Supplementary Consultation Report
Arrow Surat Gas Project

April 2013

jta Australia

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GLOSSARY OF TERMS AND ABBREVIATIONS

TERM	MEANING
AIFLC	Arrow Intensively Farmed Land Committee
ADR	alternative dispute resolution
APPEA	Australian Petroleum Production and Exploration Association
ASCRG	Arrow Surat Community Reference Group
BTEX	benzene, toluene, ethylbenzene, and xylene
C3MR	propane precooled (C3) mixed refrigerant (MR) liquefaction process
CSG	coal seam gas
Coffey	Coffey Environments
DEEDI	(former) Department of Employment, Economic Development and Industry
EHP	Department of Environment and Heritage Protection
DERM	(former) Department of Environment and Resource Management (now EHP)
DTMR	Department of Transport and Main Roads
EIS	environmental impact statement
EMP	Environmental Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act* (Cwlth)
EPC	engineering, procurement and construction
FIFO	fly in/fly out
IFL	intensively farmed land
JTA	JTA Australia
LNG	liquefied natural gas
QWC	(former) Queensland Water Commission
SEWPaC	Federal Department of Sustainability, Environment, Water, Population and Communities
SIMP	social impact management plan
TRC	Toowoomba Regional Council
USQ	University of Southern Queensland
WDRC	Western Downs Regional Council

Executive Summary

This supplementary consultation report describes the consultation activities that have occurred subsequent to the completion of the consultation report for the Surat Gas Project Environmental Impact Statement (EIS) in 2011.

Since the consultation report was prepared for the EIS, Arrow Energy Pty Ltd (Arrow) has continued to consult and engage with the community and relevant stakeholders. This has occurred through stakeholder meetings, drop-in sessions, community information sessions, shed meetings, Area Wide Planning meetings, bi-monthly meetings of the Arrow Surat Community Reference Group (ASCRG) and the Arrow Intensively Farmed Land Committee (AIFLC), and the opening of the Community Information Centre in Dalby.

During the fifth phase of consultation, which began in July 2011 and continued until December 2011, Arrow held three meetings with the ASCRG and three meetings with the AIFLC. The key community-wide activity undertaken during the fifth phase was a week of community information sessions held from Monday 24 October to Friday 28 October 2011. Promotion of the sessions occurred through various means, including invitations via letters and emails, newspaper advertisements, posters placed in strategic locations and information on Arrow's website. The sessions were held in Goondiwindi, Millmerran, Dalby, Cecil Plains and Chinchilla. The issues raised at the sessions related to legislative and regulatory requirements for coal seam gas, water and salt management, wellhead and gasfield issues, drilling and operations, land impacts (particularly to intensively farmed agricultural land), landholder/stakeholder relations, social impacts, amenity and Arrow corporate issues. In total, more than 180 people attended these sessions. A small number of people who attended did not register, so are not included in the attendance figures.

During the sixth phase of consultation, which ran from January 2012 to July 2012, Arrow continued to hold the bi-monthly ASCRG and AIFLC meetings. Each group met three times during this period.

Following the submission of the EIS to the Department of Environment and Heritage Protection (formerly the Department of Environment and Resource Management), the public exhibition period for the Surat Gas Project EIS extended from 16 March to 14 June 2012. The exhibition period was designed to give the public the opportunity to officially comment on the EIS, including the project's potential environmental effects and/or the effectiveness of measures proposed to manage impacts. The EIS was accessible through multiple avenues, including online and hard copies available in libraries. The availability of the EIS was advertised through local newspapers and written notice given to all landholders in the project development area.

The key community-wide activities undertaken during the sixth phase of consultation were a series of drop-in sessions and community information sessions held during the EIS exhibition period. Two rounds of drop-in sessions were held in Chinchilla, Millmerran, Dalby and Toowoomba from 17 to 20 April 2012 and 29 May to 1 June 2012. These sessions were designed to give stakeholders the opportunity to speak one-on-one with representatives from the project team. A series of community information sessions were also held from 30 April to 10 May 2012 in Millmerran, Cecil Plains, Chinchilla, Dalby, Miles, Wandoan and Goondiwindi. These sessions included a presentation, a question and answer segment and the opportunity to speak one-on-one with project staff. The sessions were promoted through

invitations via letters and emails, newspaper advertisements, media releases to print and radio outlets, posters placed in strategic locations and information on Arrow's website. Information materials were displayed at both the drop-in and community information sessions, including free copies of the DVD containing the EIS and a hard copy of the EIS. In total, more than 369 people attended the drop-in and community information sessions. A small number of people who attended did not register, so are not included in the attendance figures. The issues raised related to water and salt management, environmental impacts, EIS-specific issues, wellhead and gasfield issues, land impacts (particularly to intensively farmed agricultural land), landholder/stakeholder relations, drilling and operations, social impacts, amenity, legislative and regulatory requirements for the coal seam gas industry and the EIS, and Arrow corporate issues.

Subsequent to the consultation for the public display of the EIS, Arrow has continued to engage with stakeholders about the Surat Gas Project. During the period of August 2012 to December 2012, one-on-one meetings were held with key government stakeholders and the ASCRG and the AIFLC both met twice during this period. Arrow also held shed meetings with local stakeholders in August 2012 at which coexistence issues (coal seam gas development and intensive farming operations) were discussed. September 2012 saw Arrow open its Community Information Centre in Dalby to provide a space where the community can access Arrow staff and information about the company's operations and long term plans. In December 2012, Arrow held Area Wide Planning meetings with groups of landholders in the Surat Gas Project area to address overland flow, an issue that had been raised in previous AIFLC meetings.

Upcoming consultation planned between January and June 2013 includes continued bi-monthly ASCRG and AIFLC meetings, one-on-one meetings with landholders and further Area Wide Planning meetings and consultation on the scope of the upstream development.

1.0 Introduction

Arrow proposes to develop a combined coal seam gas to liquefied natural gas project, including two upstream fields in the Bowen and Surat basins as well as an LNG facility on Curtis Island off the Central Queensland coast near Gladstone. The consultation upon which this report is based was undertaken in the Surat Basin, as part of the Surat Gas Project, a component of the larger Arrow LNG Project.

Community consultation and stakeholder engagement have been integral to the EIS process undertaken to assess the impacts of the Surat Gas Project. A Consultation Report was prepared as part of the EIS and provided detailed information on the consultation and engagement activities undertaken during the first four phases of the consultation process established for the project.

This supplementary consultation report describes the consultation activities and outcomes that have occurred subsequent to the completion of the consultation report for the EIS. This period covers the fifth and sixth phases of the consultation process and includes the public exhibition of the EIS. Information is also included on consultation activities undertaken by Arrow since the sixth phase of consultation, including future planned consultation activities.

2.0 Phase 5 Consultation – July to December 2011

Phase 5 consultation began in July 2011 and continued until December 2011. A range of activities were undertaken to provide information to the community about the progress of the EIS and the findings of the EIS studies that were available, as well as activities that gave stakeholders the opportunity to provide feedback and input into the project.

2.1 Community Committees

In 2010 Arrow established two community committees in the Surat Basin as part of its broader engagement strategy to address local issues. The committees were established as a way of addressing issues of a technical nature and of highest community concern that could not be addressed in detail by the more general EIS consultation program.

2.1.1 Arrow Surat Community Reference Group

The Arrow Surat Community Reference Group (ASCRG) meets every two months to provide a forum for the open exchange of information amongst Arrow, landholders and broader community representatives. It identifies and provides regular feedback to Arrow on issues and opportunities relating to the general development of Arrow's coal seam gas resources over its tenements in the Surat Basin. It also provides advice to Arrow on community development concerns and opportunities to work with landholders and broader communities in the development of a coal seam gas industry in the region.

The ASCRG met three times during this period on the following dates:

- 4 August 2011
- 6 October 2011
- 15 December 2011

The topics discussed at the meetings included:

- water update
- bushfire management
- specialist study on agriculture
- workforce
- membership of committee
- a presentation by Department of Employment, Economic Development and Industry (DEEDI) on farming sustainably with coal seam gas
- update on the project at Theten and substitution of allocation (beneficial use approval)
- Arrow's new water management policy
- update on EIS
- exploration results (Chinchilla to Wandoan)
- pitless drilling and showcase well
- pipelines
- workforce projects in the region
- update on recent well incident including investigation, environmental testing, recovery process, impact on well spacing and timelines
- Strategic Cropping Land update by landholders

- recent community consultation
- water management

Copies of the meeting minutes from these sessions are available at: http://www.arrowenergy.com.au/page/Community/Community_Committees/Surat_Community_Reference_Group/

The membership for the group during the fifth phase of consultation was as follows:

- Leisa Elder — Vice President, Community and Sustainable Development, Arrow Energy
- Feng Jianhua — Chief Operating Officer, Arrow Energy
- Carolyn Collins — General Manager, Water, Arrow Energy
- Tony Knight — Vice President Exploration, Arrow Energy
- Sarah Delahunty — Senior Community Officer, Dalby, Arrow Energy
- Ian Hayllor — Basin Sustainability Alliance
- Ross Dunn — Director, Australian Petroleum Production and Exploration Association (APPEA)
- Andrew Brier — (former) General Manager DERM
- Bill Date — Director DEEDI
- Geoff Hewitt — Future Foods QLD
- Cr Mick Cosgrove — Deputy Mayor, Western Downs Regional Council (WDRC)
- Cr Paul Antonio — Deputy Mayor, Toowoomba Regional Council (TRC)
- Cr Ray Jamieson — Councillor, WDRC
- Michael Murray — Cotton Australia
- Graham Clapham — Central Downs Irrigators
- Anna Stephenson — USQ (commenced December 2011)
- Ben Maher — Mort & Co (commenced December 2011)

2.1.2 Arrow Intensively Farmed Land Committee

The AIFLC also meets every two months. The Committee provides a forum for the open exchange of information between Arrow and landholders representing different agricultural enterprises on intensively farmed land (IFL). The forum aims to identify issues, provide feedback and collaboratively review opportunities for coexistence for coal seam gas development on intensively farmed land within the Surat Basin. The committee provides advice to Arrow on development concerns and opportunities as part of a case study involving landholders on IFL in the development of Arrow's coal seam gas reserves in the Surat Basin.

The AIFLC continued to meet during Phase 5, meeting three times during this period as follows:

- 4 August 2011
- 6 October 2011
- 15 December 2011

The topics discussed at the meetings included:

- drilling operations and programs
- desktop development case studies
- proposed Pipeline Construction Standard Work Practice for IFL
- feedback on community consultation in the area
- water studies
- bushfire management
- results of EIS specialist study on agriculture
- Arrow land access and agreements
- case study: coal seam gas impacts on irrigation farm
- in field power supply

Copies of the meeting minutes from these sessions are available at: http://www.arrowenergy.com.au/page/Community/Community_Committees/Intensively_Farmed_Land_Committee/

The membership of the AIFLC during this phase was as follows:

- Darren Stevenson (former) Asset General Manager (South), Arrow Energy
- Mike Ward Vice President, Well Delivery, Arrow Energy
- Carey Bradford Exploration Manager (South), Arrow Energy
- Ed Curl Appraisal Manager, Arrow Energy
- Glenda Viner Community Manager, Arrow Energy
- Melita Keast Senior Community Officer, Arrow Energy
- Gerard Coggan EIS Manager, Arrow Energy
- Andrew Thompson Environment Leader (Operations & Project Support), Arrow Energy
- Jonny Shirley Field Development Manager (South), Arrow Energy
- Julian Leonard Land Manager, Arrow Energy
- Rod Williams Land Manager (South), Arrow Energy
- Harley Bligh Landholder
- Jamie Grant Landholder
- Jeff Bidstrup Landholder
- John Cameron Landholder
- Neville Wirth Landholder
- Paul McVeigh Landholder
- Wayne Newton Landholder
- Roy Flett Landholder
- Stuart Armitage Landholder
- Charlie Mort Landholder

2.2 Consultation program

The key community-wide consultation activity undertaken during Phase 5 for the EIS was a week of community information sessions held between 24 and 28 October 2011.

Consultation activities were supported by a communication and awareness program to ensure interested community members and stakeholders were aware of the consultation program and received information about the progress of the EIS.

2.2.1 Promotional activities

To facilitate attendance at the community information sessions during Phase 5, the sessions were promoted through 3,139 invitation letters and 920 emails to stakeholders listed on Arrow's Consultation Manager database. These stakeholders included people who were invited and/or had attended Phases 1, 2, 3 and 4 of consultation, and additional stakeholders who had been added to the Consultation Manager database since Phase 4. Full details of the community information sessions were included in the invitation along with an outline of what the sessions would cover. A sample of the invitation can be found in Appendix A.

To attract community members who were not on Arrow's database but may have an interest in the project, advertisements were placed in the *Dalby Herald, Toowoomba Chronicle, Pittsworth Sentinel, Goondiwindi Argus, Chinchilla News, The Northern Downs News and Queensland Country Life (Southern Edition)* over the month of October. A copy of the advertisement is contained in Appendix A.

Display posters promoting the session details were placed in 53 venues, including shops, libraries, and other prominent locations. These posters outlined venues, dates and times of the community information sessions. They also included details of how the community could contact the project team through the 1800 freecall service, project email address, reply paid postal address and website.

2.2.2 Communication management

JTA continued to manage the 1800 freecall service (1800 038 856) and an email information address (suratgas@arrowenergy.com.au) as well as a reply paid postal service. The Consultation Manager database was used to record, manage and track enquiries and action items for the project team. The database played an important role by recording details of individuals and groups with specific interests, influences or triggers that could be impacted by the project, and those who required additional attention. Actions arising from consultation events were issued via email to the relevant Arrow employee.

During Phase 5, JTA received 37 calls on the 1800 freecall line, three project emails and one letter.

2.2.3 Printed information materials

A range of printed materials were displayed at each of the community information sessions to provide updates to the community on issues relevant to Arrow and the project.

Twelve fact sheets were available for the community to take as they wished. Some previous information sheets were updated or were still in use for Phase 5 and new fact sheets were introduced. The fact sheets used included:

- *Arrow Energy*
- *Drilling Fluids*

- *Fraccing*
- *Information for Landholders*
- *Salt Management*
- *Surat Gas Project Overview*
- *Understanding Groundwater*
- *Well Integrity*
- *What is BTEX?*
- *Working at Arrow Energy*
- *Zonal Isolation.*

As part of the display Arrow's land team had a series of detailed maps available showing Arrow's tenure for landholders to examine. Other maps showed Arrow's existing infrastructure in the Surat Basin, Arrow-owned properties in the Surat Basin, Arrow's exploration activities and a Surat Basin directory.

The following Queensland Government coal seam gas fact sheets were also available at the community information sessions:

- *Adaptive environmental management regime for the coal seam gas industry*
- *Aquifer Impacts and 'Make Good' Arrangements*
- *Baseline assessment plans*
- *Bore assessment*
- *Coal seam gas water*
- *Coal seam gas water dams*
- *Coal seam gas water feasibility study*
- *Code of Practice: CSG will head emissions detection and reporting*
- *Commencement of the Water and Other Legislation Amendment Act 2010*
- *Complete hydraulic fracture activities*
- *Environmental assessment and management of coal seam gas developments*
- *Environmental impact statement and the role of the Coordinator-General*
- *Flaring in the coal seam gas industry*
- *Fraccing and BTEX*
- *Hydraulic fracturing (fraccing) in CSG wells*
- *Impacts of CSG extraction on underground water – Managing impacts on the Great Artesian Basin*
- *Integrated laws to manage water impacts*
- *Intended hydraulic fracture activities*
- *Make good obligations*
- *New arrangements to Protect Groundwater Resources in coal seam gas extraction areas*
- *Petroleum and gas approval process*
- *Petroleum and gas laws – a guide for landholders*
- *Protect your property from weeds, pests and diseases*
- *QWC's role in coal seam gas groundwater management*
- *Rehabilitation of land disturbance and coal seam gas activities*
- *Safety in coal seam gas fields/around coal seam gas wells.*
- *Salt and brine management in coal seam gas production*

- *Underground water impact report*
- *Underground water management framework*
- *Well head safety.*

In addition, as in previous rounds, government fact sheets specific to land access were made available at the sessions:

- *Guide to Queensland's new land access laws*
- *Land access code: November 2012*
- *Mediation and negotiation options – How to call a conference for independent alternative dispute resolution (ADR)*
- *Negotiation notice for advanced activities on private land – Information for landholders and occupiers.*
- *Notice of entry to conduct preliminary activities on private land – Information for landholders and occupiers*
- *Tips for landholders negotiating agreements with resource companies.*

2.2.4 Banners

Banners providing a snapshot of key elements of the project were also included as part of the display. A list of the banners displayed is provided below:

- *Brighter Futures*
- *Business Opportunities*
- *Careers*
- *Drilling Process*
- *EIS groundwater study*
- *EIS Studies*
- *Exploring for a cleaner source of energy*
- *Good Quality Agricultural Land*
- *Good Quality Agricultural Land Map*
- *Land Access Rules*
- *Land Access Rules*
- *Managing Groundwater Impacts*
- *Our Commitments to You*
- *Strategic Cropping Land Map*
- *Strategic cropping land*
- *Surat Gas Project EIS Area*
- *Surat gas project EIS process*
- *Water and Salt*
- *Water and Salt Management*
- *What does 'make good' mean?*
- *What is an Environmental Impact Statement?*
- *Working with Landholders.*

2.2.5 Community information sessions

During the fifth phase of consultation community information sessions were held in six locations in the project development area (please see Table 1). The approach for this round

of consultation activities was to continue the process adopted in previous rounds where information sessions were publicised and open to the whole community.

Table 1: Phase 5 community information sessions

Town	Date (2011)	Time	Location	Registered Attendees*
Goondiwindi	Monday 24 October	9.00am-12.00pm	Goondiwindi Waggamba Community & Cultural Centre	7
Millmerran	Monday 24 October	3.00pm-6.00pm	Community & Cultural Centre	24
Dalby	Tuesday 25 October	8.45am-2.30pm	Dalby Showground Pavilion	33
Cecil Plains	Wednesday 26 October	8.45am-2.30pm	Cecil Plains Hall	58
Chinchilla	Thursday 27 October	8.45am-2.30pm	Bulldog Park	42
Miles	Friday 28 October	10.00am-1.00pm	Leichhardt Centre Columboola Function Room	17
TOTAL				**181**

**Note that the figures for those attending include only people who registered; at all sessions there are a number people who do not register.*

In each location the venue was organised in such a way as to separate the formal (presentation and question and answer session) and informal elements (one-on-one discussions and displays). The presentation and question and answer session were set up theatre style, and the staffed informal displays were set up near banners (grouped by topic) around the room. A variety of supplementary materials were also available including the relevant Arrow and government information sheets as well as large banners. Detailed maps showing the Surat project development area were also on display. Core samples from coal seam gas exploration activities were provided by the water team, and were taken to all locations.

The community information sessions were divided into two formats. A longer format was prepared for the sessions held in Cecil Plains, Chinchilla and Dalby as experience from previous consultation sessions had shown that attendees in those towns liked to receive in-depth presentations and information requiring more time for questions. The format included full presentations on the agricultural and water impacts set out in the EIS as well as a general presentation covering the other impacts set out in the EIS. The barbecues at the end of the sessions provided a forum where community members could ask questions in an informal environment. A shortened format was prepared for the sessions held in Goondiwindi, Millmerran and Miles, although the presentation still covered all topic areas.

The community information sessions in Chinchilla, Cecil Plains and Dalby followed the below format:

- presentation giving an overview of the findings of the EIS
- presentation dealing with the detailed agricultural findings of the EIS followed by Arrow's mitigation strategies regarding agricultural impacts

- question and answer session to give the community a chance to ask questions about the agricultural findings
- morning tea break
- short presentation by Dr Lloyd Townley (Dr Townley previously gave an *Introduction to Groundwater* presentation as part of the consultation activities in Phase 4) giving a brief overview on groundwater modelling
- presentation covering the impacts on groundwater as well as highlighting Arrow's mitigation strategies for any water impacts
- question and answer session during which the community could ask Arrow staff questions on any topic covered by the EIS
- barbecue lunch (although in Cecil Plains it was requested that the question and answer session be continued after lunch) during which Arrow staff were available to talk to community members one-on-one.

The sessions in Goondiwindi, Millmerran and Miles were much shorter; the session started with an informal one-on-one session along with a morning or afternoon tea. Following that was a formal presentation which gave an overview of the EIS results, and a question and answer session. In all locations the question and answer sessions continued until the community had no more questions. Appendix A contains a summary of the questions and answers from all sessions in Phase 5.

The formal presentation (Appendix A) that was given at all the community information sessions provided an update on the project and Arrow's current activities, outlined the potential route for the Arrow Surat pipeline, provided information on Arrow's social investment in the Surat Basin, explained the purpose of the EIS, detailed the key environmental issues including groundwater, agriculture, amenity (noise, air, visual), socio-economic conditions and roads and traffic, and outlined the project approvals timeframe.

The presentation on groundwater modelling (see Appendix A) provided at the Cecil Plains, Chinchilla and Dalby meetings related to groundwater modelling and the agriculture impact assessment. It included an introduction to groundwater and modelling, a description of the purposes and stages of modelling, results of a peer review, the scope of the groundwater impact assessment, projected groundwater abstractions from the Walloon Coal Measures, modelled impacts of depressurisation and the proposed mitigation measures and studies.

The presentation on the agriculture impact assessment (see Appendix A) at these same meetings included its scope, and an outline of Queensland Government planning policies, agricultural enterprises and challenges in the Surat Basin, potential impacts of coal seam gas development, lasting (residual) impacts and the conclusions and recommendations from the studies.

A total of 181 people registered at the sessions during Phase 5. This compares with 396 people who attended consultation activities in Phase 1, 445 who attended in Phase 2, 359 who attended in Phase 3 and 318 who attended in Phase 4 (please see Table 2). At most sessions, there were a number of people who did not register.

Table 2: Comparison of attendance at Phase 1 to Phase 5 community information sessions

Location	Round 1 (Nov 2009)			Round 2 (Jun 2010)	Round 3 (Nov 2010)	Round 4 (May 2011)			Round 5 (October 2011)
	Community information session	Community display	Total	Community information session	Total	Technical water session	Community information session	Combined total	Community information session
Dalby	33	99	132	138	92	47	41	88	33
Chinchilla	17	68	85	68	65	38	28	66	42
Millmerran	14	58	72	49	33	-	23	23	24
Cecil Plains	-	45	45	107	73	59	44	103	58
Wandoan	-	9	9	13	26	-	14	14	-
Miles	-	23	23	34	49	-	16	16	17
Goondiwindi	-	30	30	36	21	-	8	8	7
Totals			**396**	**445**	**359**	**144**	**174**	**318**	**181**

2.2.6 Key community and stakeholder issues and concerns

Key issues raised across consultation activities are summarised below.

Amenity

- Noise impacts

Arrow Energy corporate issues

- Bow Energy takeover
- Corporate responsibility past the end of the project
- Relinquishment of tenure
- Value of production

Drilling and operations

- Alternative drilling techniques
- Fraccing
- Chemicals used in drilling process
- Current local activities
- Pipeline construction
- Project lifetime/ timeframe

Land impacts

- Co-existence with intensively farmed land
- Gas found in soils in the area
- Impact of buried infrastructure
- Impact on farming activities/industry
- Impact on land
- Rehabilitation of well sites
- Strategic cropping land
- Subsidence caused by gas extraction

Landholder/ stakeholder relations

- Arrow's credibility in the community
- Compensation
- Conduct and compensation agreements - confidentiality
- Failures in Arrow's past dealings with stakeholders
- Land access

Legislative and regulatory

- Boundaries of the Surat Gas Project
- Comment on regulation of industry
- Effect of submissions to the EIS
- Environmental legislation governing Arrow's activities
- Interpretation of environmental impact studies
- Length and format of public consultation period
- Ongoing community input into the project
- Size of EIS document
- Sources of information for the EIS

Social impacts

- Community benefits
- Impact on lifestyle
- Social impacts - population growth and housing

Water and salt management

- Beneficial use of water
- Effects on groundwater

- Groundwater modelling
- Groundwater monitoring
- Interconnectivity of groundwater systems
- Make good requirements
- Recharge of affected aquifers
- Reinjection
- Salt management
- Substitution of allocations
- Storage of coal seam gas water
- Treatment of coal seam gas water

Wellhead and gas field issues

- Gas flaring
- Monitoring of well sites
- Safety around wells
- Well density
- Well field design and footprint
- Well integrity.

3.0 Phase 6 Consultation – January to July 2012

3.1 Introduction

Phase 6 consultation activities commenced in January 2012 and continued through to July 2012. This phase included the public exhibition period for the Surat Gas Project EIS which commenced on 16 March 2012 and concluded 14 June 2012.

A range of activities were undertaken to provide information to the community about the results of the EIS, including drop-in sessions and community information sessions. The community committees also continued to meet which provided a regular forum for project stakeholders to communicate with Arrow.

3.2 Community Committees

3.2.1 Arrow Surat Community Reference Group

The ASCRG continued to meet every two months during the sixth phase of consultation.

The ASCRG met three times during Phase 6 as follows:

- 9 February 2012
- 12 April 2012
- 14 June 2012

The topics discussed at the meetings included:

- Beaudesert exploration program
- Bow Energy acquisition
- brine use and the reverse osmosis process
- coal seam gas and agricultural co-existence
- committee membership
- development trials
- EIS project update (post submission to government)
- housing strategy update by Western Downs Regional Council
- information on ATP 683 (exploration activities)
- tenure update
- update on land access submissions
- water activities
- water management policy review by Department of Environment and Resource Management (DERM).

Copies of the meeting minutes from these sessions are available at: http://www.arrowenergy.com.au/page/Community/Community_Committees/Surat_Community_Reference_Group/

The membership of the ASCRG stayed predominantly the same although there were a few membership changes. A list of the members for this period follows:

- Leisa Elder — Vice President Community and Sustainable Development, Arrow Energy

- Feng Jianhua Chief Operating Officer, Arrow Energy
- Carolyn Collins General Manager, Water, Arrow Energy
- Tony Knight Vice President Exploration, Arrow Energy
- Sarah Delahunty Senior Community Officer, Dalby, Arrow Energy
- Ian Hayllor Basin Sustainability Alliance
- Ross Dunn Director APPEA
- Wally Kearan DERM
- Bill Date Executive Director, DEEDI
- Geoff Hewitt Future Foods QLD
- Cr Mick Cosgrove Deputy Mayor WDRC (ceased membership April 2012)
- Cr Charlene Hall Councillor WDRC (commenced June 2012)
- Cr Paul Antonio Deputy Mayor TRC
- Cr Ray Jamieson Councillor WDRC
- Marie-Louise Offner Cotton Australia
- Graham Clapham Central Downs Irrigators
- Anna Stephenson USQ
- Sarah Due AgForce
- Ben Maher Grassdale feedlot, Dalby

3.2.2 Arrow Intensively Farmed Land Committee

The AIFLC also continued to meet every two months during Phase 6 consultation.

The AIFLC met three times during Phase 6 as follows:

- 9 February 2012
- 12 April 2012
- 14 June 2012.

