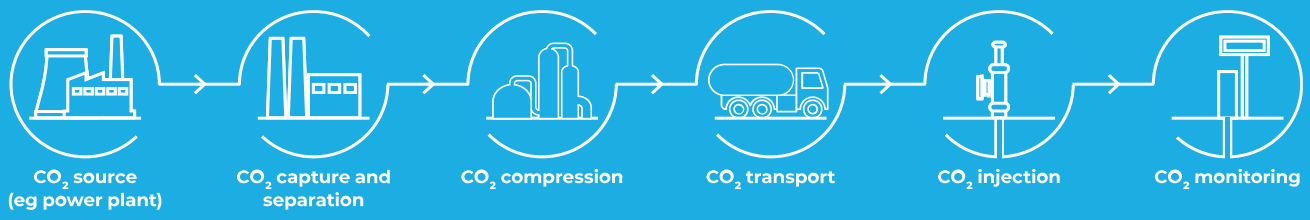
CTSCo
Carbon Transport & Storage

A GLENCORE Company



Surat Basin Carbon Capture and Storage Project

EXECUTIVE SUMMARY

NOVEMBER 2022

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Disclaimer: This document is an executive summary of the key findings of the Project's Environmental Impact Statement (EIS). This document does not constitute the Project EIS, nor does it detail all of the existing environmental values, benefits and potential impacts, cumulative impacts, avoidance and mitigation measures, or commitments relevant to the Project. Full details of the Project and specific matters are contained in the main body of the EIS.

Surat Basin Carbon Capture and Storage Project

1. Proposed Project Overview and Purpose

This Executive Summary of the Environmental Impact Statement (EIS) for the Surat Basin Carbon Capture and Storage (CCS) Project (the Project) summarises the most important aspects of the Project, including the existing environmental values, benefits and potential impacts, cumulative impacts, avoidance and mitigation measures, and commitments.

Under provisions of the Queensland *Greenhouse Gas Storage Act 2009* (GHG Act), Carbon Transport and Storage Corporation (CTSCo) Pty Limited was granted the greenhouse gas (GHG) exploration permit, EPQ10 on the 9 December 2019, to explore the potential for GHG storage. EPQ10 is 1,200 sub-blocks (approximately 3,664 km^2), as shown in Figure 1-1. Table 1-1 summarises the tenement and environmental authority (EA) details.

Table 1-1 Summary of Tenement and Environmental Authority Details

Item	Details
Exploration Tenement	GHG Exploration Permit 10 (EPQ10)
Grant Date commenced	9 December 2019
Term of Grant	12 years
Expiry Date	8 December 2031
Current Holder	Carbon Transport and Storage Corporation (CTSCo) Pty Limited (100%)
Area of Authority	1,200 sub-blocks or 3,664 km^2
Environmental Authority (EA)	EPPG00646913
EA Issued Date	27 January 2011
Locality of Authority	See Figure 1-1

CTSCo is developing the Surat Basin Carbon Capture and Storage (CCS) Project (the Project) in EPQ10 and is seeking to progress to the next stage of feasibility assessment by conducting GHG stream (predominately carbon dioxide (CO_2)) injection testing of up to 110,000 tonnes per year for three years.

Carbon capture and storage (CCS) presents one of the few technologies capable of abating large volumes of CO_2. If future large-scale CCS is to be adopted, viable storage locations are required to be developed. Viable storage is required irrespective if CO_2 is sourced from fossil fuel emissions or extracted directly from the atmosphere using direct air capture. The primary purpose of the proposed Project, being CTSCo's injection testing of a GHG stream, is to demonstrate the viability of geological storage of CO_2 in the Surat Basin to allow the later assessment of the region for potential future large-scale CO_2 storage. The Project has been scaled to adequately demonstrate the monitoring and verification technologies that would be required for any future large-scale GHG stream geological storage project, with only a relatively small volume of GHG stream to be injected and permanently stored as part of the injection testing. The Project also seeks to provide confidence in the GHG stream geological storage technology for both the community and regulators via a successful fixed duration injection testing, monitoring and verification program. Although the Project expects to successfully abate CO_2 emissions, the reduction in CO_2 emissions from the injection testing alone are incidental. The aim of the injection testing is to provide sufficient information to prove the feasibility of future large-scale GHG storage within the Surat Basin, and to allow timely decisions for potential development of a CCS hub in the region.

CTSCo completed an initial assessment on the capacity of the target reservoir in the EPQ10 tenement (being the Precipice Sandstone aquifer) for GHG storage in July 2020. The assessment found that the potential GHG storage capacity within the target reservoir ranged from a low of 183 million metric tonnes to a high of 730 million metric tonnes, indicating its potential for a safe and cost-effective permanent CO_2 storage at potential future industrial-scale.

The key elements of the Project include:

- transportation of the GHG stream by truck from the Millmerran Power Station (MPS) for 260 km to the injection testing site using existing public roadways (see Figure 1-1);
- within EPQ10:
  - an access road, improving the intersection of the Moonie Highway and Harts Road and a section of Harts Road to the Transportation Facility;
  - a Transportation Facility to transfer the GHG stream from trucks to holding tanks via Harts Road, adjacent to the Moonie Highway;
  - conversion of the GHG stream from a cryogenic liquid at -20°C to a supercritical (liquid-like) fluid at 31°C using a water bath heater and pump;
  - a 9.5 km buried flowline to carry the GHG stream as a supercritical fluid from the Transportation Facility to the West Moonie-1 Injection Well;
  - transfer of the supercritical GHG stream via the West Moonie-1 Injection Well (drilled in 2020) to the Precipice Sandstone, 2,250 m to 2,350 m below surface; and
  - monitoring infrastructure including the West Moonie-2 Monitoring Well (drilled in 2021), the Gubberamunda Monitoring Bore (to be drilled in 2024), the West Moonie Shallow Monitoring Bore (drilled in 2021 to 48 m into the Griman Creek Formation), an air quality and atmospheric monitoring station (to be installed in late 2024), and a buried seismic monitoring network (to be installed in late 2024 or early 2025). Note that the drilling of all wells, installation of air quality and atmospheric monitoring, and seismic activities are already permitted under EPQ10 and the current EA, and are not subject to EIS processes and assessment.

CTSCo does not propose the use of any novel or emerging technology as part of the injection testing. The Project's GHG storage injection testing is to allow an informed decision on the potential future development and permitting of GHG storage in the Surat Basin. The Project is not intended as a new technology trial. The infrastructure, technology and monitoring techniques proposed by CTSCo are established and have proven successful in CO_2 geological storage projects worldwide and within Australia. The wells and infrastructure required adopt petroleum technology that is long-established in Australia and is currently regulated within Queensland under the *Petroleum Act 1923* or the *Petroleum and Gas (Production and Safety) Act 2004* and associated regulations.

Notably, the monitoring techniques proposed by CTSCo are conventional and well established, having been successfully deployed in large-scale CO_2 storage projects in Canada and Norway in addition to the CO_2 storage project by CO2CRC in Victoria, Australia. The Australian Government has also acknowledged the standing of CCS technology as non-emerging in its "Environmental Guidelines for Carbon Dioxide Capture and Geological Storage – 2009" (Commonwealth of Australia, 2009).

Further details describing the Project are given in section 7.

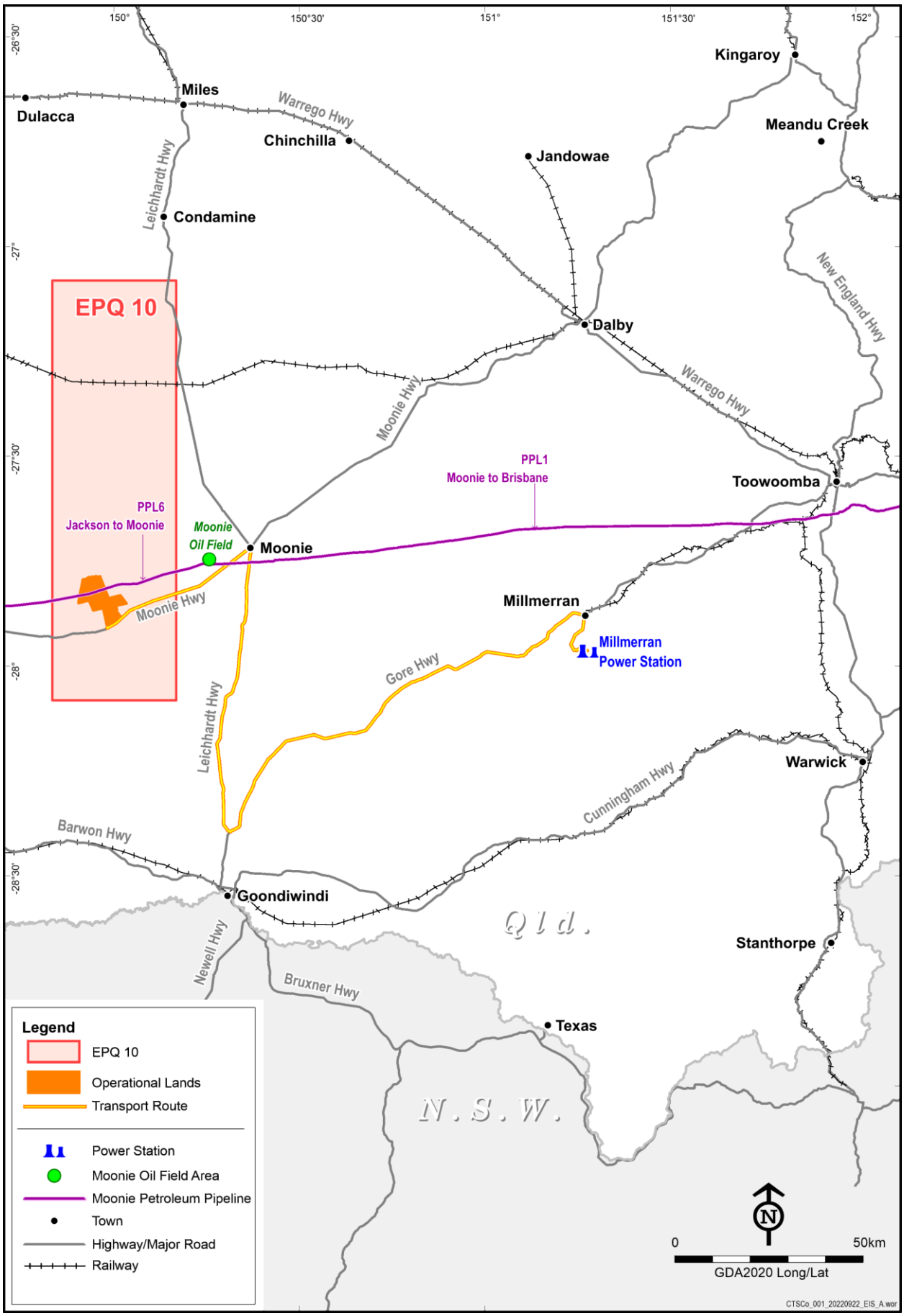

Figure 1-1 Locality of EPQ10 with Transport Route from Millmerran Power Station

2. Proponent

Carbon Transport and Storage Corporation (CTSCo) Pty Limited is the Project Proponent. CTSCo is a wholly owned subsidiary in Australia of Glencore Holdings Pty Limited (ABN 41 104 160 689), itself being a wholly owned subsidiary of Glencore plc. Glencore plc headquarters are in Baar, Switzerland, and is one of the world's largest diversified natural resource companies. Glencore has a significant presence in Australia through its coal, cobalt, copper, lead, nickel, zinc and agricultural businesses, with 25 active mining operations. Table 2-1 summarises the Proponent's details.

Table 2-1 Summary of Proponent Details

Proponent Item	Details
Proponent	Carbon Transport and Storage Corporation (CTSCo) Pty Limited
Australian Business Number (ABN)	12 143 012 971
Registered Business Address	Level 44 Gateway, 1 Macquarie Place, Sydney NSW 2000
Postal Address	GPO Box 1433, Brisbane QLD 4001
Registered Suitable Operator	RSO 653365

Glencore plc's and Glencore Holdings Pty Limited's commercial, risk management, health, safety, environment, community, and human rights policies have been adopted by CTSCo for day-to-day management activities. For further information on Glencore's policies, see: https://www.glencore.com/sustainability.

CTSCo has not committed any breaches against the Acts and regulations of Queensland or Australia, and has not been prosecuted under any relevant Queensland or Australian environmental laws since its establishment.

Across its Australian businesses, Glencore depends on and supports local businesses, with about 80% of annual spend on goods and services sourced from suppliers with operations in the regions in which Glencore's mines and other facilities are located. Local suppliers provide key services to Glencore's business, including rehabilitation, equipment maintenance, facilities management and environmental monitoring.

The Project is supported with funding from the Australian Government, Low Emission Technology Australia (LETA), Glencore plc, Electric Power Development Co. Ltd (J-Power), and Marubeni Corporation.

3. EIS and Project Approvals Processes

Under the *Greenhouse Gas Storage Act 2009* (GHG Act) section 30, GHG storage injection testing is a principal authorised activity for a GHG permit holder. However, the current Environmental Authority (EA) (EPPG00646913) for EPQ10, authorises GHG exploration in the form of exploration drilling and associated activities, but Condition 1(a) "*does not authorise the carrying out of CO_2 injection tests on EPQ10*".

Figure 3-1 provides a flowchart outlining the approvals process, including activities completed at time of EIS submission, and activities following EIS submission.

On 12 August 2021, for the injection testing, CTSCo lodged an "*Application for a decision on whether an environmental impact statement EIS would be required for an environmental authority (EA) application*".

On 10 September 2021, the appointed delegate for the Chief Executive of the *Environmental Protection Act 1994* (EP Act), the Department of Environment and Science (DES) as the administering authority of the EA, provided the Notice of decision, advising that an EIS would be required. As per the EP Act, Chapter 3, Part 1, sections 37, 40 and 73C and the DES Guideline "*The environmental impact statement process for resource projects under the Environmental Protection Act 1994*" (ESR/2016/2171, Version 2.00, Last reviewed 23 April 2019), the Project is to undertake the EIS process for resource projects to amend EA EPPG00646913.

Following the decision by DES that the Project is to be subject to EIS processes, on 7 January 2022 CTSCo referred the Project to the Australian Government (via the Department of Agriculture, Water and Environment, now the Department of Climate Change, Energy, the Environment and Water) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)(Cth), to determine whether or not the Project is considered a controlled action. On 9 February 2022, the authorised person of the Australian Government gave notice of their decision that the Project is not a controlled action under the EPBC Act, s.75 (EPBC 2021/9122). The Project therefore does not require assessment and approval under the EPBC Act.

CTSCo prepared an Initial Advice Statement (IAS) in support of a draft Terms of Reference (ToR). The Department of Environment and Science published the ToR notice, with the draft ToR subject to public consultation from 6 April to 23 May 2022 in accordance with EP Act s.42(3). A total of 24 submissions from the public were provided on the draft ToR to DES, with the final ToR published on 12 July 2022.

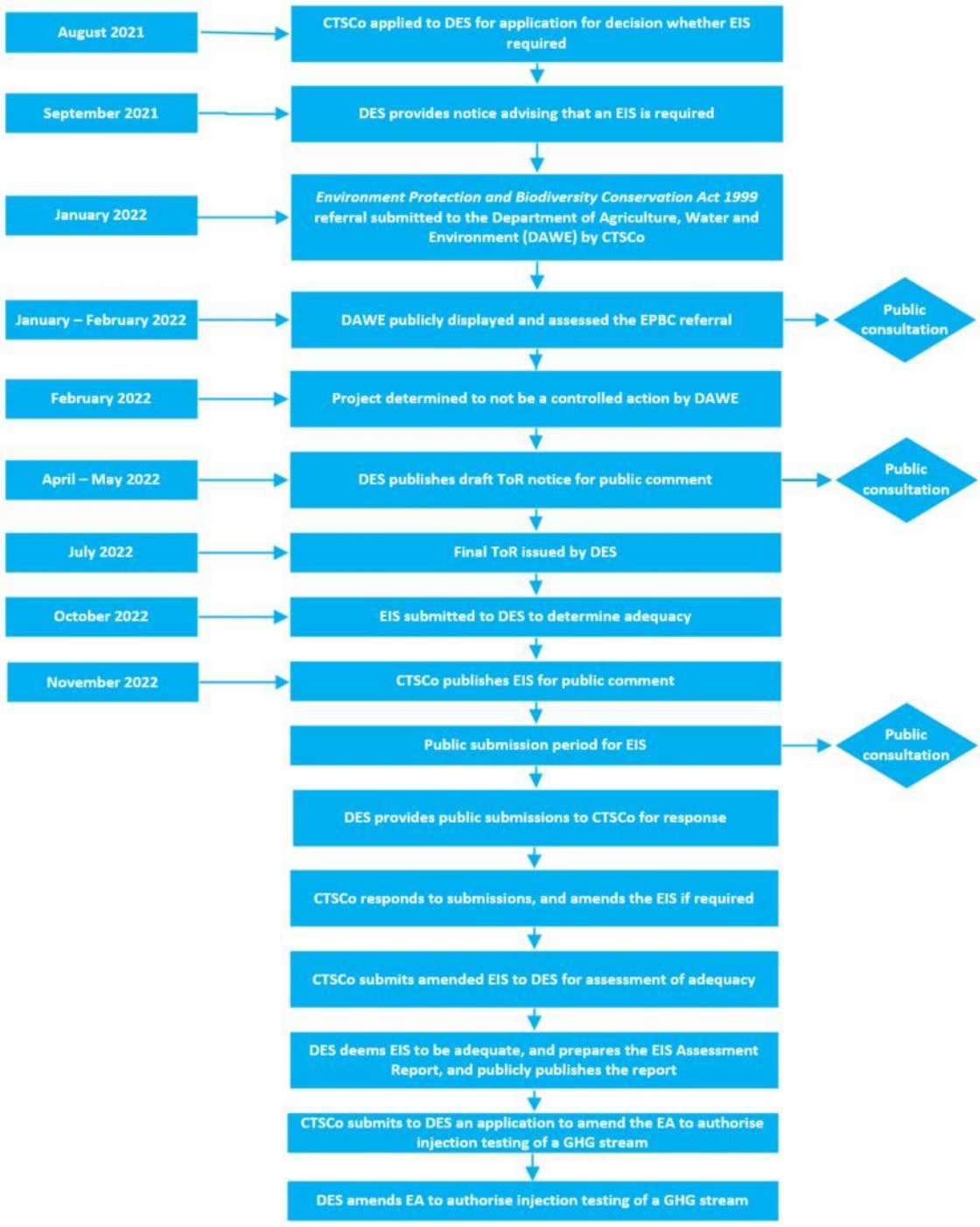

Figure 3-1 Approvals Process

In accordance with EP Act, s.40, the purposes of the EIS and the EIS process are to:

- assess:
  - the potential adverse and beneficial environmental, economic and social impacts of the Project;
  - management, monitoring, planning and other measures proposed to minimise any adverse environmental impacts of the Project;
- consider feasible alternative ways to carry out the Project;
- give enough information to Commonwealth and State authorities and the public;
- prepare or propose an environmental management plan for the Project;
- help the administering authority decide an environmental authority (EA) application for which the EIS is required, or in the case for the Project, decide the EA amendment;
- give information to other Commonwealth and State authorities to help them make informed decisions.

Under the EP Act s.107, a GHG storage activity is considered a resource activity. In accordance with EP Act s.226 and 226A, particularly with reference to s.226A(2)(a)(i), the EIS has been prepared as part of the EA amendment application process for environmental authorities to amend the current EA. A summary of key commitments and proposed EA condition amendments is provided in section 7 below, with the EIS providing a comprehensive list of all commitments and proposed EA condition amendments to authorise the carrying out of CO_2 (i.e. GHG stream) injection testing in EPQ10.

Concurrently or subsequent to amendment of the EA, other approvals to be sought by CTSCo include, but may not be limited to:

- an Injection Test Plan (ITP) including a Monitoring and Verification Plan (MVP), for submission to the Minister of Resources, as required by the GHG Act s.80 and Greenhouse Storage Regulation 2021 s.6;
- Conduct and Compensation Agreements (CCAs) with landowners of the operational lands as per the requirements of the *Mineral and Energy Resources (Common Provisions) Act 2014*;
- a Cultural Heritage Management Plan, with the Bigambul People as the Aboriginal party for the area of the operational lands, as required under provisions of the *Aboriginal Cultural Heritage Act 2003*;
- Infrastructure Agreements with the Department of Transport and Main Roads, and Western Downs Regional Council associated with road upgrade activities, as considered in the *Planning Act 2016*; and
- permit/s for crossing of watercourse/s or waterway barrier works, unless otherwise exempt.

4. Project Need

4.1 Australia's Technology Challenges and Opportunities

Australia is endowed with significant energy resources, both fossil fuel and renewable. Fossil fuels have underpinned Australia's standard of living for generations via direct and indirect employment, domestic power generation and export earnings. Building on this prosperity, Australia is now well-positioned to further benefit from this energy abundance by using newer technologies, including renewables and hydrogen. However, fossil fuels will continue to play an important part in Australia's energy mix for at least the short to medium-term. In addition, the associated CO_2 emissions from energy production and other industrial processes such as the production of cement, steel and fertiliser, present a challenge to Australia in meeting its emissions targets.

CCS presents a significant opportunity for Australia to reduce CO_2 emissions, and export emissions reduction expertise to other countries, while simultaneously building our renewable energy and hydrogen economies.

The key advantages of CCS for GHG emissions reduction include:

- direct capture of emissions from a point source could be economically feasible with a potential future price mechanism;
- potential to reduce emissions from existing hard to abate industries that generate CO_2 emissions with current technology, e.g. cement manufacturing, steel manufacturing, fertiliser production, and chemical manufacturing;
- proving the viability of CO_2 storage is an essential prerequisite if direct air capture (DAC) is required in the future;
- CTSCo's injection testing seeks to demonstrate the viability of storage in the Surat Basin for potential future large-scale CO_2 storage; and

- CTSCo's EPQ10 GHG tenement offers the potential for a future large-scale CCS Hub to enable a range of carbon capture projects within a geographical area.

The Clean Energy Regulator (CER) has developed the "*Carbon Capture and Storage Method 2021 – Simple Method Guide*" (CER, V1 September 2021) under the Emissions Reduction Fund to incentivise emissions avoidance CCS projects in Australia.

4.1.1 Technology Investment for CO_2 Abatement

4.1.1.1 INTERNATIONAL

The International Energy Agency (IEA) Report, "*Net Zero by 2050, A Roadmap for the Global Energy Sector*" (May 2021), states that for a net-zero scenario (NZE), carbon capture, utilisation and storage (CCUS) "*can facilitate the transition to net-zero CO_2 emissions by: tackling emissions from existing assets; providing a way to address emissions from some of the most challenging sectors; providing a cost-effective pathway to scale up low-carbon hydrogen production rapidly; and allowing for CO_2 removal from the atmosphere through* bioenergy equipped with CCUS *(BECCS) and* direct air capture with carbon capture and storage *(DACCS). … By 2030, 1.6 Gt CO_2 per year is captured globally, rising to 7.6 Gt CO_2 in 2050. Around 95% of total CO_2 captured in 2050 is stored in permanent geological storage and 5% is used to provide synthetic fuels. Estimates of global geological storage capacity are considerably above what is necessary to store the cumulative CO_2 captured and stored in the NZE.*" (IEA 2021, section 2.5.7).

Retrofitting coal and gas-fired power plants with CCS or co-firing with hydrogen-based fuels can enable existing fossil fuel fired power plants to contribute to the transition to a NZE economy.

Globally, the technology to capture, transport and inject a GHG stream into a deep reservoir is well proven. Table 4-1 summarises the commercial CCS facilities, as of September 2021 by number and total capacity (Global CCS Institute, 2021, Figure 6).

Table 4-1 Commercial CCS Facilities as of September 2021 by Number and Total Capacity

	Operational	In Construction	Advanced Development	Early Development	Operation Suspended	Total
Number of facilities	27	4	58	44	2	135
Capture capacity (Mtpa)	36.6	3.1	46.7	60.9	2.1	149.3

An internationally analogous CCS project is SaskPower's Aquistore/Boundary Dam Project in Canada, an industrial-scale CCUS project capturing and storing over 4.15 Mt of CO_2 since 2015. The post combustion capture (PCC) plant was the world's first commercial-scale PCC plant, with injection of CO_2 into saline sandstone aquifers of the Winnipeg and Deadwood formations, occurring at 3,200m underground, with each formation approximately 150 m thick. Monitoring of the CO_2 plume with regular seismic surveys and down-hole logs in the monitoring well shows that CO_2 has been securely retained in the reservoir with no adverse environmental impacts or induced seismicity observed (SaskPower, July 2021).

4.1.1.2 AUSTRALIA

In 2021, the Australian Government published "*Australia's Long-Term Emissions Reduction Plan, A whole-of-economy Plan to achieve net zero emissions by 2050*" and the associated document "*Australia's Long-Term Emissions Reduction Plan: Modelling and Analysis*" (Commonwealth of Australia, 2021 a and b). The NZE Plan identifies CCS as part of "*unlocking the critical pathways to net zero by 2050 for Australia's economic sectors*" (CoA, 2021a, p.45). The Modelling and Analysis identifies CCS as one of six priority low emissions technologies, stating that the Surat Basin, in addition to other basins within the nation, "*host carbon storage sites at an advanced stage of development, and each have genuine industry interest and support*" (CoA, 2021b, p.25).

The Modelling and Analysis built upon the Australian Government's "*Low Emissions Technology Statement 2021*" (DISER, 2021) which includes a stretch goal for CO_2 compression, transport and storage to be available for under $20 per tonne of CO_2. The Australian Government is investing in CCS through the Carbon Capture Use and Storage Development Fund that includes investing over $250 million from 2021 to 2030 to establish CCUS hubs, and support research, development and commercialisation of CCUS technologies.

On 16 June 2022, the Australian Government lodged an updated Nationally Determined Contribution (NDC) with the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, as part of Australia's obligations under the Paris Agreement. The updated NDC commits Australia to reducing its emissions to 43% below 2005 levels by 2030 (DCCEEW, 2022).

On 14 September 2022, the *Climate Change Act 2022* (Cth) came into force, with s.10 stipulating:

(1) Australia's greenhouse gas emissions reduction targets are as follows:
- *a. reducing Australia's net greenhouse gas emissions to 43% below 2005 levels by 2030:*
  - *i. implemented as a point target; and*
  - *ii. implemented as an emissions budget covering the period 2021-2030;*
- b. *reducing Australia's net greenhouse gas emissions to zero by 2050.*

The *Climate Change Act 2022*, s.12 also requires that the Minister prepare an Annual Climate Change Statement within 6 months of the end of each financial year, and under Part 4 the Climate Change Authority is to give advice to the Minister on preparation of the Annual Climate Change Statement and on greenhouse gas emissions reduction targets to be included in a new or adjusted nationally determined contribution.

Australia's installations of CCS include:

- Western Australia: Chevron's Gorgon Carbon Dioxide Injection Project is an industrial-scale development which reported a total of 2.26 Mt of CO_2 injected for the period 1 July 2020 to 30 June 2021 from the Gorgon liquefied natural gas (LNG) facility, with capacity to inject up to 4 Mt per year of CO_2. CO_2 is injected into a sandstone formation over 2 km below surface of Barrow Island (Chevron Australia, 2021).
- Victoria: since 2003, CO2CRC has been operating the Otway International Test Centre in Nirranda South, designing and managing research in carbon capture, storage, utilisation and monitoring (CO2CRC, 2022).

