Australia's National
Science Agency

GISERA | Gas Industry Social and Environmental Research Alliance

Project Order

Short Project Title

Understanding controls and constraints of potential microbially induced corrosion in onshore gas wells

Long Project Title	Understanding controls and constraints of potential microbially induced corrosion in onshore gas wells: microbes and geochemical conditions in aquifers of south-central Queensland.
GISERA Project Number	W.35
Start Date	01/07/2024
End Date	30/04/2025
Project Leader	David Midgley

GISERA State/Territory

- [x] **Queensland**
- [ ] New South Wales
- [ ] Northern Territory
- [ ] South Australia
- [ ] Western Australia
- [ ] Victoria
- [ ] National scale project

Basin(s)

- [ ] Adavale
- [ ] Amadeus
- [ ] Beetaloo
- [ ] Canning
- [ ] Western Australia
- [ ] Carnarvon
- [ ] Clarence-Morton
- [ ] Cooper
- [ ] Eromanga
- [ ] Galilee
- [ ] Gippsland
- [ ] Gloucester
- [ ] Gunnedah
- [ ] Maryborough
- [ ] McArthur
- [ ] North Bowen
- [ ] Otway
- [ ] Perth
- [ ] South Nicholson
- [x] **Surat**
- [x] **Other (please specify) Bowen**

GISERA Research Program

- [x] **Water Research**
- [ ] Health Research
- [ ] Biodiversity Research
- [ ] Social & Economic Research
- [ ] Greenhouse Gas Research
- [ ] Agriculture Research
- [ ] Land and Infrastructure Management Research
- [ ] Other (please specify)

1. Project Summary

Significant public concerns exist around well infrastructure integrity. A part of these concerns is the potential hazards microbes may pose on casing failure. Microbes can cause Microbial Influenced Corrosion (MIC), which if it occurs, could present a hazard to materials used in wells. There is, however, little publicly available knowledge on microbes in the subsurface onshore gas producing regions.

The recently completed GISERA project 'Queensland CSG well integrity: cements, steels and microbial activity' searched the literature and online databases for microbiological data in the subsurface in South East Queensland. This study showed limited data exist on the microbiology of aquifers, outside of information available from the aquifers of the coal seams. No information is available for domestic or agricultural aquifers. Those data for the CSG producing wells indicate that while organisms capable of acid production via sulphur/sulphate reduction are relatively common, they are unlikely to undertake these activities in these wells due to an absence of suitable oxidized forms of sulphur containing chemicals.

For microbes to cause corrosion to well infrastructure, there are key ecological and physicochemical contributors required for this process. These are adherence or biofilm formation materials, and the presence of suitable chemical compounds that allow microbial activity generally. For the former questions around biofilm formation, no data are available in Queensland in CSG or non-CSG subsurface settings.

This project is an extension of the GISERA project 'Queensland CSG well integrity: cements, steels and microbial activity', and aims to better understand the hazard of microbial activity on materials. This project will conduct a sampling campaign in Surat and Bowen basin region; collecting samples from CSG-related, agricultural and domestic aquifers of the region. These samples will include bulk water and swabs of well infrastructure surfaces. DNA sequencing analyses will be used to determine and compare microbial community profiles from planktonic communities in bulk water and adherent (biofilm) communities on infrastructure surfaces. Additionally, analyses on a suite of water chemistry values that underpin specific microbial activity will also be carried out on samples.

The resultant data will provide valuable information on which microbes adhere to subsurface materials and their putative activities in south central Queensland. Together with the water chemistry data, this information will provide insights into the potential hazards and risks associated with MIC in wells found in south central Queensland. These data will be compared to a selection of agricultural and domestic well bore water and swab samples.