The topics discussed at the meetings included:

- update on EIS
- update on water
- petroleum tenure relinquishments
- the Coal Seam Gas Well Code of Practice including the mandatory requirements governing drilling and grout volumes, quality and application
- update on core hole trial on IFL
- petroleum tenure management
- coal seam gas and agriculture co-existence
- update on multi well pad drilling project trial at Theten
- effectiveness of the committee and an Accomplishment Review of the committees activities
- EIS progress
- exploration update
- update and summary of trials
- desktop development case studies

Copies of the meeting minutes from these sessions are available at: http://www.arrowenergy.com.au/page/Community/Community_Committees/Intensively_Farmed_Land_Committee/

The membership of the AIFLC also stayed predominantly the same although there were a few membership changes. Below is a list of the members during the sixth phase of consultation:

- Mike Ward — Vice President, Well Delivery, Arrow Energy
- Carey Bradford — Exploration Manager (South), Arrow Energy
- Ed Curl — Appraisal Manager, Arrow Energy
- Colin Whyte — Sustainable Development Team Lead, Arrow Energy
- Melita Keast — Senior Community Officer, Arrow Energy
- Gerard Coggan — EIS Manager, Arrow Energy
- Andrew Thompson — Environment Leader (Operations & Project Support), Arrow Energy
- Jonny Shirley — Field Development Manager (South), Arrow Energy
- Julian Leonard — Land Manager, Arrow Energy
- Rod Williams — Land Manager (South), Arrow Energy
- Harley Bligh — Landholder
- Jamie Grant — Landholder
- Jeff Bidstrup — Landholder
- John Cameron — Landholder
- Neville Wirth — Landholder
- Paul McVeigh — Landholder
- Wayne Newton — Landholder
- Roy Flett — Landholder
- Stuart Armitage — Landholder
- Charlie Mort — Landholder

3.3 Notice of Public Exhibition of Surat Gas Project Environmental Impact Statement

Following the submission of the EIS to the Queensland Coordinator-General, the public exhibition period for the Surat Gas Project EIS extended from 16 March to 14 June 2012. The exhibition period provided the public with the opportunity to formally comment on the EIS, including the project's potential environmental effects and/or the effectiveness of measures proposed to manage impacts.

The community was able to view the EIS by:

- viewing it online at www.arrowenergy.com.au
  - via a web-based version of the EIS
  - pdf download version
- telephoning 1800 038 856 or emailing suratgas@arrowenergy.com.au for a DVD (free copy) or to purchase a printed copy
- viewing a printed copy at:

- Department of Environment and Resource Management Business Centre (Level 3, 400 George St, Brisbane)
- Department of Environment and Resource Management Business Centre (173 Hume St, Toowoomba)
- Toowoomba Regional Council, Millmerran Service Centre (2-16 Campbell St, Millmerran)
- Western Downs Regional Council (107 Drayton St, Dalby)
- Western Downs Regional Council Customer Service Centre (80-86 Heeney St, Chinchilla)
- Cecil Plains Library (Taylor St, Cecil Plains)
- Wandoan Visitor Information Centre (41 Royd St, Wandoan)
- Miles Library (Cnr Dawson and Murilla Sts, Miles)
- Goondiwindi Regional Council Library (4-6 McLean St, Goondiwindi)

To assist in promoting the availability of the EIS an advertisement was placed in local newspapers at the commencement of the official public exhibition period. Table 3 below shows the newspapers in which the public notice was placed and the dates they appeared. A copy of the public notice can be found in Appendix B.

Table 3: Public notice publication details

Newspaper	Publication date
The Australian	Friday 16 March 2012
Courier Mail	Friday 16 March 2012 Saturday 17 March 2012
Toowoomba Chronicle	Saturday 17 March 2012
Dalby Herald	Tuesday 20 March 2012
Northern Downs News	Thursday 22 March 2012
Chinchilla News	Thursday 22 March 2012
Pittsworth Sentinel	Wednesday 21 March 2012
Goondiwindi Argus	Wednesday 21 March 2012
Queensland Country Life (South Edition)	Thursday 22 March 2012

In addition to the advertisement, Arrow sent out 5,420 letters to stakeholders who had an interest in or were potentially affected by the project. This included landholders, elected representatives, government officials and community groups. A copy of the letter can be found in Appendix B.

3.4 Consultation program

The key community-wide consultation activities undertaken during Phase 6 was a series of community information sessions and drop-in sessions held during the EIS exhibition period. Two rounds of drop-in sessions were held in Chinchilla, Millmerran, Dalby and Toowoomba from 17 to 20 April 2012 and 29 May to 1 June 2012, and a series of community information sessions were held from 30 April to 10 May 2012.

Consultation activities were supported by a communication and awareness program to ensure interested community members and stakeholders were aware of the consultation program and received information about the public display of the EIS.

3.4.1 Promotional activities

A total of 3,439 invitation letters (Appendix B) were sent on 3 April 2012 to stakeholders listed on the Consultation Manager database. These stakeholders included people who were invited and/or had attended a session during the first five phases of the consultation, and additional stakeholders who had been added to the Consultation Manager database since Phase 5. Full details of the community information sessions were provided. Invitations were also sent by email on 11 April 2012 to approximately 1,187 stakeholders listed on the Consultation Manager database.

To publicise the community information sessions, advertisements were placed in the *Dalby Herald, Toowoomba Chronicle, Pittsworth Sentinel, Goondiwindi Argus, Chinchilla News, The Northern Downs News and Queensland Country Life (Southern Edition)* over the month of April. Copies of the advertisement are contained in Appendix B.

Posters were again placed in prominent locations throughout the Surat Gas Project area. These posters outlined venues, dates and times of the community information sessions. They also included details of how the community could contact the project team through the 1800 freecall service, project email address, reply paid postal address and website.

3.4.2 Communication management

JTA continued to manage the 1800 freecall service (1800 038 856) and an email information address (suratgas@arrowenergy.com.au) as well as a reply paid postal service. The Consultation Manager database was used to record, manage and track enquiries and action items for the project team. The database played an important role by recording details of individuals and groups with specific interests, influences or triggers that could be impacted by the project, and those who required additional attention. Actions arising from consultation events were issued via email to the relevant Arrow employee, in order to provide a response to the issue.

During Phase 6, JTA received 134 calls on the 1800 freecall line, 24 project emails and five letters.

3.4.3 Printed information materials

Information sheets about the project and Arrow's activities were available for people to take as they wished. The fact sheets included the following:

- *Arrow Energy*
- *Arrow Energy Environmental Policy*
- *Arrow in the Surat Basin*
- *Arrow Surat Pipeline*
- *Baseline assessment of water bores*
- *Brighter Futures: Arrow Energy in the community*
- *Exploration*
- *Fraccing*
- *Information for landholders*
- *Salt Management*
- *Surat Gas Project Environmental Impact Statement*

- *Understanding Groundwater*
- *Well Integrity*
- *What is BTEX?*
- *Zonal Isolation.*

Information available to the community also included poster boards with an Arrow tenure map, a coal seam gas proponents' map and exploration plans.

The following Queensland Government coal seam gas fact sheets were available at the community information sessions for people to take:

- *Adaptive environmental management regime for the coal seam gas industry*
- *Aquifer impacts and 'make good' arrangements*
- *Coal seam gas water dams*
- *Environmental assessment and management of coal seam gas developments*
- *Flaring in the coal seam gas industry*
- *Guide to Queensland's new land access laws*
- *Hydraulic fracturing (fraccing) in coal seam gas wells*
- *Impacts of coal seam gas extraction and underground water*
- *Land access code*
- *Mediation and negotiation options*
- *Negotiation notice for advanced activities on private land*
- *New arrangements to protect groundwater resources in coal seam gas extraction areas*
- *Notice of entry to conduct preliminary activities on private land*
- *Protect your property from weeds, pests and diseases*
- *Rehabilitation of land disturbance from coal seam gas activities*
- *Safety in coal seam gas fields/around coal seam gas wells*
- *Salt and brine management in coal seam gas production*
- *Tips for landholders negotiating agreements with resource companies.*

3.4.4 Banners

For the sixth phase of consultation, some of the banners used in previous rounds were displayed along with new banners pertaining specifically to the Surat Gas Project EIS. The banners used included:

- *Arrow Energy Business Opportunities*
- *Brighter Futures*
- *Coal Seam Gas Process*
- *Co-existence with Strategic Cropping Land*
- *Drilling Process*
- *EIS Groundwater Studies*
- *EIS Studies*
- *Good Quality Agricultural Land (Surat Focus)*
- *Good Quality Agricultural Land (Map)*
- *Land Access Rules*
- *Managing Groundwater Impacts*
- *Our commitments to you*

- *Strategic Cropping Land Trigger Mapping*
- *Traffic and Roads*
- *What does Make Good mean?*
- *What is an Environmental Impact Statement?*
- *Working with Landholders.*

3.4.5 Drop-in sessions

As part of the consultation activities organised during the Surat Gas Project EIS public exhibition period, two rounds of drop-in sessions were held in Chinchilla, Millmerran, Dalby and Toowoomba from 17 April to 20 April 2012 and 29 May to 1 June 2012. These sessions were designed to give stakeholders the opportunity to speak one-on-one with experts from Coffey Environments as well as representatives from Arrow. Sessions ran from 10am until 4pm, and were staffed at all times by representatives of Arrow's EIS team, Coffey Environments and JTA Australia.

Attendance at these sessions was rather modest (see Table 4), however those who did attend expressed the view that they provided a valuable opportunity to ask questions without time constraints being imposed and in an informal setting.

Table 4: Phase 6 Drop-in sessions

Location	Date (2012)	Venue	Time	Attendees
Round 1				
Chinchilla	Tuesday 17 April	Boardroom, Chinchilla Council Building	10am-4pm	13
Millmerran	Wednesday 18 April	Millmerran Community and Cultural Centre	10am-4pm	4
Dalby	Thursday 19 April	Myall Youth and Community Network Centre	10am-4pm	9
Toowoomba	Friday 20 April	Burke and Wills Hotel	10am-4pm	10
Total round 1				**36**
Round 2				
Chinchilla	Tuesday 29 May	Boardroom, Chinchilla Council Building	10am-4pm	8
Millmerran	Wednesday 30 May	Millmerran Community and Cultural Centre	10am-4pm	4
Dalby	Thursday 31 May	Myall Youth and Community Network Centre	10am-4pm	2
Toowoomba	Friday 1 June	Burke and Wills Hotel	10am-4pm	11
Total round 2				**25**
Total attendees				**61**

3.4.6 Community Information sessions

In addition to the drop-in sessions, one of the key community-wide consultation activities undertaken during Phase 6 was a series of community information sessions held between 30 April to 10 May 2012 during the EIS exhibition period. The sessions were well-publicised

and were open to anyone to attend. The table below shows the number of registered attendees at each of the community information sessions.

Table 5: Phase 6 Community information sessions

Town	Date	Time	Location	Registered Attendees*
Millmerran	Monday 30 April 2012	9.00am-3.30pm	Millmerran Community and Cultural Centre	27
Cecil Plains	Tuesday 1 May 2012	9.00am-3.30pm	Cecil Plains Hall	154
Chinchilla	Wednesday 2 May 2012	9.00am-3.30pm	Bulldog Park	18
Dalby	Thursday 3 May 2012	9.00am-3.30pm	Dalby RSL	56
Miles	Tuesday 8 May 2012	3.30pm-6.30pm	Leichhardt Centre Columboola Function Room	21
Wandoan	Wednesday 9 May 2012	9.00am-12.00pm	Wandoan Community & Cultural Centre	12
Goondiwindi	Thursday 10 May 2012	9.00am-12.00pm	Goondiwindi Waggamba Community & Cultural Centre	20
TOTAL				**308**

**Note that the figures for those attending include only people who registered; at all sessions there are a number of people who do not register.*

The approach for this round of consultation activities was to continue the process adopted in previous rounds where information sessions were open to the whole community. In each location the venue was organised to separate the formal (presentation and question and answer session) and informal elements (one-on-one discussions and display). The presentation and question and answer session were set up theatre style, and the staffed informal displays were set up (in topic areas) near banners placed around the room. A variety of supplementary materials were also available including the relevant Arrow and government information sheets. Detailed maps showing the Surat project development area were also on display.

Similar to the arrangement used in the fifth phase, the community information sessions were divided into two formats. In Phase 6, Millmerran, Cecil Plains, Chinchilla and Dalby were provided with a longer presentation format to provide the level of detail that previous experience at consultation session showed was sought by these communities, and to allow more time for questions. In these towns, full presentations were given on the agricultural and water impacts set out in the EIS as well as a general presentation covering the other impacts set out in the EIS. A shortened format with a general presentation that provided an overview of environmental impacts was prepared for sessions held in Goondiwindi, Wandoan and Miles.

The community information sessions in Millmerran, Chinchilla, Cecil Plains and Dalby took the following format:

- presentation giving an overview of the EIS results and information on how to officially respond to the EIS, followed by a question and answer session on the presentation

- morning tea
- presentation outlining the findings of the groundwater impact assessment and Arrow's mitigation strategies regarding the impacts on water, followed by a question and answer session on the presentation
- lunch break
- presentation on the potential impacts regarding air, noise, vibration and agricultural land was delivered, followed by a question and answer session
- set up of three tables, each devoted to a particular topic (EIS response, water, agriculture and amenity), giving attendees the opportunity to ask further questions of Arrow representatives.

The sessions in Goondiwindi, Wandoan and Miles started with an informal one-on-one session along with a morning or afternoon tea. Following was a formal presentation which gave an overview of the EIS results, and a question and answer session. In all locations the question and answer sessions were allowed to continue until the community had no more questions. Appendix B contains a summary of the questions and answers from all sessions in Phase 6.

The formal presentation (Appendix B) made at all the community information sessions provided an update on the project and Arrow's current operations including the status of its EIS approvals, Arrow's approach to strategic cropping land, water management, project timeline, indicative central gas processing facilities and development areas. The presentation also included information about the purpose of the EIS, the EIS process, assessment of impacts, environmental framework, key environmental impacts of the Surat Gas Project including groundwater and agriculture, how to make a submission on the EIS, and the environmental impact assessment.

The additional information that was provided at the Millmerran, Cecil Plains, Chinchilla and Dalby meetings related to the groundwater impact assessment and the air, noise, vibration and agriculture impact assessment. The presentation on the groundwater impact assessment (see Appendix B) included an explanation of groundwater, potential impacts on it, groundwater systems, groundwater modelling, predicted drawdown impacts, mitigation and management measures, recharge from flooding and ongoing studies.

The presentation on the air, noise, vibration and agriculture impact assessment (see Appendix B) included information on emission sources and impact assessment scenarios, predicted concentration of noise and noise criteria, agricultural planning policies and legislation, agricultural enterprises and associated potential impacts of coal seam gas, lasting (residual) impacts of coal seam gas on agriculture, roads and siting, and production well footprints.

A total of 308 people registered at the community information sessions, with 68 people attending the drop-in sessions. This compares with 396 people who attended consultation activities in Phase 1, 445 who attended in Phase 2, 359 who attended in Phase 3, 318 who attended in Phase 4 and 181 people who attended Phase 5. There were a number of people who did not register at most sessions. The increase in attendance can be attributed to the

increase in drop-in sessions to two rounds, the inclusion of content on the results of the EIS, and additional sessions in Wandoan and Toowoomba in this round of consultation activities.

Table 6: Comparison of attendance at Phase 1 to Phase 6 community information sessions

Location	Round 1 (Nov 2009)	Round 2 (Jun 2010)	Round 3 (Nov 2010)	Round 4 (May 2011)	Round 5 (Oct 2011)	Round 6 (Apr/May 2012)
Dalby	132	138	92	88	33	67
Chinchilla	85	68	65	66	42	39
Millmerran	72	49	33	23	24	35
Cecil Plains	45	107	73	103	58	154
Wandoan	9	13	26	14	-	12
Miles	23	34	49	16	17	21
Goondiwindi	30	36	21	8	7	20
Toowoomba	-	-	-	-	-	21
Totals	**396**	**445**	**359**	**318**	**181**	**369**

Please note that both community information sessions and drop-in sessions were held in Dalby Chinchilla and Millmerran, only community information sessions were held in Cecil Plains, Wandoan, Miles and Goondiwindi, and only drop-in sessions in Toowoomba. The combined totals of attendance have been used for each phase.

3.4.7 Key community and stakeholder issues and concerns

Key issues raised across consultation activities are summarised below.

Amenity

- Air quality and dust mitigation
- Noise impacts/regulation
- Noise monitoring
- Noise modelling
- Proximity to homes
- Vibration

Arrow corporate issues

- Accessibility of information.
- Arrow's public commitments
- Community consultative committees
- Final investment decision (FID)
- Foreign ownership of Arrow
- Other Arrow activities outside the SGP
- Petroleum tenure relinquishments

Drilling and Operations

- Alternative drilling techniques
- Chemicals used in drilling process
- Decommissioning bores/wellheads
- Fracing
- Gas extraction process
- Location of project area
- Pipeline lifecycle
- Project development timeframes

EIS-specific issues

- Concern regarding use of out-of-date data
- Concern regarding misrepresentation of land use
- Lack of land-use specific studies
- Process used to map location of homes in EIS
- Public submission process

- Response to public submissions
- Risk management matrix
- Uncertainty of basis of modelling data
- Uncertainty of process - effect of ongoing studies

Environmental impacts

- Buffer zones around waterways
- Effect of environmental change on EIS information
- Environmental constraints
- Environmental offsets
- Rehabilitation of natural environments

Land impacts

- Changes to farming practices - effect on Arrow's activities
- Coexistence with IFL/SCL
- Impact of buried infrastructure on farming activities
- Impact on farming activities/ industry
- Pipeline marking
- Procedures for dealing with spills
- Rehabilitation of land
- Soil contamination
- Subsidence
- Trials on black soil land
- Weed, seed and disease spread mitigation

Landholder/Stakeholder relations

- Compensation
- Conduct and compensation agreements
- Lack of trust in public submission process
- Land access process
- Landholders' ability to have a say in how activities will be carried out on their property
- Supervision of company activities on private land

Legislative and regulatory

- Access to crown land
- Conditioning of project
- Environmental compliance
- Effect of Strategic Cropping Land legislation
- Notification requirements regarding changes to projects
- Ongoing opportunities for public input into the process
- Post-EIS approval process
- Role of GasFields Commission (established by Qld Government to improve coexistence)

Social impacts

- Impact on lifestyle
- Mental health impacts
- Police checks for staff entering private properties
- Reliance on existing town services
- Traffic and road impacts
- Workforce based in local area

Water and Salt Management

- Baseline bore testing
- Contamination mitigation measures
- Cumulative impacts
- Disposal of coal seam gas water
- Effect of project on existing licences/allocations
- Fail-safe strategies for when the impacts on groundwater go beyond the worst case scenarios modelled
- Groundwater Interconnectivity
- Groundwater modelling
- Groundwater monitoring program
- Groundwater recharge
- Impact of changes to field development plan to water production
- Impact of project on the Great Artesian Basin
- Impacts on groundwater
- 'Make good' requirements
- Management of salt by-products
- Protecting water users in the future
- Queensland Water Commission groundwater impact report
- Reinjection
- Results of water modelling in the EIS
- Storage of coal seam gas water
- Substitution of allocations
- Surface water
- Treatment of coal seam gas water
- Water quality monitoring

Wellhead and gas field issues

- Impact of cracking clays on buried infrastructure
- In-fill drilling
- Location of facilities and other activities
- Monitoring around facilities
- Placement of buried infrastructure
- Power supply to facilities
- Size of facilities
- Well field infrastructure
- Wellhead maintenance
- Well field design and footprint
- Well integrity

Over the course of consultation activities, the response to coal seam gas development has varied within communities, and across the region. Some community members expressed support of development of the industry, particularly due to the employment and business prospects the industry will generate. Other community members have expressed opposition to the project on the grounds of a range of social, economic and environmental concerns. Principal environmental concerns include adverse impacts to groundwater, impacts to Condamine flood plain soils and farming practices, and management of coal seam gas water and brine. Principal social and economic concerns relate to uncertainty about how landholders' properties will be affected, particularly in regard to effects on lifestyle, the future of family businesses and the overall financial viability of agricultural operations.

In some cases, community members have advised that uncertainty related to coal seam gas development is a significant and ongoing source of anxiety and stress, which in turn has impacted on the health of some community members, their family and community relationships. The EIS presented a conceptual development scenario based on ongoing gas reserves assessment and early design. Community members want to understand Arrow's detailed development plans and potential project impacts, both regionally and at a property level. Refinement of field development plans is ongoing with an update presented in the Supplementary Report to the Environmental Impact Statement (SREIS) Chapter 3, Project Description, while planning and negotiation of the siting of wells and associated infrastructure on properties will be ongoing throughout the life of the project.

Some community members have expressed disappointment and in some cases frustration at the staggered delivery of information, i.e., development sequence, groundwater modelling results. The fact that Arrow has not been in the position to provide the detailed level of information sought by the community further adds to their stress and sense of being not adequately informed of the potential impacts of the proposed development. Other community members accept that project planning is still underway and property-level impacts will be resolved through negotiation with individual landholders. As described in Section 4.2.1, Arrow commenced a process of Area Wide Planning in December 2012, which incorporates individual landholder requirements into an integrated plan across neighbourhoods and catchment areas. Area-wide planning aims to balance individual needs of landowners with the needs of neighbouring properties and the project.

4.0 Phase 7 Consultation – August to December 2012 (ongoing)

4.1 Stakeholder and community consultation

Following on from the sixth phase of consultation, Arrow continued to engage with stakeholders about the Surat Gas Project. Between August and December 2012, Arrow held one-on-one meetings, shed meetings and Area Wide Planning meetings with project stakeholders. The ASCRG and AIFLC continued to meet, and JTA maintained the freecall number, project email and reply paid postal services. Arrow also opened its Community Information Centre in Dalby.

4.1.1 One-on-one stakeholder meetings

During this period representatives from Arrow held five meetings with representatives of the Federal Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) and the Queensland Department of Environment and Heritage Protection (EHP).

4.1.2 Shed meetings

As part of Arrow's commitment to coexistence, Arrow hosted a series of shed meetings for landholders in August 2012 to promote the company's 12 coexistence committments. The meetings were held over three days at Arrow's property Theten and were invitation-only. A total of 13 landholders attended the meetings to learn about the 12 committments and speak with Arrow representatives.

The meetings were held at the Brumby Homestead at Theten on the following dates:

- Monday 27 August 2012
- Tuesday 28 August 2012
- Wednesday 29 August 2012.

4.1.3 Area Wide Planning meetings

As a result of some of the issues raised in the AIFLC meetings, Arrow held a series of Area Wide Planning meetings to focus on issues including overland flow with selected landholders from regions within the Surat Gas Project area. The meetings were held on 14 December 2012 in two locations with a total of 31 landholder in attendance.

4.1.4 Meetings of ASCRG

Arrow continued to hold the ASCRG meetings. Meetings were held on the following dates:

- 9 August 2012
- 11 October 2012

The December meeting was cancelled and replaced with an Arrow facilities tour.

The topics discussed at the meetings included:

- presentation on coexistence on intensively farmed land
- joint presentation given to both the ASCRG and AIFLC on groundwater, substitution of water allocation and pipelines

- Theten/beneficial use update
- project update
- Area Wide Planning presentation including a field development presentation, a presentation on farm mapping and group discussions
- tenure management
- update on fire at bore hole originally drilled by Peabody Energy

Copies of the meeting minutes from these sessions are available at: http://www.arrowenergy.com.au/page/Community/Community_Committees/Surat_Community_Reference_Group/

The membership of the ASCRG stayed predominantly the same although there were a few membership changes. A list of the members for this period follows:

- Leisa Elder — Vice President Community and Sustainable Development, Arrow Energy
- Carolyn Collins — General Manager, Water, Arrow Energy
- Tony Knight — Vice President Exploration, Arrow Energy
- Sarah Delahunty — Senior Community Officer, Dalby, Arrow Energy
- Ian Hayllor — Basin Sustainability Alliance
- Matt Paull — APPEA
- Bill Date — Executive Director, DEEDI
- Geoff Hewitt — Future Foods QLD
- Cr Charlene Hall — Councillor WDRC
- Cr Nancy Sommerfield — Councillor TRC
- Cr Ray Jamieson — Councillor WDRC
- Marie-Louise Offner — Cotton Australia
- Graham Clapham — Central Downs Irrigators
- Anna Stephenson — USQ
- Sarah Due — AgForce
- Jordan Peach — Grassdale feedlot, Dalby

4.1.5 Meetings of AIFLC

Arrow also continued to meet with the AIFLC on the following dates:

- 9 August 2012
- 11 October 2012

The December meeting was cancelled and replaced with the Area Wide Planning meetings.

The topics discussed at the AIFLC meetings included:

- nomination of new members and review of Terms of Reference
- a workshop on framing IFL committee projects
- joint presentation given to both the ASCRG and AIFLC on groundwater, substitution of water allocation and pipelines
- Area Wide Planning presentation, including a field development presentation, a presentation on farm mapping and group discussions

- review of opportunity framing workshop

Copies of the meeting minutes from these sessions are available at: http://www.arrowenergy.com.au/page/Community/Community_Committees/Intensively_Farmed_Land_Committee/

The membership of the AIFLC saw some rotation of members, with the addition of four new members (see bottom of list):

- Mike Ward — Vice President, Well Delivery, Arrow Energy
- Carey Bradford — Exploration Manager (South), Arrow Energy
- Ed Curl — Appraisal Manager, Arrow Energy
- Colin Whyte — Sustainable Development Team Lead, Arrow Energy
- Melita Keast — Senior Community Officer, Arrow Energy
- Gerard Coggan — EIS Manager, Arrow Energy
- Andrew Thompson — Environment Leader (Operations & Project Support), Arrow Energy
- Jonny Shirley — Field Development Manager (South), Arrow Energy
- Chris Wicks — IFL Project Lead, Arrow Energy
- Darren Holmes — Manager Southern Operations, Arrow Energy
- Julian Leonard — Land Manager, Arrow Energy
- Rod Williams — Land Manager (South), Arrow Energy
- Jamie Grant — Landholder
- Jeff Bidstrup — Landholder
- Paul McVeigh — Landholder
- Wayne Newton — Landholder
- Stuart Armitage — Landholder
- Steve Hanlon — Landholder
- Chris Barry — Landholder

4.1.6 Communication management

JTA continued to manage the 1800 freecall service (1800 038 856) and an email information address (suratgas@arrowenergy.com.au) as well as a reply paid postal service. The Consultation Manager database was used to record, manage and track enquiries and action items for the project team. Actions arising from consultation events were issued via email to the relevant Arrow employee to provide a response.

During the period August to December 2012, JTA received 19 calls on the 1800 freecall line, 10 project emails and 1 letter.

4.1.7 Dalby Community Information Centre

In September 2012, Arrow opened the Dalby Community Information Centre at 42 Cunningham Street with the purpose of providing an interactive information centre for residents of the Western Downs and Darling Downs regions. The centre is open daily between 9am and 5pm, Monday to Friday and was designed to provide a space where the

community can access Arrow staff and information about the company's operations and long-term plans.

The information centre features maps, displays, multimedia presentations and fact sheets which address how Arrow is managing potential environmental impacts such as groundwater, salt, drilling, land access and exploration. It also provides a central location for landholders to meet with Arrow staff and for smaller groups to meet about Arrow's community investment program Brighter Futures.

4.2 Upcoming consultation

Arrow is committed to ongoing engagement with stakeholders and the community throughout the EIS process and beyond.

Between January and June 2013, Arrow has planned the following activities:

- continued ASCRG and AIFLC meetings
- one-on-one meetings with landholders during February
- further Area Wide Planning meetings scheduled to commence in March
- consultation on the field development scope currently scheduled for 18 March.

JTA will also continue to manage the communication channels for the project, including the freecall number, project email and reply paid postal services.

5.0 Conclusion

Through this consultation program, Arrow has continued to undertake a comprehensive approach to stakeholder engagement and has sought to respond to the information needs of different stakeholder groups through events such as open community information sessions, shed meetings, Area Wide Planning meetings and the opening of the Dalby Community Information Centre.

Multiple consultation avenues were utilised in an effort to ensure all interested stakeholders had access to the project team and to the EIS while it was on display. These activities included community information sessions, drop-in sessions and one-on-one discussions. The sessions open to the wider community were promoted through a diverse range of communication techniques to expose the widest audience to the intended activities in the region and the findings of the EIS.

Arrow will continue to build and maintain relationships with stakeholders as the project progresses, including through its community relations and project staff and its Brighter Futures community investment program.

Through Arrow's various consultation avenues, the company will continue to seek to address the key concerns of community members and stakeholders.