4.1.1.3 QUEENSLAND

In September 2022, the Queensland Government released the "*Queensland Energy and Jobs Plan*" (Queensland Government, 2022) outlining a vision of "*clean, reliable and affordable energy providing power for generations*" (2022, p.5). The Plan provides a number of goals, including that by 2035 there is no regular reliance on coal-fired generation (2022, p.7), and reducing electricity emissions to be 50% lower on 2005 levels by 2029-30 (2022, p.9). To make the ambitions of the Queensland Government clear, legislation will enshrine into law a 50% renewable energy target by 2030, and two new renewable energy targets, being 70% by 2032, and 80% by 2035. The Plan sets out actions across three focus areas to transform the Queensland energy system, being:

- *clean energy economy;*
- *empowered households and businesses; and*
- *secure jobs and communities* (2022, p.18 and 19).

The "*Queensland Energy and Jobs Plan*" builds on the Queensland Government's *"Pathways to a clean growth economy, Queensland Climate Transition Strategy"* (DEHP, 2017) provides the *"Queensland Government's* three key climate commitments:

- *powering Queensland with 50% renewable energy by 2030;*
- *doing our fair share in the global effort to arrest damaging climate change by achieving zero net emissions by 2050;*
- *demonstrating our commitment to reducing carbon pollution by setting an interim emissions reduction target of at least 30% below 2005 levels by 2030*."

Queensland is Australia's highest CO_2 emitting state and is "*looking to find ways to offset that pollution in another part of the economy, such as increasing carbon storage in the landscape*."…"*Queensland has also set an interim target of at least a 30% reduction in greenhouse gas emissions by 2030, contingent on continued national and global action to meet the goals of the Paris Agreement. The purpose of this target is to guide Queensland policy makers and industry in their medium-term planning and investment, while providing a clear signpost for monitoring progress towards the 2050 target*." (DEHP, p6, 2017).

The Project will assist Queensland in meeting its emissions reduction targets. There are multiple power stations within the region of the Project that may utilise CCS to help meet emissions reduction targets. Many decarbonisation actions may also produce co-benefits in areas such as health, amenity, and the environment (DEHP, 2017).

The GHG emission targets indicate that the Australian and Queensland Governments will rely on CCS projects during the transition phase to a low carbon economy, especially in the power, industrial and manufacturing sectors.

4.1.2 Glencore plc's Pathway to Net Zero Emissions

Glencore plc's position on climate change:

- supports the global climate change goals outlined in the United National Framework Convention on Climate Change (UNFCCC) and the Paris Agreement to limit the rise in global temperature to well below 2°C by the second half of this century;
- that only through collective global action can the world achieve the goals of the Paris Agreement and limit the impact of climate change, as well as deliver the United Nations Sustainable Development Goals, including universal access to affordable energy;
- recognises its responsibility to contribute to the global effort to achieve the goals of the Paris Agreement by decarbonising the company's operational emissions footprint. Glencore plc's contribution should be based on a holistic approach considering the company's total emissions footprint; and
- has a well-positioned portfolio that supports the transition to a low-carbon economy, while also meeting the need for universal access to reliable energy (Glencore plc, 2022).

Glencore plc's climate change commitments are "*in line with the ambitions of the 1.5°C scenarios set out by the Intergovernmental Panel on Climate Change (IPCC), we target a short-term reduction target of 15% by 2026 and a medium-term 50% reduction of our total (Scope 1, 2 and 3) emissions by 2035 on 2019 levels. Post-2035, our ambition is to achieve, with a supportive policy environment, net zero total emissions by 2050.*" (Glencore plc, 2022)

As outlined in Glencore plc's *Pathway to Net Zero 2021 Progress Report* (Glencore plc, 2021, p14), Glencore plc recognises the importance of abatement mechanisms such as CCS, in addition to adapting to emerging pricing mechanisms, to achieve the goals of the Paris Agreement. Development and deployment of these mechanisms requires collective action; and Glencore plc is supporting these efforts directly and through policy advocacy. The Project is an example of this commitment.

For Glencore plc, CTSCo's Project and CCS generally, align with its global sustainability and climate change aspirations, indicating the importance that it places on direct carbon capture technology for the transition to a low carbon future.

5. Project Alternatives

5.1 Do Nothing

If this Project does not proceed:

- CO_2 emissions would continue to be emitted to the atmosphere;
- the potential for improving the understanding of the suitability and feasibility of undertaking geological storage of a GHG stream (CO_2) in the Precipice Sandstone aquifer of the Surat Basin, would not occur or be delayed for several years while other proponents develop EPQs;
- development by the administering authorities of suitable EA conditions for injection testing in EPQs, and injection within GHG storage leases (QLs) would not occur or be delayed for several years; and
- the opportunity to assist the Queensland Government in driving climate action to meet its emissions targets of 30% emissions reduction below 2005 level by 2030 and zero net emissions by 2050, would be potentially delayed.

5.2 EPQ7

CTSCo previously held EPQ7 in the northern Surat Basin. At an identified development site 16 km west of Wandoan township, CTSCo conducted extensive studies of the feasibility of GHG injection testing between 2009 and 2019, including the drilling of the West Wandoan-1 well to a depth of 1,293 m below surface into the Moolayember Formation, the acquisition of detailed geological and hydrogeological data from the Glenhaven 3D Seismic Survey, studies into existing CO_2 atmospheric dynamics, and various baseline studies of surface water quality, groundwater quality, air quality and the atmosphere. The characteristics of the site included:

- a freshwater source for existing community and shared bores that draw water from the Precipice Sandstone aquifer for agriculture and community use, including the drinking water supply of Wandoan township;
- water quality that meets various water quality objectives including for aquatic ecology, town water supply, and irrigation, stock and domestic use; and
- potential for community opposition to GHG storage injection testing at this location due to the community's existing use of the water drawn from the Precipice Sandstone aquifer.

Given the potential impacts associated with water quality within the predicted plume, and community concerns from users of water from the Precipice Sandstone aquifer, in close consultation with Department of Resources, CTSCo made the decision to cease activities in EPQ7, with EPQ7 fully relinquished in 2019.

The decision to investigate EPQ10 and locate the West Moonie-1 Injection Well in its current location was that the Precipice Sandstone aquifer is saline, and the closest entity that accesses the aquifer is for the purposes of oil and gas production.

5.3 Infrastructure Alternatives

During development of the Project, various types of infrastructure, processes, methods, siting, sizing, layouts and configurations have been examined. However, the three key infrastructure alternatives considered were:

- transmission of the GHG stream from Millmerran Power Station via pipeline versus trucking by road. Pipeline construction was assessed as cost prohibitive, given the short duration of the Project and pipeline use, small volume of GHG stream, and the extent of land disturbance for pipeline construction. For a large industrial-scale GHG stream injection project, use of a pipeline to move a GHG stream from a source to an injection well becomes feasible, and would not have B-double trucks delivering a GHG stream to an injection well, thereby reducing impacts on road users and road infrastructure, and minimising greenhouse gas emissions from truck transportation.
- siting of the Transportation Facility was an iterative process, designed to minimise potential impacts on the landowner, flora and fauna habitat, sensitive places such as habitable dwellings, and sites of known cultural heritage.
- siting of the flowline was an iterative process, designed to minimise disruption to the landowner's agricultural activities, and minimise potential impacts on flora and fauna. Using horizontal directional drilling (HDD) to install a 107 m section under South Branch Stephens Creek and a 380 m section under a stand of brigalow (RE 11.4.3), will minimise construction delays and avoids potential disturbance and impacts to terrestrial and aquatic flora and fauna, and the watercourse including fish passage, flow regimes, and erosion and sediment generation.

6. GHG stream source

The GHG stream for the Project is to be sourced from a Post Combustion Capture (PCC) plant to be constructed at Millmerran Power Station (MPS), approximately 100 km west of Toowoomba, and 260 km from CTSCo's injection well, as shown in Figure 1-1. Approvals processes for the PCC plant are separate to the EIS and Project approvals processes for the Project.

Consistent with the GHG Act s.12, the CO_2 product from the PCC plant is defined as a GHG stream for the purposes of CO_2 geological storage. The CO_2 will typically be more than 98% of the volume of the product stream from the PCC plant, with the expected specification for CO_2 content greater than 99.5%. The EIS provides further details on the proposed GHG stream composition.

As per the *Guidance on Best Available Techniques and Best Environmental Practices* under Article 8 of the Minamata Convention on Mercury (UNEP, 2019), and the specification of the proposed GHG stream composition, no mercury is anticipated to be presented in the GHG stream.

The GHG stream will be stored at the PCC plant in two 200 tonne CO_2 Storage Tanks. The CO_2 will be held as a low-pressure, low-temperature cryogenic liquid at 332 psi (2.29 MPa) and -20°C for collection by truck.

7. Proposed Project Description

7.1 Proposed Project Site and Locality Description

The Project is a greenfield site development located approximately 44 km south-west of Moonie township and 27 km east of Westmar township, being the closest population centres. The Harts Road entry to the injection testing site is from the Moonie Highway.

The *Environmental Protection Act 1994* (EP Act) s.39 defines operational land as "*the land on which the project is to be carried out*." In developing the Project, consideration of an affected person as defined under EP Act s.38 is required, which includes any land adjoining the operational land. Figure 7-1 shows the operational land and land adjoining the operational land for activities within EPQ10. Note that the Moonie Highway is not considered as operational land, as it is a public road used for the transport of the GHG stream.

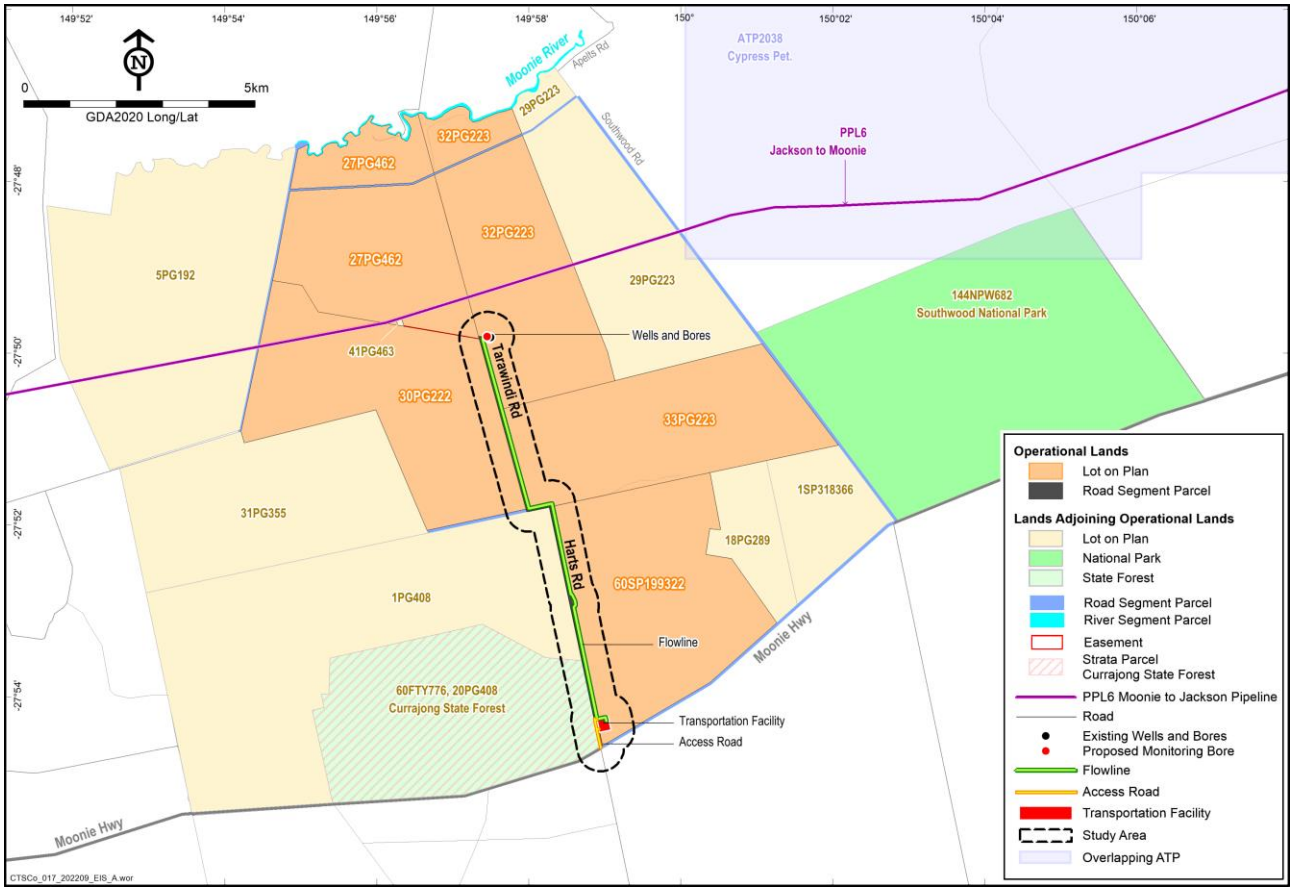

Figure 7-1 Operational Lands and Land Adjoining Operational Lands in EPQ10

The key features of the Project within EPQ10, as shown in Figure 7-2 are:

- 640 m of bitumen seal along Harts Road from the Moonie Highway intersection;
- 7.35 ha (294 m x 250 m) Transportation Facility on lot 60 SP199322;
- 9.5 km flowline, with a 107 m section under South Branch Stephens Creek and a 380 m section under a stand of brigalow (RE 11.4.3) to be installed using horizontal directional drilling (HDD), to carry the GHG stream from the Transportation Facility to the West Moonie-1 Injection Well;
- 1 ha well pad area that includes the West Moonie-1 Injection Well, West Moonie-2 Monitoring Well, West Moonie Shallow Monitoring Bore, Gubberamunda Monitoring Bore, air quality and atmospheric monitoring, and associated telemetry equipment; and
- approximately 32 km of 2D buried seismic monitoring lines.

The drilling of all wells and bores, installation of air quality and atmospheric monitoring, telemetry, and all seismic activities are already authorised under EPQ10 and the current EA, and are not subject to EIS processes and

assessment. All other key features are subject to the EIS processes and EA amendment. Figure 7-3 highlights the key features which are already authorised, and which are subject to EIS processes and EA amendment.

Important land coverage considerations for the EIS processes are:

- Disturbance Area: 13.61 ha, based on the Project's key features direct land disturbance;
- Study Area: 1,079 ha, based on a 500 m buffer distance being applied around the disturbance area of all key features, excluding 2D buried seismic monitoring lines;
- operational lands: 7,766 ha, based on five freehold lot on plans and part of Harts Road road reserve; and
- land adjoining the operational lands: six freehold lot on plans, one national park, one state forest, and nine other land parcel types.

Figure 7-2 Key Features of the Project

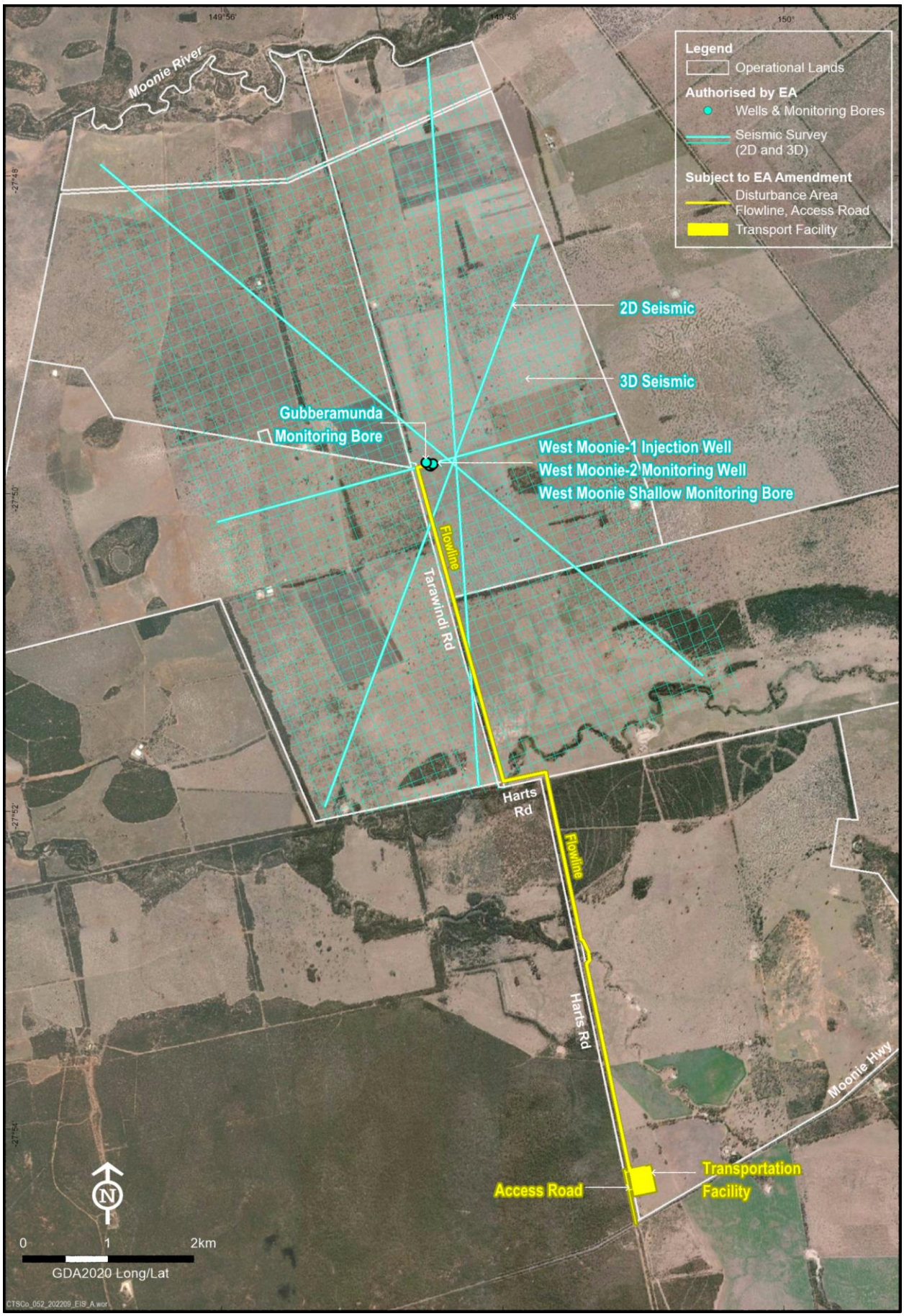

Figure 7-3 Project Key Features already authorised and those subject to EA amendment

7.2 Project Program of Activities within EPQ10

As the commencement date for construction is dependent upon the timing of the EIS processes and EA amendment, only indicative dates are provided. Table 7-1 outlines the various phases of the Project's program.

Table 7-1 Indicative Project Program Phases

Project Program Phases	Indicative Dates	Already authorised by EA	Subject to EA amendment
Exploration and Appraisal, excluding injection testing	9 December 2019 to 8 December 2031	Yes	No
Construction	January 2024 to September 2024	No	Yes
Operation (injection testing)	April 2025 to May 2028	No	Yes
Monitoring (prior to injection operation commencing) Monitoring (during injection operation) Monitoring (post-injection)*	January 2025 to April 2025 April 2025 to May 2028 June 2028 to June 2030	No	Yes
Rehabilitation	June 2028 to December 2028 June 2030 to December 2030	Partially	Yes

The monitoring (post-injection)* period is to verify the final plume position, being when the plume has ceased expansion plus two seismic surveys at a 6-monthly interval after the plume as ceased to expand, or 2 years, whichever is longer.

To enable the Project to undertake injection testing, a number of amendments to the existing EA conditions are proposed. Section 10 provides a summary of the key Project commitments and proposed EA condition amendments.

7.3 Exploration and Appraisal Activities

Exploration and appraisal activities are not subject to EIS processes or EA amendment. All exploration and appraisal activities are already authorised under EPQ10 and EA EPPG00646913. The exploration and appraisal activities are provided for context in the achievement of the overall purpose of CTSCo's activities for conducting the GHG storage injection testing, as defined by the GHG Act, s.16.

Exploration and appraisal activities include, but are not limited to:

- access tracks to the well pad;
- establishment of a 100m x 100m well pad;
- drilling of the West Moonie-1 Injection Well, the West Moonie-2 Monitoring Well, the West Moonie Shallow Monitoring Bore, and the Gubberamunda Monitoring Bore, as listed in Table 7-2 and shown in Figure 7-4;
- air quality and atmospheric monitoring equipment;
- equipment telemetry; and
- seismic monitoring (2D and 3D seismic programs) including installation of buried seismic monitors.

A Conduct and Compensation Agreement (CCA) was agreed with the landowner prior to undertaking advanced exploration and appraisal activities.

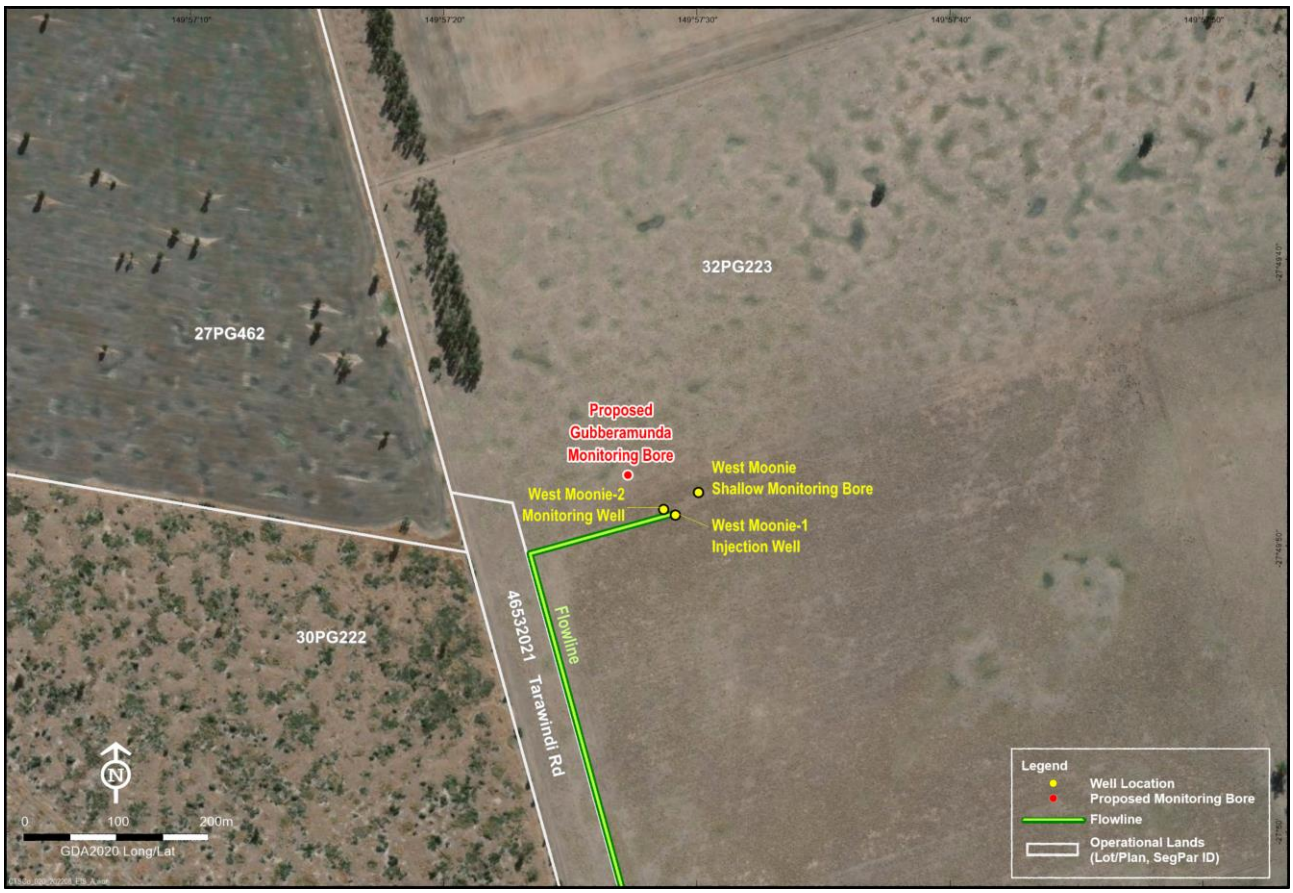

Figure 7-4 Well Layout

Table 7-2 Wells and Bores of the Appraisal Program

Well or Bore Name	Target Formation	Date Drilled	Status	Total Depth (m)
West Moonie-1 Injection Well	lower Precipice Sandstone	11/08/2020 to 14/09/2020	cased and suspended	2,710.5
West Moonie-2 Monitoring Well	lower Precipice Sandstone	01/07/2021 to 22/07/2021	cased and suspended	2,445.0
West Moonie Shallow Monitoring Bore	Griman Creek	25/05/2021 to 26/05/2021	cased (PVC) gravel packed and suspended	48.0
Gubberamunda Monitoring Bore*	Gubberamunda	April 2024 (planned)	yet to be drilled	1,400.0 (approx.)
Milgarra 1 (RN 23075)**	Gubberamunda	October 1982	producing water bore	1,242.6

Note: * planned, yet to be drilled
** does not form part of the Project, but was sampled for groundwater quality analysis of the Gubberamunda Sandstone aquifer

All wells designed, drilled, constructed and equipped by or on behalf of CTSCo comply with the relevant Australian Standards, code and guidelines, including the "*Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland*" (DNRME, 2019).

7.3.1 West Moonie-1 Injection Well

The West Moonie-1 Injection Well is the well for GHG storage injection testing for the Project. Figure 7-5 is a photo of the well in situ. Design features include:

- corrosion resistant alloy casing, with metal-to-metal gas tight connections, across flow-wet zones;
- a second casing/cement barrier for regionally important aquifers, such as the Gubberamunda Sandstone;

- GHG stream resistant cement used for cementing of steel casing, with cement integrity confirmed via cement bond logging;
- perforated steel production casing to allow connection to the Precipice Sandstone for water testing between 2,313.8 m to 2,315.8 m below surface. Approximately 8 m of additional perforations will be added to the existing 2 m perforated section prior to the commencement of GHG stream injection; and
- the wellhead and adjacent injection control equipment will include remote, real-time monitoring via a telemetry system. This system will allow continuous monitoring of pressure, temperature, and leak detection sensors to facilitate remote control. The system will also include automated shut-down, alarm and notification should injection operations deviate from expected conditions, or any leak be detected.

Figure 7-5 Photo of West Moonie-1 Injection Well

7.3.2 West Moonie-2 Monitoring Well

The West Moonie-2 Monitoring Well is the primary monitoring well in the Precipice Sandstone aquifer for the Project. Design features include:

- corrosion resistant alloy casing, with metal-to-metal gas tight connections, across flow-wet zones;
- a second casing/cement barrier for regionally important aquifers, such as the Gubberamunda Sandstone;
- GHG stream resistant cement used for cementing of steel casing, with cement integrity to be confirmed via cement bond logging prior to well completion;
- being directionally drilled from the West Moonie-1 well pad, with the bottom-of-hole location 170 m west of the West Moonie-1 Injection Well, and positioned to be within the predicted future GHG stream plume; and
- the wellhead and adjacent control equipment will include remote, real-time monitoring via a telemetry system. This system will allow continuous monitoring of pressure, temperature, and leak detection sensors to facilitate remote control. The system will also include automated shut-down, alarm and notification should injection operations deviate from expected conditions, or any leak be detected.

The West Moonie-2 Monitoring Well is currently suspended, ready for completion and fit-out of monitoring equipment prior to commencement of injection testing.

7.3.3 West Moonie Shallow Monitoring Bore

The West Moonie Shallow Monitoring Bore monitors the water present within the Griman Creek Formation. The key design features include:

- PVC casing to the Griman Creek formation;
- gravel packed across the Griman Creek formation; and
- grouted from the top of the Griman Creek formation to surface.

