Project Order, Variations and Research Progress

Project Title: Monitoring of geochemical and isotopic characteristics of CSG formation waters, adjacent aquifers and springs

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

1 Original Project Order

Research project plan

Proforma 2011

1. Short Project Title (less than 15 words)

Project 4: Geochemical baseline monitoring

Long Project Title	Monitoring of geochemical and isotopic characteristics of CSG formation waters, adjacent aquifers and springs
GISERA Project Number	W4 1114
Proposed Start Date	July 2011
Proposed End Date	June 2014
Project Leader	Fred Leaney

2. GISERA Research Program

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

3. Research Leader, Title and Organisation

(Include time commitment to project by the Research Leader)

Fred LeaneyResearch Scientist
CSIRO Land and Water

4. Summary (less than 300 words)

This project is aimed at: (i) a comprehensive geochemical and isotopic characterisation of groundwater and formation water within the proposed CSG extraction area prior to development; (ii) developing protocols for monitoring aquifers and formation water over the time period of extraction and post-development and; (iii) establishing a set of criteria for ongoing assessment of the monitoring program and implications for aquifer interactions.

A practical aim of the project is to provide a means of monitoring the progress and impact of large scale pumping and to inform potential modification of the pumping process to minimise potential impacts on spring-fed or baseflow ecosystems.

5. Budget Summary (From Excel Budget Pack worksheet "Project Plan Summary")

Expenditure	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	Total
Labour	106,399	208,837	124,414		439,650
Operating	48,403	101,000	78,000		227,403
Total Costs	**154,802**	**309,837**	**202,414**		**667,053**
CSIRO	154,802	309,837	202,414		667,053
Total Expenditure	**154,802**	**309,837**	**202,414**		**667,053**

Expenditure per Task	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	Total
Task 1	112,058	113,101	90,525		315,684
Task 2	42,744	122,412			165,156
Task 3		74,324	111,889		186,213
Total Expenditure	**154,802**	**309,837**	**202,414**	-	**667,053**

Cash Funds to Project Partners	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	Total
CSIRO	123,841	247,870	161,931	-	533,642
Sub Total	123,841	247,870	161,931	-	533,642
Total Cash to Partners	**123,841**	**247,870**	**161,931**	-	**533,642**

Source of Cash Contributions	2011/12 Year 2	2012/13 Year 3	2013/14 Year 4	2014/15 Year 5	Total
Australia Pacific LNG	123,841	247,870	161,931	-	533,642
Total Cash Contributions	**123,841**	**247,870**	**161,931**	-	**533,642**

In-Kind Contribution from Partners	2011/12 Year 1	2012/13 Year 2	2013/14 Year 3	2014/15 Year 4	Total
CSIRO	30,961	61,967	40,483		133,411

Total In-Kind Contribution from Partners	**30,961**	**61,967**	**40,446**		**133,411**

	Total funding over all years	Percentage of Total Budget
Australia Pacific LNG Investment	533,642	80%
CSIRO Investment	133,411	20%
Total Other Investment		
TOTAL	**667,053**	**100%**

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	Sampling protocols and conceptual model completed	GISERA	CSIRO	Sept-11	Jun-12	2011/12	Q 4	154,802
Task 2	2.1	Report on isotopic and geochemical distributions including maps and depth profile	GISERA	CSIRO	Jul-12	Jun-13	2012/13	Q 4	309,837
Task 3	3.1	Final report incorporating all geochemical data and integration with hydraulics and inferred impacts on groundwater flow systems and spring discharge	GISERA	CSIRO	Jul-13	Jun-14	2013/14	Q 4	202,414

6. Other Researchers (include organisations)

Researcher	Time Commitment	Principle area of expertise	Years of experience	Organisation
Fred Leaney	0.37 FTE over 3 years	Project leader, isotope hydrology sampling and analysis	30+	CSIRO
Leif Wolf	0.15 FTE over 3 years	GISERA integration, project management & capacity building	15+	CSIRO
Axel Suckow	0.75 FTE over 3 years	Groundwater modelling incorporating isotope hydrological data	25+	CSIRO
Phil Davies	0.15 FTE over 3 years	GIS support	15+	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 framework for the CSG-LNG industry.