Appendix A

Phase 5 Sample invitation letter

5 October 2011

Dear [ ]

Invitation to information sessions 24 to 28 October 2011

Arrow Energy will be holding a series of information sessions in the Surat Basin in late October. These sessions will provide the community with an opportunity to hear and discuss the results of Arrow's Environmental Impact Statement (EIS) studies and the chance to speak with our senior staff and independent technical experts about the latest on Arrow's activities in the area.

Since Arrow last held community information sessions earlier in May, the company has been continuing its work on the project EIS and has examined environmental, economic and social matters, and the associated impacts and benefits.

The sessions will commence with a brief Arrow update followed by key presentations on the EIS. The focus of the presentations will be on the key areas of concern to the community – agriculture and groundwater. There will be a question and answer session to follow, and lunch, which will include the opportunity for one-on-one and small group discussions with the project team.

The sessions will be held from 24 to 28 October. Details of the sessions are overleaf; they are open to the whole community and refreshments will be available.

If you require any further information, and to assist with catering, please RSVP by contacting the project team on freecall **1800 038 856** or email **suratgas@arrowenergy.com.au**. Feel free to pass this information on to anyone who may be interested.

I do hope you will be able to attend one of the sessions.

Yours sincerely

Leisa Elder
Vice President
Community and Corporate Affairs

Surat Gas Project EIS information sessions October 2011

Location	Date	Time	Venue
Goondiwindi	Monday 24 October	9.00am – 12.00pm presentation commences 9.30am	Goondiwindi Waggamba Community Cultural Centre Corner Russell & Short Streets
Millmerran	Monday 24 October	3.00pm – 6.00pm presentation commences 3.30pm	Community & Cultural Centre Walpole Street
Dalby	Tuesday 25 October	8.45am – 2.30pm presentations commence 9.00am	Dalby Showground Pavilion Nicholson Street
Cecil Plains	Wednesday 26 October	8.45am – 2.30pm presentations commence 9.00am	Cecil Plains Hall Geraghty Street
Chinchilla	Thursday 27 October	8.45am – 2.30pm presentations commence 9.00am	Bulldog Park Slessar Street
Miles	Friday 28 October	10.00am – 1.00pm presentation commences 10.30am	Leichhardt Centre Columboola Function Room Corner Marian & Dawson Streets

Phase 5 Advertisement

COMMUNITY INFORMATION SESSIONS

FIND OUT MORE ABOUT ARROW ENERGY ›

Arrow Energy invites you to a community information session to update you about our Environmental Impact Statement (EIS), current operations and exploration activities.

LOCATION	DATE	TIME	VENUE
Goondiwindi	Monday 24 October	9am – 12pm	Waggamba Community Cultural Centre, Cnr Russell and Short Streets
Millmerran	Monday 24 October	3pm – 6pm	Community and Cultural Centre, Walpole Street
Dalby	Tuesday 25 October	8.45am – 2.30pm	Showground Pavilion, Nicholson Street
Cecil Plains	Wednesday 26 October	8.45am – 2.30pm	Town Hall, Geraghty Street
Chinchilla	Thursday 27 October	8.45am – 2.30pm	Bulldog Park, Slessar Street
Miles	Friday 28 October	10am – 1pm	Leichhardt Centre – Columboola Function Room, Cnr Marian and Dawson Streets

To RSVP your attendance or find out more about the information sessions you should contact the project team at:

Freecall 1800 038 856
Email suratgas@arrowenergy.com.au
Post Arrow Energy, Reply Paid 81 Hamilton Q 4007
Also visit www.arrowenergy.com.au/community

Find out more online at
www.**arrowenergy**.com.au
BRISBANE DALBY MORANBAH GLADSTONE

arrow energy
go further

Phase 5 General presentation

ARROW ENERGY SURAT BASIN

Community Information Session

October 2011

arrow energy
go further

ARROW ENERGY
TODAY'S AGENDA

- Arrow Energy introduction and overview of session
- Surat Basin update
- EIS process and overview of findings
- Agricultural findings and strategies
- Introduction to groundwater modelling
- Water findings, strategies (EIS) and future actions

ARROW ENERGY
COMPANY OVERVIEW

Arrow is a leading coal seam gas company with five domestic gas supply operations, interests in three gas-fired power stations and plans to deliver liquefied natural gas to the international market through a world class plant in Gladstone.

- Queensland based company which started in 2000
- Joint venture Shell (50%) and PetroChina (50%) established owners committed to safety, environment and long term relationships with stakeholders
- Currently have almost 500 producing coal seam gas wells across Queensland
- Provide approximately 20 per cent of Queensland's gas needs which is primarily used for electricity

中国石油天然气股份有限公司
PetroChina Company Limited

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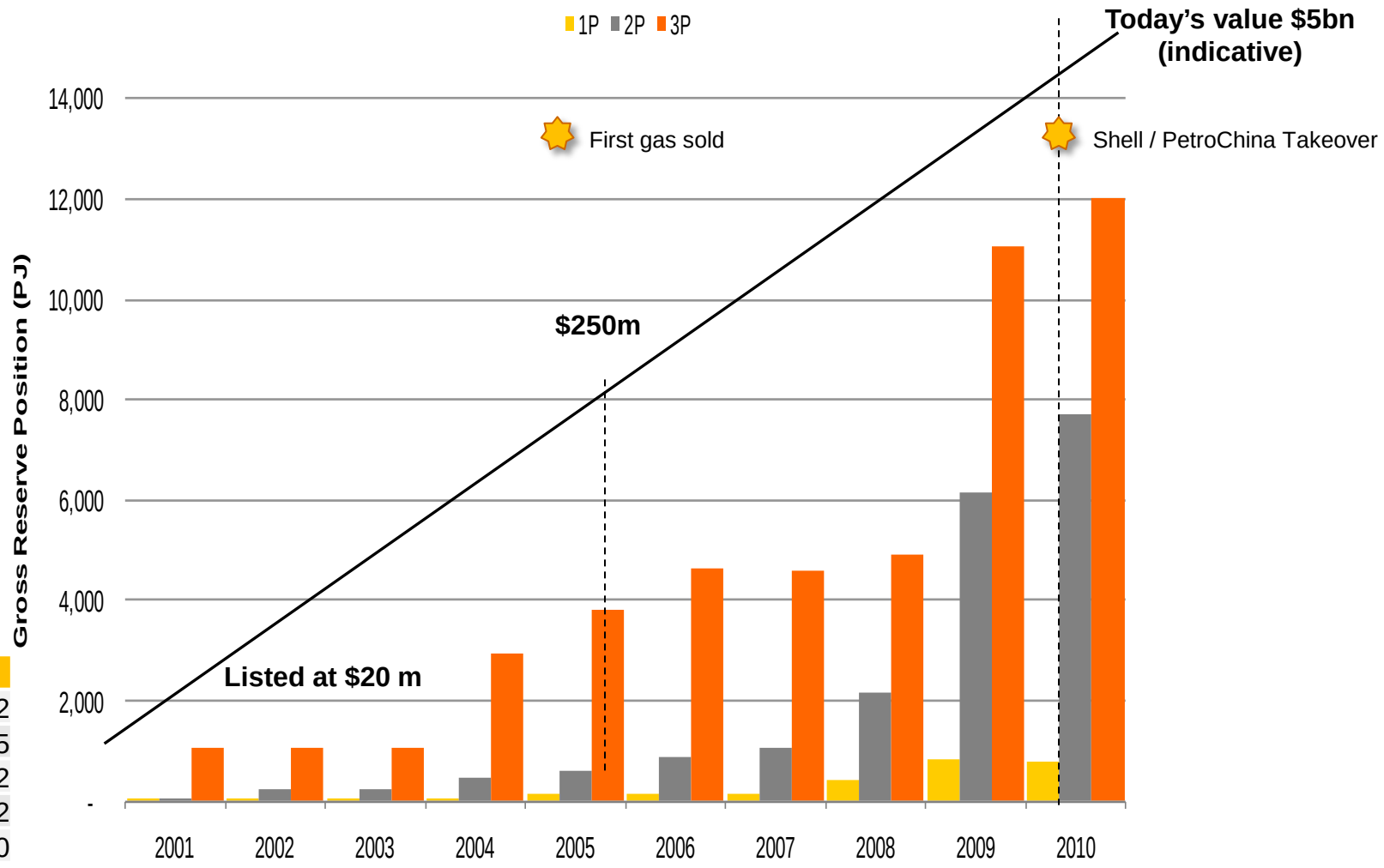
ARROW ENERGY
OUR STORY



Staff numbers	
2007	212
2008	235
2009	372
2010	432
2011*	900

*year to date

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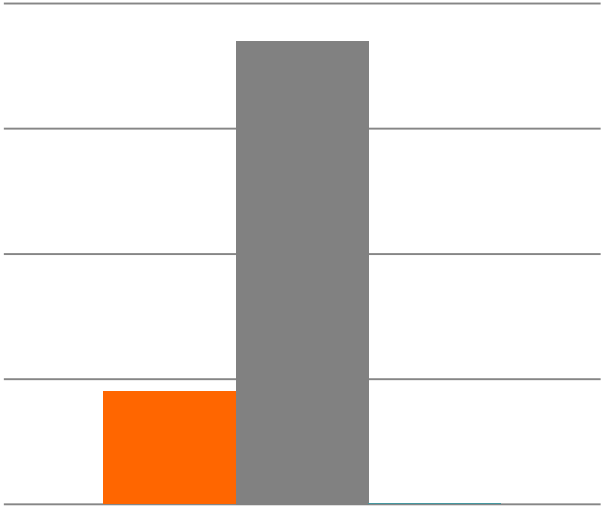
ARROW ENERGY
GAS RESOURCES IN THE TENEMENTS

	Surat Basin	All Qld Arrow tenements	Current Qld usage
Gas resources:	18 000 PJ	74 000 PJ	150 PJ
Equivalent to:	3 billion barrels of oil	12 billion barrels of oil	25 million barrels of oil



Surat Basin

All Qld Arrow tenements

Current Qld use

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ARROW ENERGY
RECENT ANNOUNCEMENT – BOW ENERGY ACQUISITION

- Arrow has entered definitive agreement to acquire Bow Energy via a Scheme of Arrangement
- The offer is subject to customary conditions including regulatory, court and shareholder approvals
- Bow directors unanimously recommended shareholders to vote in favour of the offer
- This is an all cash offer of $1.52 per share and represents 72 per cent premium to the Bow closing price before the initial approach
- The acquisition of Bow enhances our opportunity to expand the size of the project trains at our planned liquefied natural gas (LNG) on Curtis Island

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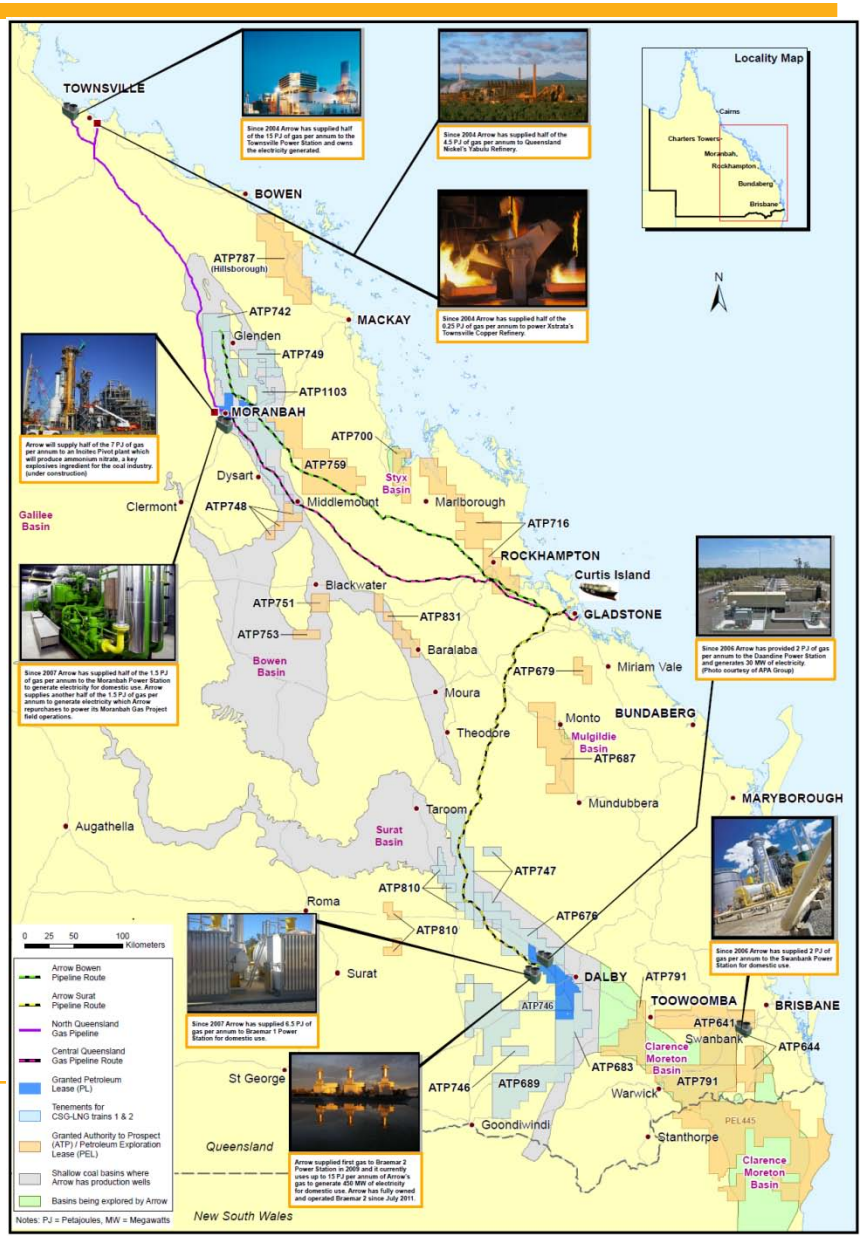
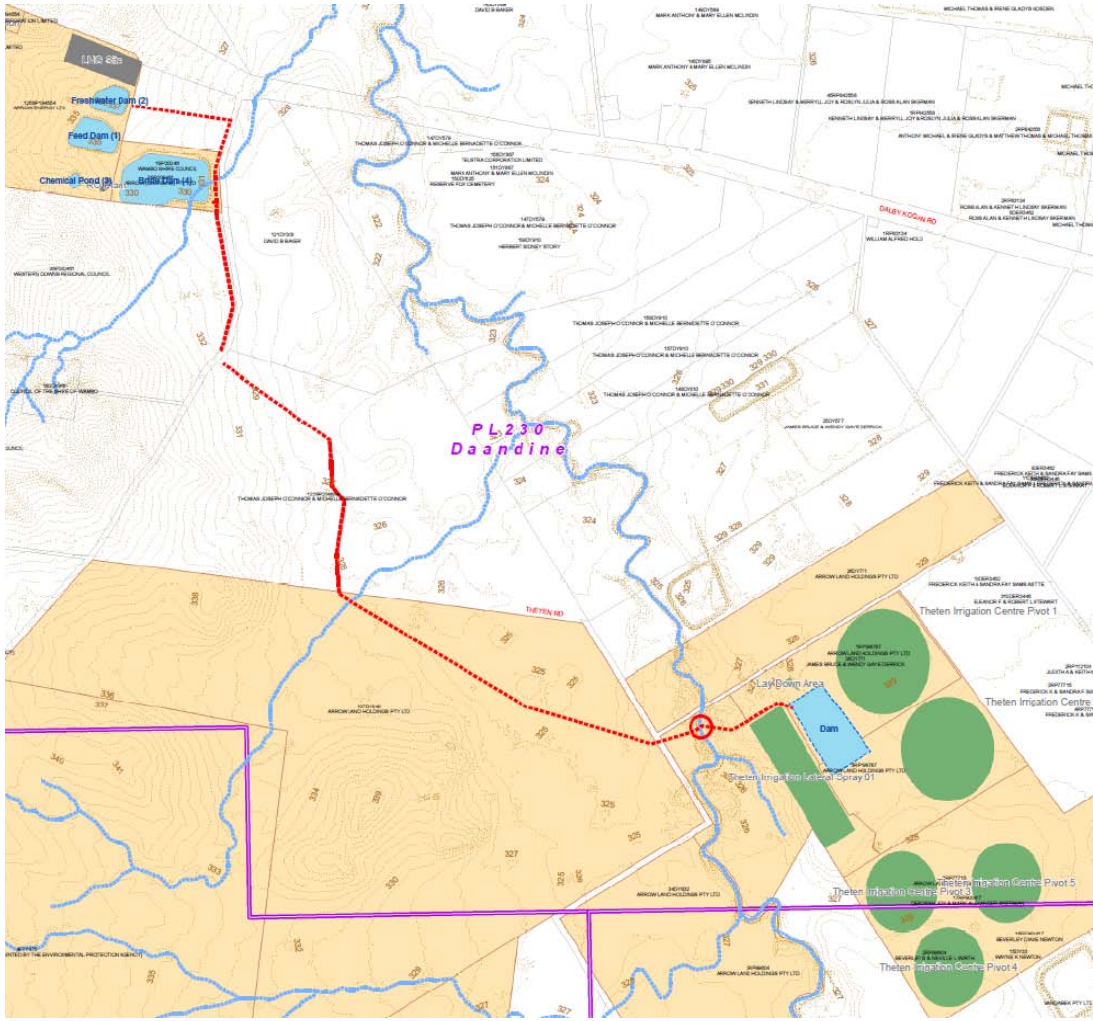
ARROW ENERGY IN THE SURAT BASIN
OVERVIEW

- Surat Gas Project (SGP) produced its first gas in 2005
  - Daandine
  - Kogan North
  - Tipton West
  - Stratheden
- Supply gas to power homes, businesses and industry:
  - Daandine Power Station
  - Braemar 1 Power Station
  - Braemar 2 Power Station
  - Swanbank Power Station
- Approximately 130 staff in Dalby



ARROW ENERGY
CURRENT ACTIVITIES

- Currently transporting water from Daandine Reverse Osmosis plant to Theten Farm for irrigation trials
- In process of building Reverse Osmosis plant at Tipton
- Rehabilitation work in Cecil Plains region



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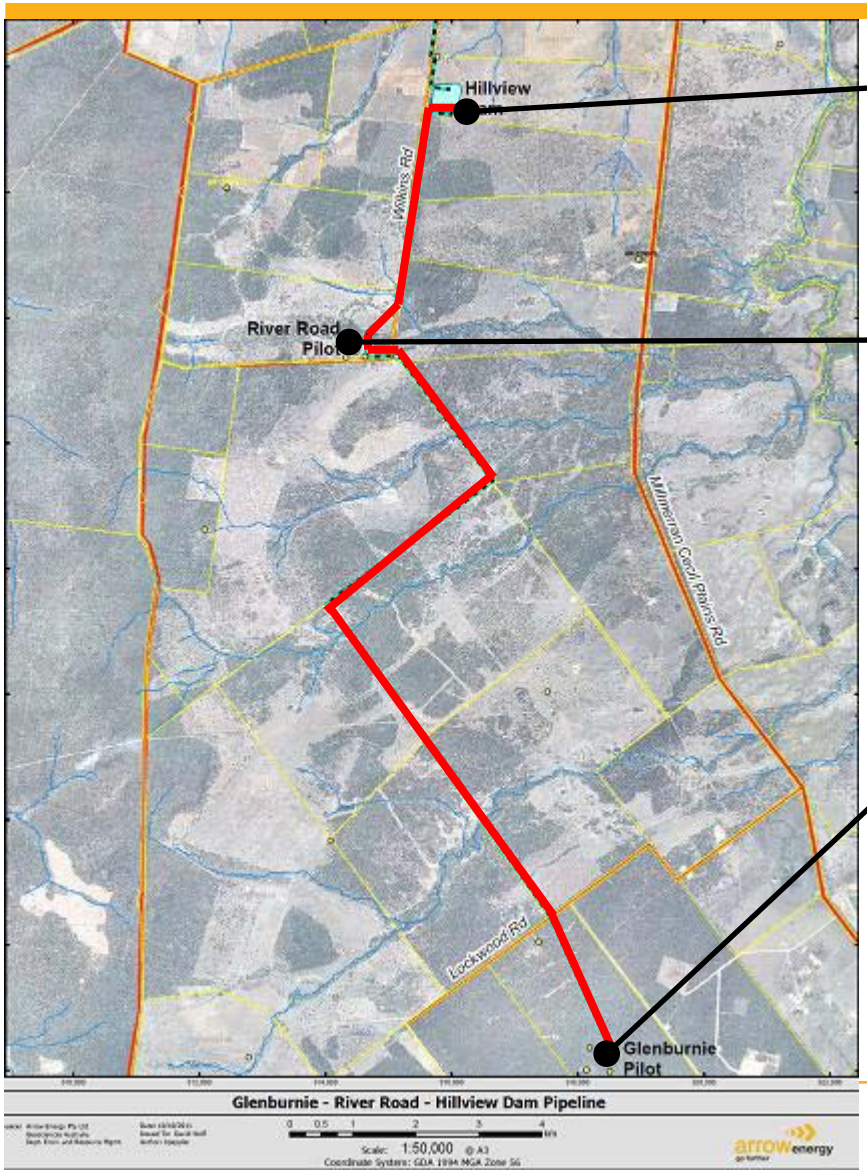
ARROW ENERGY

CURRENT ACTIVITIES – RIVER ROAD/GLENBURNIE PILOTS



Hillview (400ML) aggregation dam

- Earthwork largely completed
- HDPE liner installation in progress
- Scheduled completion mid Nov

River Road Pilot

- Pilot wells drilled
- 3 wells has been completed
- Surface equipment on site
- RR-HV pipeline (5km) late Oct start
- On pump Dec 2011

Glenburnie Pilot

- Pilot wells drilled
- Well completions start in next 2 weeks
- GB-RR pipeline (15km) early Nov start
- On pump Q1 2012

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SURAT BASIN

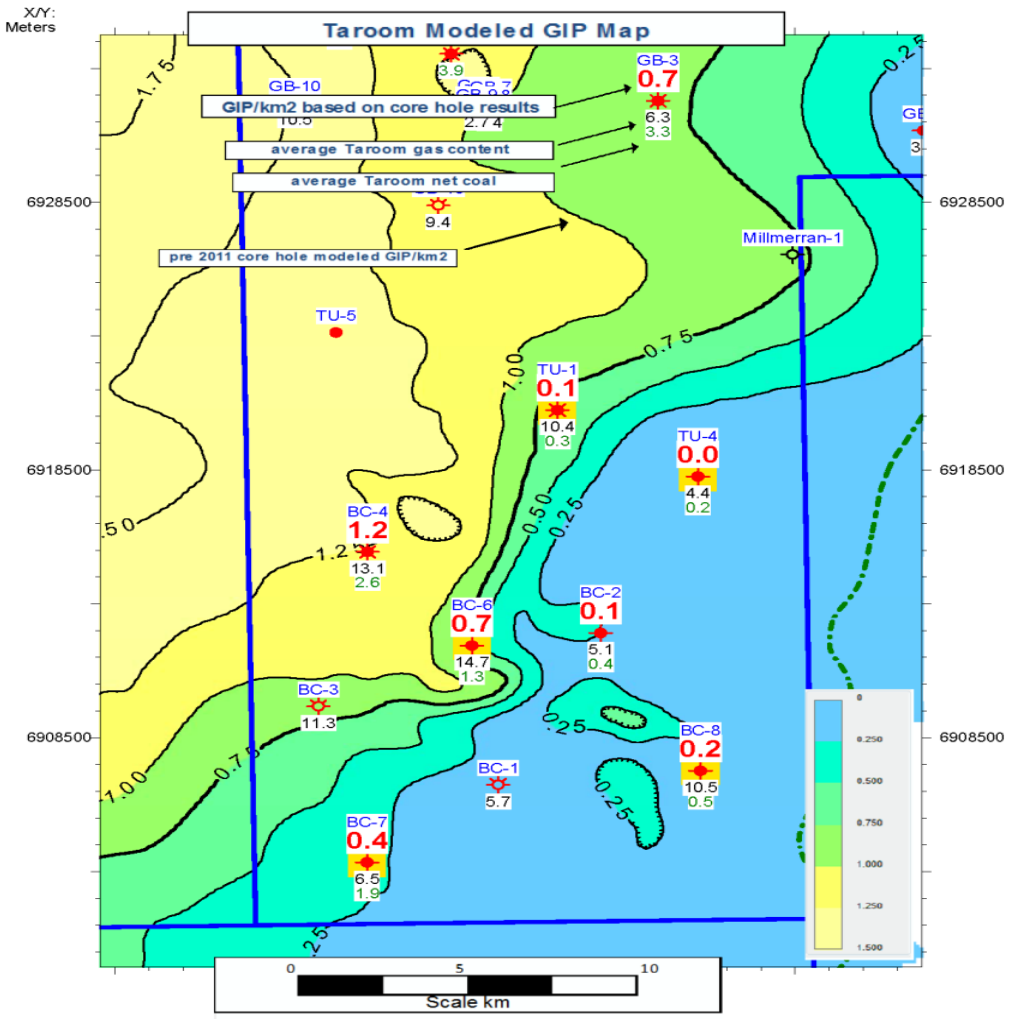
GAS IN PLACE AND RESOURCE IMPLICATIONS

2012:

- Drill two core holes around central north portion of the tenement;
- Obtain clearances to test one core hole within a current Native Title area.
- Relinquish 15 blocks in non- to poorly prospective areas of ATP689

2013-2016:

- Drill one core hole in 2013;
- Re-evaluate tenement potential and establish strategies until 2016