The main aim in drilling the well was to conduct water quality monitoring and stygofauna sampling as part of the EIS process, and for any future monitoring of the Griman Creek Formation

7.3.4 Gubberamunda Monitoring Bore

The Gubberamunda Monitoring Bore will monitor the aquifer in the Gubberamunda Sandstone. The key design features are to include:

- steel casing from surface through to the Gubberamunda Sandstone; and
- perforations to connect the aquifer of the Gubberamunda Sandstone to the wellbore.

Drilling and bore construction of the Gubberamunda Monitoring Bore is planned for early 2024. The main aims for drilling of the bore are to allow ongoing monitoring of water quality and pressure in the aquifer of the Gubberamunda Sandstone, close to the West Moonie-1 Injection Well.

7.3.5 3D Seismic Program

The 3D seismic program aims to provide a high resolution of data points of geological structures from ground surface into the Moolayember Formation, being approximately 2,600 m below surface. This survey is primarily designed to determine the reservoir properties in the Precipice Sandstone aquifer away from existing well data. Data from the 3D seismic survey will further improve the reservoir model, and will also provide additional data on any faults, fractures, deformation, stratigraphy, and other geological or hydrogeological features across a 40 km^2 surface area (5 km x 8 km) covering four lot on plans in the operational lands. Existing seismic data interpretation has shown that no faulting is present around the West Moonie-1 Injection Well location. The data outputs from the 3D seismic survey are expected to further demonstrate an absence of faulting around the West Moonie-1 Injection Well.

The 3D seismic program is scheduled to be undertaken in Quarter 1 (Q1) 2023, depending upon weather and ground conditions. Seismic lines running nominally north-south and east-west with nominal 150 m spacing between each line have been identified, as shown in Figure 7-3. Establishment of the seismic lines will avoid tall vegetation (trees and shrubs), permanent standing waterbodies or wetlands, any cultural heritage sites, existing structures, and agricultural infrastructure, as agreed with the landowners. Where grass is long, slashing of the grass will be undertaken for safe access. Wireless geophones will be inserted into the ground, each having the ability to record data for up to three weeks. Vibro-seismic vehicles will generate vibrations of known frequency and amplitude and will drive across the operational lands over a three-week period. All geophones will be removed following the survey, with recorded data taking approximately six months to process to create 3D imagery and a geophysical model of the 40 km^2 area around the West Moonie-1 Injection Well.

7.3.6 2D Seismic Program

The 2D seismic monitoring program will commence approximately three months prior to the start of the operation phase to collect a baseline data set ahead of GHG stream injection testing.

The purpose of obtaining the 2D seismic data, when partnered with other monitoring techniques includes:

- obtaining additional baseline seismic data prior to commencing the injection testing;
- monitoring GHG plume movement within the Precipice Sandstone storage reservoir to assess whether the GHG stream injected has behaved or is behaving as predicted (conformance monitoring);
- detecting if there is a risk of leakage, or leakage into other geological formations (containment monitoring); and
- obtaining scientific data to demonstrate the performance of the predicted plume area and any associated impacts.

The 2D seismic monitoring program will involve the installation of eight (8) seismic lines extending approximately 4 km each in radius from near West Moonie-1 Injection Well, as shown in Figure 7-3, with a total of approximately 32 km of seismic lines. Seismic monitoring will occur at least every six (6) months during the operation and monitoring phases. The seismic monitoring program will utilise the MicroVibe system to obtain seismic survey data. This system involves installing fixed signal source units and signal retrieval lines (also called seismic lines). The source units will emit a short duration (approximately 8 seconds) of ground-penetrating sound waves generated by a vibrating pad when a survey is required.

Installation of the receiver lines will involve excavating a 0.1 m wide trench to a depth of 1 m to 2 m. Unlike conventional seismic survey methods, the MicroVibe system does not require any clearance tracks. Receiver lines will be placed to avoid tall vegetation (trees and shrubs), permanent standing waterbodies or wetlands, any cultural

heritage sites, existing structures, and agricultural infrastructure, as agreed with the landowners. Topsoil will be immediately respread after trenching activities.

7.3.7 Air Quality Monitoring Equipment

At least 6 months prior to commencement of GHG stream injection testing, an air quality and atmospheric monitoring station will be installed on concrete footings within the well pad adjacent to West Moonie-1 Injection Well. The station and equipment will be approximately 10 m high. For all air quality and atmospheric monitoring equipment, data points will be recorded every 10 minutes, including temperate, barometric pressure, relative humidity, wind speed, wind direction, and rainfall (tipping bucket). CO_2 concentrations will be measured approximately 1.2 m above ground level in three locations, one on the monitoring station, one on West Moonie-1 Injection Well, and one on West Moonie-2 Monitoring Well. Figure 7-6 shows an indicative air quality and atmospheric monitoring station.

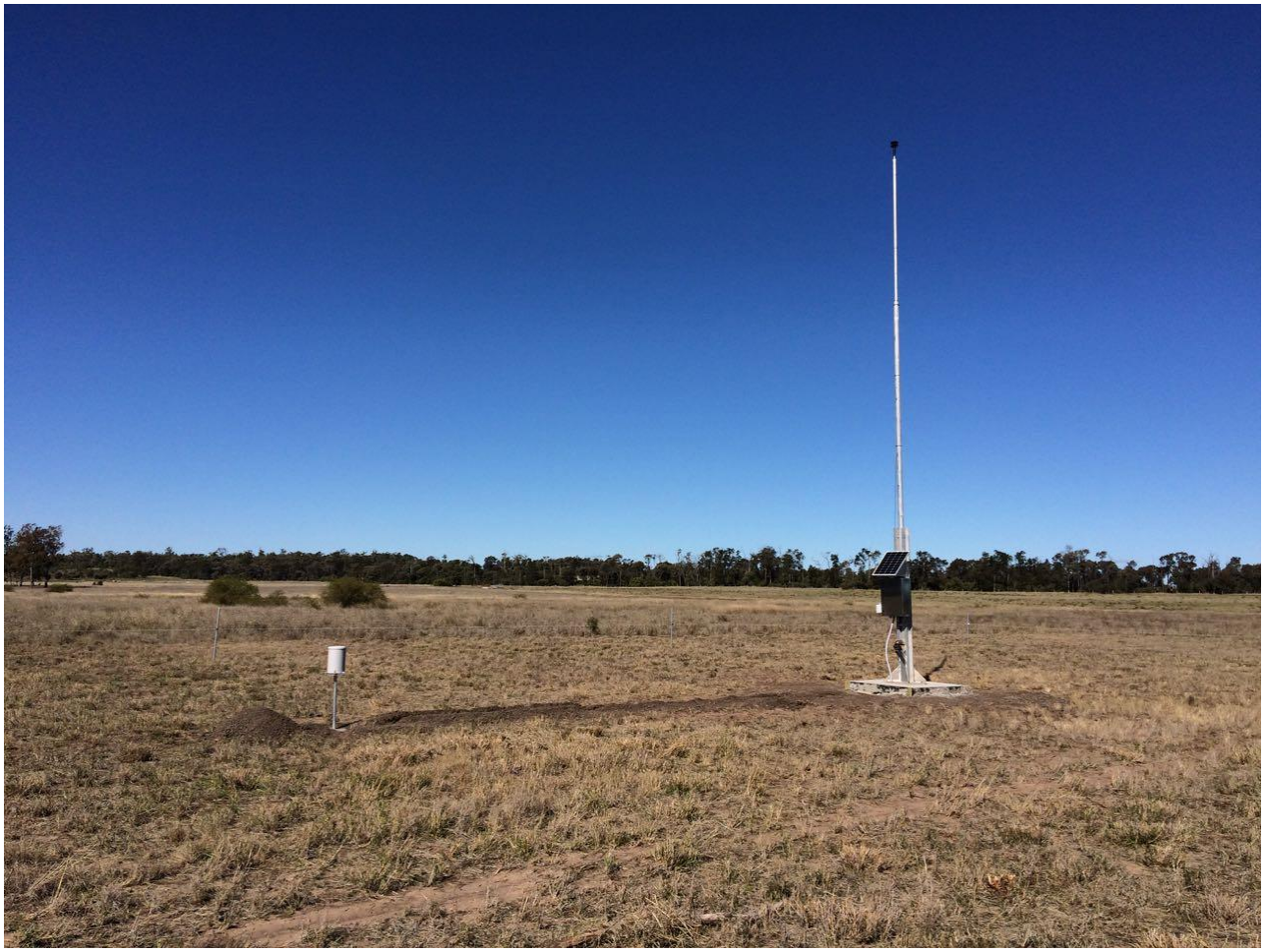

Figure 7-6 Indicative Air Quality and Atmospheric Monitoring Station (top of mast is 10 m above ground level)

7.3.8 Telemetry and Telecommunications

All equipment for the exploration and appraisal program has data recording and individual telemetry equipment installed or to be installed.

All data will be transmitted to a mobile/satellite communications relay to be installed on the well pad. The relay will boost the mobile signal in the area, sending recorded data from all monitoring equipment to a dedicated CTSCo data room in Brisbane. A satellite communications back-up system will also be installed at the Transportation Facility.

7.4 Construction, Operation, Monitoring and Rehabilitation Phases

Project key features and activities that are proposed to be undertaken as part of the construction, operation, monitoring and rehabilitation phase are considered to be advanced activities, and subject to EIS processes and where relevant, proposed EA condition amendments.

7.4.1 Fleet Profile

All vehicles and equipment will either be road registered, or transported to site on standard road registered low-loaders, B-doubles or similar. If oversized, over-mass, wide-load or similar deliveries are necessary, they will be escorted where required.

Construction and rehabilitation phase activities are anticipated to be undertaken with:

- daily workforce travel:
  - up to 6 x light vehicles;
- for earthworks:
  - 1 x D8 or D9 dozer;
  - 1 x 14 t excavator;
  - 2 x bobcats;
  - 1 x spool and reel trencher;
  - 1 x horizontal directional drilling rig (HDD) on prime mover (construction only);
  - 2 x dump trucks;
  - 3 x low loaders;
  - 1 x truck-mounted crane; and
  - 2 x concrete trucks.

Operation phase activities are anticipated to be undertaken with:

- for GHG stream deliveries:
  - up to 9 x dedicated B-double trucks with each truck fitted with purpose built 20-foot-long CO_2 cryogenic iso tank containers (in accordance with UN T75). Each iso tank container will hold 18 tonnes of GHG stream, with each truck fitted with two iso tank containers, totalling 36 tonnes per truck;
  - transportation of the GHG stream in a cryogenic state in iso tank containers is the same method used by commercial CO_2 suppliers for food and industrial applications across Australia, and meets the relevant Australian National Transport laws, regulations, codes and guidelines;
  - up to nine (9) return trips per day (one return trip per truck), up to 6 days a week (Monday to Saturday), equating to up to 18 truck movements per day during daylight hours;
- for deliveries and vehicle access during operations via Harts Road will include:
  - LPG tanker deliveries of up to 16 tonnes of LPG on a weekly basis;
  - one light vehicle every 7 days for cleaning of the office in the Transportation Facility; and
  - one light vehicle daily for inspection of plant and equipment along the access road, in the Transportation Facility, along the flowline and at the injection testing site.

Monitoring phase activities are anticipated to be undertaken with:

- one or two light vehicles occasionally inspecting plant and equipment at the injection testing site.

7.4.2 Workforce Management

Table 7-3 summarises the anticipated full-time equivalent (FTE) number of persons during the various phases of the Project in the field at any one time.

Table 7-3 Summary of FTE Persons in the Project Program Phases, in-field

Project Program Phases	Indicative Dates	FTE Persons
Exploration & Appraisal*, excluding injection testing	9 December 2019 to 8 December 2031	Not applicable to EIS
Construction	January 2024 to September 2024	10
Operation (injection testing)	April 2025 to May 2028	5
Monitoring	January 2025 to May 2028 June 2028 to June 2030	2
Rehabilitation	June 2028 to December 2028 June 2030 to December 2030	15
	Total FTE Persons	**32**

***** Note that exploration and appraisal activities are not included in the workforce numbers, as these activities have been or will be undertaken under the current conditions of EPQ10 and the EA.

Office-based technical personnel will also be based in Brisbane, with up to 10 people during construction, 4 people during operation, 4 people during monitoring, and 4 people during rehabilitation phases.

All personnel will drive in, drive out (DIDO) to the Project area. No fly-in, fly-out (FIFO) of the workforce is proposed for any phase of the Project.

Contracting of local people in the area will be considered, depending upon the skills available. During all phases, the local area is considered to be localities within 1 hour to 1.5 hours drive of the Transportation Facility, such as Moonie, Westmar, Dalby, Goondiwindi and St George. For the operation phase for activities associated with transportation of the GHG stream, the local area will additionally include Millmerran and surrounds.

Workdays are nominated as Monday to Saturday inclusive, excluding any public holidays recognised for Queensland, Brisbane or Moonie areas. However, the majority of activities are anticipated to be conducted Monday to Friday.

Personnel work hours are anticipated to be 10-hour days, daylight only, typically between 7 am and 6 pm for all nominated workdays. Fatigue management requirements will be considered in all journey planning, mobilisation and demobilisation, general travel to and from site to accommodation, and personnel rostering.

For the GHG stream injection activities, operations will be conducted 24 hours a day, 7 days a week, but will not require personnel on-site at all timeframes, with continuous remote monitoring of all critical equipment.

Various skills across professional and trade qualifications will be required during the Project phases, including but not limited to:

- engineers;
- construction supervisors;
- plant operators for earthworks;
- B-double qualified truck drivers;
- crane operators;
- concreters;
- welders;
- plumbers;
- electricians;
- surveyors;
- fencing contractors;
- clerical;
- inspectors;

- health and safety supervisors;
- environmental officers or technicians; and
- cleaners.

All in-field personnel will be required to hold suitable qualifications and certification under the health and safety requirements of the *Petroleum and Gas (Production and Safety) Act 2004*. Truck drivers transporting the GHG stream or other materials subject to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) will also be required to be suitably licenced or otherwise accredited.

Where potential employees or contractors require training, accreditation or certification to be compliant with various health, safety, environmental, commercial, governance or other regulatory requirements, CTSCo will facilitate the necessary training accordingly, including implementation of Glencore plc's conduct of conduct, procurement, and human rights policies.

7.4.3 Access Road

Access to the Project during construction, operation, monitoring and rehabilitation phases will be from the Moonie Highway into Harts Road, then into the one-way access and egress points of the Transportation Facility. The Moonie Highway – Harts Road intersection is 44 km west of Moonie township.

The Moonie Highway (35A) is a regional state-controlled road, featuring a fully sealed dual lane carriageway, suitable for B-double trucks operating at a 100 km/h speed environment.

Harts Road is a local road, currently with a gravel surface, single plus lane carriageway. Opposite Harts Road is the Dicks Road intersection with the Moonie Highway. Dicks Road is also a local road with gravel surface.

Although the traffic volumes and vehicle movements associated with the Project are below the design thresholds to modify the Moonie Highway – Harts Road intersection, CTSCo proposes to construct a channelised right-turn lane from the Moonie Highway into Harts Road, and left-turn acceleration lane on the Moonie Highway from Harts Road to improve access and egress to the Harts Road.

Development of Harts Road to allow access and egress to and from the Transportation Facility will require the forming, shaping and bitumen sealing of approximately 640 m of the existing carriageway into a dual lane local road suitable for B-double and low-loader trucks.

Access and egress from Harts Road into the Transportation Facility will provide a one-way traffic flow through the Transportation Facility. Access will be approximately 612 m and egress approximately 404 m from the Moonie Highway intersection.

Road improvements of both the Moonie Highway and Harts Road will be negotiated and agreed with the Department of Transport and Main Roads for the highway, and Western Downs Regional Council for Harts Road. All necessary permits and approvals and any Infrastructure Agreements will be sought by CTSCo prior to the commencement of construction. Subject to commercial negotiations, construction will be undertaken by either a local road construction contractor or council.

During the operation phase, as depicted in Figure 1-1, trucks will transport the GHG stream on 260 km of public roads, from the MPS:

- 15 km along Moffatt Reserve Road and the Millmerran-Inglewood Road to Millmerran;
- turn left onto the Gore Highway (28B), heading west for 122 km;
- turn right onto the Leichhardt Highway (26C), heading north for 79 km;
- turn left onto the Moonie Highway (35A) at Moonie, heading west for 44 km; and
- then turn right at the Harts Road intersection.

The return journey to MPS will be via the same route.

Given that the access road is Harts Road, which is a local public road, no restrictions on the access to Harts Road are anticipated during the Project phases, except for potential delays during access road improvements as part of the construction phase.

Landowners and/or leaseholders of operational lands or land adjoining operational lands are understood to be the only current users of Harts Road. This is not anticipated to change during the Project.

CTSCo proposes that the improvements to the Moonie Highway and Harts Road remain once the Project is completed.

7.4.4 Transportation Facility

The Transportation Facility will be accessed from Harts Road, and will cover 7.35 ha, as shown in Figure 7-7. The Transportation Facility includes the following key features:

- office, including crib room and amenities for personnel to allow for personal comfort and fatigue management;
- one-way traffic flow on bitumen sealed roadway through security gates;
- cryogenic GHG stream off-loading and storage tanks;
- water bath heater and LPG tanks; and
- pumps and flowline valves and connections.

The Transportation Facility allows for the delivery of the GHG stream by B-double trucks onto operational land into a defined and secure area, where the GHG stream is converted from low-pressure, low-temperature cryogenic liquid at 332 psi (2.29 MPa) and -20°C to a high pressure, dense, liquid-like state up to 1,500 psi (10 MPa) and approximately 31°C using a water bath heater and pump, to then be pumped down the flowline.

Any quarried materials (rock, gravel, road base) and concrete required will be sourced locally from existing licenced suppliers. No new quarries, concrete batching plants or similar will be required for construction of the Transportation Facility.

Most of the plant, equipment and structures will be delivered to the Transportation Facility as fully prefabricated units, ready for installation during construction, then removal during rehabilitation.

During the rehabilitation phase, all plant, equipment, structures, concrete, gravel, roads, and the like will be removed, and the land rehabilitated to pasture consistent with the surrounding paddock.

Figure 7-7 Transportation Facility

7.4.5 Flowline

During the operation phase, the flowline will convey the supercritical GHG stream from the water heater bath to the West Moonie-1 Injection Well. The flowline will be constantly charged, delivering up to 15 t/h of GHG stream to the well head. Monitoring equipment will monitor all inlets, outlets and any other connection points for temperature, pressure, flow rate and other items as required by the relevant standards.

As shown in Figure 7-2, the flowline corridor and right of way (ROW) is anticipated to be 9.5 km in length and 5 m wide, commencing at the Transportation Facility, along western boundaries of lots 60 SP199322, 33 PG223 and 32 PG223, and then turning east to the West Moonie-1 Injection Well. The western boundaries of the properties have been historically cleared due to installation of boundary fencing and firebreaks.

A 107 m section under South Branch Stephens Creek and a 380 m section under a stand of brigalow (RE 11.4.3) will be installed using horizontal directional drilling (HDD), minimising construction delays, and disturbance and impacts to the watercourse, flora, and fauna.

Otherwise, construction of the flowline will be by standard open trench and pipe laying methods for a spool and reel system. Typical spool and reel construction configuration involves a trench excavator removing soil to 1.5 m depth in a 0.5 m wide slot, with the flowline spooled directly into the trench. The trench is then backfilled with a small excavator. One flowline spool contains 1 km of flowline. All flowline connections will be undertaken at time of laying the flowline.

Once installed, integrity testing of the flowline will be by hydrotesting, that is, filling the flowline with potable or stock/domestic quality water to detect any leaks.

During the rehabilitation phase, the flowline will be disconnected at each end and filled with cement to remain in situ.

7.4.6 Wells

All injection testing activities and monitoring and verification activities will be in accordance with the Injection Test Plan (ITP) which will include a Monitoring and Verification Plan (MVP) as required by the GHG Act s.80 and GHG Regulation s.6.

7.4.6.1 WEST MOONIE-1 INJECTION WELL

The primary purpose of the West Moonie-1 Injection Well is to inject GHG stream into the Precipice Sandstone aquifer. The injection well infrastructure will inject up to 110,000 tonnes per year of the GHG stream, injecting for a 3-year period. Injection is anticipated to be conducted continuously 24 hours a day, 7 days a week, with the site being unmanned, and the performance of all injection infrastructure remotely monitored and controlled from the control room in the Transportation Facility and from Brisbane.

As shown in Figure 7-8 at depths below surface of 800 m (0.8 km), CO_2 naturally increases in density and becomes a supercritical fluid. Supercritical fluids take up less space by increasing in density and diffuse better than either gases or ordinary liquids through the tiny pore spaces in storage rocks, such as sandstone. The blue numbers in Figure 7-8 show the volume of CO_2 at each depth below surface, compared to a volume of 100 at the surface (CO2CRC, 21 February 2021).

Injection testing of the GHG stream supercritical fluid will be via the West Moonie-1 Injection Well. The GHG stream will be injected into the wellhead at approximately 31°C and 1,377 psi (9.5 MPa). The GHG stream will take approximately 52 minutes to travel from the wellhead to the perforated injection zone in the lower Precipice Sandstone. During this process, the well is expected to act as an effective heat exchanger, warming the GHG stream as it travels between the surface and the injection depth. The relatively slow transport speed of the GHG stream within the well tubing results in the GHG stream being delivered to the injection zone at a temperature of approximately 80°C and a pressure of 3,270 psi (22.54 MPa). Figure 7-9 demonstrates the expected changes in temperature, pressure and pH as the GHG stream moves through to the target formation. Further discussion on the behaviour of the GHG plume and its interaction with the target reservoir and surrounding geology is given in sections 7.5, and 9.5 below.

At the West Moonie-1 Injection Well, a suite of sensors will be installed to monitor for any GHG stream leakage or changes in well operating conditions that require intervention. Continuous atmospheric CO_2 monitoring and wellhead temperature monitoring will be installed at the injection wellhead to detect any GHG stream leaks at the wellhead.

Pressure monitoring will be installed in both the tubing-production casing annulus and in the surface casing-production casing annulus to detect any leakage within the well. Downhole temperature and pressure gauges shall be installed on the production tubing to monitor injection pressures close to the Precipice Sandstone. All well monitoring will be integrated into the automated control system at the well to allow immediate shutdown of injection operations should any leak and deviation from expected operating parameters are detected. Measurements from the well monitoring system will be transmitted via a 4G communication link (with satellite back-up) to allow remote monitoring, alarm notification and control (if required).

Following completion of injection activities, West Moonie-1 Injection Well will be suspended, in accordance with the GHG Act, and any applicable provisions of the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act) and regulations. Monitoring of the well will be ongoing throughout the monitoring phase.

The findings of the Project will determine whether or not the Project wells are:

- immediately plugged, abandoned and rehabilitated following completion of the anticipated 5-year period of injection and monitoring phases; or
- suspended and shut-in for future development, subject to further approvals.

Final rehabilitation will be in accordance with EPQ10 conditions, EA conditions and legislative requirements, including the "*Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland*" (DNRME, 2019) or later version thereof.

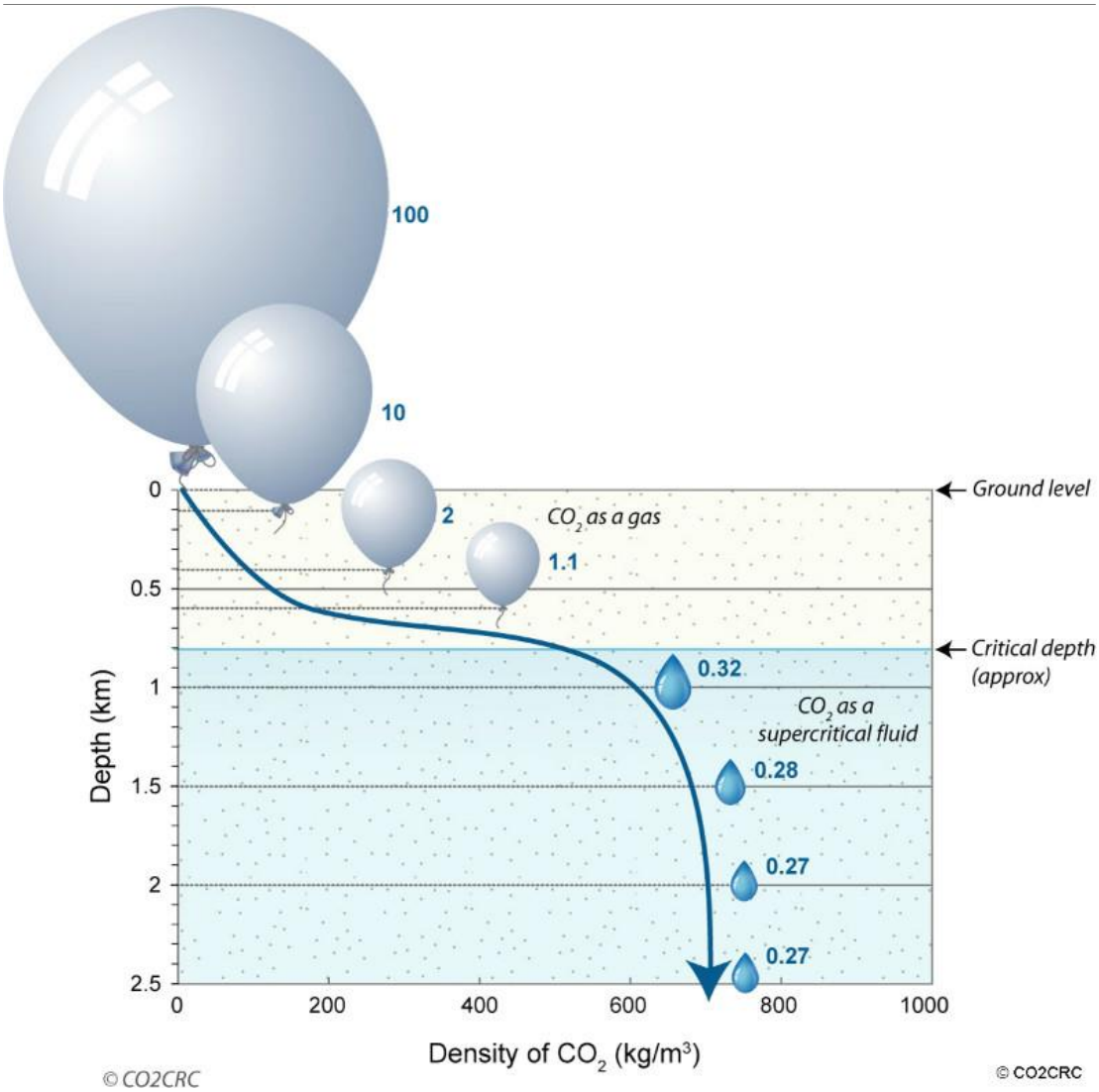

Figure 7-8 Storage Phases of GHG stream (density of CO_2 vs depth (km)) (source: CO2CRC, 21 February 2022)

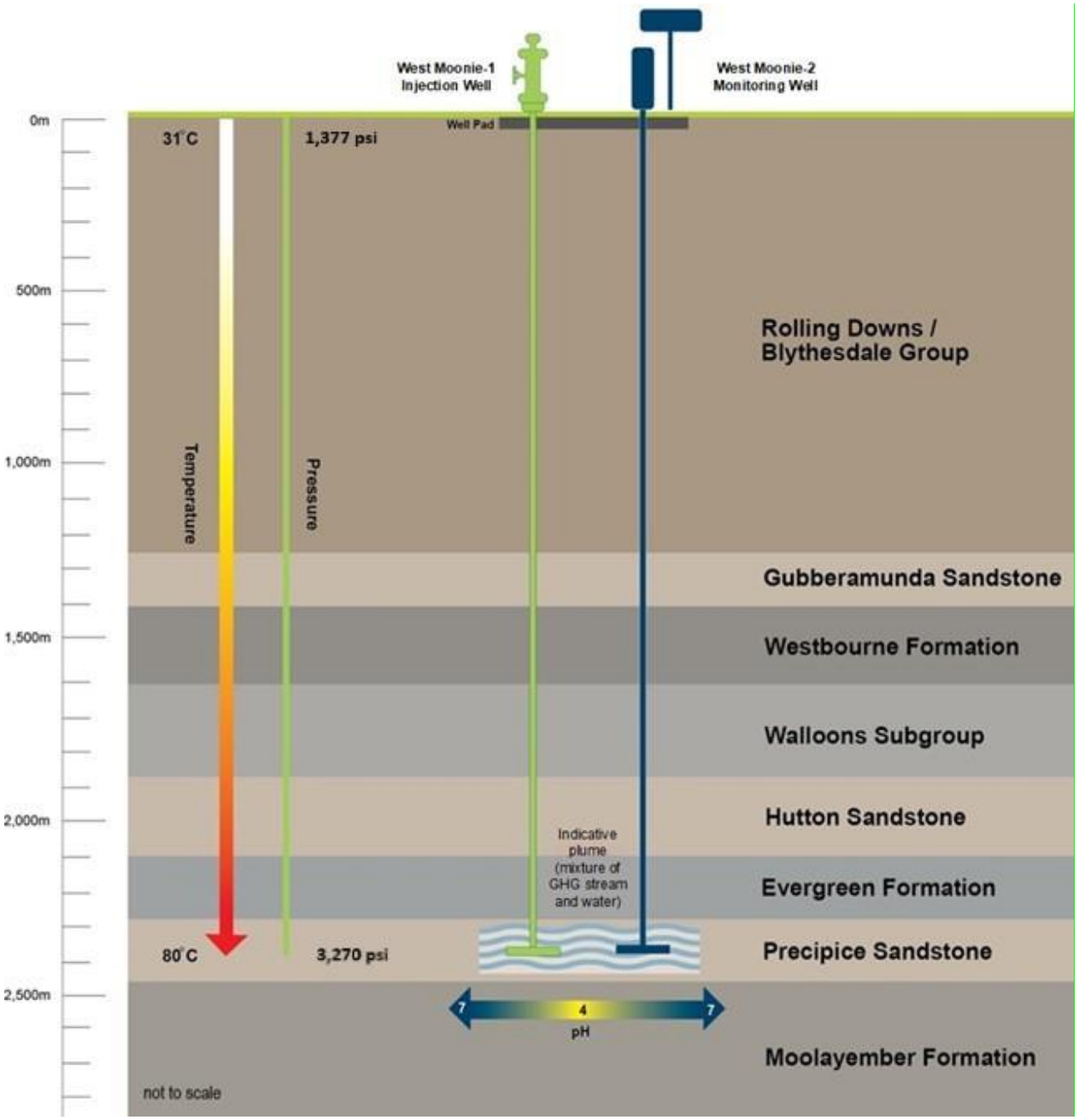

Figure 7-9 Temperature, Pressure and pH changes through GHG stream injection

7.4.6.2 WEST MOONIE-2 MONITORING WELL

The West Moonie-2 Monitoring Well has been located to be within the plume perimeter during the injection testing phase. The primary purposes of the West Moonie-2 Monitoring Well is to allow measurement of the plume position vertically within the reservoir (using wireline logging), and to allow for water sampling and subsequently water chemistry testing from within the plume.