2. Project description

Introduction

In the GISERA project 'Queensland CSG well integrity: cements, steels and microbial activity' data was sought on putative microbial hazards to materials used in well completions. At various government inquiries and in the media, Microbially Influenced Corrosion (MIC) and its potential hazard are frequently raised as an issue of significant public concern. In the most recent online survey conducted by CSIRO's GISERA to gather stakeholder views, identify areas of concern and prioritise future research activities, there were concerns raised about longevity of well infrastructure relating to microbial activity associated with corrosion, and also short, medium and long term impacts of microbial corrosion on well casings leading to chemical leakage into water resources.

Globally, microbes are widespread in subsurface environments, being excluded only from depths where temperatures exceed ~120°C. Most microbes, however, occur inside fracture or pore networks within rocks that are filled with water. It is worth noting the size of microbes; many bacterial are in the order of 1µm long and ~0.5µm across and their presence in any given rock strata is limited by the absence of rock pore sizes greater than or equal to 1µm (Bartlett et al., 2010; Phadnis & Santamarina, 2011).

Regardless, our understanding of subsurface microbiology and ecology is poor. The most well studied subsurface microbial communities are related to hydrocarbon fuels (e.g. coal, oil or gas), however these environments are somewhat different to other subsurface locations. Principally because there is significant quantities of carbon in fossilised organic matter in coal and oil-bearing rock strata.

In the subsurface (similarly to other anoxic environments) microorganisms with the ability to generate acidic byproducts or interact directly with metals have been frequently observed. It is important to note, however, that the presence of a microbe with said *ability* does not necessarily indicate its *activity* in a given environment. Examples of this phenomena can be seen in the studies of coal seam microbiomes in the Surat and Bowen basin (Bryant et al., 1977; Vick et al., 2018), which are generally deficient in oxidised forms of sulphur. Here, the microbial communities tend to be dominated by an abundant methanogen[1] and a similarly abundant syntrophic bacterial partner[2]. The syntrophic partners of the methanogens are mostly bacteria, frequently from either the Firmicutes or deltaproteobacterial lineages. It is a similar process to symbiosis. One of the best studied examples of these syntrophies is between *Desulfovibrio vulgaris* (a sulfate-reducing bacterium) and the methanogens: *Methanobacterium* or *Methanococcus* (Figure 1).

[1] Methanogens are superficially similar to bacteria but are unrelated organisms from a different domain of life (Archaea). In general, they are known to metabolise simple carbon sources (methanol, formate, acetate and CO_2) to methane.
[2] Syntrophy is a relationship between organisms where one (or both) organisms are reliant on each other for nutrition.

In this specific syntrophic relationship, in the absence of suitable sulphur sources, *Desulfovibrio* ferments simple organic compounds like acetate or lactate to a range of products generating H_2 or electrons or other byproducts. In this example below, *Desulfovibrio vulgaris* has been shown to ferment lactate to H_2. Production of hydrogen in this fashion limits the growth of the *Desulfovibrio* species, and it is reliant on its methanogen partner (*Methanococcus*) to consume the hydrogen (for methanogenesis). In turn, the methanogen is reliant on the *Desulfovibrio* for this source of hydrogen.