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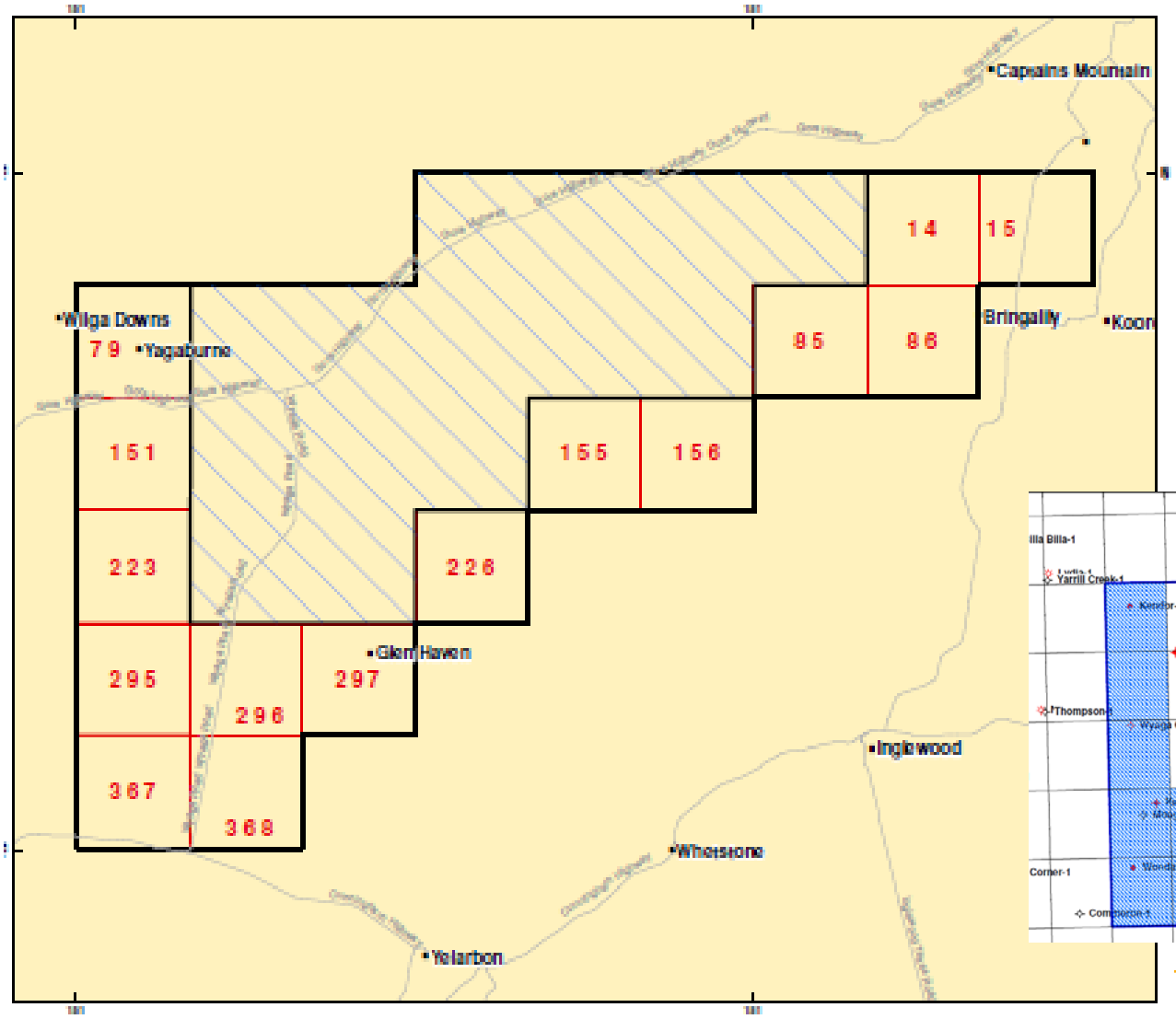
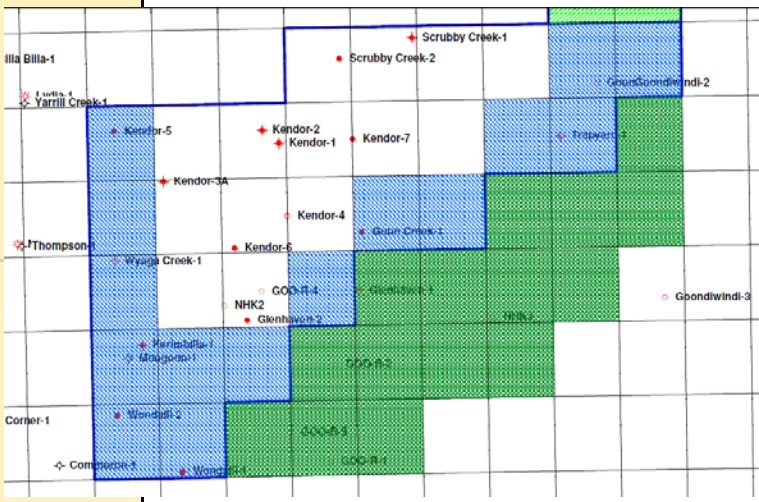
SURAT BASIN

GAS IN PLACE AND RESOURCE IMPLICATIONS





Surat Basin - ATP689 Inglewood - Block Details and Location Map

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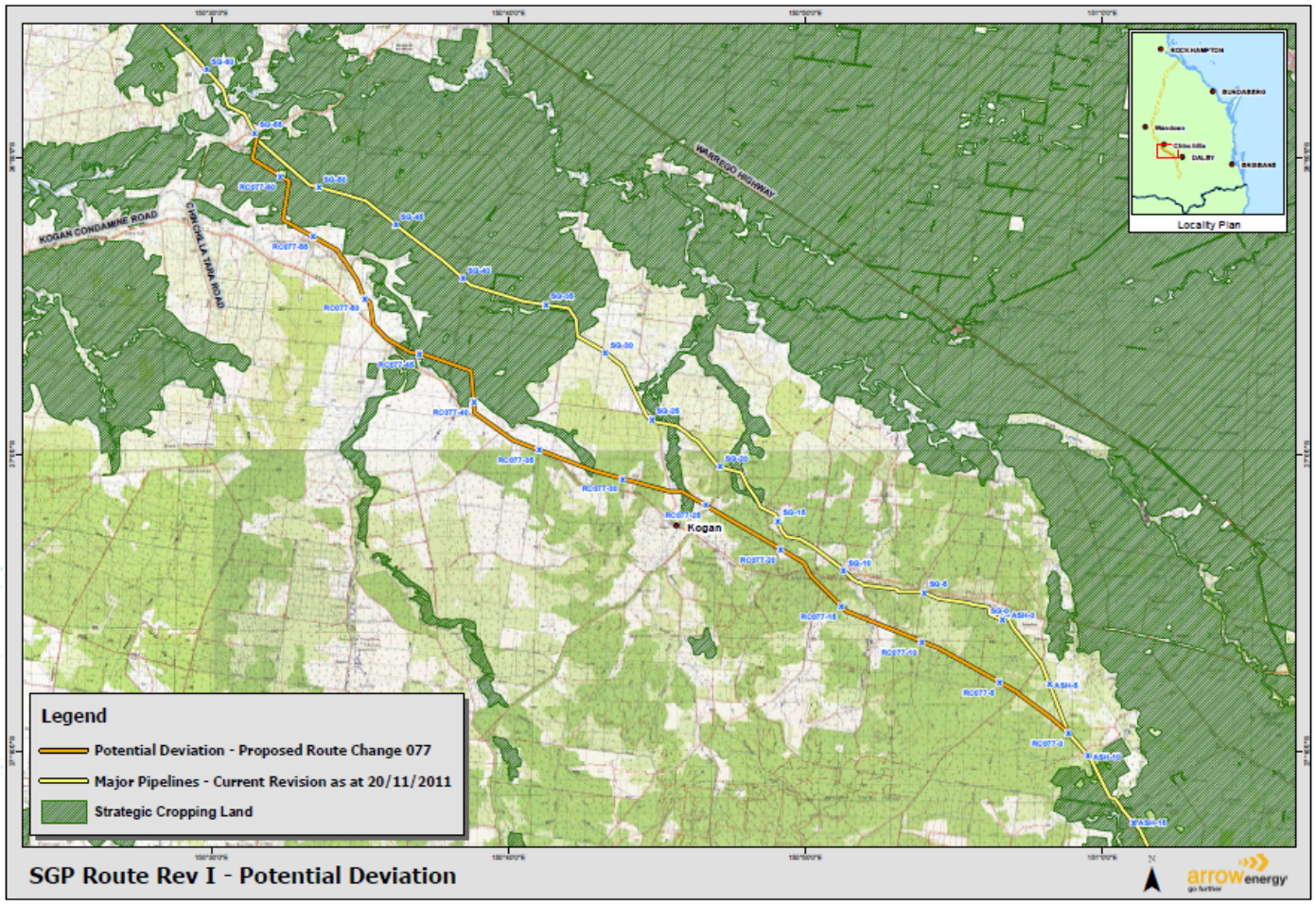
ARROW ENERGY
ARROW SURAT PIPELINE – POTENTIAL ROUTE

- Arrow currently has a licensed pipeline route (PPL 141)
- Considering re-routing 70km to minimise impact on good quality agricultural land in Chinchilla area
- Potentially affected landholders have been consulted



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COMMUNITY ENGAGEMENT
BRIGHTER FUTURES – COMMUNITY INVESTMENT PROGRAM

Local employee committees assess applications for donations, sponsorships and partnerships in the following focus areas:

- Health and safety
- Education
- Environment

Recent successful applicants in the Surat Basin include:

- Dalby Delicious and DeLIGHTful Festival
- Bluecare Dalby
- Bowenville Ladies Auxiliary
- Brigalow State School
- Chinchilla Ambulance Committee
- Goondir Health Services
- Lions Club of Cecil Plains
- Waminda Services

- 2011 applications have now closed. We invite applications for 2012 – first round closes March 30.

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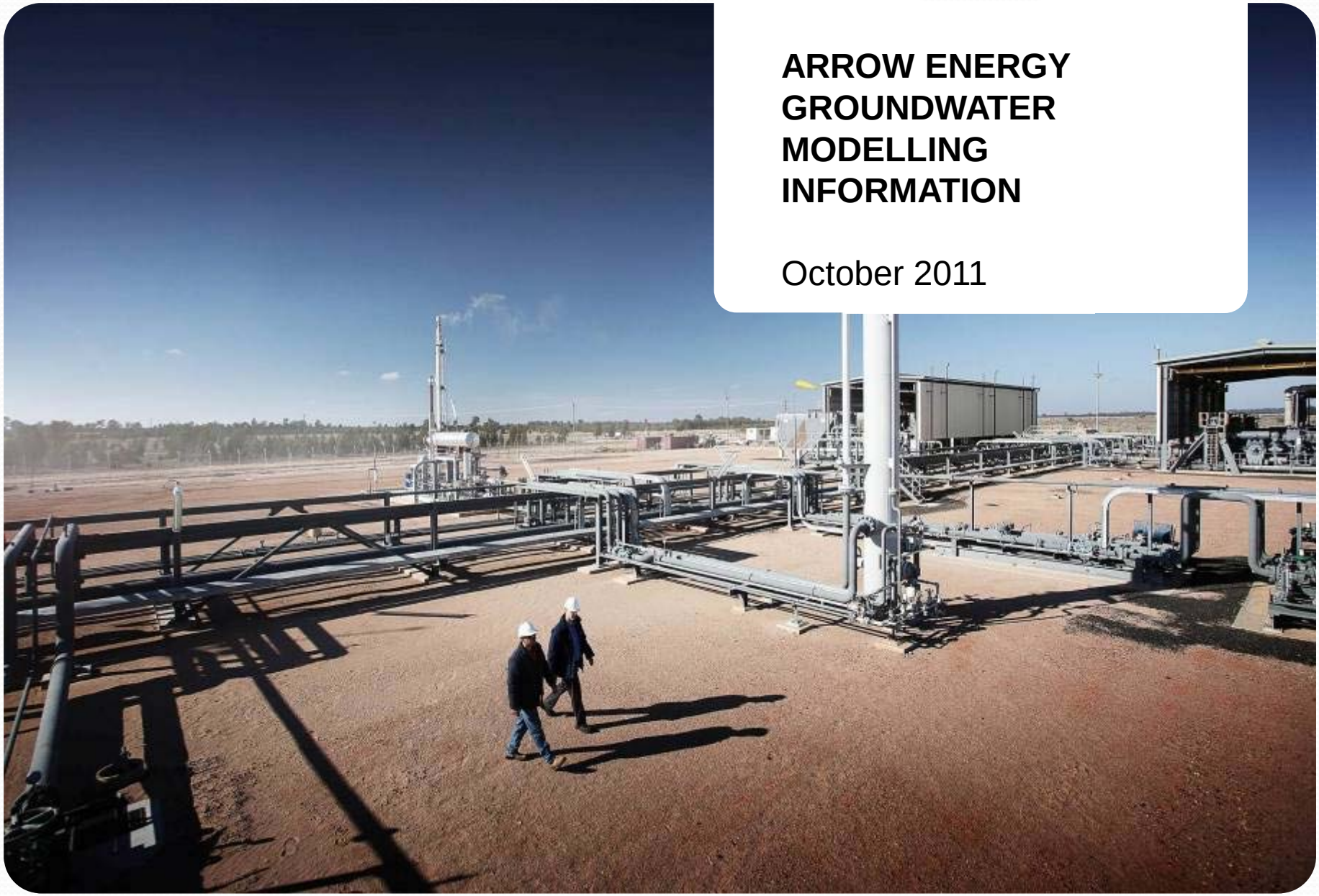
Questions and Answers

Freecall: 1800 038 856

Email: info@arrowenergy.com.au

Phase 5 Groundwater modelling presentation



ARROW ENERGY GROUNDWATER MODELLING INFORMATION

October 2011

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GROUNDWATER MODELLING
PRESENTATION SUMMARY

- What is groundwater modelling?
- What did the peer review say?
- What were the predictions from the model?
- What are we doing to understand more?

An introduction to groundwater modelling

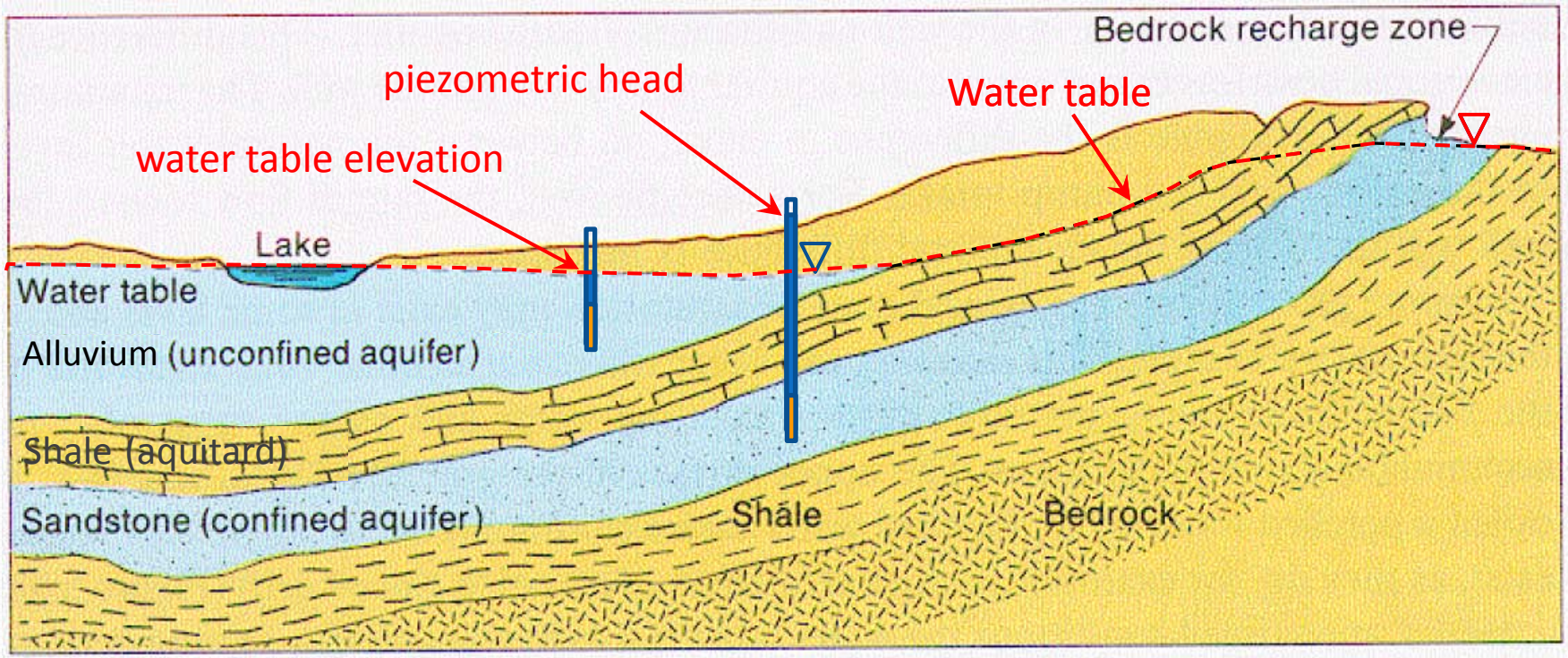
Objectives

- What are “groundwater models”?
- What do we mean by:
  - “conceptual model”
  - “water balance”
  - “numerical groundwater flow model”
- Calibration
- Prediction and uncertainty

First, a refresher…

- Groundwater occurs in pores and fractures in rock and soil.
- Aquifers are layers that transmit groundwater, mainly horizontally.
- Aquitards impede the movement of groundwater. Flow in aquitards is mainly vertical.
- Groundwater flow is driven by differences in head, which is a measure of potential energy
- The rate of flow of groundwater is controlled by hydraulic conductivity, which can be different in different directions.

Aquifers, aquitards, pressure, head



Groundwater flows due to differences in “head”

What is a groundwater model?

- A “groundwater model” is a representation in computer software of a regional scale hydrogeological system:
  - based on a complete description of the natural system (geometry, material properties, recharge etc.)
  - including proposed changes (e.g. pumping)
  - with which we can predict water levels, piezometric heads and flows in space and time

Purpose of modelling

- Modelling is the only methodology that allows us predict future behaviour
- Models can have different levels of detail ("complexity")
  - To illustrate or explain
  - To predict potential environmental impacts
  - To predict short-term operational response (an "aquifer simulator")

Stages in modelling

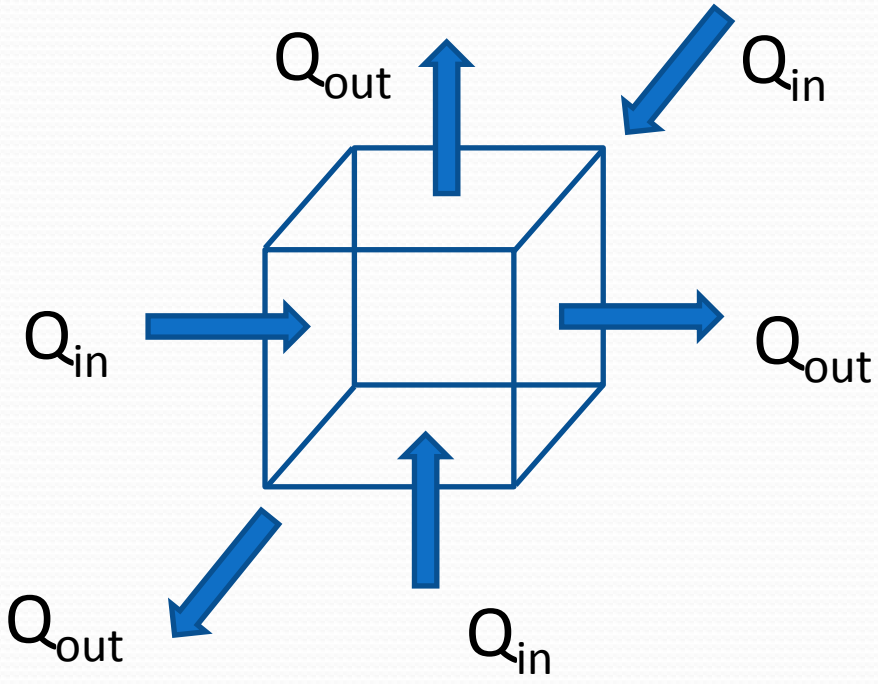
1. Conceptual model
   - Sketch how a hydrogeological system is believed to work
2. Mathematical model
   - Use equations to represent the physics of groundwater flow
3. Numerical model
   - Convert to a form suitable for computers

Conceptual model

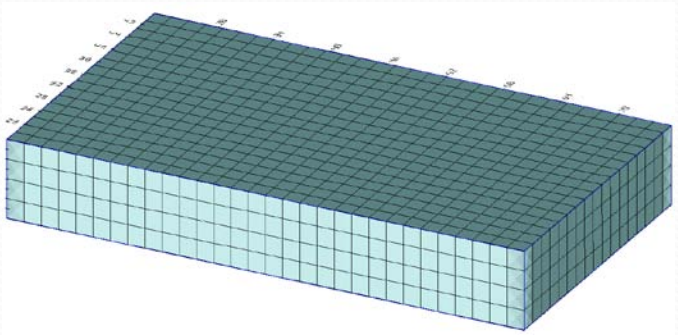
- The first stage in understanding a hydrogeological system is the development of a conceptual model
  - Regional geology, including faults and shear zones
  - Layering, and hydrostratigraphy
  - Hydrogeological properties (S_y, S_0, K_h, K_v)
  - Recharge, pumping, rivers, streams
  - Initial heads

Water balance → numerical model

Consider a small volume of aquifer or aquitard:

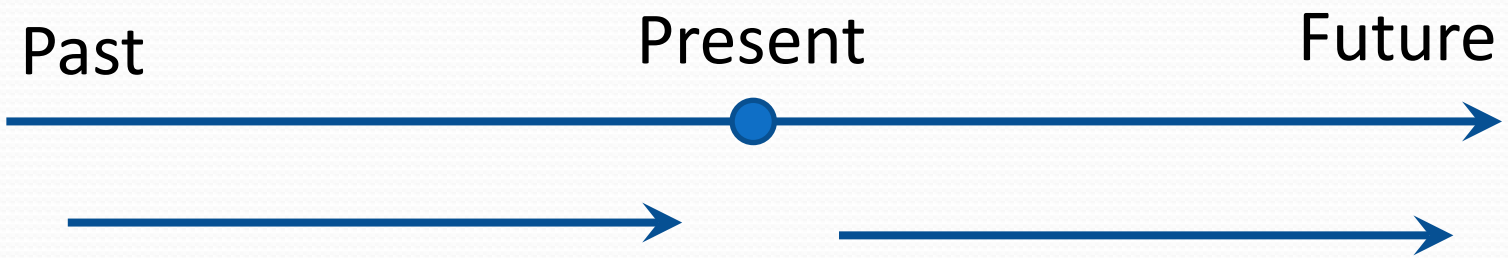


Water balance allows us to compute h(x,y,z,t) at any time



Calibration versus prediction

- Important distinction between simulating the past and the future

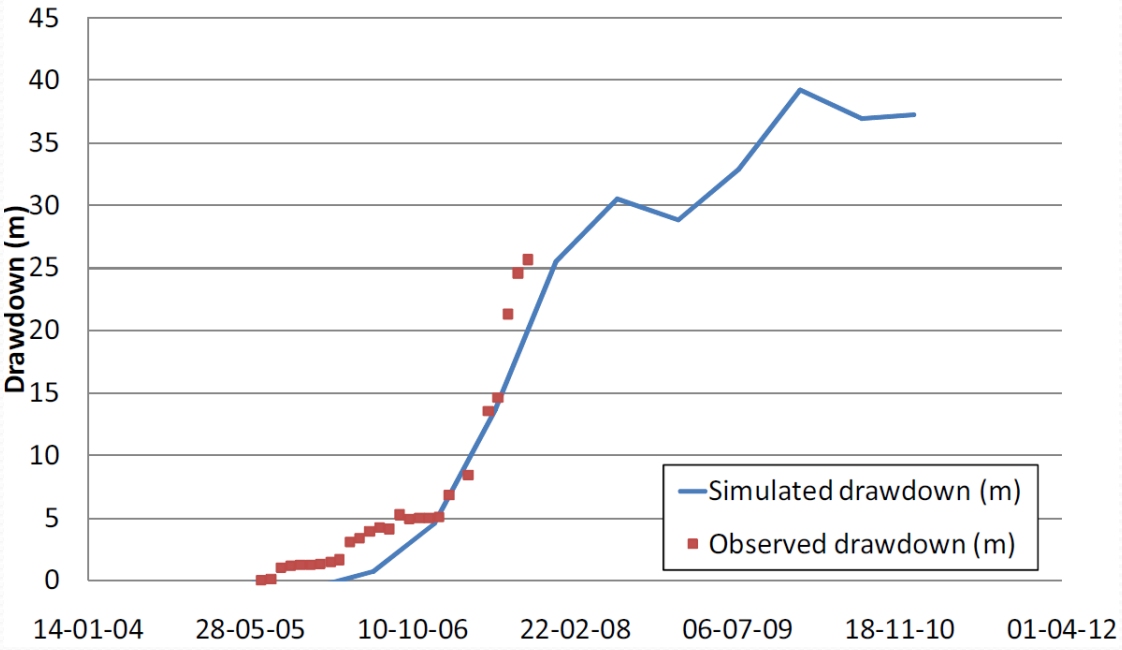


Calibration:
adjust parameters until simulated heads match historical observations

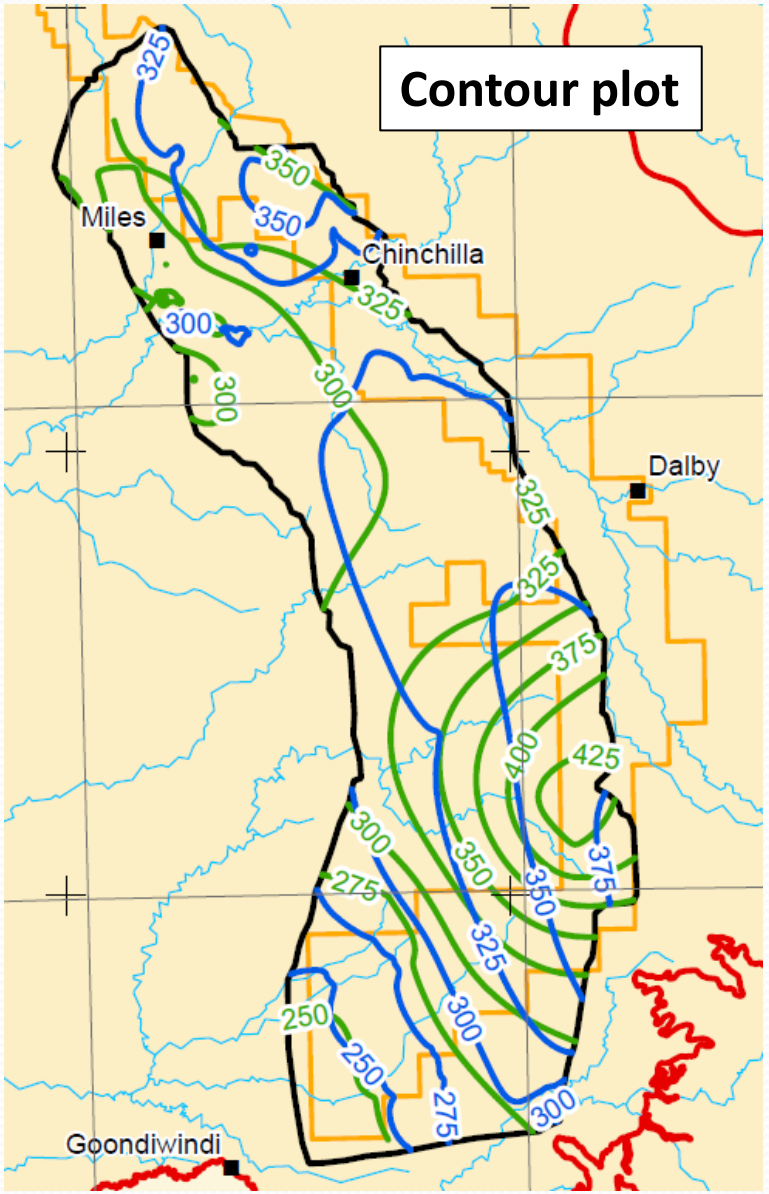
Prediction:
simulate future behaviour

Calibration

Time series plot



Contour plot



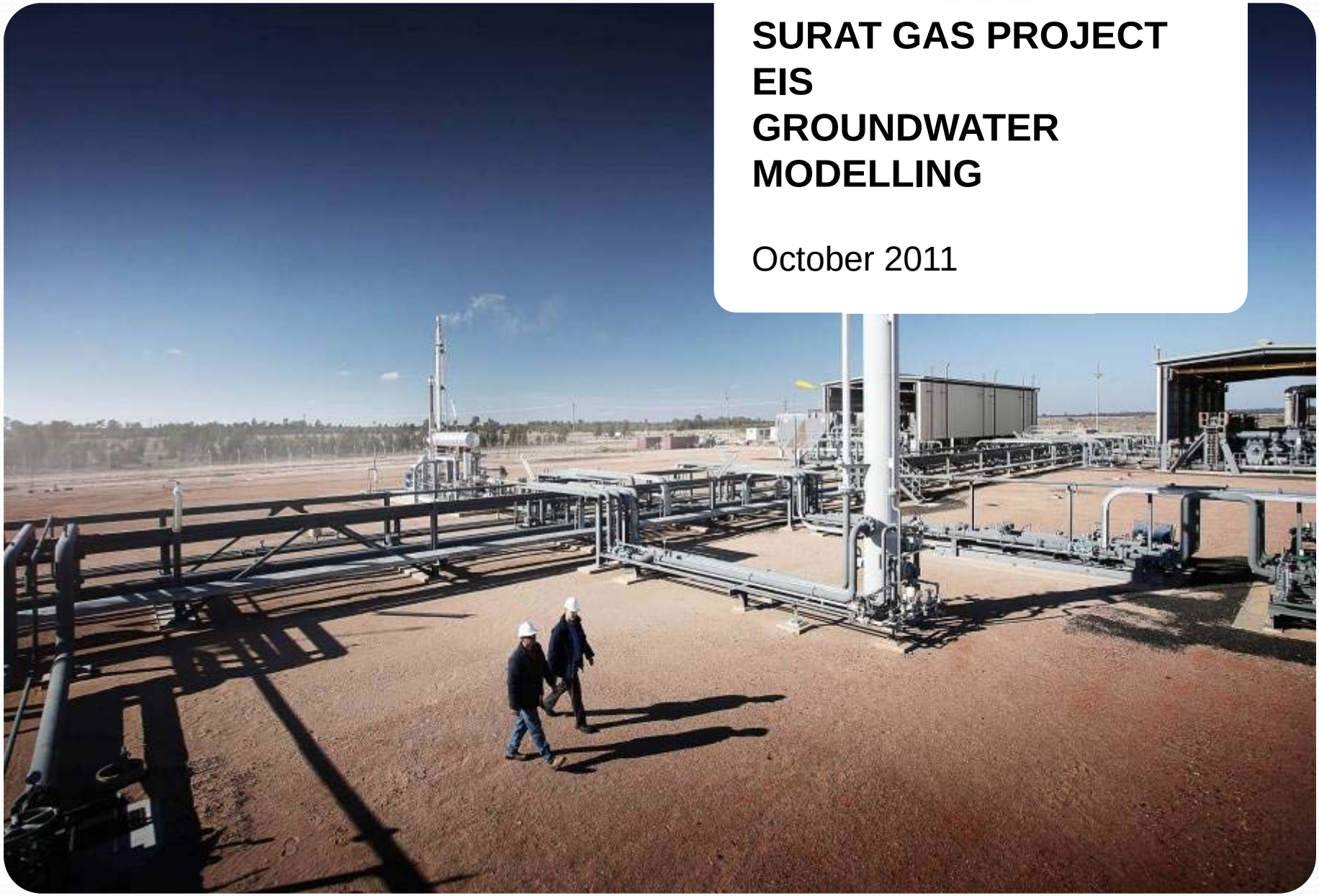
ENVIRONMENTAL TECHNOLOGY

Results of Peer Review

- The conceptual hydrogeological model is supported by a detailed geological model
- Some aspects of calibration are very good
- Predicted impacts are of the right order of magnitude
- Consistent with models developed by other CSG proponents
- Model needs to evolve from an “impact assessment model” towards an “aquifer simulator”