8. Program Outcomes Achieved

The outcomes of this project will provide a baseline of the isotope/hydrochemistry of the groundwater and thereby provide a means of monitoring the impact of large scale pumping. If necessary, this can inform potential modification of the pumping process to minimise possible impacts on spring-fed or baseflow ecosystems. This will help inform government regulators and policy makers on the potential for detrimental environmental outcomes as a result of development of CSG in the region.

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 main knowledge gap that this project will address is an improved understanding of the current groundwater flow systems and potential for inter-aquifer leakage**.**

11. How will these Research outputs and outcomes be used in State Government and other water managers to achieve Adaptive Management of Water Resources?

The research outputs and outcomes will help to inform government, regulators and policy-makers on key issues regarding policy and legislative framework for the CSG-LNG industry,

particularly in the area of water quality in aquifers as a result of pumping large quantities of water from coal seams. The project will improve understanding of the current groundwater flow systems and potential for inter-aquifer leakage.

12. Project Development (1 page max.)

The project was developed after consultation with key Australia Pacific LNG staff that identified the need for a better understanding of current groundwater residence time and inter-aquifer leakage. This would enable early identification of changes to the hydrological system as a result of pumping large volumes of groundwater.

This project will utilise the groundwater dating and "fingerprinting" tools available in the field of isotope hydrology to support or refute the current conceptual model and constrain estimates of groundwater flow and potential for inter-aquifer leakage.

13. Project Objectives and Outputs

Year 1: A set of sampling protocols for baseline monitoring of geochemical and isotopic parameters in groundwater and surface water systems. Qualitative conceptual model of groundwater flow systems inferred from geochemistry and hydraulics.

Year 2: Initial maps and depth distribution of geochemical and isotopic characteristics. Report on interpretation of geochemical and isotopic data in the hydrogeological framework.

Year 3: Final report including: assessment of changes in geochemistry of key aquifer systems, criteria for assessment of changes to groundwater flow dynamics and assessment of changes to discharge to surface water systems.

14. Project Plan

14.1 Project Schedule

ID	Task Title	Task Leader	Scheduled Start	Scheduled Finish	Predecessor
1	Sampling protocols and conceptual model completed	Fred Leaney	Sept 2011	End June 2012	
2	Report on isotopic and geochemical distributions including maps and depth profile	Axel Suckow	July2012	June 2013	
3	Final report incorporating all geochemical data and integration with hydraulics and inferred impacts on groundwater flow systems and spring discharge	Axel Suckow	July 2013	June 2014	

14.2 TASK NAME:)

See table above.

14.3 TASK LEADER:

See table above

14.4 OVERALL TIMEFRAME:

See table above

14.5 BACKGROUND:

The pumping of formation water to facilitate CSG extraction from the Great Artesian Basin (GAB) will likely lead to entrainment and mixing of water from adjacent aquifers. The decrease in pressure from production wells may also affect discharge of deep groundwater to surface water systems and springs. Understanding the source and flux of water involved in these processes can be traced using distinct signatures of various end-member compositions to distinguish pathways and interactions that cannot be done through conventional hydrological monitoring.

Most effectively monitoring the evolution of these processes requires some a priori baseline sampling so that end-member compositions can be well characterised and to develop the most suitable suite of environmental tracers that can meet the criteria for ongoing monitoring. The ideal tracers are those that are conservative and do not react significantly with the aquifer solid matrix (e.g., 2H/1H, 18O/16O, Cl-, Br-, noble gases – Herczeg and Edmunds, 2000; Coplen et al, 2000; Stute, et al., 2000). There are other tracers that have well defined geochemical characteristics that can be used to distinguish the CSG formation water and production water (e.g., major and minor ions, 13C of DIC, 34S of SO4, 87Sr/86Sr, 37Cl/35Cl, and 226Ra). Furthermore, the use of age tracers such as 14C, 36Cl, 4He would also be an important component in establishing groundwater residence time and changes in the relative contribution of short and long flow-paths at various sites.