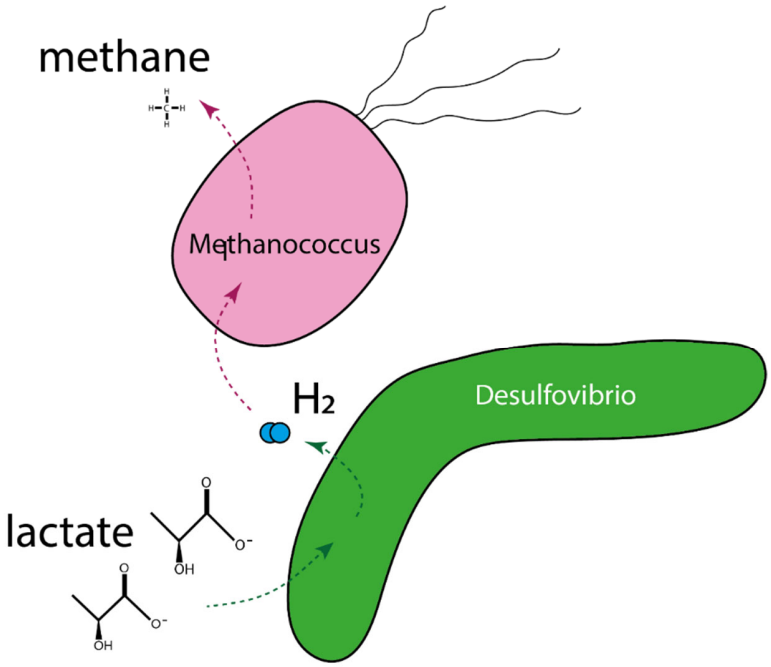

Figure 1. Syntrophy between methanogens and sulfate reducing bacteria. In the absence of sulfur compounds, sulfate reducing bacteria engage in relationships with methanogens. Here, Desulfovibrio can only ferment lactate to hydrogen at low hydrogen partial pressures, it is reliant on the methanogen to consume produced hydrogen and thus keep these partial pressures low. In turn, the methanogen is dependent on the Desulfovibrio for a source of hydrogen.

It should be noted that when suitable oxidized sulphur compounds are present, the *Desulfovibrio* would instead engage in sulphate reduction producing sulphides, as these processes are more energetically favorable for the *Desulfovibrio*.

Microbial activity and the production of various byproducts is thus intrinsically linked to geochemical conditions. Their dependence on specific chemicals can be direct, exemplified by the requirement for oxidised sulphur-containing chemicals: e.g. sulphate, sulphite, thiosulphate, or elemental sulphur for microbial sulphide production in the example above. Conversely, reliance on chemicals can be indirect; for instance, the absence of essential macronutrients like nitrogen or phosphorus limits the ability of microbes to actively engage in metabolism and growth in a given environment.
Finally, it should be noted that there are alternate microbial pathways for acid production[3] not contingent upon sulphur presence and also microbes able to interact directly with metals to remove electrons, although these processes are even more poorly understood.

[3] Mostly organic acids e.g. citric, malic or lactic acids.

Further complicating our understanding on microbial processes as it relates to casing is the known spatial niche partitioning that occurs in many environments including the subsurface. Vick et al., 2019 for example, demonstrated that in the Surat Basin microbial communities that adhere to coal surfaces (adherent) are notably distinct from the communities that occur in the water (planktonic). This same niche partitioning likely exists on other materials in the subsurface, including casing materials, though no data is available on which microbes occur in adherent biofilms on casings and pipes in Queensland. Analysing only the planktonic microbial communities of the water provides an incomplete picture of the subsurface microbiome, particularly as it is much more likely that microbes that are adhered to surfaces have more potential to carry out microbial processes on these materials.

Prior Research

This project is a direct extension project to the GISERA project 'Queensland CSG well integrity: cements, steels and microbial activity' and seeks to address the identified knowledge gaps found in that research, particularly around microbial community data from non-CSG aquifers and microbial biofilm communities from well casing.

The GISERA report, "Potential microbial interactions with cements and steels" collated microbial information from subsurface environments from South East Queensland to determine the hazards of microbial activity on materials used in well infrastructure (steels and cements). The key finding and learnings from the research were:

- Microbial activity has the potential to both positively or negatively impact corrosion and cement performance.
- Analysis of the available data from the microbes associated with the coal seams indicate approximately one fifth of the identified species of microbes likely have the potential to produce sulphide when in the presence of suitable sulphur sources.
- Sulphur-active microbes are the best studied organisms in corrosion research; however, these organisms are metabolically flexible and their presence alone does not necessarily indicate H_2S production. Instead, H_2S production is contingent on both sufficient sulphur in oxidised forms, and sufficient essential macronutrients for microbial growth.
- Microbial biofilm formation in Queensland CSG and shallow aquifers pipework or casing is unknown. No data exist on biofilms in casings, wells or pipework associated with South East Queensland groundwater.
- Microbial metabolic processes that affect steels or cements (acid production or electron uptake) exist commonly in microbes from the subsurface in the region, but it is unknown whether groundwater or ecological conditions favour the expression of these activities.