Recommendations

- Some aspects require further testing/refinement:
  - Representation of regional faults
  - Representation of connections between key hydrostratigraphic units
  - Representation of recharge and evapotranspiration



SURAT GAS PROJECT
EIS
GROUNDWATER MODELLING

October 2011

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ARROW ENERGY

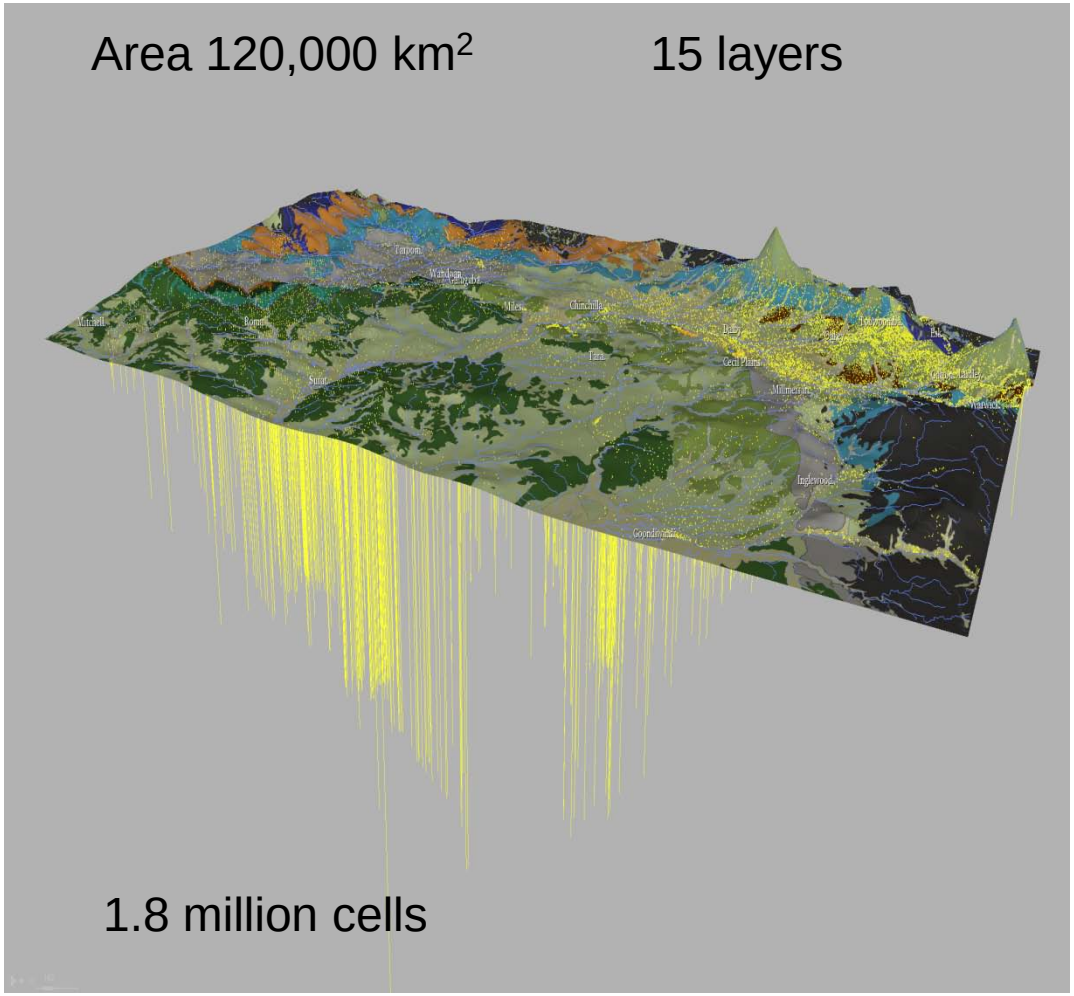
OVERVIEW

- Scope of groundwater impact assessment
- Key assumptions
- Projected groundwater abstractions from Walloon Coal Measures
- Modelled impacts of depressurisation
- Proposed mitigation measures and studies

ARROW ENERGY

SCOPE OF GROUNDWATER IMPACT ASSESSMENT

- Develop a **regional** groundwater model based on most **accurate** data
- **Calibration** to the best available data
- **Predict** groundwater abstraction that **simulates** the operations of Arrow and other CSG proponents
- To understand the **resilience** of groundwater systems and how they will **recover**



ARROW ENERGY
KEY ASSUMPTIONS

Deeper aquifers

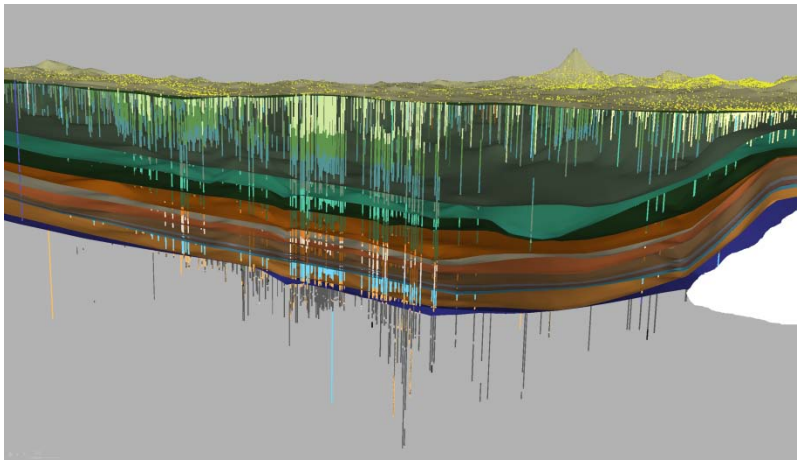
- Comprise extensive thicknesses of **consolidated rock**
- Mainly **sub-artesian** through project study area
- **Recharged** through **infiltration** along Great Dividing Range

Condamine Alluvium

- Forms a surface unconfined aquifer in some parts of the basin
- **Recharged** mainly from Condamine River **seepage**

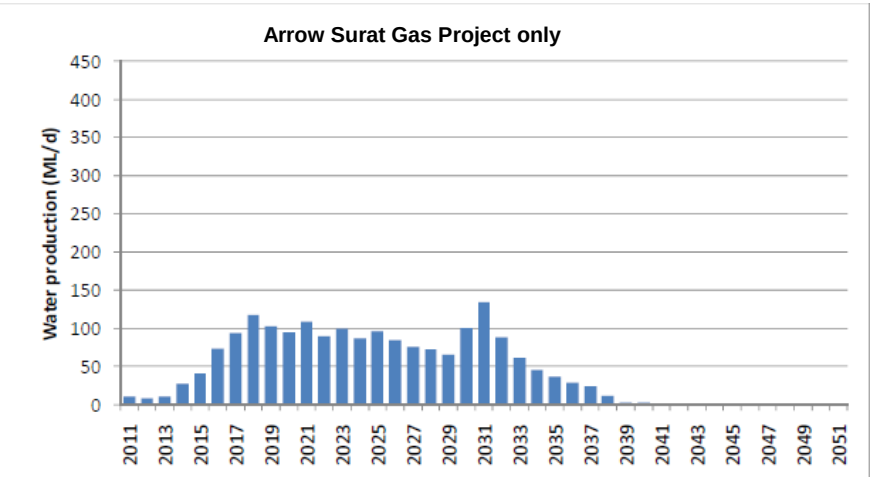
Groundwater movement

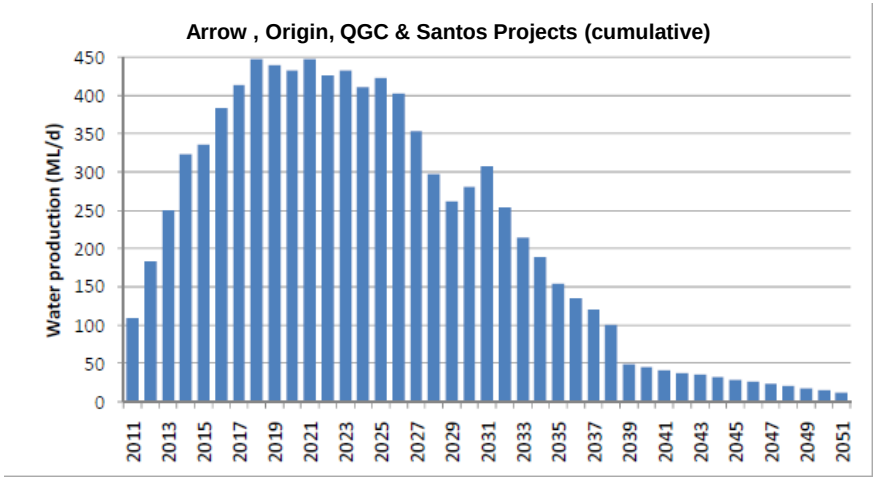
- Movement of groundwater will occur based upon the properties of the aquifers and aquitards.



ARROW ENERGY
ABSTRACTION VOLUMES

- Groundwater abstraction from **coal measures (Walloons)**
- Model development **scenarios** for proposed CSG projects
  - Arrow only 25GL/yr
  - Condamine 40~60 GL/yr “allocated”
  - Walloons 7~13 GL/yr “allocated”
- Aquifers influenced by **multiple** CSG projects.





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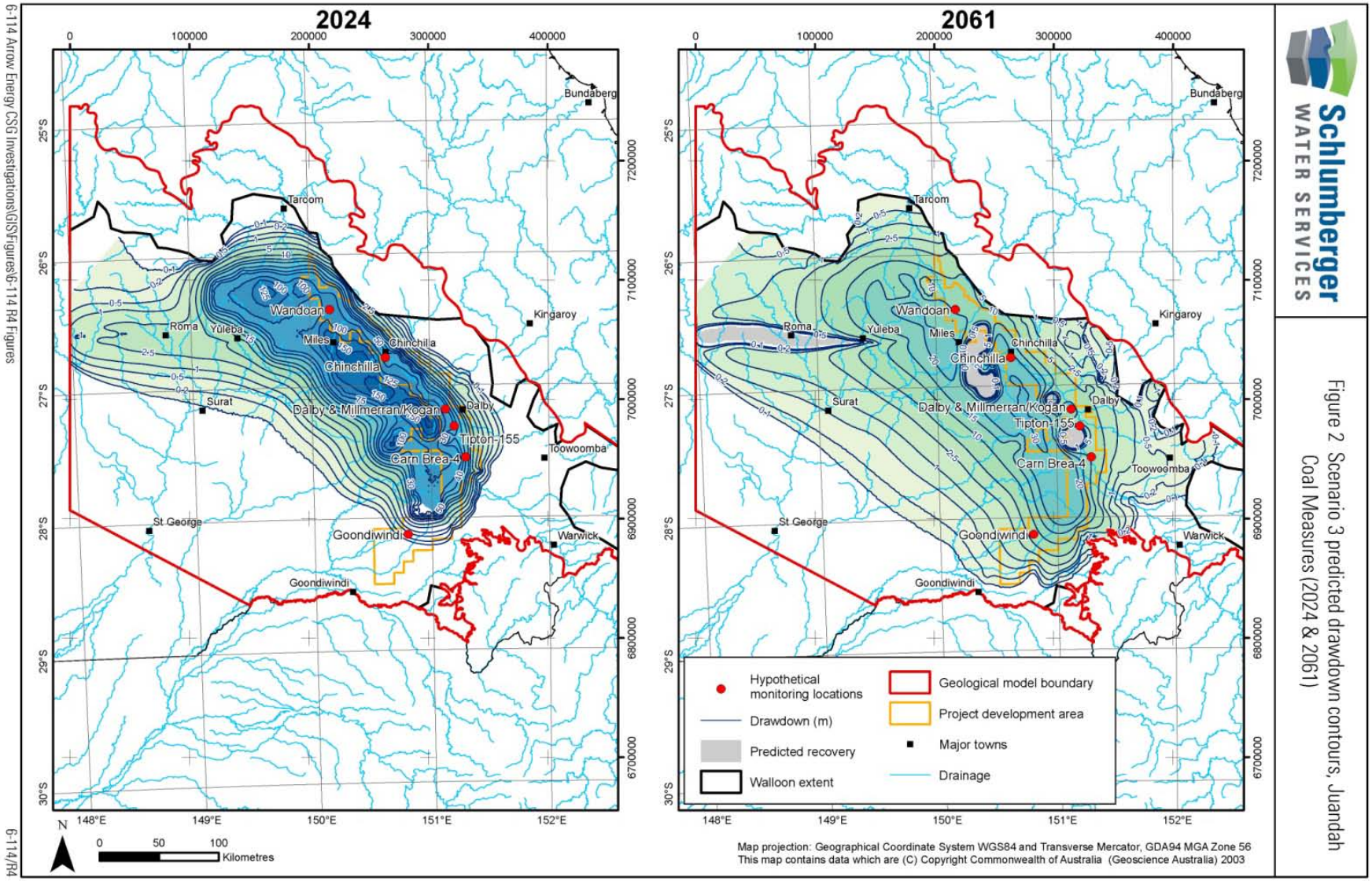
COAL SEAM AQUIFERS
(WALLOON COAL MEASURES)



Schlumberger WATER SERVICES

Figure 2 Scenario 3 predicted drawdown contours, Juandah Coal Measures (2024 & 2061)

- **Peak impact in 2024 with recovery occurring as abstraction winds down**
- **With no mitigation**

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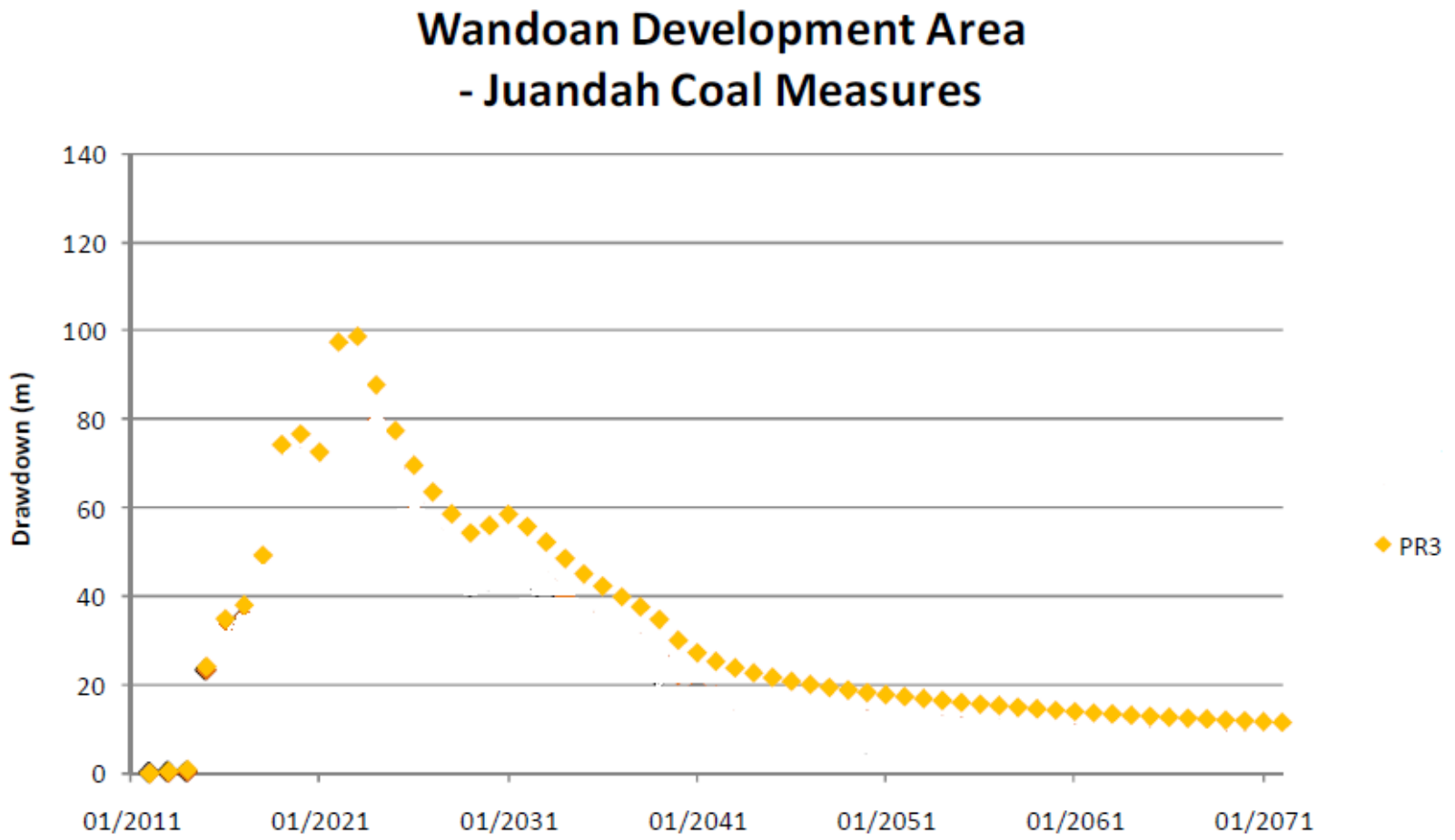
COAL SEAM AQUIFERS
(WALLOON COAL MEASURES)



- **Recovery occurring as abstraction winds down**
- **With no mitigation**

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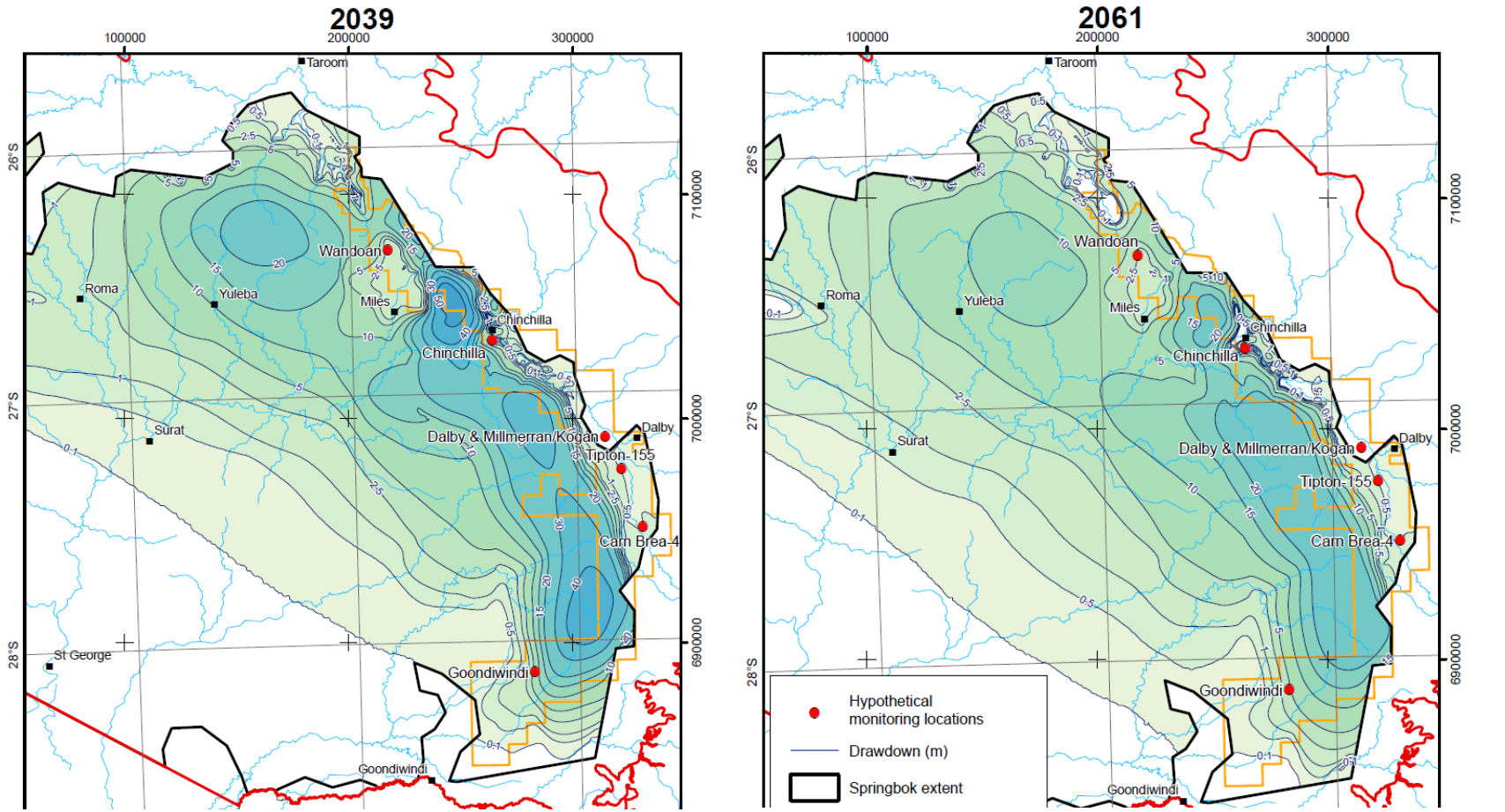
INTERMEDIATE AQUIFERS
(SPRINGBOK SANDSTONE)



- **Peak drawdown of 40 to 50 m**
- **Recovery so that drawdown is generally reduced to 20 m by 2061**
- **With no mitigation**

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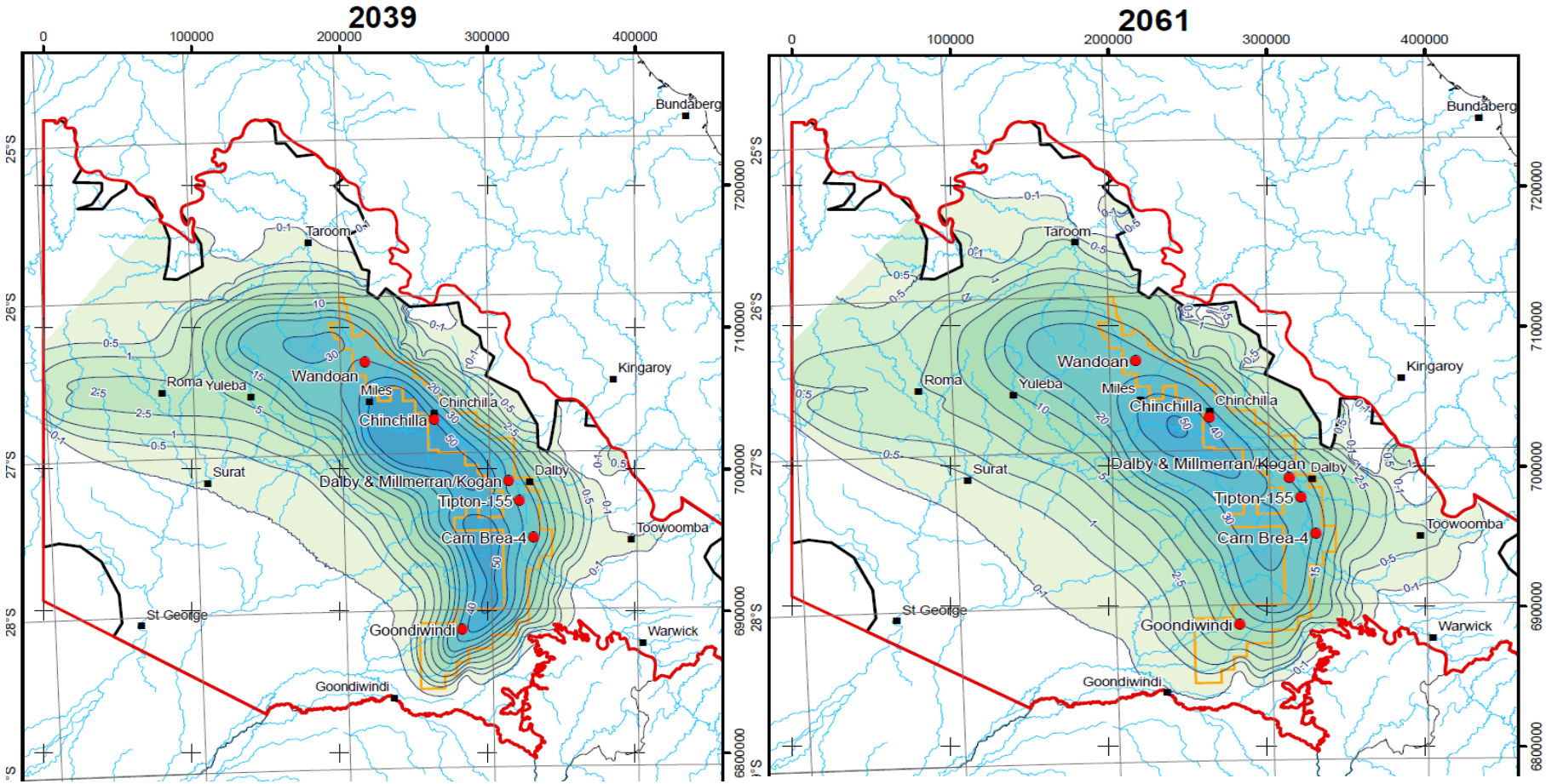
DEEP AQUIFERS
(HUTTON SANDSTONE)



- **Peak drawdown of 50 to 75 m**
- **Recovery to 20 to 30 m by 2061**
- **With no mitigation**

