

# Project Order, Variations and Research Progress

Project Title: Assist in the preservation of agricultural productivity during land use change

This document contains three sections. Click on the relevant section for more information.

Section 1: [Research Project Order as approved by the GISERA Research Advisory Committee and GISERA Management Committee before project commencement](#)

Section 2: [Variations to Project Order](#)

Section 3: [Progress against project milestones](#)



Australian Government  
Department of Industry,  
Innovation and Science

# 1 Original Project Order



# Project Order

## Proforma 2011

### 1. Short Project Title (less than 15 words)

Project 1 - Preserving agricultural productivity

Long Project Title	Assist in the preservation of agricultural productivity during land use change.
GISERA Project Number	A1 1215
Proposed Start Date	July 2012
Proposed End Date	June 2015
Project Leader	Oswald Marinoni

### 2. GISERA Research Program

- Biodiversity Research       Marine Research       Land Research  
 Water Research       Social & Economic Research

### 3. Research Leader, Title and Organisation

Oswald Marinoni  
Senior Research Scientist  
CSIRO Ecosystem Sciences

### 4. Summary (less than 300 words)

The emerging issue of global food security has stimulated interest in efforts to ensure the preservation of agricultural productivity. This has led to policy for the protection of strategic cropping land and guidelines for its development. Land is often categorised according to local scale attributes. However, considerations for widespread land use changes (i.e. many land use changes at a small scale) need to also consider preservation of productivity at a

larger scale. For example, the effect of preservation of smaller, highly productive land areas at the expense of larger less productive areas should be considered. This requires a spatial planning process which should account for opportunities such as energy (gas) production, regional economics and potential impacts (on agricultural productivity and profits, ecosystem services and others). Every land planning scenario will have some impact on agriculture or the environment. It is therefore important to understand interactions between opportunities and associated impacts so that trade-offs between land management scenarios can be evaluated. The knowledge of the order of magnitude of opportunities and impacts is crucial for land use planning and for the design of land use planning policies. In developing a process and providing model results for a region affected by coal seam gas (CSG) production, this project will provide the necessary tools and information to inform spatial planning on various scales.

### 5. Budget Summary (From Excel Budget Pack worksheet “Project Plan Summary”)

Expenditure	2012/13 Year 1	2013/14 Year 2	2014/15 Year 3	2015/16 Year 4	2016/17 Year 5	Total
Labour	120,771	142,498	149,487			412,756
Operating	28,000	48,000	44,000	15,000		135,000
<b>Total Costs</b>	<b>148,771</b>	<b>190,498</b>	<b>193,487</b>	<b>15,000</b>		<b>547,756</b>
CSIRO	148,771	190,498	193,487	15,000		547,756
<b>Total Expenditure</b>	<b>148,771</b>	<b>190,498</b>	<b>193,487</b>	<b>15,000</b>		<b>547,756</b>

Expenditure per Task	2012/13	2013/14	2014/15	2015/16	2016/17	Total
	Year 1	Year 2	Year 3	Year 4	Year 5	
Task 1	148,771	190,498	193,487	15,000		547,756
Task 2						
Task 3						
Task 4						
Task 5						
<b>Total Expenditure</b>	<b>148,771</b>	<b>190,498</b>	<b>193,487</b>	<b>15,000</b>		<b>547,756</b>

Cash Funds to Project	2012/13	2013/14	2014/15	2015/16	2016/17	Total
Partners	Year 1	Year 2	Year 3	Year 4	Year 5	
CSIRO	104,000	133,600	136,500	11,250		385,350
<b>Total Cash to Partners</b>	<b>104,000</b>	<b>133,600</b>	<b>136,500</b>	<b>11,250</b>		<b>385,350</b>

Source of Cash	2012/13	2013/14	2014/15	2015/16	2016/17	Total
Contributions	Year 1	Year 2	Year 3	Year 4	Year 5	
Australia Pacific LNG	104,000	133,600	136,500	11,250		385,350
<b>Total Cash Contributions</b>	<b>104,000</b>	<b>133,600</b>	<b>136,500</b>	<b>11,250</b>		<b>385,350</b>

In-Kind Contribution from Partners	2012/13	2013/14	2014/15	2015/16	2016/17	Total
	Year 1	Year 2	Year 3	Year 4	Year 5	
CSIRO	44,770	56,898	56,987	3,750		162,405
<b>Total In-Kind Contribution from Partners</b>	<b>44,770</b>	<b>56,898</b>	<b>56,987</b>	<b>3,750</b>		<b>162,405</b>

