



GISERA | Gas Industry Social and Environmental Research Alliance

Project Order

Short Project Title

North Perth Basin Subsurface Resources Conflicts

Long Project Title

Assessment of potential conflicts of subsurface resources development in the North Perth Basin

GISERA Project Number

Oth.4

Start Date

01/03/2024

End Date

31/03/2025

Project Leader

Karsten Michael



GISERA State/Territory

- | | | |
|---|---|---|
| <input type="checkbox"/> Queensland | <input type="checkbox"/> New South Wales | <input type="checkbox"/> Northern Territory |
| <input type="checkbox"/> South Australia | <input checked="" type="checkbox"/> Western Australia | <input type="checkbox"/> Victoria |
| <input type="checkbox"/> National scale project | | |

Basin(s)

- | | | |
|--|--|---|
| <input type="checkbox"/> Adavale | <input type="checkbox"/> Amadeus | <input type="checkbox"/> Beetaloo |
| <input type="checkbox"/> Canning | <input type="checkbox"/> Western Australia | <input type="checkbox"/> Carnarvon |
| <input type="checkbox"/> Clarence-Morton | <input type="checkbox"/> Cooper | <input type="checkbox"/> Eromanga |
| <input type="checkbox"/> Galilee | <input type="checkbox"/> Gippsland | <input type="checkbox"/> Gloucester |
| <input type="checkbox"/> Gunnedah | <input type="checkbox"/> Maryborough | <input type="checkbox"/> McArthur |
| <input type="checkbox"/> North Bowen | <input type="checkbox"/> Otway | <input checked="" type="checkbox"/> Perth |
| <input type="checkbox"/> South Nicholson | <input type="checkbox"/> Surat | <input type="checkbox"/> Other (please specify) |

GISERA Research Program

- | | | |
|--|---|--|
| <input type="checkbox"/> Water Research | <input type="checkbox"/> Health Research | <input type="checkbox"/> Biodiversity Research |
| <input type="checkbox"/> Social & Economic Research | <input type="checkbox"/> Greenhouse Gas Research | <input type="checkbox"/> Agriculture Research |
| <input type="checkbox"/> Land and Infrastructure Management Research | <input checked="" type="checkbox"/> Other (Resources development conflicts) | |

1. Project Summary

The North Perth Basin is undergoing a significant resurgence in the exploration of natural subsurface resources such as natural gas, geological storage of carbon dioxide (CCS), geothermal energy, natural hydrogen exploration and storage, and sediment-hosted mineral deposits. These resources occupy the pore space between rock grains in the subsurface, which are generally filled with formation water. The result is an increasing potential for conflicting use of pore space between natural gas extraction and CCS, other resources development and groundwater production.