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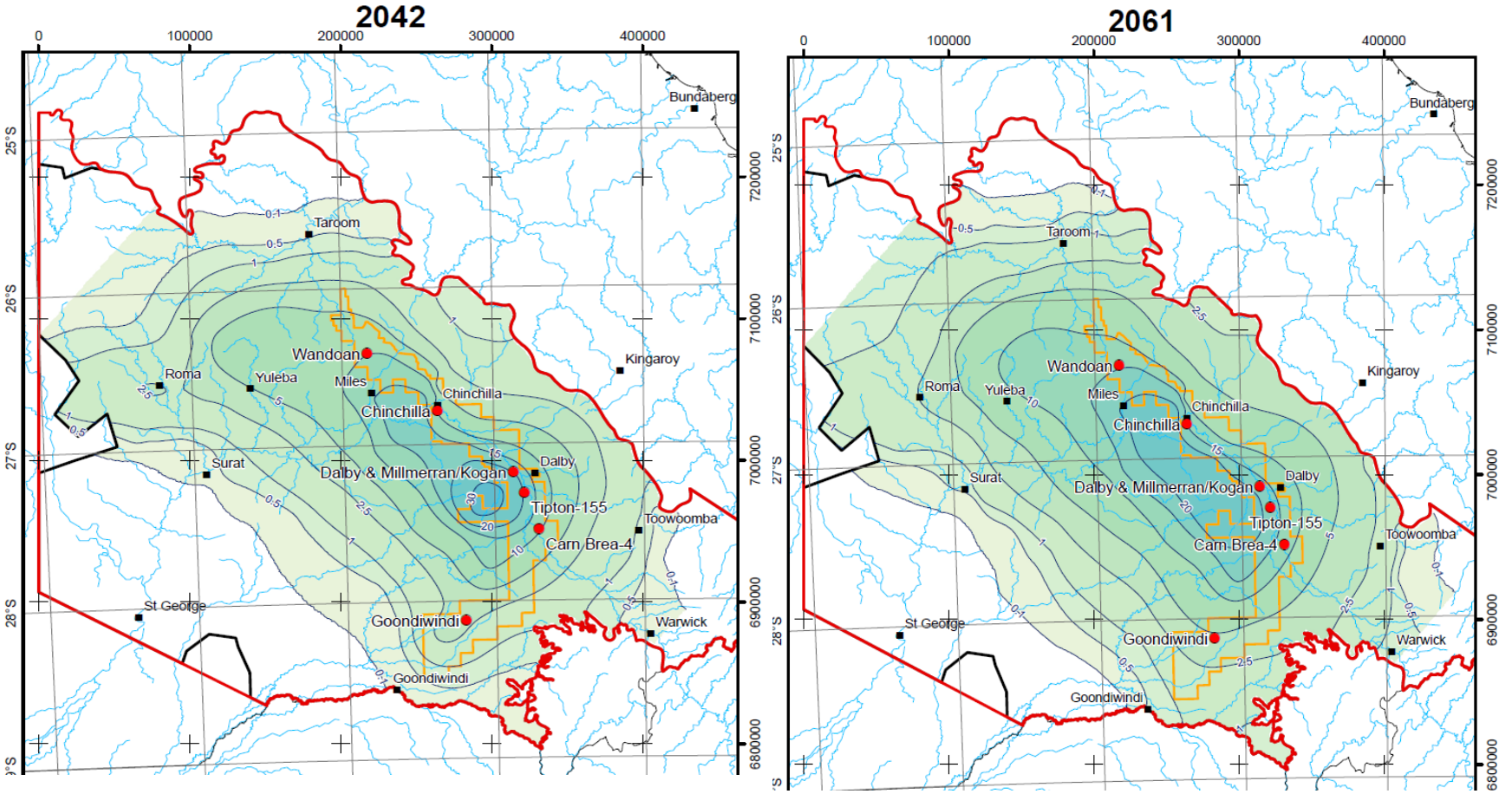
DEEP AQUIFERS
(PRECIPICE SANDSTONE)



- **Peak drawdown of 30 to 40 m in 2042**
- **Recovery to 20 to 30 m by 2061**
- **With no mitigation**

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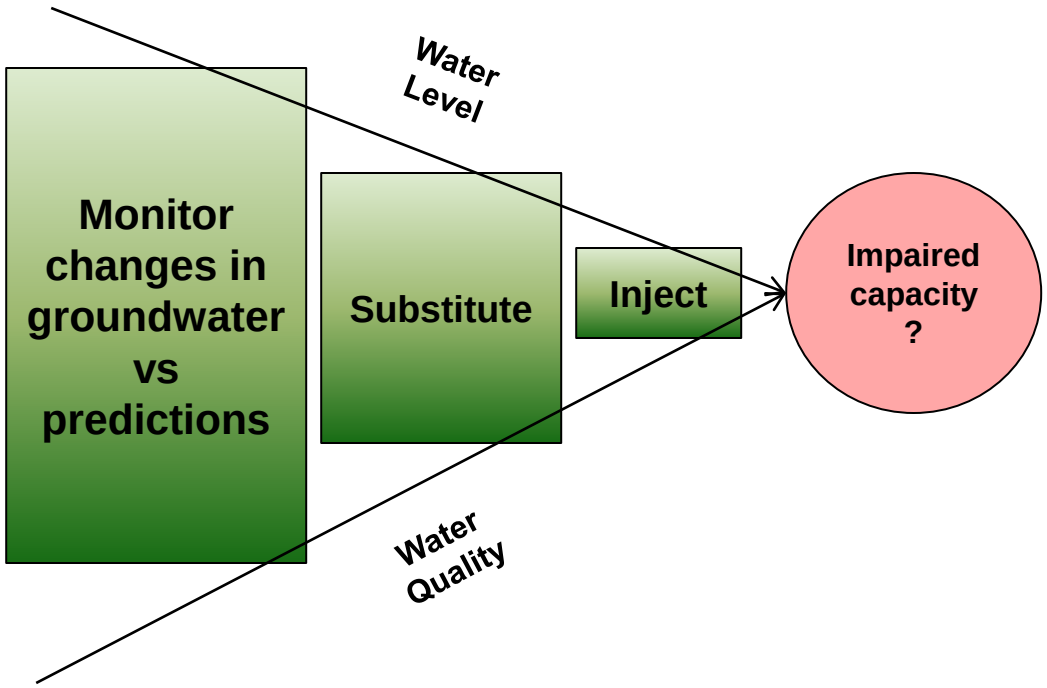
ARROW ENERGY

STUDIES TO ADDRESS POTENTIAL IMPACTS

Preventative Measures

Recovery Actions



- Replace water supply
- Modify pump
- Lower pump
- Deepen bore
- New bore

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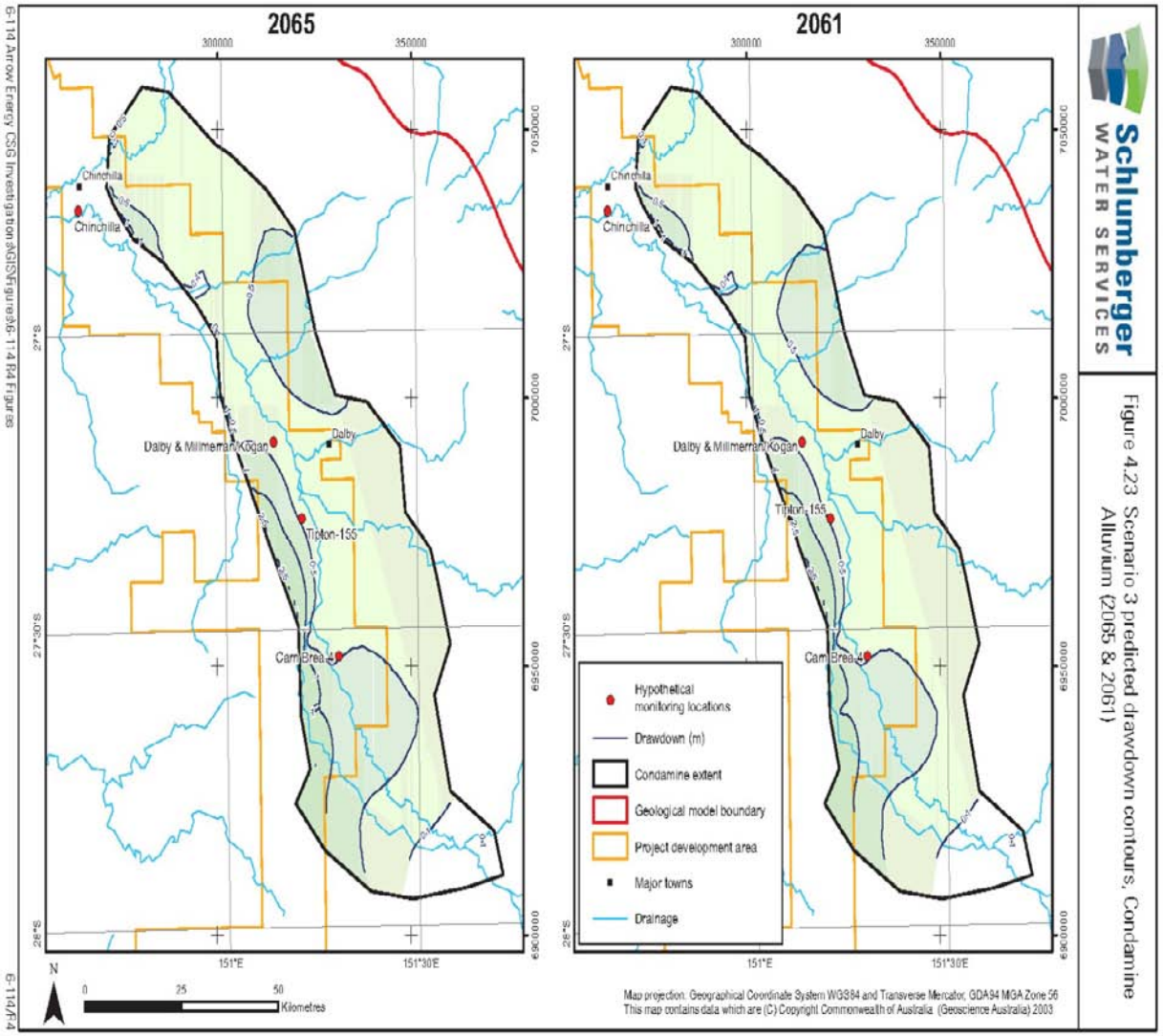
SHALLOW AQUIFERS
(CONDAMINE ALLUVIUM)

- **Cumulative impact** of all CSG proponents **without mitigation**
- Maximum incremental impact in **2065 of ~2.5m** (potential uncertainty range of 1 to 4 m)
- **Impact** in western portion of Condamine Alluvium



- **With no mitigation**

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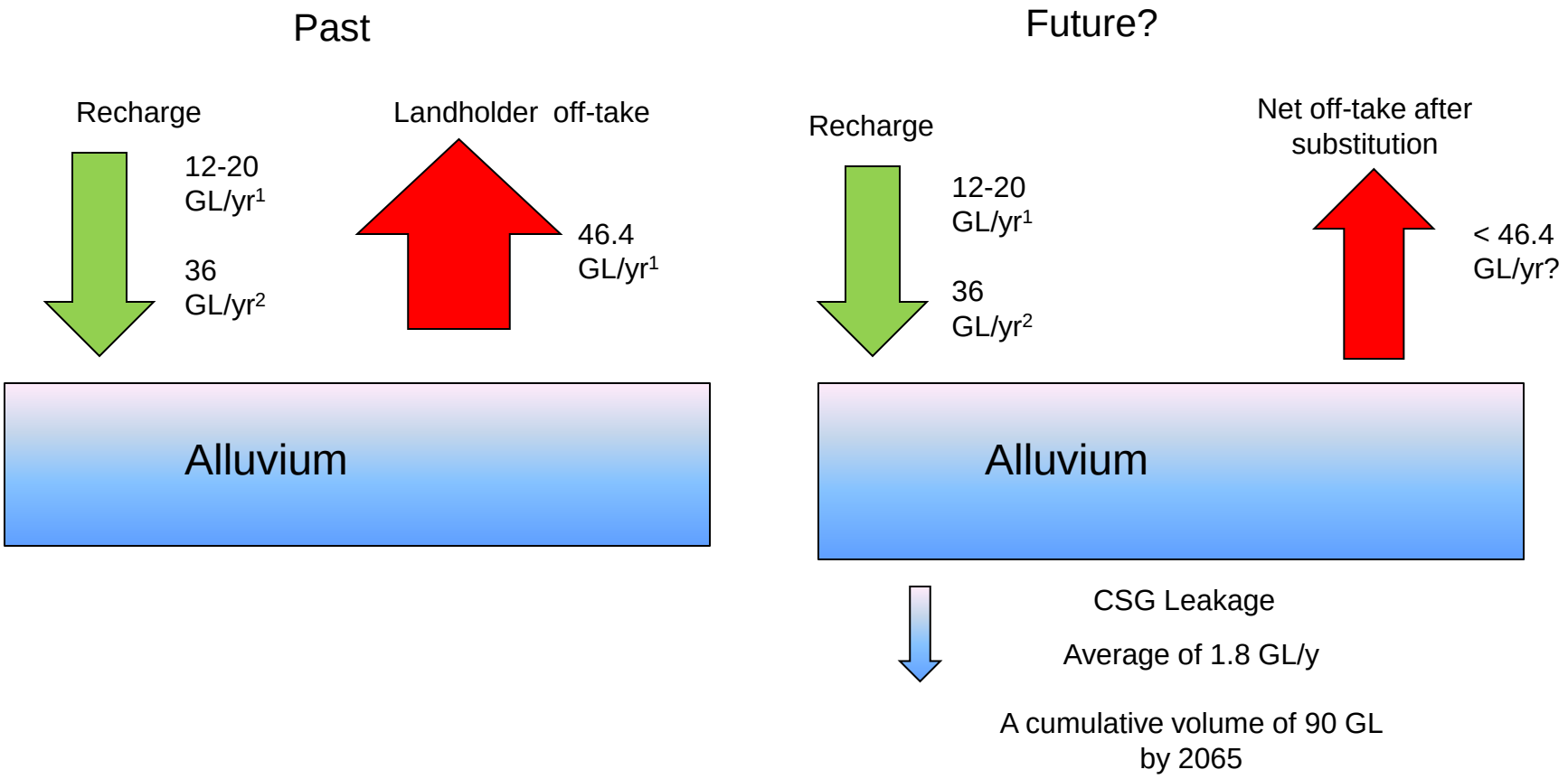
CONDAMINE ALLUVIUM
HIGH LEVEL STUDIES

- Substitution to maintain water balance



1. DERM 2010, central Condamine Alluvium data availability review
2. CSIRO 2008, upper Condamine groundwater model calibration report

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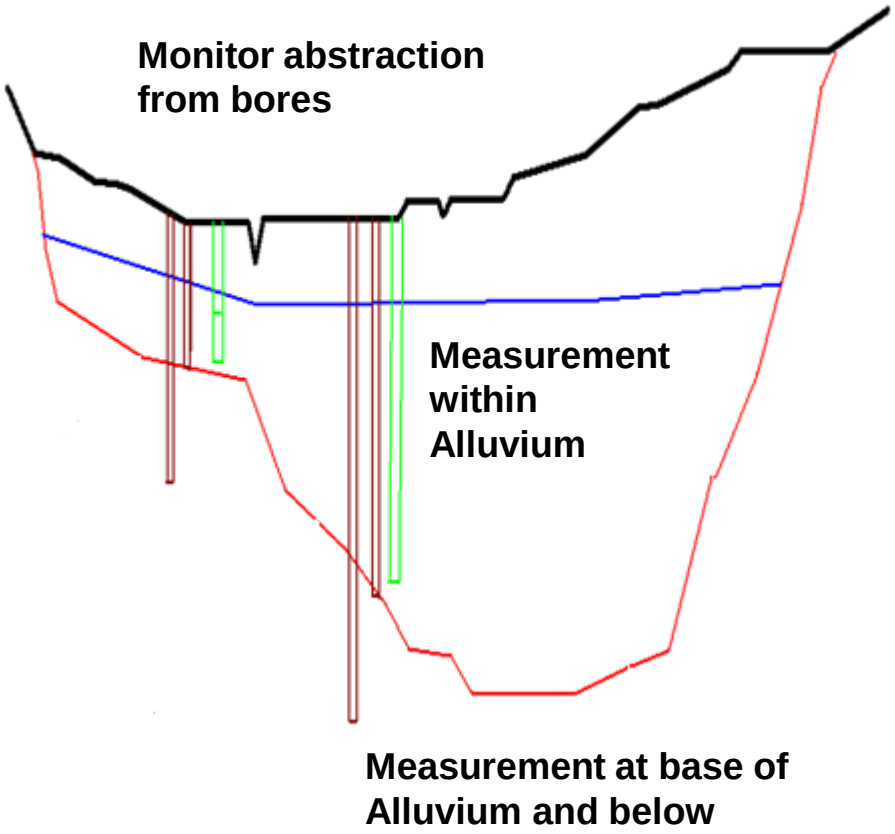
CONDAMINE ALLUVIUM DETAILED STUDIES
CONNECTIVITY TO THE WALLOON COAL MEASURES

- Monitor:
  - **Abstractions** in the Condamine
  - **Responses** in water levels
    - Alluvium
    - Underlying coal measures
  - Geochemistry including:
    - Naturally occurring Isotopes: Rn 222, Kr, Sr, Ar, delta O18
    - CFC, SF6
    - Anion/cation ratios
  - Isotope and isotope/ion ratios to assess **mixing of waters**
  - The **rate of exchange** can be used in future model simulations



HIGH LEVEL STUDIES
OTHER AQUIFERS

Modelling

- expanding calibration datasets & including allocations for aquifer simulation
- modelling substitution & injection scenarios
- uncertainty analysis

- Analysis of model predictions to 90-95% confidence intervals assess both the rate of change and the scale of future changes via hypothesis testing

DETAILED STUDIES
OTHER AQUIFERS

- Hydrochemistry
- Use of hydrochemistry and isotope hydrology to test hydraulic connectivity between aquifers and Walloon Coal Measures

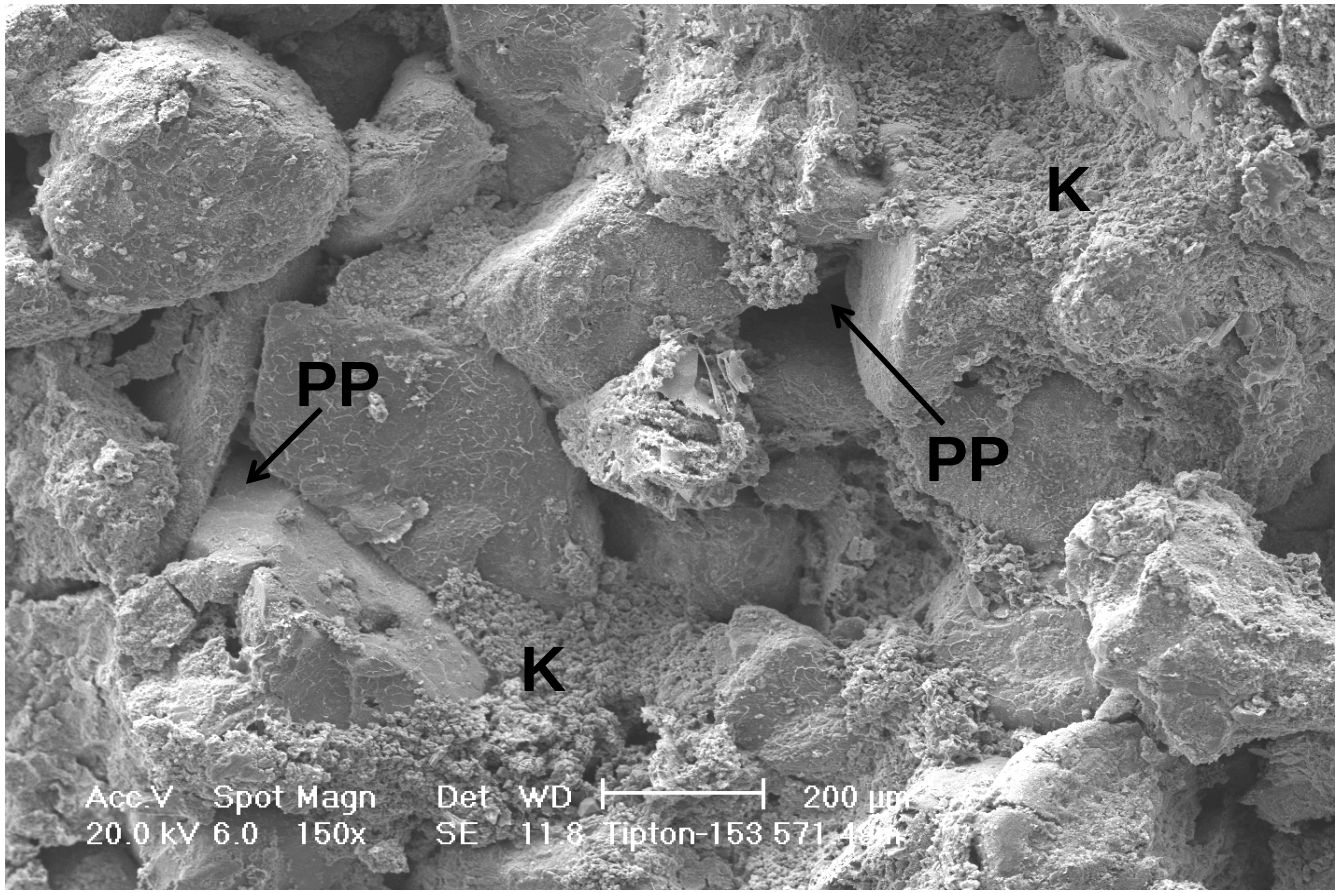
- Connectivity studies of Walloons and intermediate and deep aquifers via hydraulic testing

- Deep injection - Tipton injection study scanning electron microscope results

HUTTON SANDSTONE
SCANNING ELECTRON MICROSCOPE IMAGES

PP = pore space

K = kaolinite



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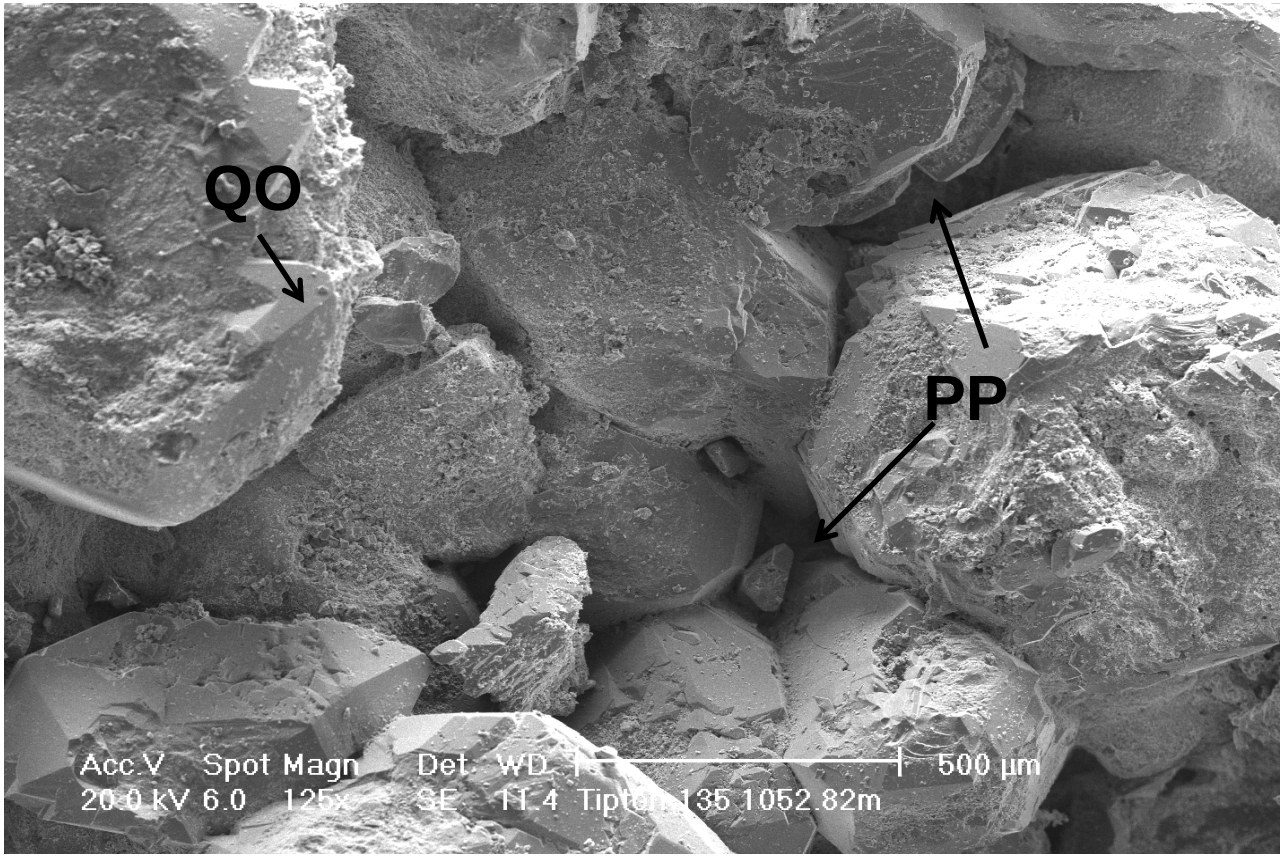
PRECIPICE SANDSTONE

SCANNING ELECTRON MICROSCOPE IMAGES

PP = pore space
QO = quartz



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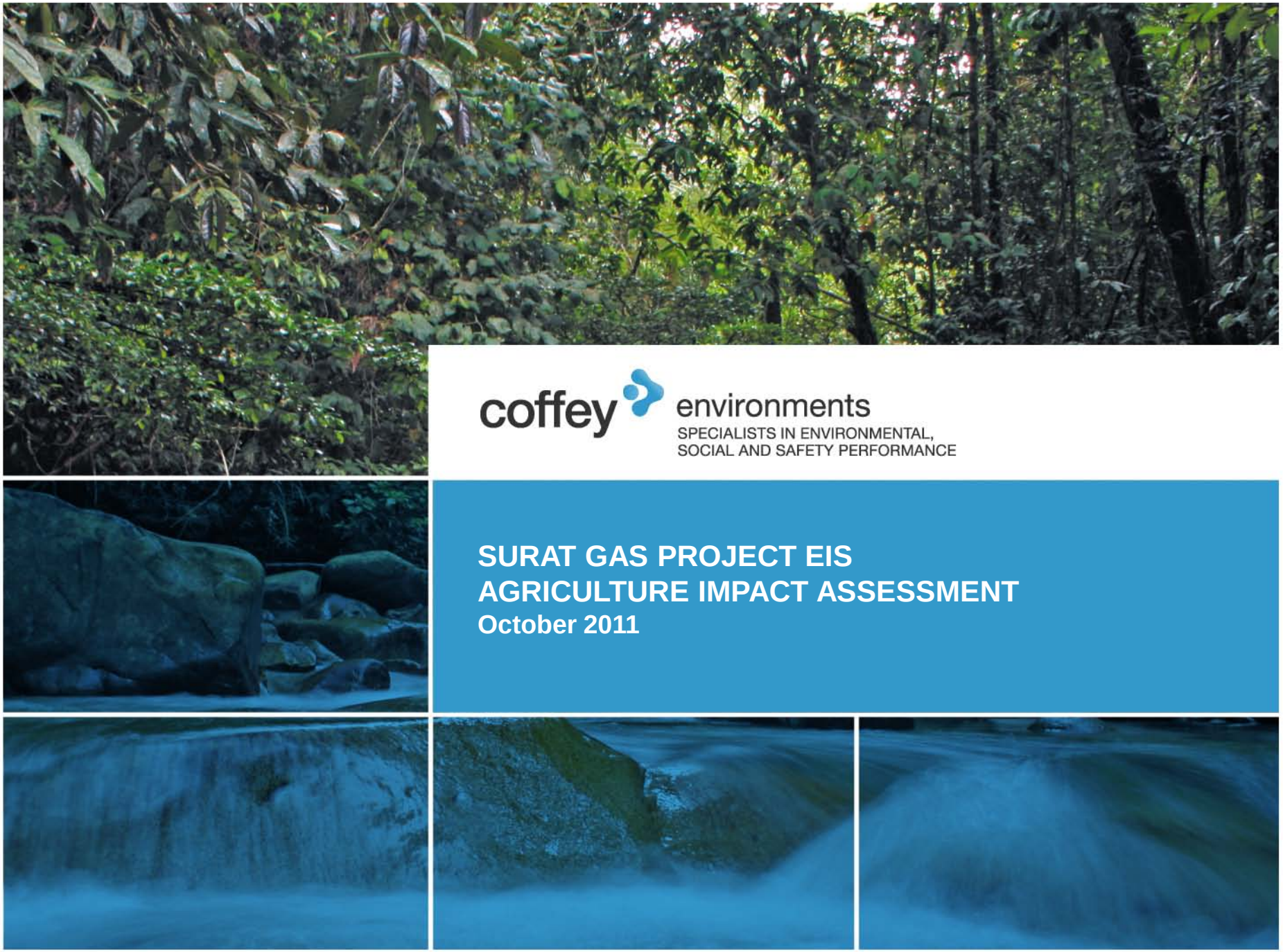
SUMMARY

