the Moon Plain are highly prone to rutting as a result of vehicle movement. This is turn can lead to soil erosion as the underlying soils are compacted or exposed to wind and water.

Breakaways and Stony Hills

The steeper slopes and escarpments of these landforms can be unstable and have high erosion potential when disturbed. Heavy vehicle trafficking and ground disturbing activity is avoided on such slopes.

Stony Plains

While gibber plains are generally considered to be a stable environment, disturbance or removal of the surface layer of stones, and the exposure of clay soils, can result in significant erosion by either wind or water. Even in gently sloping areas, water can gather enough force to cause erosion gullies in exposed soils. The erosive potential of these soils is clearly evident in areas where grading or removal of gibber has resulted in severe erosion and long-term scarring on the

landscape. The removal of the protective stone cover is generally avoided or carefully managed in gibber areas.

Dunefields and Sandy Plains

Dunefields are generally resilient and less likely to suffer long term impacts from soil disturbance. Removal of vegetative cover has the potential lead to blowouts and deflation, however a study of seismic lines in the Cooper Basin concluded that natural rates of erosion on dunes were not accelerated as a result of disturbance to the soil surface (Santos 2003).

Salt Lakes

Salt lakes are often comprised of a thin salty crust overlying a wet clay. As a result trafficking salt lakes is difficult and can result in deep and persistent rutting. Salt lakes are avoided under most circumstances as they can be very difficult to rehabilitate once disturbed and are therefore likely to be scarred by any activity on their surface.

5.1.1.2 Borrow pits

Borrow pits are generally required for the excavation of material for use on the stabilisation of access tracks, campsites and well sites, depending upon the nature of the substrates at each location. Borrow pits may present a bogging hazard to stock and wildlife. Borrow pits in some locations also provide an alternative water source for stock if not appropriately located and rehabilitated, which results in a redistribution of stock to areas that may not have otherwise been available for grazing.

Borrow material is generally not moved over large distances. However, there is the potential for weed species to be moved along with the construction material if not appropriately managed.

5.1.1.3 Vehicle Movement

The movement of heavy vehicles (e.g. trucks, bulldozers, drill rigs, supply trucks, etc) to and from a well site can lead to the damage of vegetation, the generation of dust and/or the compaction of soil, damage to infrastructure (e.g. roads) and collision with wildlife.

Vehicles, especially trucks, also have the potential to cause a hazard to other road users. Rig moves for an oil and gas drilling rig typically involve 30-40 trailer loads for the rig and camp plus additional loads for supplies and equipment. However, these moves are infrequent (approximately once per month) and are usually staged over several days.

The Stuart Highway (and to a lesser extent the other major roads in the region) carries a relatively high level of heavy traffic. The additional traffic on major roads due to petroleum exploration is not likely to be significant. Use of minor roads and tracks requires careful management (e.g. planning of routes, setting and observance of appropriate speed limits, use of signage where appropriate) in order to minimise the risk and potential disturbance to other road users and landholders.

5.1.1.4 Vegetation Clearance

The clearance of vegetation during survey line, access track and well site preparation cannot be entirely avoided. Vegetation clearance can result in loss of vegetation and fauna habitat, siltation of natural drainage lines and watercourses, destabilisation of creek crossings or watercourses, weed invasion and damage to heritage sites. Vegetation clearance may also impede the movement of fauna, particularly small mammals or reptiles across cleared areas. However, this is considered unlikely in most land systems in the region due to the presence of naturally bare or unsheltered locations.

During the preparation of survey lines and access tracks, particular care will be taken to minimise the clearance of vegetation in heavily wooded areas (e.g. River Red Gum or Coolibah

woodlands associated with drainage lines). Campsites will be located at the nearest available naturally clear area in which construction does not require significant disturbance to vegetation.

The significance of vegetation clearance for seismic lines needs to be considered in the context of the temporary nature of the impact, the small proportion of the land surface affected and other ongoing activities (e.g. grazing) that are affecting the local environment. With appropriate planning and management measures (as outlined in Section 5.3) the impact is generally not significant.

Fatchen & Woodburn 2000 and Woodburn and Fatchen 2008 have found that construction methods have a significant impact on the ability to effectively restore well leases and access tracks. Studies of well site restoration in the Cooper Basin have indicated that vegetation is likely to need active assistance (i.e. respreading cleared vegetation and topsoil or spreading seed on prepared surfaces) to recolonise well sites. It is suggested that without this active assistance, it is unlikely that a cover similar to or compatible with the plant cover on surrounds can be achieved in under at least a decade.

5.1.1.5 Campsites

Campsites have the potential to result in the disturbance or clearance of vegetation to for accommodation and laydown areas. Vehicle traffic can cause soil compaction and damage to vegetation. Where practical, campsites will be located in naturally clear areas to reduce potential hazards. Vehicle access will be confined to defined routes to restrict wheel track impact.

Campsites require the provision of systems for the management of sewage wastes, which must be managed in accordance with the *South Australian Public Health (Wastewater) Regulations 2013*. Following treatment via an approved system, waste water may be disposed of on-site (onto land, well away from any place from which it is reasonably likely to enter any waters, and well away from infrastructure) when in remote areas. The method of disposal for wastewater must comply with the Standard for the Construction, Installation and Operation of Septic Tank Systems in SA, or be to the satisfaction of the Department of Health.

A variety of chemicals and wastes are also stored at campsites which have the potential to result in soil or water contamination in the event of a spill.

Inappropriate storage of domestic waste, including food scraps also has the potential to attract scavenging animals (e.g. crows, black kites and dingoes) and lead to issues such as the spread of rubbish or fauna injury.

With appropriate management, significant impacts from these activities can be avoided.

5.1.1.6 Down-hole Operations

The type and severity of potential impacts of down hole activities during drilling, completion and workover is dependent on geological location down hole, whether there is casing cemented in competent formation, down hole conditions, condition of equipment on surface, condition of tubulars, safety awareness, pressures encountered and exposure of reservoirs.

The primary hazard associated with down hole activities is a blowout, which would result in loss of containment of oil or gas, produced water and drilling fluids, possible crossflow between aquifers, possible loss of pressure of aquifers and possible loss of reservoir pressures and possibly an explosion or fire. There are considerable safety measures that can be implemented to avoid a drilling blowout including guidelines, procedures, safety practices, design considerations, well control equipment and certification of trained individuals in drilling.

The chance of a blowout in completion activities is considerably less because the well is cased. Therefore, the well bore is in a stable condition and down hole pressures are fairly well known.

Drilling fluids in the down hole environment have the potential to invade freshwater aquifers and cause contamination. Constituents of drilling muds are generally non-toxic or have a low effective chronic toxicity at the concentrations present in the drilling mud. Detailed studies have shown that although this is an area of concern, drilling fluid impact is not a major component of potential down-hole problems, and that the main consequence of drilling fluid loss is reservoir formation damage rather than an irreversible contamination of the aquifer (Mavroudis 2001).

5.1.1.7 Waste Management

The storage and management of waste generated during well operations (including drilling and completions) may attract scavenging native and pest animal species, such as crows, black kites and dingoes. Inappropriate storage and handling of waste has the potential to result in localised impacts to soil, surface water and shallow groundwater resources.

Disposal of drill cuttings and muds to excavated sumps has the potential to impact soil and shallow groundwater resources. Impacts to cattle could occur if they are able to access sumps.

A risk-based study (Egis Consulting, 2001) that was undertaken to evaluate the potential for bioaccumulation of contaminants in cattle as a result of exposure to drilling fluids, cuttings and other materials associated with well completion activities suggested the following:

- Constituents from which drilling muds are formulated are generally non-toxic or have a low effective chronic toxicity at the concentrations present in the drilling mud. They also have chemical properties which indicate that they are unlikely to bioaccumulate in cattle.
- Drilling muds and water may become contaminated with petroleum hydrocarbons (including polyaromatic hydrocarbons (PAHs)) during drilling operations. The results of the study suggested that detectable concentrations of petroleum hydrocarbons in cattle could occur if cattle are allowed uncontrolled access to drilling sumps and sump contents.
- Drilling muds and water may contain heavy metals naturally occurring in geological formations. Heavy metals are unlikely to be present at levels which would result in detectable concentrations in cattle.

The report recommended that measures, such as fencing and final fill coverage, are effective in mitigating the risks posed to cattle by drilling sumps.

The risk of soil and shallow groundwater contamination associated with the disposal of drilling fluids and cuttings into unlined sumps is considered to be low. The low effective toxicity associated with additives (Egis 2001), and the presence of fine bentonite clays allowing the formation of a relatively impervious mud cake in the base of drilling sumps, are the basis for the utilisation of bury and cover techniques. These techniques are generally accepted industry practice for the disposal of non-oil-based mud systems cuttings.

5.1.1.8 Hydrocarbon, Fuel and Chemical Management

Spills or leaks may occur as a result of the failure of equipment or human error associated with the following activities:

- storage or transport of oil, fuels and chemicals (including failure of storage tanks)
- drilling operations (including casing or cement failure, equipment or tubular failure)
- storage and disposal of drilling and completion fluids (e.g. produced formation water, oil and condensate)
- refuelling operations
- use of high-pressure hydraulic systems.

Unplanned emissions of liquid hydrocarbons, gases and over-pressured fluids from a well, including blow out, have the potential to cause significant environmental damage. Spills or leaks can result in the contamination of soil or water (both surface and groundwater) which in turn may lead to impacts on vegetation, fauna, wildlife and people. The loss and subsequent ignition of some hazardous substances may also lead to an explosion or fire.

Appropriate management measures are implemented during planning and conduct of operations, to ensure that these hazards do not result in significant environmental impacts.

5.1.1.9 Disturbance to Livestock and Land Use

The presence of a seismic survey vehicles and personnel or a drill rig and drilling personnel, and the associated vehicle movements, have the potential to disturb livestock, landholders and existing land use activities. Close and ongoing liaison is carried out with landholders during the planning and conduct of operations, to ensure that disturbance (e.g. to stock grazing and movement) is minimised. Appropriate access routes are chosen in consultation with landholders and any deterioration of station tracks as a result of drilling-related traffic is rectified.

The loss of organic beef certification could occur on those properties that are certified for organic production if stock are allowed access to chemicals or contaminated areas (and if this is detected during tissue tests or inspections by the certifying body). However, the petroleum industry has been working on organic certified properties in the Cooper Basin for many years without adversely affecting their organic status. Practices have been developed to protect the organic status such as fencing off any areas that may contain hydrocarbons (e.g. spills, drilling sumps), secure storage of hydrocarbons and chemicals and use of appropriate fencing materials (e.g. CCA-free treated pine). Similar practices would be implemented in the Arckaringa Basin, in consultation with landholders.

5.1.1.10 Disturbance to Native Fauna

Potential disturbance to native fauna from site activities (e.g. light, noise, presence of a drill rig, camp and personnel) is short term, localised. The environmental assessment undertaken during the planning process will identify whether there are specific issues at a specific site (e.g. presence of listed species) and develop measures to avoid or mitigate potential impacts. Relevant agencies (e.g. DEW) will be consulted where required.

The presence of excavations and temporary ponds at well sites (e.g. the drilling sump, turkey's nest) also has the potential for localised impacts (e.g. entrapment) to fauna. The presence of site personnel and the fencing of ponds and the drilling sump following drilling will generally preclude impacts to larger species. Well sites are likely to be located in areas where there is limited habitat value for smaller species and their presence on the well lease is unlikely, however excavations will be regularly checked for trapped fauna to minimise potential impacts. Egress ramps will be built into the sumps and storage ponds to limit accessibility by fauna.

5.1.2 Injection

Injectivity testing would be undertaken on the cleared well lease following drilling and well completion, and relatively small amounts of CO_2 are planned to be injected into the target reservoirs. Consequently, the potential impacts are limited. Key impacts are discussed below.

5.1.2.1 CO_2 migration or release

The main potential pathways that could lead to exposure of injected CO_2 at the surface or downhole are well integrity failure or vertical migration through permeable geological structures. Releases of CO_2 could also occur at the surface from leaks or failure of surface equipment.

The severity of potential impacts, should they occur, would be dependent on the rate and duration of the CO_2 migration or release, the sensitivity of the receptor and any resultant mixing in the relevant media (water, air, soil). Due to the small volumes of CO_2 injected, the scale of potential impacts would be very limited. Potential impacts to shallow groundwater pH and CO_2 concentration would be expected to be localised, as such, any impacts on flora and fauna would also be expected to be localised. The potential for impact to third parties is limited due to the generally low utilisation of shallow groundwater and restrictions on public access in the proximity of the activities.

Lateral flow of injected CO_2 could potentially impact groundwater quality and groundwater users (if present in the immediate vicinity), however as discussed in Section 3.3.2 the small scale of injection means that it is unlikely to produce any meaningful plume migration. Injection locations are also not likely to be in proximity to existing groundwater wells.

A range of measures will be implemented to prevent migration or release of CO_2, including well design and construction, geological risk assessment, equipment selection and design and downhole and surface monitoring. Impacts are not likely to occur.

5.1.2.2 Other impacts

Other impacts from injection activities (e.g. waste management, storage and handling of fuel and chemicals, disturbance of livestock and land use) are similar to those discussed above for drilling and seismic. They are generally smaller in scale and can be successfully managed with standard management measures.

5.2 Impact Assessment Methodology

The impact assessment method has been developed in accordance with the Environmental Impact Assessment Criteria published under the ER Act (DEM 2024a), using guidance provided in the Environmental Impact Assessment Criteria Guideline (DEM 2024b).

The impact assessment was undertaken using the following steps:

Identifying environmental elements that could be impacted by the proposed regulated activities (Criteria 1)

Identifying the potential impact events that could impact elements of the environment during the construction, operation and decommissioning phases (Criteria 2).

Confirming the potential of impact events to occur (Criteria 3).

Identifying relevant control and management strategies for each potential impact event, needed to eliminate or otherwise reduce any potential environmental harm to as low as reasonably practicable (part Criteria 4)

Identifying uncertainties and assumptions associated with the effectiveness of control and management strategies (part Criteria 4)

Assessing environmental significance of each potential impact event, based on the sensitivity of the receiving environment and the magnitude of potential impacts, considering factors such as the frequency, duration, extent and severity of impacts as well as potential cumulative impacts (Criteria 5).

Developing environmental objectives and assessment criteria for all potential impacts determined for the elements of the environment. These objectives will be carried through to the SEO (Criteria 6).

The results of the impact assessment were then captured in the impact assessment summary tables provided in Sections 5.3.

The steps followed in the impact assessment are described below.

5.2.1 Identifying environmental elements

Elements of the environment that have the potential to be impacted by the regulated activities were first identified. All phases of the regulated activities were considered including construction, operation, decommissioning and rehabilitation. Table 5-1 lists the elements of the environment that could potentially be affected by the proposed activities and identifies where the potential effects have been addressed in the EIR.

Table 5-1: Elements of the environment potentially affected by proposed activities

Environmental element[1]	Potentially affected	Relevant section
Public health and safety	Yes	Section 5.3.1
Heritage (Aboriginal and non-Aboriginal)	Yes	Section 5.3.2
Soil	Yes	Section 5.3.3
Groundwater, including quality and quantity	Yes	Section 5.3.4
Surface water, including quality and quantity	Yes	Section 5.3.5
Noise and vibration	Yes	Incorporated into Public health and safety

Environmental element[1]	Potentially affected	Relevant section
Air quality	Yes	Incorporated into Public health and safety
Existing land use and infrastructure	Yes	Section 5.3.6
Native fauna and vegetation	Yes	Section 5.3.7
Weeds, pests and plant pathogens	Yes	Section 5.3.8
Waste	Yes	Section 5.3.9
Visual amenity	Yes	Section 5.3.10

[1] Elements of the environment in this table reflect the listing in the Environmental Impact Assessment Criteria Guideline (DEM, 2024b)

5.2.2 Identifying potential impacts

Elements of the environment may be impacted in different ways by the regulated activities. All potential impacts from the regulated activities were identified and defined as potential impact events.

Each potential impact event was characterised by:

- the source of impact, defined as the activities associated with the proposed operation that could reasonably be expected to negatively impact a receptor for the environmental element (considering construction, operation or decommissioning and rehabilitation stages)
- the pathway of impact, defined as the mechanism by which a proposed activity may interfere with environmental elements
- the environmental receptor of impact, defined as the component of the environmental element that may be detrimentally affected by the proposed activity in the absence of control measures.

Any uncertainties in the identification and description of the sources, pathways and environmental receptors as a result of assumptions or knowledge gaps were identified for each potential impact event.

5.2.3 Confirming the potential of impact events to occur

For each potential impact event, the occurrence of the source, pathway and environmental receptor within the proposed regulated activities scope and at the proposed location was verified.

Potential impact events for which the full source, pathway and environmental receptor linkage was confirmed were considered as having the potential to occur and relevant control and management measures were then identified.

Potential impact events for which the source, pathway and environmental receptor linkage was incomplete were not considered as having the potential to occur and were not considered further in this environmental impact assessment.

5.2.4 Identifying relevant control and management measures

Measures to control and manage potential impact events were identified. The hierarchy of controls approach was adopted consistently with the Environmental Impact Assessment Criteria Guideline (DEM, 2024b). Identification of control and management measures considered the following priority of order:

- **Elimination** measures that eliminate the source of a potential impact event, preventing the impact from occurring.
- **Substitution** measures that replace the material or process at the source of a potential impact event with a less hazardous one, significantly reducing the likelihood of a potential impact event to occur.
- **Design and engineering (physical) control** measures that act to separate the source from the pathway and environmental receptor to either:
    - avoid or reduce the likelihood of a potential impact event to occur, or
    - avoid or reduce the consequences of an impact event occurring.
- **Management system control** measures that implement a procedure to manage the activity at the source of a potential impact event to either:
    - avoid or reduce the likelihood of a potential impact event to occur, or
    - avoid or reduce the consequences of an impact event occurring.

5.2.5 Identifying uncertainties and assumptions

Uncertainties and assumptions related to the likely effectiveness of the proposed control and management strategies were identified. This included the assumptions underlying any analysis or modelling undertaken to assess potential impacts and effectiveness of proposed measures.

5.2.6 Assessing environmental significance

The level of significance of potential impact events was assessed, considering the following factors outlined in the Environmental Impact Assessment Criteria Guideline (DEM, 2024b):

- the level to which a potential impact can be avoided through elimination (prevention)
- the estimated frequency of the potential impact occurring
- the anticipated duration of the potential impact
- the extent of the potential impact
- the severity of the potential impact
- the cumulative effects (if any) of the potential impact when considered in conjunction with other impacts on the same receptor
- the sensitivity of the receiving environment.

To assist in describing potential impacts for each factor listed above, the definitions in Table 5-2 and Table 5-3 were used.

Table 5-2: Definitions used to describe potential impacts

Factor		Description
Avoidance		**Yes**: Impacts can be avoided through the identified controls
		No: Impact cannot be avoided through the identified controls
Magnitude	Frequency	**High**: Impacts occur frequently or are present throughout the life of the project
		Moderate: Impacts occur several times during the lifespan of activities
		Low: Impacts occur infrequently

Factor		Description
		Rare: Impacts not expected or only occur in exceptional circumstances
	Duration	**Permanent**: Impacts to the environment are permanent and non-reversible
		Long lasting: Impact to the environment persist for a period of years but are reversible
		Short term: impacts of less than a year duration and are reversible
	Extent	**Widespread**: Impacts occur on a regional scale
		Moderate: Impacts extend beyond the project site and immediate surrounds without occurring on a regional scale
		Localised: Impacts are limited to the project site and immediate surrounds
	Severity	**High**: Statutory reference values or environmental quality standards are exceeded
		Moderate: Statutory reference values or environmental quality standards are not exceeded but the impact results in an increase in the occurring content/level
		Low: imperceptible or indistinguishable from natural background levels
Cumulative effects		**Yes**: Receptors are already impacted by similar activities
		Possible: Receptors could be impacted by similar activities depending on the site
		No: Receptors are not already impacted by similar activities
Sensitivity		Refer Table 5-3:

Overall environmental significance

The overall environmental significance of each potential impact event was assessed using a matrix that considered the sensitivity of the receiving environment and the magnitude of the impact (Table 5-5).

Categories for sensitivity and magnitude used in this matrix are defined in Table 5-3 and Table 5-4. (Note: The categories of magnitude consider frequency, duration, extent, severity and cumulative effects, and align with the more detailed definitions provided in Table 5-2).

Impacts were considered acceptable if they were in the 'Negligible' or 'Low' category of environmental significance, while impacts in the 'Moderate' category were generally considered acceptable if they were as low as reasonably practicable (ALARP) following the application of mitigation measures. High and Major impacts would be considered unacceptable necessitating redesign of the regulated activities (however there were no High or Major impacts identified).

Additional commentary providing justification why impacts are considered ALARP for 'Moderate' impacts is provided in the impact assessment summary tables in Sections 5.3.

The environmental significance assessment considers any proposed controls or management measures to determine the outcome of the significance assessment.

Table 5-3: Criteria for sensitivity

Sensitivity	Description
High	• The environmental value is protected as a result of Australia's international commitments • The environmental value holds a statutory protection (national parks, etc) • The environmental value is intact • The environmental value is unique to the environment in which it occurs. It is isolated to the affected system/area which is poorly represented in the region, territory, country or the world. • It has not been exposed to threatening processes, or they have not had a noticeable impact on the integrity of the environmental value.
Moderate	• The environmental value is recorded as being important at a regional or local level • The environmental value is in a moderate to good condition despite it being exposed to threatening processes. • It is relatively well represented in the systems/areas in which it occurs but its abundance and distribution are limited by threatening processes. • Threatening processes have reduced its resilience to change.
Low	• The environmental value is not listed on any recognised or statutory register. • It is in a poor to moderate condition as a result of threatening processes • It is abundant and widely distributed or representative examples exists throughout the host systems/areas. • There is no detectable response to change or change does not result in further degradation of the environmental value.

Table 5-4: Criteria for magnitude

Magnitude	Description
High	• An impact that is widespread and/or is permanent or long-lasting. • An impact that occurs frequently. • Statutory reference values or environmental quality standards are exceeded.
Moderate	• An impact that has a relatively large scope or is long-lasting. • An impact that occurs several times during the lifespan of activities. • Statutory reference values or environmental quality standards are not exceeded but the impact results in an increase in the occurring content/level.
Low	• An impact with no or little effects on the receptor. • The effects have a limited scope and are short-term. • An impact that is infrequent. • The effect is deemed to be imperceptible or indistinguishable from natural background levels

*Note: If one or more of these criteria are exceeded, the magnitude would generally be elevated to the next level.

Table 5-5: Significance assessment matrix

Sensitivity of environmental values	Magnitude of impact		
	High	Moderate	Low
High	Major	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Negligible

5.2.7 Developing environmental objectives and assessment criteria

Environmental objectives and assessment criteria were developed for all potential impacts determined through the environmental impact assessment process. Objectives were developed to align with the elements of the environment. These objectives are defined in the impact assessment summary tables provided in Sections 5.3 and will be carried through to the SEO.

Leading performance criteria are identified for impact events that rely significantly on controls and provide an early indication of the effectiveness of the control measure to understand whether the environmental objective is at risk of not being achieved.

5.3 Environmental Impact Assessment Findings

The results of the environmental impact assessment for the identified impact event(s) are provided in Section 5.3.1 to 5.3.10. Environmental impact assessments have been undertaken for each activity outlined in this EIR namely seismic, drilling and injection. For each environmental aspect and proposed activity an assessment of impact events, controls and environmental objectives and significance assessment are detailed.

5.3.1 Public Health and Safety

5.3.1.1 Setting the context

Table 5-6 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to public health and safety.

Table 5-6: Public Health and Safety Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Public health and safety	• *Environment Protection Act 1993* • *South Australian Public Health Act 2011* • *Work Health and Safety Act 2012.* • *Road Traffic Act 1961* • *Fire and Emergency Services Act 2005*		To be updated to include views of affected parties from original consultation and new consultation.	• Local and regional community • Traditional Owners and Aboriginal communities • Landowners • Land users • General public

5.3.1.2 Potential impact events

Potential impacts to the health and safety of the general public, arise principally from:

Seismic:

- Direct disturbance from vehicle movement, use of explosives and unauthorised public access
- Generation of dust and noise.

Drilling:

- Direct disturbance from vehicle movements and unauthorised public access
- Well control incidents.

Injection:

- Inadequate well integrity
- CO_2 release via undetected permeable geological structures such as open faults and fractures.

Public Health and Safety – Seismic Activities

Table 5-7: Public Health and Safety (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-HS-01	Seismic activities	Impact to public health and safety from direct disturbance associated with vehicle movements, explosives or unauthorised access	Vehicle movements. Use of explosives. Unauthorised public access.	Direct disturbance	Public health and safety	Assumes that limited receptors are present within the area	Low sensitivity to change – sources and controls are well known.	Yes. Unplanned event could result in SPR linkage.
S-HS-02	Seismic activities	Impact to public health and safety from airborne emissions or soundwave transmission	Exposed soils. Earthmoving equipment. Vibrator trucks and associated activities.	Airborne emissions. Soundwave transmission.	Public health and safety	Assumes that limited receptors are present within the area	Low sensitivity to change	Yes. Unplanned event could result in SPR linkage.

Table 5-8: Public Health and Safety (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-HS-01	Impact to public health and safety from direct disturbance associated with vehicle movements, explosives or unauthorised access	• Employees and contractor personnel complete applicable safety training and inductions (and refreshers) prior to commencement of work in the field. • Active promotion of appropriate road-use behaviours. • Induction of employees and contractor personnel with respect to road-use and driver behaviour. • Appropriate speed limits are set for personnel and contractors and vehicles to travel at slow speed in the vicinity of homesteads and tourist sites. • Driver awareness training for company and contractor personnel. • Use of vehicle flags for increased safety. • Warning signage erected during operations where necessary. • Seismic lines adjacent to public roads are ripped where appropriate to discourage third party access. Fencing and signage are erected if needed to discourage ongoing public access. • Lines adjacent to public roads may also be blocked with timber (or other suitable deterrent installed) as an access deterrent. • Explosives are used only by appropriately trained personnel, and stored and handled in accordance with legislative requirements. • Reporting systems in place.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S1. No injuries, deaths or adverse health impacts to the public or third parties from regulated activities that could have been reasonably prevented by the operator	• Records (e.g. audits / site inspections) demonstrate that reasonable measures have been implemented to ensure no injuries or health risks to the public. • Any notifiable incidents (as per s35 of the Work Health and Safety Act 2012) involving the public investigated by a suitably qualified independent third party and the results of the investigation show that the accident could not have been reasonably	Records demonstrate all employees have undergone applicable safety training and inductions. Records show that no vehicle/driving incidents -or unauthorised access have occurred

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						prevented by the operator.	
S-HS-02	Impact to public health and safety from airborne emissions or soundwave transmission	• Vegetation to be retained on site where possible. • Use of water trucks, where appropriate, on unpaved roads or other exposed areas if required. • Vehicle speed limits will be managed in accordance with construction traffic management procedures and site conditions to mitigate wheel-generated dust. • Selection and maintenance of vehicles and equipment will be compliant with current noise standards. • Equipment will be shut off or throttled down whenever it is not in actual use.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S1. No injuries, deaths or adverse health impacts to the public or third parties from regulated activities that could have been reasonably prevented by the operator	• Compliance with relevant legislation or approvals regarding noise and air quality where applicable.	• Records of complaints from landholders/users are maintained for the life of the project and show that no complaints are left unresolved.