	Total funding over all years	Percentage of Total Budget
Australia Pacific LNG Investment	385,350	70%
CSIRO Investment	162,405	30%
Total Other Investment		
<b>TOTAL</b>	<b>547,756</b>	<b>100%</b>

Task	Milestone Number	Milestone Description	Funded by	Participant Recipient	Start Date (mm-yy)	Delivery Date (mm-yy)	Fiscal Year	Fiscal Quarter	Payment \$
Task 1	1.1	Initial Team Meeting (including GISERA collaborators), Initial concepts and engagement with University, literature research	GISERA	CSIRO	Jul-12	Sep-12	12/13	1 <sup>st</sup>	26,000
Task 2	2.1	Identify required models, data collection, advertise PhD position	GISERA	CSIRO	Oct-12	Dec-12	12/13	2 <sup>nd</sup>	26,000
Task 3	3.1	Identify required models, data collection, PhD student commence (late task 2/early task 3)	GISERA	CSIRO	Jan-13	Mar-13	12/13	3 <sup>rd</sup>	26,000
Task 4	4.1	Data collection, begin of model assembly	GISERA	CSIRO	Apr-13	Jun-13	12/13	4 <sup>th</sup>	26,000
Task 5	5.1	Annual Team Meeting including key staff from GISERA	GISERA	CSIRO	Jul-13	Sep-13	13/14	1 <sup>st</sup>	33,400
Task 6	6.1	Data collection, model assembly	GISERA	CSIRO	Oct-13	Dec-13	13/14	2 <sup>nd</sup>	33,400
Task 7	7.1	Scenario Evaluation	GISERA	CSIRO	Jan-14	Mar-14	13/14	3 <sup>rd</sup>	33,400
Task 8	8.1	Scenario Evaluation	GISERA	CSIRO	Apr-14	Jun-14	13/14	4 <sup>th</sup>	33,400
Task 9	9.1	Annual Team Meeting	GISERA	CSIRO	Jul-14	Sep-14	14/15	1 <sup>st</sup>	34,125
Task 10	10.1	Compilation of Results	GISERA	CSIRO	Oct-14	Dec-14	14/15	2 <sup>nd</sup>	34,125
Task 11	11.1	Development of manuscript(s)	GISERA	CSIRO	Jan-15	Mar-15	14/15	3 <sup>rd</sup>	34,125
Task 12	12.1	Draft Manuscripts(s), submission to scientific journal(s)	GISERA	CSIRO	Apr-15	Jun-15	14/15	4 <sup>th</sup>	34,125
Task 13	13.1	Thesis Production	GISERA	CSIRO	Jul-15	Dec-15	15/16	2 <sup>nd</sup>	11,250

## 6. Other Researchers

Researcher	Time Commitment (project as a whole)	Principle area of expertise	Years of experience	Organisation
Oswald Marinoni	0.70 FTE	Spatial analysis and modelling of geo-data, Informing land management decision processes	>15	CSIRO
Javier Navarro Garcia	0.90 FTE	GIS analysis and data mining, Systems modelling, software and DB development, life cycle assessment	>5	CSIRO

## 7. GISERA Objectives Addressed

Research that improves and extends knowledge of environmental impacts and opportunities of CSG-LNG projects, enabling the CSG-LNG industry to better meet the expectations of relevant communities and the broader public.

Informing government, regulators and policy-makers on key issues regarding policy and legislative frameworks for the CSG-LNG industry.

GISERA performance indicators addressed in this work include:

- Publication of results
- Involvement of a university local to CSG and LNG activity participating in research projects
- PhD studentship
- Engagement with local gas and agricultural industries.

## 8. Program Outcomes Achieved

Details are provided in *Section 13. Project Objectives and Outputs*.

## 9. Program Outputs Achieved

Details are provided in *Section 13. Project Objectives and Outputs*.

## 10. What is the knowledge gap that these research outputs will address?

The research outputs derived from this project will provide information on the impact of various policy or management decisions at the regional or farm level. These include analysis of the effectiveness of a range of land use policies and practices in preserving local and regional scale agricultural productivity; analyses of potential trade-offs between land use changes and impacts on ecosystem services, identification of areas that most cost-effectively preserve agricultural productivity.

## 11. How will these Research outputs and outcomes be used by government, agriculture or the CSG-LNG industry?

The research outputs and outcomes will help to inform farmers, CSG staff, government, scientists and the general community with regards to small scale impacts on agricultural productivity in the vicinity of CSG production wells. The project will also provide a method to scale up many small scale impacts to a larger scale. The project outcomes should influence the direction of future work in the land management research portfolio.