- Initial Impact Assessment Model results completed for EIS
- Aquifer Simulation Model for mitigation scenarios in preparation
- Field studies are progressing to support mitigation development
- Overarching mitigation measure planning is progressing

Questions

Phase 5 Agriculture impact assessment presentation



coffey environments
SPECIALISTS IN ENVIRONMENTAL,
SOCIAL AND SAFETY PERFORMANCE

SURAT GAS PROJECT EIS
AGRICULTURE IMPACT ASSESSMENT
October 2011

Outline

- Scope of agriculture impact assessment
- Planning policies
- Darling Downs: prime farming country
- Constraints to agricultural development
- Agricultural enterprises
- Potential impacts of CSG development
- Lasting (residual) impacts
- Conclusions and recommendations

Scope of agriculture impact assessment

- Informed by a technical study
- Arrow commitments
  - No development on intensively farmed land (IFL) until stakeholder concerns properly addressed
- Objectives
  - Describe agricultural enterprises/activities
  - Describe farming practices that underpin success/viability
  - Describe key impacts
  - Propose management measures

Planning policies

- Good Quality Agricultural Land (GQAL)
  - Class A and B
- Draft Strategic Cropping Land (SCL)
  - Draft trigger maps define potential SCL
  - Defined at property level through on-site mapping
  - Triggers type 1 and possibly type 2(c) developments
    - Type 1 – temporary diminished productivity
    - Type 2(c) – causes long-lasting impacts that prevent cropping capability (soil structure or contamination)

Darling Downs: prime farming country

- Temperate climate
  - Good rainfall, few frosts
- Relatively flat to gently undulating terrain
  - Condamine River floodplain
- Seasonal flooding
  - Replenishes nutrients and recharges soil water
- Soils
  - Black (clayey) soils (Vertosols, Dermosols)
  - Sandy loams (Rudosols, Tensols and Kandosols)

Challenges to agricultural development

- Giglai
  - Localised waterlogging, irrigation water distribution
- Dissected landscapes/erosive flooding
  - Gullies, drainage lines limit cultivation; loss of topsoil
- Salinity
  - Shallow groundwater, saline soils, saline irrigation water
- Sodic/impermeable soils
  - Impeded subsurface drainage, perched water tables
- Water supply
  - Surface water (drought exposed), groundwater

Agricultural enterprises

- Rangeland grazing
- Dryland broadacre farming
  - Cereals, pulses and cotton
- Irrigated broadacre farming
  - Surface, spray and localisted
- Horticulture, vineyards, agro-forestry
- Animal industries
  - Feedlots, piggeries, dairies and poultry farms
- Each enterprise is unique with its own challenges and sensitivities; some are more tolerant to change than others

Potential impacts of CSG development

- Loss of arable land
- Crop yield (productivity)
  - Disturbance of soils
    - Inverted soil horizons, breakdown of soil structure
    - Compaction
  - Farm workability
    - Headlands, cultivation islands and controlled traffic runs
    - Irrigation infrastructure (head ditches, tail drains, booms)
    - Inconvenience of working around CSG infrastructure

Potential impacts of CSG development cont'd

- Farm management
  - Operating overheads including management of CSG activities
  - Coordination of activities (spraying and withholding periods)
- Amenity
  - Contractors and employees entering and working on properties
  - Disruption to lifestyle
  - Noise
  - Dust
  - Visual impact of CSG infrastructure

Potential impacts of CSG development cont'd

- Project development area – 8,600 km^2 (860,000 ha)
  - GQAL 59%
  - Potential SCL 49%
- To be developed on land to be purchased by Arrow
  - Integrated processing facilities (~223 ha per facility)
  - Central gas processing facilities (~18 ha per facility)
  - Field compression facilities (~0.50 ha per facility)
- Production wells and gathering systems
  - 2-3 % of typical 160 acre (~65 ha) production spacing during construction i.e., ~1.95 ha per 65 ha production area

Lasting (residual) impacts

The majority of impacts are temporary in nature, during construction and rehabilitation, however some may be lasting in nature:

- Changed operations (reduction of cultivated/irrigated area)
  - Installation of coal seam gas infrastructure
  - Ability to develop or modify farm plan
- Potential for diminished productivity
  - Unsuccessful rehabilitation (soil structure, surface relief)
  - Effects may not be known for some time
- Changed land use
  - Rehabilitation of production facility sites to sustainable land use e.g., grazing land

Lasting (residual) impacts cont'd

Example of unsuccessful rehabilitation

Example of successful rehabilitation

coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

Conclusions and recommendations

- Plan development to integrate with farming practices, including:

A. Design and planning objectives
   - Twelve objectives aimed to design out impacts where possible

B. Specific mitigation and management measures
   - Accepted practice

C. Rehabilitation trials
   - Techniques and treatments to return land to former use/productivity

D. Develop assessment method for productivity
   - To measure success of rehabilitation

E. Rehabilitation of soils fundamental to long-term productivity

Phase 5 Summary of question and answer session

Surat Gas Project

Community information sessions 24-28 October 2011

Introduction

In October 2011 Arrow Energy (Arrow) held a series of community information sessions to provide an update on the Surat Gas Project, and to communicate the preliminary findings of, and the proposed strategies for, the associated Environmental Impact Statement (EIS). Questions and answers from those sessions were captured by JTA Australia and are presented in this document.

The purpose of these meeting notes is to reflect the questions asked and answers provided during the community meetings. While the notes include some paraphrasing and summarising; every effort has been made to preserve the integrity of the discussions.

Questions varied across the six sessions. To ensure that valuable information is shared amongst the communities of the Surat Basin, these notes contain questions and answers asked across all sessions.

The Surat Gas Project community information sessions were held from 24 to 28 October 2011 at:

- Goondiwindi 24 October
- Millmerran 24 October
- Dalby 25 October
- Cecil Plains 26 October
- Chinchilla 27 October
- Miles 28 October

The proposed project is Arrow's largest gas exploration and development program in the Surat Basin and involves continued exploration in the basin to identify the most economic and environmentally acceptable areas for future gas production. The areas covered by the project extend from Wandoan to Dalby and south to Millmerran and Goondiwindi.

Copies of the presentations given at the October community information sessions are available on the Arrow Energy website at **www.arrowenergy.com.au**.

How to read these notes

Questions and comments from the audience are in bold type. The unbolded responses are from Arrow staff. In some cases responses have been summarised. In others, additional information is included to provide further context or explanation; this information is italicised following the answer.

Arrow will hold another round of information sessions in April or May 2012 to coincide with the public exhibition of the EIS. The purpose of those sessions will be to present the EIS and to assist the community to understand its results. Arrow will advise of session dates nearer

to the time. If you have questions or comments about the project or these meeting notes, please contact the project team during working hours on:

freecall 1800 038 856
email: suratgas@arrowenergy.com.au
post: Surat Gas Project, Reply Paid 81 Hamilton QLD 4007

Acronyms

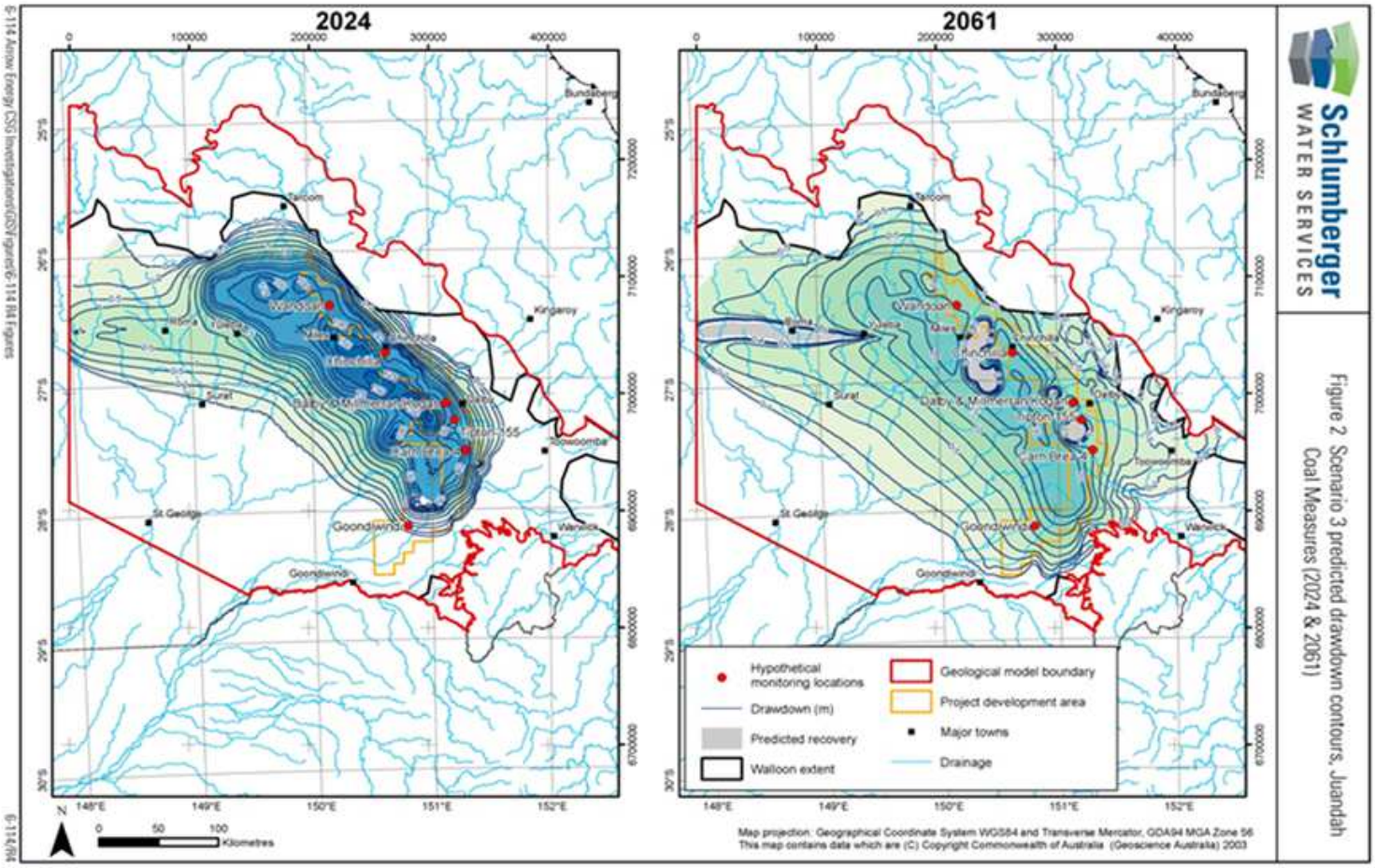
ATP	Authority to prospect
CSG	coal seam gas
dB	decibel
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DNR	Department of Natural Resources
EA	environmental authority
EIS	environmental impact statement
EMP	environmental management plan
FID	final investment decision
GAB	Great Artesian Basin
GJ	gigajoules
kPa	kilopascals
LNG	liquefied natural gas
PJ	petajoules
PL	petroleum lease
psi	pounds per square inch
QWC	Queensland Water Commission
RO	reverse osmosis
SAR	sodium absorption ratio
TDS	total dissolved solids
TRC	Toowoomba Regional Council

Conversions
1 megalitre (ML) = 1,000,000 litres
1 gigalitre (GL) = 1,000,000,000 litres

Queensland Government Acts mentioned:
Environmental Protection Act 1994
Petroleum and Gas (Production and Safety) Act 2004
Mineral Resources Act 1989
Water Act 2000
Water Supply (Safety & Reliability) Act 2008

Figure 1 – Diagram showing predicted impacts in 2024 and 2061 with no mitigation.

COAL SEAM AQUIFERS
(WALLOON COAL MEASURES)



- Peak impact in 2024 with recovery occurring as abstraction winds down
- With no mitigation

Figure 2 – Diagram showing example of potential well-field layout

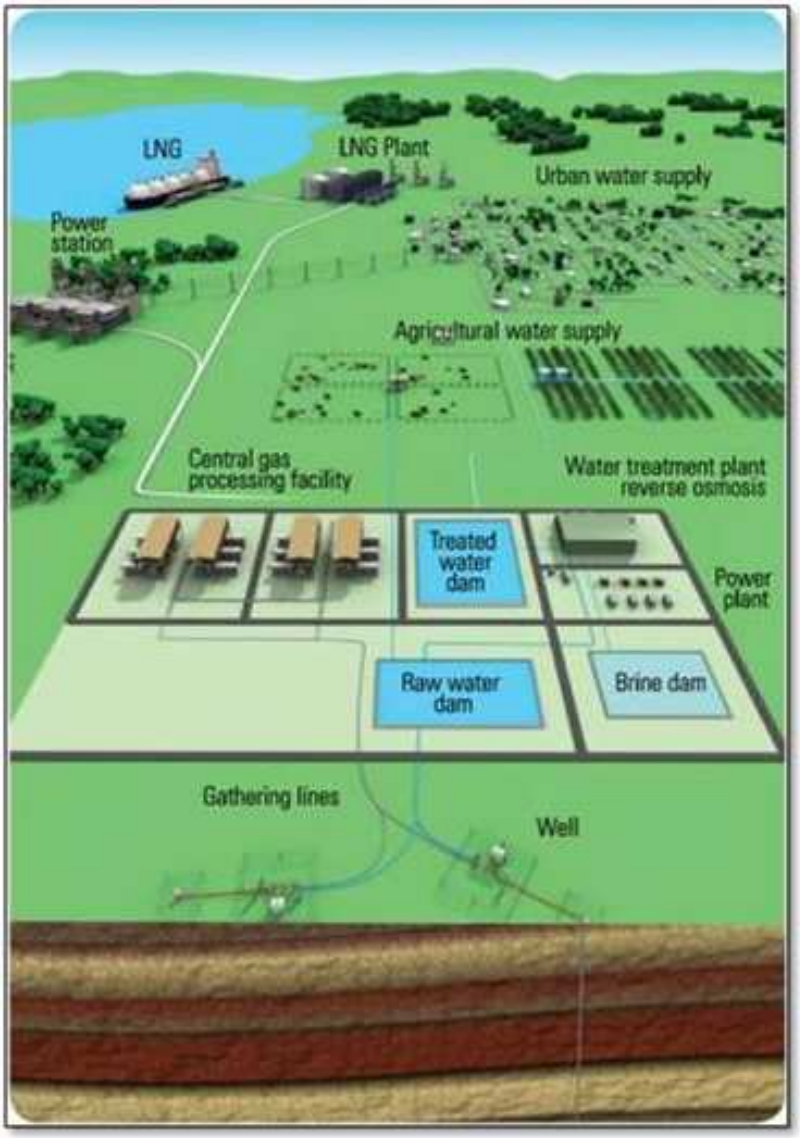


Figure 3 – Map showing Surat Gas Project area

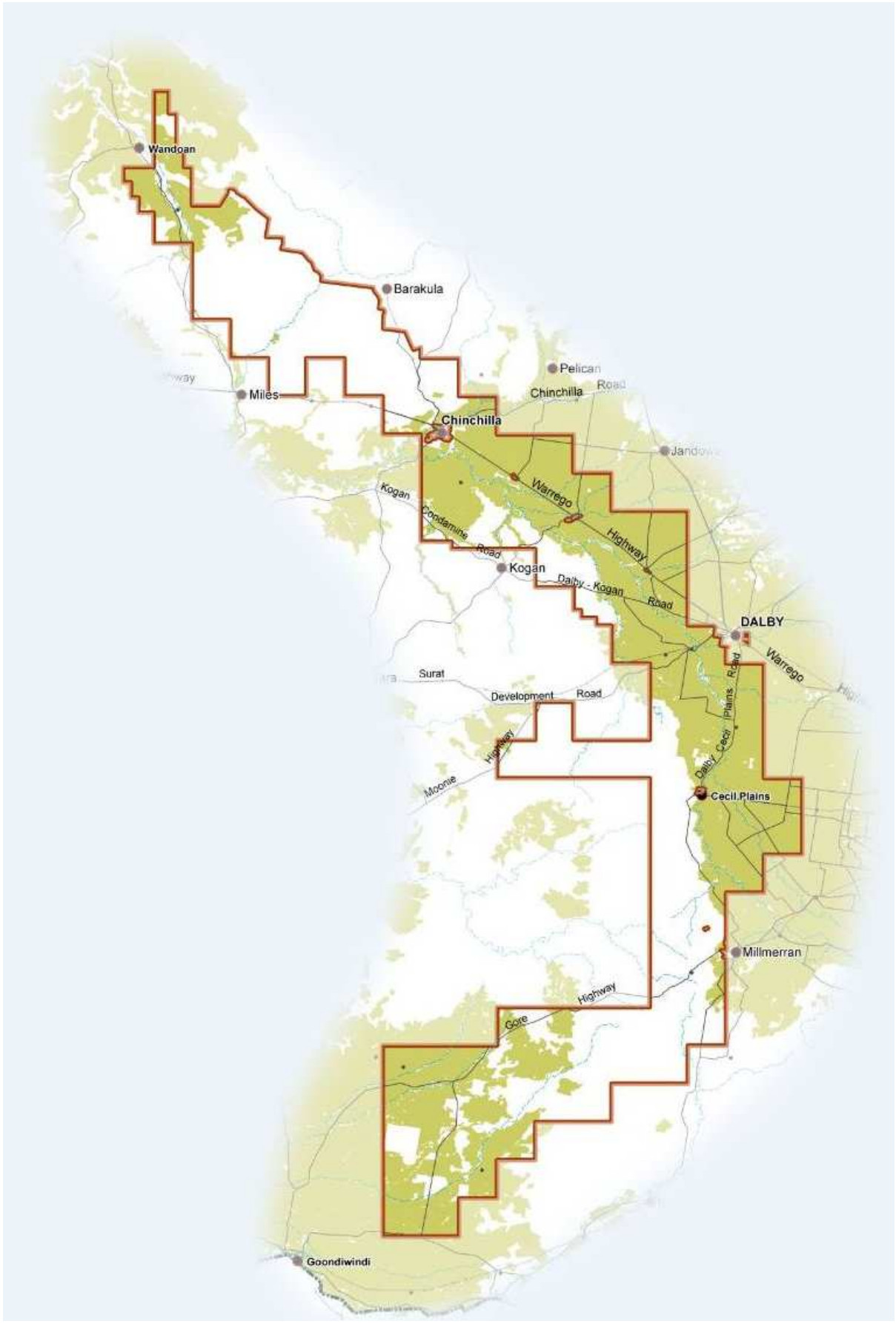


Figure 4 - Moranbah gas processing facility

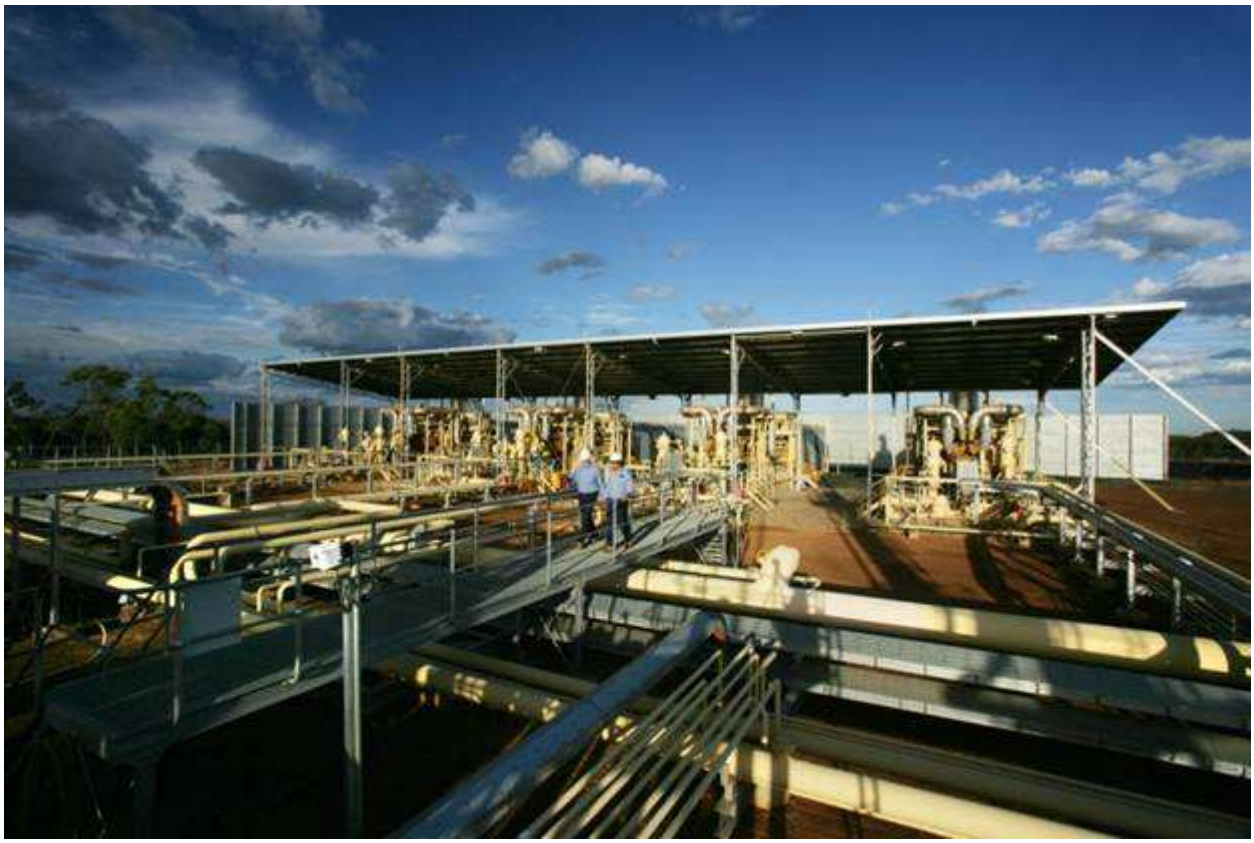
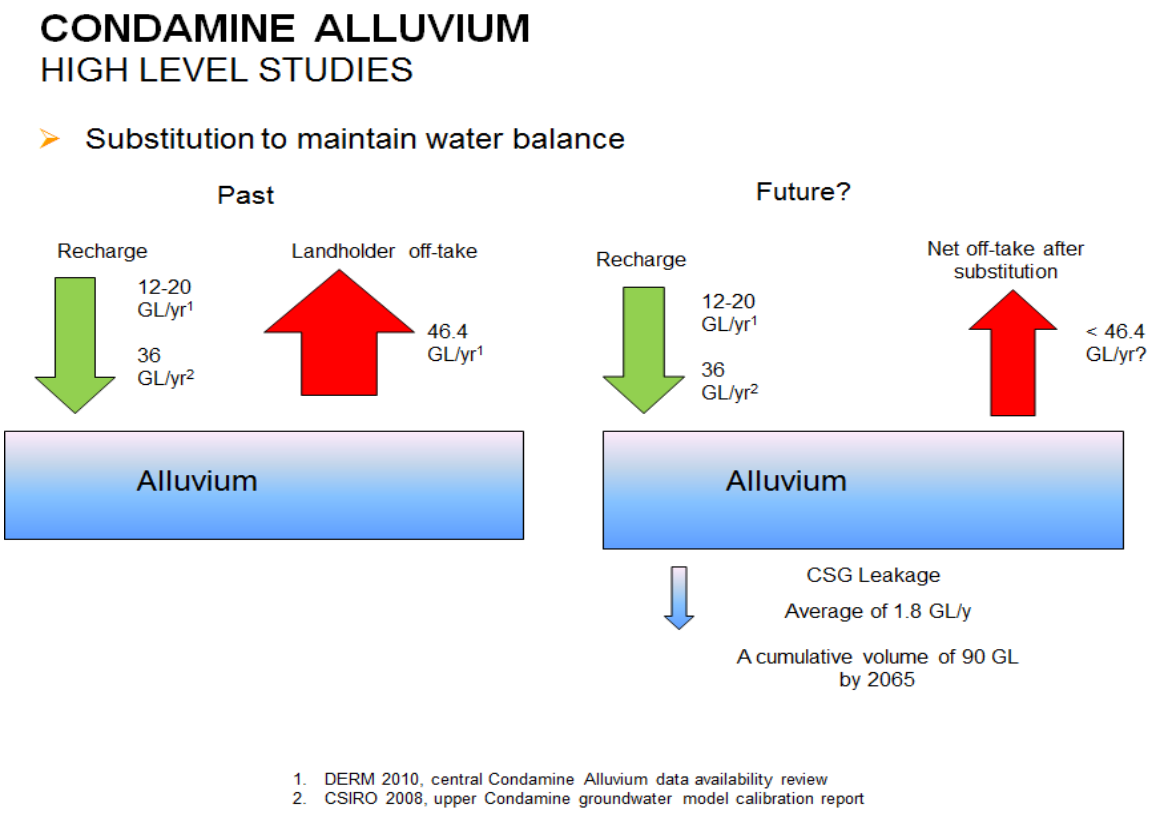


Figure 5 – Slide showing substitution to maintain water balance

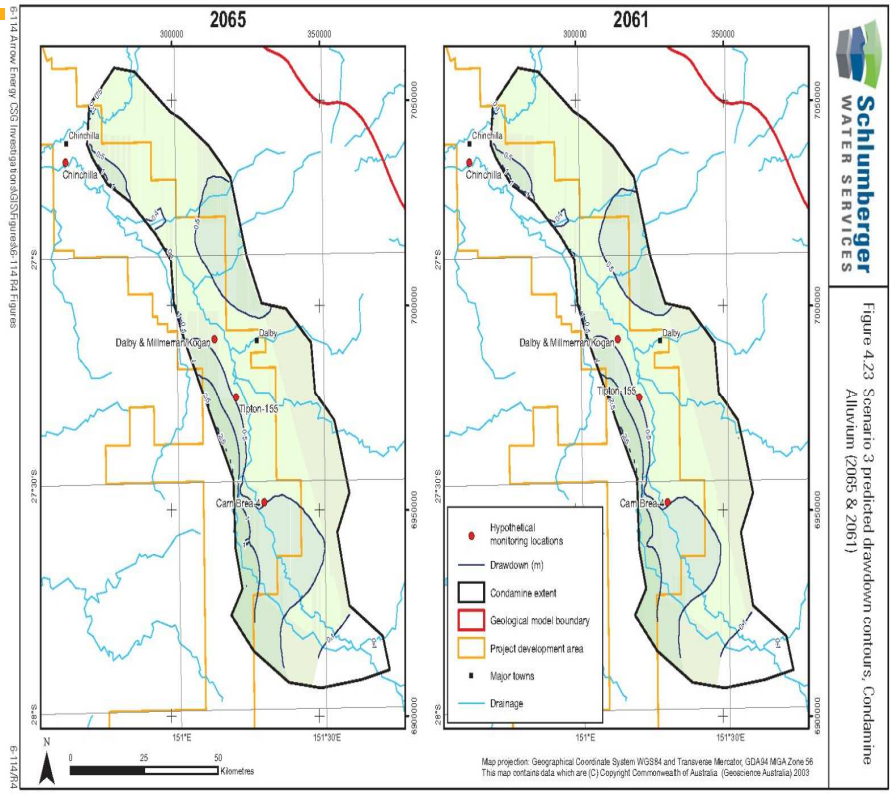


1. DERM 2010, central Condamine Alluvium data availability review
2. CSIRO 2008, upper Condamine groundwater model calibration report

Figure 6 – Slide showing predicted impacts on the Condamine Alluvium without mitigation

SHALLOW AQUIFERS
(CONDAMINE ALLUVIUM)

- **Cumulative impact** of all CSG proponents **without mitigation**
- Maximum incremental impact in **2065 of ~2.5m** (potential uncertainty range of 1 to 4m)
- **Impact** in western portion of Condamine Alluvium



- **With no mitigation**

arrow energy go further

GOONDIWINDI

Date:	24 October 2011	
Venue:	Goondiwindi Waggamba Community Cultural Centre	
Presenters:	Carolyn Collins, General Manager Environment and Water	Arrow Energy
	Darren Stevenson, Asset General Manager, South	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. Could you elaborate on the subject of confidentiality agreements between Arrow and landowners?