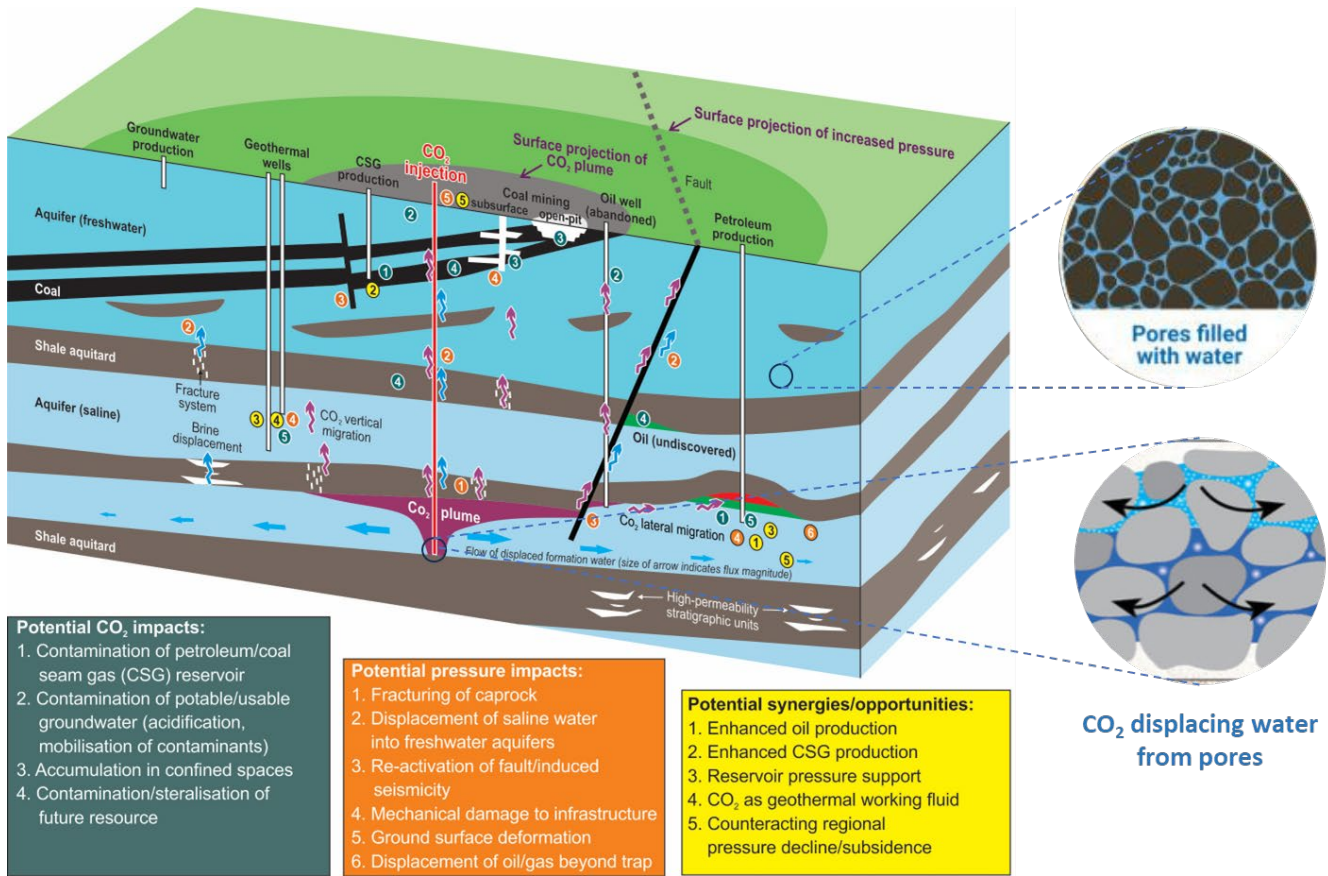


Figure 1. Schematic showing potential impacts of CO₂ geological storage on other basin resources and depicting how the pore space between rock particles in the subsurface that is typically filled with groundwater can be displaced by other fluids like dioxide (CO₂).

The aquifers of the northern Perth Basin currently supply about 95 percent of all water used for town water supply, irrigated agricultural activities, mines and industries across the region, and potential impacts of potential resource developments on groundwater resources are a cause for concern in the local community. A second community issue of concern is the competition for land access between subsurface resources, agricultural use and emerging renewable energy projects in the form of wind and solar farms, each of which have large surface footprints. This project will primarily focus on (1) the cumulative impacts of natural gas extraction and CO₂ storage on proven and potential subsurface resources and groundwater resources, (2) examining how these activities affect future development of surface facilities, as well as (3) the availability and quality of groundwater for other essential uses.

Determining the distribution, overlap and relationship between subsurface resources, and the timing of different decisions and investments into future industry activities will aid community groups and regulators to better understand how to prioritise and stage various potential projects that involve onshore gas and related activities.

The proposed project aims to provide a comprehensive framework that will offer valuable scientific advice for resources development in the North Perth Basin, taking into account the physical, chemical and geological information pertinent to the region. It will identify potential conflicts of onshore gas development and any associated CCS development with a) groundwater usage, b) other subsurface activities like mining and geothermal, and c) land-use for agriculture and renewable energy. The main tasks will be:

1. Identifying and characterising the most significant or likely resource conflicts in the North Perth Basin.
2. Understanding the cost benefits, environmental and social impacts in case of conflicts.
3. Proposing management strategies for consideration in the development of overlapping or conflicting resources.
4. Developing a GIS for visual representations of data related to resource conflict and management to aid regulatory decision-making and stakeholder communication.

By identifying key natural resources, stakeholders, potential conflicts and risks, this project aims to provide comprehensive data-driven advice to the community, government, and industry stakeholders for consideration in the development of resources in the North Perth Basin and land-use decision-making. This will facilitate informed planning and approvals processes, ensuring that both subsurface and above-ground resources are developed with a comprehensive understanding of potential overlapping or conflicting interests. The project goal is to enable a sustainable and pragmatic coexistence of multiple uses of the subsurface, backed by the best available information.

2. Project description

Introduction

The North Perth Basin, also recognised as the Mid-West region (Figure 2), is seeing a significant increase in energy related industrial activities, both in the form of subsurface resources development (natural gas, geothermal energy, geological storage of carbon dioxide, natural hydrogen, underground hydrogen storage, sediment-hosted mineral deposits) and above-ground renewable energy developments (wind and solar farms). The result of the varied land use and subsurface demands is becoming increasingly challenging for regulators and residents in the community. Technically, many of the different potential activities could be complementary (e.g., use of renewable energy to power transport of gas, mining and communities). However, other activities could be in conflict, such as use of subsurface structures for storage of natural gas, hydrogen or carbon dioxide. Impacts of any of the potential industrial activities may also have varying surface footprints, energy needs and water use.

This project aims to evaluate the relative activities, and map out interdependencies and risks that could occur if they come into competition. Staging and timing of different activities may be beneficial, in addition to sharing costs or identifying opportunities for improvement in community outcomes (more renewable energy, cleaner water etc.). Only by conducting a resource conflict evaluation of the region can the challenges be unpacked, and the risks mitigated to result in better outcomes for the people who live and work in the region.

Local decision-makers are already finding that there is extensive and time-consuming stakeholder engagement by a number of different industry types in the region. A more comprehensive assessment of activities will be beneficial to determining best outcomes when assessing potential projects, approvals and investment in the region.