## 12. Project Development (1 page max.)

The project was developed in consultation between Australia Pacific LNG staff. The proposed activity was discussed with members of various farmer/stakeholder groups and was endorsed as an important research need.

There is considerable uncertainty as to the impact that the establishment of a CSG production well has on its nearest vicinity. It can be expected that the establishment of a CSG production well, including a track for drilling equipment and an access road that is operational for some years, is going to have local impacts on the natural resource base (soils) which includes (amongst others) changes to the bulk density, its hydraulic conductivity and ultimately agricultural productivity. As such, impacts on revenues generated from agriculture can be expected as well. If or how far these disturbances are reversible is unclear. Thus, there is some uncertainty as to the order of magnitude of potential local changes on productivity, its potential spatial extent and possible long term consequences. As CSG production wells are to be developed across an extended geography, the capacity to up-scale local impacts to a regional scale will help to understand cumulative impacts of gas infrastructure on agricultural productivity.

An independent quantification of the impacts of gas development on agricultural productivity, established for a wide range of geographies and enterprise mixes, is required to underpin initiatives to foster the co-existence of agriculture and gas development, and to understand the trade-offs required to minimise costs and maximise benefits. Spatially-explicit work of this type will make it possible to inform land planning that aims to maintain the long term functionality of landscapes. The project will thus provide the basis for an informed dialogue between farmers, CSG producers and regional governments about the trade-offs required to foster agriculture-gas industry co-existence and the sustainable management of the landscape.

The work is taking advantage of recent and ongoing research activities, including a system that produces a map of agricultural productivity on large scales.

## 13. Project Objectives and Outputs

The main aim of this project is to develop a process that will help to understand trade-offs between CSG-related opportunities and impacts on a local and regional scale. It will quantify the impacts of CSG development on the mass and value of agricultural production at farm through to regional scale, enabling impacts to be assessed at individual enterprise through to industry levels. The analysis will include explicit accounting of key benefits and



costs associated with CSG development on agricultural land and, whilst the analysis will focus on existing CSG fields in Queensland, the analytical tools have been designed to support broad scale land use planning in other regions where gas (or other) development may occur.

Project outputs include:

- Conceptual framework that facilitates evaluation of CSG related opportunities and costs
- Spatial models for identifying and analysing local to regional scale agricultural productivity and potential productivity impacts
- Quantitative assessments of a range of development and land use scenarios and their impacts on agricultural production
- Reports
- Scientific papers
- PhD thesis
- Popular précis of research findings and implications.

## 14. Project Plan

### 14.1 Project Schedule

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
<b>Task 1</b>	Initial Team Meeting (including GISERA collaborators), Initial concepts and engagement with University, literature research	Oswald Marinoni	1.7.2012	30.9.2012	
<b>Task 2</b>	Identify required models, data collection, advertise PhD position	Oswald Marinoni	1.10.2012	31.12.2012	Task 1
<b>Task 3</b>	Identify required models, data collection, PhD student commence (late task 2/early task 3)	Oswald Marinoni	01.01.2013	31.3.2013	Task 2
<b>Task 4</b>	Data collection, begin of model assembly	Oswald Marinoni	31.3.2013	31.6.2013	Task 3
<b>Task 5</b>	Annual Team Meeting including key staff from GISERA	Oswald Marinoni	1.7.2013	30.9.2013	Task 4
<b>Task 6</b>	Data collection, model assembly	Oswald Marinoni	1.10.2013	31.12.2013	Task 5
<b>Task 7</b>	Scenario Evaluation	Oswald Marinoni	01.01.2014	31.3.2014	Task 6
<b>Task 8</b>	Scenario Evaluation	Oswald Marinoni	31.3.2014	31.6.2014	Task 7
<b>Task 9</b>	Annual Team Meeting	Oswald Marinoni	1.7.2014	30.9.2014	Task 8
<b>Task</b>	Compilation of Results	Oswald Marinoni	1.10.2014	31.12.2014	Task 9

<b>10</b>					
<b>Task 11</b>	Development of manuscript(s)	Oswald Marinoni	01.01.2015	31.3.2015	Task 10
<b>Task 12</b>	Draft Manuscripts(s), submission to scientific journal(s)	Oswald Marinoni	31.3.2015	31.6.2015	Task 11
<b>Task 13</b>	Thesis Production	Oswald Marinoni	1.7.2015	31.12.2015	

## Task 1.

**TASK NAME: Initial team meeting and literature review**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

### **TASK OBJECTIVES:**

- Establish a project team
- Establish contact with GISERA collaborators
- Gather background information for methodology
- Start literature research
- Refine work plan according to Australia Pacific LNG-CSIRO discussions.