Table 5-9: Public Health and Safety (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-HS-01	Impact to public health and safety from direct disturbance associated with vehicle movements, explosives or unauthorised access	No - design and engineering controls, and management system controls are put in place, however impact due to an incident / unplanned event, although very unlikely, remains a possibility.	Rare – only expected to cause impact in exceptional circumstances.	Short-term to long-lasting– seismic activities and related impacts are generally short term, however longer-term impacts (e.g. injury or death) are possible.	Localised - any impact would be confined to the site and immediate surrounds.	Low to high - an incident / unplanned event could result in injury or death	Possible – Receptors may be impacted by other potential impact events.	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Moderate Significance = Low
S-HS-02	Impact to public health and safety from airborne emissions or soundwave transmission	No - design and engineering controls, and management system controls are put in place, however an impact may occur during exceptional circumstances.	Rare – only expected to cause impact in exceptional circumstances.	Short-term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - any impact would be confined to the site and immediate surrounds.	Low - not expected to exceed statutory reference values or environmental quality standards.	Possible – Receptors may be impacted by other potential impact events.	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Moderate Significance = Low

Public Health and Safety - Drilling Activities

Table 5-10: Public Health and Safety (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-HS-01	Drilling activities	Impact to public health and safety from drilling activities including vehicle movements and unauthorised access	Vehicle movements Unauthorised public access	Direct disturbance	Public health and safety	Assumes that limited receptors are present within the area	Low	Yes. Unplanned event could result in SPR linkage.
D-HS-02	Drilling activities	Impact to public health and safety from direct disturbance associated with well construction, and decommissioning.	Drilling and completion activities Use of drill rigs Well Decommissioning	Direct disturbance	Public health and safety	Assumes that limited receptors are present within the area	Low	Yes. Unplanned event could result in SPR linkage.

Table 5-11: Public Health and Safety (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-HS-01	Impact to public health and safety from drilling activities including vehicle movements and unauthorised access.	Unauthorised Access by Third Parties • "No Entry" signs warning of dangers associated with drilling operations placed at the entry to all site access track. Vehicle Movement • Control production and dispersion of dust on unsealed roads and drilling lease areas. • Compliance with relevant speed restrictions on access roads and tracks • Warning signage and traffic management measures installed where appropriate in the vicinity of well sites. • If necessary, unsealed roads will be sprayed with water as required to minimise dust generation. Woomera Prohibited Area • Appropriate, necessary authorisations are obtained for access to the Woomera Prohibited Area.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D1. No injuries, deaths or adverse health impacts to the public or third parties from regulated activities that could have been reasonably prevented by the operator.	• Records (e.g. audits / site inspections) demonstrate that reasonable measures have been implemented to ensure no injuries or health risks to the public. • Any notifiable incidents (as per s35 of the *Work Health and Safety Act 2012*) involving the public investigated by a suitably qualified independent third party and the results of the investigation show that the accident could not have been reasonably prevented by the operator.	• Planning has been undertaken to minimise impacts of operations and records are available for review.
D-HS-02	Impact to public health and safety from direct disturbance associated with well construction, and decommissioning.	Drilling and Completion Activities • Drill rig, ancillary and any testing equipment to comply with Regulations, meet relevant industry standards and be "Fit for Purpose". • Casing design carried out to meet worst case expected loads and environmental conditions determined for the specific geology intercepted by the well. Details of work to be performed are set out in the Drilling Program. • Casing set in accordance with design parameters.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D1. No injuries, deaths or adverse health impacts to the public or third parties from regulated activities that could have been	• Records (e.g. audits / site inspections) demonstrate that reasonable measures have been implemented to ensure no injuries or health risks to the public. • Any notifiable incidents (as per s35 of the *Work Health and Safety Act*	• Planning has been undertaken to minimise impacts of operations and records are available for review. • Reasonable practical measures implemented in design and operation

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Casing cemented to surface with visible return. • Blow out prevention precautions / well control equipment in place in accordance with defined procedures and appropriate to the expected downhole conditions. • Sufficient kick tolerance in casing program design. • Emergency Response Procedures in place. • Confinement of flammable sources, restrictions on certain procedures and ready access to suitable firefighting equipment. • All activities in conducted in accordance with appropriate industry accepted standards and legislative requirements. • Well production diverted to flare as soon as practicable. • Well testing curtailed when test objectives are satisfied. Well Decommissioning Activities • Downhole decommissioning is carried out to meet worst case expected loads and downhole environmental conditions. • Effective isolation maintained between any potential aquifers to prevent crossflow. • Decommissioning plugs must be set to ensure long term isolation of any potential aquifers intersected to avoid shallow zones becoming over-pressured. Wellsite Restoration Activities • Assessment of the threat to third parties from well completion / downhole decommissioning. • Necessary measures (e.g. fencing, signage) taken to prevent the public accessing the wellhead equipment or waste relating to the well. • Effective rehabilitation of the wellsite so that potentially dangerous perturbations in ground level do not remain.			reasonably prevented by the operator.	*2012*) involving the public investigated by a suitably qualified independent third party and the results of the investigation show that the accident could not have been reasonably prevented by the operator.	to minimise emissions. • No unnecessary venting during well operations

Table 5-12: Public Health and Safety (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-HS-01	Impact to public health and safety from drilling activities including vehicle movements and unauthorised access.	No – design and engineering controls, and management systems controls are put in place to avoid impacts from vehicle movements and	Rare – only expected to cause impact in exceptional circumstances.	Short-term to long-lasting– seismic activities and related impacts are generally short term,	Localised - any impact would be confined to the site and immediate surrounds.	Low to high - an incident / unplanned event could result in injury or death.	Possible – Receptors may be impacted by other potential impact events.	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Moderate Significance = Moderate Control measures in place require design and

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
		unauthorised public access.		however longer-term impacts (e.g. injury or death) are possible.					operation in accordance with standards and controls on members of the public accessing hazardous areas. Control measures are recognised as standard industry practice and are considered effective. As such, impacts are managed to ALARP.
D-HS-02	Impact to public health and safety from direct disturbance associated with well construction, and decommissioning.	No – well construction, and decommissioning are an essential part of drilling activities.	Rare – only expected to cause impact in exceptional circumstances.	Short-term to long-lasting– seismic activities and related impacts are generally short term, however longer-term impacts (e.g. injury or death) are possible.	Localised - any impact would be confined to the site and immediate surrounds.	Low to high - an incident / unplanned event could result in injury or death.	Possible – Receptors may be impacted by other potential impact events.	Low – location of seismic activities will typically seek to be away from communities and/or landholders.	Magnitude = Moderate Significance = Moderate Control measures in place require design and operation in accordance with standards and controls on members of the public accessing hazardous areas. Control measures are recognised as standard industry practice and are considered effective. As such, impacts are managed to ALARP.

Public Health and Safety - Injection Activities

Table 5-13: Public Health and Safety (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-HS-01	CO_2 injection	Uncontrolled release of CO_2, hydrocarbons and other substances to the atmosphere, surface and / or near-surface environments, from inadequate well integrity adversely impacting public health and safety.	Migration of CO_2 through well bore.	Inadequate well integrity.	Public health and safety	• High certainty that proposed control measures will be effective. • Carbon storage design and control measures are similar to existing measure used for other geophysical operations and drilling, completions and well operations in the Arckaringa Basin. Industry standard control measures for these operations are well understood. Additionally, carbon storage control measures are well understood and have been successfully implemented. • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage
I-HS-02	CO_2 injection	Injection of CO_2 into the storage complex results in uncontrolled release of CO_2, hydrocarbons and other substances into non-target geological formation adversely impacting public health and safety.	Injection of CO_2 into the storage complex.	Undetected permeable geological structures such as open faults and fractures.	Public health and safety	• High certainty that proposed control measures will be effective. • Carbon storage design and control measures are similar to existing measure used for other geophysical operations and drilling, completions and well operations in the Arckaringa Basin. Industry standard control measures for these operations are well understood. Additionally, carbon storage control measures are well understood and have been successfully implemented. • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage

Table 5-14: Public Health and Safety (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-HS-01	Uncontrolled release of CO_2, hydrocarbons and other substances to the atmosphere, surface and / or near-surface environments, from inadequate well integrity adversely impacting public health and safety.	• Aquifers isolated behind casing string(s) cemented in place. • Casing string and cement slurry designed by qualified and competent engineers and confirmed by senior engineers or external consultants where necessary. • Appropriately designed casing and wellhead installed on new wells drilled and retained for use.	I1. No injuries, deaths or adverse health impacts to the public or third parties that could have been reasonably prevented by the operator.	• Records (e.g. audits / site inspections) demonstrate that reasonable measures have been implemented to ensure no injuries or health risks to the public. • Any notifiable incidents (as per s35 of the *Work Health and Safety Act 2012*) involving the public investigated by a suitably qualified independent third party and the results of the investigation show that the accident	• Monitoring of CO_2 injection demonstrates maximum injection pressure not exceeded. • If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.

Impact ID	Impact Event	Control Measures	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Identification and evaluation of existing well bores and where necessary, workover or decommissioning undertaken to appropriately manage integrity. • Equipment design and monitoring to ensure injection pressures remain below fracture gradient. which also avoids the potential for creating new permeable pathways. • Reservoir modelling calibrated with pressure measurements to support modelling. • Effective barriers exist to maintain well control and prevent crossflow between separate aquifer systems or hydrocarbon reservoirs outside of the defined storage complex. • Operational reports verify that barriers have been set and/or remedial cement work carried out in accordance with the work program as submitted to and/or agreed by DEM. • Cased hole cement bond logs to confirm quality of cement job in the production casing string. • Well integrity management system and checks to confirm well integrity through well life.		could not have been reasonably prevented by the operator.	

I-HS-02	Injection of CO_2 into the storage complex results in uncontrolled release of CO_2, hydrocarbons and other substances into non-target geological formation adversely impacting public health and safety	• Evaluation of reservoirs and target formation before carbon storage commences including:
		  ○ geological risk assessment including review of production history
		  ○ reservoir modelling to determine storage capacity and injection scheme design.
		• Pressure monitoring during and post injection in accordance with the Monitoring, Reporting and Verification Plan.
		• Reservoir modelling calibrated with pressure measurements to support modelling.
		• Response plan in place for abnormal pressure events during injection.
			I1. No injuries, deaths or adverse health impacts to the public or third parties that could have been reasonably prevented by the operator.	• Records (e.g. audits / site inspections) demonstrate that reasonable measures have been implemented to ensure no injuries or health risks to the public.
				• Any notifiable incidents (as per s35 of the *Work Health and Safety Act 2012*) involving the public investigated by a suitably qualified independent third party and the results of the investigation show that the accident could not have been reasonably prevented by the operator.
					• Monitoring of CO_2 injection demonstrates maximum injection pressure not exceeded.
					• If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.

Table 5-15: Public Health and Safety (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-HS-01	Uncontrolled release of CO_2, hydrocarbons and other substances to the atmosphere,	Yes. Design and engineering controls, and management system controls are put	Rare – only expected to cause impact in exceptional circumstances.	Short-term to long-lasting– seismic activities and	Localised - impact confined within site boundaries.	Low to high - an incident / unplanned event could result in injury or death.	Yes - Repeated loss of well integrity may involve an increase of gas leakage,	Low – location of seismic activities will typically seek to be away from	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
	surface and / or near-surface environments, from inadequate well integrity adversely impacting public health and safety.	in place to avoid loss of well integrity.		related impacts are generally short term, however longer-term impacts (e.g. injury or death) are possible.			subsidence or aquifer contamination, all of which increase the risk of danger/injury to people.	communities and/or landholders.	
I-HS-02	Injection of CO_2 into the storage complex results in uncontrolled release of CO_2, hydrocarbons and other substances into non-target geological formation adversely impacting public health and safety.	Yes – impacts may be avoided through effective implementation of controls	Rare – only expected to cause impact in exceptional circumstances.	Short-term to long-lasting– seismic activities and related impacts are generally short term, however longer-term impacts (e.g. injury or death) are possible.	Localised - impact confined within site boundaries.	Low to high - an incident / unplanned event could result in injury or death.	Possible – Receptors may be impacted by other potential impact events.	Low – location of seismic activities will typically seek to be away from communities and/or landholders.	Magnitude = Moderate Significance = Low

5.3.2 Heritage (Aboriginal and non-Aboriginal)

5.3.2.1 Setting the context

Table 5-16 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to heritage (Aboriginal and non-Aboriginal).

Table 5-16: Heritage Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Aboriginal and non-Aboriginal Heritage	• *Aboriginal Heritage Act 1988* • *Aboriginal and Torres Strait Islander Act 2005* • *Native Title Act 1993* • *Coroners Act 2003.*	• A Guide to Aboriginal Heritage in South Australia (AGD 2025)	To be updated to include views of affected parties from original consultation and new consultation.	• Aboriginal and non-Aboriginal heritage • Traditional Owners

5.3.2.2 Potential impact events

Potential impacts to the heritage (Aboriginal and non-Aboriginal), arise principally from:

Seismic:

- Direct disturbance from earthworks and construction, vehicle movements and uphole drilling.

Drilling:

- Direct disturbance from vehicle movements, use of drill rigs and clearing operations.

Injection:

- Inadequate well integrity.

Heritage (Aboriginal and non-Aboriginal) - Seismic Activities

Table 5-17: Heritage (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-H-01	Seismic activities	Impact to cultural heritage from direct disturbance associated with earthworks, vehicle movements and uphole drilling.	Earthworks and construction. Vehicle movements. Uphole drilling.	Direct disturbance	Sites, objects or remains, whether known or unknown.	It is not known how many cultural heritage sites may be impacted by seismic activities, with the assumption that not all cultural heritage sites along the pipeline have been identified.	Should a heritage site be identified during construction activities, the likelihood of additional heritage discoveries would increase.	Yes – based on advice received from Traditional Owners, searches of Aboriginal Affairs and Reconciliation (AAR)'s central archives and heritage surveys or assessments.

Table 5-18: Heritage (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-H-01	Impact to cultural heritage from direct disturbance associated with earthworks, vehicle movements and uphole drilling.	• Systems are in place to avoid known Aboriginal sites, object or remains, and sites of cultural and heritage significance including ongoing consultation with the relevant Aboriginal heritage organisation, RNTBC and relevant government agencies (AAR and DEW). • Processes are in place to meet requirements of legislation and agreements with Native Title claimant groups with respect to protection and reporting of discovery of unknown heritage sites during regulated activities. • Aboriginal heritage surveys (commonly referred to as Work Area Clearance (WAC) surveys) and / or assessments are conducted in collaboration with the relevant native title group prior to conducting regulated activities. • All geophysical operations are contained within areas subject to Aboriginal heritage survey, or undertaken in accordance with conditions of the survey report. • Documents and / or reports of surveys and / or assessments for cultural / heritage are maintained.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S2. No unauthorised damage, disturbance or interference to sites, objects or remains of Aboriginal and / or non-Aboriginal heritage	• Records demonstrate that a cultural heritage survey (or Work Area Clearance - WAC) has been undertaken prior to commencement of activities. • Records (e.g. audits / site inspections) demonstrate that damage, disturbance or interference to any Aboriginal sites, objects and remains (all as defined under the *Aboriginal Heritage Act 1988*) is avoided unless authorisation has been obtained under the *Aboriginal Heritage Act 1988*. • Records (e.g. audits / site inspections) demonstrate there has been no impact to non-Aboriginal heritage places and related objects protected under the *Heritage Places Act 1993 u*nless approval has been obtained	• Processes are in place to meet requirements of legislation and agreements with Native Title claimant groups with respect to protection and reporting of discovery of unknown heritage sites during regulated activities. • Records demonstrate that non-Aboriginal heritage sites have been identified and avoided. • In the event the conditions of a Work Area Clearance(s) are not complied with, the incident is appropriately reported, investigated and remediated in consultation with the relevant Native Title holders and in accordance with any applicable NT Agreement.

Impact ID	Impact Event	Control Measures	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						under the *Heritage Places Act 1993*. • Records demonstrate that any Aboriginal and non-Aboriginal heritage sites, objects and remains discovered during operations have been appropriately reported and responded to, consistent with the applicable NT Agreement and the *Aboriginal Heritage Act 1988* and *Heritage Places Act 1993*.	

Table 5-19: Heritage (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-H-01	Impact to cultural heritage from direct disturbance associated with earthworks, vehicle movements and uphole drilling.	No – impacts cannot be completely avoided based on controls due to the partially unknown nature of the location of the receptor.	Known heritage: Low – desktop and in person surveys of the areas identified for seismic activities have identified known heritage areas and these areas have been fenced off/flagged as an exclusion area. Unknown heritage: Low/moderate – obscured/subsurface Aboriginal Heritage sites have been identified in proximity to the area, which may increase the risk of heritage discoveries in parts of the project area.	Permanent – impacts to heritage sites are permanent and non-reversible.	Localised – impacts confined to disturbed site.	High (worst case) – permanent impact to heritage, Traditional Owners and their communities.	Possible - multiple incidents of damage or loss of Aboriginal heritage would result in cumulative impacts, however this is very unlikely to occur.	High	Magnitude = High Significance = Moderate Potential impacts to heritage managed to ALARP (low frequency) by control measures adopted to identify Aboriginal heritage prior to undertaking earthworks

Heritage (Aboriginal and non-Aboriginal) - Drilling Activities

Table 5-20: Heritage (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-H-01	Drilling activities	Drilling activities result in damage to shallow artefact scatters and/or subsurface material or other sites, objects, remains or places of Aboriginal or non-Aboriginal heritage significance.	Vehicle movements. Use of drill rigs. Clearing operations.	Direct disturbance	Sites, objects or remains, whether known or unknown.	It is not known how many cultural heritage sites may be impacted by drilling activities, with the assumption that not all cultural heritage sites within the drilling area have been identified.	Should a heritage site be identified during drilling activities, the likelihood of additional heritage discoveries would increase.	Yes – based on advice received from Traditional Owners, searches of Aboriginal Affairs and Reconciliation (AAR)'s central archives and heritage surveys or assessments.

Table 5-21: Heritage (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-H-01	Drilling activities result in damage to shallow artefact scatters and/or subsurface material or other sites, objects, remains or places of Aboriginal or non-Aboriginal heritage significance.	• Cultural heritage inspection of proposed well sites and access tracks undertaken with relevant Natie Title group, • Known heritage sites have been identified and protected from operations (e.g. temporary flagging). • A procedure is in place for the appropriate response to any sites discovered during drilling activities. • Reports of any accidental discoveries during drilling activities are available for review. • Records of sites forwarded to the Aboriginal Heritage Branch in compliance with the Aboriginal Heritage Act. • Consult with Heritage Branch, DEW regarding location of non-indigenous heritage sites. • Non-Aboriginal heritage sites identified and avoided • Any Aboriginal and non-Aboriginal heritage sites, objects and remains discovered during operations have been appropriately reported and responded to, consistent with the applicable NT Agreement and the Aboriginal Heritage Act 1988	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D2. No unauthorised damage, disturbance or interference to sites, objects or remains of Aboriginal and / or non-Aboriginal heritage	• Records demonstrate that a cultural heritage survey (or Work Area Clearance - WAC) has been undertaken prior to commencement of activities. • Records (e.g. audits / site inspections) demonstrate that damage, disturbance or interference to any Aboriginal sites, objects and remains (all as defined under the *Aboriginal Heritage Act 1988*) is avoided unless authorisation has been obtained under the *Aboriginal Heritage Act 1988*. • Records (e.g. audits / site inspections) demonstrate there has been no impact to non-Aboriginal heritage places and related objects protected under the *Heritage Places Act 1993 u*nless approval has been obtained	• Processes are in place to meet requirements of legislation and agreements with Native Title claimant groups with respect to protection and reporting of discovery of unknown heritage sites during regulated activities. • Records demonstrate that non-Aboriginal heritage sites have been identified and avoided. • In the event the conditions of a Work Area Clearance(s) are not complied with, the incident is appropriately reported, investigated and remediated in consultation with the relevant Native Title holders and in accordance with any applicable NT Agreement.

Impact ID	Impact Event	Control Measures	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						under the *Heritage Places Act 1993*. • Records demonstrate that any Aboriginal and non-Aboriginal heritage sites, objects and remains discovered during operations have been appropriately reported and responded to, consistent with the applicable NT Agreement and the *Aboriginal Heritage Act 1988* and *Heritage Places Act 1993*.	

Table 5-22: Heritage (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-H-01	Drilling activities result in damage to shallow artefact scatters and/or subsurface material or other sites, objects, remains or places of Aboriginal or non-Aboriginal heritage significance.	No – impacts cannot be completely avoided based on controls due to the partially unknown nature of the location of the receptor.	Known heritage: Low – desktop and in person surveys of the areas identified for seismic activities have identified known heritage areas and these areas have been fenced off/flagged as an exclusion area. Unknown heritage: Low/moderate – obscured/subsurface Aboriginal Heritage sites have been identified in proximity to the area, which may increase the risk of heritage discoveries in parts of the project area.	Permanent – impacts to heritage sites are permanent and non-reversible.	Localised – impacts confined to disturbed site.	High (worst case) – permanent impact to heritage, Traditional Owners and their communities.	Possible - multiple incidents of damage or loss of Aboriginal heritage would result in cumulative impacts, however this is very unlikely to occur.	High	Magnitude = High Significance = Moderate Potential impacts to heritage managed to ALARP (low frequency) by control measures adopted to identify Aboriginal heritage prior to undertaking earthworks.

Heritage (Aboriginal and non-Aboriginal) - Injection Activities

Table 5-23: Heritage (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-H-01	Injection activities	Uncontrolled release of CO_2, hydrocarbons and other substances from inadequate well integrity adversely impacting heritage values and reputation	Migration of CO_2 through well bore	Inadequate well integrity	Aboriginal and non-Aboriginal Heritage	It is not known how many cultural heritage sites may be impacted by seismic activities, with the assumption that not all cultural heritage sites along the pipeline have been identified.	Should a heritage site be identified during construction activities, the likelihood of additional heritage discoveries would increase.	Yes – based on advice received from Traditional Owners, searches of Aboriginal Affairs and Reconciliation (AAR)'s central archives and heritage surveys or assessments.

Table 5-24: Heritage (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-H-01	Uncontrolled release of CO_2, hydrocarbons and other substances from inadequate well integrity adversely impacting heritage values and reputation.	• Cultural heritage inspection of proposed well sites and access tracks undertaken with relevant Native Title group, • Known heritage sites have been identified and protected from operations (e.g. temporary flagging). • A procedure is in place for the appropriate response to any sites discovered during drilling activities. • Records of sites forwarded to the Aboriginal Heritage Branch in compliance with the Aboriginal Heritage Act. • Consult with Heritage Branch, DEW regarding location of non-indigenous heritage sites. • Non-Aboriginal heritage sites identified and avoided • Any Aboriginal and non-Aboriginal heritage sites, objects and remains discovered during operations have been appropriately reported and responded to, consistent with the applicable NT Agreement and the *Aboriginal Heritage Act 1988*	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I2. No unauthorised damage, disturbance or interference to sites, objects or remains of Aboriginal and / or non-Aboriginal heritage	• Records demonstrate that a cultural heritage survey (or Work Area Clearance - WAC) has been undertaken prior to commencement of activities. • Records (e.g. audits / site inspections) demonstrate that damage, disturbance or interference to any Aboriginal sites, objects and remains (all as defined under the *Aboriginal Heritage Act 1988*) is avoided unless authorisation has been obtained under the *Aboriginal Heritage Act 1988*. • Records (e.g. audits / site inspections) demonstrate there has been no impact to non-Aboriginal heritage places and related objects protected under the *Heritage Places Act 1993 u*nless approval has been obtained under the *Heritage Places Act 1993*. • Records demonstrate that any Aboriginal and non-Aboriginal heritage sites, objects and remains discovered during operations	• Processes are in place to meet requirements of legislation and agreements with Native Title claimant groups with respect to protection and reporting of discovery of unknown heritage sites during regulated activities. • Records demonstrate that non-Aboriginal heritage sites have been identified and avoided. • In the event the conditions of a Work Area Clearance(s) are not complied with, the incident is appropriately reported, investigated and remediated in consultation with the relevant Native Title holders and in accordance with any applicable NT Agreement.

Impact ID	Impact Event	Control Measures	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						have been appropriately reported and responded to, consistent with the applicable NT Agreement and the *Aboriginal Heritage Act 1988* and *Heritage Places Act 1993*.	

Table 5-25: Heritage (Injection) Significance assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-H-01	Uncontrolled release of CO_2, hydrocarbons and other substances from inadequate well integrity adversely impacting heritage values and reputation	No – impacts cannot be completely avoided based on controls due to the partially unknown nature of the location of the receptor.	Known heritage: Low – desktop and in person surveys of the areas identified for seismic activities have identified known heritage areas and these areas have been fenced off/flagged as an exclusion area. Unknown heritage: Low/moderate – obscured/subsurface Aboriginal Heritage sites have been identified in proximity to the area, which may increase the risk of heritage discoveries in parts of the project area.	Permanent – impacts to heritage sites are permanent and non-reversible.	Localised – impacts confined to disturbed site.	High (worst case) – permanent impact to heritage, Traditional Owners and their communities.	Possible - multiple incidents of damage or loss of Aboriginal heritage would result in cumulative impacts, however this is very unlikely to occur.	High	Magnitude = High Significance = Moderate Potential impacts to heritage managed to ALARP (low frequency) by control measures adopted to identify Aboriginal heritage prior to undertaking earthworks

5.3.3 Soil

5.3.3.1 Setting the context

Table 5-26 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to soil.

Table 5-26: Soil Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Soil	• *Environment Protection Act 1993* • *Landscape South Australia Act 2019*	• National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013 (Site Contamination NEPM)	To be updated to include views of affected parties from original consultation and new consultation.	• Soil quality • Soil resources

5.3.3.2 Potential impact events

Potential impacts to soil, arise principally from:

Seismic:

- Direct disturbance from associated with line and access preparation, earthworks and vehicle movements
- Uncontrolled releases (spills, leaks etc)
- Storage and transport of waste.