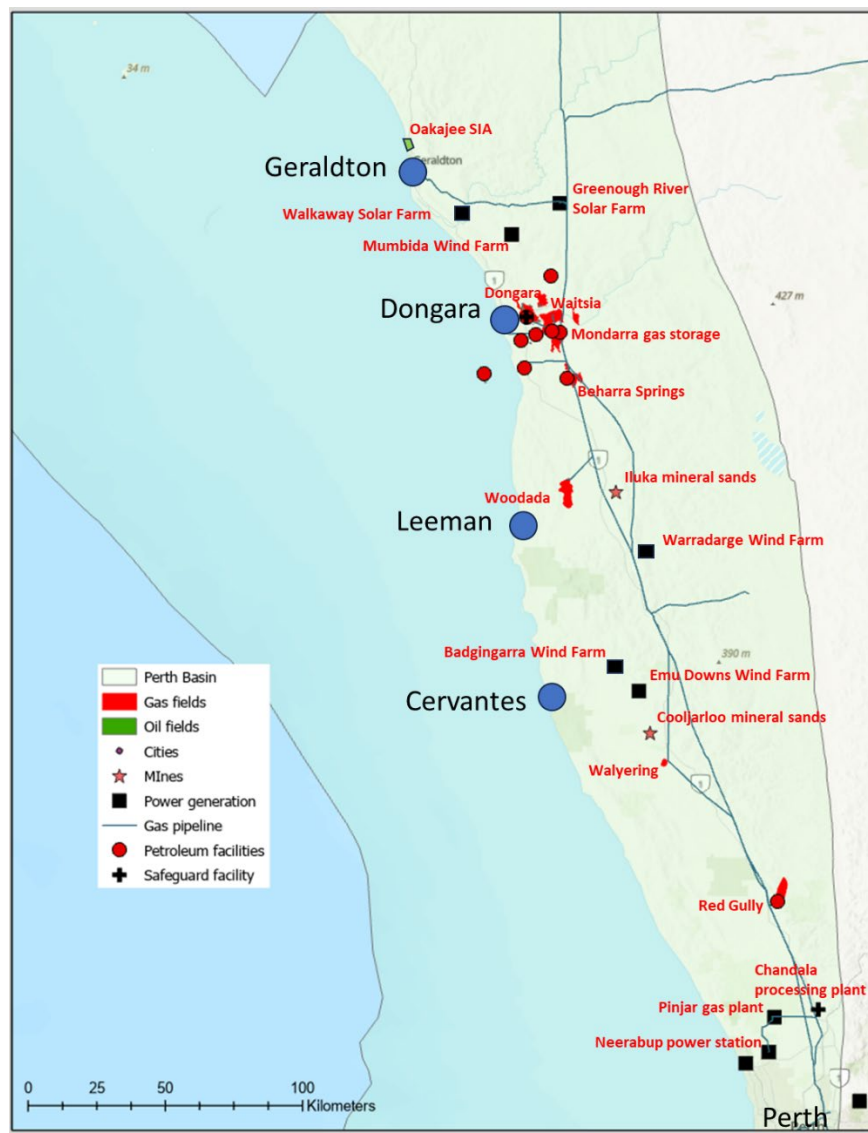


Figure 2. Map of the North Perth Basin showing locations of petroleum operations, mineral sands, and electricity generation.

Subsurface resources development

The subsurface of the earth can be conceptualised as a vast repository, with the pore space between the rocks that can be occupied by various resources like groundwater or natural gas. In other words, this pore space can function as a subsurface reservoir, facilitating the storage or movement of fluids. The result is an increasing potential for conflicting use of pore space between various resource development activities and with groundwater resources, and a competition for land access between industrial projects and agricultural use.

Petroleum production in the Perth Basin had declined in recent years, but the basin is still considered to be a significant hydrocarbon resource and exploration continues for natural gas. There are a number of exploration and development projects underway in the basin (e.g., Waitsia, North Erregulla, Dongara) and it is possible that production could increase in the future. There are two underground gas storage facilities near Dongara, the Mondarra Gas Storage Facility (operated by AGIG) with a capacity of 20 petajoules (PJ), and the Waitsia Gas Storage Facility (under development by Strike Energy) with an expected capacity of 10 PJ.

Building on the existing natural gas operations, blue ammonia projects are planned by Mitsui and Wesfarmers, involving the steam-assisted conversion of natural gas (methane) to ammonia with carbon dioxide as a by-product. Carbon capture and storage (CCS) is needed to make this a low-emissions process. The Pilot Energy Mid West Clean Energy Project (MWCEP) proposes hydrogen production using both partial oxidation reforming with > 1 Mt/yr of integrated CCS capacity and renewables-based hydrogen to produce up to 220,000 t/yr of low-carbon ammonia. Ammonia can be used as a low-emissions fuel for power generation, transportation and other applications, or to produce fertilisers and other chemicals. CCS associated with blue ammonia production will require the injection of storage of carbon dioxide in subsurface reservoirs, and the community and regulators need to be assured that the injected carbon dioxide is safely contained without leaking to the surface or contaminating groundwater.

Strike Energy is developing a geothermal power project near Dongara, the Mid-West Geothermal Power Project, which is expected to have a capacity of 226 megawatts (MW) and will use hot water from a geothermal reservoir to generate electricity. The potential for basin resource conflict by cooling rocks from adjacent operations may be perceived and result in challenges between different subsurface industrial activities. Hence the need for this project to evaluate the actual risks between different subsurface use of pore-space.