Significant chemistry data exist for groundwater from the resource Surat and Bowen region (Kinnon et al., 2010; Owen et al., 2015; Raiber & Suckow, 2017; Ransley et al., 2015; Schinteie et al., 2018; Wolhuter et al., 2020). Significant, localised data are also held in private hands (e.g. landholders and irrigators).

The best sources of microbial information available for the coal seam aquifers in the Surat Basin is from work investigating microbial coal degradation (Campbell et al., 2021; McLeish et al., 2022; McLeish et al., 2021; Vick et al., 2019; Vick et al., 2018). This literature has provided the only available microbial community data from the Surat and Bowen basins; although it is limited to aquifers related to the coal resource, it provides useful microbial learnings about microbial communities in the region.

Need & Scope

The GISERA project 'Queensland CSG well integrity: cements, steels and microbial activity' identified knowledge gaps around the potential hazards of microbial activity, noting that no data are available on adherent communities attaching to materials used in the subsurface (principally steels and cements).

This project will provide valuable data for the assessment of MIC as a potential hazard for well integrity in south central Queensland.

Objectives

The project's objectives are to:

- Undertake a comprehensive sampling campaign in the study area at specific wells, including onshore gas-related, agricultural and domestic, to collect water and casing biofilm swab samples.
- Carry out rDNA sequencing analyses of water and biofilm swab samples to determine and compare planktonic and adherent microbial communities.
- Carry out water chemistry analyses for a suite of analytes, underpinning microbial activity in aquifers.
- Analyse the resultant data to determine which microbial species are present on casings or pipework and how these differ from those in the water. Using what is known about their physiology infer the potential hazards for materials used in the subsurface in south central Queensland.
- Understand microbial activity vs microbial presence for a selected subset of water-swab pairs using rRNA instead of rDNA, and undertake transcriptomic (RNA) sequencing to examine the expression of genes involved in deleterious processes.

Methods

This project will include a logistics phase (Task 1) to identify suitable samples from infrastructure that interacts with the subsurface in the Surat and Bowen Basin region. This task will require input from people with gas industry, local government, and agricultural connections. The technical reference group is being assembled with the specific intent of assisting in this logistic task.

This project will then collect groundwater and swab samples from the inside of pipes, casings, separators and other infrastructure from industry (Task 2). For comparison, a range of non-gas subsurface bores e.g. domestic, water monitoring and agricultural bores will also be sampled. Swabbing methods will use commercially-available sterile sponge swabs.

All samples, regardless of the collection type, will be stored in DESS[4] to ensure that microbial community structure is maintained.

In parallel, all samples will be subject to water chemistry analyses at an external NATA-accredited laboratory (Task 3).

All samples will then be subject to DNA extraction and microbial community profiling (Tasks 4 and 5) (DNA sequencing followed by bioinformatic analyses). A selected subset of water-swab pairs will be subject to RNA analyses, to provide data on which microbes are metabolically active. This approach differs from traditional microbial community profiling in that RNA, not DNA, will be extracted.

A final report will analyse and discuss results in an ecological and risk context (Task 6) and communication and engagement activities (Task 7) will provide both decision-making and policy-making levels of government, community and industry stakeholders increased understanding and awareness of the potential hazards of microbial activity to well infrastructure materials.

[4] Rachel NM, Gieg LM. (2020) Preserving Microbial Community Integrity in Oilfield Produced Water. **Frontiers in Microbiology** doi: 10.3389/fmicb.2020.581387.