Drilling:

- Earthworks, camp site construction and rehabilitation; use of roads and tracks; movement of vehicles and heavy machinery
- Well control incidents or inadequate well integrity
- Uncontrolled releases (spills, leaks etc)
- Storage and transport of waste.

Injection:

- Inadequate well integrity
- Infrastructure failure.

Soil - Seismic Activities

Table 5-27: Soil (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-SO-01	Seismic activities	Impact to soil quality / resources from direct disturbance associated with line and access preparation, earthworks and vehicle movements.	Line and access preparation including: • Earthworks • Movement of heavy machinery and vehicles	Direct disturbance.	Soil quality/resources	Low - Soils have not been fully characterised but sufficient general information about soil types/properties is known.	Presence of steep topography or erosion prone soils in the survey area could increase the potential for adverse impacts.	Yes.
S-SO-02	Seismic activities	Impact to soil quality / resources from spills, leaks and uncontrolled releases associated with seismic activities such as surveying, drilling and restoration.	Seismic activities including: • Line preparation • Line surveying • Uphole drilling • Restoration	Uncontrolled releases (spills, leaks etc).	Soil quality/resources	Low - Soils have not been fully characterised but sufficient general information about soil types/properties is known.	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.
S-SO-03	Seismic activities	Impact to soil quality / resources from inadequate storage and transport of waste results in a decrease in soil quality.	Waste management	Storage and transport of wastewater and waste (litter).	Soil quality/resources	Low - Soils have not been fully characterised but sufficient general information about soil types/properties is known.	Low sensitivity to change.	Yes. Unplanned event could result in SPR linkage.

Table 5-28: Soil (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-SO-01	Impact to soil quality / resources from direct disturbance associated with line and access preparation, earthworks and vehicle movements.	• Pre-survey planning is undertaken to ensure that the impact of operations is minimised. • Where possible, existing tracks, roads or seismic lines are used for access. • Dozers are walked with the blade up wherever possible and limited blading is only carried out where the terrain is exceptionally rough and sparse ephemeral vegetation is present (e.g. crabhole floodplain) and is avoided if at all practicable. • Where line preparation is required, lines are prepared to a single blade width only (approximately 4 m to 5 m). • Blade work is avoided on gibber, tablelands, clay pans or flat easy terrain. • Minimal blade work is permitted elsewhere e.g. sand dunes and crabhole floodplains. • No survey line or access track preparation is carried out on salt lakes. • Cuts are minimised at dune crests and base of dunes.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S3. To maintain soil quality and reduce impact to soil resources.	• Records of inspections/audits demonstrate that proposed survey lines and campsites have been appropriately located and prepared to minimise the disturbance to soil resources. • Attainment of 0, +1 or +2 GAS criteria for 'Disturbance to land surface' objective, as listed	• Records demonstrate that planning has been undertaken to minimise impacts of operations and records are available for review. • There is no evidence of off-line driving or creation of shortcuts.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Removed sand is ramped to the side of dune cuts as opposed to the base of the dune. • Windrows are removed either during or on completion of work. • Vehicles use appropriate tyre pressures and reduced speeds to minimise risk of rutting and damage to dunes. • Balloon tyres on vibrator machines, or tracked vibrator machines, are used to reduce ground pressures and minimise impact on soil, particularly on dunes. • Unavoidable compaction is reported and ripped on completion of work where appropriate (e.g. not in gibber areas). • Camp sites, other than in gibber areas are ripped, if necessary, on completion of work. • Any sumps and excavations shall be backfilled with subsoil being placed below topsoil. • Compacted areas will be ripped on completion of activities (other than in gibber areas).				in the SEO-Appendix A.	
S-SO-02	Impact to soil quality / resources from spills, leaks and uncontrolled releases associated with seismic activities such as surveying, drilling and restoration.	• Transportation, storage and handling of chemicals, fuels and oils is undertaken in accordance with the Safety Data Sheet (SDS), licencee's environmental management system, and relevant standards and guidelines such as the EPA Bunding Guidelines and AS 1940. • Water based drilling muds are used if mud drilling is undertaken. • Surplus cuttings may be removed for disposal at EPA licensed facility in particularly sensitive areas. • Vehicles and equipment are operated and maintained in accordance with specifications to minimise the potential for a spill or leak (e.g. oil leak or hydraulic hose failure). • Chemical and fuel storage procedures, including signage, are reviewed and monitored in accordance with relevant standards. • Storage of fuel at camp sites is contained within tankers utilising safety features such as double-skins, safety cut-off valves, top accessing. • Spill leak and drip trays are provided to address minor drips and spills resulting from re-fuelling operations. • Specific training in spill response equipment is provided, where required. • Spill response and clean-up is implemented in the event of loss of containment. Affected areas are fenced if threat is posed to livestock or native fauna, and consult with landholders to ensure appropriate practices are developed and implemented to mitigate risks and impacts to properties that are organic certified.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S3. To maintain soil quality and reduce impact to soil resources.	• An escape of petroleum, chemical or fuel that cannot be immediately contained or remediated is assessed and managed in accordance with the requirements of the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (NEPM), and where required, remediated in line with relevant guidelines.	• Records (e.g. audits/site inspections) demonstrate that fuel and chemicals are stored and handled in accordance with relevant standards and guidelines, including AS 1940, EPA Bunding and Spill Management guideline and the Australian Dangerous Goods Code (ADG). • Inspections demonstrate no evidence of spills or leaks as a result of activities. • Personnel trained in spill

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Spills to ground (if they occur) may be chemically treated or bioremediated and the ground ripped, or the impacted soil may be removed and disposed of at a licensed facility. • Assessment of releases that cannot be immediately contained or remediated is undertaken in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (NEPM). • Loss of containment is managed via an incident management system (IMS) and implementation of corrective actions is based on incident investigation.					response procedures. • Appropriate spill response equipment is available on site.
S-SO-03	Impact to soil quality / resources from inadequate storage and transport of waste results in a decrease in soil quality.	• All wastewater disposed in accordance with the South Australian *Public Health (Wastewater) Regulations 2013* or to the satisfaction of the Department of Health) and consistent with the *Environment Protection (Water Quality) Policy 2015*. • Application of the waste hierarchy system (avoid, reduce, reuse, recycle, treat, and dispose). • Waste management is undertaken in accordance with applicable regulatory requirements. • All sewage and kitchen grey water is collected and transported to a suitable, designated waste disposal centre, or treated on site in an approved aerobic wastewater treatment system. • Storage, transport and handling of all hazardous or regulated wastes is managed in accordance with the requirements of relevant legislation and industry standards. • Waste streams are segregated on site where appropriate to maximise opportunities for waste recovery, reuse and recycling. • Production of waste is minimised by purchasing biodegradable or recyclable materials where practical.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S3. To maintain soil quality and reduce impact to soil resources.	• Records and inspections/audits demonstrate that wastes are segregated and transported to an Environment Protection Authority (EPA) licensed waste disposal facility for recycling or disposal. • 0, +1 or +2 GAS criteria are attained for 'Pollution and Litter' listed in the SEO-Appendix A.	• Inspections demonstrate waste is appropriately stored and contained. • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.

Table 5-29: Soil (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-SO-01	Impact to soil quality from seismic activities including line and access preparation, earthworks, vehicle movements, campsites	No – vehicle movement is an essential part of seismic activities.	Low – although there are frequent vehicle movements, any impact would occur once (during the seismic survey).	Short term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - impacts are generally confined to seismic lines and camps.	Low to Moderate - potential impact event may have a low/moderate severity impact but is dependent on the nature of the land use of the seismic survey area, recognising that	Possible - Receptors could be impacted by similar activities depending on the site.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
						selection will seek to avoid ecologically sensitive areas.			
S-SO-02	Impact to soil resources from spills, leaks and uncontrolled releases associated with seismic activities such as surveying, drilling and restoration	No - design and engineering controls, and management system controls are put in place to avoid spills, however spills may occur during exceptional circumstances.	Rare - impacts of any notable severity are not expected to occur.	Short-term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - impacts are generally confined to seismic survey area.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the seismic survey area, recognising that selection will seek to avoid ecologically sensitive areas.	Possible - Receptors could be impacted by similar activities depending on the site.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Low to Moderate Significance = Low
S-SO-03	Impact to soil resources from inadequate storage and transport of waste results in a decrease in soil quality	No - design and engineering controls, and management system controls are put in place, however an impact may occur during exceptional circumstances.	Rare – impacts of any notable severity are not expected to occur.	Short-term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - impacts are generally confined to seismic survey area.	Low to moderate - potential impact event severity is anticipated to have low – moderate severity impact relative to the mostly disturbed background levels associated with the area	Possible - Receptors could be impacted by similar activities depending on the site.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Low Significance = Low

Soil - Drilling Activities

Table 5-30: Soil (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-SO-01	Drilling activities	Impact to soil quality / resources from drilling activities including earthworks and vehicle movements.	Earthworks for well lease, access track, borrow pit and camp site construction and rehabilitation; use of roads and tracks; movement of vehicles and heavy machinery.	Direct disturbance	Soil quality / resources	Low - Soils have not been fully characterised but sufficient general information about soil types/properties is known.	Presence of steep topography or erosion prone soils on access or well locations could increase the potential for adverse impacts.	Yes.
D-SO-02	Drilling activities	Impact to soil quality / resources from well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure).	Well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure).	Inadequate well integrity	Soil quality / resources	Low - Soils have not been fully characterised but sufficient general information about soil types/properties is known.	Low sensitivity to change due to knowledge gained from prior drilling activities.	Yes. Unplanned event could result in SPR linkage.
D-SO-03	Drilling activities	Impacts to soil quality / resources from spills and leaks associated with drilling activities and associated infrastructure.	Spills or leaks associated with: • drilling procedures and storage of drilling muds and cuttings in sump • storage of fuel, oil and chemicals • operations and high-pressure hydraulic systems • initial production testing / flaring.	Direct disturbance	Soil quality / resources	Low - Soils have not been fully characterised but sufficient general information about soil types/properties is known.	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.
D-SO-04	Drilling activities	Impact to soil quality / resources from inadequate storage and transport of waste results in a decrease in soil quality.	Waste management	Storage, handling and transportation of waste	Soil quality / resources	Low - Storage and handling requirements well understood and known to be effective.	Low sensitivity to change.	Yes. Unplanned event could result in SPR linkage.

Table 5-31: Soil (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-SO-01	Impact to soil quality / resources from drilling	• Planning undertaken to minimise impacts of operations. • Orientate site constructions to minimise soil removal.	High certainty that proposed control measures will be	Low	D3. To maintain soil quality and	• The attainment of 0, +1 or +2 GAS criteria for 'Minimising impact to soil'	• Planning has been undertaken to minimise impacts

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
	activities including earthworks and vehicle movements	• Separate topsoil and sump spoil stockpiles • Soil removed in construction to be stored on site and returned to its original stratigraphic level upon restoration of the drill site. • Monitoring of local erosion rates in place – establish photo points. • Minimal use grading/bulldozing in the Arckaringa region. Rolling and clearing is preferred in order to avoid windrows which restrict water movement across the landscape and potentially lead to water channelling and erosion. • Compacted soil areas ripped (except in stony plains and tablelands) and soil profile and contours are reinstated following completion of operations. • Soil removed in construction to be stored on site and returned to its original stratigraphic level upon restoration of the drill site. • Rehabilitation/decommissioning plans for surface activities will be developed in consultation with relevant stakeholders. • Assessment of the threat to third parties from well completion / downhole decommissioning. • Necessary measures (e.g. fencing, signage) taken to prevent the public accessing the wellhead equipment or waste relating to the well. • Effective rehabilitation of the wellsite so that potentially dangerous perturbations in ground level do not remain. • Control production and dispersion of dust on unsealed roads and drilling lease areas. • All vehicles will be required to remain on designated roads and access track or parking areas.	effective. Industry standard control measures that are well understood and that have been successfully implemented.		reduce impact to soil resources.	objectives for wellsite construction and borrow pit construction and rehabilitation listed in the SEO Appendix B. • Records demonstrate that no construction activities are carried out on salt lakes, wetlands or steep breakaway/tableland/stony hills landforms (as defined in the EIR). • Records of inspections/audits demonstrate that local erosion rates are not significantly accelerated above those of surrounding land.	of operations and records are available for review. • There is no evidence of off-road driving or creation of shortcuts.
D-SO-02	Impact to soil quality / resources from well control incidents (e.g. blowout, kick) and Loss of well integrity (e.g. casing or cement failure).	• Drill rig, ancillary and any testing equipment to comply with Regulations, meet relevant industry standards and be “Fit for Purpose”. • Casing design carried out to meet worst case expected loads and environmental conditions determined for the specific geology intercepted by the well. Details of work to be performed are set out in the Drilling Program. • Casing set in accordance with design parameters. • Casing cemented to surface with visible return. • Blow out prevention precautions / well control equipment in place in accordance with defined procedures and appropriate to the expected downhole conditions. • Plugs will be installed between aquifers to prevent mixing and uncontrolled flow to the surface. • Sufficient kick tolerance in casing program design.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D3. To maintain soil quality and reduce impact to soil resources.	• An escape of petroleum, chemical or fuel that cannot be immediately contained or remediated is assessed and managed in accordance with the requirements of the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (NEPM), and where required, remediated in line with relevant guidelines.	• Records and inspections/audits demonstrate that identified controls are in place.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Sump to have sufficient capacity. • Camp and drill rig generators to be located in polyethylene lined bunded areas to contain any spills. • Production storage tanks to be stored in clay-lined bunded areas. • Bunded areas must have sufficient freeboard (e.g. to hold a 1:25 year, 24hr rainfall event). • Bunded areas will be in accordance with EPA Bunding and Spill Management guideline. • Initial production lines and tanks to be inspected prior to use. • MSDS information readily available on the wellsite. • Emergency Response Procedures in place.					
D-SO-03	Impacts to soil quality / resources from spills and leaks associated with drilling activities and associated infrastructure.	• Hazardous material stored, used and disposed of in accordance with relevant legislation on dangerous substances. • All hazardous materials including fuels, oils and chemicals are to be stored in approved containers in polythene lined bunded pits or on bunded pallets. • Initial production lines and tanks to be inspected prior to use. • No refuelling outside designated refuelling/servicing areas. • Appropriate spill response equipment is available on site. • Spills or leaks are immediately reported and clean up actions initiated. • All contaminated soil will either be treated in-situ or removed to an EPA licenced facility. • Records of spill events and corrective actions are maintained. Assessment and remediation of uncontained spills with larger scale impact (e.g. greater than 200 litres to land, or any volume to water) is consistent with the National Environment Protection (Assessment of Site Contamination) Measure and relevant SA EPA guidelines.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D3. To maintain soil quality and reduce impact to soil resources.	• An escape of petroleum, chemical or fuel that cannot be immediately contained or remediated is assessed and managed in accordance with the requirements of the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (NEPM), and where required, remediated in line with relevant guidelines. • Records demonstrate that any in situ remediation of spills is monitored and decrease in hydrocarbons over time can be demonstrated.	• Records (e.g. audits/site inspections) demonstrate that fuel and chemicals are stored and handled in accordance with relevant standards and guidelines, including AS 1940, EPA Bunding and Spill Management guideline and the Australian Dangerous Goods Code (ADG). • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.
D-SO-04	Impact to soil quality / resources from inadequate	• All drill cuttings, muds and drill fluids will be contained within designated mud sumps with adequate freeboard at the completion of operations to allow for a 1m cover of clean fill.	High certainty that proposed control measures will be	Low	D3. To maintain soil quality and	• All wastes to be disposed of at an EPA licensed facility in accordance with	• Inspections demonstrate waste is

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
	storage and transport of waste results in a decrease in soil quality.	• Covered bins are provided for the collection and storage of wastes. All loads of rubbish are covered during transport to an approved waste facility. • Waste transported to EPA licensed facility with other waste where practical. • Hazardous waste handled in accordance with relevant legislation and standards. • All Wastewater treatment and disposal will be via a product approved aerated wastewater treatment system and be disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* and the SA Health On-site Wastewater Systems Code. • Treated sewage wastewater disposed of onto land should not pool, and disposal should be well away from any place from which it is reasonably likely to enter any waters (through seepage or runoff). • Septage to be disposed of in accordance with EPA Septage Management Guidelines • Production of waste is minimised by purchasing reusable, biodegradable or recyclable materials where practical. • Wellsite is kept free of litter and rubbish.	effective. Industry standard control measures that are well understood and that have been successfully implemented.		reduce impact to soil resources.	EPA Licence conditions, with the exception of: ○ drilling fluids, drill cuttings and other benign completion fluids disposed during well clean-up ○ sewage and grey water ○ putrescible domestic wastes (may be buried on-site in accordance with EPA requirements for short-term and temporary sites if transportation impractical). • Records of inspections/audits demonstrate that reasonable steps are taken to securely contain waste prior to removal from site. • Records of inspections/audits demonstrate that all wastewater disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* or to the satisfaction of the Department of Health. • Attainment of GAS criteria for 'Site to be left in a clean, tidy and safe condition' objective for wellsite restoration and borrow pit rehabilitation as listed in the SEO-Appendix B.	appropriately stored and contained.

Table 5-32: Soil (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-SO-01	Impact to soil quality / resources from drilling activities including earthworks and vehicle movements.	No – access track, well lease preparation and vehicle movement is an essential part of drilling activities.	Low – Notable impacts generally only occur during initial earthworks.	Short-term (possibly long lasting if appropriate controls not implemented)	Localised - impacts are generally confined to seismic area.	Low to Moderate - potential impact event may have a low/moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	Possible - Receptors could be impacted by similar activities depending on the site.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Low to Moderate Significance = Low
D-SO-02	Impact to soil quality / resources from well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure).	No - design and engineering controls, and management system controls are put in place to avoid releases, however they may occur during exceptional circumstances.	Rare - potential impact events are not expected to occur.	Long-lasting - Impact to the environment persist for a period of years but are reversible.	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low
D-SO-03	Impacts to soil quality / resources from spills and leaks with drilling activities and associated infrastructure.	No - design and engineering controls, and management system controls are put in place to avoid spills, however spills may occur during exceptional circumstances.	Rare - impacts of any notable severity are not expected to occur.	Long-lasting - Impact to the environment persist for a period of years but are reversible.	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low
D-SO-04	Impact to soil quality / resources from inadequate storage and transport of waste results in a decrease in soil quality.	No - design and engineering controls, and management system controls are put in place, however an impact may occur during exceptional circumstances.	Rare - potential impact events are not expected to occur.	Short-term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - impacts are generally confined to seismic area.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low

Soil - Injection Activities

Table 5-33: Soil (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-SO-01	CO_2 Injection	Uncontrolled CO_2 release from well integrity failure resulting in accumulation of CO_2 in soils adversely impact users and quality.	Well integrity failure	Migration of CO_2 through well bore	Soils quality / resources	• Source-Pathway-Receptor linkage assumes there is potential for a well integrity failure during injection (which is extremely unlikely). Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage.
I-SO-02	CO_2 injection	Impact to soil quality / resources from infrastructure failure which release CO_2 at the surface.	Infrastructure failure	CO_2 pooling at the surface	Soils quality / resources	• Source-Pathway-Receptor linkage assumes there is potential for a release during injection (which is unlikely). • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage.

Table 5-34: Soil (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria

I-SO-01	Uncontrolled CO_2 release from well integrity failure resulting in accumulation of CO_2 in soils adversely impact users and soil quality	*Design*:
		• Well design in accordance with SEO, such as:
		  ○ Aquifers isolated behind casing string(s) cemented in place.
		  ○ Casing string and cement slurry designed by qualified and competent engineers and confirmed by senior engineers or external consultants where necessary.
		  ○ Appropriately designed casing and wellhead installed on new wells drilled and retained for use.
		• Identification and evaluation of existing well bores and where necessary, workover or decommissioning undertaken to appropriately manage integrity.
		• Geological risk assessment including review of production history.
		• Equipment design and monitoring to ensure injection pressures remain below fracture gradient. which also avoids the potential for creating new permeable pathways.
			High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I3. To maintain soil quality and reduce impact to soil resources.	• Pressure monitoring during injection demonstrates maximum injection pressure not exceeded.
						• Operational/real-time audits / inspections show maximum injection pressure not exceeded.
							• If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Reporting and records of loss of well integrity events and corrective actions are in accordance with the requirements of the SEO. • Response plan in place for abnormal pressure events during injection.					
I-SO-02	Impact to soil quality / resources as a result of CO_2 release at the surface	• Design and operation of injection equipment implemented in accordance with applicable industry and regulatory standards. • Pipework and tanks to be inspected and integrity verified prior to use. • Releases or leaks are immediately responded to and reported.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I3. To maintain soil quality and reduce impact to soil resources.	• Records of monitoring and inspections demonstrate no adverse impact to soil as a result of CO_2 release.	• Monitoring of CO_2 levels demonstrates no evidence of uncontrolled release. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.

Table 5-35: Soil (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-SO-01	Uncontrolled CO_2 release from well integrity failure resulting in accumulation of CO_2 in soils adversely impact users and quality	Yes. Design and engineering controls, and management system controls are put in place to avoid loss of well integrity.	Rare - potential impact events are not expected to occur.	Short-term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - impacts are generally confined to CO_2 injection area.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the CO_2 injection area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Low Significance = Negligible
I-SO-02	Impact to soil quality / resources as a result of CO_2 release at the surface	Yes. Design and engineering controls, and management system controls are put in place to avoid failure of CO_2 storage.	Rare - potential impact events are not expected to occur.	Short-term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - impacts are generally confined to CO_2 injection area.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the CO_2 injection area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Low Significance = Negligible

5.3.4 Groundwater (including quality and quantity)

5.3.4.1 Setting the context

Table 5-36 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to groundwater.

Table 5-36: Groundwater Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Groundwater	• *Environment Protection Act 1993* • *Environment Protection (Water Quality) Policy 2015* • *Landscape South Australia Act 2019*	• Guideline EPA 080/16 Bunding and Spill Management • AS 1940 - The storage and handling of flammable and combustible liquids • Australian Dangerous Goods Code • *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013)	To be updated to include views of affected parties from original consultation and new consultation.	• Groundwater quality • Groundwater users

5.3.4.2 Potential impact events

Potential impacts to groundwater, arise principally from:

Seismic:

- Uphole drilling and logging.
- Management of wastewater
- Fuel and chemical storage and handling.

Drilling:

- Spills or leaks associated with drilling activities
- Groundwater use
- Drilling and completion activities.

Injection:

- Injection of CO_2 into the storage complex
- Well integrity failure.

Groundwater - Seismic Activities

Table 5-37: Groundwater (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-GR-01	Seismic activities	Impact to shallow groundwater resources from uphole drilling activities.	Uphole drilling and logging.	Uphole drilling activity.	Shallow groundwater resources.	Groundwater depths suggest most spills would not reach shallow groundwater.	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.
S-GR-02	Seismic activities	Impact to shallow groundwater resources from inadequate management of camp wastewater.	Storage of wastewater.	Disposal of camp wastewater.	Shallow groundwater resources.	Groundwater depths suggest most spills would not reach shallow groundwater.	Low sensitivity to change.	Yes. Unplanned event could result in SPR linkage.
S-GR-03	Seismic activities	Impact to shallow groundwater resources from spills, leaks and uncontrolled releases associated with seismic activities.	Fuel and chemical storage and handling.	Loss of containment of fuel or chemicals.	Shallow groundwater resources.	Larger spills or leaks could impact a greater area	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.

Table 5-38: Groundwater (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-GR-01	Impact to shallow groundwater resources from uphole drilling activities.	• Upholes are constructed and later backfilled in accordance with relevant industry standards and guidelines (e.g. DEM Earth Resources information sheet M21 *Mineral Exploration Drillholes — General specifications for construction and backfilling*). • Plugs are installed during backfilling in accordance with standards and guidelines if confined or artesian aquifers are present. • Water based drilling muds are used if mud drilling is undertaken. • Surplus cuttings may be removed for disposal at EPA licensed facility in particularly sensitive areas.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S4. To maintain drainage patterns and avoid contamination of surface water and groundwater resources.	• Records of inspections/audits demonstrate that no uncontrolled flows were detected to surface from aquifers intersected in upholes / shallow boreholes.	• Inspections demonstrate that upholes are constructed and later backfilled in accordance with relevant industry standards and guidelines (e.g. DEM Earth Resources information sheet M21 *Mineral Exploration Drillholes — General specifications for construction and backfilling*).
S-GR-02	Impact to shallow groundwater resources from inadequate storage of camp wastewater.	• Department for Health approved transportable wastewater treatment plants used for camps, or septic tank systems used with collection of wastewater for disposal at a licensed facility (e.g. Moomba). • Appropriate controls for management of sewage effluent (developed in consultation with Department for Health) implemented for situations where excursions outside	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S4. To maintain drainage patterns and avoid contamination of surface water and groundwater resources.	• Records and inspections/audits demonstrate that wastes are segregated and transported to an Environment Protection Authority (EPA) licensed waste disposal facility for recycling or disposal.	• Inspections demonstrate waste is appropriately stored and contained.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		effluent quality guidelines may occur (e.g. start-up or system upset). • Secondary treated sewage wastewater is disposed of onto land well away from any place from which it is reasonably likely to enter any waters, and to minimise spray drift and ponding.				• 0, +1 or +2 GAS criteria are attained for 'Pollution and Litter' listed in the SEO-Appendix A.	
S-GR-03	Impact to shallow groundwater resources from spills, leaks and uncontrolled releases associated with seismic activities.	• Vehicles and equipment are operated and maintained in accordance with specifications to minimise the potential for a spill or leak (e.g. oil leak or hydraulic hose failure). • Chemical and fuel storage procedures, including signage, are reviewed and monitored in audit process in accordance with relevant licencee's environmental management system., • Appropriate emergency / spill response procedures are in place for loss of containment. • Spill response and clean-up is implemented.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S4. To maintain drainage patterns and avoid contamination of surface water and groundwater resources.	• An escape of petroleum, chemical or fuel that cannot be immediately contained or remediated is assessed and managed in accordance with the requirements of the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (NEPM), and where required, remediated in line with relevant guidelines.	• Records (e.g. audits / site inspections) demonstrate that fuel and chemicals are stored and handled in accordance with relevant standards and guidelines, including AS 1940, EPA Bunding and Spill Management guideline and the Australian Dangerous Goods Code (ADG). • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.