Above-ground industrial developments

Various surface facilities are associated with the processing and transport of natural gas. The natural gas produced in the North Perth Basin is currently processed at two gas processing plants (Xyris, Beharra Springs) but others are in the planning or construction phase (e.g., Waitsia). The 250 km-long Parmelia gas pipeline is located in the northern part of the basin and connects the Dongara gas field

to the Dampier Gas Terminal. A second pipeline of similar length, the Waitsia Gas Pipeline, is currently under construction and will connect the Waitsia gas field to the Dampier Gas Terminal.

The WA Government designated the Oakajee Strategic Industrial Area (<https://developmentwa.com.au/projects/industrial-and-commercial/oakajee-sia/overview>) to create a new heavy industrial area and multi-user deep water port for strategic and downstream processing industries to service Western Australia's Mid West region. AGI Projects in collaboration with Suez Global is planning to build a seawater desalination plant (H2Oakajee) 15 km north of Geraldton to cover the additional demand on water from the Oakajee Strategic Industrial Estate.

Another desalination plant in Alkimos south of Yanchep is currently under construction by the Water Corporation to help reduce the region's dependence on rainfall and groundwater (www.watercorporation.com.au/Our-water/Desalination/Alkimos-Seawater-Desalination-Plant).

The 10 MW Greenough River Solar Farm has been operating since 2012, 50 km southeast of Geraldton, and a 30 MW expansion is being planned (www.brightenergyinvestments.com.au/greenough-river-solar-farm).

The Pilot Energy Mid West Clean Energy Project (MWCEP) is expected to have a capacity of 1,100 megawatts (MW) and will consist of a combination of solar and wind farms located near Dongara.

Understanding the above-ground industrial developments is crucial in addressing the community's concerns, as these developments are intrinsically linked to the subsurface activities that also require a surface footprint. The development of gas processing plants, pipelines, and industrial areas, while vital for the processing and transport of natural gas, will significantly affect parts of the landscape and could potentially lead to conflicts with other land uses. This is compounded by the fact that subsurface activities such as natural gas extraction also necessitate surface facilities, creating a competition for land access between different industrial activities and other land uses such as agriculture and renewable energy projects. The development of renewable energy projects, such as solar and wind farms, is vital for ensuring a sustainable and reliable energy supply for the community. By having a clear picture of both the above-ground and subsurface industrial developments, community groups and regulators can make informed decisions on how to balance the different industrial activities, ensuring that the benefits to the community are maximized while minimizing any potential negative impacts and conflicts.

Groundwater resources (Department of Water, 2017)

The aquifers of the northern Perth Basin currently supply about 95 per cent of all water used for town water supply, irrigated agricultural activities, mines and industries across the region. These aquifers also support many groundwater-dependent wetlands, watercourses, vegetation associations, and cave and aquifer ecosystems. The largest fresh groundwater resources are in the Superficial,

Leederville, Leederville–Parmelia and Yarragadee aquifers, whereas three secondary sources are the Mirrabooka, Cattamarra and Eneabba–Lesueur aquifers.

There are four main drivers of future water demand in the northern Perth Basin region:

- proposed and planned mining projects, including water sources for mines outside the region
- a potential future port facility and industrial estate at Oakajee (24 km north of Geraldton)
- growth of Geraldton and other rural towns, including Jurien Bay and Morawa
- northward expansion of irrigated agriculture and horticulture, including the Water for Food Midlands area between Moora and Dongara.

The development of subsurface resources, particularly natural gas extraction and Carbon Capture and Storage (CCS), has a direct relationship with groundwater resources due to the potential risk of contamination and the utilization of pore space. In the case of CCS, the injection of CO₂ into underground formations requires a comprehensive understanding of the geology to ensure safe and effective storage, while also preventing any potential contamination of groundwater resources. Similarly, natural gas development poses a risk of groundwater contamination if not managed properly. A data-driven understanding of the groundwater resources is therefore crucial in mitigating these risks and ensuring the sustainable development of both subsurface and groundwater resources. This comprehensive understanding will also aid in addressing the community's concerns regarding the potential impacts of resource development on their water supply, as well as informing the planning and approvals process for future projects in the region. It will provide confidence to communities that the best available, science-based information is used by local and State Governments to make land use planning decisions.

Prior Research

There is a long history of CSIRO research related to the petroleum geology (e.g., Kempton et al., 2011; Langhi et al., 2012), hydrogeology (e.g., Bekele et al., 2006; Hortle et al., 2017), CO₂ geological storage (e.g., Varma et al., 2013) and the geothermal resource potential (e.g., Sheldon et al., 2012; Pujol et al., 2015) of the North Perth Basin. Hortle et al. (2017) in collaboration with Latent Petroleum, AWE Limited, Origin Energy, Norwest Energy and the WA Department of Mines and Petroleum (DMP) established a research program into methods of calculating baseline values of environmental indicators and monitoring techniques during development of tight gas resources in the northern Perth Basin. More recently in 2022/23, CSIRO researchers conducted various small studies for Mitsui in support of their plans of a CO₂ pilot injection project at their depleted Dongara gas field.