3. Project Inputs

Resources and collaborations

Researcher	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
David Midgley	39 days	Microbial ecology	>20	CSIRO
Carla Mariani	27 days	Molecular biology	>5	CSIRO
Nai Tran-Dinh	47 days	Molecular microbiology	>20	CSIRO
Kyle Gavrily	30 days	Analytical chemistry	>5	CSIRO
Se Gong	20 days	Environmental chemistry	>20	CSIRO
Elaheh Arjomand	5 days	Civil engineering	>10	CSIRO
Cameron Huddlestone-Holmes	7 days	Geology	>20	CSIRO

Subcontractors (clause 9.5(a)(i))	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Sequencing service provider	6-8 weeks turnaround on receipt of samples	DNA sequencing	Many. Commercial DNA sequencing facility.	Molecular Research DNA Laboratories, Texas, USA
ALS	1-2 weeks turnaround on receipt of samples	Environmental chemistry	Many. Commercial laboratory.	ALS NATA accredited testing

Technical Reference Group

The project will establish a Technical Reference Group (TRG) aimed at seeking peer-to-peer technical advice on contextual matters and to discuss research needs as well as outputs as the project progresses. The TRG will include the project leader and a group of different stakeholders as appropriate which may include:

- Regulators (Queensland Department of Resources)
- Other government agencies (Western Downs Regional Council)
- Company representatives (Santos, Origin, Shell)
- Technical expertise (agricultural consultants and domestic water bore drilling consultants)

Budget Summary

Source of Cash Contributions	2023/24	2024/25	2025/26	2026/27	% of Contribution	Total
GISERA	$0	$274,630	$0	$0	70.1%	$292,265
- Federal Government	$0	$190,337	$0	$0	52.1%	$190,337
- APLNG	$0	$31,053	$0	$0	8.5%	$31,053
- Origin	$0	$31,053	$0	$0	8.5%	$31,053
- QGC	$0	$3,653	$0	$0	1%	$3,653
Total Cash Contributions	**$0**	**$256,097**	**$0**	**$0**	**70.1%**	**$256,097**

Source of In-Kind Contribution	2023/24	2024/25	2025/26	2026/27	% of Contribution	Total
CSIRO	$0	$109,234	$0	$0	29.9%	$109,234
Total In-Kind Contribution	**$0**	**$109,234**	**$0**	**$0**	**29.9%**	**$109,234**

TOTAL PROJECT BUDGET	2023/24	2024/25	2025/26	2026/27	-	TOTAL
All contributions	**$0**	**$365,331**	**$0**	**$0**	-	**$365,331**
TOTAL PROJECT BUDGET	**$0**	**$365,331**	**$0**	**$0**	-	**$365,331**

4. Communications Plan

Stakeholder	Objective	Channel	Timeframe
Regional community stakeholders including landholders, traditional owners and wider public	To communicate project objectives, and key messages and findings from the research	A fact sheet at commencement that explains in plain English the objectives of the project.	At project commencement
		Project progress reported on GISERA website to ensure transparency for all stakeholders including regional communities.	Ongoing
		Public release of final reports. Plain English fact sheet summarising the outcomes of the research.	At project completion
		Preparation of a news article for the GISERA newsletter and other media outlets, as advised by GISERA's communication team.	At project completion
		CSIRO to explore opportunities for greater communication and engagement of project outcomes - such as on ground presence e.g. regional community events such as agricultural shows and development of frequently asked questions.	At completion or within 6 months of completion of the project.
		Presentation of research findings to regional community stakeholders/landowners (virtual or face-to-face) to learn of research results	At completion or within 6 months of completion of project.
Gas Industry & Government	To communicate the outcome of the project.	A fact sheet at commencement that explains in plain English the objectives of the project.	At project commencement
		Project progress reporting (on GISERA website)	Ongoing
		Final project report and fact sheet.	At project completion
		Discussion on results with Queensland regulator	At project completion
		Presentation of findings at joint gas industry/government Knowledge Transfer Session.	At project completion
		Peer-reviewed scientific publication. Dataset(s) available through CSIRO's data repository.	After completion of project
Scientific Community	Provide scientific insight into potential hazards to well infrastructure materials associated with microbial activity.	Peer-reviewed scientific publication. Dataset(s) available through CSIRO's data repository.	After completion of project

In addition to project-specific communication activities, CSIRO's GISERA has a broader communication and engagement strategy. This strategy incorporates activities such as webinars, workshops, newsletters and development of other communication products.