**SPECIFIC DELIVERABLE:** Short report providing information about initial team meeting, established relationships and list of initial findings of methodologies found in previous studies and the scientific literature. List of people with whom to establish contact and access data. Protocol for approaching institutions external to CSIRO. Initial list of datasets needed (e.g. DEM, soil types, land use, vegetation, weeds, climate data, land prices, cadastral data (property outlines)), predominant crop rotations, well density for CSG production, depth of wells (or depth of geologic horizons from which gas is supposed to be extracted), estimated production rate of wells, time wells are supposed to be operational and more). Geographic boundaries of study area identified.

## Task 2.

**TASK NAME: Identify required models, begin data collection**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

**BACKGROUND:** Start identifying existing and relevant models to be used to quantify benefits and impacts of land use change related to CSG production.

**TASK OBJECTIVE:** Based upon the continuing literature research and discussions with stakeholders a holistic process understanding needs to be developed. This includes an understanding of common agricultural land use management practises and CSG production. This will determine the choice of models to be used, and how individual models can be consistently linked to determine a benefit or impact of CSG production. It may be necessary to modify existing models or to (partially) develop new models. The holistic process understanding will be supported through close collaboration with other project areas, e.g. with the *A shared space* project.

**TASK OUTPUTS:** A first list of processes considered relevant plus an account of models to be used/modified/developed.

**SPECIFIC DELIVERABLE:** See task output, above, plus a progressed list of datasets to be collected. Based upon the knowledge of existing models and the process understanding acquired at this stage, it will be possible to be more specific in regards to the research and the skills that are required to fill a PhD position. A position description and advertisement for a PhD position is planned at the end of this stage or the beginning of the next.

### Task 3.

**TASK NAME:** Identify required models, begin data collection

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

**BACKGROUND:** Continuation of the previous task. Start of data collection.

**TASK OBJECTIVE:** Continuation of task 2. Working towards a complete collection of models and data to quantify impacts and benefits related to CSG production.

**SPECIFIC DELIVERABLE:** PhD student commencing work and getting involved in research activities. Outline of the PhD thesis and its envisaged objectives.

### Task 4.

**TASK NAME:** Data collection, begin model assembly

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

**BACKGROUND:** Development of a process framework to logically put individual model components together in close collaboration with other projects of the land research program such as *Gas farm design* and *Making tracks*. Continuation of data collection.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Draft of a process framework capturing the linkages between individual model components and the capacity to up-scale model results.

### Task 5.

**TASK NAME:** Annual team meeting including key staff from GISERA

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Team meeting (includes PhD student) to discuss research objectives for the coming year.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Outline of the research objectives and tasks for the year to come.

## Task 6.

**TASK NAME: Data collection, model assembly**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Finalising data collection, model framework and conceptualisation of scenarios that are to be developed. Scenarios are to be developed in consultation with stakeholders from GISERA. (See task 7 also).

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Brief report on the design of the model framework. Definition of a baseline scenario. List of scenarios that are going to be evaluated.

## Task 7.

**TASK NAME: Scenario definition**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Definition of a baseline land use scenario and subsequent definition of comparative scenarios. Comparative land use scenarios could include, for example, a shift of production wells to locations where agricultural productivity is knowingly lower than envisaged production sites. Changes in the impact and the benefits will be quantified. The scenarios selected for further development will depend upon the availability of data; which is not entirely known at this stage. List of scenarios to be developed will be decided in consultation with GISERA staff (see task 6).

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Finalised list of scenarios.

## Task 8.

**TASK NAME: Scenario evaluation**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Continuation of task 7. Evaluation of baseline scenario and subsequently comparative scenarios.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Brief progress report.

## Task 9.

**TASK NAME: Annual team meeting**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Team meeting (includes PhD student) to discuss research findings and objectives for the coming year which is going to be targeted towards output.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Preliminary report including preliminary findings, maps and charts etc. List of envisaged publications with targeted journals.

#### Task 10.

**TASK NAME:** Compilation of results

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Compilation of results, maps, charts etc. for the purpose of communicating project results to local communities as well as to the scientific community.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** List of maps, charts and tables that capture the main findings. Summary of the principles used in approaching the study.

#### Task 11.

**TASK NAME:** Development of manuscripts

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Communication of findings to the scientific community.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Draft manuscript(s) prepared for journal(s) and/or conference proceedings.

#### Task 12.

**TASK NAME:** Publication of results

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Communication of findings to the scientific community.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Draft manuscript(s) prepared for journal(s) and/or conference proceedings.