Table 5-39: Groundwater (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-GR-01	Impact to shallow groundwater resources from uphole drilling activities.	No. Design and engineering controls, and management system controls are put in place, however an impact may occur during exceptional circumstances.	Rare – impacts of any notable severity are not expected t occur.	Short term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - Confined to localised groundwater area	Moderate - depending on level of contamination and type of contaminant.	Possible - Receptors could be impacted by similar activities depending on the site.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low
S-GR-02	Impact to shallow groundwater resources from inadequate storage	No. Design and engineering controls, and management system controls are put in place, however an	Rare - Measures to prevent groundwater contamination from wastewater are well developed.	Short term - With identified controls in place, any issues are anticipated to be	Localised - Confined to localised groundwater area	Moderate - depending on level of contamination and type of contaminant.	Possible - Receptors could be impacted by similar activities	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
	of camp wastewater.	impact may occur during exceptional circumstances.		minor, with impacts of less than a year in duration and are reversible.			depending on the site.		
S-GR-03	Impact to shallow groundwater resources from spills, leaks and uncontrolled releases associated with seismic activities.	No. Design and engineering controls, and management system controls are put in place to avoid spills, however spills may occur during exceptional circumstances.	Rare - Measures to prevent groundwater contamination from drilling and storage of fuels/chemicals are well developed.	Short term - With identified controls in place, any issues are anticipated to be minor, with impacts of less than a year in duration and are reversible.	Localised - Confined to localised groundwater area.	Moderate - depending on level of contamination and type of contaminant.	Possible - Receptors could be impacted by similar activities depending on the site.	Low – location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low

Groundwater - Drilling Activities

Table 5-40: Groundwater (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-GR-01	Drilling activities	Impact to groundwater aquifer from spills or leaks associated with drilling activities including: • Storage of fuel, oil and chemicals • Operations and high-pressure hydraulic systems • Initial production testing / flaring	• Drilling procedures and storage of drilling muds and cuttings in sump • Storage of fuel, oil and chemicals • Operations and high-pressure hydraulic systems initial production testing / flaring	Spills or leaks	Groundwater aquifer	Larger spills or leaks could impact a greater area.	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.
D-GR-02	Drilling activities	Impact to groundwater aquifer from groundwater use depleting the GAB and sub-artesian water supplies	Groundwater use	Depletion of GAB and sub-artesian water supplies	Groundwater aquifer	Supply bores for a drill site will be chosen on the basis of minimising the distance for the water haul and minimising impacts on pastoral activities.	Excessive use of groundwater, beyond allocated licenced amount	Yes. Unplanned event could result in SPR linkage.
D-GR-03	Drilling activities	Impact to groundwater aquifer from uncontrolled release of water and hydrocarbons to surface from drilling and completion activities	Drilling and completion activities	Uncontrolled release of water and hydrocarbons to surface	Groundwater aquifer	Larger spills or leaks could impact a greater area	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.
D-GR-04	Drilling activities	Impact to groundwater aquifer from crossflow, aquifer contamination or reduction in pressure in aquifers from routine drilling activities	Routine drilling	Crossflow, aquifer contamination or reduction in pressure in aquifers	Groundwater aquifer	Casing and cementing practices will be designed to isolate groundwater aquifers	Inadequate well integrity could impact aquifer	Yes. Unplanned event could result in SPR linkage.

Table 5-41: Groundwater (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-GR-01	Impact to groundwater aquifer from spills or leaks associated with drilling activities including: • Storage of fuel, oil and chemicals	• Hazardous material stored, used and disposed of in accordance with relevant legislation on dangerous substances. • All hazardous materials including fuels, oils and chemicals are to be stored in approved containers in polythene lined bunded pits or on bunded pallets. • Initial production lines and tanks to be inspected prior to use.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D4. To preserve reservoir and aquifer pressure and avoid aquifer contamination.	• No unauthorised discharge or escape of petroleum, processed substance, chemical, fuel or solid wastes to groundwater.	• Inspections demonstrate waste is appropriately stored and contained. • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
	• Operations and high-pressure hydraulic systems initial production testing / flaring	• No refuelling outside designated refuelling/servicing areas. • Appropriate spill response equipment is available on site • Spills or leaks are immediately reported and clean up actions initiated. • All contaminated soil will either be treated in-situ or removed to an EPA licenced facility. • Records of spill events and corrective actions are maintained. Assessment and remediation of uncontained spills with larger scale impact (e.g. greater than 200 litres to land, or any volume to water) is consistent with the National Environment Protection (Assessment of Site Contamination) Measure and relevant SA EPA guidelines.					• Appropriate spill response equipment is available on site.
D-GR-02	Impact to groundwater aquifer from groundwater use depleting the GAB and sub-artesian water supplies	• Wellsite and water extraction points are discussed with landholders prior to use to eliminate any impact issues. • Wells not to be drilled within 5 km of GAB springs as per Far North WAP principle 12.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D4. To preserve reservoir and aquifer pressures and avoid aquifer contamination.	• Landholder complaints are documented and reasonable steps taken to resolve them can be demonstrated No impact on mound spring flow rates due to water extraction activities. • Records of inspections/audits demonstrate no impact on other groundwater users due to the water extraction activities.	• Undertake regional groundwater monitoring and sampling of the existing water bores in the area where it is possible.
D-GR-03	Impact to groundwater aquifer from uncontrolled release of water and hydrocarbons to surface from drilling and completion activities	• Information on muds and chemicals to be readily available on the rig. • All drill cuttings, muds and non-toxic drill fluids are to be contained within a designated sump with adequate freeboard at completion of operations to allow for a 1m cover of clean fill at remediation. • On completion of drilling the sump will be allowed to dry out and then backfilled level with the surrounding landscape.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D4. To preserve reservoir and aquifer pressures and avoid aquifer contamination.	• Records of inspections/audits demonstrate no uncontrolled flow to surface • Sufficient barriers exist in casing annulus to prevent crossflow between separate aquifers or	• Inspections demonstrate waste is appropriately stored and contained.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Fluid losses will be controlled during drilling. • Where shallow aquifers present mud pits will be lined with impervious material e.g. polyethylene				hydrocarbon reservoirs.	
D-GR-04	Impact to groundwater aquifer from crossflow, aquifer contamination or reduction in pressure in aquifers from routine drilling activities	• Fluid losses will be controlled during drilling. • New casing and wellhead installation • Casing and well head designed to meet pressure, temperature, operational stresses and loads • Casing seating depths will be designed to cover formations at risk and the cementing program will allow for sufficient cement returns at surface to ensure bond to formation • Observed volumes of cement return to surface match calculations. • If there is evidence of insufficient isolation, remedial action to be conducted. • Well decommissioning program to be submitted to DEM with wireline logs prior to approval. The identification of aquifers (stratigraphic layers) to be separated in well decommissioning activities. Isolation barriers to be set in place to ensure that crossflow, contamination, or pressure reduction does not occur. Records of plug depths and intervals are kept. • Downhole decommissioning is carried out to meet worst case expected loads and downhole environmental conditions. • Effective isolation maintained between any potential aquifers to prevent crossflow. • Decommissioning plugs must be set to ensure long term isolation of any potential aquifers intersected to avoid shallow zones becoming over-pressured.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D4. To preserve reservoir and aquifer pressures and avoid aquifer contamination.	• No crossflow behind casing between aquifers, and between aquifers and hydrocarbon reservoirs unless approved by the Department for Environment and Water.	• Well decommissioning program to be submitted to DEM with wireline logs prior to approval • The identification of aquifers (stratigraphic layers) to be separated in well decommissioning activities. Isolation barriers to be set in place to ensure that crossflow, contamination or pressure reduction does not occur. Records of plug depths and intervals are kept.

Table 5-42: Groundwater (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-GR-01	Impact to groundwater aquifer from spills or leaks associated with drilling activities including: • Storage of fuel, oil and chemicals • Operations and high-pressure hydraulic systems initial production testing / flaring	No – design and engineering controls, and management system controls are put in place to avoid spills, however spills may occur during exceptional circumstances.	Rare - impacts of any notable severity are not expected to occur.	Long-lasting - Impact to the environment persist for a period of years but are reversible.	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low
D-GR-02	Impact to groundwater aquifer from groundwater use depleting the GAB and sub-artesian water supplies	Yes – groundwater extraction is expected to be within licensed limits.	Rare - impacts of any notable severity are not expected to occur.	Long-lasting - Impact to the environment persist for a period of years but are reversible.	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	Possible - Receptors could be impacted by similar activities depending on the site.	High -	Magnitude = Moderate Significance = Low
D-GR-03	Impact to groundwater aquifer from uncontrolled release of water and hydrocarbons to surface from drilling and completion activities	No - design and engineering controls, and management system controls are put in place to avoid spills, however spills may occur during exceptional circumstances.	Rare - impacts of any notable severity are not expected to occur.	Long-lasting - Impact to the environment persist for a period of years but are reversible.	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low
D-GR-04	Impact to groundwater aquifer from crossflow, aquifer contamination or reduction in pressure in aquifers from routine drilling activities	Yes - design and engineering controls, and management system controls are put in place to avoid loss of well integrity.	Rare - impacts of any notable severity are not expected to occur.	Long-lasting - Impact to the environment persist for a period of years but are reversible.	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of the drilling area, recognising that selection will seek to avoid ecologically sensitive areas.	No - Receptors are not already impacted by similar activities.	Low – location of drilling activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low

Groundwater - Injection Activities

Table 5-43: Groundwater (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-GR-01	CO_2 injection	Injection of CO_2 into the storage complex results in lateral flow of CO_2 from storage reservoirs adversely impacting groundwater quality and users	Injection of CO_2 into the storage complex	Lateral flow of CO_2 from storage reservoirs	• Groundwater quality • Groundwater users	• Source-Pathway-Receptor linkage assumes there is potential for a well integrity failure during injection (which is extremely unlikely). • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage.
I-GR-02	CO2 injection	Uncontrolled CO_2 release from well integrity failure adversely impacting groundwater quality and users	Injection of CO_2 into the storage complex	Well integrity failure	• Groundwater quality • Groundwater users	• Source-Pathway-Receptor linkage assumes there is potential for a well integrity failure during injection (which is extremely unlikely). • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage.

Table 5-44: Groundwater (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-GR-01	Injection of CO_2 into the storage complex results in lateral flow of CO_2 from storage reservoirs adversely impacting groundwater quality and users	• Geological risk assessment including review of production history • Response plan in place for abnormal pressure events during injection. • Nearby groundwater users are identified and considered in the design and operation of carbon storage schemes to reduce potential adverse impacts. • Pre-storage assessment / monitoring of identified sensitive receptors where appropriate to establish baseline (e.g. naturally occurring CO_2 chemistry). • Any nearby groundwater users are identified and considered in the design of the injection well to reduce potential adverse impacts. • Equipment design and monitoring to ensure injection pressures remain below fracture gradient. which also	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I4. Demonstrate storage of CO_2 in deep geological formations	• Pressure monitoring during injection demonstrates containment of injected CO_2 in the well and receiving formations.	• If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to Change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		avoids the potential for creating new permeable pathways.					
I-GR-02	Uncontrolled CO_2 release from well integrity and infrastructure failure adversely impacting groundwater quality and users	• Aquifers isolated behind casing string(s) cemented in place. • Casing string and cement slurry designed by qualified and competent engineers and confirmed by senior engineers or external consultants where necessary. • Appropriately designed casing and wellhead installed on new wells drilled and retained for use. • Any nearby groundwater users are identified and considered in the design of the injection well to reduce potential adverse impacts. • Equipment design and monitoring to ensure injection pressures remain below fracture gradient. which also avoids the potential for creating new permeable pathways.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I4. Demonstrate storage of CO_2 in deep geological formations	• Pressure monitoring during injection demonstrates containment of injected CO_2 in the well and receiving formations.	• If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.

Table 5-45: Groundwater (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-GR-01	Injection of CO_2 into the storage complex results in lateral flow of CO_2 from storage reservoirs adversely impacting groundwater quality and users	Yes – impacts may be avoided through effective implementation of controls	Rare - With control measures, loss of well integrity is unlikely.	Long-lasting – if contamination, lateral flow or loss of pressure occurs	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate - depending on level of contamination, lateral flow or loss of pressure.	No - Receptors are not already impacted by similar activities	Low location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low
I-GR-02	Uncontrolled CO_2 release from well integrity and infrastructure failure adversely impacting groundwater quality and users	Yes – impacts may be avoided through effective implementation of controls	Rare - With control measures, loss of well integrity is unlikely.	Long-lasting – if contamination, lateral flow or loss of pressure occurs	Moderate - Impacts may extend beyond the project site and immediate surrounds without occurring on a regional scale.	Moderate- depending on level of contamination, lateral flow or loss of pressure.	No - Receptors are not already impacted by similar activities	Low location of seismic activities will typically seek to avoid areas of environmental value.	Magnitude = Moderate Significance = Low

5.3.5 Surface Water (including quality and quantity)

5.3.5.1 Setting the context

Table 5-46 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to surface water.

Table 5-46: Surface Water Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Surface Water	• *Environment Protection Act 1993* • *Environment Protection (Water Quality) Policy 2015* • *Landscape South Australia Act 2019*	• Guideline EPA 080/16 Bunding and Spill Management • AS 1940 - The storage and handling of flammable and combustible liquids • Australian Dangerous Goods Code • National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013 (Site Contamination NEPM)	To be updated to include views of affected parties from original consultation and new consultation.	• Surface water quality • Surface water users

5.3.5.2 Potential impact events

Potential impacts to surface water, arise principally from:

Seismic:

- Line and access preparation, earthworks and movement of heavy machinery and vehicles
- Uncontrolled releases (spills, leaks etc).

Drilling:

- Earthworks, camp site construction and rehabilitation; use of roads and tracks; movement of vehicles and heavy machinery.
- Well control incidents or loss of well integrity
- Uncontrolled releases (spills, leaks etc).
- Storage and transport of waste.

Injection:

- Well integrity or infrastructure failure.

Surface Water - Seismic Activities

Table 5-47: Surface Water (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-SW-01	Seismic activities	Impact to surface water quality and availability from direct disturbance associated with line and access preparation, earthworks and vehicle movements	Line and access preparation including: • Earthworks • Movement of heavy machinery and vehicles	Direct disturbance	• Surface water quality • Users of surface water	Low – surface water resources have not been fully characterised but sufficient general information about location and properties is known.	Low sensitivity to change	Yes
S-SW-02	Seismic activities	Impact to surface water quality and availability from spills, leaks and uncontrolled releases associated with seismic activities such as surveying, drilling and restoration	Spill of fuel or chemicals from maintenance activities	Uncontrolled releases (spills, leaks etc)	• Surface water quality • Users of surface water	Low – surface water resources have not been fully characterised but sufficient general information about location and properties is known.	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.

Table 5-48: Surface Water (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-SW-01	Impact to surface water quality and availability from direct disturbance associated with line and access preparation, earthworks and vehicle movements	• Campsites and survey lines / traverses are located and constructed to avoid diversion of water flows. • All access through watercourses are carefully assessed to determine the locations of least impact to channels and creek banks. • Natural drainage channels are left clear at line crossings. • Creek channels are crossed at pre-determined strategic locations where gaps in vegetation and the channel profile allow vehicles to cross without significant earthworks. Minor earthworks (if required) only at a limited number of locations to decrease the entry and exit angles for vehicles. Remediation of such crossings is carried out where required to ensure that there is no significant increase in erosion potential or blockage of flow. • Major creek channels are not cut, and cables and geophones are carried across them by hand if vehicles cannot cross without earthworks. • No activities undertaken within 500 m of a creek's main channel (excluding limited earthworks at creek crossing locations) i.e. no earthworks or vegetation clearing.: • Low impact walk-in seismic activities permitted in all areas e.g. walk-in node / geophone placement.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D5. To maintain drainage patterns and avoid contamination of surface water and groundwater resources.	• The attainment of 0, +1 or +2 GAS criteria for 'Disturbance to land surface' measure listed in the SEO-Appendix A. • No new water affecting activities as defined under the Landscape South Australia Act undertaken unless applicable permits have been obtained.	• There is no evidence of uncontrolled flows to surface from aquifers intersected in upholes / shallow boreholes.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Vehicle crossings of creeks are limited (e.g. no more than 1 crossing location every 5 km of creek line). • Vehicle crossing locations are limited to those areas where gaps in the vegetation and a shallow bank profile allow vehicles to cross without the need for significant earthworks. Minor earthworks (if required) only to decrease the entry and exit angles for vehicles, and to ensure remediation of such crossings is carried out where required (as described above). • No upholes located within 500 m of a creek's main channel. • Camps are not established near major watercourses, creeks or surface water bodies. • Windrows or other disturbance to drainage patterns are removed from creek bed crossings and swales. • Wastewater (sewage and grey water) disposal in accordance with the South Australian Public Health (Wastewater) Regulations 2013 and / or in consultation with the Department for Health and / or in accordance with licences / permits, if any.					
S-SW-02	Impact to surface water quality and availability from spills, leaks and uncontrolled releases associated with seismic activities such as surveying, drilling and restoration	• Refuelling occurs at an appropriate distance from watercourses or sensitive ecological environments (e.g. wetlands). • See control measures for Soils (S-SO-02).	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S5. To maintain drainage patterns and avoid contamination of surface water and groundwater resources.	• No unauthorised discharge or escape of any liquid (including wastewater, petroleum, chemical or fuel) or solid wastes to surface water and / or groundwater. • An escape of petroleum, chemical or fuel that cannot be immediately contained or remediated is assessed and managed in accordance with the requirements of the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (NEPM), and where required, remediated in line with relevant guidelines.	• Records (e.g. audits/site inspections) demonstrate that fuel and chemicals are stored and handled in accordance with relevant standards and guidelines, including AS 1940, EPA Bunding and Spill Management guideline and the Australian Dangerous Goods Code (ADG). • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures.

Table 5-49: Surface Water (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-SW-01	Impact to surface water quality and availability from direct disturbance associated with line and access preparation, earthworks and vehicle movements	No. Design and engineering controls, and management system controls are put in place, however an impact may occur during exceptional circumstances	Rare – impacts of any notable severity are not expected to occur.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible.	Localised – impacts are generally confined to activity area or immediately adjacent.	Low to Moderate – potential impact event severity is anticipated to have low severity however failure of controls could result in a higher level of impact.	Possible – Receptors may be impacted by other activities in the area.	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Moderate Significance = Low
S-SW-02	Impact to surface water quality and availability from spills, leaks and uncontrolled releases associated with seismic activities such as surveying, drilling and restoration	No. Design and engineering controls, and management system controls are put in place, however an impact may occur during exceptional circumstances	Rare – impacts of any notable severity are not expected to occur.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible.	Localised – impacts are generally confined to activity area or immediately adjacent.	Low to Moderate – potential impact event severity is anticipated to have low severity however failure of controls could result in a higher level of impact.	Possible – Receptors may be impacted by other activities in the area.	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Moderate Significance = Low

Surface Water - Drilling Activities

Table 5-50: Surface Water (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-SW-01	Drilling activities	Impact to surface water quality and availability from drilling activities including earthworks and vehicle movements	• Earthworks for well lease, access track, borrow pit and camp site construction and rehabilitation; use of roads and tracks; movement of vehicles and heavy machinery	Direct disturbance	• Surface water quality • Users of surface water	Low – surface water resources have not been fully characterised but sufficient general information about location and properties is known.	Low sensitivity to change	Yes
D-SW-02	Drilling activities	Impact to surface water quality and availability y from well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure)	• Well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure)	Inadequate well integrity	• Surface water quality • Users of surface water	Low – surface water resources have not been fully characterised but sufficient general information about location and properties is known.	Low sensitivity to change due to knowledge gained from prior drilling activities	Yes. Unplanned event could result in SPR linkage.
D-SW-03	Drilling activities	Impacts to surface water quality and availability from spills and leaks associated with drilling activities and associated infrastructure	• Spills or leaks associated with: • drilling procedures and storage of drilling muds and cuttings in sump • storage of fuel, oil and chemicals • operations and high-pressure hydraulic systems • initial production testing / flaring	Direct disturbance	• Surface water quality • Users of surface water	Low – surface water resources have not been fully characterised but sufficient general information about location and properties is known.	Larger spills or leaks could impact a greater area.	Yes. Unplanned event could result in SPR linkage.
D-SW-04	Drilling activities	Impact to surface water quality and availability from inadequate storage and transport of waste results in a decrease in soil quality	• Waste management	Storage, handling and transportation of waste	• Surface water quality • Users of surface water	Low – surface water resources have not been fully characterised but sufficient general information about location and properties is known.	Low sensitivity to change	Yes. Unplanned event could result in SPR linkage.

Table 5-51: Surface Water (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-SW-01	Impact to surface water quality and availability from drilling activities including	Wellsite and Access Track Construction and Restoration • All access through watercourses areas carefully assessed to determine the	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood	Low	D5. To maintain drainage patterns and avoid contamination of surface waters and	• Wellsites and access tracks are constructed to maintain pre-existing water flows as far as practicable (e.g. channel contours are maintained on floodplains and at creek crossings	• Planning has been undertaken to minimise impacts of operations and records are available for review.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
	earthworks and vehicle movements	locations of least impact to channels and creek banks. • The South Australian Arid Lands (SAAL) Landscape Region consulted prior to the commencement of activities where disturbance of a water course/ drainage line is to occur, to determine permitting requirements. • Original drainage patterns restored • Any soil removed during the construction of the drill pad will be respread over the disturbed area during restoration. • Any required remediation work carried out as soon as possible after completion of all activities.	and that have been successfully implemented.		shallow groundwater resources.	and overland flows diverted around site if required) • No new 'water affecting activities' as defined under the Landscape South Australia Act undertaken unless relevant permits have been obtained • The attainment of 0, +1 or +2 GAS criteria for 'Minimising impact to drainage patterns' objectives for wellsite restoration and 'Minimising water retention in the pit' for borrow pit construction and rehabilitation listed in the SEO-Appendix B	• There is no evidence of off-road driving or creation of shortcuts.
D-SW-02	Impact to surface water quality and availability from well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure)	• Drill rig, ancillary and any testing equipment to comply with Regulations, meet relevant industry standards and be "Fit for Purpose". • Casing design carried out to meet worst case expected loads and environmental conditions determined for the specific geology intercepted by the well. Details of work to be performed are set out in the Drilling Program. • Casing set in accordance with design parameters. • Casing cemented to surface with visible return. • Blow out prevention precautions / well control equipment in place in accordance with defined procedures and appropriate to the expected downhole conditions. • Sufficient kick tolerance in casing program design. • Emergency Response Procedures in place. • All drill cuttings, muds and drill fluids will be contained within designated mud sumps with adequate freeboard at the completion of operations to allow for a 1m cover of clean fill.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D5. To maintain drainage patterns and avoid contamination of surface waters and shallow groundwater resources.	• No unauthorised discharge or escape of petroleum, processed substance, chemical, fuel or solid wastes to surface water and/or groundwater.	• Records and inspections/audits demonstrate that identified controls are in place.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-SW-03	Impacts to surface water quality and availability from spills and leaks associated with drilling activities and associated infrastructure	Fuel and Chemical Storage and Handling • Appropriate spill response equipment is available on site. • If any contamination from spillage of oils or fuel occurs, immediate effective clean-up procedures must be employed. • Refer to Section 5.3.3 (soil).	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D5. To maintain drainage patterns and avoid contamination of surface waters and shallow groundwater resources.	No unauthorised discharge or escape of petroleum, processed substance, chemical, fuel or solid wastes to surface water and/or groundwater.	• Records (e.g audits/site inspections) demonstrate that fuel and chemicals are stored and handled in accordance with relevant standards and guidelines, including AS 1940, EPA Bunding and Spill Management guideline and the Australian Dangerous Goods Code (ADG). • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.
D-SW-04	Impact to surface water quality and availability from inadequate storage and transport of waste results in a decrease in surface water quality	Waste Management • Refer to Section 5.3.9 (waste) Drilling and Completion Activities • Information on muds and chemicals to be readily available on the rig. • All drill cuttings, muds and non-toxic drill fluids are to be contained within a designated sump with adequate freeboard at completion of operations to allow for a 1m cover of clean fill at remediation. • On completion of drilling the sump will be allowed to dry out and then backfilled level with the surrounding landscape. Drilling and Production Testing • Sump to have sufficient capacity. • Camp and drill rig generators to be located in self bunded container or polyethylene lined bunded areas to contain any spills.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D5. To maintain drainage patterns and avoid contamination of surface waters and shallow groundwater resources.	• Refer to Assessment Criteria for Objective 5.3.9 (waste) • All wastes to be disposed of at an EPA licensed facility in accordance with EPA Licence conditions, with the exception of: ○ drilling fluids, drill cuttings and other benign completion fluids disposed during well clean-up ○ sewage and grey water ○ putrescible domestic wastes (may be buried on-site in accordance with EPA requirements for short-term and temporary sites if transportation impractical). • Records of inspections/audits demonstrate that reasonable steps are taken to securely contain waste prior to removal from site. • Records of inspections/audits demonstrate that all wastewater disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* or to	• Inspections demonstrate waste is appropriately stored and contained.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Wastewater is not allowed to drain to surface water drainage features • Any oil contamination of sump from contaminated drill cuttings will be controlled and pumped out to a disposal tank • Production storage tanks to be stored in clay-lined bunded areas. Initial production lines and tanks to be inspected prior to use.				the satisfaction of the Department of Health. • Attainment of GAS criteria for 'Site to be left in a clean, tidy and safe condition' objective for wellsite restoration and borrow pit rehabilitation as listed in the SEO-Appendix B.	

Table 5-52: Surface Water (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-SW-01	Impact to surface water quality and availability from drilling activities including earthworks and vehicle movements	No – access track, well lease preparation and vehicle movement is an essential part of drilling activities	Low – activities are short term and minor alteration to flow (with controls in place) would not be a frequent event.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible	Localised – impacts are generally confined to activity area or immediately adjacent.	Moderate - depending on level of impact.	Possible - Receptors could be impacted by similar activities depending on the site	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Low to Moderate Significance = Low
D-SW-02	Impact to surface water quality and availability from well control incidents (e.g. blowout, kick) and loss of well integrity (e.g. casing or cement failure)	No - design and engineering controls, and management system controls are put in place to avoid releases, however they may occur during exceptional circumstances.	Low – impact not expected to occur as controls ensure appropriate prevention and clean up measures.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible.	Localised – impacts are generally confined to activity area or immediately adjacent	Moderate - depending on level of contamination and type of contaminant.	Possible - Receptors could be impacted by similar activities depending on the site	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Moderate Significance = Low
D-SW-03	Impacts to surface water quality and availability from spills and leaks associated with drilling activities and associated infrastructure	No - design and engineering controls, and management system controls are put in place to avoid releases, however they may occur during exceptional circumstances.	Low – impact not expected to occur as controls ensure appropriate prevention and clean up measures.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible.	Localised – impacts are generally confined to activity area or immediately adjacent	Moderate - depending on level of contamination and type of contaminant.	Possible - Receptors could be impacted by similar activities depending on the site	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Moderate Significance = Low
D-SW-04	Impact to surface water quality and availability from	No - design and engineering controls, and management	Low – impact not expected to occur as controls ensure	Short term – with identified controls in place,	Localised – impacts are generally confined	Moderate - depending on level of	Possible - Receptors could be impacted by	Medium – majority of the watercourses crossed by the	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
	inadequate storage and transport of waste results in a decrease in soil quality	system controls are put in place to avoid releases, however they may occur during exceptional circumstances.	appropriate prevention and clean up measures.	any issues are anticipated to be minor, and short duration and are reversible.	to activity area or immediately adjacent	contamination and type of contaminant.	similar activities depending on the site	project are small, ephemeral creek lines.	