At the West Moonie-2 Monitoring Well, a suite of sensors shall be installed to monitor for any GHG stream leakage or changes in well conditions requiring intervention. Continuous atmospheric CO_2 monitoring and wellhead temperature monitoring will be installed at the monitoring wellhead to detect any GHG stream leaks at the wellhead. Pressure monitoring will be installed in both the tubing-production casing annulus and in the surface casing-production casing annulus to detect any leakage within the well. Downhole temperature and pressure gauges shall be installed on the production tubing to monitor Precipice Sandstone pressure. All well monitoring will be integrated into the automated control system at the well to allow immediate shutdown of injection operations should any leak and deviation from expected monitoring parameters be detected. Measurements from the well monitoring system will be transmitted via a 4G communication link (with satellite back-up) to allow remote monitoring, alarm notification and control (if required).

7.4.6.3 WEST MOONIE SHALLOW MONITORING BORE

The purpose of the West Moonie Shallow Monitoring Bore is primarily to allow sampling of the Griman Creek Formation to monitor for any changes in water quality.

During the rehabilitation phase, the bore will be fully rehabilitated.

7.4.6.4 GUBBERAMUNDA MONITORING BORE

The primary purpose of the Gubberamunda Monitoring Bore is to allow sampling of the Gubberamunda aquifer to monitor for any changes. No impacts are expected in the Gubberamunda aquifer as a result of the injection testing. This monitoring bore is design to provide additional verification of the absence of any impacts on this important regional water source by the injection testing in the deeper Precipice Sandstone aquifer.

Subject to negotiations with the landowner, the Gubberamunda Monitoring Bore may be converted to a water supply bore for stock and domestic or irrigation purposes during the rehabilitation phase of the Project. Otherwise, the bore will be fully rehabilitated.

7.4.7 2D Seismic Monitoring Program

Further to section 7.3.6, when 2D seismic monitoring is conducted at least every 6 months during the operation and monitoring phases, data obtained by each of the geophones will be transmitted to CTSCo for processing, interpretation, and reporting. Raw data from survey will be transmitted directly over a 4G network (or back-up satellite network) to the Brisbane office data centre.

The seismic monitoring network will be used to monitor early plume development and its maximum extents. Seismic surveys will be undertaken using all seismic lines on at least 6-monthly intervals. Groundwater, CO_2 and CO_2 rich water produce distinctly different seismic responses. Hence, seismic surveys are ideally suited to monitoring the plume extent. Seismic surveys will be undertaken prior to commencement of injection activities to establish baseline conditions (i.e. the seismic properties of the groundwater-bearing formations in the absence of injected CO_2). Seismic surveys will continue on at least 6-monthly intervals during and post-completion of injection activities to detect any changes in the baseline seismic conditions due to the presence of CO_2. Seismic surveys will continue in the post-injection monitoring phase to verify the final plume position, being when the plume has ceased expansion plus two seismic surveys at a 6-monthly interval after the plume has ceased to expand, or 2 years, whichever is longer. The results of each seismic survey will show the vertical and horizontal extent of the plume along each seismic line. The results collected from each seismic line and the West Moonie-2 Monitoring Well will be integrated to show the plume extent in three dimensions. This form of seismic surveying allows for a time-lapse view of plume location.

CTSCo has selected time-lapse seismic surveying as the primary monitoring method for the injection testing. Seismic monitoring allows for robust CO_2 plume position determination, both vertically and horizontally, within the storage reservoir. The technique also allows for detection of unanticipated CO_2 in overlying formations, both adjacent and distant to the West Moonie-1 Injection Well. Consequently, seismic monitoring offers spatial monitoring that can not be achieved reliably using monitoring wells. Seismic monitoring of CO_2 plumes is also an established and proven technology, with the majority of CO_2 storage projects globally using the technology as their primary plume monitoring technique. Furthermore, some international CCS projects have eliminated monitoring wells from their reservoir surveillance programs in favour of time-lapse seismic monitoring.

7.5 Management of Departures from Predicted Plume Behaviour

Section 9.5 Geology and Groundwater below outline the predicted GHG plume behaviour based on various types of analysis and modelling already undertaken.

CTSCo recognises the importance of appropriate monitoring to demonstrate compliance with EP Regulation s.41, including comparison to the predicted GHG plume behaviour and observations obtained from monitoring data. The monitoring and verification program has been designed to detect movements of the GHG plume, and changes in water quality parameters of the target reserviour, being the Precipice Sandstone aquifer. The monitoring and verification program is specifically designed for early detection of any potential departures from predicted plume behaviour and associated effect.

Based on the requirements of EP Regulation s.41, learnings from other global CCS projects, and knowledge of the geological charactieristics of the Surat Basin, CTSCo has identified the potential departures from the predicted plume behaviour may include:

- if not released entirely within a confined aquifer (s.41(2)(a)):
  - the plume spreading beyond its predicted spatial extents;
  - the plume leaking through the reservoir seal (Evergreen Formation) into the overlying Hutton Sandstone aquifer;
  - the plume leaking into overlying aquifers due to failure of the West Moonie-1 Injection Well;
  - injection resulting in larger and/or more extensive pressure level changes in the Precipice Sandstone aquifer than predicted;
  - any standing water level changes due to injection activities in the Gubberamunda aquifer;
- if a surface ecological system is adversely affected or there is deterioration in the environmental values of the receiving water (s.41(2)(b) and s.41(2)(c)):
  - changes in groundwater quality within the plume beyond predicted levels compared to existing water quality of the Precipice Sandstone aquifer; and
  - changes in CO_2 concentrations in the atmosphere immediately adjacent to the West Moonie-1 Injection Well or West Moonie-2 Monitoring Well.

CTSCo does not expect these departures to occur during the Project given the Precipice Sandstone is a confined aquifer. Further detail is provided in section 9.5.5 below.

To ensure that the above departures will not cause unmitigated impacts, monitoring will include:

- continuous monitoring of plant and equipment in the Transportation Facility and flowline;
- continuous monitoring of the integrity of the wells via annulus pressure monitoring;
- continuous groundwater pressure monitoring;
- continuous monitoring of CO_2 concentrations in the atmosphere at and immediately adjacent to the wells;
- twice daily monitoring of groundwater standing water level within the Gubberamunda Monitoring Bore;
- 6-monthly pulsed-neutron wireline logging of the wells;
- 6-monthly 2D seismic surveys;
- 6-monthly sampling of the groundwater from the West Moonie-2 Monitoring Well for water quality analysis; and
- 6-monthly sampling of the groundwater from the Gubberamunda Monitoring Bore and West Moonie Shallow Monitoring Bore for water quality analysis.

If the monitoring results show a potential departure from the predicted GHG plume behaviour based on various triggers, an investigation will be undertaken. The scope of an investigation will include confirming the cause of the departure and where relevant, updating the modelling predictions using the available monitoring data. If investigation findings show that the departure is due to the Project activities rather than natural fluctuations, additional mitigation measures will be implemented, and reporting to the administering authorities undertaken. The potential additional mitigation measures include, but may not be limited to:

- additional pulsed-neutron wireline logging of the wells;
- additional 2D seismic survey;
- additional groundwater quality sampling and analysis;
- temporary suspension of injection activities;
- injection activities permanently cease; and
- development of a Trigger Action Response Plan (TARP) with input from administering authorities. Content of a TARP would be dependent upon the investigation findings.

7.6 Capital and Operational Expenditure

The total anticipated capital expenditure (CAPEX) and operational expenditure (OPEX) for the both the PCC plant and Project (the subject of the EIS) is $210 million (AUD). The PCC plant expenditure is $165.4 million (AUD) and the Project expenditure is $44.6 million (AUD).

8. Consultation

CTSCo's current Community and Stakeholder Engagement Program for the Project builds on the foundations and key learnings from numerous carbon capture and storage (CCS) projects within Australia and overseas, including the insights from the activity in EPQ7 around the township of Wandoan. CTSCo has applied these learnings to help shape the engagement program in EPQ10 that is appropriate and relevant to interested and affected persons and the broader Project stakeholders. This approach is designed to ensure the benefits of the Project can be demonstrated to the community and stakeholders to enable long-term sustainable economic growth for Queensland.

The objectives of the community and stakeholder consultation process are to:

- identify affected and interested stakeholders for the Project;
- establish open and transparent lines of communication with all stakeholders;
- maintain and build on existing relationships between CTSCo and those stakeholders already engaged as part of consultation conducted for EPQ7;
- ensure stakeholders have an understanding of the Project, how it may affect them, the EIS processes and how they can participate, be informed and consulted;
- provide accurate, timely, and relevant Project information to all stakeholders;
- identify stakeholder issues and concerns regarding the Project;
- identify potential Project opportunities with stakeholders; and
- respond to stakeholder issues raised and identify appropriate strategies to address those issues.

Table 8-1 summarises the methods of consultation and communication for the Project.

Table 8-1 Methods of Consultation and Communication

Method	Description
One-on-one sessions with stakeholders at a local and regional level	Direct engagement with individuals and groups including face-to-face meetings, telephone calls, MS Teams teleconferences, and presentations. People are provided with opportunities to raise questions and concerns and discuss matters raised. Note that COVID restrictions are considered during engagement sessions.
Communication materials (diagrams, maps, images, factsheets, videos, presentations, media statements	Technical and non-technical information presented to provide detail on the Project, including but not limited to the Project's purpose, site selection, geology, groundwater, injection testing process, and monitoring and verification processes, plus information on other CCS projects from around the world and in Australia.
Correspondence	Communication materials are provided via email or post, typically following one-on-one sessions with stakeholders.
CTSCo website	A centralised project and GHG stream industry information source, including links to third-party independent information sources www.ctsco.com.au
Direct contact and interaction with government personnel	Open book approach with the sharing of data and information to ensure robust processes and outcomes.
Interviews with journalists and media presenters	Providing relevant fact-based information on CCS to the broader public.

CTSCo has established consultation reporting and feedback methods, including complaints processes that align with EA condition 57.

Following the EIS processes and amendment of the EA, CTSCo will set-up a Community Reference Group (CRG) consisting of representatives from state and local governments, industry, regionally based non-government

organisations (NGOs), local community members and landowners, to meet periodically to discuss the Project and review outcomes from the injection testing process.

Identifying interested and affected persons, sensitive places, commercial places, other interested parties and local area of engagement considered the:

- definitions in the EP Act, s.38 and s.41;
- definitions of sensitive place and commercial place in the EA;
- townships within a 50 km radius of the West Moonie-1 Injection Well, being Moonie and Westmar;
- groundwater bores within a 50 km radius of the West Moonie-1 Injection Well;
- the proposed transport route for the GHG stream during operations, including towns or villages along the route; and
- native title determination area associated with the Project, with the Bigambul Native Title Aboriginal Corporation (BNTAC) being the recognised Aboriginal party for cultural heritage purposes.

In undertaking consultation, the three most raised issues and views are associated with:

- the Project's description including understanding what is CCS and how does it work;
- EIS processes including what the EIS will cover and how to have input; and
- hazards and safety, particularly the transportation of the GHG stream and truck movements.

Resolution of issues and views raised will be progressed during the Project phases, with matters addressed:

- as part of the EIS process;
- as part of the Cultural Heritage Management Plan (CHMP) process under the *Aboriginal Cultural Heritage Act 2003*;
- by entering into Conduct and Compensation Agreements (CCAs) with landowners and occupiers (as defined under the *Minerals and Energy Resources (Common Provisions) Act 2014*) of operational lands;
- by entering into Infrastructure Agreements with the Department of Transport and Main Roads, and Western Downs Regional Council for upgrading of road infrastructure,
- by developing and implementing an emergency response plan with the various Queensland Emergency Services organisations;
- by developing and implementing a Community and Stakeholder Engagement Strategy and Plan for all Project phases;
- fostering genuine relationships with owners of operational lands, land adjoining operational lands, credible local influencers, including community leaders, NGOs, government bodies, and those that have an interest in the Project's activities, including the formation of the CRG prior to the construction phase of the Project and conducting meetings throughout the Project phases, with the first meeting at commencement of construction;
- fostering educational opportunities around CCS;
- continue to implement the Complaints Process; and
- engaging stakeholders with methods of communication that are direct, relevant, appropriate, credible, and COVID safe (when required), including publishing key data and results during the operation (injection testing) and monitoring phases on the Project website.

As a result of feedback from various stakeholders, alterations to the Project that have been included in the Project's description and approach, include:

- moving the proposed injection site from EPQ7 to EPQ10;
- proposing to inject into a saline aquifer (i.e. non-potable water);
- proposing monitoring and verification based on progressive findings during the monitoring phase;
- proposing bitumen sealing of Harts Road where vehicles will access the Transportation Facility;
- locating the Transportation Facility to minimise clearance of habitat trees and protected ecosystems, thereby minimising potential environmental impacts;
- proposing to construct the flowline within private properties;
- proposing horizontal directional drilling (HDD) under a watercourse and listed regional ecosystem to minimise clearance of habitat trees and protected ecosystems, thereby minimising potential environmental impacts;
- nominating that the GHG stream transportation route does not use local roads in Millmerran township, and travels only existing b-double truck designated state-controlled roads; and
- proposing that delivery of the GHG stream at the Transportation Facility is conducted during daylight hours only.

9. Impact Assessment of Project Specific Matters

9.1 Impact Assessment Methodology

The EIS process is a systematic analysis of the Project in relation to the existing environment. The overall methodology of EIS preparation has been to:

- identify environmental values for Project specific matters, including critical matters;
- identify the relevant Project key features, processes or timeframes that are applicable to each Project specific matter;
- assess the potential impacts, including potential cumulative impacts;
- describe avoidance and mitigation measures; and
- propose EA condition amendments and commitments for relevant approvals.

The preparation of the EIS was an iterative process, linking the initial description of the Project, design development processes, input from technical specialists, and input from interested and affected persons and other stakeholders.

9.2 Climate

Impact assessment associated with Climate and greenhouse gas (GHG) assessment:

- characterised the existing climate patterns and conditions;
- the potential impacts on the Project from projected climate changes;
- projected inventories and potential impacts from the Project due to GHG emissions during the life of the Project;
- adaptation activities of the Project to minimise climate change impacts;
- a decarbonisation plan; and
- residual impacts.

The Project is located in Western Downs Regional Council, and is characterised as having a temperate climate with hot summers and cool winters. The climate is cooler than the rest of the state of Queensland. The region's annual average potential evaporation is more than twice the annual average rainfall, which contributes to the depletion of soil moisture. Activities of the Project are not anticipated to change the climate of the region.

The *National Greenhouse and Energy Reporting Act 2007* (the NGER Act) establishes a national framework for Australian corporations to report Scope 1 and Scope 2 GHG emissions, and energy consumption and production. CTSCo currently reports under s.22X of the NGER Act as a group member of Glencore Holdings Pty Limited for NGER purposes.

The *Greenhouse Gas Protocol* defines direct and indirect emissions through the concept of emission scopes:

- Scope 1: Direct GHG emissions. Direct GHG emissions occur from sources that are owned or controlled by a company (i.e. CTSCo).
- Scope 2: Indirect GHG emissions. This accounts for GHG emissions from the generation of purchased electricity consumed by the company and steam (i.e. CTSCo).
- Scope 3: Other Indirect GHG emissions. This is an optional reporting class that accounts for all other indirect GHG emissions resulting from a company's activities but occurring from sources not owned or controlled by the company (i.e. Millmerran Power Station or other third parties).

Due to the very nature of the Project being injection testing 330,000 tonnes of GHG stream (CO_2) for geological storage, the Project reduces CO_2-e emissions to atmosphere by 57,032 tCO_2-e for the life of the Project, when considering total Scope 1, 2 and 3 GHG emissions. Table 9-1 summarises the emissions generated and stored for the Project.

The Scope 1 and 2 emissions sources presented in Table 9-1 will be subject to CTSCo's NGER reporting requirements. The bulk of the Scope 1 emissions result from diesel usage during construction and operation phases, and LPG usage to heat the water bath and power pumps in the Transportation Facility during operation. Scope 2 emissions relate to predicted electricity usage in the Brisbane office.

Separately, CTSCo's Scope 3 emissions, with the largest Scope 3 emissions relating to the construction and operation of PCC plant, will be reported by Millmerran Power Station under their Scope 1 and 2 NGER reporting requirements.

Table 9-1 Summary of modelled GHG emissions for all phases of the Project

CO_2 Emissions Scope	**tCO_2-e**
Scope 1 total	22,875
Scope 2 total	6
Scope 3 total	243,487
Total	***266,368***
Geological Storage	-330,000
Correction factor*	+6,600
Net Total	**-57,032**

* correction factor has been applied for use of 98% by volume of CO_2 associated with the GHG stream specification

The Project is a decarbonisation project that contributes towards Queensland's emissions reduction and renewable energy targets. Queensland's interim target by 2030 of 30% GHG emissions below 2005 levels would lead to a GHG budget of 133,437.5 $ktCO_2$-e. Over the life of the Project, considering:

- the 330,000 tonnes of CO_2 geologically stored, the Project will contribute 0.577% in meeting Queensland's emission reduction.
- all incurred (net total) emissions, the Project will contribute 0.1% in meeting Queensland's emission reduction.

Given that the Project GHG stream injection testing, outcomes for the Project will:

- provide a better understanding of the optimisation and reduction of the life cycle and embodied energy carbon intensity of the Project's processes;
- demonstrate the viability for geological storage of a GHG stream (CO_2) in the Surat Basin;
- impart learnings into optimising measures for emission controls, energy consumption, and monitoring measures for geological storage for future large-scale CO_2 storage conforming with future best practice international environmental management in the relevant industry sector;
- contribute to the improved understanding of the feasibility of GHG stream geological storage in Queensland, thereby contributing to achieving Queensland's 2030 emissions reduction target; and
- provide training and learning opportunities to not only CTSCo personnel, but to peak bodies, the Queensland Government and the Australian Government.

9.3 Waste

CTSCo has considered the principles of the circular economy and waste management hierarchy of avoidance, re-use, recycle, and disposal.

Many of the structures, plant, and equipment components (office, tanks, pumps, mountings, housings, pipes, racks, etc) will be prefabricated prior to construction, avoiding or reducing the generation of packaging waste or construction and building wastes. These items are to be removed from site during the rehabilitation phase, with many to be made available for sale for re-use or sold as scrap for recycling.

Total waste generated by Project activities across all phases will be small volumes of:

- general waste: 62 tonnes;
- recyclable waste (bottles, cans, plastics, cardboards): 98 tonnes;
- food waste: 25 tonnes;
- packaging materials (timber, metal, plastics, cardboard): 142 tonnes;
- tyres: four sets of tyres per GHG stream delivery truck (to be managed off-site);
- oils, fuels, lubricants, paints, solvents, cleaning agents and other similar materials: 2,000 litres; and
- sewage.

All wastes generated will require appropriate storage to manage safety and environmental risks. CTSCo will engage a suitable waste contractor to provide three skip bins (general waste, recyclables, food waste) with a weekly collection frequency during construction and rehabilitation phases from the Transportation Facility. Additional bins will be provided for separate waste streams as required. During operations, the bin collection frequency will reduce to monthly in line with the decrease in expected waste generation.

Bins will have lids to avoid water infiltration and leachate generation. Waste will be placed in the bins and separated at the source to avoid contamination and avoid increased disposal volumes.

Wastes will be transported to the nearest available licensed waste transfer and/or disposal facility.

Sewage treatment will be in an on-site sewage treatment system within the Transportation Facility, sized to accommodate less than 21 equivalent persons (EPs), consistent with existing EA condition 55.

9.4 Land

Under the *Planning Act 2016* and the Planning Regulation 2017, Schedule 6, Item 24 GHG storage activities under the GHG Storage Act, cannot be made assessable under a local planning instrument. Therefore, the Project is exempt from assessment from local government planning schemes.

The operational lands are mapped as a strategic cropping area and identified in the WDRC Planning Scheme as having an Agricultural Land Class of Class A crop land, across mostly vertosol (gilgai) soils. Entering into Conduct and Compensation Agreements (CCAs) with the landowners of the operational lands provides exemption under the *Regional Planning Interests Act 2014* regime for conducting injection testing activities on strategic cropping areas.

The operational lands and land adjoining the operational lands are predominately used for grazing of stock, with some portions of the lands used for cropping. No stock routes are within or immediately adjacent to the operational lands.

One certified organic farm is located approximately 50 km west of the West Moonie-1 Injection Well. None of the operational lands or land adjoining the operational lands are certified organic farms.

With regards to sensitive places, on the operational lands there are three dwellings that are occupied on a permanent or semi-permanent basis, and there is one dwelling that is abandoned and not fit for habitation. In the land adjoining the operational lands, there are four dwellings that are occupied on a permanent or semi-permanent basis. Potential impacts associated with dwellings are predicated to be low, as the closest dwelling to the Project's key features is over 1 km east of the Transportation Facility on lot 60 SP199322, and the next closest dwelling is on lot 33 PG223 which is over 1 km from the flowline. Potential impacts would be experienced for short durations of construction and rehabilitation phases for the access road, Transportation Facility and flowline, from vehicle and equipment noise, dust generation, and interruption to normal land access. Potential impacts during the operation phase would be from GHG stream truck movements and operation of equipment within the Transportation Facility, associated with noise generation, and turning vehicles at the Moonie Highway / Harts Road intersection. The majority of operation activities will be conducted during daylight hours, thereby minimising potential night-time impacts.

On the operational lands or land adjoining the operational lands, there are no motels, hotels, hostels, libraries, childcare centres, kindergartens, schools, or other educational institutions, medical centres, surgeries, hospitals or public gardens.

Environmentally Sensitive Areas (ESAs) are present on the operational lands as Endangered regional ecosystems, Of Concern regional ecosystems, and/or essential habitats; and in the land adjoining the operational lands as Currajong State Forest and Southwood National Park. CTSCo does not propose to conduct activities within Currajong State Forest or Southwood National Park. However, Project activities are proposed within the 200 m protection zone and 500 m buffer zone of Currajong State Forest, as defined in the existing EA conditions, therefore amendments to the relevant EA conditions are proposed. Avoidance and mitigation measures associated with Endangered regional ecosystems, Of Concern regional ecosystems, and/or essential habitats are outlined in section 9.11.

A search for contaminated lands on the Department of Environment and Science's Environmental Management Register (EMR) and Contaminated Land Register (CLR) indicate that the operational lands are not listed. There are no notifiable activities proposed for the Project, as defined by the EP Act, Schedule 3. CTSCo commits that bulk materials, GHG stream (as CO_2) and LPG, will be appropriately stored and used in accordance with the required standards, codes and practices; materials that have safety data sheets (SDS), where present on site in minor quantities, will be stored,

bunded or otherwise handled in accordance with SDS storage and handling recommendations; and that spill kits will be available for clean-up of minor spills.

A search of the Australian Government's Defence Unexploded Ordnance (UXO) mapping layer indicated that no UXO exist within the operational lands. The Project does not propose the use of any ordnances.

The operational lands are generally flat with slight undulations. Ground elevations predominantly range between 235 m and 245 m Australian Height Datum (mAHD), generally rising towards the south with distance from the Moonie River. There are no defined or prominent viewpoints, high points or outlooks. The general character of the operational lands is that of rural broadacre cropping and cattle grazing land, with some rural dwellings, clumps of standing native trees and shrubs, wetlands (permanent and ephemeral), and watercourses. The Moonie Highway is classified as a scenic route under the WDRC Planning Scheme, and indicates that existing vegetation should be retained near the scenic route and proposed development should incorporate landscaping to visually screen and soften built form elements, whilst not impeding distant views or view corridors from the scenic route. The Project does not propose to disturb existing vegetation between the Moonie Highway and the Transportation Facility, with the Transportation Facility approximately 400 m away the Moonie Highway. The Transportation Facility will not have personnel present at night, therefore the Project is not considered to result in the generation of adverse light on the operational lands or lands adjoining operational lands.

9.5 Geology and Groundwater

The Project is located in the Surat Basin, which overlays the southern Bowen Basin. Figure 9-1 shows a simplified structural elements map of the southern Bowen Basin and Surat Basin. EPQ10 is situated on the eastern flank of the Mimosa Syncline, which is the deepest part of the southern Surat Basin and is broadly coincident with the underlying Taroom Trough of the Bowen Basin.

Figure 9-2 is a compressed composite of the east-west regional seismic line (BMR84-2 and SH84-118) showing a cross-section across the northern part of EPQ10, annotated to show the primary structural elements of the Surat and Bowen Basins (modified from Willink, 2008), including an exaggerated vertical scale. EPQ10 and the West Moonie-1 Injection Well are located on the eastern slope of the Taroom Trough and Mimosa Syncline.