The age distribution of various aquifers and formation waters will likely evolve in response to pumping and depressurisation within and adjacent to CSG target sites. Careful monitoring at discrete depth intervals and appropriate spatial scale will allow assessment of altered groundwater flow systems, and the extent of entrainment of "old' formation water into the main aquifer systems.

14.6 TASK OBJECTIVE:

Task 1: Develop and demonstrate protocols to APLNG staff for sampling of formation water during drilling, and sampling groundwater and surface water.

Meet with APLNG to discuss current conceptual model and decide on which environmental tracers to measure (i.e. those likely to be commensurate with groundwater ages and likely to give differentiation between different aquifers)

Task 2: Undertake analyses and present data in a report with maps and depth profiles where applicable. Interpret initial data set and use a combination of spatial patterns, geochemical, and isotopic and geochemical model such as PHREEQC2 to evaluate data in forward and inverse modelling framework.

Task 3: Incorporate all geochemical data and integration with hydraulics and inferred impacts on groundwater flow systems and spring discharge

14.7 TASK OUTPUTS:

Task 1: Protocols demonstrated to Australia Pacific LNG staff to enable them to carry out sampling without CSIRO supervision. Conceptual model of groundwater flow to be shared and types of analyses to be undertaken decided.

Task 2: Analyses completed and data presented in a report with maps and depth profiles where applicable.

Task 3: Report incorporating all geochemical data and integration with hydraulics and inferred impacts on groundwater flow systems and spring discharge.

14.9 SPECIFIC DELIVERABLES

Two reports as per section 14.7.

15. Budget Justification

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

- Provision of background data for discussions re potential bores available for sampling groundwater samples from the different aquifers and (where possible) aquicludes.
- Collection and submission of samples for analysis.
- Detailing current conceptual model(s) for groundwater flow and inter-aquifer leakage (results from isotope hydrology studies to confirm/refute).
- Feedback on revised conceptual model(s) for groundwater flow/interaquifer leakage.

16. Project Governance

A project reference panel will be established. Twice a year, project meetings with Australia Pacific LNG and CSIRO staff will be held. Once a year, the project reference panel will be consulted. Modifications of the work plan may be discussed at these meetings.

Progress against milestones and tasks will be assessed twice a year within project meetings and reported in the minutes of these meetings. Beyond that, standard procedures defined in the overall GISERA management framework will be applied.

Users of the research output will be involved via the project reference panel.

17. Communications Plan

General communication will be managed by GISERA.

The pathway to impact for this project includes:

- This project will utilise isotope hydrology and "fingerprinting tools" to determine the age of groundwater for a large number of samples taken from the GAB. This is critical to understanding groundwater flow mechanisms in a system where water level

measurements are only available for a few decades at best, but groundwater residence times are up to one million years.
- This project will establish a critical baseline dataset before large scale groundwater pumping occurs as part of CSG development.
- This project will produce primary data to assess the potential for inter-aquifer leakage.
- This project will help inform government regulators and policy makers on the potential for detrimental environmental outcomes as a result of CSG development in the region.
- Direct technical cooperation with the industry experts in the planning of sampling locations, the collection of samples and the analysis of the results ensures effective knowledge transfer.
- Other industry experts (Santos, Arrow, QGC) are in the process of conducting similar sampling campaigns and have indicated their interest in participating in this work in the near future. They process samples at the CSIRO Adelaide laboratories, which are unique in Australia in terms of the capabilities in isotope hydrology. A scientific interpretation framework developed as part of the current project will be of high value to other industry partners. Avenues for collaboration will continue to be pursued. By this means, the work is poised to extend its impact to the CSG-LNG industry as a whole, across a broader commercial and geographic base.
- For broader public benefit, stakeholder workshops with government agencies, interested communities and GISERA representatives will be organised.
- The results will be disseminated at national and international conferences as well as a number of peer reviewed journal papers.
- PhD students will be integrated into the work program to allow for direct capacity building. The research group in Adelaide is heavily involved in teaching for the National Centre for Groundwater Research and Training (NCGRT) at Flinders University.