Surface Water - Injection Activities

Table 5-53: Surface Water (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-SW-01	CO_2 Injection	Uncontrolled CO_2 release from well integrity failure resulting in accumulation of CO_2 in surface water adversely impact users and quality	• Migration of CO_2 through well bore	Well integrity failure	• Surface water quality • Users of surface water	• Source-Pathway-Receptor linkage assumes there is potential for a well integrity failure during injection (which is extremely unlikely). Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage
I-SW-02	CO_2 injection	Impact to surface water quality and availability as a result of CO_2 release at the surface	• CO_2 storage at surface	Infrastructure failure	• Surface water quality • Users of surface water	• Source-Pathway-Receptor linkage assumes there is potential for a release during injection (which is unlikely). • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage

Table 5-54: Surface Water (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria

I-SW-01	Uncontrolled CO_2 release from well integrity failure resulting in accumulation of CO_2 in surface water adversely impact users and quality	*Design*:
		• Well design in accordance with SEO, such as:
		  ○ Aquifers isolated behind casing string(s) cemented in place.
		  ○ Casing string and cement slurry designed by qualified and competent engineers and confirmed by senior engineers or external consultants where necessary.
		  ○ Appropriately designed casing and wellhead installed on new wells drilled and retained for use.
		• Identification and evaluation of existing well bores and where necessary, workover or decommissioning undertaken to appropriately manage integrity.
		• Geological risk assessment including review of production history.
		• Equipment design and monitoring to ensure injection pressures remain below fracture gradient. which also avoids the potential for creating new permeable pathways.
		• Reporting and records of loss of well integrity events and corrective actions are in accordance with the requirements of the SEO.
			High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I5. To maintain surface water quality and reduce impact to surface water resources.	• Pressure monitoring during injection demonstrates maximum injection pressure not exceeded.	• If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Response plan in place for abnormal pressure events during injection.					
I-SW-02	Impact to surface water quality and availability as a result of CO_2 release at the surface	• Design and operation of injection equipment implemented in accordance with applicable industry and regulatory standards • Pipework and tanks to be inspected and integrity verified prior to use • Releases or leaks are immediately responded to and reported.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I5. To maintain surface water quality and reduce impact to surface water resources.	• Records of monitoring and inspections demonstrate no adverse impact to soil as a result of CO_2 release.	• Monitoring of CO_2 levels demonstrates no evidence of uncontrolled release. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.

Table 5-55: Surface Water (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-SW-01	Uncontrolled CO_2 release from well integrity failure resulting in accumulation of CO_2 in surface water adversely impact users and quality	Yes. Design and engineering controls, and management system controls are put in place to avoid loss of well integrity.	Rare – impacts of any notable severity are not expected to occur.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible.	Localised – impacts are generally confined to activity area or immediately adjacent.	Low to Moderate – potential impact event severity is anticipated to have low severity however failure of controls could result in a higher level of impact.	Possible – Receptors may be impacted by other activities in the area.	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Low Significance = Negligible
I-SW-02	Impact to surface water quality and availability as a result of CO_2 release at the surface	Yes. Design and engineering controls, and management system controls are put in place to avoid failure of CO_2 storage	Rare – impacts of any notable severity are not expected to occur.	Short term – with identified controls in place, any issues are anticipated to be minor, and short duration and are reversible.	Localised – impacts are generally confined to activity area or immediately adjacent.	Low to Moderate – potential impact event severity is anticipated to have low severity however failure of controls could result in a higher level of impact.	Possible – Receptors may be impacted by other activities in the area.	Medium – majority of the watercourses crossed by the project are small, ephemeral creek lines.	Magnitude = Low Significance = Negligible

5.3.6 Existing Land Use and Infrastructure

5.3.6.1 Setting the context

Table 5-56 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to existing land use and infrastructure.

Table 5-56: Existing Land Use and Infrastructure Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Land Use and Infrastructure	• *Landscape South Australia Act 2019* • *Biosecurity Act 2015* (Cth) • *Public Health (Wastewater) Regulations 2013*	• Guideline EPA 080/16 Bunding and Spill Management • AS 1940 - The storage and handling of flammable and combustible liquids • Australian Dangerous Goods Code • *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013 (Site Contamination NEPM)	To be updated to include views of affected parties from original consultation and new consultation.	• Landholders • Livestock

5.3.6.2 Potential impact events

Potential impacts to Existing Land Use and Infrastructure, arise principally from:

Seismic:

- Earthworks, vehicle movements and campsites.

Drilling:

- Vehicle movements, unauthorised public access and well site and camp site construction and rehabilitation

Injection:

- Uncontrolled CO_2 release due to infrastructure failure.

Land Use and Infrastructure - Seismic Activities

Table 5-57: Land Use and Infrastructure (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-LU-01	Seismic activities	Impact to land use and landholders due to seismic activities including: • Temporary loss of land utilisation for grazing • Disturbance/collision to stock or restriction to stock movement • Impeded property access • Campsite preparation • Recording – use of energy sources (vibrator machines or explosives	• Line and access preparation including: ○ Earthworks r ○ Vehicle movement along seismic lines ○ Temporary campsites	Direct disturbance Earthworks and access	• Stakeholder infrastructure, activities and land use • Stock	• Low sensitivity to change	Low sensitivity to change – sources and controls are well known.	Yes. Unplanned event could result in SPR linkage.

Table 5-58: Land Use and Infrastructure (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-LU-01	Impact to land use and landholders due to seismic activities including: • Temporary loss of land utilisation for grazing • Disturbance/collision to stock or restriction to stock movement • Impeded property access • Campsite preparation • Recording – use of energy sources (vibrator machines or explosives	• Relevant landowners and occupiers are notified prior to survey of preparation of campsites and survey lines and undertaking of operations (pursuant to the Energy Resources Regulations). • Liaison is undertaken with landholders regarding any specific requirements/agreements including stock management, access tracks. • System is in place for logging landholder complaints to ensure that issues are addressed as appropriate. • Lines are planned, or deviated in the field, to avoid infrastructure such as homesteads, associated buildings, stockyards, airstrips, dams, bores and tanks. • Damage to roads and tracks is avoided. • Operations in wet weather are not allowed. • All gates are left in the condition in which they were found (i.e. open/closed). • When necessary, all fences are restored to satisfaction of landowner/managers • Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues.	Moderate certainty that proposed control measures will be effective.	Low	S6. No significant disturbance to livestock, pastoral infrastructure and landholders	• Records of audits / inspections show the attainment of 0, +1 or +2 GAS criteria for 'Impact on infrastructure' objective listed in the SEO-Appendix A. • Records of audits / inspections show no adverse impact on livestock as a result of activities. • Records of audits / inspections show no disruption to landholder activities as a result of regulated activities unless by prior arrangement. • Where disturbance is unavoidable or accidental, infrastructure or land use is restored to the satisfaction of the	• Stakeholder consultation prior to and during seismic activities. • Landholder contact database and liaison program maintained. • Site access in accordance with stakeholder consultation plan prior to and during seismic activities. • Any impact on landholder activities, as a consequence of maintenance, to be minimized, where practicable.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• In recognised conservation reserves excavations are left in a state as agreed with the responsible statutory body. • Water is drawn only from authorised sources. • Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues. • Potential sources of contamination are fenced as appropriate to prevent stock access. • In the event of an oil spill, contingency plan to be implemented after the spill event.				landholder, or as otherwise agreed. • No reasonable concerns raised by stakeholders are left unresolved. • Compliance with relevant sections of the *Energy Resources Act 2000* in relation to notification of landholders.	
			Moderate certainty that proposed control measures will be effective.	Low	S7. Remediate and rehabilitate operational areas to agreed standards.	The attainment of 0, +1 or +2 GAS criteria for • 'Visual impact' • 'Impact on infrastructure' • 'uphole site restoration' • 'disturbance to land surface' Measures/goals listed in the SEO-Appendix A. • Records demonstrate no reasonable landowner complaints regarding rehabilitation of land are left unresolved.	• Stakeholder consultation during development of the rehabilitation/abandonment plans for surface activities. • Rehabilitation of disturbed areas to be approved by the landowner or in accordance with landowner's wishes.

Table 5-59: Land Use and Infrastructure (Seismic) Significance assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-LU-01	Impact to land use and landholders due to seismic activities including: • Temporary loss of land utilisation for grazing • Disturbance/collision to stock or restriction to stock movement • Impeded property access • Campsite preparation • Recording – use of energy sources (vibrator machines or explosives	No – use of private land is required for seismic activities	Low - impacts to land use/holders due to seismic activities will occur several times during the project lifespan.	Short term – most impacts are reversible and last less than a year.	Localised – impacts are limited to land/ landholders in close proximity to seismic activities	Moderate – impacts from construction are expected to impact environmental values beyond any naturally occurring impacts	Possible – receptors could be impacted by similar activities depending on the location of seismic activities.	Low	Magnitude = Moderate Significance = Low

Land Use and Infrastructure - Drilling Activities

Table 5-60: Land Use and Infrastructure (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-LU-01	Drilling activities	Impact to land use and landholders due to drilling activities including: • vehicle movements • unauthorised access • well site and camp site construction and rehabilitation	• Vehicle movements • Unauthorised public access	Direct disturbance	• Stakeholder infrastructure, activities and land use • Stock	• Low sensitivity to change	Low sensitivity to change – sources and controls are well known.	Yes. Unplanned event could result in SPR linkage.

Table 5-61: Land Use and Infrastructure (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-LU-01	Impact to land use and landholders due to drilling activities including: • vehicle movements • unauthorised access • well site and camp site construction and rehabilitation	• Relevant landowners and occupiers are notified prior to operations (pursuant to the Energy Resources Regulations). • Liaison is undertaken with landholders regarding any specific requirements/agreements including stock management, access tracks. • Induction for all employees and contractors to cover pastoral, conservation, tourism, infrastructure and legislation issues. • Gates or cattle grids are installed to a standard, consistent with pastoral infrastructure in fences where crossings are required for access. • All gates left in the condition in which they were found (i.e. open/closed). • Potential sources of contamination are fenced, as appropriate, to prevent stock access. • System is in place for logging landholder complaints to ensure that issues are addressed. • Recognised conservation reserves excavations are left in a state as agreed with the responsible statutory body. • Appropriate, necessary authorisations are obtained for access to the Woomera Prohibited Area. • In the event of an oil spill, contingency plan to be implemented after the spill event. • Rehabilitation/decommissioning plans for surface activities will be developed in consultation with relevant stakeholders.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D6. No significant disturbance to stakeholders and associated infrastructure.	• Records of audits / inspections show no adverse impact on livestock as a result of activities. • Records of audits / inspections show no disruption to landholder activities as a result of regulated activities unless by prior arrangement. • Where disturbance is unavoidable or accidental, infrastructure or land use is restored to the satisfaction of the landholder, or as otherwise agreed.	• Stakeholder consultation prior to and during drilling activities. • Landholder contact database and liaison program maintained. • Site access in accordance with stakeholder consultation plan prior to and during drilling activities. • Any impact on landholder activities, as a consequence of maintenance, to be minimized, where practicable.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						• Records of audits / inspections show landholder complaints are documented and reasonable steps have been taken to resolve them.	
			High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D7. Remediate and rehabilitate operational areas to agreed standards.	• The attainment of 0, +1 or +2 GAS criteria for 'Minimise visual impact', 'Re-establish natural vegetation on abandoned well sites and access tracks' and 'Site to be left in a clean, tidy and safe condition' objectives listed for well sites in Appendix B. • The attainment of 0, +1 or +2 GAS criteria for 'Minimise impacts on vegetation', 'Minimise impact on soil', 'Minimise visual impacts' and 'Site to be left in a clean and tidy condition objectives listed for	• Stakeholder consultation during development of the rehabilitation/abandonment plans for surface activities. • Rehabilitation of disturbed areas to be approved by the landowner or in accordance with landowner's wishes.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						borrow pits in Appendix B. • Records demonstrate no reasonable landowner complaints regarding rehabilitation of land are left unresolved.	

Table 5-62: Land Use and Infrastructure (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-LU-01	Impact to land use and landholders due to drilling activities including: • vehicle movements • unauthorised access • well site and camp site construction and rehabilitation	No – use of private land is required for seismic activities	Low - impacts to land use/holders due to seismic activities will occur several times during the project lifespan.	Short term – most impacts are reversible and last less than a year.	Localised – impacts are limited to land/ landholders in close proximity to seismic activities	Moderate – impacts from construction are expected to impact environmental values beyond any naturally occurring impacts	Possible – receptors could be impacted by similar activities depending on the location of seismic activities.	Low	Magnitude = Moderate Significance = Low

Land Use and Infrastructure - Injection Activities

Table 5-63: Land Use and Infrastructure (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-LU-01	Injection activities	Impact to land use and landholders due to injection activities as a result of CO_2 release at the surface.	Infrastructure failure	Surface gas seepage	Landholders/ land users	• Source-Pathway-Receptor linkage assumes there is potential for a release during injection (which is unlikely). • Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage

Table 5-64: Land Use and Infrastructure (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-LU-01	Impact to land use and landholders due to injection activities as a result of CO_2 release at the surface.	• Relevant landowners and occupiers are notified prior to operations (pursuant to the Energy Resources Regulations). • Liaison is undertaken with landholders regarding any specific requirements/agreements including stock management, access tracks. • Design and operation of injection equipment implemented in accordance with applicable industry and regulatory standards • Pipework and tanks to be inspected and integrity verified prior to use • Releases or leaks are immediately responded to and reported.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I6. No significant disturbance to livestock, pastoral infrastructure and landholders	• Records of audits / inspections show no adverse impact on livestock as a result of activities. • Records of audits / inspections show no disruption to landholder activities as a result of regulated activities unless by prior arrangement. • Where disturbance is unavoidable or accidental, infrastructure or land use is restored to the satisfaction of the landholder, or as otherwise agreed. • Records of audits / inspections show landholder complaints are documented and reasonable steps have been taken to resolve them.	• Stakeholder consultation prior to and during drilling activities. • Landholder contact database and liaison program maintained. • Site access in accordance with stakeholder consultation plan prior to and during drilling activities. • Any impact on landholder activities, as a consequence of maintenance, to be minimized, where practicable.

Table 5-65: Land Use and Infrastructure (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-LU-01	Impact to land use and landholders due to injection activities as a result of CO_2 release at the surface.	No – use of private land is required for seismic activities	Low - impacts to land use/holders due to seismic activities will occur several times during the project lifespan.	Short term – most impacts are reversible and last less than a year.	Localised – impacts are limited to land/ landholders in close proximity to seismic activities	Moderate – impacts from construction are expected to impact environmental values beyond any naturally occurring impacts	Possible – receptors could be impacted by similar activities depending on the location of seismic activities.	Low	Magnitude = Moderate Significance = Low

5.3.7 Native Fauna and Vegetation

5.3.7.1 Setting the context

Table 5-66 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to native fauna and vegetation.

Table 5-66 Native Fauna and Vegetation Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Native Fauna and vegetation	• *Native Vegetation Act 1991* • *National Parks and Wildlife Act 1972* • *Landscape South Australia Act 2019* • *Fire and Emergency Services Act 2005* • *Environment Protection and Biodiversity Conservation Act 1999* (Cth)	• National Light Pollution Guidelines for Wildlife • Australian Weeds Strategy 2017-2027 (Commonwealth of Australia, 2017) • AS1940 - The storage and handling of flammable and combustible liquids. • South Australia's Biosecurity Policy 2020-2023 • Controlled Substances (Pesticides) Regulations 2017	To be updated to include views of affected parties from original consultation and new consultation.	• Native vegetation • Native flora and fauna species

5.3.7.2 Potential impact events

Potential impacts to native fauna and vegetation, arise principally from:

Seismic:

- Earthworks and vehicle movements, use of energy sources (vibrator machines or explosives) and fuel and chemical storage
- Uphole drilling
- Campsite construction and wastewater management
- Fires resulting from regulated activities.

Drilling:

- Earthworks and vehicle movements and fuel and chemical storage
- Campsite construction and wastewater management
- Fire resulting from regulated activities.

Injection:

- Uncontrolled release of CO_2.

Native flora and fauna - Seismic Activities

Table 5-67: Native Fauna and Vegetation (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-FF-01	Seismic activities	Impact to native flora and fauna from direct disturbance associated with line and access preparation including: • earthworks and vehicle movements • operation of vibrators and use of explosives • fuel and chemical storage	Line and access track preparation including: • Earthworks • Vehicle movements • Recording – use of energy sources (vibrator machines or explosives) • Fuel and chemical storage	Direct disturbance	Native flora and/or fauna	• Location of vegetation and/or fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.
S-FF-02	Seismic activities	Impact to native fauna from direct disturbance associated uphole drilling and logging activities	Upholes created by drilling and logging activities	Direct disturbance	Native fauna	• Location of fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.
S-FF-03	Seismic activities	Impact to native flora and fauna from direct disturbance as a result of campsite construction and associated wastewater	Campsite construction including: • preparation and site activities • Disposal of camp wastewater	Direct disturbance	Native flora and fauna	• Location of vegetation and fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.
S-FF-04	Seismic activities	Impact to native flora and fauna from direct disturbance as a result of fires caused by seismic activities	Fire (resulting from activities)	Direct disturbance	Native flora and fauna	• Location of vegetation and fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.

Table 5-68: Native Fauna and Vegetation (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-FF-01	Impact to native flora and fauna from direct disturbance associated with line and access preparation, earthworks and vehicle movements	• Seismic lines placed and prepared appropriately to minimise impact to vegetation, fauna and sensitive ecological areas. Terrain and vegetation are considered in planning stage when designing layout of the survey. • Appropriately trained and experienced personnel have scouted proposed survey lines access tracks and campsites.	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S8. No significant disturbance to native vegetation and native fauna	Line and access preparation • Records of audits/inspections demonstrate there has been no unauthorised clearing of native vegetation. • The attainment of either 0, +1 or +2 GAS criteria for 'Impact	• Records demonstrate that terrain and vegetation is considered in planning stage when designing layout of the survey. • There is no evidence of off-line driving or creation of shortcuts.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Documents and/or reports of scouting for flora/fauna are available for review. • Vehicle access to survey lines is to be via existing access tracks or pre-existing survey lines, except where they have rehabilitated. Other temporary access tracks may be utilised where such use is likely to result in less environmental impact than other options. • No unauthorised off-road or off-line driving or creation of shortcuts. • Vegetation clearance has been minimised and the conservation needs of specific species have been considered. • Root stock, topsoil and seeds left on line during line preparation. Fuel and Chemical Storage and Management • No refuelling outside designated refuelling/servicing areas. • All fuel, oil, and chemicals to be stored/contained within bunds in accordance to appropriate standards, including AS1940 and EPA guidelines. • Spills or leaks are immediately reported and clean up actions initiated. • Records of spill events and corrective actions are maintained. • Personnel have undertaken training in the use of spill response equipment.				on vegetation' objective listed in the SEO-Appendix A. • Records (e.g. audits / site inspections) demonstrate no mature trees are removed. Fuel and Chemical Storage and Management • No spills/leaks outside areas designed to contain them. • Appropriate spill response equipment is available on site. • No impact to rare, vulnerable or endangered flora and/or fauna due to an escape of petroleum, chemical or fuel.	
S-FF-02	Impact to native fauna from direct disturbance associated uphole drilling and logging activities	• Upholes capped and backfilled to prevent injury or death to wildlife • Uphole locations sited and prepared in accordance with requirements listed for 'Line and access track preparation'. • Daily inspection of excavations for trapped fauna.	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S8. No significant disturbance to native vegetation and native fauna	• Records of site audits/inspections carried out in accordance with site management plans demonstrate that there are no native fauna casualties that could have reasonably prevented through management measures/controls.	• Daily inspection of open trenches and excavations for trapped fauna and livestock.
S-FF-03	Impact to native flora and fauna from direct disturbance as a result of campsite construction and	Campsites • As few campsites as possible used (aim to share existing sites if possible, to minimise land disturbance).	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well	Low	S8. No significant disturbance to native vegetation and native fauna	• The attainment of either 0, +1 or +2 GAS criteria for 'Impact on vegetation' objective listed in the SEO-Appendix A.	• Records demonstrate that terrain and vegetation is considered in planning stage when designing layout of the survey.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
	associated wastewater	• Areas set aside for the specific purposes of vehicle parking, refuelling, engine and vehicle maintenance. • Camps located wherever possible on previously disturbed areas and / or areas with minimal vegetation cover. • Campsites positioned close to existing roads where possible and where the preparation of a new access track is not necessary. Waste management • Refer to Section 5.3.9 (Waste). Fauna Management • No domestic pets allowed at camps or worksites. • Feeding of wildlife (e.g. dingoes) is not permitted.	understood and that have been successfully implemented.			• Records (e.g. audits / site inspections) demonstrate no mature trees are removed.	
S-FF-04	Impact to native flora and fauna from direct disturbance as a result of fires caused by seismic activities	• Fire Season education included in induction. • All personnel are fully informed on the fire danger season and associated restrictions. • Procedures are in place to minimise the risk of initiating and propagating fire during periods of high temperatures and high winds. • Selection of camp sites and car parking areas in areas of low fuel load where available to minimise likelihood of fires. • Fire and Emergency Services Act requirements are complied with.	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S8. No significant disturbance to native vegetation and native fauna	• Records demonstrate that no uncontrolled fires have resulted from regulated activities.	• Appropriate fire-fighting equipment is readily available. • Appropriate personnel are readily available and suitably informed to action response.

Table 5-69: Native Fauna and Vegetation (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-FF-01	Impact to native flora and fauna from direct disturbance associated with line and access preparation, earthworks and vehicle movements	Potentially, however there may be locations where minor impact to degraded vegetation is unavoidable	Rare - Clearance is expected to be avoided	Short term – impact to fauna species is limited to the period of seismic activities.	Localised – impacts are on individuals but will not significantly affect populations.	Low – impacts not perceptible on a population basis.	Possible. Minor vegetation clearance for other activities but these would also be localised and small scale	Low - medium – seismic activities would generally be located in areas of low sensitivity and avoid native vegetation in good condition; however complete avoidance may not be possible.	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-FF-02	Impact to native fauna from direct disturbance associated uphole drilling and logging activities	No – activities resulting in fauna mortality cannot be avoided.	Low – impacts limited in occurrence (low incidence).	Permanent – impact irreversible for individual fauna.	Localised – impacts are on individuals but will not significantly affect populations.	Low – impacts not perceptible on a population basis.	Possible – similar activities could impact on specific species in the area.	Low - medium – seismic activities would generally be located in areas of low sensitivity and avoid native vegetation in good condition; however complete avoidance may not be possible.	Magnitude = Moderate Significance = Low
S-FF-03	Impact to native flora and fauna from direct disturbance as a result of campsite construction and associated wastewater	No - however there may be locations where minor impact to degraded vegetation is unavoidable and some activities resulting in fauna mortality cannot be avoided	Rare - Clearance is expected to be avoided	Long lasting - impact is longer term, but generally reversible through site rehabilitation and revegetation.	Localised – impacts would be restricted to the project site and immediate surroundings.	Low– impacts not likely to be significant on a population basis.	Possible - Minor vegetation clearance for other activities but these would also be localised and small scale	Low - medium – seismic activities would generally be located in areas of low sensitivity and avoid native vegetation in good condition; however complete avoidance may not be possible.	Magnitude = Moderate Significance = Low
S-FF-04	Impact to native flora and fauna from direct disturbance as a result of fires caused by seismic activities	No – unplanned fires cannot not be avoided	Rare - impacts are only expected to occur in exceptional circumstances.	Long term – should there be a fire, vegetation will take 5 – 10 years to recover	Localised – fires would be controlled quickly by onsite crew before about to spread.	Moderate – impact can be widespread should activities cause a fire on a day with unfavourable weather conditions. Impact is extremely rare to occur.	Yes – receptors could be impacted by fire at other sources.	Low - Australian environments have been adapted to fire and native vegetation will recover quickly.	Magnitude = Moderate Significance = Low

Native flora and fauna - Drilling Activities

Table 5-70: Native Fauna and Vegetation (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-FF-01	Drilling activities	Impact to native flora and fauna from direct disturbance associated with drilling activities including: • earthworks and vehicle movements • fuel and chemical storage	Drilling activities	Direct disturbance	• Native flora and/or fauna	• Location of vegetation and/or fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.
D-FF-02	Drilling activities	Impact to native flora and fauna from direct disturbance as a result of campsite construction and associated wastewater	Campsite construction including: • preparation and site activities • Disposal of camp wastewater	Direct disturbance	• Native flora and fauna	• Location of vegetation and fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.
D-FF-03	Drilling activities	Impact to native flora and fauna from direct disturbance as a result of fires caused by drilling activities	• Fire (resulting from activities)	Direct disturbance	• Native flora and fauna	• Location of vegetation and fauna relative to activity	Low sensitivity to change due to existing knowledge of sources and use of control measures	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area.