#### Task 13.

**TASK NAME:** Thesis production

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2015/16

**BACKGROUND:** Finalising thesis of PhD student.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** PhD thesis and/or publication(s) related to PhD thesis.

## 15. Budget Justification

The budget for this project has been approved by GISERA's Research Advisory Committee and Management Committee.

## 16. Project Governance

Project management tasks and dissemination activities are specified *Section 14. Project Plan*.

## 17. Communications Plan

General communication will be managed by GISERA.

## 18. Risks

At this stage no major risks particular to this project are foreseen.

Capacity to deliver: Both staff members have sufficient experience to lead and supervise the various technical activities and ascertain the research outcomes. Close collaboration with other GISERA land management projects will provide opportunity for project awareness by other CSIRO researchers who could assume extra responsibilities in the event of unplanned staff departures. The impact of key staff departure is low and could be mitigated.

There are risks inherent with working closely with human research subjects. Though the risks in this project are considered to be low, the project will be managed in accordance with CSIRO Human Research Ethics policies.

The project will develop methods for assessing agricultural productivity and potential changes in agricultural productivity occurring as a consequence of gas development (and potentially other influences). The capacity of these methods to influence perceptions of land value will be closely considered and managed, guided by previous experience in this matter.

## 19. Intellectual Property and Confidentiality

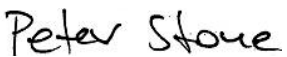

Background IP (clause 10.1, 10.2)	Party	Description of Background IP	Restrictions on use (if any)	Value
				\$
				\$
Ownership of Non-Derivative IP (clause 11.3)	CSIRO			
Confidentiality of Project Results (clause 15.6)	Project results are not confidential.			

## 2 Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority provided by the GISERA National Research Management Committee, in accordance with the [National GISERA Alliance Agreement](#).

The table below details variations to research Project Order.

### Register of changes to Research Project Order

Date	Issue	Action	Authorisation
19/04/13	Research project start date delayed; milestone dates require rescheduling	All milestone dates rescheduled to reflect later project start date; timing of milestones relative to start date not altered.	
07/04/16	Submission date of thesis is February 2017.	Milestone 13 will be pushed back to February 2017 to coincide with PhD student's thesis submission date.	

### 3 Progress against project milestones

Progress against milestones are approved by the GISERA Director, acting with authority provided by the GISERA National Research Management Committee, in accordance with the [National 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 approved for one amber light.
  - 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 and undertaken by GISERA Research Advisory Committee.

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

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
Task 1	Initial Team Meeting (including GISERA collaborators), Initial concepts and engagement with University, literature research	Oswald Marinoni	1.10.2012	30.12.2012	
Task 2	Identify required models, data collection, advertise PhD position	Oswald Marinoni	01.01.2013	31.03.2013	Task 1
Task 3	Identify required models, data collection, PhD student commence (late task 2/early task 3)	Oswald Marinoni	01.04.2013	30.06.2013	Task 2
Task 4	Data collection, begin of model assembly	Oswald Marinoni	30.06.2013	30.09.2013	Task 3
Task 5	Annual Team Meeting including key staff from GISERA	Oswald Marinoni	01.10.2013	31.12.2013	Task 4
Task 6	Data collection, model assembly	Oswald Marinoni	01.01.2014	31.03.2014	Task 5
Task 7	Scenario Evaluation	Oswald Marinoni	01.04.2014	30.06.2014	Task 6
Task 8	Scenario Evaluation	Oswald Marinoni	30.06.2014	30.09.2014	Task 7
Task 9	Annual Team Meeting	Oswald Marinoni	01.10.2014	31.12.2014	Task 8
Task 10	Compilation of Results	Oswald Marinoni	01.01.2015	31.03.2015	Task 9
Task 11	Development of manuscript(s)	Oswald Marinoni	01.04.2014	30.06.2015	Task 10
Task 12	Draft Manuscripts(s), submission to scientific journal(s)	Oswald Marinoni	30.06.2015	30.09.2015	Task 11
Task 13	Thesis Production	Oswald Marinoni	01.10.2015	28.02.2017	

## Project Schedule Report

### Task 1.

**TASK NAME:** Initial team meeting and literature review

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

#### TASK OBJECTIVES:

- Establish a project team.
- Establish contact with GISERA collaborators.
- Gather background information for methodology.
- Start literature research.
- Refine work plan according to APLNG-CSIRO discussions.

