Australia's National
Science Agency

GISERA | Gas Industry Social and Environmental Research Alliance

Progress report

Sources and mobility of gas in formations below the Walloon Coal Measures

Progress against project milestones

Progress against milestones/tasks are approved by the GISERA Director, acting with authority in accordance with the GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: Traffic light reports and descriptive Project schedule reports.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:

- **Green**:
  - Milestone fully met according to schedule.
  - Project is expected to continue to deliver according to plan.
  - Milestone payment is approved.
- **Amber**:
  - Milestone largely met according to schedule.
  - Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
  - Milestone payment is withheld.
  - Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.
- **Red**:
  - Milestone not met according to schedule.
  - Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
  - Milestone payment is withheld.
  - Project review initiated by GISERA Director.

2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

Project schedule table

TASK NUMBER	TASK DESCRIPTION	SCHEDULED START	SCHEDULED FINISH	COMMENT
1	Project management, stakeholder engagement including with OGIA, UQ and CSG operating companies as well as communication management	Duration of project		
2	Collection of well data, gas geochemistry data and collation	1 Jul 2024	30 Nov 2024	Complete
3	Hydrochemistry data collection and collation	1 Jul 2024	30 Nov 2024	Complete
4	Conceptual modelling	1 Sept 2024	30 Apr 2025	Complete
5	Building the geological model	1 Jan 2025	31 Jul 2025	
6	Petroleum Systems modelling	1 Jul 2025	31 Jan 2026	
7	Numerical modelling	1 Dec 2024	31 Jan 2026	
8	Final report compilation	1 Feb 2026	30 Jun 2026	
9	Communicate findings to stakeholders	1 Jul 2024	30 Jun 2026	

Project schedule report

TASK 1: Project management, stakeholder engagement including with OGIA, UQ and CSG operating companies as well as communication management

BACKGROUND

This project will require engagement with industry, OGIA and the Centre for Natural Gas Research at UQ. These institutions have previously conducted hydrogeological and geochemical studies in the Surat Basin region that will provide important background information required to conduct the proposed modelling study. This task also includes time for the project leaders to manage the project and undertake administrative actions associated with project progress.

TASK OBJECTIVES

Engage with OGIA, UQ, industry, government agencies and Technical Reference Group representatives to obtain information for the project, manage project staff, deliverables and project reporting.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Communicate project objectives, progress and results to GISERA stakeholders according to standard GISERA project procedures which may include, but not limited to:

1. Communicate and engage with OGIA, UQ, industry and various government regulators are required to implement and communicate the project
2. Complete milestone reports, undertake project team meetings
3. Establish and engage with Technical Reference Group
4. Engage with industry and government and record these interactions via the GISERA communications register
5. Oversee overall project delivery and preparation of final reporting

PROGRESS REPORT

This task is due June 2026.

TASK 2: Collection of well data, gas geochemistry data and collation

BACKGROUND

Well data required to develop the model include stratigraphy, depth and ages for top of key formations, lithologies, coal layers, porosity, bottom hole temperature, pressure and vitrinite reflectance. Gas data from water bores including concentrations as well as stable C and H isotopic compositions of methane are required to determine the volumes and origin of gas.

TASK OBJECTIVES

Collate the data from well completion reports, OGIA database and other company reports where accessible. Communicate with the operating companies to access data that are not publicly accessible. Structural, stratigraphic and geochemical database construction.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

The area of interest (AOI) for the basin model will be determined according to availability of suitable data. A database of available data compiled in Excel and included in the Petromod or Trinity basin modelling package.

PROGRESS REPORT

This milestone is completed.

There was a significant delay in receiving well and geological model data and they were only received during November 2024. We have now incorporated these data in a excel database and currently QCing the data. During the QCing process we noticed several issues with the depth structure maps, which need to be highlighted in the report as uncertainties that will affect parts of the petroleum systems model. We have also flagged these issues with provider as feedback on their geological model.

TASK 3: Hydrochemistry data collection and collation

BACKGROUND

Previous studies (e.g. Mallants et al., 2014 and Raiber and Suckow, 2017) suggested that there are distinct relationships between concentrations of major and minor ions and methane in many groundwater samples in the Hutton and Precipice sandstones. While pre-CSG development methane concentration baseline data are limited throughout the Surat and Bowen basins, there are abundant pre-CSG development hydrochemistry data available.