Table 5-71: Native Fauna and Vegetation (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-FF-01	Impact to native flora and fauna from direct disturbance associated with drilling activities including: • earthworks and vehicle movements • fuel and chemical storage	Vehicle movements • All vehicles will be required to remain on designated roads and access track or parking areas. • Compliance with relevant speed restrictions on access roads and tracks • Appropriately trained and experienced personnel have scouted proposed wellsite and access tracks and campsites for purpose of identifying and flagging significant (or rare, vulnerable and endangered) flora and fauna. • Vegetation removed for the passage of large vehicles is not left on the track or in a position to create a nuisance for visitors using nearby highway or roads. • Documents and/or reports of scouting for flora/fauna are available for review. Earthworks	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D8. No significant disturbance to native vegetation and native fauna	• Records (e.g. audits / site inspections) demonstrate there has been no unauthorised clearing of native vegetation. • Records demonstrate that any sites of rare, vulnerable and endangered flora and fauna have been identified, flagged and subsequently avoided.	Records (e.g. ecological assessments) demonstrate that vegetation and fauna have been considered in the planning stage.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Appropriately trained and experienced personnel have scouted proposed wellsite and access tracks and campsites for purpose of identifying and flagging significant (or rare, vulnerable and endangered) flora and fauna.Vegetation clearance has been minimised and the conservation needs of specific species have been considered. • Facilities (e.g. borrow pits, well cellars) are designed and constructed as far as practicable to minimise fauna entrapment. • Sumps and mud pits are fenced as appropriate to minimise wildlife access. • Appropriate escape ramps for trapped animals will be installed. • Excavation (e.g. sump, flare pit) checked regularly for trapped fauna. • Borrow pits are restored to minimise water holding capacity where agreements are not in place with stakeholders. • Leaving borrow pits capable of holding water has impacts on pastoral activities as well as native fauna and as such should involve consultation with both the pastoral board and lessee of pastoral properties. Fuel and Chemical Storage and Management • Hazardous material stored, used and disposed of in accordance with relevant legislation on dangerous substances. • All hazardous materials including fuels, oils and chemicals are to be stored in approved containers in polythene lined bunded pits or on bunded pallets. • Initial production lines and tanks to be inspected prior to use. • No refuelling outside designated refuelling/servicing areas. • Appropriate spill response equipment is available on site • Spills or leaks are immediately reported and clean up actions initiated.				• Records (e.g. ecological assessments, audits / site inspections) demonstrate that no rare, vulnerable or endangered flora have been removed without appropriate permits • The attainment of 0, +1 or +2 GAS criteria for ‘disturbance to vegetation’ and ‘Minimising impact on native vegetation and native fauna’ objectives for wellsite construction, ‘re-establishment natural vegetation on abandoned wellsite’s and tracks’ under wellsite restoration ‘Minimising impacts on native vegetation’ for borrow construction listed in Appendix B.	
D-FF-02	Impact to native flora and fauna from direct disturbance as a result of campsite construction and associated wastewater	Campsites • As few campsites as possible used (aim to share existing sites if possible, to minimise land disturbance). • Areas set aside for the specific purposes of vehicle parking, refuelling, engine and vehicle maintenance. • Camps located wherever possible on previously disturbed areas and / or areas with minimal vegetation cover.	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that	Low	D8. No significant disturbance to native vegetation and native fauna	• Records (e.g. audits / site inspections) demonstrate there has been no unauthorised clearing of native vegetation.	• Records (e.g. ecological assessments) demonstrate that vegetation and fauna have been considered in the planning stage.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Campsites positioned close to existing roads where possible and where the preparation of a new access track is not necessary. Waste management • Refer to Section 5.3.9 (Waste) Fauna Management • No domestic pets allowed at camps or worksites. • Feeding of wildlife (e.g. dingoes) is not permitted.	have been successfully implemented.			• Records demonstrate that any sites of rare, vulnerable and endangered flora and fauna have been identified, flagged and subsequently avoided. • Records (e.g. ecological assessments, audits / site inspections) demonstrate that no rare, vulnerable or endangered flora have been removed without appropriate permits • The attainment of 0, +1 or +2 GAS criteria for 'disturbance to vegetation' and 'Minimising impact on native vegetation and native fauna' objectives for wellsite construction, 're-establishment natural vegetation on abandoned wellsite's and tracks' under wellsite restoration 'Minimising impacts on native vegetation' for borrow construction listed in Appendix B.	

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-FF-03	Impact to native flora and fauna from direct disturbance as a result of fires caused by drilling activities	• Confinement of flammable sources, restrictions on certain procedures and ready access to suitable fire fighting equipment. • Activities undertaken on cleared well lease • Where necessary, construction of a fire break around wellsite area and access track. • Response to fire included in Emergency Response Plan. • Combustible materials cleared from area surrounding flowback equipment • Firefighting equipment available as appropriate for location and use • Fire and Emergency Services Act requirements will be complied with (e.g. permits for 'hot work' on total fire ban days) • Appropriately designed flare stack where required • Personnel are trained to supervise and instruct individuals entering lease to conduct work • No smoking or safe smoking areas away from equipment or well	Moderate to high certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D8. No significant disturbance to native vegetation and native fauna	• Records demonstrate that no uncontrolled fires have resulted from regulated activities.	• Appropriate fire-fighting equipment is readily available. • Appropriate personnel are readily available and suitably informed to action response.

Table 5-72: Native Fauna and Vegetation (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-FF-01	Impact to native flora and fauna from direct disturbance associated with drilling activities including: • earthworks and vehicle movements • fuel and chemical storage	Potentially, however there may be locations where minor impact to degraded vegetation is unavoidable	Rare - Clearance is expected to be avoided	Short term – impact to fauna species is limited to the period of seismic activities.	Localised – impacts are on individuals but will not significantly affect populations.	Low – impacts not perceptible on a population basis.	Possible. Minor vegetation clearance for other activities but these would also be localised and small scale	Low - medium – seismic activities would generally be located in areas of low sensitivity and avoid native vegetation in good condition; however complete avoidance may not be possible.	Magnitude = Moderate Significance = Low
D-FF-03	Impact to native flora and fauna from direct disturbance as a result of campsite construction and associated wastewater	No - however there may be locations where minor impact to degraded vegetation is unavoidable and some activities resulting in fauna	Rare - Clearance is expected to be avoided	Long lasting - impact is longer term, but generally reversible through site rehabilitation and revegetation.	Localised – impacts would be restricted to the project site and immediate surroundings.	Low– impacts not likely to be significant on a population basis.	Possible - Minor vegetation clearance for other activities but these would also be localised and small scale	Low - medium – seismic activities would generally be located in areas of low sensitivity and avoid native vegetation in good condition; however	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
		mortality cannot be avoided						complete avoidance may not be possible.	
D-FF-04	Impact to native flora and fauna from direct disturbance as a result of fires caused by drilling activities	No – unplanned fires cannot not be avoided	Rare - impacts are only expected to occur in exceptional circumstances.	Long term – should there be a fire, vegetation will take 5 – 10 years to recover	Localised – fires would be controlled quickly by onsite crew before about to spread.	Moderate – impact can be widespread should rupture cause a fire on a day with unfavourable weather conditions. Impact is extremely rare to occur.	Yes – receptors could be impacted by fire at other sources.	Low - Australian environments have been adapted to fire and native vegetation will recover quickly.	Magnitude = Moderate Significance = Low

Native flora and fauna - Injection Activities

Table 5-73: Native Fauna and Vegetation (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-FF-01	Injection activities	Injection of CO_2 into the storage complex results in uncontrolled CO_2 release from undetected permeable geological structures such as open faults and fractures results in a loss of native flora and fauna and biodiversity	Injection of CO_2 into the storage complex	Undetected permeable geological structures such as open faults and fractures.	Native flora and fauna	Source-Pathway-Receptor linkage assumes there is potential for a well integrity failure during injection (which is extremely unlikely). Limited potential for unplanned event to occur.	Low	Yes. Unplanned event could result in SPR linkage

Table 5-74: Native Fauna and Vegetation (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-FF-01	Injection of CO_2 into the storage complex results in uncontrolled CO_2 release from undetected permeable geological structures such as open faults and fractures results in a loss of native flora and fauna and biodiversity	Design: • Well design in accordance with SEO, such as: ○ Aquifers isolated behind casing string(s) cemented in place. ○ Casing string and cement slurry designed by qualified and competent engineers and confirmed by senior engineers or external consultants where necessary. ○ Appropriately designed casing and wellhead installed on new wells drilled and retained for use. • Identification and evaluation of existing well bores and where necessary, workover or decommissioning undertaken to appropriately manage integrity. • Geological risk assessment including review of production history. • Equipment design and monitoring to ensure injection pressures remain below fracture gradient. which also avoids the potential for creating new permeable pathways. • Reporting and records of loss of well integrity events and corrective actions are in accordance with the requirements of the SEO. • Response plan in place for abnormal pressure events during injection.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I7. No impacts to flora and fauna from the unintended migration of CO_2 to surface and shallow subsurface environments.	Records of monitoring and inspections demonstrate no adverse impact to flora and fauna as a result of CO_2 release.	• Monitoring of CO_2 levels demonstrates no evidence of uncontrolled release. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.

Table 5-75: Native Fauna and Vegetation (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-FF-01	Injection of CO_2 into the storage complex results in uncontrolled CO_2 release from undetected permeable geological	Yes - Design and engineering controls, and management system controls are	Rare - impacts are only expected to occur in exceptional circumstances	Short term - With identified controls in place, any issues are anticipated to be minor, with	Localised – impacts are on individuals but will not significantly	Moderate - potential impact event may have a moderate severity impact but is dependent on the nature of the land use of	No - Receptors are not already impacted by similar activities.	Low – location of injection activities will typically seek to avoid areas of	Magnitude = Low Significance = Negligible

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
	structures such as open faults and fractures results in a loss of native flora and fauna and biodiversity	put in place to avoid loss of well integrity.		impacts of less than a year in duration and are reversible.	affect populations.	the CO_2 injection area, recognising that selection will seek to avoid ecologically sensitive areas.		environmental value.	

5.3.8 Weeds and Pests

5.3.8.1 Setting the context

Table 5-76 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to weeds and pests.

Table 5-76: Weeds and Pests Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Weeds and Pests	• *Native Vegetation Act 1991* • *National Parks and Wildlife Act 1972* • *Landscape South Australia Act 2019* • *Environment Protection and Biodiversity Conservation Act 1999* (Cth)	• Australian Weeds Strategy 2017-2027 (Commonwealth of Australia, 2017) • South Australia's Biosecurity Policy 2020-2023 • Controlled Substances (Pesticides) Regulations 2017	To be updated to include views of affected parties from original consultation and new consultation.	• Native vegetation • Native flora and fauna species

5.3.8.2 Potential impact events

Potential impacts from weeds and pests, arise principally from:

Seismic:

- Earthworks and vehicle movements.

Drilling:

- Earthworks and vehicle movements.

Injection:

- Vehicle movements.

Weeds and Pests - Seismic Activities

Table 5-77: Weeds and Pests (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-WP-01	Seismic Activities	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	• Spread of weeds/ pathogens/ diseases between properties • Introduction of weeds/ pathogens/ diseases from vehicles	Vehicles carrying pathogenic/ diseased soil material	• Native vegetation • Adjacent landholders.	Low	Low sensitivity to change due to existing knowledge of sources and use of control measures.	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area

Table 5-78: Weeds and Pests (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-WP-01	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	• Appropriate consultation regarding weeds, pathogens and pests is carried out with landholders and DEW / SAAL Landscape Board. • All reasonable and practical endeavours taken to minimise the risks of introducing weeds, pathogens and pests into the Licence Area. • Environmental assessment undertaken during the planning stage to identify specific issues within survey area. • Vehicles and equipment entering the Licence Area must be clean and free of soil and plant material. • Weed identification training for grader operators and other relevant personnel to facilitate identification of weeds. • Pre-operation weed inspections are undertaken in the survey area when appropriate to identify areas where weeds of concern may occur e.g. at creek and road crossings. • Areas of known weed infestation are clearly marked and avoided. Personnel are to be aware for potential weed occurrences and avoid these areas where possible. • Records of significant weeds detected (e.g. Buffel Grass) are kept and forwarded to DEW for information. • Where the introduction of declared weeds and pests has occurred due to undertaking regulated activities, appropriate remediation and / or rehabilitation activities will be undertaken (e.g. weed spraying) in consultation with landholders / DEW and SAAL Landscape Board. Records of detection, monitoring or management of weeds and pests are kept and are available for audit. • Sites and access tracks will be monitored for the presence of weed species / infestations and treated (e.g. weed spraying) as necessary	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S9. No introduction or spread of weeds, pest animals and pathogens as a consequence of regulated activities, and implement control measures as necessary	• Records (e.g. audits/site inspections) demonstrate that the presence of weeds, pest animals or pathogens is consistent with or better than pre-disturbance conditions and adjacent land or where this is not the case, a management plan is implemented promptly. • Declared plants[7] occurring as a result of regulated activities are reported and managed in accordance with relevant regulations.	• No reasonable complaints received from landholders in relation to new outbreaks of weeds, pathogens or diseases for the duration of the project. • Records of site audits and inspections are maintained and demonstrate that the presence of weeds and pathogens is consistent with or better than pre-disturbance conditions and adjacent land. • Records demonstrate that all equipment and vehicles are inspected and

[7] Declared plants as listed under the *Landscape South Australia Act 2019*.

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		in accordance with requirements of the landholder, and if appropriate DEW / SAAL Landscape Board.					cleared where required before arrival at the site.

Table 5-79: Weeds and Pests (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-WP-01	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	No – control measures will generally prevent introduction or spread; however impact could occur.	Low – impact would only occur rarely to infrequently.	Short term to long lasting – impacts can generally be successfully managed in the short-term with the implementation of identified controls, however, could have longer term effects in the worst case.	Localised – impacts not likely to extend beyond the project site and immediate surrounds.	Moderate – if the impact event occurs, it could result in an increase in the occurrence of weeds, pests or pathogens and may require a high level of management.	Possible – if the spread of weeds, pests or pathogens occurs on multiple occasions at the same site, or has occurred at nearby sites, the potential for cumulative impacts exists.	Low – seismic activities would generally be located over land cleared of native vegetation, with minimal vegetation of high environmental value. Weeds, pests and pathogens are a hazard to agricultural productivity and to livestock wellbeing.	Magnitude = Moderate Significance = Low

Weeds and Pests - Drilling Activities

Table 5-80: Weeds and Pests (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-WP-01	Drilling Activities	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	• Spread of weeds/ pathogens/ diseases between properties • Introduction of weeds/ pathogens/ diseases from vehicles	Vehicles carrying pathogenic/ diseased soil material	• Native vegetation • Adjacent landholders.	Low	Low sensitivity to change due to existing knowledge of sources and use of control measures.	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area

Table 5-81: Weeds and Pests (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-WP-01	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	• Appropriate consultation regarding weeds, pathogens and pests is carried out with landholders and DEW / SAAL Landscape Board. • All reasonable and practical endeavours taken to minimise the risks of introducing weeds, pathogens and pests into the Licence Area. • Environmental assessment undertaken during the planning stage to identify specific issues and required management. • All vehicles and equipment appropriately cleaned and checked prior to entering the Licence Area in Coober Pedy or Port Augusta • Vehicles and equipment are to be cleaned and checked when moving from areas within the Licence Area where weeds are present. • Cleaning to be carried out in accordance with best practice guidelines. • Records of vehicle and equipment cleaning are kept and available for review. • The site and access will be monitored on a regular basis for new weed species and treated as necessary following discussions with the regional SA Arid Lands Landscape Board and the landholder. • Records of detection, monitoring or eradication of exotic weeds or noxious species introduced by industry activities are kept and are available for review.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	D9. No introduction or spread of weeds, pest animals and pathogens as a consequence of regulated activities and implement control measures as necessary.	• Records (e.g. audits/site inspections) demonstrate that the presence of weeds, pest animals or pathogens is consistent with or better than pre-disturbance conditions and adjacent land or where this is not the case, a management plan is implemented promptly. • Declared plants[8] occurring as a result of regulated activities are reported and managed in accordance with relevant regulations.	• No reasonable complaints received from landholders in relation to new outbreaks of weeds, pathogens or diseases for the duration of the project. • Records of site audits and inspections are maintained and demonstrate that the presence of weeds and pathogens is consistent with or better than pre-disturbance conditions and adjacent land. • Records demonstrate that all equipment and vehicles are inspected and cleared where required before arrival at the site.

[8] Declared plants as listed under the *Landscape South Australia Act 2019*.

Table 5-82: Weeds and Pests (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-WP-01	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	No – control measures will generally prevent introduction or spread; however, impact could occur.	Low – impact would only occur rarely to infrequently.	Short term to long lasting – impacts can generally be successfully managed in the short-term with the implementation of identified controls, however, could have longer term effects in the worst case.	Localised – impacts not likely to extend beyond the project site and immediate surrounds.	Moderate – if the impact event occurs, it could result in an increase in the occurrence of weeds, pests or pathogens and may require a high level of management.	Possible – if the spread of weeds, pests or pathogens occurs on multiple occasions at the same site, or has occurred at nearby sites, the potential for cumulative impacts exists.	Low – drilling activities would generally be located over land cleared of native vegetation, with minimal vegetation of high environmental value. Weeds, pests and pathogens are a hazard to agricultural productivity and to livestock wellbeing.	Magnitude = Moderate Significance = Low

Weeds and Pests - Injection Activities

Table 5-83: Weeds and Pests (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-WP-01	Injection Activities	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	• Spread of weeds/ pathogens/ diseases between properties • Introduction of weeds/ pathogens/ diseases from vehicles	Vehicles carrying pathogenic/ diseased soil material	• Native vegetation • Adjacent landholders.	Low	Low sensitivity to change due to existing knowledge of sources and use of control measures.	Yes – potential for impact to biodiversity and/or ecological value within and surrounding the project area

Table 5-84: Weeds and Pests (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-WP-01	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	• All vehicles and equipment appropriately cleaned and checked prior to entering the Licence Area in Coober Pedy or Port Augusta • Vehicles and equipment are to be cleaned and checked when moving from areas within the Licence Area where weeds are present. • Cleaning to be carried out in accordance with best practice guidelines. • Records of vehicle and equipment cleaning are kept and available for review. • The site and access will be monitored on a regular basis for new weed species and treated as necessary following discussions with the regional SA Arid Lands Landscape Board and the landholder.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	I8. No introduction or spread of weeds, pest animals and pathogens as a consequence of regulated activities and implement control measures as necessary.	• Records (e.g. audits/site inspections) demonstrate that the presence of weeds, pest animals or pathogens is consistent with or better than pre-disturbance conditions and adjacent land or	• No reasonable complaints received from landholders in relation to new outbreaks of weeds, pathogens or diseases for the duration of the project. • Records of site audits and

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Records of detection, monitoring or eradication of exotic weeds or noxious species introduced by industry activities are kept and are available for review.				where this is not the case, a management plan is implemented promptly. • Declared plants[9] occurring as a result of regulated activities are reported and managed in accordance with relevant regulations.	inspections are maintained and demonstrate that the presence of weeds and pathogens is consistent with or better than pre-disturbance conditions and adjacent land. • Records demonstrate that all equipment and vehicles are inspected and cleared where required before arrival at the site.

Table 5-85: Weeds and Pests (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-WP-01	Impact to native vegetation species, loss of biodiversity and/or ecological value from introduced weeds and/or pests	No – control measures will generally prevent introduction or spread; however, impact could occur.	Low – impact would only occur rarely to infrequently.	Short term to long lasting – impacts can generally be successfully managed in the short-term with the implementation of identified controls, however, could have longer term effects in the worst case.	Localised – impacts not likely to extend beyond the project site and immediate surrounds.	Moderate – if the impact event occurs, it could result in an increase in the occurrence of weeds, pests or pathogens and may require a high level of management.	Possible – if the spread of weeds, pests or pathogens occurs on multiple occasions at the same site, or has occurred at nearby sites, the potential for cumulative impacts exists.	Low – injection activities would generally be located over land cleared of native vegetation, with minimal vegetation of high environmental value. Weeds, pests and pathogens are a hazard to agricultural productivity and to livestock wellbeing.	Magnitude = Moderate Significance = Low

[9] Declared plants as listed under the *Landscape South Australia Act 2019*.

5.3.9 Waste

5.3.9.1 Setting the context

Table 5-86 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to waste.

Table 5-86: Waste Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Waste	• *Environment Protection Act 1993* • *Environment Protection (Waste to Resources) Policy 2010* • *Work Health and Safety Act 2012* • *South Australian Public Health (Wastewater) Regulations 2013* • South Australian On-site Wastewater Systems Code 2013	• N/A	To be updated to include views of affected parties from original consultation and new consultation.	• Amenity • Native fauna

5.3.9.2 Potential impact events

Potential impacts from waste, arise principally from:

Seismic:

- Storage and transport of waste
- Wastewater and putrescible waste.

Drilling:

- Storage and transport of waste
- Wastewater and putrescible waste.

Injection:

- Storage and transport of waste
- Wastewater and putrescible waste.

Waste - Seismic Activities

Table 5-87: Waste (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-W-01	Seismic activities	Impact to public health, amenity and native fauna from waste produced during seismic activities	• Storage and transport of wastewater and waste (litter). • Wastewater • Putrescible waste	Direct disturbance	• Amenity • Native fauna • Public health	• Depending on the seismic area, identified receptors may not be present.	Low	Yes – there is potential for impacts to amenity and native fauna

Table 5-88: Waste (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-W-01	Impact to public health, amenity and native fauna from waste produced during seismic activities	• Covered bins are provided for the collection and storage of wastes. All loads of rubbish are covered during transport to an approved waste facility. • Waste transported to EPA licensed facility with other waste where practical. • Hazardous waste handled in accordance with relevant legislation and standards. • All Wastewater treatment and disposal will be via a product approved aerated wastewater treatment system and be disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* (or to the satisfaction of the Department of Health) and consistent with the SA Health On-site Wastewater Systems Code April 2013 and *Environment Protection (Water Quality) Policy 2015*. • Treated sewage wastewater disposed of onto land should not pool, and disposal should be well away from any place from which it is reasonably likely to enter any waters (through seepage or runoff). • Septage to be disposed of in accordance with EPA Septage Management Guidelines • Production of waste is minimised by purchasing reusable, biodegradable or recyclable materials where practical. • Wellsite is kept free of litter and rubbish. • Application of the waste hierarchy system (avoid, reduce, reuse, recycle, treat, and dispose). • Storage, transport and handling of all hazardous or regulated wastes is managed in accordance with the requirements of relevant legislation and industry standards. • Waste streams are segregated on site where appropriate to maximise opportunities for waste recovery, reuse and recycling.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low - Standard industry management strategies and short-term duration of program	S10. No significant impact on the environment of waste storage, handling and disposal.	• Records and inspections/audits demonstrate that wastes are segregated and transported to an Environment Protection Authority (EPA) licensed waste disposal facility for recycling or disposal. • 0, +1 or +2 GAS criteria are attained for 'Pollution and Litter' listed in Appendix A. • Reasonable steps are taken to securely contain waste prior to removal from site. • All wastewater disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* or to the	• On site treatment of camp waste water to appropriate water quality standards prior to discharge (e.g. – grey water and effluent) in a manner that prevents entry into water bodies or water courses. • Compliance with the relevant local Government regulations and sanitation regulations. • Liquid waste is disposed in a manner which prevents discharge or runoff to environmentally sensitive areas. • Records maintained in relation to disposal/discharge method and location and any third-party consultation. • Containment and treatment on-site or removal off-site for appropriate treatment/disposal where water quality is

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Loss of containment is managed via an incident management system (IMS) and implementation of corrective actions is based on incident investigation.				satisfaction of the Department of Health, and consistent with the *Environment Protection (Water Quality) Policy 2015*.	unsuitable for on-site disposal. • Inspection of water disposal sites for evidence of water entering a environmentally sensitive area. • Waste water disposal systems comply with legislative requirements. • Facility and maintenance audits to validate compliance. • Inspections demonstrate waste is appropriately stored and contained. • Inspections demonstrate no evidence of spills or leaks of as a result of activities. • Personnel trained in spill response procedures. • Appropriate spill response equipment is available on site.

Table 5-89: Waste (Seismic) Significance assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-W-01	Impact to public health, amenity and native fauna from waste produced during seismic activities	Yes – impacts can be avoided through the identified controls.	Rare – potential impact events are not expected to occur.	Long lasting – potential contamination of water and soils can last for years, but the impact can be reversed.	Moderate – Impacts to waterbodies/courses may spread beyond the project site and immediate surrounds. Impacts to vegetation and soils are likely to be localised.	Moderate – It is unlikely that impacts would result in reference values or quality standards being exceeded but it is likely that the impacts would result in an increase in the occurring level of water and soil contamination.	Possible – Receptors may be impacted by other potential impact events.	Low	Magnitude = Moderate Significance = Low

Waste – Drilling Activities

Table 5-90: Waste (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-W-01	Drilling activities	Impact to amenity and native fauna from waste produced during drilling activities	• Drilling wastes • Storage and transport of wastewater and waste (litter). • Wastewater • Putrescible waste	Direct disturbance	• Amenity • Native fauna	Depending on the drilling area, identified receptors may not be present.	Low	Yes – there is potential for impacts to amenity and native fauna

Table 5-91: Waste (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-W-01	Impact to amenity and native fauna from waste produced during drilling activities	• Covered bins are provided for the collection and storage of wastes. All loads of rubbish are covered during transport to an approved waste facility. • Waste transported to EPA licensed facility with other waste where practical. • Hazardous waste handled in accordance with relevant legislation and standards. • All drill cuttings, muds and non-toxic drill fluids are to be contained within a designated sump with adequate freeboard at completion of operations to allow for a 1m cover of clean fill at remediation. • On completion of drilling the sump will be allowed to dry out and then backfilled level with the surrounding landscape. • All Wastewater treatment and disposal will be via a product approved aerated wastewater treatment system and be disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* and the SA Health On-site Wastewater Systems Code April 2013. • Treated sewage wastewater disposed of onto land should not pool, and disposal should be well away from any place from which it is reasonably likely to enter any waters (through seepage or runoff). • Septage to be disposed of in accordance with EPA Septage Management Guidelines • Production of waste is minimised by purchasing reusable, biodegradable or recyclable materials where practical. • Wellsite is kept free of litter and rubbish.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low - Standard industry management strategies and short-term duration of program	D10. No significant impact on the environment of waste storage, handling and disposal.	• All wastes to be disposed of at an EPA licensed facility in accordance with EPA Licence conditions, except for: • Drilling fluids, drill cuttings and other benign completion fluids disposed during well clean-up • Putrescible domestic wastes (may be buried on-site in accordance with EPA requirements for short-term and temporary sites if transportation impractical). • Records of inspections/audits demonstrate that reasonable steps are taken to securely contain	• On site treatment of camp waste water to appropriate water quality standards prior to discharge (e.g. – grey water and effluent) in a manner that prevents entry into water bodies or water courses. • Compliance with the relevant local Government regulations and sanitation regulations. • Liquid waste is disposed in a manner which prevents discharge or runoff to environmentally sensitive areas. • Records maintained in relation to disposal/discharge method and location and any third-party consultation. • Containment and treatment on-site or removal off-site for appropriate treatment/disposal where water quality is

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						waste prior to removal from site. • All wastewater disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* or to the satisfaction of the Department of Health • Attainment of GAS criteria for 'Site to be left in a clean, tidy and safe condition' objective for wellsite restoration and borrow pit rehabilitation as listed in the SEO-Appendix B. • No adverse effects on native fauna from waste management through any stage of construction, drilling and/or production.	unsuitable for on-site disposal. • Inspection of water disposal sites for evidence of water entering a environmentally sensitive area. • Waste water disposal systems comply with legislative requirements. • Facility and maintenance audits to validate compliance.