**SPECIFIC DELIVERABLE:** Short report providing information about initial team meeting, established relationships, list of initial findings of methodologies found in previous studies and the scientific literature. List of people to establish contact with and to get data from. Establishment of a protocol to approach institutions external to CSIRO. Initial list of datasets needed (e.g. DEM, soil types, land use, vegetation, weeds, climate data, land prices, cadastral data (property outlines), predominant crop rotations, well density for CSG production, depth of wells (or depth of geologic horizons from which gas is supposed to be extracted), estimated production rate of wells, time wells are supposed to be operational and more). Identification or clear outline of target region within which research is supposed to be conducted.

#### PROGRESS REPORT:

GISERA kick-off meeting held at the Qld Bioscience Precinct on 25 and 26 July 2012. The workshop provided an opportunity to meet other scientists working on GISERA projects to find out what they are working on and how GISERA can integrate research on the various environmental and social impacts on coal seam gas.

Mainly due to staff commitments overseas and some delays related to the administrative setup of the project, a team meeting that involved all team members was not held in quarter 1; however staff members managed to keep ongoing communication via phone and email. Project team kick-off meeting was held in late November 2012 in Toowoomba.

Tasks performed:

1. A literature research was started that focussed on:
  - reported findings related to projects that impact the landscape on a larger scale
  - existing analyses methods that may be helpful for an evaluation of a re-configuration of landscapes for example in regards to agricultural returns (\$) or benefits resulting from ecosystem services.
2. Data collection.

## Task 2.

**TASK NAME:** Identify required models, begin of data collection

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

**BACKGROUND:** Start identifying existing and relevant models to be used to quantify benefits and impacts of land use change related to CSG production.

**TASK OBJECTIVE:** Based upon the continuing literature research and discussions with stakeholders a holistic process understanding needs to be developed. This includes an understanding of common agricultural land use management practises and CSG production. This will determine the choice of models to be used, and how individual models can be consistently linked to determine a benefit or impact of CSG production. It may be necessary to modify existing models or to (partially) develop new models. The holistic process understanding will be supported through close collaboration with other project areas, e.g. with the “A shared space” project.

**TASK OUTPUTS:** A first list of processes considered relevant plus a list of models to be used/modified/developed.

**SPECIFIC DELIVERABLE:** See task output plus a progressed list of datasets to be collected. Based upon the knowledge of existing models and the process understanding acquired at this stage, it will be possible to be more specific in regards to the research and the skills that are required to fill a PhD position. It is envisaged to develop a position description and advertise a PhD position during this stage with the position being filled at the end of this or at the early next stage.

### PROGRESS REPORT:

- Data collection continued.
- Literature research continued.
- PhD position advertised.
- Start of the production of first datasets. E.g. based upon existing work (map of agricultural profit for the year 2005/06) profit maps for selected years before 2005 are being developed/compiled.

## Task 3.

**TASK NAME:** Identify required models, data collection

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

**BACKGROUND:** Continuation of the previous task. Start of data collection.

**TASK OBJECTIVE:** Continuation of task 2. Working towards a complete collection of models and data to quantify impacts and benefits related to CSG production.

**SPECIFIC DELIVERABLE:** PhD student commencing work and getting involved in research activities. Outline of the PhD thesis and its envisaged objectives.

## PROGRESS REPORT:

- Data collection continued.
- Literature research continued.
- PhD student appointed. Student is enrolled to commence on July 15 at the University of Southern Queensland.

## Task 4.

**TASK NAME:** Data collection, begin model assembly

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2012/13

**BACKGROUND:** Development of a process framework to logically put individual model components together in close collaboration with other projects of the land research program such as Gas farm design and Making tracks. Continuation of data collection.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Draft of a process framework capturing the linkages between individual model components and the capacity to up-scale model results.

## PROGRESS REPORT:

- Data collection continued.
- Literature research continued.
- Land use statistics and statistics of agricultural returns and profits within the target tenement areas produced.

## Task 5.

**TASK NAME:** Annual team meeting including key staff from GISERA

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Team meeting (includes PhD student) to discuss research objectives for the coming year.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Outline of the research objectives and tasks for the year to come.

## PROGRESS REPORT:

In general, the task 5 timeframe involved issues of data collection and communication of current research findings, as well as of planned research objectives.

A two day workshop was held at the Ecosciences Precinct (ESP), Dutton Park which involved scientific staff, as well as staff from industry. Current findings of this project in terms of the economic footprint of agriculture in the APLNG development areas in the northern Surat basin were presented. The presentation also provided an outline as to where future research will be going and what data would be needed to spatially determine the CSG footprint on agricultural production and revenues.