5. Project Impact Pathway

Activities	Outputs	Short term Outcomes	Long term outcomes	Impact
Logistics, planning and bore soil selection	Logistics, occupational health and safety, environmental and community concerns, along with detailed sampling procedures. A list of available water bores will be compiled. A briefing document will be prepared for the sampling campaign	Characterisation of microbial communities and water chemistry from bore water samples and swabbed surface samples will provide understanding of the potential hazards of microbial activity to well infrastructure materials in south central Queensland region.	• Assist in informing governments, regulators as well as policy-makers on the microbial activity hazards to well infrastructure materials in south central Queensland region. • Increased industry and community awareness of the potential hazards of microbial activity to well infrastructure materials in south central Queensland region. • The project will improve Industry's knowledge and practices related to mitigating the potential hazards of microbial activity to well infrastructure materials.	The impact of this research extends to government, industry and everyday Australians. All Australian communities that are located in onshore gas regions as well as industry will benefit from the outcomes of this research, through increased understanding and awareness of the potential hazards of microbial activity to well infrastructure materials. The project provides knowledge about the microbial communities from both water and biofilms associated with water bores from onshore gas-related, agricultural and domestic bores from the south central Queensland region. This information will assist those at both the decision-making and policy-making levels of government.
Sampling campaign	Provision of both water and soil samples for the experimental program of this project. Briefing document with details of collection and sample availability will be prepared.			
Water chemistry and microbial sequencing data collection, analysis and reporting.	Technical report to include the water chemistry, microbial community profiling and microbial activity data from water and swab samples from onshore gas-related, agricultural and domestic bore sites. The report will detail the potential hazards of microbial activity to well infrastructure materials.			
Develop fact sheets with project objectives and key findings	GISERA Communication Team will develop a plain English factsheet at project commencement and at completion. Completed fact sheet(s) will be published to the GISERA website.			
Prepare and submit scientific manuscripts for publication in peer-reviewed journals	Manuscript submission to peer-reviewed journals.			

6. Project Plan

Project Schedule

ID	Activities / Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
Task 1	Sampling logistics and planning	David Midgley	1 July 2024	31 August 2024	None
Task 2	Sampling campaign	David Midgley	1 September 2024	30 November 2024	Task 1
Task 3	Water chemistry analyses	Se Gong	1 December 2024	31 December 2024	Task 1 & 2
Task 4	Microbial community profiling	Carla Mariani	1 November 2024	31 March 2025	Task 1, 2 & 3
Task 5	RNA sequencing for microbial activity	Nai Tran-Dinh	1 November 2024	31 March 2025	Task 1, 2 & 3
Task 6	Project management, data analysis and reporting	David Midgley	1 July 2024	3o April 2025	All previous tasks
Task 7	Communicate findings to stakeholders	David Midgley	1 July 2024	3o April 2025	All previous tasks

Task description

Task 1: Sampling logistics and planning

OVERALL TIMEFRAME: 2 months (1 July 2024 – 31 August 2024)

BACKGROUND: The project's TRG and other industry contacts will be consulted to guide the sampling campaign to ensure that appropriate and representative water and swab samples are collected from onshore gas-related, agricultural and domestic bores/wells/infrastructure. Preparation of sampling equipment and reagents, and subsequent transport to sampling region. This task may include travel to the region to liaise with onsite contacts in industry, government and local stakeholders.

TASK OBJECTIVES: Identification of sites for water and swab sampling to ensure adequate representative samples from the south central Queensland region.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: This task will yield a series of documents describing the contacts, sampling sites, relevant permissions, sampling equipment and OH&S considerations for the sampling campaign.

Task 2: Sampling campaign

OVERALL TIMEFRAME: 3 months (1 September 2024 – 30 November 2024)

BACKGROUND: Task 2 will involve at least two staff traveling to south central Queensland with the purpose of collecting representative water and swab samples across the region from onshore gas-related, agricultural and domestic bores/wells/infrastructure.

