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
Total Costs	**148,771**	**190,498**	**193,487**	**15,000**		**547,756**
CSIRO	148,771	190,498	193,487	15,000		547,756
Total Expenditure	**148,771**	**190,498**	**193,487**	**15,000**		**547,756**

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

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

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

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

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

Task	Mile-stone 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	1st	26,000
Task 2	2.1	Identify required models, data collection, advertise PhD position	GISERA	CSIRO	Oct-12	Dec-12	12/13	2nd	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	3rd	26,000
Task 4	4.1	Data collection, begin of model assembly	GISERA	CSIRO	Apr-13	Jun-13	12/13	4th	26,000
Task 5	5.1	Annual Team Meeting including key staff from GISERA	GISERA	CSIRO	Jul-13	Sep-13	13/14	1st	33,400
Task 6	6.1	Data collection, model assembly	GISERA	CSIRO	Oct-13	Dec-13	13/14	2nd	33,400
Task 7	7.1	Scenario Evaluation	GISERA	CSIRO	Jan-14	Mar-14	13/14	3rd	33,400
Task 8	8.1	Scenario Evaluation	GISERA	CSIRO	Apr-14	Jun-14	13/14	4th	33,400
Task 9	9.1	Annual Team Meeting	GISERA	CSIRO	Jul-14	Sep-14	14/15	1st	34,125
Task 10	10.1	Compilation of Results	GISERA	CSIRO	Oct-14	Dec-14	14/15	2nd	34,125
Task 11	11.1	Development of manuscript(s)	GISERA	CSIRO	Jan-15	Mar-15	14/15	3rd	34,125
Task 12	12.1	Draft Manuscripts(s), submission to scientific journal(s)	GISERA	CSIRO	Apr-15	Jun-15	14/15	4th	34,125
Task 13	13.1	Thesis Production	GISERA	CSIRO	Jul-15	Dec-15	15/16	2nd	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
Task 1	Initial Team Meeting (including GISERA collaborators), Initial concepts and engagement with University, literature research	Oswald Marinoni	1.7.2012	30.9.2012	
Task 2	Identify required models, data collection, advertise PhD position	Oswald Marinoni	1.10.2012	31.12.2012	Task 1
Task 3	Identify required models, data collection, PhD student commence (late task 2/early task 3)	Oswald Marinoni	01.01.2013	31.3.2013	Task 2
Task 4	Data collection, begin of model assembly	Oswald Marinoni	31.3.2013	31.6.2013	Task 3
Task 5	Annual Team Meeting including key staff from GISERA	Oswald Marinoni	1.7.2013	30.9.2013	Task 4
Task 6	Data collection, model assembly	Oswald Marinoni	1.10.2013	31.12.2013	Task 5
Task 7	Scenario Evaluation	Oswald Marinoni	01.01.2014	31.3.2014	Task 6
Task 8	Scenario Evaluation	Oswald Marinoni	31.3.2014	31.6.2014	Task 7
Task 9	Annual Team Meeting	Oswald Marinoni	1.7.2014	30.9.2014	Task 8
Task	Compilation of Results	Oswald Marinoni	1.10.2014	31.12.2014	Task 9

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Task 11	Development of manuscript(s)	Oswald Marinoni	01.01.2015	31.3.2015	Task 10
Task 12	Draft Manuscripts(s), submission to scientific journal(s)	Oswald Marinoni	31.3.2015	31.6.2015	Task 11
Task 13	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.			