The workshop led to a few follow up meetings:

- Follow-up meeting with research team at ESP to discuss workshop findings and strategies to proceed.
- Follow-up meeting with key Origin staff at Origin's offices, Coronation Drive, Brisbane.
  - Discussion of data requirements CSIRO staff has, development of a to do list, so that industry data can be forwarded to CSIRO staff by Origin staff.
- Meeting with PhD student to discuss research objectives and (common) data requirements.

## Task 6.

**TASK NAME: Data collection, model assembly**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Finalising data collection, model framework and conceptualisation of scenarios that are to be developed. Scenarios are to be developed in consultation with stakeholders from GISERA. (See task 7 also).

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Brief report on the design of the model framework. Definition of a baseline scenario. List of scenarios that are going to be evaluated.

### PROGRESS REPORT:

Task 6 mainly involved the management of the collection of data.

GIS data that comprise spatial features of CSG infrastructure for a small subregion within one APLNG CSG development area (Condabri) were provided by APLNG. However, there were identified some missing spatial data (e.g. access roads to wells) which will need to be obtained to provide a more accurate and comprehensive spatial footprint of CSG activity on agricultural production and revenues. Our industry partners were asked to provide these missing data. Our partners were also asked for some attribute information of the data already obtained. Therefore the data collection for this sub-region in the Condabri development area is estimated to be 80% complete. The amount and the spatial extent of the provided industry data will determine the spatial extent but also the comprehensiveness of the subsequent analysis.

Furthermore, a technical workflow has been conceptualised. Once the aforementioned delivery of spatial datasets is considered finalised, the workflow will be implemented and tested in the region for which spatial data are available for.

## Task 7.

**TASK NAME: Scenario definition**

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Definition of a baseline land use scenario and subsequent definition of comparative scenarios. Comparative land use scenarios could include, for example, a shift of production wells to locations where agricultural productivity is knowingly lower than envisaged production sites. Changes in the impact and the benefits will be quantified. The scenarios selected for further development will depend upon the availability of data; which is not entirely known at

this stage. List of scenarios to be developed will be decided in consultation with GISERA staff (see task 6).

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Finalised list of scenarios.

### PROGRESS REPORT:

The remaining CSG infrastructure data have been obtained from APLNG for the central part of the Condabri development area which will be the area any subsequent modelling will be focused on. The infrastructure data layers can be considered complete. GIS work with the spatial layers has started.

Data will be integrated into the process that was developed during the last stage of the project (milestone 6).

The definition of explicit scenarios has not started yet as priority is still given to making the aforementioned process operational. Once this is done, a scenario could include the magnitude of the impact of changes to a variety of parameters (e.g. economic impacts of CSG assuming a high agricultural revenue scenario vs a low agricultural revenue scenario etc.).

Data will be integrated into the process that was developed during the last stage of the project (milestone 6). As soon as the GIS layers of the access tracks will have been obtained they will be included in the analysis.

The definition of explicit scenarios has not started yet as priority is still given to making the aforementioned process operational. Once this is done, a scenario could include the magnitude of the impact of changes to a variety of parameters (e.g. economic impacts of CSG assuming a high agricultural revenue scenario vs a low agricultural revenue scenario etc.).

## Task 8.

**TASK NAME:** Scenario evaluation

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2013/14

**BACKGROUND:** Continuation of task 7. Evaluation of baseline scenario and subsequently comparative scenarios.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Brief progress report.

### PROGRESS REPORT:

The process to estimate economic impacts of CSG infrastructure on agriculture has started to be developed as a sequential GIS – database – model code workflow. Once the process is complete the following tasks can be accomplished:

- Aggregation of economic losses to agriculture across specific spatial entities, e.g. potential losses can be provided for strategic cropping land only, for a particular type of soil, for a specific land use etc.
- Provision of statistical figures of average spatial and economic impacts per well. E.g. the study area in the Condabri development area has about 150 CSG wells. Average figures will

be provided based on that statistical sample. These figures provide useful information to project economic impacts of CSG on agriculture in areas yet to be developed.

- Being aware of the great amount of uncertainty in all parameters involved, a re-iteration of the model using varied parameters will be possible. These parameters can include, for example, the operational times for wells which are currently assumed to be 20 years. It is known however that these operational times can vary from well to well.

The conceptual evaluation framework will be presented at the GISERA workshop at the EcoSciences Precinct at Dutton Park on October 21 and 22.

## Task 9.

**TASK NAME:** Annual team meeting

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Team meeting (includes PhD student) to discuss research findings and objectives for the coming year which is going to be targeted towards output.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Preliminary report including preliminary findings, maps and charts etc. List of envisaged publications with targeted journals.