Figure 9-3 shows a cross-section at 1:100 vertical exaggeration of the southern Surat Basin associated with West Moonie-1 Injection Well and adjacent wells and bores in the broader area. For clarity only the stratigraphic interval from the top Evergreen Formation to the upper part of the Moolayember Formation immediately below the base Jurassic Unconformity is shown. West Moonie-1 Injection Well is located on the eastern slope of the Mimosa Syncline and the true angle of dip of the Precipice Sandstone is approximately 2 degrees. The Fault zone shown is the Moonie-Goondiwindi Fault zone.

Of particular relevance to the Project is the stratigraphic interval that includes the Moolayember Formation of the Bowen Basin and the entire overlying Surat Basin sequence. The GHG stream is to be injected into, and stored within, the Precipice Sandstone. The underlying Moolayember Formation and overlying Evergreen Formation are the primary geological seals preventing leakage of the stored GHG stream from the Precipice Sandstone. A storage reservoir and its bounding sealing formations are commonly termed a "storage complex". The West Moonie storage complex is schematically illustrated in Figure 9-4 and includes the full stratigraphic interval intersected in the West Moonie wells.

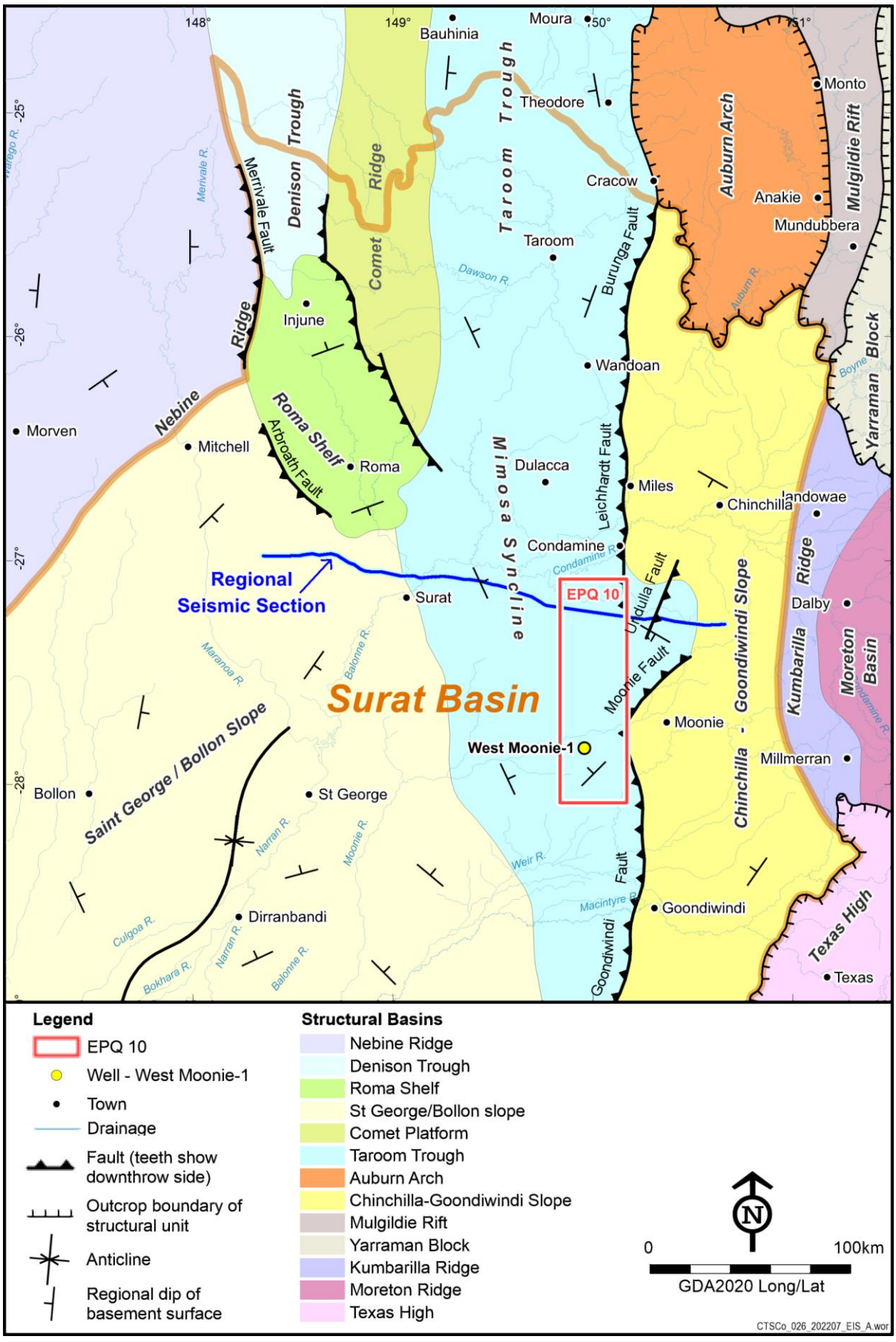

Figure 9-1 Structural Elements of the southern Bowen Basin and Surat Basin

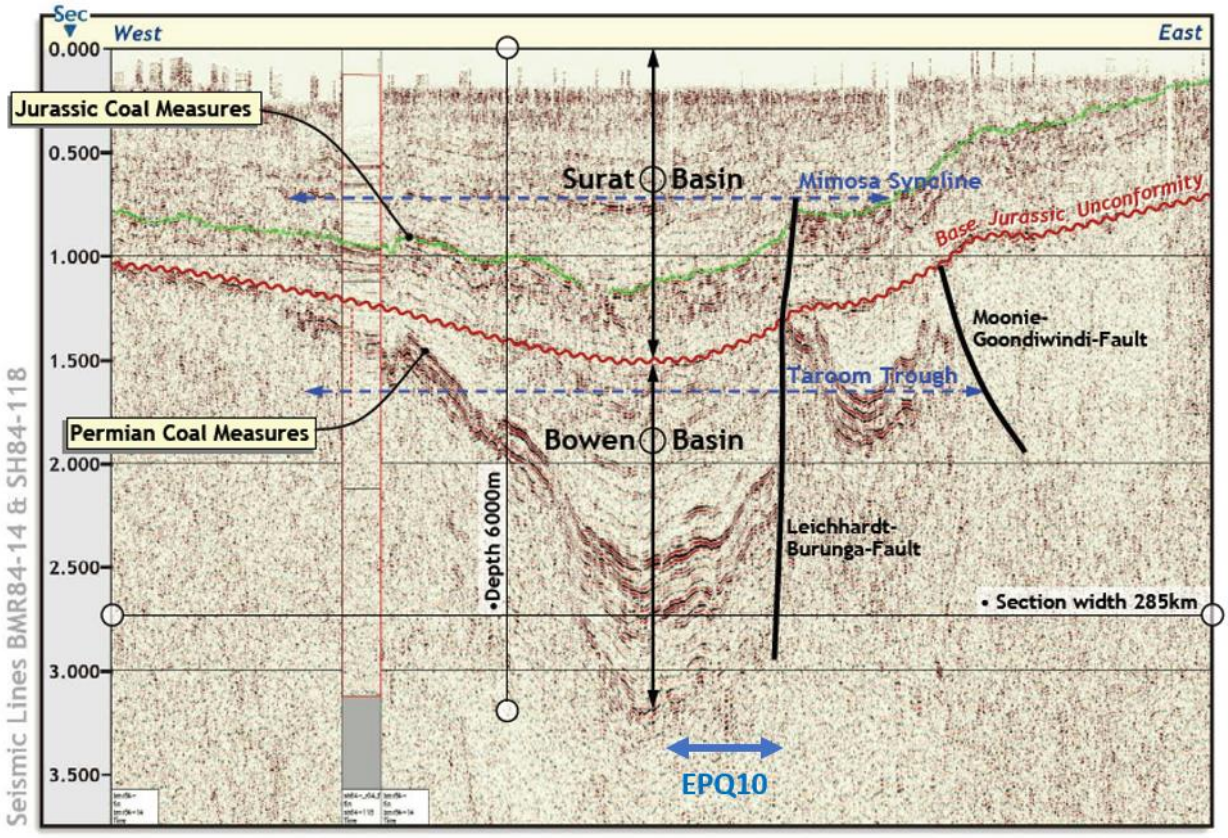

Figure 9-2 Regional Seismic Section across Surat and Bowen Basins showing major elements (modified Willink, 2008)

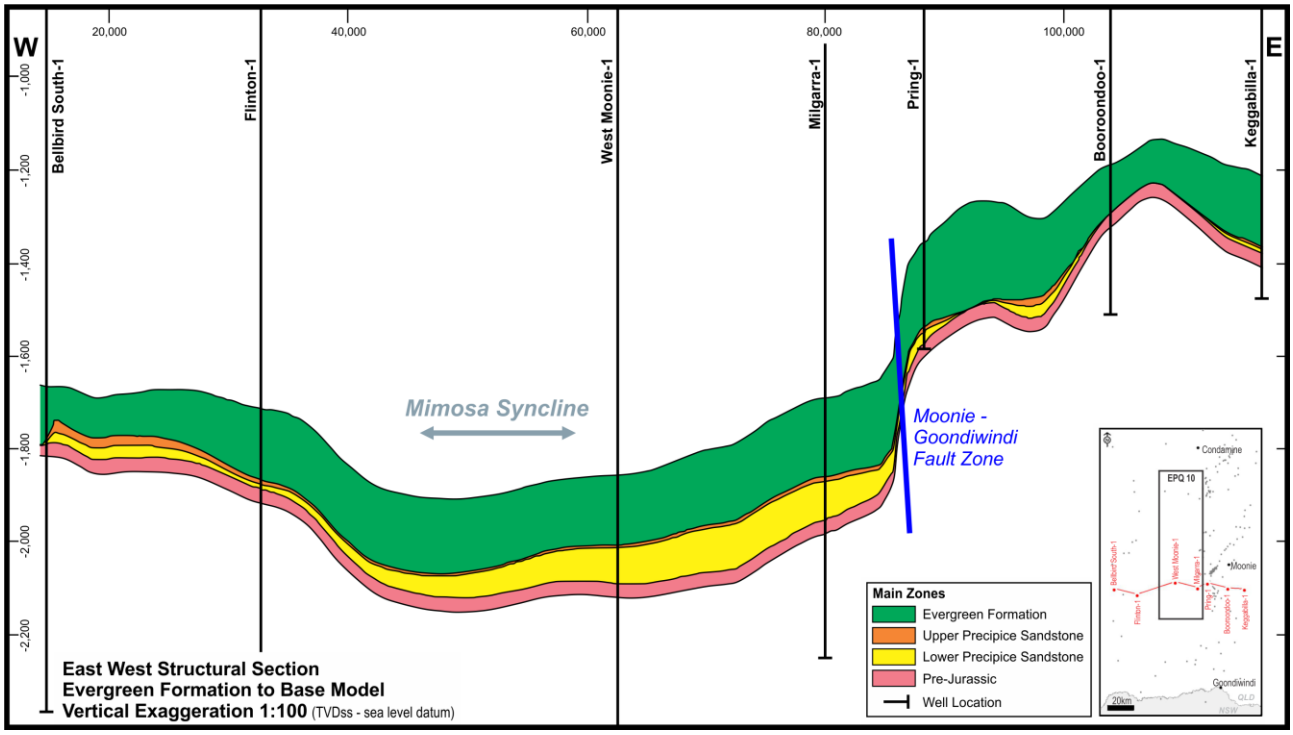

Figure 9-3 Representative east--west Structural Section (vertical exaggeration 1:100)

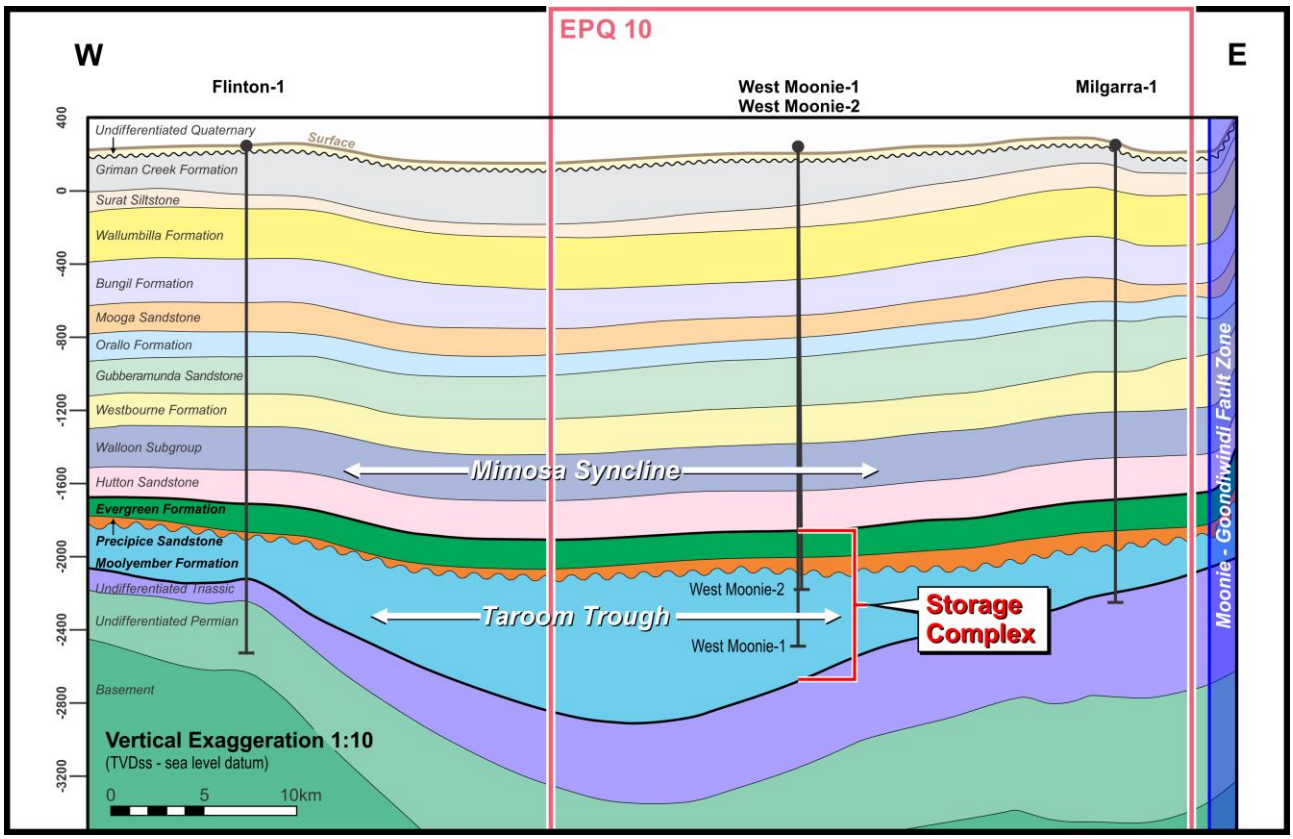

Figure 9-4 Full Stratigraphic Sequence at West Moonie-1 Injection Well

To further understand the geological properties of the storage complex and the stratigraphic intervals, the geological assessment has required integration of a diverse input dataset derived from desktop studies, field work, and laboratory work.

Field work in EPQ10 was conducted during 2020 and 2021, and included:

- Milgarra Bore:
  - nearest deep well, approximately 17.3 km east southeast of West Moonie-1 Injection Well;
  - drilled in 1982 to 2,509 m by Shell Development Australia. No hydrocarbons were found, so plugged to 1,248m and handed over to the landowner as Gubberamunda Sandstone aquifer water bore (RN 23075);
  - water samples taken from the Gubberamunda Sandstone aquifer in June and August 2021 and the water quality analysed in a NATA certified laboratory;
- West Moonie-1 Injection Well:
  - drilled in August 2020 to 2,714.7 m within the Moolayember Formation by CTSCo;
  - data acquisition program was designed to acquire rock quality data (petrology, rock chemistry, porosity, permeability) from the storage complex (Evergreen Formation, Precipice Sandstone and Moolayember Formation) and water chemistry data from the Precipice Sandstone;
  - coring operations commenced in the lower Evergreen Formation and a total of 31 cores were acquired from intervals within the Evergreen Formation, Precipice Sandstone and Moolayember Formation;
  - wireline logging included gamma ray, density, neutron, sonic scanner and an image log (FMI);
  - water samples were taken from the Precipice Sandstone aquifer after the purging of water, and the water quality analysed in a NATA certified laboratory;
- West Moonie-2 Monitoring Well:
  - drilled in July 2021 to 2,450 m within the Precipice Sandstone aquifer by CTSCo;
  - the purpose of the well is for long term monitoring of the GHG stream that is to be injected into the West Moonie-1;
  - the surface location of the well is 15 m north-west of the West Moonie-1 Injection Well. However, drilling of West Moonie-2 Monitoring Well was with a deviated trajectory so that at the depth of the well reached the top Moolayember Formation (i.e. the base of the Precipice Sandstone), with the well bores 178m apart;

  - the location of the well was determined from plume modelling, which predicted that West Moonie-2 Monitoring Well will be able to detect the GHG plume within 1 year of injection commencing, thereby providing early monitoring data of plume movement;
  - data acquisition program was designed to confirm continuity of rock quality interpreted from West Moonie-1 Injection Well;
  - core was cut at the top of the Evergreen Formation;
  - wireline logging included gamma ray, density, neutron, sonic scanner and an image log (FMI);
- West Moonie Shallow Monitoring Bore:
  - located 35 m east of the West Moonie-1 Injection Well;
  - drilled in May 2021 to 48 m by CTSCo;
  - data acquisition was for lithological information about the near surface geology including water chemistry data;
  - the first water bearing strata were intersected at 44 m at the top of the Griman Creek Formation and a water sample was taken and analysed in a NATA certified laboratory.

The datasets acquired from the field work have been used to characterise the existing environment, and to calibrate the various models that have been used to predict the potential impacts that injection testing will have on the existing environment.

The future drilling of the Gubberamunda Monitoring Bore will also provide further data.

Data will continue to be acquired from the West Moonie-1 Injection Well, West Moonie-2 Monitoring Well, West Moonie Shallow Monitoring Bore, and the Gubberamunda Monitoring Bore through the construction, operation and monitoring phases that will contribute additional data for modelling, monitoring and verification purposes.

The results from desktop studies, field work, and laboratory work have been incorporated into a suite of models used to characterise the existing environment and to predict potential hydrochemistry and hydrogeology changes resulting from the Project. The peer reviewed models are deemed “fit for purpose” meeting industry standards. Table 9-2 summarises the models used in the geological assessment.

Table 9-2 Models used in Geological Assessment

Model Type	Objective
Seismic	Definition of spatial geological structure including faults
Petrophysics	Quantification of rock properties including porosity, permeability and fluid saturation
Geological (static)	Synthesis of seismic, petrophysics and sedimentological interpretations into a pre-injection 3D representation of the subsurface geology
Plume migration (dynamic)	Dynamic modelling of pressure, GHG stream saturation within the geological model during injection and post injection phases of the Project
Geochemical	Characterise existing rock and groundwater chemistry and model temporal and spatial changes that take place due to chemical reactions caused by interaction with GHG stream
Geomechanical	Characterise current earth stresses and investigate effects that might result from the planned GHG stream injection such as fracture initiation and/or reactivation
Hydrogeological	Model aquifer and aquitard properties and changes in local and regional aquifer pressure conditions resulting from GHG stream injection

The current models are the result of a staged modelling process involving iteration and refinement as new data is acquired. The primary input parameters included in the models and the source of these data are listed in Table 9-3. They represent the current knowledge and interpretation of pre-injection (initial) geological conditions. Initially the models have been used to assess the containment risk, that is that the injected GHG stream will remain with the storage complex within the operational lands. The models are then used to predict changes in geological conditions that may take place as a result of injection testing. Further modelling work will be undertaken once injection has commenced to include monitoring data acquired during the injection (operation) and post-injection (monitoring) phases of the Project, and will be used to assess conformance between the actual injected plume behaviour and the predicted (modelled) behaviour.

Table 9-3 Parameters used to model the existing environment and model potential impacts caused by injection testing

Parameter	Characteristic	Data Source	Analysis	Model	Model Use
Facies, Facies association and depositional environment	Sedimentology	West Wandoan-1, West Moonie-1, West Moonie-2	Core description Rock Typing Focussed Micro Imager (FMI)	Petrophysical Geological Plume Migration	Containment Conformance
Porosity and permeability	Rock quality	West Wandoan-1, West Moonie-1, West Moonie-2	Core analysis (Routine and Digital) Wireline log analysis Rock Typing of cuttings and core chips Petrology – thin section and Scanning Electron Microscope (SEM) Modular dynamics tester (MDT) - probe and dual packer	Petrophysical Geological Plume Migration	Conformance Containment
Trace metal content & mineralogy	Rock chemistry	West Moonie-1, West Moonie-2, West Wandoan-1	Batch analysis of core chips Quantitative evaluation of minerals by scanning electron microscope (QEMSCan) Hylogger (West Wandoan-1) 4-acid (complete acid digestion) cation and anion analysis of rock cuttings and core chips	Geochemical	Conformance
Lithology and strength	Seal quality	West Moonie-2 core Formation Micro Imager (FMI) logs West Moonie-1, West Moonie-2 and West Wandoan Modular Formation Dynamics Tester (MDT) Dual packer pressure data	Uniaxial and Triaxial rock strength analysis Petrology (thin section and SEM) *Insitu* stress tensor analysis	Geomechanical	Containment

Parameter	Characteristic	Data Source	Analysis	Model	Model Use
pH, conductivity, Total Dissolved Solids (TDS), total hardness, alkalinity, sulfide content, chloride content, dissolved major cations, Total Metals, recoverable mercury, fluoride, ammonia, Nitrite, Nitrate, Total Organic Carbon, dissolved oxygen, C1-C4 hydrocarbon gases, total recoverable hydrocarbons, BTEXN	Groundwater analysis	West Moonie-1 (Precipice Sandstone), West Moonie Shallow Monitoring Bore (Griman Creek Formation), Milgarra bore (Gubberamunda Sandstone)	Analyte analysis	Petrophysical Geochemical	Conformance
Pressure and temperature	GHG stream behaviour	West Moonie-2 wireline logs (temperature) and MDT (pressure)	Pressure and Temperature profiles	Plume Migration Geochemical Hydrogeological	Conformance

Findings of the modelling and the laboratory work and analysis of the rock samples (from cores) and groundwater quality samples are given in the following sections.

9.5.1 Predicted Plume Behaviour

In summary, the plume migration modelling results predict that:

- the plume will expand through the Precipice Sandstone around West Moonie-1 Injection Well;
- the plume will be less dense than water and will rise as it expands through the Precipice Sandstone. The plume will stop rising when it encounters low permeability "baffle" sediments within the Precipice Sandstone and confining sediments in the upper Precipice Sandstone and lower Evergreen Formation;
- the plume extent at the end of the three-year injection period is predicted to be approximately 510 m from the West Moonie-1 Injection Well;
- once injection ceases gravity becomes the dominant force. The movement is largely vertical at West Moonie-1 Injection Well due to the low structural dip of approximately 2°. Initially movement is upwards, but as more CO_2 dissolves, the contacted groundwater increases in density and the movement is downwards;
- the plume is predicted to continue to move slowly and ceases moving after 2 years of shut-in whereupon the extent is approximately 525 m from West Moonie-1 and no significant lateral movement of the plume occurs from 5 years shut-in to 100 years shut-in;
- the plume extents are expected to remain present within the Project's operational lands in perpetuity within the confined aquifer of the Precipice Sandstone and will not contravene the Environmental Protection Regulation 2019, s.41;
- the maximum pressure increase within the Precipice Sandstone aquifer is less than 12 psi and this occurs at the West Moonie-1 Injection Well; and
- at no point does the change in pressure exceed 2 psi at the interface of the lower and upper Precipice Sandstone.

Figure 9-5 shows the predicted extent of the plume at three different modelled time steps:

- Year 3: at the end of the GHG stream injection testing;
- Year 5: two years after the cessation of the GHG stream injection testing; and
- Year 100: 97 years following the cessation of the GHG stream injection testing.

The predicted change in pressure as a result of injection testing is shown in Figure 9-6. The maximum pressure increase (11.2 psi) is predicted to occur at the end of the 3-year injection period. During the subsequent shut-in period the pressure increase diminishes with time.