With respect to resource conflicts, CSIRO in collaboration with Curtin University has conducted a comprehensive study for ANLEC R&D on Basin Resource Management and Carbon Storage (Michael et

al., 2013; EP1210162;), which assessed the interaction of various subsurface resources developments (e.g. groundwater, petroleum, geothermal, CO₂ geological storage) in the Australian context. Sub-surface (geological) characterisation, static and dynamic modelling, monitoring and risk evaluation were identified as essential activities needed for understanding and managing potential impacts of resources development within a basin resources assessment framework (Michael et al., 2016).

Previous experience with respect to subsurface resource characterisation in the North Perth Basin in conjunction with more general aspects of a basin resources management framework will be used in the proposed project to develop a framework for assessing and managing specifically subsurface resources in the North Perth Basin.

The prior research conducted by CSIRO and its collaborators provides a valuable foundation for addressing the community's concerns regarding subsurface resource development in the North Perth Basin. The studies on petroleum geology, hydrogeology, CO₂ geological storage, and geothermal resource potential have generated crucial data and insights that can be utilized to identify potential conflicts and inform the planning and approvals process for future projects. Additionally, the research on methods of calculating baseline values of environmental indicators and monitoring techniques during the development of tight gas resources is directly relevant to the community's concern regarding the potential impacts of resource development on groundwater resources. The comprehensive study on Basin Resource Management and Carbon Storage further highlights the importance of sub-surface characterisation, static and dynamic modelling, monitoring, and risk evaluation in understanding and managing the potential impacts of resource development. By building on this prior research, the proposed project aims to develop a framework that will provide the best available information to community groups, government, and industry stakeholders, thereby addressing the community's concerns and supporting informed decision-making for the sustainable development of subsurface resources in the North Perth Basin.

Need & Scope

The North Perth Basin is witnessing a resurgence in natural resources exploration and planning of renewable energy projects, making it imperative to understand and manage potential resource conflicts and environmental impacts. The West Australian Government has recognized the need for expanding low-emissions energy industries in the Mid West region and announced the Oakajee Strategic Industrial Area just north of Geraldton for establishing a new heavy industrial area and multi-user deep water port for strategic and downstream processing industries. This development, coupled with the Western Australian Government's recognition of the increased need for groundwater due to industrial and agricultural growth, necessitates sustainable and efficient resource management, which this project aims to address.

The scientific value of this research lies in its potential to build on our existing understanding of the impacts of subsurface resources development by offering a holistic and data-driven management framework for the North Perth Basin's resources. This project will generate crucial data and further our understanding of the distribution of subsurface resources and potential conflicts, as well as the potential impact on water resources and their interaction with above-ground industries and facilities. By understanding the interplay of various subsurface activities, requirements for surface facilities, and the potential impacts on the environment and other above-ground industries, this project aims to provide objective and comprehensive information that aids regulators and community groups in developing a balanced approach to resource exploration and development that benefits the community, industry, and environment.

Out-of-scope

As part of the resources conflict assessment, the project will specifically assess the impacts of subsurface resource development on water resources and competition for groundwater with other industries, domestic and agricultural use. However, the project will not assess other potential impacts on the environment, national parks, agricultural use, renewable energy or cultural issues.

Objective

The primary objective of this project is to provide a comprehensive framework for data-driven decision-making and for managing economic, environmental and social aspects of developing subsurface resources in the North Perth Basin. By identifying key natural resources, stakeholders, potential conflicts, and risks, this project aims to:

- Specifically address the timing and sequencing of industry activities and investments to mitigate basin resource conflicts.
- Equip community groups and regulators with the necessary tools and information to prioritise and stage future projects involving onshore gas and related activities, with a focus on the potential impacts on groundwater resources.
- Offer a systematic approach to assess and manage the risks associated with subsurface resource development, including potential contamination of groundwater resources, a significant concern for the local community.
- This targeted approach will ensure that both subsurface and above-ground resources are developed in a way that is mutually beneficial and sustainable, with a particular emphasis on preserving the quality and availability of groundwater resources for the region.

Methodology

The workflow for the evaluation of resource interactions in the North Perth Basin will build on the methodology developed by Michael et al. (2013) for basin resource management strategies

associated with large-scale CO₂ geological storage development within pre-existing and future activities in the region.

Task 1: Data Integration for the existing North Perth Basin's resources and future development plans.

This task will encompass a comprehensive knowledge synthesis, including a thorough review of literature and engagement with stakeholders to access non-public data. The process will involve data validation and quality control to accurately identify existing and future subsurface resources, industrial and renewable energy developments, land and groundwater use, as well as historically and environmentally sensitive areas. The collated data will then be analyzed and discussed in the context of government strategies, and policies and community concerns, such as the timing of different decisions and investments into future industry activities, understanding and prioritizing different projects, and potential impacts on groundwater resources. This task will also entail the identification of pertinent data sources essential for the mapping and assessment of resource conflicts.