Table 5-92: Waste (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-W-01	Impact to amenity and native fauna from waste produced	Yes – impacts can be avoided through the identified controls.	Rare – potential impact events are not expected to occur.	Long lasting – potential contamination of water and soils can last for years, but the	Moderate – Impacts to waterbodies/courses may spread beyond the project site and immediate surrounds. Impacts to vegetation and soils are likely to be localised.	Moderate – It is unlikely that impacts would result in reference values or quality standards being exceeded but it is likely	Possible – Receptors may be impacted by other potential impact events.	Low	Magnitude = Moderate Significance = Low

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
	during drilling activities			impact can be reversed.		that the impacts would result in an increase in the occurring level of water and soil contamination.			

Waste – Injection Activities

Table 5-93: Waste (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-W-01	Injection activities	Impact to amenity and native fauna from waste produced during injection activities	• Storage and transport of wastewater and waste (litter). • Wastewater • Putrescible waste	Direct disturbance	• Amenity • Native fauna	• Depending on the area for injection, identified receptors may not be present.	Low	Yes – there is potential for impacts to amenity and native fauna

Table 5-94: Waste (Injection) Controls and, Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-W-01	Impact to amenity and native fauna from waste produced during injection activities	• Covered bins are provided for the collection and storage of wastes. All loads of rubbish are covered during transport to an approved waste facility. • Waste transported to EPA licensed facility with other waste where practical. • Hazardous waste handled in accordance with relevant legislation and standards. • All Wastewater treatment and disposal will be via a product approved aerated wastewater treatment system and be disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* and the SA Health On-site Wastewater Systems Code April 2013. • Treated sewage wastewater disposed of onto land should not pool, and disposal should be well away from any place from which it is reasonably likely to enter any waters (through seepage or runoff). • Septage to be disposed of in accordance with EPA Septage Management Guidelines • Production of waste is minimised by purchasing reusable, biodegradable or recyclable materials where practical. • Wellsite is kept free of litter and rubbish.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low - Standard industry management strategies and short-term duration of program	I9. No significant impact on the environment of waste storage, handling and disposal.	• All wastes to be disposed of at an EPA licensed facility in accordance with EPA Licence conditions, with the exception of: • Drilling fluids, drill cuttings and other benign completion fluids disposed during well clean-up • Putrescible domestic wastes (may be buried on-site in accordance with EPA requirements for short-term and temporary sites if	• On site treatment of camp waste water to appropriate water quality standards prior to discharge (e.g. – grey water and effluent) in a manner that prevents entry into water bodies or water courses. • Compliance with the relevant local Government regulations and sanitation regulations. • Liquid waste is disposed in a manner which prevents discharge or runoff to environmentally sensitive areas. • Records maintained in relation to

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
						transportation impractical). • Records of inspections/audits demonstrate that reasonable steps are taken to securely contain waste prior to removal from site. • All wastewater disposed of in accordance with the *South Australian Public Health (Wastewater) Regulations 2013* or to the satisfaction of the Department of Health • No adverse effects on native fauna from waste management through any stage of construction, drilling and/or production.	disposal/discharge method and location and any third-party consultation. • Containment and treatment on-site or removal off-site for appropriate treatment/disposal where water quality is unsuitable for on-site disposal. • Inspection of water disposal sites for evidence of water entering a environmentally sensitive area. • Waste water disposal systems comply with legislative requirements. • Facility and maintenance audits to validate compliance.

Table 5-95: Waste (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-W-01	Impact to amenity and native fauna from waste produced during injection activities	Yes – impacts can be avoided through the identified controls.	Rare – potential impact events are not expected to occur.	Long lasting – potential contamination of water and soils can last for years, but the impact can be reversed.	Moderate – Impacts to waterbodies/courses may spread beyond the project site and immediate surrounds. Impacts to vegetation and soils are likely to be localised.	Moderate – It is unlikely that impacts would result in reference values or quality standards being exceeded but it is likely that the impacts would result in an increase in the occurring level of water and soil contamination.	Possible – Receptors may be impacted by other potential impact events.	Low	Magnitude = Moderate Significance = Low

5.3.10 Visual Amenity

5.3.10.1 Setting the context

Table 5-96 summarises the view of affected parties, government legislation and non-legislated standards and key environmental receptors relevant to visual amenity.

Table 5-96: Visual Amenity Views of Affected Parties, Legislation, Standards and Receptors

Environmental Element	Applicable Legislation	Applicable non-Legislated Standards	Views of Affected Parties	Environmental Receptor
Visual Amenity	• N/A	• SA Arid Lands Regional Landscape Plan. • Marla Oodnadatta District Plan 2024-2026	To be updated to include views of affected parties from original consultation and new consultation.	• Amenity • Remote and natural qualities / visitor experience • Natural values

5.3.10.2 Potential impact events

Potential impacts to visual amenity, arise principally from:

Seismic:

- Earthworks and uphole drilling activity
- Campsite preparation and site activities.

Drilling:

- Well lease, access track, borrow pit, and camp site construction and rehabilitation

Injection:

- Presence of vehicles and equipment during operations.

Visual Amenity - Seismic Activities

Table 5-97: Visual Amenity (Seismic) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
S-VA-01	Seismic activities	Impact to visual amenity to the remote and natural qualities / visitor experience of the Licence Area region from the direct disturbance associated with earthworks and uphole drilling activities	Earthworks Uphole drilling activity	Direct disturbance	• Remote and natural qualities / visitor experience	• Assumes that limited receptors are present within the area	Low sensitivity to change – sources and controls are well known.	Yes
S-VA-02	Seismic activities	Impact to the natural values of the Licence Area region as a result of campsite preparation and site activities	Campsite preparation and site activities	Direct disturbance	• Natural values	• Assumes that limited receptors are present within the area	Low sensitivity to change – sources and controls are well known.	Yes

Table 5-98: Visual Amenity (Seismic) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
S-VA-01	Impact to visual amenity to the remote and natural qualities / visitor experience of the Licence Area region from the direct disturbance associated with earthworks and uphole drilling activities	*Earthworks* • Pre-survey planning has been undertaken to minimise visibility of operations and records are available for audit. • Vegetation or landforms are used to disguise operations as far as possible. • Lines are smoothly weaved about the general line of traverse and stands of vegetation where appropriate for the soil type. • Lines are doglegged at road and track crossings preferably around vegetation. • Dozers are walked with blade up wherever possible • Sand dune crest cuts are offset along the length of the survey line to minimise visibility. • Extensive side cuts on dune flanks are avoided. • Where lines cross dunes located near public roads or tourist tracks, and unauthorised public access is likely to be an issue (e.g. if dunes are close to roads or highly visible from the road), vehicles avoid crossing dunes and use more suitable crossing locations. Equipment is hand carried over such dunes where appropriate. • Dune cuts or significant line preparation are not undertaken on dunes located immediately adjacent to public roads or tourist access tracks. Equipment is hand carried over such dunes where appropriate. • Seismic lines adjacent to public roads are ripped where appropriate to discourage third party access. Fencing and signage are erected if needed to discourage ongoing public access.	High certainty that proposed control measures will be effective	Low - Standard industry management strategies and short-term duration of program	S11. To maintain the visual amenity during regulated activities	• Records of inspections/audits demonstrate that proposed survey lines and campsites have been appropriately located and prepared to minimise the visual impact. • The attainment of 0, +1 or +2 GAS criteria for 'Visual impact' objective listed in the SEO-Appendix A.	• Adverse impacts from disturbed areas resolved to the reasonable satisfaction of the landowner

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
		• Lines adjacent to public roads may also be blocked with timber (or other suitable deterrent installed) as an access deterrent. Uphole drilling • Actions are taken to lessen visual impact of uphole cuttings where they contrast with the surface e.g. by use of appropriate colouring agents. • Drill cuttings are returned to hole and surplus cuttings buried or spread to minimise visual impact.					
S-VA-02	Impact to the natural values of the Licence Area region as a result of campsite preparation and site activities	• Refer to measures listed under 'Soil erosion and compaction', 'Damage to native vegetation and fauna habitat' and Line and access track preparation.	High certainty that proposed control measures will be effective. Industry standard control measures that are well understood and that have been successfully implemented.	Low	S11. To maintain the visual amenity during regulated activities	• Records of inspections/audits demonstrate that proposed survey lines and campsites have been appropriately located and prepared to minimise the visual impact. • The attainment of 0, +1 or +2 GAS criteria for 'Visual impact' objective listed in the SEO-Appendix A.	• Planning has been undertaken to minimise impacts of operations and records are available for review. •

Table 5-99: Visual Amenity (Seismic) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
S-VA-01	Impact to visual amenity to the remote and natural qualities / visitor experience of the Licence Area region from the direct disturbance associated with earthworks and uphole drilling activities	No – proposed works are an essential part of seismic activities	Rare – impacts of any notable severity are not expected to occur	Short-term – the impact may occur for the duration of the project activity. It will cease to occur upon activity completion.	Localised – the impact is confined to the locations that the project activity is observable from.	Low - impacts are generally very limited.	No – low-minimal other external visual impacts visible to receptors	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Low Significance = Low
S-VA-02	Impact to the natural values of the Licence Area region as a result of campsite preparation and site activities	No – proposed works are an essential part of seismic activities	Low – impacts of any notable severity are not expected to occur	Short-term – the impact may occur for the duration of the project activity. It will cease to occur upon activity completion.	Localised – the impact is confined to the locations that the project activity is observable from.	Low - impacts are generally very limited.	No – low-minimal other external visual impacts visible to receptors	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Low Significance = Low

Visual Amenity - Drilling Activities

Table 5-100: Visual Amenity (Drilling) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
D-VA-01	Drilling Activities	Impact to landforms from drilling activities resulting in degraded visual amenity	Well lease, access track, borrow pit, and camp site construction and rehabilitation	Disturbance of soil and landforms	• Landforms	• Limited potential for unplanned event to occur.	Low	Yes

Table 5-101: Visual Amenity (Drilling) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
D-VA-01	Impact to landforms from drilling activities resulting in degraded visual amenity	• Compacted soil areas ripped (except in stony plains and tablelands) and soil profile and contours are reinstated following completion of operations. • Soil removed in construction to be stored on site and returned to its original stratigraphic level upon restoration of the drill site. • DEM (2024d) Field Guide contains photographic examples of GAS criteria. • Rehabilitation/decommissioning plans for surface activities will be developed in consultation with relevant stakeholders • Effective rehabilitation of the wellsite so that potentially dangerous perturbations in ground level do not remain	High certainty that proposed control measures will be effective.	Low	D11. To maintain visual amenity during regulated activities	• The attainment of 0, +1 or +2 GAS criteria for 'Minimise visual impact' objectives for wellsite restoration and borrow pit construction and rehabilitation listed in the SEO-Appendix B.	• Adverse impacts from disturbed areas resolved to the reasonable satisfaction of the landowner

Table 5-102: Visual Amenity (Drilling) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
D-VA-01	Impact to landforms from drilling activities resulting in degraded visual amenity	No – proposed works are an essential part of seismic activities	Rare – impacts of any notable severity are not expected to occur	Short-term – the impact may occur for the duration of the project activity. It will cease to occur upon activity completion.	Localised – the impact is confined to the locations that the project activity is observable from.	Low - impacts are generally very limited.	No – low-minimal other external visual impacts visible to receptors	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Low Significance = Low

Visual Amenity - Injection Activities

Table 5-103: Visual Amenity (Injection) Potential Impact Events

Impact ID	Phase of Project	Potential Impact Event	Source	Pathway	Environmental Receptor	Uncertainties and Assumptions	Sensitivity to Change in Assumptions	Confirmation of Source-Pathway-Receptor
I-VA-01	Injection activities	Impact to visual amenity of landholders/land users from the direct disturbance associated with the presence of vehicles and equipment during injection activities	Presence of vehicles and equipment during operations.	Direct disturbance	• Remote and natural qualities / visitor experience • Landholders / land users	• Location and scale of injection activities.	Low sensitivity to change – sources, receptors and controls are well known.	Yes – potential for impact.

Table 5-104: Visual Amenity (Injection) Controls and Environmental Objectives

Impact ID	Impact Event	Control Measures	Uncertainties and assumptions (Control Measures)	Sensitivity to change of assumptions	Environmental Objective	Assessment Criteria	Leading Performance Criteria
I-VA-01	Impact to visual amenity of landholders/land users from the direct disturbance associated with the presence of vehicles and equipment during injection activities	• Selecting the site to minimise visual impact as far as practicable. • Maintain work areas in a neat and orderly manner.	High certainty that proposed control measures will be effective.	Low	I10. To maintain visual amenity during regulated activities	• Location of injection activities have been appropriately located and prepared to minimise the visual impact.	• Adverse impacts from disturbed areas resolved to the reasonable satisfaction of the landowner.

Table 5-105: Visual Amenity (Injection) Significance Assessment

Impact ID	Potential Impact Event	Avoidance (Yes/No)	Frequency (High, Moderate, Low, Rare)	Duration (Permanent, Long lasting, Short term)	Extent (Widespread, Moderate, Localised)	Severity (High/Moderate/Low)	Cumulative Effects (Yes/Possible/No)	Sensitivity of Receiving Environment (High/Medium/Low)	Outcome
I-VA-01	Impact to visual amenity of landholders/land users from the direct disturbance associated with the presence of vehicles and equipment during injection activities	No – proposed works are an essential part of injection activities	Rare – impacts of any notable severity are not expected to occur	Short-term – the impact may occur for the duration of the project activity. It will cease to occur upon activity completion.	Localised – the impact is confined to the locations that the project activity is observable from.	Low - impacts are generally very limited.	No – low-minimal other external visual impacts visible to receptors	Low – location of seismic activities will typically seek to be away from communities and/or landholders	Magnitude = Low Significance = Low

6. Environmental Management System

Operations in the Arckaringa Basin will be undertaken in accordance with the principles of an Environmental Management System (EMS). An EMS is a key tool in the management of the proponent and associated contractors' environmental responsibilities, issues and risks. An EMS also provides a framework for the coordinated and consistent management of environmental issues by ensuring the.

- establishment of environmental policy
- identification of environmental risks and legal and other requirements relevant to drilling operations
- setting of appropriate environmental objectives and targets
- delineation of responsibilities
- establishment of a structure and program to implement environmental policy and achieve objectives and targets, including the development of procedures or guidelines for specific activities and education and induction programs
- facilitation of planning, control monitoring, corrective action, auditing and review of activities to ensure that the requirements and aspirations of the environmental policy are achieved.

ACV / D3 and its contractors' operating standards will follow or lead accepted best practice and industry-accepted standards. Ongoing audits of the EMS and associated systems will be conducted on a regular basis to ensure that systems are maintained and being successfully implemented.

6.1 Responsibilities

Environmental management and compliance are the responsibility of all personnel.

The overall responsibility for environmental compliance lies with ACV / D3, who will maintain a high level of on-site supervision. The well testing and reinjection contractor and individuals will also be responsible and accountable through their conditions of contract. The training of all personnel will ensure that each individual is aware of their environmental responsibility.

Indicative organisation and responsibilities for environmental management are outlined in Table 6-1. It is noted that the exact nature and title of these roles may vary, and positions may be amalgamated or the responsibilities shared.

Table 6-1: Indicative roles and responsibilities

Role	Responsibility
ACV / D3 management	Licence holders. Hold overall responsibility for activities and environmental management Responsible for coordinating the management of the activities, including all environmental aspects. Responsible for overall implementation of EMS. Responsible for the overseeing and fulfilling of commitments contained in EIR and SEO. Overall responsibility for reporting on environmental performance and due diligence.

Role	Responsibility
	Coordinates environmental incident internal reporting, investigation and emergency response. Incident notification to authorities.
ACV / D3 on-site representative	Directly responsible for on-site management, including all environmental aspects and emergency response. Responsible for the overseeing and fulfilling of commitments contained in EIR and SEO. Reports to ACV / D3 management on environmental performance and due diligence. Coordinates the monitoring and audit program. Environmental internal reporting and incident investigation.
Well testing and reinjection contractor	Responsible for ensuring that works meet regulatory requirements and all environmental objectives contained in the SEO. Directly responsible for the overseeing and fulfilling of commitments contained in relevant approvals, EIR and SEO. Responsible for ensuring adequate resources are provided for constructing and maintaining environmental controls. Inspection of work area to ensure appropriate environmental management. Environmental internal reporting and incident investigation.

6.2 Environmental Training

Prior to the start of field operations, all field personnel will be required to undertake an environmental induction to ensure they understand their role in protecting the environment. This induction will be part of a general induction process also including safety procedures. The induction shall include notification of environmental objectives and environmental requirements and include the distribution and explanation of any site-specific environmental material.

A record of induction and attendees will be maintained.

6.3 Emergency Response and Contingency Planning

In the course of normal operations, there is always the potential for environmental incidents and accidents to occur. To manage these potential incidents, emergency response plans will be developed to guide actions to be taken to minimise the impacts of accidents and incidents. Emergency response plans will be reviewed and updated on a regular basis to incorporate new information arising from any incidents, near-misses and hazards and emergency response simulation training sessions. These plans will also include the facilitation of fire danger season restrictions and requirements.

Emergency response drills will also be undertaken at regular intervals to ensure that personnel are familiar with the plans and the types of emergencies to which it applies, and that there will be a rapid and effective response in the event of a real emergency occurring.

6.4 Environmental Monitoring and Audits

Ongoing monitoring and auditing of operations will be undertaken to determine whether significant environmental risks are being managed, minimised and where reasonably possible, eliminated.

Monitoring programs will be designed to assess:

- compliance with regulatory requirements (particularly the Statement of Environmental Objectives)
- impact on flora and fauna
- site contamination
- site revegetation following program completion and any restoration activity
- potential future problems.

6.5 Incident Management, Recording and Corrective Actions

ACV / D3 and its contractors will have a system in place to record environmental incidents, near-misses and hazards, track the implementation and close out of corrective actions, and allow analysis of such incidents to identify areas requiring improvement. Such review should be undertaken at least annually. The system will also provide a mechanism for recording 'reportable' incidents, as defined under the ER Act and associated regulations.

6.6 Reporting

Internal and external reporting procedures will be implemented to ensure that environmental issues and/or incidents are appropriately responded to. A key component of the internal reporting will be contractors' progress and incident reports to ACV / D3.

External reporting (e.g. incidents, annual reports) will be carried out in accordance with the ER Act requirements. Incident reporting requirements are detailed in the SEO.

7. Stakeholder Consultation

ACV and D3 will conduct targeted consultation with relevant interested parties during both the development of this EIR (and accompanying SEO) and planning for specific exploration programs and seismic surveys. This consultation will assist in identifying potential impacts from the proposed activities and the best form of mitigation or management measures to reduce those impacts.

ACV and D3 are committed to maintaining effective communication and good relations with all stakeholders.

The strategy is designed to ensure consistent, respectful, and effective engagement with stakeholders (landholders, communities, local government, Traditional Owners). It supports ACV and D3's operational, regulatory and community obligations relating to the Project and more broadly its exploration portfolio in South Australia.

7.1 General Engagement Activities

ACV / D3 has held in person meetings with landowner of site of first well, September 2025.

ACV / D3 will work closely with landowners at proposed activity locations to develop agreements for land access and land use, understand and address any concerns, provide compensation as required and to realise any opportunities or benefits that may arise from the proposed activities.

7.2 Engagement on activities prior to ACV / D3 formal consultation

During planning for the well testing and reinjection activities and the development of this EIR and the SEO, engagement by ACV / D3 has included the following activities:

- meetings with the Department for Energy and Mining to discuss approval requirements for the program
- using existing planned engagement sessions such as scheduled landowner meetings to discuss the proposed activities
- contacted Antakirinja Matu-Yankunytjatjara Aboriginal Corporation and Arabana Aboriginal Corporation RNTBC to provide information about the proposed activities
- developed communication materials including factsheets.

7.3 ACV / D3 formal consultation on EIR and SEO

As discussed in Section 2.1.3, the ER Act requires licensees to undertake consultation on a proposed EIR and SEO in compliance with an approved consultation plan, prepared and implemented in accordance with the ER Regulations.

An Arckaringa Basin Exploration Activities EIR and SEO consultation plan was submitted to DEM for approval in July 2026. The consultation approach outlined in the plan has been informed by the overarching stakeholder engagement and communication strategy and the consultation requirements under the ER Act. It is targeted to relevant stakeholders with the purpose of receiving feedback on the draft EIR and SEO documents.

Key details of the consultation under the plan are summarised below.

- Commencement date: TBC

- Upload draft EIR and SEO documents to the company website and, if requested, provide a PDF copy to stakeholders directly.
- ACV / D3 will contact all relevant pastoralists and landowners — prioritising those with existing relationships — by written correspondence (letter or email) in the first instance providing a fact sheet and link to draft documents for comment with the offer of a telephone call and/or meeting, with a subsequent follow-up call to confirm receipt where telephone numbers are available.

- Targeted emails to District Council of Coober Pedy, Arabana Aboriginal Corporation RNTBC and relevant government agencies, including a fact sheet, a link to the draft EIR and SEO documents, and details of feedback process. If directly requested, hard copy documents can be supplied.

- In-person meetings can be scheduled with relevant landowners to provide the opportunity to ask questions in person.

- ACV / D3 will respond to feedback and questions raised through ACV / D3's EIR/SEO formal consultation process and will acknowledge all stakeholder's feedback via the provision of a summary document outlining how feedback has been considered.

Key stakeholders identified as having an interest in or potentially being affected by the proposed activities are listed in Table 7-1.

Table 7-1: Key stakeholders for consultation on the EIR and SEO for proposed activities

Category	Stakeholder / stakeholder group
Relevant landholders	Pastoralists / occupiers of the following pastoral stations: • Allandale • Anna Creek • Billa Kalina • Mount Barry • Mount Willoughby • Nilpinna • Stuart Creek • The Peake
Aboriginal Heritage / Native Title	Arabana Aboriginal Corporation RNTBC (formerly known as Arabana People's Native Title Group)
Regulatory Authorities / Stage Government agencies	Department for Energy and Mining (DEM)
	Department for Environment and Water (DEW)
	Primary Industries and Regions South Australia (PIRSA)
	Department for Transport and Infrastructure (DIT)
	South Australian Arid Lands Landscape Board (SAAL)
	Aboriginal Affairs and Reconciliation (AAR)
	SafeWork SA
Commonwealth Government	Department of Defence
Local Government	Outback Communities Authority

Category	Stakeholder / stakeholder group
Local Government (nearest)	District Council of Coober Pedy
Mining companies with overlapping tenements	Australian Consolidated Gold Holding Pty Ltd Vintage Energy Ltd PTR Minerals Ltd South Australian Coal Pty Ltd Copper Search Australia Pty Ltd Mac Minerals Pty Ltd Eversley Resources Pty Ltd Wilan Resources Pty Ltd OZ Minerals Prominent Hill Operations Pty Ltd OZ Exploration Pty Ltd South Australian Coal Pty Ltd Smooth Bore Resources Pty Ltd Tigers Dominion Group Pty Ltd River Property Investments Pty Ltd Darryl Keith Borrett Michael Alfonz Nagy

[Table will be included to show actions from consultation period– stakeholder/actions undertaken & response]

7.4 Outcomes of Stakeholder Consultation on the draft EIR and SEO

[When consultation is completed, this text will be included: Issues raised in stakeholder comments and ACV/D3's responses are summarised in Table D-1 in Appendix D. The EIR and draft SEO were updated accordingly for formal submission to DEM, for further review and consultation under the formal ER Act consultation process (summarised below in Section 7.5).]

7.5 Formal ER Act Consultation Process

Following ACV / D3's stakeholder consultation, this EIR and the accompanying SEO will be updated to address the issues raised during the consultation and submitted to DEM for consideration under the ER Act.

An assessment will be undertaken to ensure the documents meet the requirements of the Act, Regulations and the Environmental Impact Assessment Criteria as required under section 97(4). Once satisfied the documents are compliant, DEM will undertake public consultation inviting written submissions for a minimum 30 business day period in accordance with Regulation 14.

Any submissions received during this consultation will be provided to ACV and D3. All relevant comments received from the public consultation will be addressed and, where appropriate, incorporated into the EIR and / or SEO.

[When consultation is completed, this text will be included: The comments received during this process and ACV/D3's responses are summarised in Table E-1 in Appendix E. The EIR and SEO have been updated accordingly.]

7.6 Ongoing Consultation

ACV / D3 will continue to engage stakeholders for the duration of its exploration activities to ensure that all potential concerns are identified and appropriately addressed. This could include (but not be limited to) consulting and advising affected stakeholders of proposed activities in a timely manner, responding to any issues raised, maintaining a database of interested stakeholders in order to provide regular updates, including information on the website on progress of the Project, and provision of factsheets and other information.