TASK OBJECTIVES: To collect groundwater and swab samples from sites identified in Task 1, for the purpose of water chemistry analyses (Task 3) and microbial DNA sequencing (Task 4). All water and swab samples collected for microbial DNA sequencing will be microbially preserved in a preservation solution.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Collection of water and swab samples for analyses of microbial community profiles and water chemistry within south central Queensland. The sampling campaign will aim to collect from each of ten sites representing onshore gas- related, agricultural and domestic bores (30 sites in total).

Task 3: Water chemistry analyses

OVERALL TIMEFRAME: 1 month (1 December 2024 – 31 December 2024)

BACKGROUND: Water chemistry will be carried out on all bulk water samples by a NATA accredited external laboratory.

TASK OBJECTIVES: The task will provide complete water chemistry data and analysis for all bulk water samples collected in Task 2.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Water chemistry data from all water samples will be provided in a technical brief.

Task 4: Microbial community profiling

OVERALL TIMEFRAME: 5 months (1 November 2024 – 31 March 2025)

BACKGROUND: The microbially preserved water samples and the swab samples will be subject to DNA extraction along with 16S rDNA sequencing.

TASK OBJECTIVES: The task will include the following objectives:

1) Complete DNA extractions from all samples;
2) DNA samples prepared and sent to external sequencing provider; and
3) Bioinformatics completed for all sequenced samples.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Raw sequencing data from microbial community profiling available.

Task 5: RNA sequencing for microbial activity.

OVERALL TIMEFRAME: 5 months (1 November 2024 – 31 March 2025)

BACKGROUND: A selected subset of the microbially preserved water samples and the swab samples will be subject to RNA extraction along with 16S rRNA sequencing and RNA transcriptomic sequencing. The task will aim to select one paired sample from each of the onshore gas-related, agricultural and domestic bores (sum total of 18 samples).

TASK OBJECTIVES: The task will include the following objectives:

1) Complete RNA extractions from a selected subset of the microbially preserved water samples and the swab samples;
2) Make cDNA libraries from RNA extractions;
3) cDNA samples prepared and sent to external sequencing provider; and
4) Bioinformatics completed for all sequenced samples.

TASK OUTPUTS AND SPECIFIC DELIVERABLES: Raw transcriptome and rRNA data available.

Task 6: Project management, data analysis and reporting

OVERALL TIMEFRAME: Duration of project

BACKGROUND: The final report for this project will collate microbial and chemistry data. These data will inform requirements for future research and will provide information for a range of stakeholders.

Critical evaluation of the results is needed to understand the outcomes of this study.

TASK OBJECTIVES: The task will include the following objectives:

1) Reporting results and analyses from Tasks 3-5;
2) Provide research options for potential hazards of microbial activity on well infrastructure materials.
3) Undertake a synthesis that considers the potential hazard and the likelihood of impacts to casing materials and in turn well integrity. Factors to be considered include microbial capabilities, microbial activity under well conditions, materials used for well completion and industry practices.

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.

Task 7: Communicate project objectives, progress and findings to stakeholders

OVERALL TIMEFRAME: Full duration of project

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 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 of findings to community stakeholders / landowners (virtual or face-to-face).

3) Face-to-face discussion on results with Queensland regulator

4) Preparation of an article for the GISERA newsletter, and other media outlets as advised by GISERA's communication team.

5) 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.