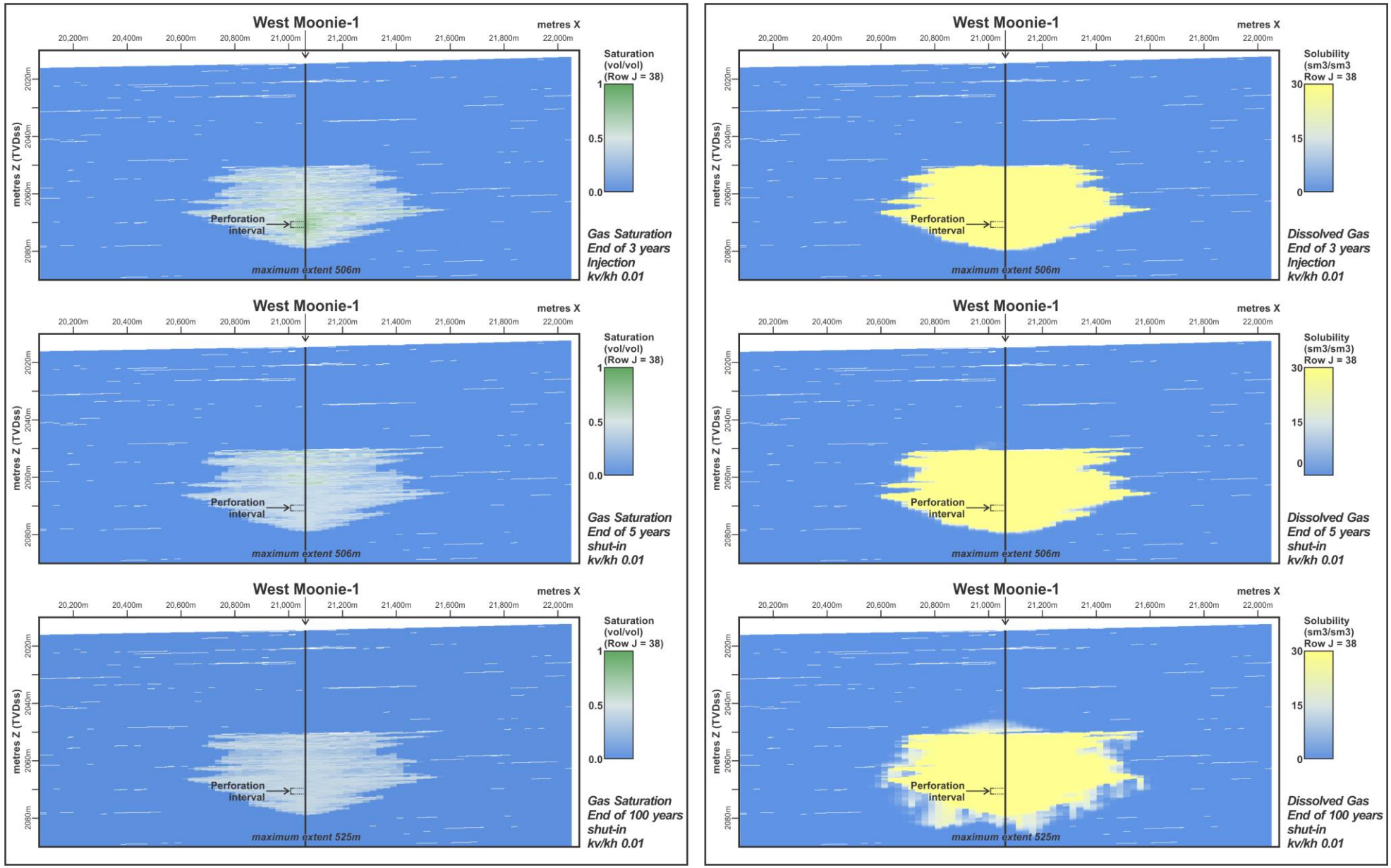

Figure 9-5 Grid Model 'C' kv:kh = 0.01, Predicted Plume movement after injection and shut-in periods

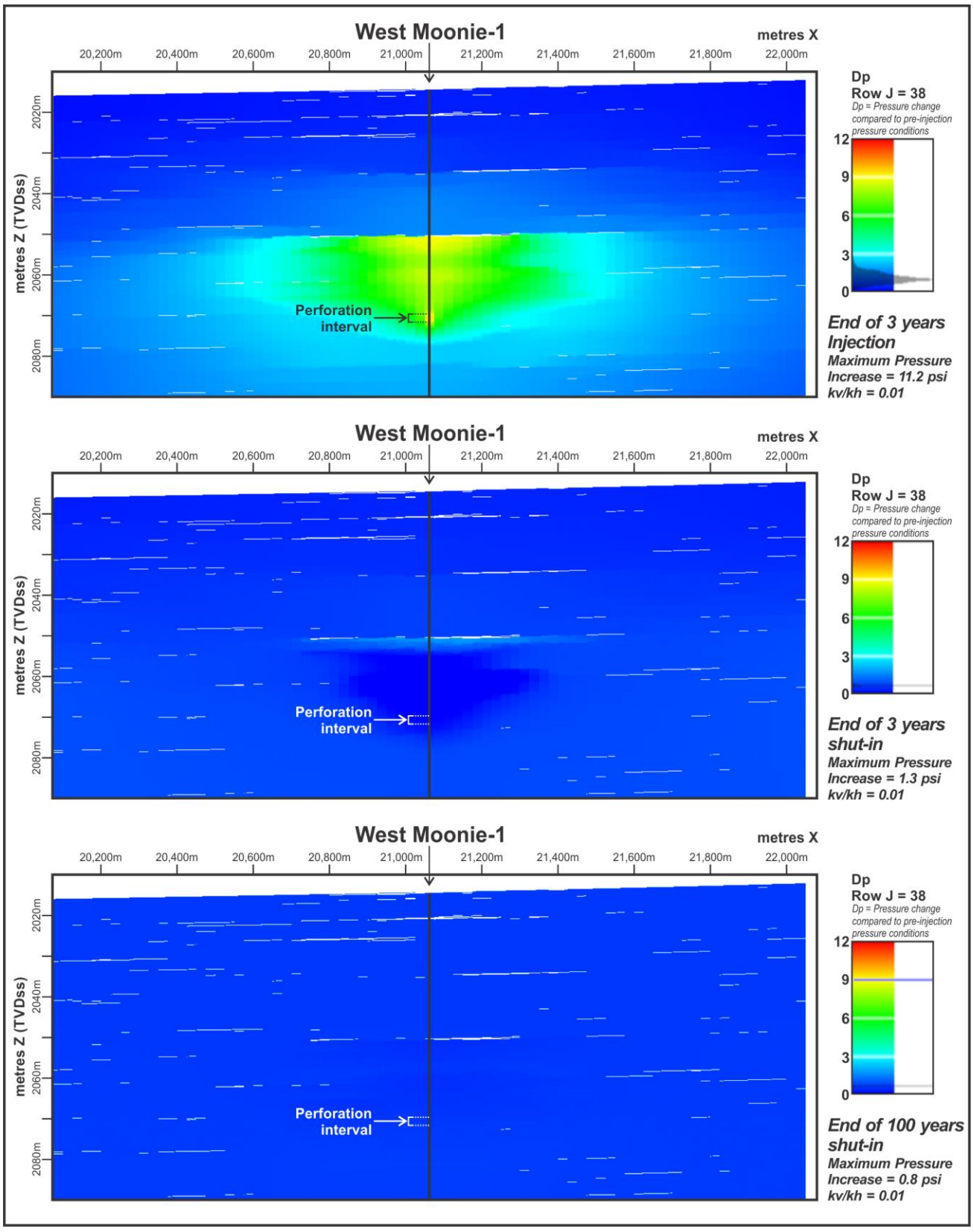

Figure 9-6 Grid model 'C', Predicted change in pressure with time

9.5.2 Groundwater Quality

As outlined in section 9.5 above, groundwater samples were collected as part of field work during 2020 and 2021 from the West Moonie-1 Injection Well (Precipice Sandstone aquifer), West Moonie Shallow Monitoring Bore (Griman Creek Formation), and Milgarra Bore (Gubberamunda Sandstone aquifer). All samples were analysed in a NATA certified laboratory to determine the water quality characteristics of the aquifers sampled.

Injection of a GHG stream (CO_2) into water slowly reacts to produce carbonic acid and hydrogen ions, resulting in a weak acid, measured as a reduction in pH. Laboratory analysis and modelling have indicated that the predicted pH in the GHG plume in the Precipice Sandstone aquifer will be around pH 4.

Under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*, water quality objectives have been established for all river basins in Queensland. Given the location of the Project, the *Queensland Murray-Darling and Bulloo River Basins, Groundwater Environmental Values and Water Quality Objectives* (Department of Environment and Science, 2020) is applicable to the Project for the comparison of water quality objectives (WQOs). Groundwater within the Precipice Sandstone aquifer for the Project is characterised as belonging to the Basal Great Artesian Basin Zone, in the Eastern Central Area, with the applicable Environmental Values (EVs) being:

- aquatic ecosystems;
- irrigation;
- farm supply / use;
- stock water;
- drinking water;
- industrial use; and
- cultural and spiritual values.

The existing water quality of the Precipice Sandstone aquifer is characterised as having low water quality that is saline, high in iron (long-term), high in fluoride, and high in total dissolved solids, and is unsuitable for aquatic ecosystems, and unsuitable for irrigation water, stock water, and drinking water.

Injection of the GHG stream reduces the pH of water within the GHG plume as water becomes increasingly saturated with carbon dioxide (CO_2). Compared to the existing water quality parameters, predicted changes show:

- decreases in the concentrations of calcium, magnesium, bicarbonate alkalinity, total alkalinity, and pH;
- increases in chloride, sulphate, iron, and total dissolved solids (TDS).

In summary, the existing groundwater quality is unsuitable for use. With the injection of a GHG stream, the groundwater quality within the GHG plume will become more acidic, and will still be unsuitable for use compared to the WQOs.

9.5.3 Geochemical Modelling

Various laboratory experiments has been undertaken has part of the geological assessment. Laboratory experiments focusing on geochemical modelling included taking one lower Evergreen Formation, one upper Precipice Sandstone, eight lower Precipice Sandstone, and two Moolayember Formation rock samples from the West Moonie-1 Injection Well and batch reacted with a mixed gas stream (CO_2, SO_2, NO, and O_2) similar to the GHG stream composition from the PCC plant.

The lower Precipice Sandstones are quartz rich, and in 110-day mixed gas batch reaction experiments generally show stabilising concentrations of Calcium (Ca), Magnesium (Mg), Manganese (Mn), Strontium (Sr), and Barium (Ba), with increasing trends from one clay rich sample.

During a 110-day batch reaction experiment on cored rock from the upper Precipice Sandstone (from 2,274.10 m (grey)), lower Precipice Sandstone (2,322.61 m (blue) and 2,328.54 m (orange)), and Moolayember Formation (from 2,363.61 m (yellow)), Figure 9-7 shows concentrations of:

- A: dissolved Iron (Fe, measured in µg/kg);
- B: dissolved Zinc (Zn, measured in µg/kg);
- C: dissolved Arsenic (As, measured in µg/kg); and
- D: dissolved Lead (Pb, measured in µg/kg).

Negative time is the initial water composition and N_2 rock soak, after time zero mixed gas was added.

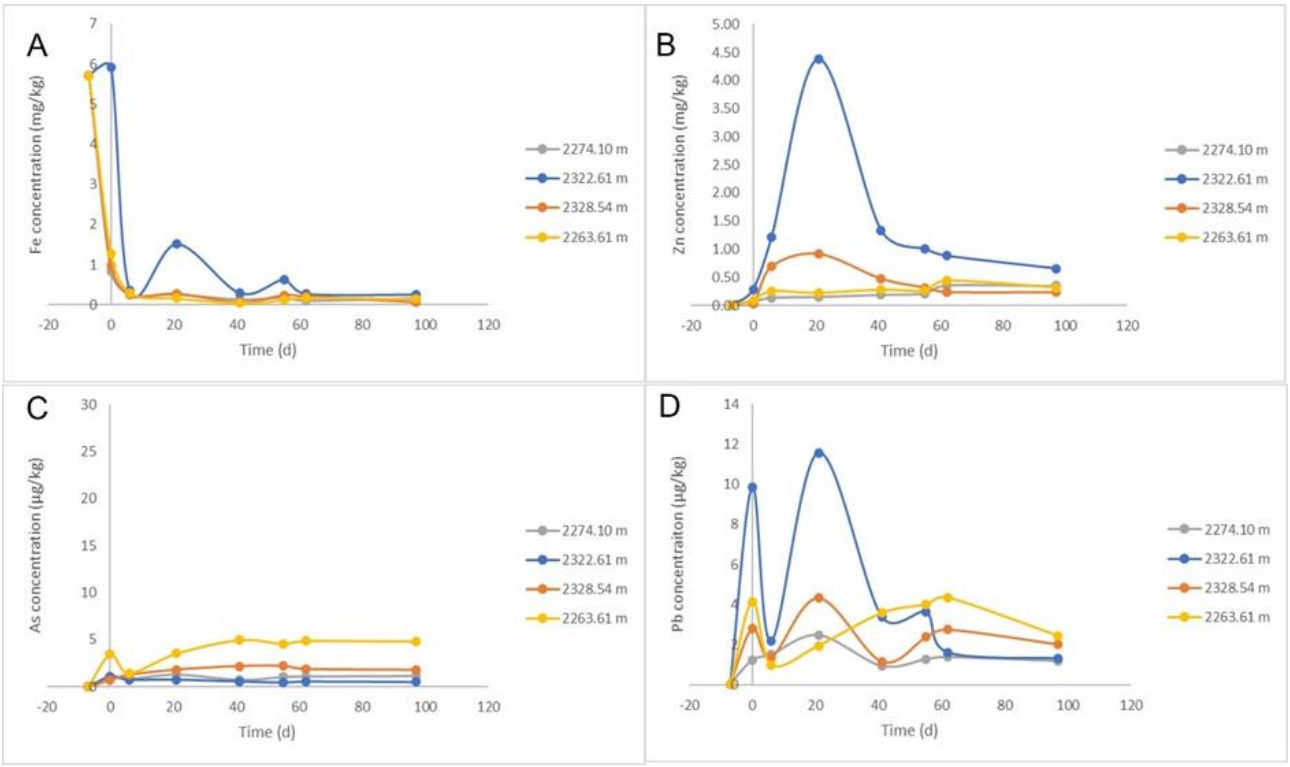

Figure 9-7 West Moonie-1 Core 110-day batch reaction experiments with mixed gas stream

The concentration of the element Iron (Fe) decreased over time whereas Lead (Pb) and Zinc (Zn), increased and subsequently decreased in concentration indicating subsequent adsorption or precipitation processes in the majority of experiments. Overall, the concentrations of Arsenic (As) and Lead (Pb) at the end of mixed gas experiments were below 30 µg/kg.

The reaction path modelling of the experiments provides information on the most important reactions taking place during the experiments and gives an indication of their rates. Understanding that a major source of trace elements are the carbonate minerals in addition to desorption/exchange as the solution chemistry evolves, allows for critical constraints on reactive transport model parameterisation. Experiments found that siderite and chlorite dissolution are two of the dominant processes after exposure of these sedimentary rocks to elevated CO_2 concentration. The reactions are relatively rapid compared to most other gas-water-rock interactions. The presence of oxygen (O_2), and rapid iron (Fe) mobilisation from mineral dissolution, results in the precipitation of iron oxyhydroxides. Those iron oxyhydroxides act as a sink for iron and deplete the oxygen content as well as provide new adsorption sites for sequestering some proportion of the trace metals mobilised through carbonate mineral dissolution, as well as those desorbed or exchanged as the fluid chemistry evolves.

The only rock/groundwater geochemical reactions that will occur during the operation phase will be restricted to the location of the injected GHG plume. Outside of the plume, there will be no change to the groundwater chemistry.

The reaction path modelling of the West Moonie-1 experiments predicts an initial increase in dissolved trace metals (e.g. lead, molybdenum, cadmium) concentrations that will either plateau or decrease in time with iron also showing this trend. This is likely related to mineral precipitation, with a contribution from adsorption to mineral surfaces.

Modelling showed that trace metal mobilisation is largely limited to the mobile component of the CO_2 impacted volume and is dominated by density driven convection that is directed towards the bottom of the storage. The end result is the accumulation of trace elements in the dense fluid collecting at the bottom of the reservoir and a decrease in their content in the CO_2 impacted volume as time progresses and the sources become depleted.

9.5.4 Hydraulic Conductivity

The first aquifer above the Precipice Sandstone aquifer is the Hutton Sandstone aquifer, which is separated from the lower Precipice Sandstone aquifer by the Evergreen Formation.

The overburden depth of the top Evergreen Formation is at approximately 2,100 m under the operational lands and the formation is around 160 m thick. The Evergreen Formation at West Moonie is comprised of interbedded sandstone, siltstone, mudstone with occasional thin coal stringers. The Evergreen Formation is a low permeability strata, and modelling suggest that the bulk vertical hydraulic conductivity is lower than previously thought, and probably less than $5x10^{-8}$ m/day. No open faults or fractures have been detected to the seismic resolution or observed in either the image log or cores acquired in West Moonie-1 Injection Well and West Moonie-2 Monitoring Well therefore no potential geological leakage conduits have been identified.

A dual packer MDT (Modular formation Dynamics Tester) test was conducted over the interval 2,130 mRT to 2,131 mRT in the upper Evergreen Formation seal at West Moonie-2 Monitoring Well to test the strength of the rock. The packers were pressured up to 7,000 psi (which was the maximum pressure for the tool) for three pressure cycles, but were unable to fracture the rock, proving that the lithologies of the Evergreen Formation seal are extremely hard. This was further confirmed by laboratory triaxial rock strength testing of core plug samples drilled from the West Moonie-2 core. Testing confirmed that the risk of fracture initiation and/or fracture reactivation and Evergreen Formation seal failure caused by the injection testing is negligible. Fracture initiation analysis indicates that a pressure increase to at least 4,000 psi can be sustained prior to initiating new fractures. Image logs acquired over the Evergreen Formation seal revealed an absence of fractures. Fracture reactivation analysis calculated that critical reactivation pressures vary between 1,000 psi and 2,000 psi. In all cases these pressures are significantly higher than the increased pressure that would be exerted as a result of injection testing in West Moonie-1 Injection Well.

The regional effectiveness of the Evergreen Formation as a seal can also be evaluated from pressure gradient data acquired from the MDT tool. The observed pressure gradient offset between the Precipice Sandstone and the Hutton Sandstone indicates that the two aquifers are not in pressure communication at the West Moonie site and that the intervening Evergreen Formation is an effective pressure seal. The Precipice Sandstone is therefore a confined aquifer.

9.5.5 Confined Aquifer

The geological formations can be classified into aquifers and aquitards as shown in Figure 9-8. In summary, aquifers present within the operational lands are the Precipice Sandstone, the Hutton Sandstone, the Springbok Sandstone, Gubbermunda Sandstone, Mooga Sandstone and alluvium. They are separated and confined by low permeability formations that are regionally recognised aquitards that inhibit the flow of groundwater vertically.

Aquifers can be further classified as confined or unconfined. Under the Environmental Protection Regulation 2019, s.41(c) a ***confined aquifer*** *means an aquifer that is contained entirely within impermeable strata*.

The Precipice Sandstone is a confined aquifer at the West Moonie-1 Injection Well owing to:

- it is underlain by an impermeable Moolayember Formation;
- it is overlain by an impermeable Evergreen Formation seal and is not in pressure communication with overlying aquifers in the Hutton Sandstone and Gubberamunda Sandstone;
- the hydrogeological definition of a confined aquifer is where the unit is fully saturated with the piezometric head (ie pressure head + elevation head) at an elevation higher than the top of the geological formation. At the West Moonie-1 Injection Well, the Precipice Sandstone is deeply confined at an overburden depth of over 2 km, as shown in Figure 9-8, and the Precipice Sandstone remains a confined aquifer for hundreds of kilometres from the operational lands.

The only area where the Precipice Sandstone is known to become an unconfined aquifer is where it outcrops on the surface approximately 240 km north of the West Moonie-1 Injection Well, as shown in Figure 9-9. The Precipice Sandstone water table is located close or at surface in these areas, supporting natural springs.

9.5.6 Aquifer Uses

Figure 9-9 depicts bores and wells that target the Precipice Sandstone aquifer, Evergreen Formation aquitard, Hutton Sandstone aquifer, and Gubberamunda Sandstone aquifer. The closest wells to the West Moonie-1 Injection Well that target the Precipice and Evergreen are 35 km north-east and associated with oil production in the Moonie Oil Field.

Figure 9-10 depicts the groundwater bores within the southern area of EPQ10. The Gubberamunda Sandstone is a regional aquifer and is the only non-alluvial aquifer that is used in the vicinity of the operational lands. The nearest Gubberamunda Sandstone bores to West Moonie-1 are RN107326, RN23075 (the Milgarra Bore), RN16039, RN77289, and RN77289.

Plume modelling predicts that the maximum extent of the stabilised GHG stream plume will be between 500 m and 600 m from the West Moonie-1 Injection Well and geochemical modelling indicates that that changes to Precipice Sandstone groundwater quality will only occur within the extent of the plume. As a result, it is very unlikely that the injection testing at West Moonie-1 will affect the groundwater levels or groundwater quality in any existing Precipice Sandstone bores and therefore no cumulative impacts or impacts to current users due to the Project are anticipated.

The nearest Hutton Sandstone bore is 50 km west of West Moonie-1 Injection Well and the Project will have no cumulative impact on the Hutton aquifer or bores accessing the Hutton Sandstone aquifer.

The Milgarra Bore located 17.3 km east southeast of the West Moonie-1 Injection Well, is the nearest groundwater abstraction bore producing water from the Gubberamunda Sandstone. Injection testing will not affect groundwater levels in the Gubberamunda Sandstone and therefore, will have no cumulative impacts from the Project.

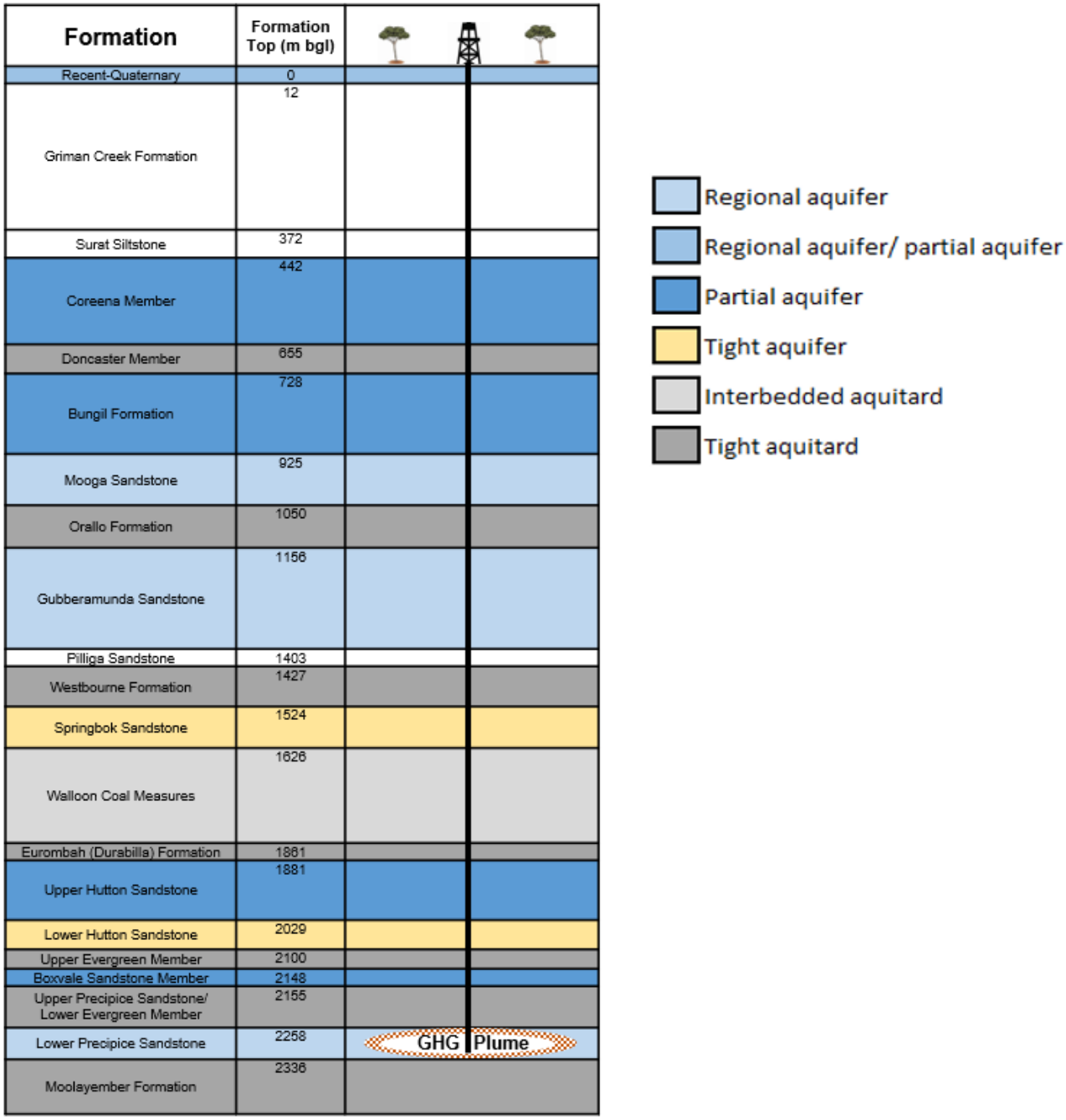

Figure 9-8 Simplified hydrostratigraphic classification of aquifers and aquitards showing overburden depths intersected at West Moonie-1 Injection Well, modified from OGIA (2019)

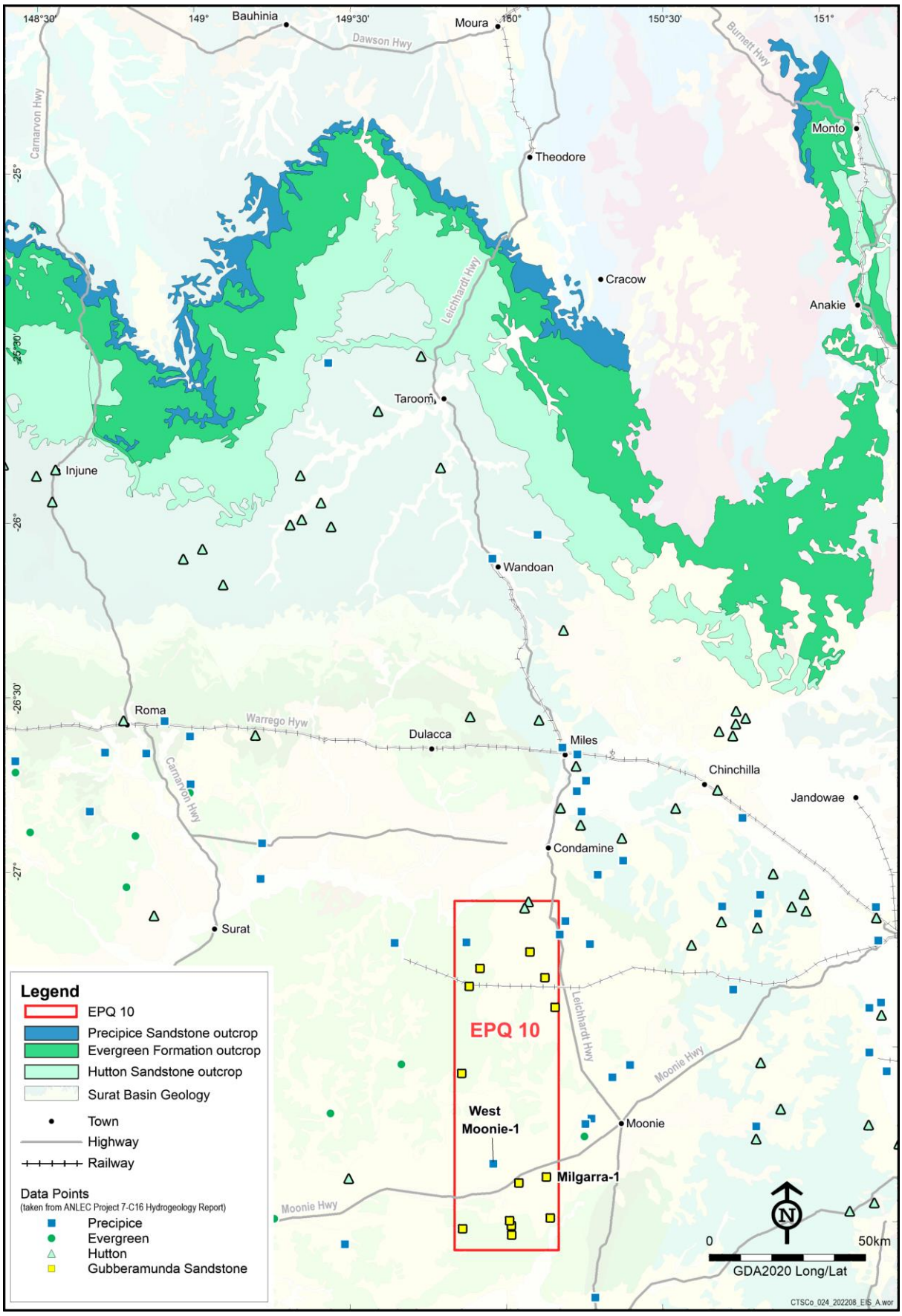

Figure 9-9 Surat Basin showing Precipice Sandstone, Evergreen Formation and Hutton Sandstone outcrop edges and selected associated groundwater bores

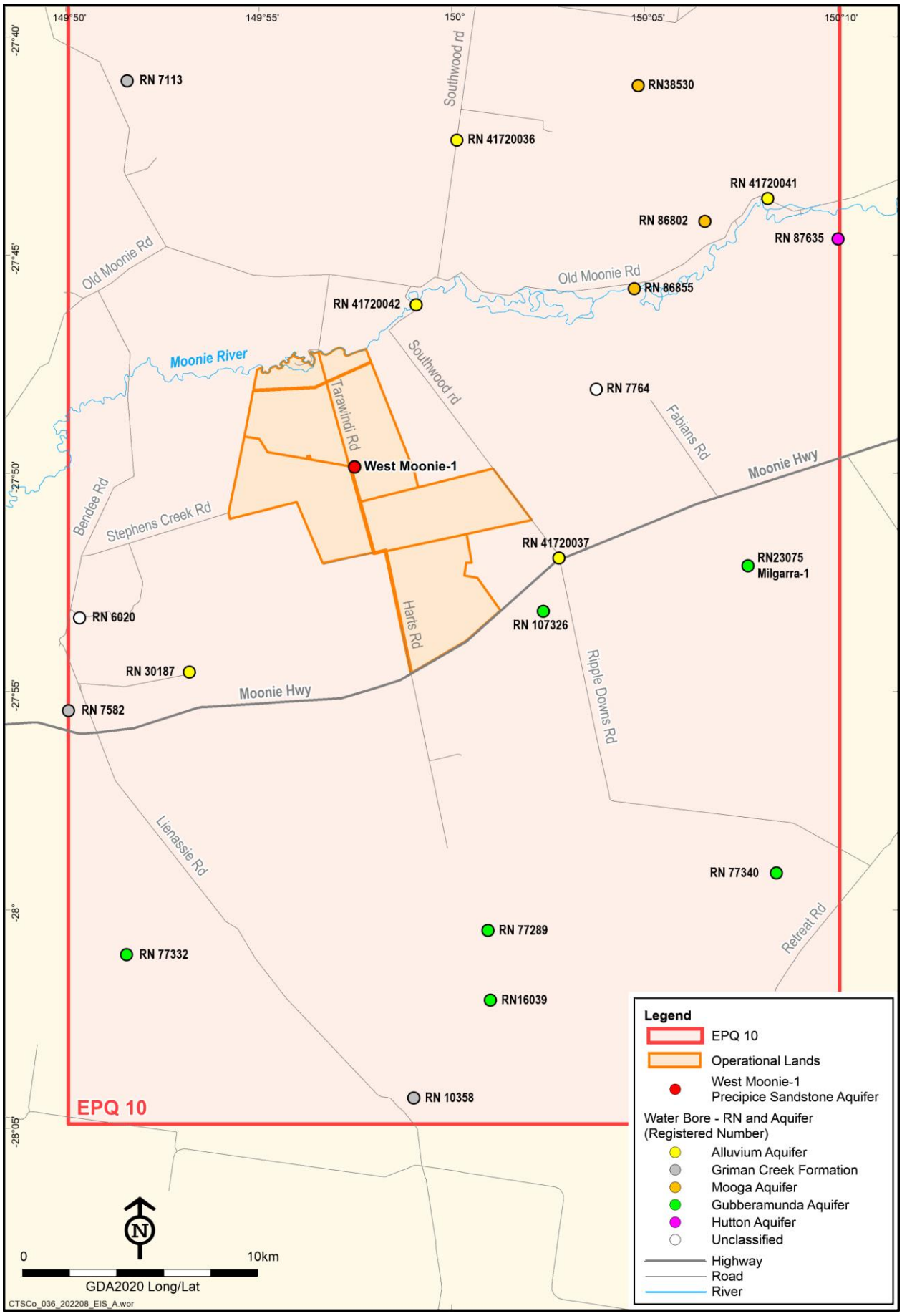

Figure 9-10 Nearest water bores to West Moonie-1 and the operational lands coloured by aquifer

9.6 Surface Water

The Project is located in the catchments of the Moonie River and Stephens Creek. Both watercourses are ephemeral.