Task 2: Mapping of resources and infrastructure

The initial stage in assessing potential resource interactions requires a comprehensive resource assessment to understand the quantity, quality, and economic viability of the identified resources. This could include the interpretation of geophysical data, the development of geological models, and delineation of migration pathways for fluids in the subsurface to support the identification, mapping, and analysis of the interactions between different subsurface resources. A Geographic Information System (GIS) will then be developed to visualize and analyse spatial data, allowing for the identification of geographic overlaps and potential conflicts between different resources and infrastructure. This will also facilitate the evaluation of economic, environmental, and technical aspects of the identified resources and their potential interactions, considering the community concerns and government policies.

Task 3: Resources conflict evaluation

Basin-scale and site-scale assessments will be conducted to understand the potential interactions between different resources at different scales. Potential interactions, either adverse or beneficial, between resources or potential environmental impacts will be identified. This could include contamination/sterilisation of other resources, contamination of groundwater and competition for land access. Migration and vertical leakage pathways will be assessed with respect to their likelihood to affect other resources or the environment, and regarding the respective consequences. General monitoring schemes and risk management strategies will be developed to mitigate potential negative impacts from resource interactions.

Task 4: Resource management strategies

In regions identified as having potential resource conflicts, a comprehensive management strategy will be formulated. This strategy will prioritise each resource based on its economic, environmental, and social values, serving as a foundation for determining the sequence in which resources should be

exploited, particularly if simultaneous development is impractical. A significant component of this task will involve the development of site-specific risk management and mitigation strategies to address potential conflicts and impacts on groundwater resources. These strategies will be tailored to minimize environmental impacts, safeguard groundwater resources, ensure safety, and harmonize land use, thereby providing a balanced approach to resource development in the North Perth Basin.

Task 5: Communicate project objectives, progress, and findings to stakeholders.

This task will include communication across the duration of the project via progress reports, fact sheets, final reporting, presentations and research papers. It will also involve engagement with selected stakeholders including local communities, government and industry.

3. Project Inputs

Resources and collaborations

Researcher	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Karsten Michael	50 days	CO ₂ geological storage and hydrogeology	25	CSIRO
Laurent Langhi	35 days	Petroleum and structural geology	20	CSIRO
Ludovic Ricard	20 days	Geothermal resources and reservoir engineering	18	CSIRO
Ryan Gee	10 days	GIS and database support	12	CSIRO
Research assistant	5 days	Wind and solar potential	<5	CSIRO
Research assistant	25 days	Renewable energy assessment	<5	CSIRO

Subcontractors (clause 9.5(a)(i))	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Specialist to develop visualization material in Geographic Information System (GIS)	N/A	Geographic Information System developed to visualize and analyse spatial data	<5	To be determined

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: WA Department of Water and Environment Regulation (DWER), WA Department of Mines, Industry, Regulation and Safety (DMIRS), Mid West Development Commission
- Other government agencies: Geoscience Australia representative
- Indigenous groups: Yamatji Marlpa Aboriginal Corporation (YMAC), South West Aboriginal Land and Sea Council (SWALSC)
- Company representatives: Mitsui E&P Australia (MEPAU) Strike Energy, Beach Energy
- Technical expertise from CSIRO Environment and CSIRO Agriculture and Food
- Other industry representatives: Grower Group Alliance – Northern Agricultural Region

Budget Summary

Source of Cash Contributions	2022/23	2023/24	2024/25	2025/26	% of Contribution	Total
GISERA	\$0	\$88,424	\$195,587	\$0	70.11%	\$284,011
- Federal Government	\$0	\$88,424	\$195,587	\$0	70.11%	\$284,011
Total Cash Contributions	\$0	\$88,424	\$195,587	\$0	70.11%	\$284,011

Source of In-Kind Contribution	2022/23	2023/24	2024/25	2025/26	% of Contribution	Total
CSIRO	\$0	\$37,698	\$83,384	\$0	29.89%	\$121,082
Total In-Kind Contribution	\$0	\$37,698	\$83,384	\$0	29.89%	\$121,082

TOTAL PROJECT BUDGET	2022/23	2023/24	2024/25	2025/26	-	TOTAL
All contributions	\$0	\$126,122	\$278,971	\$0	-	\$405,093
TOTAL PROJECT BUDGET	\$0	\$126,122	\$278,971	\$0	-	\$405,093

4. Communications Plan

Stakeholder	Objective	Channel (e.g. meetings/media/factsheets)	Timeframe (Before, during at completion)
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 of the project that explains in plain English the objective of the project.	At project commencement
		Engage with local government and community stakeholders to present the objectives of the project and discuss individual concerns regarding the impacts on resources development on groundwater development and land use.	Early stages of project
		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 article for the GISERA newsletter and other media outlets as advised by GISERA's communication team.	At project completion
		Presentation of research findings to regional community stakeholders such as identified business and/or community groups in a workshop (virtual or face-to-face)	At completion or within 6 months of completion of the project.
Gas Industry & Government	To communicate the outcome of the project.	Fact sheet that explains the objectives of the project.	At project commencement
		Project progress reporting (on GISERA website).	Ongoing
		Final project report and fact sheet.	At project completion
		Presentation of findings at joint gas industry/government Knowledge Transfer Session.	At project completion
Scientific Community	Provide scientific insight into how different subsurface resources development activities may interfere with each other and with groundwater resources.	Peer-reviewed scientific publication. Dataset(s) available through CSIRO's data repository and through a web-based GIS map (showing location of resources development, groundwater usage and interpreted areas of potential conflicts hosted on GISERA website	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, roadshows, newsletters and the development of other communication products, where appropriate and utilising results from a broad range of GISERA's research.