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9. Abbreviations

Term	Description
ºC	Degrees Centigrade
ACV	Australian Carbon Vault
BOM	Bureau of Meteorology
D3 Energy	D3 Energy Limited
DEH	Formerly the Department for Environment and Heritage, now the Department for Environment and Water
DEM	Department for Energy and Mining
DEW	Department for Environment and Water
DEWR	Formerly the Department of the Environment and Water Resources (Commonwealth), now the Department of Climate Change, Energy, the Environment and Water
DIT	Department for Infrastructure and Transport
EIR	Environmental Impact Report
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ER Act	*Energy Resources Act 2000*
ER Regulations	*Energy Resources Regulations 2013*
GAB	Great Artesian Basin
GSEL	Gas Storage Exploration Licence
h	hours
ha	hectares
IPA	Indigenous Protection Area
IBRA	Interim Biogeographic Regionalisation for Australia
IPA	Indigenous Protection Area
kg	kilogram
km	kilometre
L	litre
Licence Area	Collectively the GSELs and PELs held by Australian Carbon Vault and D3 Energy in the Arckaringa Basin in South Australia
m	metre
mg	milligram
MNES	Matters of national environmental significance
NPW Act	*National Parks and Wildlife Act 1972* (SA)
NVC	Native Vegetation Council
PEL	Petroleum Exploration Licence

Term	Description
PIRSA	Primary Industries and Resources, South Australia
ppm	Parts per million
RNE	Register of the National Estate
s	seconds
SCB	Soil Conservation Board
SEO	Statement of Environmental Objectives

Appendix A Land Systems in the Licence Area

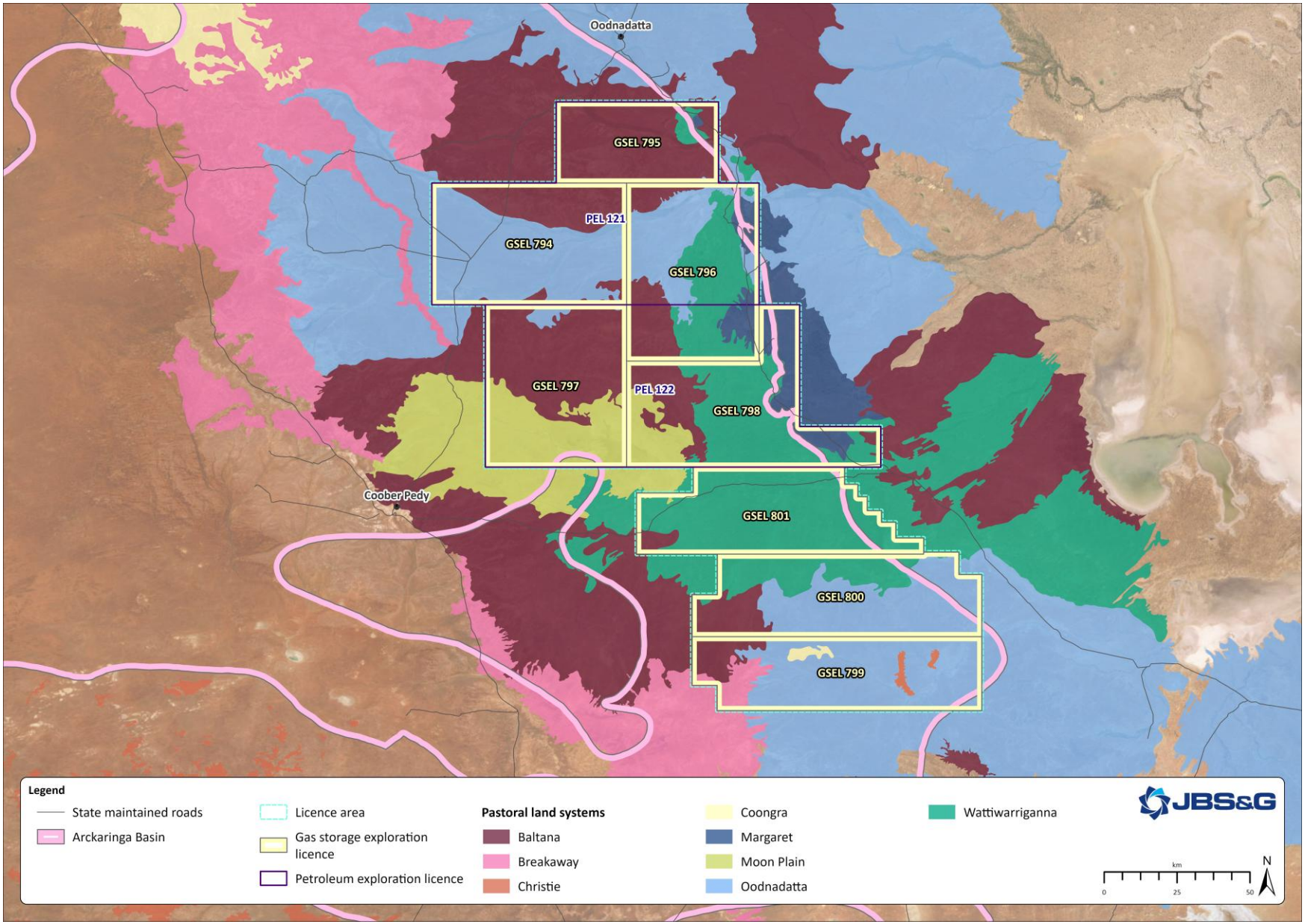

Figure 9-1: Land systems in the Licence Area

Appendix A provides a detailed description of the land systems in the Licence Area that are briefly discussed in the EIR. The descriptions are taken from Kingoonya SCB (2002), Marla-Oodnadatta SCB (2002) and Marree SCB (2004).

Table 9-1: Land system summary

Name	Landform	Land features	IBRA Region	
			STP	SSD
Baltana	P	Moon plain, Drainage lines/watercourses	X	
Breakaway	U	Tablelands, Drainage lines/watercourses	X	
Christie	U	Stony plain	X	
Coongra	StP / U	Stony plain, Stony Hills, Drainage lines/watercourses	X	
Moon Plain	P	Moon plain, Drainage lines/watercourses, Salt lakes	X	
Mt Margaret	U	Ranges, Tableland, Stony plain (footslopes)	X	
Oodnadatta	P	Stony plain, Drainage lines/watercourses, Stony Hills	X	
Wattiwarriganna	D	Dunes, Swales, Claypans, Drainage lines/watercourses, Salt lakes, GAB Springs	X	X

Key to Landform
D = Dunefield (dunes with clay swales, occasional claypans, salt lakes); StP - Stony Pain; P = Plain; U = uplands including hills, mesas

Key to IBRA Regions
STP = Stony Plains; SSD = Simpson Strzelecki Dunefields

General Land System Descriptions from SCB District Plans

Baltana Land System (K, Ma)

The Baltana land system occupies a large area to the east and south of the Stuart Range on McDouall Peak station. It also occurs on Billa Kalina Station.

This land system has formed where erosion of the silcrete capping has exposed the softer Bulldog Shale which has mixed with alluvium from the ranges. This has resulted in the formation of extensive undulating plains with numerous gilgais and some areas of sandsheet. This is known locally as "moon" or "loomy" country. It has distinct similarities with the nearby Oodnadatta land system. Soils, which include silts, sands and grey clays, are covered with a lag of silcrete and quartzite gibbers. The soils comprise brown saline clay which separates it from the softer grey clays of the Moon Plain land system.

No perennial species truly dominate the vegetation on plains and there are often large bare areas, which support ephemeral species following rain, between patches of perennial vegetation. The dominant plant species on the plains are Oodnadatta saltbush, bladder saltbush, neverfail, Mitchell grasses, Flinders grass, button grass, Cooper clover, pale poverty-bush, tangled poverty-bush and samphires (glassworts).

Creeks and watercourses have alluvial sand and cracking clay soils and contain large amounts of shales and gypsum and support very little vegetation. Prickly wattle is the dominant species in the creeks with coolibah, cottonbush and silky browntop also common. Verbine and Cooper clover grow following good rains. Old man saltbush occurs in swamps and some creeks.

Plains, watercourses and run-on flats are all dominated by chenopod low shrublands. Bladder saltbush, woolly bluebush, barley Mitchell grass, neverfail and pale poverty-bush are common on plains with brown clay or silty soils. Watercourses with brown cracking clays and alluvial sands support cottonbush and showy groundsel. Run-on flats have saline grey-brown clays and are characterised by black bluebush, cottonbush, samphire, showy groundsel and swamp canegrass, with barley Mitchell grass and neverfail occurring where gilgais are present.

Sandsheets have formed in some areas from residual yellow sands deposited on the underlying gibber plain. These areas support low open shrublands with Sturt's pigface prominent in the vegetation. Elegant wattle (prickly wattle) and bladder saltbush also occur here.

Breakaway (Ma)

This land system has formed from an eroding basement of Bulldog Shale. Eroding shales and silcretes have resulted in mixtures of silcrete gibber, grey shales and other variously coloured hard and soft shales. The various colours result from the amount of leaching of iron from the shales, with red coloured shales containing more iron and paler ones containing less.

Vegetation of all land units except broad watercourses is dominated by chenopod low shrubland. Tall shrublands of bastard mulga, mulga, northern myall and emubushes are also common. Clay soils over silicified shales of tablelands and low hills are dominated by bladder saltbush, low bluebush and three-winged bluebush, sometimes with mulga and sennas. Vegetation of footslopes also includes bristly sea-heath and samphires, reflecting the more saline nature of the soils, and has fewer trees and tall shrubs.

Solonized red duplex soils of plains support bladder saltbush, low bluebush, samphire and bristly sea-heath, but also have barley Mitchell grass in the gilgais. Alluvial soils of smaller watercourses support bladder saltbush, cottonbush, spiny saltbush, round-leaf emubush, native apricot and showy groundsel. Larger watercourses have mulga or coolibah woodland, with marpoo and bullock bush also present.

Christie Land System (K)

The Christie land system is an ancient system formed from granitic and gneissic rocks as well as quartz bedrock and silcrete, with silcrete often present on hilltops. It is widespread in the western half of the Kingoonya SCB district.

Mulga scrub dominates on shallow stony sandy loams and stony earthy sands on outwash slopes. Tall shrublands of crimson turkey-bush, green turkey-bush, round-leaf emubush, three-wing bluebush and cassias are also present, often with an understorey of perennial grasses including woollybutt and bandicoot grass. Chenopod low shrublands dominate three land units within this land system; silcrete rises with shallow stony sandy loams, silcrete rises with shallow calcareous loams, and valley plains with sandy earth soils. Bladder saltbush and low bluebush are common in all three of these units, with black bluebush joining them on valley plains. Round-leaf emubush and cassias occur in both units featuring silcrete rises, with pearl bluebush present on calcareous soils, and three-wing bluebush and silky bluebush present on non-calcareous soils. Mulga scrub is also found on shallow alluvial sands of watercourses, with dead finish and spiny saltbush.

Coongra (Ma)

This land system consists of vast sandstone and shale covered slopes, plateaus and plains dominated by bladder saltbush. Undulating stony tablelands with gilgais are dissected by an extensive drainage

system although much of the initial drainage is into gilgais. Stones are rounded or angular and range in size from 3 to 30cm in diameter and these form an erosion resistant layer unless they are disturbed.

The slopes are treeless except for the occasional rock emubush tall shrubs. Sparse mulga occurs along shallow creek lines, with this species accompanied or replaced by gidgea on the eastern side of the land system. Coolibahs occur with river red gums along the larger watercourses, often with an understorey of Australian cupgrass.

On the tablelands bladder saltbush grows in association with the perennial grasses like the Mitchell grasses, native millet, katoora, the perennial shrub bristly sea-heath and occasional rock everlastings. Understorey plants include mulga grass, bottlewashers and bogan flea. The majority of perennial plants growing here are the same as those growing on the Oodnadatta land system, with the major difference being that Oodnadatta saltbush is uncommon in the Coongra land system and is a dominant plant in the Oodnadatta land system.

After rain, the Coongra land system is very productive, growing a wide variety of annual, ephemeral and short-lived perennials, even in dry times. This system is relatively productive due to its perennial plant component.

Moon Plain (Ma)

This land system occurs north-west of Coober Pedy. Its dominant feature is an undulating plain with soft grey cracking gypseous clay soils which generally lack any cover of gibber or other stones. This soil type separates it from the heavier brown clays of the Baltana land system, which it abuts to the west, south and east. The Moon Plain has little drainage and becomes very boggy after rain. However, two major drainage lines run through this system and provide drainage following very heavy rain. They also provide a habitat for the majority of perennial shrubs found in this land system.

The Moon Plain has very little plant cover in most years, with only a few perennial species present. Mitchell grasses and neverfail are two of the few perennial grasses found on the Plain, together with annual and pop saltbushes, mulka grass, pale poverty-bush, tangled poverty-bush, Blacks copperburr and buckbush.

Several species of samphire are common in the drainage lines, along with prickly wattle, old man saltbush, lignum, swamp canegrass and a few stunted coolibahs. Annual saltbush, pop saltbush, limestone bottle-washers, Darling pea, mulka grass, buckbush and various copperburr's also occur. Numerous ephemerals, including Cooper clover, flourish after good soaking rains of more than 50mm.

Mount Margaret (Ma)

This is a small land system located 100 km west of Lake Eyre North. It consists of rugged ranges with deep gorges, a deeply dissected plateau on top of the range, and long-lasting rock holes. The slopes of the range are rough and rocky. These ranges were once part of an inland sea and tidal ripple marks can be seen on rocks at the top of the range. The stripping process of the ancient soils is far more advanced here than in the Breakaway land system, although residual formations of up to 50 m or more above the level of the surrounding Oodnadatta land system are present. Soils may be up to several metres in depth.

The footslopes of this land system can be separated from the adjoining Oodnadatta land system by the presence of ferruginous rather than quartzite gibbers in the Mount Margaret land system.

The upper parts of creeks which begin in the ranges support the northern form of the river red gum, but this tree is replaced by coolibah when the creeks leave the ranges and become wider and the soils are sandier. The creeks also support dead finish and chenopod shrubs and perennial grasses which include lemon-scented grass, cotton grass and swamp wanderrie, often on skeletal rocky soils. The steep rocky gorges at the head of many of the creeks support mountain wanderrie and spinifex on shallower soils.

An undulating gibber tableland occurs on top of the range, with clay soils and numerous deep drainage lines. This tableland is covered with bladder saltbush, short-winged copperburr, salt copperburr and Mitchell grasses and is similar to the Oodnadatta land system, but lacks the Oodnadatta saltbush.

Steep hill slopes support a tall open shrubland of bastard mulga, mulga, emubushes, sennas, silver tails and perennial sunray, with other daisies, paper daisies and mulga grass. The lower undulating footslopes surrounding the ranges contain gilgais and support numerous chenopods (dominated by Oodnadatta saltbush), mulga grass, Mitchell grasses and other vegetation similar to the Oodnadatta land system.

Oodnadatta (Ma, M)

The Oodnadatta land system is the largest and most extensive land system found in the Marla - Oodnadatta Soil Conservation District. This extremely extensive land system extends from Dalhousie southward along the western side of Lake Eyre and into the south-west of the Marree SCD.

This land system is comprised of extensive undulating plains with a lag of silcrete and quartzite gibbers with numerous gilgais and occasional plateaus. It has an extensive drainage system with large braided creeks such as the Neales and Arckaringa Creek.

As for similar tableland land systems, the major soils are the duplex loams over clays of the gibber "shelf" areas, and the self-mulching clays of the gibber-free gilgais. Gibber soils are saline and dispersive, being either deep red clays or clay loams. Much of the soil salinity is now thought to have arisen through vertical leakage at the margins of the Great Artesian Basin, which this land system follows. Gilgais have much lower salinity. Gibber cover may be derived from silcrete or gypcrete, and there are areas with a very high gypseous content south of Lake Eyre South

Gilgais are the most productive component of this land system due to the combination of water run-on from shelves, cracking clays which do not seal until much of the profile has been wetted and the lower salinity. They are able to trap water run-off from the impervious stony flats which surround them. This water is then retained for extended periods by the clayey soil. Gilgais vary in size from only a few metres to approximately 10 metres in diameter and may be irregular in shape. The densest vegetation occurs in gilgais and on gilgai fringes or along watercourses. The stony shelves between the gilgais are often bare or covered only with a few bindyis or sparsely distributed samphire.

Gilgais support perennial low shrubs, Oodnadatta saltbush and / or samphire depending on salinity, and perennial grasses particularly native millet, barley Mitchell grass and katoora. Other common species include fairy grass, neverfail, plains lantern-bush, five-minute grass, bladder saltbush and occasionally cottonbush. The irrigation from adjoining shelves results in dense growth of ephemerals after rain, particularly windmill grasses, Australian cup-grass, Flinders grasses and bottlewasher. The edges of gilgais support perennial shrubs such as bladder saltbush and bristly seaheath. Trees and tall shrubs are usually absent, whether because of limited water storage, salinity or excessive gypsum at depth.

Predominantly perennial plants such as bladder saltbush, katoora, neverfail, bristly sea-heath and rock everlasting grow on the less productive gilgai fringes. A sparse scattering of ephemeral herbs and forbs occur after winter rainfall.

Gibber areas between gilgais are by comparison almost unvegetated. Ephemerals appear after major rains which are sufficiently heavy to leach salts out of the upper soil profile. Such rains have to be major and prolonged, since the gibber soil surface seals rapidly when wet, and most water runs off into gilgais.

Low hills and escarpments, (jump-ups) have gypseous clay loam soils, without gilgai formation. Bladder saltbush, low bluebush, black bluebush, harlequin fuchsia-bush typically occur. Annual

species include Tate's bindyi, spear grass, kerosene / mulga grass, and common and jointed bottlewasher.

Gidgee is common along creek lines in northern parts of the land system and mulga grows along creek lines throughout the land system. Coolibah grows along the larger watercourses, sometimes in association with river red gums.

Alluvial soils of watercourses support coolibah, river red gum, Broughton willow, prickly wattle and gidgea, and mineritchie in the north of the District. The shrub layer is dominated by old man saltbush, cottonbush and lignum with an understorey of grasses which may include swamp canegrass, neverfail, Mitchell grasses, silky brown tops, and perennial cupgrass. Cooper clover and verbine are common in wet seasons. The sandy floodouts adjacent to the creek support gidgea, coolibah and Mitchell grasses. Claypans with heavy brown clays are generally bare other than at their margins.

Numerous mound springs occur in this land system. Springs vary from active with visible flows to extinct and include the whole range between the two extremes. Mound springs often support dense grasslands of common reed when they are not subject to persistent grazing. Prolonged grazing removes the common reed and the more resilient but much smaller bore-drain sedge replaces it.

Wattiwarriganna (Ma)

The Wattiwarriganna land system is formed from a series of large parallel sand ridges overlying an older gibber plain, with swales usually containing a gibber pavement. Dunes are generally from 100 m to 500 m apart and up to 10 m in height.

The quartzite and silcrete gibbers are gravel rather than scree size because they have been sorted as they travelled further from their source. Numerous large watercourses dissect the land system. Dunes usually have deep red sandy soils, although dunes in this land system on Billa Kalina Station are generally paler. Sandy or clay-loam soils occur in the swales, which are generally flat, but may contain low sandy or calcareous clay rises. The swamps have brown clay, or cracking grey or brown clay, or yellow or red sandyloam soils. Numerous large watercourses dissect the land system.

Vegetation of the dunes is dominated by a hummock grassland of sandhill canegrass or a tall shrubland of horse mulga. Marpoo occurs in isolated stands and narrow-leaved hopbush is also moderately common. Few understorey species grow under or near these two shrubs. Silver needlebush also occurs as scattered plants and mulga occurs on some dune footslopes. The understorey includes tall kerosene grass, buckbush and cattle bush.

Interdune corridors include both sandy flats and claypans. Sandy flats support low shrublands of Sturts pigface, cottonbush, low bluebush, bladder saltbush, emubushes, sennas and neverfail, with mulga grass dominant in the understorey. Some claypans support swamp canegrass, old man saltbush, cottonbush, neverfail and lignum. Blue rod is common at claypan margins.

Larger watercourses are usually lined with coolibah, with marpoo, old man saltbush, cottonbush, sennas, samphire, neverfail, cupgrasses, silky browntop and swamp canegrass all present in the understorey. Cane-grass (swamp cane-grass) is common at some swamps and claypans. Swamps have similar understorey vegetation to watercourses but usually lack the associated riparian woodlands.

Several mound springs occur within this land system and support their characteristic vegetation including common reed, bore-drain sedge, cutting grass, bare twig rush, sea rush and salt couch.

Appendix B Rare or Threatened Species Recorded in the Region

Rare or Threatened Species in the Licence Area
A search of the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) online database (Protected Matters Search Tool, PMST)(DCCEEW accessed January 2026) and the South Australian Department for Environment and Water (DEW) Biological Databases of South Australia (DEW accessed January 2026) has identified the following rare or threatened flora and fauna species as being recorded or predicted to occur in the Licence Area.

1. Threatened Flora

Species Name	Common Name	Conservation Status[1]	
		C'wlth (EPBC)	SA (NPW Act)
Atriplex eichleri	Eichler's Saltbush		R
Bergia occultipetala			V
Eleocharis papillosa		VU	R
Embadium johnstonii	Johnston's Slipper-plant		R
Eragrostis lacunaria	Purple Love-grass		R
Frankenia cinerea			R
Frankenia cupularis			R
Frankenia plicata		E	
Goodenia anfracta			R
Goodenia chambersii			R
Goodenia valdentata	Davenport Range Goodenia		R*
Hemichroa mesembryanthema	Pigface Hemichroa		V
Nicotiana truncata			R
Ophioglossum polyphyllum	Large Adder's-tongue		R
Poa fax	Scaly Poa		R
Roepera humillima	Small-fruit Twinleaf		R
Roepera hybrida			R
Sclerolaena blackiana	Black's Bindyi		R
Senecio gypsicola	Gypsum Groundsel		R
Stemodia sp. Haegii (J.Z.Weber 9055)	Haegi's Stemodia		R
Swainsona oligophylla			R
Tecticornia cupuliformis			V
Wurmbea nilpinna			V
Wurmbea stellata	Star Nancy		R

[1]Conservation status under the SA *National Parks and Wildlife Act 1972* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*: R – Rare, V – Vulnerable, E – Endangered, EX – Extinct

2. Threatened Fauna

Species Name	Common Name	Conservation Status[1]	
		C'wlth (EPBC)	SA (NPW Act)
Amytornis modestus	Thick-billed Grasswren	VU	
Amytornis modestus indulkanna	Thick-billed Grasswren (NW)	VU	
Antigone rubicunda	Brolga		V
Aphelocephala leucopsis leucopsis	Southern Whiteface	VU	
Aphelocephala pectoralis	Chestnut-breasted Whiteface		R
Ardeotis australis	Australian Bustard		V
Aspidites ramsayi	Woma		R
Calidris acuminata	Sharp-tailed Sandpiper	VU	
Cladorhynchus leucocephalus	Banded Stilt		V
Dromaius novaehollandiae	Emu	ssp	ssp
Elanus scriptus	Letter-winged Kite		V
Falco hypoleucos	Grey Falcon	VU	
Hamirostra melanosternon	Black-breasted Buzzard		R
Hieraaetus morphnoides	Little Eagle		V
Liopholis kintorei	Great Desert Skink, Tjakura, Warrarna, Mulyamiji, Tjalapa, Nampu	VU	
Manorina flavigula	Yellow-throated Miner (complex)	ssp	ssp
Neosilurus gloveri	Dalhousie Catfish	CR	
Pedionomus torquatus	Plains-wanderer	CR	
Pezoporus occidentalis	Night Parrot	CR	
Phaps histrionica	Flock Bronzewing		R
Plegadis falcinellus	Glossy Ibis		R
Polytelis alexandrae	Princess Parrot, Alexandra's Parrot	VU	
Pseudomys australis	Plains Rat, Palyoora, Plains Mouse	VY	
Trichosurus vulpecula	Common Brushtail Possum		R
Tringa glareola	Wood Sandpiper		R
Tringa nebularia	Common Greenshank	EN	
Zapornia tabuensis	Spotless Crake		R

[1]Conservation status under the SA *National Parks and Wildlife Act 1972* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*: R – Rare, V – Vulnerable, E – Endangered, EX – Extinct

3. Declared Weed Species

Species Name	Common Name	Declared
Arundo donax	Giant Reed	Declared
Cenchrus ciliaris	Buffel Grass	Declared
Cenchrus pennisetiformis	Buffel Grass	Declared
Lycium ferocissimum	African Boxthorn	Declared / WoNS
Tamarix aphylla	Athel Pine	Declared
Tribulus terrestris	Caltrop	Declared

Appendix C Priority Plant Species

Priority Plant Species

Exploration activities often require the clearance of vegetation to facilitate access to areas of interest. Where possible the clearance of vegetation is avoided, however when clearance is required it is important that steps be taken to minimise the clearing of important species.

To assist with determining which plant species should be avoided or minimally cleared, four categories of conservation priority have been defined for the Licence Area. These conservation priorities take into account characteristics such as longevity, growth rate, regeneration rate and abundance, and any State or Commonwealth listing.

These priorities provide a general guide, however the significance of some species will depend to some extent on the species' location and the characteristics of the land form in which it is located. Site specific assessments will be used to refine the priorities for a given activity or location.

The conservation priorities are as follows:

Table A3-1: Conservation Priorities

Priority	Typical Plant Type/Characteristics[10]	Clearance
Priority 1	Long time to reach maturity Slow growth rate Poor regeneration from seed or rootstock May be uncommon State or Commonwealth listed species	Avoid clearance of mature trees Very high conservation priority
Priority 2	Long time to reach maturity Slow growth rate May be relatively uncommon May regenerate from seed &/or rootstock	Avoid clearance wherever possible High conservation priority
Priority 3	Short to moderate time to maturity Moderate growth rate Regenerates from seed &/or rootstock Relatively abundant	Clear only the minimum necessary Moderate conservation priority
Priority 4	Short time to maturity Fast growth rate Good regeneration from seed &/or rootstock Abundant Short-lived annuals and ephemerals generally fall in this category	May be cleared if necessary Low conservation priority

[10] A specific plant species may not necessarily exhibit all of these characteristics

Table A3-2 provides some examples of plant species in each category of priority.

Prior to the commencement of activities relevant personnel will be provided with information sheets (including photographs) to assist in the identification and management of priority plant species present at the location.

Table A3-2: Examples of plant species for each conservation priority

Priority	Common Name	Scientific Name
Priority 1	Western Myall	*Acacia papyrocarpa*
	River Red Gum	*Eucalyptus camaldulensis*
	Coolibah	*Eucalyptus coolabah*
	Black Oak	*Casuarina pauper*
Priority 2	Mulga	*Acacia aneura*
	Dead Finish	*Acacia tetragonophylla*
	Old Man Saltbush	*Atriplex nummularia*
	Bluebush	*Maireana sedifolia*
	Bullock Bush	*Alectryon oleifolius* ssp. *canescens*
	White Cypress-pine	*Callitris glaucophylla*
Priority 3	Tar Bush	*Eremophila glabra*
	Samphire	*Tecticornia* sp.
Priority 4	Sandhill Canegrass	*Zygochloa paradoxa*
	Most grasses	*Graminae sp.*

Appendix D Summary of issues raised – ACV / D3 Energy consultation

Comments on the draft EIR and SEO were received from LIST AGENCIES and are addressed below.

Comments received from landowners have been addressed in Section 7 Stakeholder Engagement (Table 7-4).

Table D-1: Summary of stakeholder comments and ACV / D3 responses

Submitter	EIR / SEO Reference	Comment / Issues Raised	Response
EIR			
SEO			

Appendix E Summary of issues raised – formal Energy Resources Act Consultation

[To be completed following consultation under the Energy Resources Act by DEM. Table will address comments on the EIR and SEO provided to DEM and how they have been addressed by ACV / D3]

Table E-1: Summary of comments and ACV / D3 responses

Submitter	EIR / SEO Reference	Comment / Issues Raised	Response
EIR			
SEO			