TASK OBJECTIVES

Collate and QA/QC hydrochemistry data from published literature, industry, the Queensland groundwater and the OGIA data bases in the Surat and Bowen basins. Integrate with data from Task 2 and identify spatial patterns in hydrochemistry (major and minor ions) and methane data for Hutton and Precipice sandstones. Use multivariate statistics to determine if there are correlations of hydrochemistry and methane and if major and/or minor ion hydrochemistry can under certain conditions represent proxies for presence/absence of methane where no measured methane concentrations exist; in bores where high post CSG-development methane concentrations have been observed and where long-term (decadal) hydrochemistry data are available, determine if any changes in hydrochemistry have occurred that could be explained by an increased degree of connectivity.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

An inventory of available hydrochemistry data for the Hutton and Precipice sandstone throughout the assessment area (combined with gas data collated as part of Task 2) will be created in Excel or Access. Hydrochemistry data are a fundamental component of conceptual hydrogeological models, and the results of Task 3 will be integrated with other lines of evidence to inform conceptual hydrogeological models developed in Task 4.

PROGRESS REPORT

This milestone is completed.

There was a significant delay in receiving hydrogeochmeistry and gas concentration data and they were only received during November 2024. We have now incorporated these data in an excel database and currently QCing the data. During the QCing process we noticed several issues with consistency in data recording, which are likely caused by errors in the measurement units for gas concentration. We are currently in the process of correcting units to ensure that measurement units are consistent for all data. Additional data were also received from UQ and Geoscience Australia which are being QCd. Data from all sources are currently combined into a master spreadsheet.

We have held multiple meetings with different government agencies to learn about which areas may be of particular interest and learn about any additional data sources and anecdotal evidence of gas shows in water bores.

TASK 4: Data integration and conceptual modelling

BACKGROUND

Conceptual hydrogeological models form the basis of groundwater management and numerical models developed for impact predictions in resource development projects. The development of reliable conceptual hydrogeological models of potential hydrogeological connectivity and gas migration pathways relies on the integration of multiple lines of evidence. This includes for example integration of geological and geophysical data and models that characterise the geometry of the subsurface with gas concentrations and isotopes and hydrochemical data.

TASK OBJECTIVES

The data and knowledge from previous studies in the Surat and Bowen basins and from Tasks 2, 3 and 5 of this project will be integrated to develop multiple conceptual models of hydrogeological connectivity pathways.

The integration of data from multiple lines of evidence (geophysics, geology including surface mapping and rock characterisation), gas concentrations and isotopes and hydrochemistry will provide valuable insights into connectivity and potential gas migration pathways.

Building up on previous work conducted by various stakeholders in the Surat and Bowen basins and in close consultation with key stakeholders, we will develop new or adopt existing conceptual hydrogeological models that describe potential gas migration pathways and development scenarios that could result in an increase of gas concentrations in the Hutton and Precipice sandstones in different parts of the Surat and Bowen basins.

It is generally acknowledged that due to geological and hydrogeological uncertainties and data limitations, multiple plausible conceptual hydrogeological models may be possible in different settings. In such circumstances, we will develop multiple models that can underpin and be tested in subsequent tasks through petroleum systems and hydrodynamic modelling.

TASK OUTPUTS AND SPECIFIC DELIVERABLES

A set of representative conceptual hydrogeological models (e.g., via annotated cross-sections, maps and simple 3D block diagrams) of connectivity and gas migration pathways in the Surat and Bowen basins based on the integrated datasets from this study and previous studies.

PROGRESS REPORT

This milestone is completed.

A number of conceptual models, including nine ‘gas source-migration scenarios’, were developed to describe possible pathways for increased gas in bores in Hutton and Precipice sandstones. Conceptual models are an abstract representation of a system in a simplified form to elicit its key characteristics intended to explore possible scenarios that could explain an observation of increased gas in water

bores. These conceptual models will provide the focus for Petroleum systems modelling and Numerical (or analytical) modelling of gas behaviour in aquifers, which are the two main tasks that will be performed during Stage 2 of the project.

STAGE GATE / DECISION POINT:

Present to the Queensland RAC the refined conceptual models and what the petroleum systems model will address and seek approval to proceed with the final stage of project.

A detailed Stage 1 completion paper and a presentation were presented to the Research Advisory Committee on 4 April 2005, and the committee endorsed the worked performed during Stage 1 and granted approval to proceed with Stage 3 of the project.

TASK 5: Building the geological model

BACKGROUND

A geological model needs to be built to develop the petroleum systems and the hydrodynamic models. The extent (AOI) and resolution of the model will be determined according to the maps and data sourced from various sources, largely from OGIA's Petrel model which includes UQ's seismic interpretations.

TASK OBJECTIVES

Review and quality control of the data and maps for their suitability to be included in the model. Construction of the basin model using depth-structure maps for the key stratigraphic layers, faults, lithofacies.

TASK OUTPUTS AND SPECIFIC DELIVERABLES

This task will produce a static 3D geological model for the AOI (AOI determined according to data availability) that will be used for Petroleum systems and hydrodynamic modelling. 1D models calibrated with respect to temperature, porosity and pressure at well locations where appropriate data are available.