5. Project Impact Pathway

Activities	Outputs	Short term Outcomes	Long term outcomes	Impact
Mapping of existing and future resources development activities within the geological context of the North Perth Basin	Database containing characteristics of resources projects. GIS project showing project locations and maps relevant for assessing development impacts (e.g., geology, aquifer distribution, land use, national parks, etc.,)	Comprehensive database and maps detailing the geographical and geological distribution of existing and future resources in the North Perth Basin. Identification of key areas for potential resource development and their geological characteristics.	Comprehensive database and maps that serve as a valuable resource for future research and development activities in the North Perth Basin. Enhanced understanding of the geological context will inform governments, regulators, and policymakers on the potential impacts and opportunities of onshore gas development in the region. Establishment of a data-driven methodology for assessing and mitigating resource conflicts in the North Perth Basin and other similar geological settings.	Economic Impact: <ul style="list-style-type: none"> Contribution to a sustainable Australian onshore gas industry, with increased productivity, job creation, and GDP. Generation of revenue and royalties for Western Australia, contributing to regional wealth generation.
Evaluation of potential resource conflicts and environmental impacts	Factsheets and report outlining and assessing the interaction between various resource development activities; specifically, the potential impacts on groundwater resources.	Detailed report on potential conflicts between different resources and their associated environmental impacts. Identification of key risk areas and potential mitigation strategies.	Improved awareness among communities and policymakers about the potential interactions between onshore gas development and other resources.	Social Impact: <ul style="list-style-type: none"> Enhanced community social and health wellbeing, with greater income, jobs, and wealth for regional communities.

Activities	Outputs	Short term Outcomes	Long term outcomes	Impact
Development of basin resources management framework	Proposal of workflow and processes for managing the sustainable development of multiple basin resources including mitigation strategies	<p>Preliminary framework for managing basin resources, considering economic, environmental, and social aspects.</p> <p>Initial guidelines and best practices for resource development in the North Perth Basin.</p>	<p>Fully developed framework for managing basin resources, with guidelines and best practices that can be adopted by industry stakeholders and policymakers.</p> <p>The framework will serve as a valuable tool for governments and regulators in developing policy and legislative frameworks that support sustainable onshore gas development.</p>	<ul style="list-style-type: none"> Increased community confidence in resource development activities. <p>Environmental Impact:</p> <ul style="list-style-type: none"> Improved land and groundwater quality, facilitating coexistence between gas and agriculture. Contribution to improved regional ecological function and reduced greenhouse gas footprint.
Communication of project findings	<ul style="list-style-type: none"> Plain English fact sheets developed at commencement to explain project objectives and another at project completion to explain project results – for distribution via the GISERA website and during community engagement. Knowledge transfer session with government and industry stakeholders Engagement activities with identified government, industry and regional community stakeholders Peer review of the final report Manuscript submission to peer-reviewed journals. News article for GISERA website. 	Dissemination of initial findings to stakeholders through reports, presentations, and workshops.	<p>Widespread dissemination of project findings, contributing to informed decision-making by stakeholders and policymakers.</p> <p>Enhanced public awareness and understanding of the complexities and challenges associated with resource development in the North Perth Basin.</p> <p>Improved industry knowledge and practices related to the social, economic, and environmental opportunities and challenges of unconventional gas projects.</p>	

6. Project Plan

Project Schedule

ID	Activities / Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
Task 1	Data integration for the existing North Perth Basin's resources and future development plans	Laurent Langhi	1 March 2024	30 June 2024	-
Task 2	Mapping of resources and infrastructure	Laurent Langhi	1 March 2024	30 June 2024	-
Task 3	Resources conflict evaluation	Karsten Michael	1 July 2024	31 January 2025	Tasks 1 & 2
Task 4	Resource management strategies	Karsten Michael	1 July 2024	31 January 2025	Tasks 1 & 2
Task 5	Communicate project objectives, progress, and findings to stakeholders	Karsten Michael	1 March 2024	31 March 2025	-

Task description

Task 1: Data Integration for the Existing North Perth Basin’s Resources and Future Development Plans

OVERALL TIMEFRAME: March 2024 – June 2024

BACKGROUND: This task will consolidate the existing knowledge and data to provide a comprehensive overview of the North Perth Basin’s subsurface resources, industrial and renewable energy developments, land and groundwater use, and historically and environmentally sensitive areas.

TASK OBJECTIVES:

1. Conduct a thorough literature review and engage with stakeholders to access non-public data.
2. Validate and perform quality control on collected data.
3. Analyze and discuss data in the context of government strategies, policies, and community concerns.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

1. A draft report that comprehensively reviews data and literature detailing existing and future resources, developments, and land use in the North Perth Basin.
2. A list of pertinent data sources for mapping and assessing resource conflicts.