18. Risks

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

19. Intellectual Property and Confidentiality

Background IP (clause 10.1, 10.2)	**Party**	**Description of Background IP**	**Restrictions on use (if any)**	**Value**
	CSIRO	CSIRO has IP insofar as accumulated experience and technical knowledge of undertaking such studies at a regional scale. These studies are published in the public domain.		$
				$
Ownership of Non-Derivative IP (clause 11.3)	CSIRO			
Confidentiality of	Not confidential			

Project Results (clause 15.6)		
Additional Commercialisation requirements (clause 12.1)	Not Applicable	
Distribution of Commercialisation Income (clause 1.1)	Not applicable	
Commercialisation Interest (clause 1.1)	**Party**	**Commercialisation Interest**
	Australia Pacific LNG	
	CSIRO	

GISERA Gas Industry Social & Environmental Research Alliance

20. Approval from Project Parties

In signing this Document you are committing your organisation to provide the specified funds, personnel and the required in-kind contributions.

Australia Pacific LNG

SIGNED for and on behalf of Australia Pacific LNG, exercising authority delegated by the GISERA Management Committee

by K.G. HORTON

in the presence of

PROJECT 4: GEOCHEMICAL BASELINE MONITORING

.....
Signature of witness

SYLVIA RAINERI
Name of witness

28 JUNE 2012
Date

CSIRO

SIGNED for and on behalf of CSIRO, exercising authority delegated by the GISERA Management Committee

by

in the presence of

.....
Signature of witness

DR BILL YOUNG
FLAGSHIP DIRECTOR

SALLY WILSON
Name of witness

29/6/12
Date

2 Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority provided by the GISERA Management Committee or Research Advisory Committee, in accordance with the GISERA Agreement (http://www.gisera.org.au/contract.html).

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	Milestone dates for tasks 2 and 3 rescheduled to reflect later project start date; timing of milestones relative to start date not altered.	Peter Stone
25/06/15	Due to delays in preparing the final report, milestone 3 will be pushed by to 31 July 2015.	Milestone 3 will be pushed back to 31 July 2015	

3 Progress against project milestones

Progress against milestones are approved by the GISERA Director, acting with authority provided by the GISERA Management Committee or Research Advisory Committee, in accordance with the GISERA Agreement (http://www.gisera.org.au/contract.html).

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
Task 1	Sampling protocols and conceptual model completed	Fred Leaney	Jul-12	Apr-13
Task 2	Report on isotopic and geochemical distributions including maps and depth profile (including transect sampling)	Axel Suckow	Apr-13	Dec-13
Task 3	Final report incorporating all geochemical data and integration with hydraulics and inferred impacts on groundwater flow systems and spring discharge (including profiles using measurements of He in quartz grains to estimate interaquifer leakage).	Axel Suckow	May-14	Jul-15

Project Schedule Report

Task 1.

TASK NAME: Sampling protocols and conceptual model completed.

TASK LEADER: Fred Leaney

OVERALL TIMEFRAME: 2012/13

TASK OBJECTIVE: Enable project partners to obtain uncontaminated samples for isotope analysis

PROGRESS REPORT:

In anticipation of the field sampling, demonstration of protocols for sampling groundwater for a range of isotope analyses was undertaken at the first meeting with APLNG in March 2011. This allowed for opportunistic samples being obtained, collected by APLNG (e.g. during installation of new wells in the Condabri region in October 2012 to February 2013).

Task 2.