PROGRESS REPORT

This task will be completed in July 2025.

TASK 6: Petroleum systems modelling

BACKGROUND

This task involves analysing the petroleum system and developing a model to investigate the source of gas in the sandstone aquifers interbedded with the coal seams.

TASK OBJECTIVES

Development of a detailed petroleum systems model for the AOI, where the AOI will be identified based on availability of suitable data. The model will be calibrated with respect to formation pressure,

temperature, porosity and thermal maturity of the coals and dispersed organic matter in the sandstones. Thermogenic gas generation will be modelled and tested using published kinetics representing humic coal (Pepper and Covie, 1995). Currently there are no published kinetics for biogenic gas generation that can be included in petroleum systems models. Therefore, biogenic gas generation will be simulated by defining arbitrary generation rates and calibrating against observed gas data in the reservoirs. Migration modelling scenarios will be tested using Darcy, 'Invasion percolation' and 'Combined flow', to match the current hydrocarbon distribution in the sandstone aquifers accumulation by minimising the difference between the observed accumulations and the simulated hydrocarbon saturations at present day – selection of a base case scenario.

TASK OUTPUTS AND SPECIFIC DELIVERABLES

A Petroleum system model for the selected AOI calibrated against pressure, porosity, temperature and thermal maturity of the coals. Output will include digital maps.

PROGRESS REPORT

This task will be completed in January 2026.

TASK 7: Numerical modelling

BACKGROUND

Conceptual models in Task 4 will have identified scenarios in which there are potential gas migration pathways. Quantification via numerical models will provide understanding of the conditions under which the gas does or does not migrate and will enable risk assessment and understanding of uncertainties.

TASK OBJECTIVES

1. Creation of numerical models for each scenario, parameterised using water abstraction rates from the discovery phase, gas contents and distributions from the petroleum systems modelling, and information from OGIA's groundwater modelling.
2. By running the numerical models with a variety of input parameters: exploration of: (a) the conditions under which gas migrates; (b) risk, and; (c) understanding of key drivers of uncertainty.

TASK OUTPUTS AND SPECIFIC DELIVERABLES

MOOSE numerical models for each scenario studied. Quantification of gas-migration conditions. Quantification of drivers of uncertainty.

PROGRESS REPORT

This task will be completed in January 2026.

TASK 8: Final report compilation

BACKGROUND

Information from this project including outputs of the model is to be made publicly available after completion of standard CSIRO publication and review processes.

TASK OBJECTIVES

Information from this project is to be made publicly available after completion of standard CSIRO publication and review processes. Outputs of the model will be presented in the report. Access to the model will be available for those who possess licence for Petromod or Trinity software package.

TASK OUTPUTS AND SPECIFIC DELIVERABLES

1. Preparation of a final report outlining the scope, methodology, scenarios, assumptions, findings and any suggestions/options for future research;
2. Following CSIRO ePublish review, the report will be submitted to the GISERA Director for final approval; and
3. Provide 6 monthly progress updates to GISERA office.

PROGRESS REPORT

This task will be completed in June 2026.

TASK 9: Communicate project objectives, progress and findings to stakeholders

BACKGROUND

Communication of GISERA's research is an important component of all research projects. The dissemination of project objectives, key findings and deliverables to relevant and diverse audiences allows discourse and decision making within and across multiple stakeholder groups.

TASK OBJECTIVES

Communicate project objectives, progress and findings to stakeholders through meetings, Knowledge Transfer Session, fact sheets, project reports and journal article/s, in collaboration with the GISERA Communication Team.

TASK OUTPUTS AND SPECIFIC DELIVERABLES

Communicate project objectives, progress and results to GISERA stakeholders according to standard GISERA project procedures, which may include but are not limited to:

1. Knowledge Transfer Session with relevant government/gas industry representatives.
2. Presentation/s about the project and research findings to community stakeholders where appropriate.
3. Preparation of an article for the GISERA newsletter and other media outlets as advised by GISERA's communication team.

4. Two project fact sheets: one developed at the commencement of the project, and another that will include peer-reviewed results and implications at completion of the project. Both will be hosted on the GISERA website.
5. Peer-reviewed scientific manuscript ready for submission to relevant journal.

PROGRESS REPORT

This task will be completed in June 2026.

Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority, in accordance with the GISERA Alliance Agreement. Any variations above the GISERA Director's delegation require the approval of the relevant GISERA Research Advisory Committee.

The table below details variations to research Project Order.

Register of changes to Research Project Order

DATE	ISSUE	ACTION	AUTHORISATION

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

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GISERA is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, greenhouse gas emissions, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research.