Western Downs Regional Plan 2017 flood overlay mapping shows that parts of the operational lands are mapped as potential flood hazard area for the 1% AEP flood event as shown in Figure 9-11, considering both the Moonie River and Stephens Creek. Peak flood levels are recorded as part of the BoM Flood Monitoring Network at Southwood (Station No. 042100) on the Moonie River. Eleven flood events have been recorded in the vicinity of the operational lands between 2005 and 2021, with peak flood levels ranging from 3.85 m to 6.90 m. CTSCo has located the Transportation Facility outside of the identified potential flood hazard area, and the wells and bores are designed to be temporarily shut-in by remote control in during a flood event, to minimise potential impacts on Project infrastructure as well as water quality.

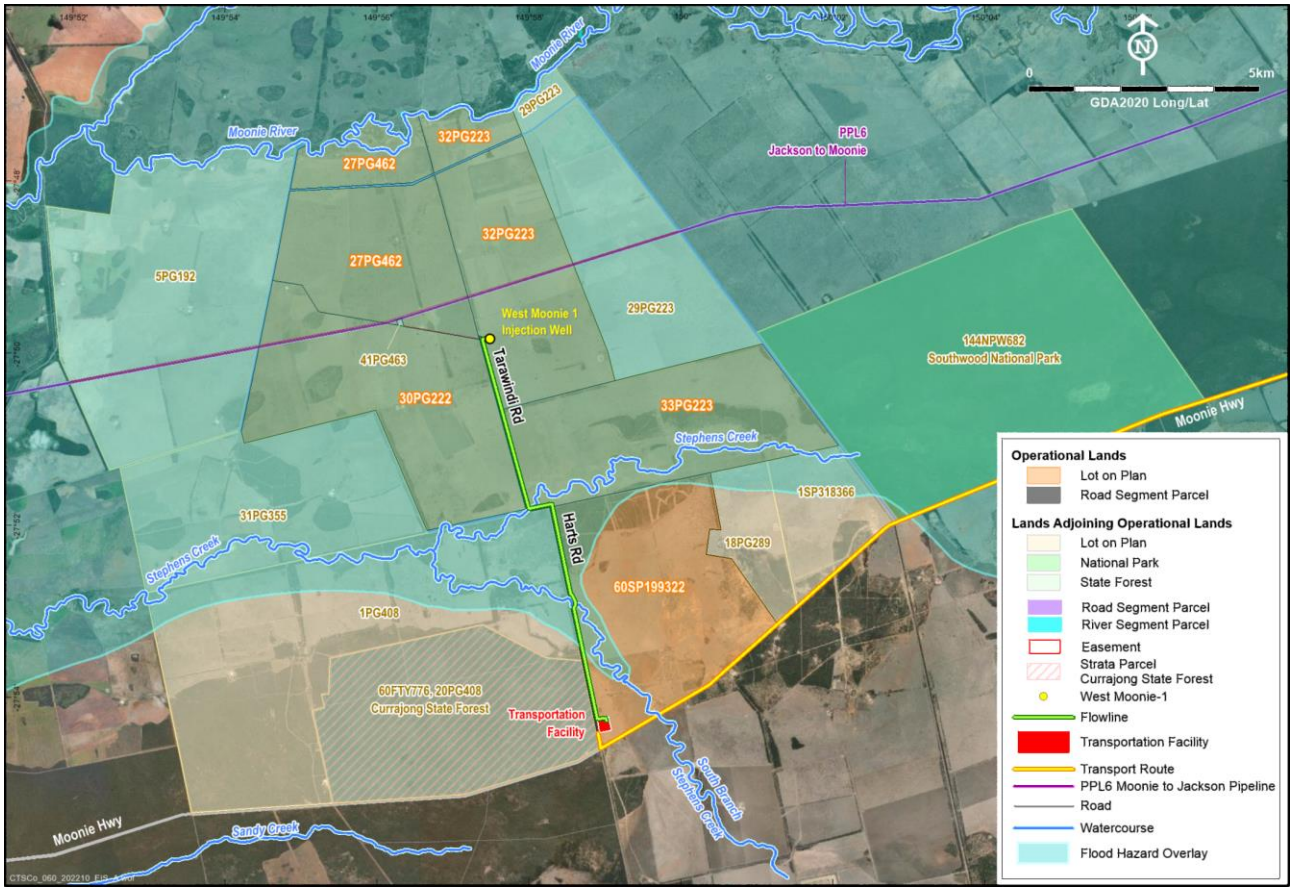

Figure 9-11 Western Downs Regional Plan 2017 1% AEP flood hazard overlay mapping of the operational lands

Within the Moonie River Water Management Area there are 20 entities that are surface water licence holders to water entitlements. Within the operational lands there are two water entitlement holders, and one water entitlement holder in land adjoining the operational lands. CTSCo does not propose to conduct any controlled releases to surface waters or extract surface waters for use, and will therefore have no impact on surface water entitlement holders. CTSCo does not propose to release any hazardous substances to the environment, with substances to be stored in designated areas and spill kits available. Discharge from on-site sewage treatment will be within the Transportation Facility, and meet the existing EA conditions.

The flowline is proposed to cross South Branch Stephens Creek and Stephens Creek. As described in section 7.4.5, the flowline is to be constructed using horizontal directional drilling (HDD) under South Branch Stephens Creek, while conventional trenching for spool and reel installation is proposed to cross Stephens Creek. Minimising the disturbance area will minimise the potential for sediment generation. Permit/s may be sought, depending upon final flowline design, construction methodologies, and site conditions at the time of construction.

9.7 Transport

The 260 km of road network between Millmerran Power Station and Harts Road Is designated as a B-double truck route. Harts Road is a local road, featuring a gravel surface, and single plus lane carriageway.

There is one unsignalised railway level crossing across the Gore Highway in Millmerran township. However, the line is currently not in use.

Modelling and assessment of the traffic proposed to be generated as a result of the Project's construction, operation, monitoring and rehabilitation activities shows that the Project will not affect the performance of the existing road network.

As described in section 7.4.3, CTSCo proposes to construct a channelised right-turn lane from the Moonie Highway into Harts Road, and left-turn acceleration lane on the Moonie Highway from Harts Road to improve access and egress to the Harts Road.

CTSCo will implement fatigue management for all drivers, as per the National Heavy Vehicle Regulator guidelines.

9.8 Air Quality

The Environmental Protection (Air) Policy 2019 (EPP (Air)), s.6 establishes the air quality values to be achieved and maintained, as further defined in the EPP (Air), Schedule 1. The air quality objectives and indicators relevant to the Project are total suspended particles (TSP), particulate matter with aerodynamic diameter less than 10 microns (PM_{10}); and particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$).

The existing ambient air quality environment associated with the Project is typical of a rural environment, most likely to be influenced by natural sources of air pollution, including windblown dusts and major air pollution events associated with bushfires and/or dust storms. Generally, ambient concentrations of gaseous and toxic air contaminants, are expected to be low.

The environmental values relating to air quality, are defined by identification of sensitive places, defined as:

- remnant and regrowth ecosystems of all types;
- a protected area under the *Nature Conservation Act 1992* or the *Marine Parks Act 2004* or a World Heritage Area;
- all dwellings, residential allotments, mobile home or caravan parks, residential marinas or other residential premises;
- a motel, hotel or hostel;
- a kindergarten, school, university or other educational institution;
- a medical centre or hospital;
- a public park or garden; and
- a place used as a workplace including an office for business or commercial purposes.

With regard to the GHG stream transport route from Millmerran Power Station to the Transportation Facility, and the operational lands of the Project, observations show:

- the majority of the area from the Millmerran Power Station to the operational lands traverses sparsely settled rural land;
- Project key features are isolated from locations with a high-density of sensitive places;
- other than the town of Millmerran, the GHG stream transport route passes primarily rural residential properties;
- protected natural areas, including national parks and state forests are adjacent to the GHG stream transport route, and occur in land adjoining the operational lands;
- sensitive places (human health and amenity) are present:
  - directly adjacent to the transport route, including dwellings and schools; and
  - greater than 1 km from the Project's key features including the Transport Facility, flowline and wells, including dwellings.

Potential impacts on observed features are predicted to be low, given the small number of vehicles to be used during all phases of the Project compared to existing traffic, and proposed daylight hours work being typically 7 am to 6 pm.

For ground disturbance activities during construction and rehabilitation of the Project, dust suppression measures will be undertaken. Bitumen sealing of road surfaces of the access road and within the Transportation Facility will minimise dust generation during all Project phases.

As part of the monitoring and verification plan for the GHG stream injection testing, as described in section 7.5, continuous monitoring of CO_2 concentrations in the atmosphere at and immediately adjacent to the wells and other Project infrastructure will be undertaken. A number of trigger levels based on measured CO_2 concentrations are proposed as part of the operation of the CO_2 monitoring stations, with actions to investigate, suspend injection or conduct emergency shutdown of injection stipulated.

9.9 Noise and Vibration

The *Environmental Protection Act 1994*, Environmental Protection Regulation 2019 and Environmental Protection (Noise) Policy 2019 all provide a range of noise and vibration default standards, standards for measuring noise and vibration, and environmental values to be protected or enhanced for the acoustic environment. The existing EA also defines noise limits for sensitive and commercial places, and vibration management measures associated with seismic surveys.

As per the definitions of sensitive places and commercial places for air quality given in section 9.8 above, and observations of the GHG stream transport route from Millmerran Power Station to the Transportation Facility and the operational lands of the Project, potential impacts on observed features are predicted to be low.

Avoidance and mitigation measures proposed to minimise the potential for any noise or vibration related complaints include:

- provide notification to affected persons (landowners or leasees of the operational lands or land adjoining the operational lands) and interested persons prior to the commencement of each of the Project phases as part of consultation activities;
- provide a complaints process, as outlined in section 8;
- undertake construction or rehabilitation activities during daylight hours (7 am to 6 pm) Monday to Friday;
- undertake operation and monitoring activities involving vehicle movements during daylight hours (7 am to 6 pm) Monday to Saturday;
- bitumen sealing of the Moonie Highway intersection with Harts Road, and a section of Harts Road to be used for access and egress of the Transportation Facility to reduce frictional noise from tyre contact with the road surface for vehicle movements during operation;
- in the Transportation Facility, the LPG generator set and pumps to have either design or acoustic housing to achieve less than 85 dB(A) at less than 1 m from the engine or pump when in operation, to achieve an overall sound power level of 98 dB(A) or less for the Transportation Facility; and
- undertake vibration management of seismic work in accordance with the existing EA condition 47.

9.10 Terrestrial and Aquatic Flora and Fauna

Assessment of both terrestrial and aquatic flora and fauna is governed by Commonwealth, State and local laws including, but not limited to the:

- *Environment Protection and Biodiversity Conservation Act 1999;*
- *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention);
- *Japan-Australia Migratory Bird Agreement* (JAMBA)*, China-Australia, Migratory Bird Agreement* (CAMBA) *and Republic of Korea-Australia, and Migratory Bird Agreement* (ROKAMBA);
- *Environmental Protection Act 1994;*
- *Biosecurity Act 2014;*
- *Fisheries Act 1994;*
- *Nature Conservation Act 1992;*
- *Vegetation Management Act 1999*; and
- Queensland State Planning Policy.

Desktop assessments were undertaken, including searches of various Commonwealth and State databases and mapping resources. Field surveys were conducted in 2021 and 2022 by qualified and experienced ecologists, with

field survey timing, techniques and effort undertaken in accordance with relevant State and Commonwealth guidelines, using the required permits and licences. The surveys aimed to:

- following analysis of the likelihood of occurrence, confirm the presence or absence of species listed under the *Environment Protection and Biodiversity Conservation Act 1999* and/or *Nature Conservation Act 1992*;
- confirm regional ecosystem boundaries and composition;
- identify pest animal species and weeds;
- assess fauna habitat and habitat features;
- assess potential breeding places;
- obtain incidental fauna observations; and
- conduct targeted searches for threatened species.

Under the *Environment Protection and Biodiversity Conservation Act* 1999 a number of Matters of National Environmental Significance (MNES) were identified within the Study Area during surveys in 2021, but none were considered likely to be impacted significantly by the Project. A referral (2021/9122) to the Australian Government was assessed in January 2022 and the Minister determined it not to be a controlled action in February 2022.

Large areas of remnant vegetation have been historically cleared for agriculture across the operational lands. Buffel Grass dominates the landscape in varying densities, with other weeds including African Lovegrass, Guinea Grass and Red Natal Grass. The Study Area has been subject to moderate levels of cattle grazing. Dams and adjacent watercourses have varying degrees of existing stock damage through localised trampling and soil compaction, dung deposition, and erosion.

The Moonie River (stream order 5) runs from east to west along the northern boundary of the operational lands. Two small watercourses (stream order 2) north of Currajong State Forest, being South Branch Stephens Creek (in Lot 60 SP199322) and Stephens Creek (in Lot 33 PG223) are proposed to be crossed by the flowline. Several lacustrine wetlands are scattered throughout the operational lands and land adjoining the operational lands.

The operational lands and land adjoining the operational lands lie within the Brigalow Belt Bioregion and the Moonie River-Commoron Creek Floodout. The Brigalow Belt bioregion is a wide band of acacia wooded grassland that runs between tropical rainforest of the coast and semi-arid interior of Queensland. The Brigalow Belt is characterised by the presence of brigalow (*Acacia harpophylla* vegetation).

Flora and fauna habitats were confirmed within the Disturbance Area, being recorded as:

- Woodlands:
  - RE 11.5.1 *Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces, with a Least Concern *Vegetation Management Act 1999* status;
  - woodlands confined to the southern end of the flowline alignment. These woodlands were generally dominated by White Cypress Pine and Bull-Oak with scattered eucalypts. Condition varied between patches but was generally average to poor due to the density of Buffel Grass or other weeds;
- Brigalow:
  - RE 11.4.3 *Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains, with an Endangered *Vegetation Management Act* 1999 status;
  - threatened ecological communities (TEC) under EPBC Act status;
  - a small patch of Brigalow occurs in the Disturbance Area but this will be avoided using horizontal directional drilling for flowline construction, as described in section 7.4.5;
- Riparian:
  - RE 11.3.7 *Eucalyptus populnea* woodland *with Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains, with an Of Concern *Vegetation Management Act 1999* status;
  - vegetation along South Branch Stephen Creek that lies within the Disturbance Area is RE 11.3.17, but does not contain Poplar Box and is therefore not a TEC under EPBC Act status;
  - a narrow riparian zone was located along the edge of the South Branch Stephens Creek and Stephens Creek, dominated by Poplar Box, Belah and Coolibah. The presence of water would attract many terrestrial mammals and birds;
  - riparian vegetation associated with South Branch Stephens Creek will be avoided using horizontal directional drilling for flowline construction, as described in section 7.4.5;
- Wetlands including gilgais:

  - one large wetland occurs just north of the Study Area and was inhabited by a large number of waterbirds including Yellow-billed Spoonbill, Teals, Great Egrets, Pacific Black Duck and more. Gilgai soils provide abundant sheltering opportunities for terrestrial mammals, amphibians and reptiles, and an abundant water source for birds including finches that need to drink every day.
- Cleared grasslands:
  - non-remnant, and covers the majority of the Study Area. These habitats provide limited sheltering and foraging opportunities for most species although species adapted to open habitats such as Australian Magpies, Emus, Cattle Egrets, Cockatiels, Galahs, Wedge-tailed Eagles, and Willie Wagtails thrive in these areas.

Various desktop assessment and field surveys for listed species were undertaken. Listed species that were confirmed to occur in the Study Area or nearby were:

- flora:
  - none;
- fauna:
  - Koala (*Phascolarctos cinereus*);
  - Squatter Pigeon (*Geophaps scripta scripta*); and
  - Latham's Snipe (*Gallinago hardwickii*).

Listed species that had habitat in the Study Area, but were not observed during field surveys included:

- flora:
  - Bluegrass (*Dichanthium setosum*), however it is unlikely that this species occurs in the Disturbance Area due to the low quality of the habitat;
  - Belson's Panic (*Homopholis belsoni*), however it is unlikely that this species occurs in the Disturbance Area due to the low quality of the habitat;
  - Woolly Wrinklewort (*Rutidosis lanata*), however it is unlikely that this species occurs in the Disturbance Area due to the low quality of the habitat;
- fauna:
  - Common Death Adder (*Acanthophis antarcticus*);
  - Fork-tailed Swift (*Apus pacificus*);
  - Australian Bittern (*Botaurus poiciloptilus*);
  - Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*);
  - Dunmall's Snake (*Furina dunmalli*);
  - Painted Honeyeater (*Grantiella picta*);
  - Grey Snake (*Hemiaspis damelii*);
  - White-throated Needletail (*Hirundapus caudacutus*);
  - Pale Imperial Hairstreak (*Jalmenus eubulus*);
  - Murray cod (*Maccullochella peelii*);
  - Satin Flycatcher (*Myiagra cyanoleuca*);
  - South-eastern Long-eared Bat (*Nyctophilus corbeni*);
  - Australian Painted Snipe (*Rostratula australis*); and
  - Golden-tailed Gecko (*Strophurus taenicauda*).

Many common flora and fauna species, including macroinvertebrate species, were also observed during field surveys within the Study Area and across the operational lands. The Australian freshwater crab (*Austrothelphusa transversa*) was not caught during field surveys.

The Moonie River is classified in the Groundwater Dependent Ecosystem (GDE) Atlas (BOM 2021) as being a 'low potential GDE from regional studies', with an ephemeral flow regime indicating that the river does not have a flow regime dependent on groundwater discharge to the waterway. Therefore, if there are groundwater discharges to the surface water of the Moonie River, they would be localised and sustain isolated pools within the river channel, rather than flow along the river channel. The desktop assessment and field survey indicated that only aquatic species that are common across the region and not dependent on discharge of groundwater to waterways occur in the Moonie River, that is there are no groundwater dependent aquatic species in the Moonie River. Therefore, the Moonie River is unlikely to be a GDE. Stephens Creek and the wetlands are not likely to be GDEs, because these waters were not identified as a potential GDEs in the GDE Atlas, nor did the desktop assessment or field studies indicate the presence of aquatic species that are dependent on the discharge of groundwater to surface waters.

Stygofauna diversity is highest where the depth to water table is low. The standing water level of the Griman Creek formation in the Study Area and operational lands is <10 m; thus, the alluvial aquifer has a suitable depth to watertable for supporting stygofauna. However, no stygofauna were recorded when sampling was undertaken.

The West Moonie-1 Injection Well targets the Precipice Sandstone aquifer between 2,275 m and 2,340 m below ground level (mbgl) with recorded groundwater temperature of approximately 75°C. While the electrical conductivity, pH and total dissolved solids of groundwater in the Precipice Sandstone aquifer are suitable for stygofauna, the likelihood that stygofauna occur in this aquifer is extremely low because:

- depth to groundwater is a major constraint on the complexity and abundance of stygofauna communities
- hyperthermophilic prokaryotes (i.e. single celled organisms that include archaea and bacteria) are the only biological groups known from environments where water temperatures are higher than 70°C. Stygofauna live under very stable thermal conditions, with experimental research demonstrating that many Australian species of stygofauna do not tolerate temperatures >30°C, and some taxa are sensitive to temperatures >16°C, but with at least one taxon reported to tolerate slightly higher than 30°C. Consequently, the water temperature of the Precipice Sandstone aquifer is three to six times higher than the water temperature reported to be tolerated by stygofauna. For comparative purposes, a thermophilic ostracod species (broadly related to ostracods that occur in groundwater) is known from hot springs where water temperature is <55°C. Thus, even thermophilic taxa that are related to stygofauna occur at temperatures well below the temperature of the Precipice Sandstone aquifer.

Consequently, it is highly unlikely that the Precipice Sandstone aquifer in the operational lands is a subterranean GDE, given the depth and temperature of the Precipice Sandstone aquifer.

Pest flora and fauna species were also observed during field surveys including:

- flora: cobblers pegs, red natal grass, common prickly pear, African love grass, noogoora burr, mayne's pest, Guinea grass, and buffel grass; and
- fauna: common myna, wild dog, feral cat, brown hare, house mouse, rabbit, cane toad, feral pig, European red fox, carp, and eastern gambusia.

The Project's avoidance and mitigation measures for flora and fauna impacts are in accordance with the development mitigation hierarchy which aims for a result of "no net loss" of biodiversity through implementing, in the following order: avoidance, mitigation, rehabilitation and offsetting. The Project has been designed to:

- avoid remnant and non-remnant vegetation as much as possible;
- avoid hollow bearing or large trees by siting the Transportation Facility between trees;
- where vegetation could not be avoided entirely, it is either avoided through using horizontal directional drilling (HDD) for construction of sections of the flowline, or disturbance minimised;
- avoid all wetlands and vegetated riparian habitat (mapped and unmapped) by using HDD for construction of sections of the flowline;
- keep the flowline construction trench, where HDD is not used, as small as possible to avoid impacts to soil (including cracking clay soils for Grey Snake), and conduct works when no water is present in the watercourse, and restoring the pre-construction bed and banks profile; and
- minimise clearing of vegetation along Harts Road for the access and egress tracks to be less than 10m in width for each track.

Broad mitigation measures include:

- injury or mortality of fauna species will be minimised by managing habitat clearing and by the supervision by a qualified fauna spotter catcher of activities with the potential to cause harm to protected wildlife (in accordance with the NC Act). This includes during soil excavation in cracking clay soil areas.
- impacts to habitat and potential habitat degradation will be minimised by maintaining the hydrology of the site, conducting weed management during construction, appropriately storing and handling fluids and chemicals with spill kits available, and managing dust, waste and water quality. Soil and erosion controls will be implemented during construction where required.
- weed management measures will be established for the site by implementation of strict weed hygiene (e.g. weed washdown certification of machinery and vehicles) during construction and the operational phases of the Project.
- erosion and sediment measures will be implemented to mitigate impact on waterways (particularly South Branch Stephens Creek) to ensure the protection of bank stability, water quality and habitat.
- develop a bushfire management plan in consultation with the Queensland Fire and Emergency Services.

- training of personnel to be aware of various risks associated with flora and fauna management during all phases of the Project.

Other site and/or species specific mitigation measures are also proposed, including proposed EA condition amendments.

As the Project is not considered to result in significant residual impacts to MNES or MSES, offsets are not required.

Additional approvals which will be required include, but may not be limited:

- a Low-risk Species Management Program (Low-risk SMP):
  - required when there is a risk that there will be impacts to low risk (non-threatened species and non-colonial breeders) species breeding places. This includes nests in trees, logs under which animals could breed, small wetlands that could contain frogs, etc. A low-risk SMP is required for all projects that require clearing and details the mitigation measures which need to be implemented to protect breeding placed during clearing. This requires approval by DES prior to any clearing being undertaken.
- a High-risk Species Management Program (High-risk SMP):
  - required due to the possibility of clearing breeding places for high-risk species such as Squatter Pigeon and Grey Snake. This plan will be used by Spotter Catchers during clearing, and will detail the species specific mitigation measures which will need to be implemented to reduce the risk to these species. The plan will require approval by DES prior to construction commencing and will need to be submitted for approval more than 40 business days prior to construction.

9.11 Hazards and Safety

The potential hazards and safety risks, both natural and man-made, were determined for all Project phases to the workforce, landowners, the public and property.

Existing hazards and safety risks include, but are not limited to:

- GHG stream transport route traverses a rail level crossing at Millmerran just west of the intersection of the Gore Highway with Campbell Street. However, the rail line is not in use, and is currently closed to trains;
- narrow, unsealed road condition of Harts Road and intersection with the Moonie Highway, which is not currently suitable for B-double movements;
- a historically low incidence of bushfires in the area;
- West Moonie-1 Injection Well and associated monitoring wells and bores, and approximately 80% of the flowline are located within a potential 1% AEP flood hazard area of the Moonie River and Stephens Creek catchments. The Transportation Facility is located outside of the potential flood hazard area;
- recorded earthquake activity, including magnitude in Queensland between 1866 and 2020 indicates little to no earthquake activity in the Study Area;
- the Study Area historically has low tropical cyclone probability;
- probability of heatwaves in the Study Area has been historically low;
- various fauna species that could pose a health risk to people such as snakes, spiders, ticks, mosquitoes, bees and other stinging insects, wild pigs, wild dogs, foxes, and cattle;
- there are no known abandoned mines in the operational lands;
- Moonie Oil Fields are approximately 34 km east of West Moonie-1 Injection Well;
- the high-pressure petroleum pipeline in PPL6 crosses through the operational lands approximately 8 km north of West Moonie-1 Injection Well;
- there is no fracking from coal seam gas (CSG) operations in the operational lands or land adjoining the operational lands; and
- sensitive places, particularly dwellings (residential buildings and associated farm infrastructure) within the operational lands which will be accessed periodically by landowners. The closest dwellings are approximately 1.3 km east of the Transportation Facility site, and 1.3 km east of the flowline alignment.