## PROGRESS REPORT:

The concept of the evaluation framework and the way it is operationalised was presented at the GISERA workshop (Ecosciences Precinct at Dutton Park on October 21-22 2014) to an audience of researchers, community representatives, representatives from industry as well as to GISERA's Research Advisory Committee. The presentation also included preliminary findings of a schematic evaluation of the impact of CSG on agri-economic returns in the Central Condabri development area. It was highlighted though that these findings represent a "first pass" which is based upon variety of parameter assumptions. The finetuning of these parameters will be the subject of the research of the months to come. This will include a re-evaluation of the collected information using updated parameter settings and monitoring the impact on the order of magnitude of results. The developed impact assessment methodology and the way it is operationalised is a "first of its kind" approach. As such the project team is confident that publication in a highly reputable journal will be possible. It is thinkable to split methodology and findings and potential implications thereof across several publications though. While specific target journals cannot be nominated at this point in time target science areas these journals would be attributed to can include: geographic information science, environmental modelling, agriculture, energy or mining. The findings of this project would also need to be put in context with findings from other GISERA research projects so that further multi-authored publications, for example in more policy orientated journals would be possible.

## Task 10.

**TASK NAME:** Compilation of results

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Compilation of results, maps, charts etc. for the purpose of communicating project results to local communities as well as to the scientific community.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** List of maps, charts and tables that capture the main findings. Summary of the principles used in approaching the study.

### PROGRESS REPORT:

Digital maps and features are identical to those that were created late last year (results shown at the GISERA workshop were based upon these maps). Draft manuscript (see task 11) that describes the evaluation method has been started. The potential range of model input parameters, such as soil recovery rates, soil impact potential, impact frequency of CSG elements were discussed within project team and are being used in the currently conducted scenario analyses.

Also required were changes to the code to fix errors and to increase performance.

The scenarios that capture the impact of changes to important parameters (soil recover rates (years), impact potential, discount rates, impact frequency of distinct infrastructure elements etc.) are currently being run and will be, using a set of defined scenarios) finished in April 2015.

Result tables are being produced in a database but are, to provide better access to non-database users, stored in an Excel spreadsheet. These tables will be used to produce charts and any statistical figure that might be required.

## Task 11.

**TASK NAME:** Development of manuscripts

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Communication of findings to the scientific community.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Draft manuscript(s) prepared for journal(s) and/or conference proceedings.

### PROGRESS REPORT:

A manuscript was developed to be submitted to and presented at the MODSIM 2015 (the MODSIM is the bi-annual conference of the Modelling and Simulation Society of Australia and New Zealand). This manuscript has been completed and been through the mandatory CSIRO internal ePublish review. It has been forwarded to the GISERA Director for approval prior to submission to MODSIM. A second manuscript to be submitted to a scientific journal is under development also. The target journal is yet to be determined.



## Task 12.

**TASK NAME:** Publication of results

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2014/15

**BACKGROUND:** Communication of findings to the scientific community.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** Draft manuscript(s) prepared for journal(s) and/or conference proceedings.

### PROGRESS REPORT:

The MODSIM manuscript titled 'A new evaluation system to estimate the impact of Coal Seam Gas activity on economic returns of agriculture' has been accepted for publication <http://www.mssanz.org.au/modsim2015/B4/marinoni.pdf> and presented at the conference of the Australian and New Zealand Modelling Society's biannual conference MODSIM.

A journal paper has been submitted to Land Use Policy Journal titled 'A novel model to estimate the impact of Coal Seam Gas extraction on agro-economic returns'. This paper is currently under review.

## Task 13.

**TASK NAME:** Thesis production

**TASK LEADER:** Oswald Marinoni

**OVERALL TIMEFRAME:** 2015/16

**BACKGROUND:** Finalising thesis of PhD student.

**TASK OUTPUTS & SPECIFIC DELIVERABLES:** PhD thesis and/or publication(s) related to PhD thesis.

### PROGRESS REPORT:

Thesis submitted on 02. March 2017. Thesis title: "Evaluating the effects of Coal Seam Gas development on farms in the Surat Basin, Queensland".

The manuscript submitted to the journal "Land Use Policy" (Task 12) has been published. It is available on the Gisera website ([https://gisera.org.au/wp-content/uploads/2017/02/Marinoni\\_2016\\_LUP\\_351-365\\_CSG\\_ImpactSystem.pdf](https://gisera.org.au/wp-content/uploads/2017/02/Marinoni_2016_LUP_351-365_CSG_ImpactSystem.pdf)).