Originally, analytical data from Geoscience Australia was to be freely available by mid 2012, but delays to their analyses and involvement/synergies with the GABWRA project delayed this until the GABWRA launch due in late March 2013. Permission was given to GISERA to view the data and start mapping in February 2013. However, the GA dataset was not yet officially available in January 2014. Once the GA data were internally available, maps of combined GA and GABWRA isotope data for a range of isotopes (^{14}C, ^{2}H, ^{18}O, ^{36}Cl) for the different aquifers in the Surat were prepared in preparation for Task 2b. A combination of the available data (Chemistry, ^{14}C, ^{2}H, ^{18}O, ^{36}Cl, SF_6, CFC11, CFC12, Noble gases) GA, GABWRA and GISERA will be used for Task 3.

Task 2A.

TASK NAME: Source of Spring water.

TASK LEADER: Fred Leaney

OVERALL TIMEFRAME: 2012/13

TASK OBJECTIVES: Assess springs for their possibility to obtain uncontaminated samples for gas tracers

PROGRESS REPORT:

With assistance from Steve Flook (QWC, now OGIA), a sampling trip was undertaken in November 2012 to sample a range of Springs in the Surat that were considered of environmental importance. The Springs sampled included several that had been sampled before for ^{14}C, ^{2}H and ^{18}O, plus a range of new Springs and, where possible, bores close to the Springs. In this field program, samples were collected for a more complete suite of analyses (^{14}C, ^{2}H, ^{18}O, ^{36}Cl, SF_6, CFC11, CFC12, Noble gases and ^{222}Rn), A total of 19 sites were sampled (10 bores, 7 springs/seeps and 2 streams. Unfortunately, the springs that were sampled were flowing even slower than the previous time sampled and hence, as before, there was an even larger potential for contact of the water sample with air prior to sampling.

Questions still remain on the results of isotopic analyses on these very low flow springs. Sourcing of the water feeding the Springs remains a very important and sensitive issue in areas where CSG

is prevalent. The only way that integrity of the samples for "sourcing" the feedwater to the springs could be ensured would be to obtain samples that have no contact with air. The only way this can be done is to use a "spearpoint" or to install a shallow piezometer for sampling. Permission has been sought to sample at least a few of the springs in this fashion. Only if this permission is granted, samples not influenced by evaporation and undisturbed by contact with atmospheric air can be collected for the most important tracers ($^{18}O/^{2}H$, CFCs/SF_6, noble gases, ^{14}C).

Results of this campaign suggest that there is a young water component (<50 years since recharge) in all bore samples collected on the field trip since all contain measurable quantities of CFC11 and CFC12. There are indications of mixing of at least two distinct "young" and "old" components since also waters containing CFCs and SF_6 have a high helium component, indicative of long residence times in the aquifer system. These apparent "groundwater age" inconsistencies will have implications for the assessment of residence time of groundwater for the different aquifers.

Task 2B.

TASK NAME: Sampling along N-S transect.

TASK LEADER: Axel Suckow

OVERALL TIMEFRAME: 2012/14

TASK OBJECTIVES:

- Sampling along at least one N-S transect in the Hutton Sandstone
- Obtain a depth profile for at least one site (Reedy Creek) through all accessible aquifers

PROGRESS REPORT:

It was necessary to review existing isotope data from the GA dataset before deciding on bores to be sampled. This data was not available for internal use until February 2013 and is still not released officially in January 2014. Maps for ^{14}C, ^{36}Cl and ^{2}H were prepared for the combined GABWRA and GA datasets. It turned out that the available data is not sufficient to create spatially interpolated maps (e.g. by kriging). Preparation for sampling started in April 2013. Sampling sites were decided upon using the map of groundwater surface provided by Origin and following two branches of "Y" shaped north-south transect from the outcrop area of the Hutton Sandstone to the latitude of Roma. The sampling along these transects took place from October-28 until November-8, 2013 and obtained a total of 23 samples. Sampling and aim of the study was documented in a video grabbed and edited by Tsuey Cham (http://www.gisera.org.au/research/water_videoupdates.html). Sampling of the depth profile at Reedy Creek was planned to be performed by Origin for the Gubberamunda, Springbock and Walloon formations, and by CSIRO for the Hutton and Precipice. Due to conflicting priorities on the Reedy Creek site, with several hundred million dollars infrastructure under construction, the sampling by Origin did not happen. Sampling performed by CSIRO of Hutton and Precipice at Reedy Creek was performed as planned but there was also no ad-hoc possibility to obtain samples from overlying aquifers. Samples from the Walloon were obtained by Origin in December 2013, samples from Gubbermunda are still planned by Origin.