Hazards and safety risks that may result from the Project, include, but may not be limited to:

- short term exposure to carbon dioxide (CO_2) at elevated concentrations. Carbon dioxide is a colourless, odourless gas and is about 1.5 times heavier than air at standard conditions. It exists in the atmosphere at concentrations of approximately 400 parts per million (ppm) and is increasing. It is also a normal component of human blood stream however, if carbon dioxide is inhaled at elevated concentrations, it can be lethal. Humans and animals are sensitive to small changes in atmospheric CO_2 concentration, but the tolerance can differ significantly between individuals. The toxicity of CO_2 has been shown to depend on the concentration and duration of exposure;
- during an instantaneous catastrophic supercritical CO_2, the formation of 'dry ice' could occur as the CO_2 depressurises, leading to burns to personnel in direct contact with the material;
- road works during construction to upgrade Harts Road and the Moonie Highway intersection;
- 260 km travel distance (one-way) from the Millmerran Power Station to the Transportation, estimated to take 3 hours and 20 minutes, resulting in driver fatigue, and increased potential of a road incident;
- hazards associated with earthworks, working with or in close proximity to machinery, handling of concrete or cement, cranage, trench excavations, fencing, pipework, plumbing, and electricity;
- hazards associated with horizontal directional drilling (HDD);
- working in close proximity to a watercourse;
- personnel working alone;
- interactions between personnel and machinery or trucks;
- interactions with wildlife or stock;
- manual handling;
- heat stress;
- short term exposure to or ignition of LPG;
- exposure to hazardous substances;
- seismic monitoring does not produce sufficient vibration to cause significant induced seismicity in the operational lands; and
- there will be no use of explosives at or near surface during any phase of the Project, and therefore no safety risks.

For the avoidance or mitigation of hazards and safety risks, CTSCo proposes but is not limited to:

- having all plant, machinery, and equipment designed, constructed, operated and decommissioned in accordance with the required Australian or international standards and guidelines;
- having all plant, equipment, and machinery to be fit-for-purpose, inspected and maintained;
- consultation with emergency services and the Resources Safety Health Queensland (RSHQ) will be ongoing through all Project phases;
- developing emergency response plans in consultation with emergency services, that cover all Project phases, including for incident management, bushfire management, and wildlife safety management;
- maintaining exchange of information with overlapping petroleum tenement holders with regards to infrastructure and future planned activities;
- B-double trucks used for transport of GHG to be licensed in accordance with the Transport Operations (Road Use Management – Dangerous Goods) Regulation 2018. They will be fit-for-purpose and be inspected and maintained (serviced) in accordance with the inspection and maintenance regimes and policies implemented by CTSCo, safety protection systems installed (rollover protection, IVMS etc);
- GHG stream truck drivers to travel only on designated B-double routes;
- upgrade of Harts Road and the Moonie Highway intersection to bitumen seal, dual-lane suitable for B-double trucks;
- implementing one-way traffic flow in the Transportation Facility, allowing for vehicle parking and overtaking lanes;
- developing fatigue management practices, considering the requirements of the National Heavy Vehicle Regulator (NHVR);
- training of B-double drivers in GHG stream leakage management;
- installing demarcation and signage of underground infrastructure;
- installing protection devices on, inside, around or adjacent to certain plant and equipment;
- operating equipment within intended design conditions;
- regular inspection of all infrastructure;
- storing of hazardous substances and dangerous goods in accordance with safety data sheets;
- training personnel in the safe handling, storage and clean-up of hazardous substances used during all phases of the Project;

- continuous monitoring of pressure wellhead and injection point, temperature and leak detection sensors, including remote control;
- automated system shutdown, alarm and notification should injection operations deviate from expected conditions, or any leak be detected;
- implementing daylight work hours, typically between 7 am to 6 pm for all phases of the Project;
- installing relevant signage;
- implementing practices for control of ignition sources on site, including a restriction or total ban on hot works (e.g. welding) on high temperature days;
- no smoking being permitted on-site;
- managing vegetation growth around infrastructure to minimise bushfire risk, wildlife safety risk, and improve visibility for personnel;
- fire fighting equipment to be available at the Transportation Facility, with personnel trained in its use;
- weather monitoring;
- installing lightning protection systems;
- identifying underground services (e.g. dial-before-you-dig) and overhead services prior to commencing construction;
- implementing a permit-to-work system for all construction and rehabilitation activities;
- implementing exclusion zones for certain activities, such as lifts, excavations, machinery operation, and around certain plant and equipment;
- installing security systems and restricting access to authorised personnel;
- ensuring all personnel are suitably qualified, certified, licenced and experienced in undertaking their respective duties;
- using personnel protection equipment (PPE) relevant to a task;
- not conducting activities of high ambient temperatures, in accordance with Queensland Health Guidelines;
- maintaining availability to drinking water;
- supplying equipment for moving heavy or bulky equipment;
- ensuring personnel trained in first aid, with first aid kits will be available in all vehicles and at the Transportation Facility; and
- ensuring that during construction and rehabilitation activities, at a minimum, personnel to work in pairs, and no working alone.

9.12 Cultural Heritage and Native Title

The Project is located entirely on freehold land or road parcels where Native Title has been extinguished. None of the operational lands are subject to native title. The Project therefore does not require the development of an Indigenous Land Use Agreement (ILUA) or similar native title agreement pursuant to provisions of the *Native Title Act 1993*.

The Bigambul Native Title Aboriginal Corporation (BNTAC) determination as the recognised native title body corporate (RNTBC) was made on 20 September 2016 and registered on 9 June 2017. The determination area includes lands in the vicinity of the operational lands, but does not include the operational lands. Although there is no native title holder of the operational lands, for the purposes of the *Aboriginal Cultural Heritage Act 2003* (ACH Act), the Bigambul People are the Aboriginal party for the area of the operational lands, as the outer boundaries of their claim included the operational lands.

Regarding Aboriginal cultural heritage, there are no places listed on the Commonwealth Heritage List and National Heritage List in the operational lands. One well is listed on the Queensland Cultural Heritage Database and Register within the operational lands, and within a 5 km of the operational lands there are a total of 13 indigenous cultural heritage sites including artefact scatters, grinding grooves, wells, scarred/cared trees, stone arrangements and burials.

Regarding non-indigenous cultural heritage, searches of State and local government databases found that there are no heritage places within the operational lands. However, Southwood National Park (being land adjoining the operational lands), has a non-statutory listing on the Register of the National Estate.

Regarding historic land use, since European settlement, clearing of vegetation and other significant ground disturbance has been conducted within the operational lands for agricultural purposes. The rate of land clearing accelerated with the use of earthworks machinery since the late 1940s. The majority of the operational lands were cleared of brigalow and other vegetation communities during the 1950s, 1960s and 1970s. The operational lands have been subject to significant ground disturbance, described as Categories 3 and 4 in the ACH Duty of Care Guidelines.

CTSCo will enter into a Cultural Heritage Management Plan (CHMP) with the BNTAC on behalf of the Bigambul People in accordance with ACH Act, Part 7. At the time of preparing the EIS, CTSCo and the BNTAC have already commenced negotiations for the CHMP. The agreed CHMP will be lodged for approval by the chief executive of the Queensland government department responsible for administration of the ACH Act in due course.

Fields surveys of the Project's Disturbance Area and other disturbance associated with exploration and appraisal activities will be undertaken with the BNTAC and their representatives, in accordance with the Duty of Care Guidelines.

Other avoidance and mitigation measures will include limiting ground disturbance to the minimum practically required, including horizontal directional drilling (HDD) for construction of the flowline under the South Branch Stephens Creek, and under a stand of brigalow (RE 11.4.3).

9.13 Social Impact Assessment

The Project's social impact assessment considered the regional area, local area, and operational lands and land adjoining the operational lands.

- The regional area includes the local government areas (LGAs) of:
  - Toowoomba Regional Council, which includes part of the transport route for the GHG stream from Millmerran Power Station; and
  - Goondiwindi Regional Council which includes part of transport route for the GHG stream, and major regional centres including Goondiwindi; and
  - Western Downs Region Council, where the Project operational lands are located, includes part of transport route for the GHG stream, and major regional centres including Dalby.

The transport route for the GHG stream during operations will travel a 260 km route from Millmerran Power Station through the township of Millmerran and Moonie. The township of Millmerran is characterised as:

- 82 km south-west of Toowoomba, 68 km north of Inglewood, and 89 km south of Dalby;
- population of 3,223 (2021 Census);
- Gore Highway passes through the north-east to the west of Millmerran and the Millmerran-Inglewood Road runs to the south;
- a regional town centre with two large grocery outlets, two large hardware stores and a bakery;
- Millmerran Power Station is the largest employer with approximately 50 direct employees and approximately 150 indirect employees (Intergen 2022);
- providing regional medical services including 24 bed public hospital and medical centre;
- having recreational and tourist facilities including a sports centre, Olympic-sized swimming pool, community centre, library and caravan parks, motels and camp sites; and
- providing educational facilities including Millmerran State School (Prep to Year 10) with approximately 300 students (Millmerran State School official website), and St Joseph's Primary School (Prep to Year 6) with approximately 65 students (St Joseph's Primary School, Millmerran official website).

Two townships are present within the local area, being a 50 km radius of the West Moonie-1 Injection Well. The townships are characterised as:

- Moonie:
  - 44 km east of the West Moonie-1 Injection Well;
  - located at the intersection of the Moonie Highway and Leichhardt Highway;
  - population of 182 people (2021 Census);
  - Moonie State School (Prep – Year 6), with 30 students (Moonie State School official website);
  - WDRC Council Library;
  - Tourist Information Centre; and
  - Moonie Crossroads, including a service station, accommodation, restaurant, and café;
- Westmar:
  - 30 km west of the West Moonie-1 Injection Well;
  - located on the intersection of the Moonie Highway and Meandarra Talwood Road, approximately 118 km east of St George;
  - population of 59 people (2021 Census);

- Westmar State School (Prep to Year 7) with 29 students (Westmar State School official website); and
- Westmar Pub and Convenience Store and roadstop with public toilets and showers.

The school bus routes of Moonie State School and Westmar State School also operate in proximity of the operational lands.

To avoid and/or minimise social impacts to the community, and enhance potential social benefits, CTSCo commits to:

- for community and stakeholder engagement:
  - implementing a community and stakeholder engagement plan for all Project phases;
  - compensation payments to landowners of the operational lands;
  - communication of CCA requirements to the workforce to ensure that landowner requirements are met;
  - direct engagement with emergency services, DTMR, WDRC, the BNTAC, and landowners, leasees or occupiers of operational lands, land adjoining operational lands or other neighbouring properties (collectively interested and affected persons) to obtain ongoing feedback during all phases of the Project;
  - liaison with DTMR and local schools on school bus routes along the GHG stream transport route
  - educational opportunities for school children and teachers about the Project that are along the GHG stream transport route;
  - consideration of community feedback and where appropriate inclusion of suggestions into the Project's design and operation;
  - implementing community complaints management processes;
- for workforce management:
  - all personnel will drive in, drive out (DIDO) to the Project area. No fly-in, fly-out (FIFO) of the workforce is proposed for any phase of the Project;
  - contracting of local people will be considered, depending upon the skills available. During all phases, the local area is considered to be localities within 1 hour to 1.5 hours drive of the Transportation Facility, such as Moonie, Westmar, Dalby, Goondiwindi and St George. For the operation phase for activities associated with transportation of the GHG stream, the local area will additionally include Millmerran and surrounds;
  - workdays are nominated as Monday to Saturday inclusive, excluding any public holidays recognised for Queensland, Brisbane or Moonie areas. However, the majority of activities are anticipated to be conducted Monday to Friday;
  - personnel work hours are anticipated to be 10-hour days, daylight only, typically between 7 am and 6 pm for all nominated workdays. Fatigue management requirements will be considered in all journey planning, mobilisation and demobilisation, general travel to and from site to accommodation, and personnel rostering;
  - for the GHG stream injection activities, operations will be conducted 24 hours a day, 7 days a week, but will not require personnel on-site at all times, with continuous remote monitoring of all critical equipment;
  - all in-field personnel will be required to hold suitable qualifications and certification under the health and safety requirements of the Petroleum and Gas (Production and Safety) Act 2004. Truck drivers transporting the GHG stream or other materials subject to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) will also be required to be suitably licenced or otherwise accredited;
  - where potential employees or contractors require training, accreditation or certification to be compliant with various health, safety, environmental, commercial, governance or other regulatory requirements, CTSCo will facilitate the necessary training accordingly, including implementation of Glencore plc's conduct of conduct, procurement, and human rights policies;
- for housing and accommodation:
  - for accommodation purposes, the workforce from the local area are anticipated to be able to go home each night;
  - for personnel not already living in the local area, the workforce is anticipated to be housed in the existing local short-term accommodation options in Moonie (Moonie Crossroads), Westmar (Westmar Roadhouse), St George, Dalby, and/or Goondiwindi;
  - no new housing, worker accommodation facilities, camps or villages will be constructed as part of the Project;
- for local businesses and industry procurement:
  - as a part of Glencore, CTSCo is guided by Glencore plc's procurement and supplier standards. Glencore's Global Supplier Standard set expectations regarding ethical business practices, safety and health requirements, adherence to human rights legislation and environmental stewardship. Further details are found at: https://www.glencore.com.au/suppliers;
  - specialist instrumentation, plant and equipment will be sourced from the relevant suppliers, some being located overseas or outside of Queensland;

  - for general or more widely available plant, equipment, and materials, CTSCo will endeavour to source these from within Queensland, and regionally or locally where possible. Procurement or supplier opportunities will include but not limited to earthworks contractors; various trades; gravel, concrete, bitumen and similar supplies; and truck haulage;
  - during the construction and rehabilitation phases, there are potential benefits to local contractors, and food and accommodation providers;
  - opportunities for supply of plant, equipment, and materials will be advertised on CTSCo's website, and other local or regional avenues such as through peak bodies, local government advertising, newspapers, or similar;
  - roadworks associated with road upgrades of Harts Road and the intersection with the Moonie Highway to provide access to the Transportation Facility will involve local contractors and suppliers. Infrastructure Agreements with WDRC and the Department of Transport and Main Roads (DTMR) will include requirements regarding local procurement, and the scope of road improvement activities such as type and sizing of intersections, speed limits, traffic management, signage, construction timing and duration, and funding;
- for health and community well-being:
  - first aid equipment will be available in the Transportation Facility, and in all vehicles present on site. Any medical requirements beyond first aid will depend upon public facilities and services;
  - fatigue management requirements for the workforce, as stipulated by Glencore plc and National Heavy Vehicle Regulator;
  - conduct of Project activities between 7 am and 6 pm to avoid or minimise potential impacts due to noise or light pollution at night impacting sensitive places and fauna;
  - minimising clearing of vegetation and undertaking dust suppression during construction and rehabilitation activities, to minimise dust generation;
  - an emergency response plan prepared in consultation with the landowners of the operational lands, and the emergency services that cover the operational lands. The emergency response plan will include, but not limited to notification processes for certain activities including planned exercises, type and availability of emergency response equipment and personnel, contact details of personnel, siting and identification of the Transportation Facility for emergency response and evacuation meeting points, workforce profiles, and Project scheduling;
  - loading of the GHG stream will be within the Millmerran Power Station, which is a secure facility. Security at the Transportation Facility will be implemented by construction of a fence that will be stock proof and will restrict access to personnel by secure gates and associated security measures. Off-loading of the GHG stream will be wholly within the Transportation Facility. Transportation of the GHG stream will be in trucks that meet the ADG Code;
  - subject to negotiations with WDRC, CTSCo proposes that the upgraded section of Harts Road is left for ongoing usage of landowners and leaseholders in the area after the Project's other key features have been rehabilitated.

9.14 Economic Assessment

Economic assessment of the Project included calculation of annual costs and benefits, finding:

- benefits:
  - decreased CO_2 emissions to atmosphere: $3,162,500 per year;
- costs:
  - increased vehicle crash risk: $203,810 per year;
  - environmental externalities from increased environmental costs associated with increased vehicle kilometres travelled: $372,779 per year;
- net benefits:
  - $2,585,911 per year.

Potential impacts and their avoidance and/or mitigation measures include:

- positive long-term benefit by reducing atmospheric CO_2 emissions from the Project;
- short-term, temporary impact of reduced labour availability to the market during Project construction and rehabilitation, as personnel will be working on the Project;
- short-term, temporary impact of decreased number of transport operators to the market during Project operation, as personnel will be working on the Project;

- short-term, temporary impact of increased road maintenance costs and increased crash risk, with mitigation by upgrade of the Moonie Highway – Harts Road intersection and section of Harts Road;
- short-term, temporary impact of environmental externalities from increased environmental costs associated with increased vehicle kilometres travelled, with mitigation by driver awareness training, and fatigue management;
- short-term, temporary impacts to recreational, commercial, indigenous and agricultural uses, including obtaining future financing or insurance coverage, with mitigation measures providing suitable compensation payments to landowners as part of the CCAs, and implementing local procurement and supply policies.

9.15 Rehabilitation

The existing environmental authority (EA) conditions stipulate topsoil management and rehabilitation objectives:

- 34 – Erosion and sediment control: for topsoil management;
- 58 – Rehabilitation: provides rehabilitation objectives;
- 59: provides requirements for maintenance of land rehabilitation;
- 60: provides requirements to measure rehabilitation success;
- 61: provides requirements for removal of above ground and management of underground infrastructure; and
- 62: provides rehabilitation responsibility requirements for transition of a GHG authority to a new authority.

As outlined in section 7.4, CTSCo commits to complying with all existing environmental authority (EA) conditions, including:

- progressive rehabilitation:
  - immediately following certain construction activities associated with the Transportation Facility and flowline;
  - immediately following the operation phase, with decommissioning of infrastructure and site rehabilitation associated with the access and egress tracks to the Transportation Facility, the Transportation Facility and flowline over an indicative 6-month period of June to December 2028; and
  - when post-injection monitoring is complete, rehabilitation of infrastructure on the well pad;
- subject to agreement with the Department of Transport and Main Roads, and Western Downs Regional Council, leave in place the upgrades to the Moonie Highway – Harts Road intersection and a section of Harts Road;
- removal of all above ground infrastructure from the Transportation Facility, and then restoring the area back to pasture similar to surrounding paddocks;
- leaving the flowline in situ, filling with cement and capping both ends;
- rehabilitation associated with infrastructure of the well pads:
  - for the wells, rehabilitation in accordance with the *Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland – Petroleum and Gas Inspectorate* (DNRME 2019);
  - for West Moonie Shallow Monitoring Bore, rehabilitation in accordance with the *Minimum construction requirements for water bores in Australia* (NUDLC 2020);
  - subject to landowner and regulatory approvals, transfer ownership of the Gubberamunda Monitoring Bore to the landowner for future conversion to a farm water supply bore;
- monitoring of rehabilitation to include visual surveillance and comparison to surrounding vegetation; and
- maintenance of rehabilitation will be undertaken as necessary in response to the results of the monitoring program. Examples of maintenance works would include reseeding to meet required revegetation parameters, the application of fertiliser, weed management and the implementation of additional erosion control measures such as minor remedial earthworks or soil conservation works in response to erosion.

10. Summary of Key Commitments and Proposed EA Condition Amendments

CTSCo proposes various commitments and EA condition amendments for undertaking of the Project. Where relevant to a Project specific matter, commitments are provided in the EIS, and a comparison made as to whether the commitment is consistent to existing EA condition/s. Where an inconsistency with an existing EA condition is apparent, a proposed EA condition amendment has been provided. However, not all commitments are relevant to EA conditions, and may align with other legislative requirements or industry best practicable practice.

Table 10-1 provides a summary of key commitments, and where relevant, EA conditions including proposed amendments. The list is not comprehensive, and reference should be made to each EIS chapter, and particularly to EIS Chapters 21 Project Commitments, and 22 Proposed Environmental Authority EPPG00646913 Amendments.

Table 10-1 Summary of Key Commitments and Proposed EA Condition Amendments

Commitment	EA conditions or other requirements
Conduct GHG storage injection testing, as defined by the GHG Act, s.16	To enable the Project to inject a GHG stream (CO_2) into EPQ10 for injection testing, the following amendments to the EA are proposed: amend EA condition 1 to read (amendment in ***bold italic text***): a. This environmental authority ***authorises the carrying out of GHG stream*** injection ***testing*** on EPQ10; b. For the purpose of assessing the feasibility of GHG stream storage, the environmental authority authorises the following activities: drilling of GHG appraisal wells, water production, ***injection testing,*** and geophysical survey. *c.* ***The environmental authority authorises the release of a GHG stream to groundwater within the Precipice Sandstone aquifer, as a confined aquifer as defined by the Environmental Protection Regulation s.41, at a rate of up to 110,000 tonnes of GHG stream per year, up to a total of 330,000 tonnes.*** *d.* ***The environmental authority authorises the released GHG stream to remain in perpetuity within the Precipice Sandstone aquifer, and not be subject to the rehabilitation requirements of Condition 58 – Rehabilitation.*** *e.* ***This environmental authority does not authorise the carrying out of GHG stream injection testing on EPQ12.***
Exploration and appraisal activities, including drilling of GHG appraisal wells, water production, and geophysical survey.	Consistent with EA condition 1(b)
Conduct and Compensation Agreements (CCAs) are in place or will be negotiated with the landowners of all operational lands, prior to advanced activities commencing on the respective lot on plans, and remain in place until rehabilitation is considered successful.	Consistent with EA condition 60 – Rehabilitation Success, and EA condition 61 – Infrastructure
Construction of the Access Road and access and egress tracks, being the upgrade of Harts Road section to Transportation Facility.	Consistent with EA condition 12, and EA condition 61 – Infrastructure
Prior to construction of the Access Road, enter into Infrastructure Agreements with the Department of Transport and Main Roads, and Western Downs Regional Council.	Consistent with the *Planning Act 2016*, Chapter 4, Part 4
Construction of the Transportation Facility	Consistent with EA condition 9 – Heritage places and archaeological artefacts, EA condition 10 – Clearing vegetation, EA condition 15 – Topsoil management, EA condition 48 – General waste management, EA condition 54 – Sewage, EA condition 55

Commitment	EA conditions or other requirements
Construction of the flowline	Consistent with EA condition 11, EA condition 13, and EA condition 36 – Activities in a watercourse, wetland or spring
Construction work hours and workdays	Consistent with EA condition 45 – Noise management
Operation of the Transportation Facility will have vehicular traffic enter and exit via a one-way traffic layout.	Not applicable to EA condition, but is considered to improve traffic safety
No on-site fuelling or maintenance of vehicles is proposed. All fuelling of vehicles will be off-site.	Consistent with EA condition 20 – Contaminant release
Operation work hours and workdays	Consistent with EA condition 45 – Noise management
Develop an Injection Test Plan (ITP) and Monitoring and Verification Plan (MVP), with copies to be submitted to the administering authority.	Consistent with EA condition 4 – Work program and development plan, and EA condition 56 – Monitoring
CTSCo will conduct targeted monitoring measures for potential departures from the predicted GHG plume behaviour, and implement mitigate measures, and where required, report to the administering authority.	Amend EA condition 41 Groundwater to read (amendment in ***bold italic text***): ***The holder of this environmental authority is to conduct targeted monitoring measures for potential departures from the predicted GHG plume behaviour, and implement mitigation measures, as described in the GHG stream Management Plan.*** ~~***If the holder of this environmental authority becomes aware that environmental harm is caused or threatened to be caused, as a result of injection activities, injection must cease immediately.***~~
Final rehabilitation will be in accordance with EPQ10 conditions, EA conditions and legislative requirements, including the "*Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland*" (DNRME, 2019) or later version thereof.	Consistent with EA condition 58 – Rehabilitation, EA condition 59 – Maintenance of land rehabilitation, and EA condition 60 – Rehabilitation Success
Subject to negotiations with the landowner, the Gubberamunda Monitoring Bore may be converted to a water supply bore for stock and domestic or irrigation purposes.	Consistent with EA condition 61 – Infrastructure
Pursuant to the GHG Act, s.31, given the temporary nature of all structures in the Transportation Facility, all structures other than the flowline will be removed from the area, with the operational lands rehabilitated to pasture consistent with the surrounding paddock.	Consistent with EA condition 58 – Rehabilitation, EA condition 59 – Maintenance of land rehabilitation, EA condition 60 – Rehabilitation Success, and EA condition 61 – Infrastructure
Rehabilitation of the flowline will involve leaving the flowline in-situ, and disconnecting the flowline from the equipment in the Transportation Facility and West Moonie-1 Injection Well. The flowline will be filled with cement.	Consistent with EA condition 61 – Infrastructure
Rehabilitation work hours and workdays	Consistent with EA condition 45 – Noise management

11. Conclusions and Recommendations

The Surat Basin Carbon Capture and Storage (CCS) Project is proposed by Carbon Transport and Storage Corporation (CTSCo) Pty Limited to allow for GHG stream injection testing of up to 110,000 tonnes per year for three years with EPQ10.

Carbon capture and storage (CCS) presents one of the few technologies capable of abating large volumes of CO_2. If future large-scale CCS is to be adopted, viable storage locations are required to be developed. Viable storge is required irrespective if CO_2 is sourced from fossil fuel emissions or extracted directly from the atmosphere using direct air capture.

The primary purpose of the proposed Project is to demonstrate the viability of geological storage of CO_2 in the Surat Basin to allow the later assessment of the region for potential future large-scale CO_2 storage. The Project has been scaled to adequately demonstrate the monitoring and verification technologies that would be required for any future large-scale GHG stream geological storage project, with only a relatively small volume of GHG stream to be injected and permanently stored as part of the injection testing. The Project also seeks to provide confidence in the GHG stream geological storage technology for both the community and regulators via a successful fixed duration injection testing, and monitoring and verification program. Although the Project predicts to successfully abate CO_2 emissions, the reduction in CO_2 emissions from the injection testing alone are incidental. The aim of the injection testing is to provide sufficient information to prove the feasibility of future large-scale GHG storage within the Surat Basin, and to allow timely decisions for potential development of a CCS hub in the region.

CTSCo does not propose the use of any novel or emerging technology as part of the injection testing. The Project is not intended as a new technology trial. The infrastructure, technology and monitoring techniques proposed by CTSCo are established and have proven successful in CO_2 geological storage projects worldwide and within Australia. The wells and infrastructure required adopt petroleum technology that is long-established in Australia and is currently regulated within Queensland under the *Petroleum Act 1923* or the *Petroleum and Gas (Production and Safety) Act 2004* and associated regulations.

Notably, the monitoring techniques proposed by CTSCo are conventional and well established, having been successfully deployed in large-scale CO_2 storage projects in Canada and Norway in addition to the CO_2 storage project by CO2CRC in Victoria, Australia. The Australian Government has also acknowledged the standing of CCS technology as non-emerging in its "*Environmental Guidelines for Carbon Dioxide Capture and Geological Storage – 2009*" (Commonwealth of Australia, 2009).

The recommendation is made to approve the Project, so that administering authorities, regulators, industry, and the community can make an informed decision on the potential future development and permitting of GHG storage in the Surat Basin.

12. Submissions about the EIS

Anyone can submit comments on the EIS during the submission period by providing written comments. The Chief Executive of the Department of Environment and Science has set an EIS submission period from **5 December 2022 to 23 February 2023**.

Copies of the EIS will be available for viewing online at: www.ctsco.com.au/about

In accordance with EP Act sections 54 and 55, to make a properly made submission, comments on the EIS must:

- be written;
- signed by or for each person (signatory) who made the submission;
- state the name and address of each signatory;
- be made to the Chief Executive of the Department of Environment and Science; and
- be received on or before the last day of the submission period.

Submissions about the EIS may be made to:

- The Chief Executive
- Department of Environment and Science
- Attention: The EIS Coordinator (Surat Basin Carbon Capture and Storage Project)
- by post: GPO Box 2454, Brisbane QLD 4001
- by email: eis@des.qld.gov.au

Following receipt of submissions on the EIS, CTSCo will respond to submissions, and amend the EIS if required. The amended EIS will then be submitted to the Department of Environment and Science for assessment of adequacy. Where the EIS is determined to be adequate, the Department of Environment and Science will prepare the EIS Assessment Report, giving CTSCo the report, and publicly publishing the report. The EA will then be amended to permit GHG stream injection testing, as described in the EIS.

CTSCo

Carbon Transport & Storage

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