6) Peer-reviewed scientific manuscript ready for submission to relevant journal

Project Gantt Chart

		2024/25									
Task	**Task Description**	**Jul 24**	**Aug 24**	**Sep 24**	**Oct 24**	**Nov 24**	**Dec 24**	**Jan 25**	**Feb 25**	**Mar 24**	**Apr 25**
1	Sampling logistics and planning	■	■								
2	Sampling campaign			■	■	■					
3	Water chemistry analyses						■				
4	Microbial community profiling					■	■	■	■	■	
5	RNA sequencing for microbial activity					■	■	■	■	■	
6	Project management, data analysis and reporting	■	■	■	■	■	■	■	■	■	■
7	Communicate findings to stakeholders	■	■	■	■	■	■	■	■	■	■

7. Budget Summary

Expenditure	2023/24	2024/25	2025/26	2026/27	Total
Labour	$0	$291,731	$0	$0	$291,731
Operating	$0	$30,900	$0	$0	$30,900
Subcontractors	$0	$42,700	$0	$0	$42,700
Total Expenditure	**$0**	**$365,331**	**$0**	**$0**	**$365,331**

Expenditure per task	2023/24	2024/25	2025/26	2026/27	Total
Task 1	$0	$40,917	$0	$0	$40,917
Task 2	$0	$63,071	$0	$0	$63,071
Task 3	$0	$43,919	$0	$0	$43,919
Task 4	$0	$39,561	$0	$0	$39,561
Task 5	$0	$54,698	$0	$0	$54,698
Task 6	$0	$109,760	$0	$0	$109,760
Task 7	$0	$13,405	$0	$0	$13,405
Total Expenditure	**$0**	**$365,331**	**$0**	**$0**	**$365,331**

Source of Cash Contributions	2023/24	2024/25	2025/26	2026/27	Total
Federal Govt (52.1%)	$0	$190,337	$0	$0	$190,337
APLNG (8.5%)	$0	$31,053	$0	$0	$31,053
Origin (8.5%)	$0	$31,053	$0	$0	$31,053
QGC (1%)	$0	$3,653	$0	$0	$3,653
Total Cash Contributions	**$0**	**$256,097**	**$0**	**$0**	**$256,097**

In-Kind Contributions	2023/24	2024/25	2025/26	2026/27	Total
CSIRO (29.9%)	$0	$109,234	$0	$0	$109,234
Total In-Kind Contributions	**$0**	**$109,234**	**$0**	**$0**	**$109,234**

	Total funding over all years	Percentage of Total Budget
Federal Government investment	$190,337	52.1%
APLNG investment	$31,053	8.5%
Origin investment	$31,053	8.5%
QGC investment	$3,653	1%
CSIRO investment	$109,234	29.9%
Total Expenditure	**$365,331**	**100%**

Task	Milestone Number	Milestone Description	Funded by	Start Date (mm-yy)	Delivery Date (mm-yy)	Fiscal Year Completed	Payment $ (excluding CSIRO contribution)
Task 1	1.1	Sampling logistics and planning	GISERA	Jul-24	Aug-24	2024/25	$28,683
Task 2	2.1	Sampling campaign	GISERA	Sep-24	Nov-24	2024/25	$44,213
Task 3	3.1	Water chemistry analyses	GISERA	Dec-24	Dec-24	2024/25	$30,787
Task 4	4.1	Microbial community profiling	GISERA	Nov-24	Mar-25	2024/25	$27,732
Task 5	5.1	RNA sequencing for microbial activity	GISERA	Nov-24	Mar-25	2024/25	$38,343
Task 6	6.1	Project management, data analysis and reporting	GISERA	Jul-24	Apr-25	2024/25	$76,942
Task 7	7.1	Communicate findings to stakeholders	GISERA	Jul-24	Apr-25	2024/25	$9,397

8. Intellectual Property and Confidentiality

Background IP (clause 11.1, 11.2)	**Party**	**Description of Background IP**	**Restrictions on use (if any)**	**Value**
				$
				$
Ownership of Non-Derivative IP (clause 12.3)	CSIRO			
Confidentiality of Project Results (clause 15.6)	Project Results are not confidential.			
Additional Commercialisation requirements (clause 13.1)	Not Applicable			
Distribution of Commercialisation Income (clause 13.4)	Not applicable			
Commercialisation Interest (clause 13.1)	**Party**		**Commercialisation Interest**	
	CSIRO		N/A	
	APLNG		N/A	
	Origin Energy		N/A	
	QGC		N/A	

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