During the second week of this sampling campaign, Steve Clohessy from the Office of Groundwater Impact Assessment (OGIA) was trained in isotope sampling and he performed an additional sampling campaign in December, obtaining 8 samples, complementing the CSIRO set of samples such that the interpretation of two independent N-S transects is possible. All samples at

present are in various laboratories (CSIRO, ANU, GNS New Zealand) for specific isotope analysis. Completion of analyses is expected until June 2014.

Task 2C.

TASK NAME: Quartz-Helium pilot study.

TASK LEADER: Axel Suckow, Stan Smith

OVERALL TIMEFRAME: 2012/14

TASK OBJECTIVES:

- Test the possibility to obtain pore water concentrations of helium from Quartz grains
- Compare quartz-derived values with earlier methods (diffusion cells & copper tubes in groundwater, canister core samples in aquitards)

PROGRESS REPORT:

Origin/APLNG has provided 99 core samples and 4 cuttings samples. The core samples come from bores at Reedy Creek (MB3-H, SCI-WB, MB2-S), Condabri (MB9-H), and Talinga (MB3-H, MB5-G, SCI-WB, MB7-S) while the cuttings come from Strathblane (WB1-P). The deeper samples have been prioritized with Reedy Creek MB3-H and Condabri MB9-H being processed first. Selected core samples are spaced approximately 60 m and span the Precipice Sandstone to the Eurombah Formation. Quartz grains have been separated from selected samples by crushing, sieving, magnetic separation, and treated with acid and separated further if necessary. The diffusivity of helium in quartz was determined from a sample from the Precipice Sandstone at Reedy Creek. The quartz was impregnated with pure helium before being heated at 290°C for various time steps. Each step was followed by a quantitative analysis of the helium released. The resulting diffusivity is similar to previous measurements and suggests that 99% equilibrium is expected in just over 1000 years (T=57°C).

Complete quartz grain analyses for the determination of helium in pore water have been performed for 11 samples from Condabri MB9-H and 18 samples from Reedy Creek SC1-Wb. Helium pore water concentrations range between $(0.2\text{-}2.1)10^{-5}$ cc ^{4}He STP/g_{water}. These concentrations exceed atmospheric solubility by a factor of 40 to 400. A total of seven groundwater samples were obtained from Condabri, Reedy Creek and Spring Gully aquifers, of which only three values could be obtained (diffusion cells had been either not closed correctly or were full water). No core samples were obtained during the project because no drilling of cores took place.

Data were interpreted with one-dimensional transport models for ^{4}He in pore water. Additional Monte-Carlo simulations allowed estimating most probable ranges for vertical distance velocities and K values. The obtained values agree with earlier centrifuge and triaxial core tests but narrow the possible range.

Task 3.

TASK NAME: Final Report.

TASK LEADER: Axel Suckow

OVERALL TIMEFRAME: 2014/15

TASK OBJECTIVES:

- Interpretation of new and known isotope data for groundwater system conceptualization
- Interpretation of the quartz pilot results, its reliability and applicability
- Maps of isotope values for the study area, depth profiles of isotope data
- Interpretation in terms of possible inter-aquifer connection and transmissivities

PROGRESS REPORT:

The report was submitted into ePublish for review on 22 September 2015. Comments have been received from the reviewers which are currently being incorporated into the report. It is expected that the report will be finalised by end of November 2015.