Task 2: Mapping of resources and infrastructure

OVERALL TIMEFRAME: March 2024 – June 2024

BACKGROUND: This task aims to identify and characterise the resources and infrastructure, and to map the geographic overlap of these elements in the North Perth Basin to assess potential resource interactions and conflicts.

TASK OBJECTIVES:

1. Conduct a comprehensive resource assessment, including geophysical data interpretation and geological modelling.
2. Develop a Geographic Information System (GIS) for visualizing and analysing spatial data.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

1. A GIS database containing mapped resources and infrastructure.
2. A report detailing the economic, environmental, and technical aspects of identified resources and their potential interactions.

Task 3: Resources conflict evaluation

OVERALL TIMEFRAME: July 2024 – January 2025

BACKGROUND: This task will identify and evaluate potential interactions, both adverse and beneficial, between resources and potential environmental impacts in the North Perth Basin.

TASK OBJECTIVES:

1. Conduct basin-scale and site-scale assessments to understand potential interactions between different resources.
2. Identify potential resource conflicts and environmental impacts.
3. Assess migration and vertical leakage pathways and their potential effects on other resources or the environment.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

A report detailing potential resource conflicts and environmental impacts and outlining general risk management strategies and monitoring schemes to mitigate potential impacts from resource interactions.

Task 4: Resources management strategies

OVERALL TIMEFRAME: July 2024 – January 2025

BACKGROUND: This task will develop specific comprehensive management framework for regions of the North Perth Basin identified as having potential resource conflicts; it will prioritise resources based on their economic, environmental, and social values.

TASK OBJECTIVES:

1. Formulate a management strategy for areas with potential resource conflicts.
2. Develop risk management and mitigation strategies to address potential conflicts and impacts on groundwater resources.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

A comprehensive management strategy report for regions identified as having potential resource conflicts.

Task 5: Communicate project objectives, progress and findings to stakeholders

OVERALL TIMEFRAME: Full duration of project (March 2024 – March 2025)

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, a 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 of findings to community stakeholders such as identified business and/or community groups in a workshop (virtual or face-to-face).
3. A web-based GIS map for visualisation of assessment results and data distribution.
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. Following CSIRO ePublish review, the consolidated report will be submitted to the GISERA Director for final approval.
7. Peer-reviewed scientific manuscript ready for submission to a relevant journal.

Project Gantt Chart

Task	Task Description	2023/24				2024/25								
		Mar 24	Apr 24	May 24	Jun 24	Jul 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25
1	Data integration for the existing North Perth Basin's resources and future development plans	█	█	█	█									
2	Mapping of resources and infrastructure	█	█	█	█									
3	Resources conflict evaluation					█	█	█	█	█	█	█		
4	Resource management strategies					█	█	█	█	█	█	█		
5	Communicate project objectives, progress, and findings to stakeholders	█	█	█	█	█	█	█	█	█	█	█	█	█

7. Budget Summary

Expenditure	2022/23	2023/24	2024/25	2025/26	Total
Labour	\$0	\$123,622	\$144,971	\$0	\$268,593
Operating	\$0	\$2,500	\$9,000	\$0	\$11,500
Subcontractors	\$0	\$0	\$125,000	\$0	\$125,000
Total Expenditure	\$0	\$126,122	\$278,971	\$0	\$405,093

Expenditure per task	2022/23	2023/24	2024/25	2025/26	Total
Task 1	\$0	\$27,197	\$0	\$0	\$27,197
Task 2	\$0	\$88,409	\$0	\$0	\$88,409
Task 3	\$0	\$0	\$74,992	\$0	\$74,992
Task 4	\$0	\$0	\$49,138	\$0	\$49,138
Task 5	\$0	\$10,516	\$154,841	\$0	\$165,357
Total Expenditure	\$0	\$126,122	\$278,971	\$0	\$405,093

Source of Cash Contributions	2022/23	2023/24	2024/25	2025/26	Total
Federal Govt (70.11%)	\$0	\$88,424	\$195,587	\$0	\$284,011
Total Cash Contributions	\$0	\$88,424	\$195,587	\$0	\$284,011

In-Kind Contributions	2022/23	2023/24	2024/25	2025/26	Total
CSIRO (29.89%)	\$0	\$37,698	\$83,384	\$0	\$121,082
Total In-Kind Contributions	\$0	\$37,698	\$83,384	\$0	\$121,082

	Total funding over all years	Percentage of Total Budget
Federal Government investment	\$284,011	70.11%
CSIRO investment	\$121,082	29.89%
Total Expenditure	\$405,093	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	Data integration for the existing North Perth Basin's resources and future development plans	GISERA	Mar-24	Jun-24	2023/24	\$19,068
Task 2	2.1	Mapping of resources and infrastructure	GISERA	Mar-24	Jun 24	2023/24	\$61,984
Task 3	3.1	Resources conflict evaluation	GISERA	Jul-24	Jan-25	2024/25	\$52,577
Task 4	4.1	Resource management strategies	GISERA	Jul-24	Jan-25	2024/25	\$34,451
Task 5	5.1	Communicate project objectives, progress, and findings to stakeholders	GISERA	Mar-24	Mar-25	2024/25	\$115,932

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		

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