That is actually quite a hot topic and a number of people have raised it. Arrow doesn't have any objections to the confidentiality clause being removed at the request of the landowner. This has been Arrow's position for a number of years.

Arrow does have this clause in some agreements at the request of the landowner. It is always optional in Arrow's view, or at least has been optional for a number of years now.

MILLMERRAN

Date:	24 October 2011	
Venue:	Millmerran Community & Cultural Centre	
Presenters:	Darren Stevenson, Asset General Manager, South	Arrow Energy
	Paul Neilson, EIS Manager	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **How many pages long will the EIS document be?**

   When Arrow is preparing the EIS it doesn't really look at the length of the document so I can't give a definite answer. It will be at least several hundred pages, including the EIS itself and the technical studies.

   Correction – the EIS is likely to be several thousand pages.

2. **Can I assume that the discovery process for the EIS will uncover everything of relevance (for example I have a licensed bore and a water entitlement)? Should I volunteer to Arrow that I have an irrigation bore I am concerned about?**

   Part of the process of the EIS is to look at groundwater and Arrow's potential impacts and usage. However, there are a number of other processes that apply to Arrow's tenures in general. One of those is developing an understanding of all the bores that are in existence out here, and also starting to take steps towards doing baseline assessments on all bores in tenures where we are going to be producing water.

   So yes we have that in our database, our model has been built from all the available information including registered bores and geological cores that have been taken. If the Department of Environment and Resource Management (DERM) already has details of your irrigation bore then Arrow will know about it.

3. **How long is the consultation period for the EIS?**

   The EIS will be out for public consultation for a period of between six and twelve weeks. Depending on the feedback during that initial round, there may be a supplementary EIS. Arrow is currently assuming that a supplementary will be required by the Queensland Government as it has been imposed on the other three proponents.

4. **Will you be supporting the consultation with information sessions or other activities?**

   There will be detailed presentations on specific things that Arrow is doing at the moment, particularly around groundwater and the impacts on agriculture, and how to mitigate the impacts on agriculture as well. You will be able to find these presentations on the Arrow website (www.arrowenergy.com.au).

   Arrow will also be doing another round of displays and information sessions after the public release of the EIS documents (early next year) to run through the specifics of exactly what you can expect to find in the EIS document. We won't be presenting the details of every single thing in the EIS, but the summaries are starting to come out now. Have a look at the Arrow website; there is a lot of information already on it.

5. Bow Energy is an offshore company isn't it?

No, Bow Energy is an Australian company. If you are a keen watcher of the Australian stock market, you might remember that Bow and Arrow were established by the same group of people, and were then split in half. Arrow was the company that held the CSG assets, and Bow was the company that held the conventional oil and natural gas assets.

After they split apart, Bow decided to move into CSG because that was where the industry was heading. Since then, Arrow has been bought out and subsequently became interested in Bow. So in a sense the two companies are just reverting to the original situation where they were operating as one.

6. Re salt, I understand you've got a long term resource, although if you are exporting it all over the world I guess it won't last as long as if we were using it here. It's said that you are going to sell some of that salt, but you'll never sell all the salt that is going to come out of this will you?

I'll get Scott to talk about it in detail, but the problem is that we don't have enough salt. I say that only half-jokingly; it takes a lot of salt to convince someone to build a factory to convert it into products.

We are in discussions with a couple of the larger companies that supply chemicals all over the world. And I'm talking about chemicals that aren't particularly nasty but used for things like glass manufacture. There is a lot of glass used in the automotive industry for windscreens and other items like that, and we know a lot of that industry happens in south-east Asia.

One of the companies that we are talking to at the moment about producing salt products from our waste water is looking to export all that salt to South-East Asia for use in the automotive and glass manufacture industries. That is just one of the potential uses. Australia is a net importer of salt, which is hard to believe.

Cheetham Salt is an Australian company that has drying beds all over Australia e.g. in NW Western Australia. Cheetham produces a lot of the salt that is used in Australia, but we still import a lot so there is a market for the salt that we are able to produce from our water.

7. Can you explain a bit more about the groundwater and substitution and how you are going to manage that?

That is a pretty open ended question and I probably can't answer all of it, but I'll start with the substitution and how we came up with that as part of our strategy.

We recognised the extraction of water required for the CSG industry would have an impact, and that we couldn't do that in isolation. The agricultural sector in particular was obviously concerned, as most of you are trying to wind back your water production to reach sustainable levels. We realised we'd be run out of town if we just said *right that's our water and we are transporting it out of the region* so we decided on a strategy that is designed to minimise the net take of water from the basin.

Substitution of allocations is one of the methods of achieving that. So when we talk about substitution of allocations what we mean is that we will take the slightly brackish water that is in the coal seams, treat it, and then deliver it in a pipe to someone who already has an

allocation for water. There are still some regulatory issues around that e.g. production and use, and matching those up.

There are other methods that we expect we will have to use such as reinjection and use on our own farm. Currently we also supply water to power stations and for other industrial uses. In brief, substitution is when you guys stop taking water, and instead we supply that water to you.

8. **I want to talk about cross aquifers. At the last meeting you indicated you would be extracting water from the Walloon Coal Measure and indicated that you might be giving some of that water to the Condamine Alluvium for example. Now in theory that is good but the reality is that the Condamine Alluvium is over-allocated already. Over the last three years we've been seeing reductions in our allocations on that aquifer. For those people who are already on the Walloon Coal Measures, how do you actually guarantee they are going to have a sustainable water supply going forward?**

   There is absolutely no doubt that the Walloon water users are going to be impacted by our activities. We don't try to hide behind that, we don't give you a BS line. But you will get priority to the water.

   We have a legal obligation but it is also part of our plan to make sure that we replace the water in the area that we take it from. We would not leave you dry to send water 50-100kms up the road. 'Make good' is the language in there.

9. **Do you know how much of the current agricultural water is taken out of the Walloon Coal Measures? And are you looking to balance that up? For example, if I've got a 500 ML licence, I'm entitled to get some of that water back if you're on that same aquifer, but what happens if the total licence is 5 GL and you are extracting 10 GL? How do we ensure the long term sustainability of the aquifer if you are outstripping the current allocations from that aquifer, but still giving (for example) 5 GL to another aquifer?**

   I guess what you are saying is that it is relatively straight forward while there is still water there and we are treating water that you would otherwise have pumped. In the longer term we are going to have to move water around to make good. We won't be pumping and extracting from every area in the basin at the same time; that will happen over phases. We don't need to do that, so that will be one of the options for obtaining water.

   Over time, there will be some recharge. We are still in the modelling and data gathering phase, but it looks like the recharge rate is better than expected and we should be able to bridge the gap on a local basis without having to haul water from (for example) Wandoan down to here.

10. **You say that (recharge) water doesn't move very fast in the Walloon Coal Measures. How are you going to get it back in there? The recharge might be better but it would take a long time wouldn't it?**

    In the time that it will take for the water to recharge the Walloons, it will be incumbent upon us to ensure that water supply is provided from somewhere else, whether that is from another

part of the project that is being developed, and water is being transferred to that area. That could be one option.

11. How would it get there?

It would go via a pipe network.

12. What is the quality of the water that goes back in? Is it very salty?

The water that we'll put back in will be better quality than the water that comes out. We can't give you an exact composition because we'll need to match it to what's in the aquifer or what suits your land. So if it is reinjection we can't just put clean water down into the ground, it has to match what is in the ground...and the same with farming. That is one of the reasons that I talked before about the Daandine and Theten farming project. A big part of that trial is for us to get the remineralisation of the water right. If the water goes straight through a reverse osmosis treatment plant, it won't have enough of the right minerals in it which means it can strip minerals out of the soil. We've got to get that right, and we are using calcium chloride at the moment to amend the sodium absorption ratio (SAR).

13. I've got a government list here with a lot of chemicals on it. If you pump any of these into the coal structure, how far will they travel? And secondly, when they are in the coal structure and it is a drought period and the ground cracks, is that going to go down and cause more gas to be released as well as pollution?

When the ground cracks it will neither affect the integrity of the well nor the integrity of the coal seam reservoir. The wells are designed in such a way that they are immune to those types of stresses. Generally speaking, the top of the coal is 150 to 200 metres underground and there are alluvial aquifers, sands, muds, all sorts of strata on top of it.

14. But in some places there aren't any strata on top of the coal.

Yes there are places where the coal is shallow, but there isn't any gas in those seams.

15. I have heavy black soil under my ground. When we drilled there for water years back you could smell gas in the bore when it was opened up.

Sorry I shouldn't have talked in absolutes. Yes, there is gas, there will be gas, but it won't be of interest to us. There won't be enough gas in a shallow coal seam for a CSG project. I don't know about other companies but if they do it the way we do they won't be interested either.

Note too that methane has no odour, so it is suggested as a possibility that gas able to be detected by smell may have been hydrogen sulphide (rotten egg gas) which can occur, for example, in stagnant pools of water.

16. When the coal releases the gas, does the land subside? Can there be subsidence after it has been extracted?

In theoretical terms, yes, as we are taking the water out of the pores in the coal. This "porosity" of the coal is a only a couple of per cent, so it is not like in a loose sandstone aquifer where the water is a large part of the volume that is there, and when you release that pressure then it collapses quite significantly. We expect that in reality there will be no subsidence, since the strength of the remaining coal will be more than adequate to maintain

the structure of the seam. Regardless, we will engage an expert in geomechanics to model these effects for us.

There may be some stresses, but there are other stresses, e.g. rock mechanic stresses that we expect will equal it out so there will be no massive changes on the surface from that process. And there is a lot of rock in between that top coal and the surface.

17. **I have some concerns, and I've expressed those to you singly and collectively. A few months ago I believed there was going to be a significant amount of water removed from the Walloon Coal Measures, in fact the word 'dewater' was used, and I guess that is enough to put the fear of God into most people who access the Walloon Coal Measures around Millmerran. Now I explained to you before that when I was first elected Mayor of this community we tried to obtain the best knowledge available in Queensland. We got Professor Ray Volker to tell us about groundwater, and the impact that extraction of significant amounts of groundwater is likely to have on this community.**

    Quite frankly I would suggest we probably wasted the $10,000 that we spent there, because at the end of the day there was nothing definitive. The point I want to make is that obviously there has been a change either in terminology or in the science in the last few months since I picked this information up. I think you've got to recognise the fact that the extraction of significant amounts of water out of the Walloon Coal Measures will have a significant impact on the economy of this community. 'Make good' is fair enough but before I was prepared to back any projects like this I want to make sure there is some comfort if you are going to continue to extract water out of the Walloon Coal Measures. They are sensitive, they are not high-producing, and dewatering could be the effect.

    The other matter is environmental impact studies. It's all very well to do them but even organisations like the one I'm involved with, i.e. the regional council, have real problems with the complexity of environmental impact studies. And we're not Robinson Crusoe here, Western Downs, Roma - all those councils have real trouble interpreting what the likely outcomes are as a result of environmental impact studies.

    These are comments and I'd like your response to them please.

    On the first issue (i.e. the use of the term 'dewatering'), we have used insensitive language about things like that – we will not 'dewater' so that there is no water left in the coal. That is not what happens. I'm qualified to make that apology – if you google my name you'll see a really stupid statement that I once made that we would drain the countryside.

    We've learnt that using words like that is insensitive; what we think is acceptable terminology for the oil and gas industry clearly ignites emotions. Yes, we are pumping off water, but the primary purpose is not to remove all the water from the coal, it is to depressurise it so that gas can desorb out of the coal. There will still be quite a significant amount of water left inside the coal when we are gone. We definitely do not want to pump any more water than is necessary. I'll take that one on the chin as we could communicate these things in a better way.

    Re the complexity of the EIS, it is complex and it is long. That is why we do sessions like today. Our website will contain good summaries of the impacts and what we plan to do to

mitigate those impacts. The presentation that we will be doing early next year will do the same thing, to try to get it to an easily digestible amount of information.

18. How are you going to 'make good'?

We don't have all the answers to that yet. When we were here six months ago we showed you the preliminary findings of our groundwater assessment. We've since done the next level of detail re our modelling which validated the answers that we got from the preliminary groundwater assessment. The next phase is to add in the mitigation methods. All the modelling that we've done so far assumes that Arrow (and, in the second model, all the CSG operators) takes the water out and it never gets into the system again. It evaporates off or gets sent to the coast or some other destination.

Clearly that is not what we propose to do. We want to bring the water back in to be beneficially reused, so after the next phase of modelling, and the next round of these meetings, we will be able to report back on that.

Last time we were here we showed the predicted drawdowns in the Condamine Alluvium. This slide (*see Figure 1 on page 3*) is for the Walloon Coal Measures which are of particular relevance not only to the people in this area but also to the rest of the Surat Basin. On the left the figure shows peak impacts in 2024 which is when we would cease production, and then recovery occurring as extraction winds down. The figure on the right shows the predicted drawdowns in 2061. In relation to our 'make good' obligations, they persist beyond the actual extraction and production of coal seam gas and we are obliged to continue to ensure that the same quantity and quality of water supplied is maintained in the basin.

19. Can I just ask what science you base that on as I'm not aware of it? The University in Toowoomba is struggling as it tries to set up a groundwater study.

The whole CSG industry is working together in terms of understanding cumulative impacts. The groundwater model that Arrow has built uses the 10,000 or so wells that have been drilled in the Surat Basin and uses water level and construction details from around 4,000 bores as well. That goes into constructing and calibrating the model which allows us to determine how certain or uncertain the model is. From there we build in a monitoring program that allows us to monitor the predictions of the model, and where they start to deviate from the observations we can make adjustments to the model. That is the process the science is based on.

20. So in 40 years you are still going to be around to put water back in to the Walloon Coal Measures?

That is our obligation. Not necessarily to put it back into the Walloon Coal Measures but to manage the impacts that we create. That is relatively normal in our industry; there are a lot of obligations that go on after production ends and they are enshrined in legislation or in our licences.

21. What is the projected yearly take from the Walloon Coal Measures…and over what period of time?

Over the 25 year estimated life of the project it is going to average 25 GL per year. A gigalitre is a thousand megalitres; for context a swimming pool holds about 1 megalitre of water.

22. What is the licensed take out of the Walloon Coal Measures?

Out of the Condamine Alluvium it is between 45 and 65 GL/yr. Out of the Walloons at the moment it is between 9 and 13 GL/yr.

23. What is Arrow's current take?

It is fewer than 2 GL. In the Surat at the moment we produce about 6 ML a day.

24. Where do you put all that?

Right now in our Kogan-Daandine fields it gets treated and put onto a farm as a trial. Eventually we won't be running farms but at the moment we need to as a trial.

At Tipton it is going into dams right now but we are building a treatment project there. We are probably about half way through right now. It will eventually go onto farms there. We also supply to feedlots, mines and power stations.

25. In regards to land access and compensation, are you using the new rules, and do you want an agreement where the landowner can't tell anyone else what is in it?

Arrow uses the new rules as a minimum. Our normal agreement is more favourable to the landowner than the rules require. And we've found by making some adjustments to our standard agreement that it is more acceptable, with fewer areas of disagreement.

Re the confidentiality thing, it is up to the landowner. We don't demand a confidentiality clause, but we are happy to have it in there if the landowner asks for it. And it is fair to say that most of the time the landowner requests it.

26. Do you have a formula for working out compensation?

Yes we do. There are fixed amounts which are around compensating you for your management time, any costs, and any professional fees that you might have. Then there is a payment around loss of productivity for the land that we take up. That is basically how it works out.

27. Does that mean the landowner receives an annual payment while the well is in production?

We make the payment whether or not the well is producing; in other words we pay you compensation while we are taking up space in your paddock and will continue to do so until the land is rehabilitated. There is also an upfront payment to cover initial costs, disturbances and that type of thing and then there is an annual payment every year until we are out of there.

28. Is there a typical well density?

For production wells, it's 800m, so one well every 800m. But we've been doing quite a bit of work on that to determine how far we can spread those wells out, because obviously the further they are apart the less impact there is. We've found we can drop 20-30% of the wells from an area, and we can move them around quite a bit. Generally what happens is that it

takes longer to get the same amount of gas out—it can be a number of years longer. So there is a compromise…if there are fewer wells then we are there for longer.

29. For each well, what is the typical area around the well?

It is a 70 x 70m area which will be connected by a gathering line which is generally up to 30 metres wide, and those gathering lines connect all the wells up so you can imagine them to be the best part of 800 metres long.

30. Does it require mains power?

If it does, we will put it there. The way that we power a well at the moment is via a generator that runs off the gas being produced. Before the well has pumped down to the coal seam, the gas gets back-fed through the gathering network, and then it gets fed from the well once the well is producing.

31. Does the 70 x 70m area include storage for the water that gets produced?

No, that goes to the dams. As the slide shows (see *Figure 2 on page 4*), the water goes into an untreated or raw water dam; the water then goes through the reverse osmosis plant and is treated and amended (salts/minerals added). The water is used for agriculture, town water supplies, power stations, coal mines (the latter are supplied with untreated water). The brine from the treatment goes to a brine dam where the salt is concentrated.

32. Is it correct there is one dam per a certain number of wells?

Yes, at Tipton we have about 150 wells, and there are currently two dams. We are building a few more dams as part of the reverse osmosis plant. But generally for several hundred wells there will be a compressor station and three or four dams, and if it is in that area there might be a water treatment plant as well.

33. So there are separate water and gas pipelines?

Yes, there are two pipes, but in the same trench, installed at the same time.

34. And I can cultivate over it?

Yes, as part of the rules and the code of practice for the installation of those gathering networks, we have to consider all the possible and current uses for that land and design the pipeline appropriately for that. Generally what that means is that you put the pipe deeper.

35. Providing you haven't got any creeks to cross?

Well you have to design for creek crossings and those types of things. You need to design so that people can drive heavy machinery across it. There is a range of different things that have to be taken into consideration. We absolutely make sure that those pipes are safe.

36. Fraccing is a concern for some people but apparently you don't use toxic chemicals. Can you tell us briefly what is involved?

We don't frac in the Surat Basin. The sort of coal that we have in the depths of the coal seams goes from about 200 to 600 metres, and we don't need to frac that to get the gas out.

As you get deeper, the coal becomes more consolidated, the gaps or pores in it close up, and companies which have that sort of coal may need to frac it.

Up in the Bowen Basin, where the coal is a different type of coal, we've tried fraccing. However, in the Surat Gas Project area we've made a commitment that we won't be fraccing, because we don't need to, and it's an expense that we just don't need.

There is a fact sheet that talks about the chemicals that we use when we frac and they are normal, household grade chemicals. There is nothing in there that includes the alarming chemicals that you see on some of the literature.

37. Does each well require permanent staffing on a shift basis?

No, only when we are drilling. The drilling process goes for a week or two, site preparation before that perhaps for a month, and then laying the pipelines and putting in the service facilities, the gas and water pumping system (which is contained on a small skid) all that sort of stuff. We might be on your place for up to three months. Generally it will be much quicker than that. If we do it well, if everything goes well, it can be a few weeks. So there will be lots of people and lots of machines running around then, but during the production phase we only visit a well three times a week.

That will be a bloke in his ute, driving around and taking readings most of the time. However, every now and again, every two to three years, we need to do a workover where we bring a rig back and basically go through two thirds of the drilling process again. That takes up that full 70 x 70 metres, there are trucks and rigs etc. Then after the workover is finished, it is back to that normal production routine with minimal visits.

38. In regard to remote monitoring, telemetry...is there any chance of getting our telephone network upgraded to support your telemetry? 3G would be very good…

It is possible that some of the networks will need to be upgraded, but generally the infield stuff is by radio rather than 3G. We'll have radio back to our base, and it will be connected by either microwave link or fibre. So industry does often bring along new main backbones; that's certainly happened up in the Daandine-Kogan region where the power stations were built.

39. Some companies are doing work on directional drilling, have you advanced that at all? And secondly, as you know I used to be Mayor of the Cecil Plains area as well as Millmerran. You have imposed an 800 metre grid onto a highly productive farm, with your 70m hardstand around it, and basically you really have stuffed up an irrigation farm that is highly developed, laser levelled and that type of thing. How are you going to deal with these irrigation farms?

Directional drilling...directional drilling is our base drilling technology up north in the Bowen Basin where all the coal is mined in Queensland. The coal up there is suited to directional drilling because it is in very thick, tight seams with very high gas content. In the Surat, the type of coal makes it quite challenging to drill directionally. There are lots and lots of seams, there can be twelve or more seams. If you drill horizontally you can't intersect all of those seams, and it is really tough to get hole stability horizontally in the Surat coals...and it is a lot more expensive.

That's why we drill a simple vertical hole. We are currently in the early stages of planning to do what is called deviated drilling; basically, from one pad we drill one well down, and then a number of other wells out at angles. That allows us to gather from a lot larger area around the one pad on the surface. It is definitely one of the technologies we are considering so that we would only need to be in one paddock rather than ten paddocks on that good country.

The other thing is, if you have a look on our website next week, there will be a slideshow on there that I'll be doing at Cecil Plains. It goes through a bit of a journey about imposing an 800 metre grid, and then moving the wells and infrastructure around so that it is sympathetic to farm activities and infrastructure.

That is the journey that we are on, and it's a journey that we are on with real live third party landowners who are helping us to understand the impacts and the best ways of doing it. So we know that we have to get it right, we know that we can't put an 800 metre grid over the floodplain country.

We did a cultivation trial at Grassdale to see how we could work it into the farm, but that was absolutely done as a cooperative type of thing. All the rest of it is on pretty rough grazing country.

40. In terms of a 70 x 70m pad, with roads and pipeline access to it, is there an additional requirement for a bushfire / grassfire buffer zone that would have an impact on grazing or cropping outside that 70 x 70m area?

Yes, there is a requirement for bushfire management inside the 70 x 70m zone but not outside it.

So grassland up to two foot high can be within 15 or 30m, and it is about 35 metres for the Brigalow or timbered country. You might have seen some pictures in the *Dalby Herald* that showed effective vegetation control. There was scorched earth that stopped before the well.

41. There is no gas flaring, or burning off of gas at a wellhead is there?

No, there isn't at a normal well but there might be gas flaring at a pilot well. We've got guys in what we call our central monitoring facility that watch what is going on with fires and will deal with those threats. If we had something like that then we'd deal with it appropriately.

42. If there is a problem with a pipeline or a leak somewhere, what contingency plans are there? Are there valves that can be shut off at certain places?

Yes, there are. Depending on where it is, we might be able to shut off one well and its connection or we might have to shut off a large section of the field. The focus is to immediately make the site safe, and if that means we have to turn half the field off, we have to do so. We then decide how to recover from that.

43. What are the pipelines made from?

The pipelines are made from two different types of material. When I talk about the gathering lines that run between the wells, that connect all the wells up to the facilities, they are made out of high-density polyethylene, i.e. plastic. They are thick and flexible, and pretty resilient to damage. You can hit them pretty hard and they won't be impacted.

44. What about movement in the soil, contractions and expansion of the soil?

They are actually more resilient to that because they are slippery and don't have a coating on them. Steel pipes are used for the high pressure side e.g. out of the compressor stations and when the gas goes off to power stations or eventually the Gladstone LNG plant; those steel pipes are run at really, really high pressures like 1500-2000 pounds per square inch (psi), so they are quite large and thick steel pipelines.

Now I'll tell the pig story...if you have a steel pipe in the ground, how do you stop that from leaking? Firstly you bury it deep so it is not in the way of deep ripping or normal farming machinery; in really sensitive spots you might even lay a concrete slab over the top underneath the surface.

How do you stop it from corroding? You put a really high integrity coating on it, and test that coating before the backfill goes in. That's one of the main quality control procedures. We also do what is called cathodic protection, which is basically where we impress a small electrical current on it which reverses corrosion. So instead of metal being released off the pipe, it's the other way around.

And how do we make sure that all of that is still okay? We run things called 'pigs' which sense whether there is any loss of the steel. They sense the magnetic flux so they can tell whether there is steel there or not, and how thick it is, and we run those pigs through every five to ten years.

45. Do you call them anything other than smart pigs?

They are called intelligent pigs.

46. That cathodic protection that you talked about, there is no sacrificial anode, and there is no submersion in water so does that really work?

There is a sacrificial anode, either a magnesium anode which is attached to the pipe and it corrodes in preference to the steel, or a silicon-iron anode, and a separate current that is driving that system.

47. Is that because most electronic rust protections systems available are a con?

Yes because you don't have a flow path back. However, what you have with soil is a flow path back. So the only time that you don't have a flow path back is if you have really clean dry sand. But with most or all other soil types you get a flow of ions through the soil. So rust protection only works on your ute if it is caked in wet mud.

DALBY

	25 October 2011	
Venue:	Dalby Showground Pavilion	
Presenters:	Darren Stevenson, Asset General Manager South	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert, Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **In terms of emissions, what is the safe distance from a well site? The slide you showed says it is 175-225m, but you gave higher figures. Is that for the wellheads or production facilities? From a workplace health and safety perspective if you have staff working around a well site, will they be exposed to emission levels which could be harmful? Will this information be made available?**

   That is the figure around a production facility because that is the main source of emissions. For a wellhead it is a much smaller distance. Production wellhead infrastructure is essentially the same as the motor in a tractor or other vehicle; in the same way that tractor or vehicle emissions disperse in the atmosphere, the same happens with the wellhead. As you know, there are some 7,500 wellheads proposed so there would be a cumulative contribution of all those; not so much at ground level but in the upper atmosphere which could cause a health effect or what we call airshed loading. The emissions at a well site are sufficiently small that they will disperse readily and not affect the airshed, and consequently not affect human health.

   The issue with air emissions is when you get significant volumes of very high rates, as from gas turbine exhausts. That's why you get a much more intense plume or emission profile from a production facility where you might have anything up to half a dozen gas turbines running in close proximity. You get a [atmospheric] loading in that immediate vicinity which is typically caused by an eddying effect that brings the plume back to ground. If it's a windy day there will be eddies bringing the pollutants back to the ground; they are air particulates, and that's what we're concerned about. If it's a nice clear day then they will just be emitted into the atmosphere and dispersed.

   All this information will be covered in the EIS.

2. **With these emissions from wells are you factoring into your assessment the fact that we may have an employee working on a machine which is emitting similar pollutants into the air so there will be cumulative impacts of not only the wells, but also other machinery being used in the vicinity.**

   The answer to that is no. The reason for this is that those emissions are what we call transient emissions. For that to be a real issue, you would have to park the tractor next to the well and run them both flat out for a long period of time to get any sort of profile of what the emission might be. With a tractor driving up and down a paddock plus an operating well the emissions will disperse very quickly so will not create a local issue. The real issue with the wells, is if they create regional issues.

Last year DEEDI required all the operators to do health impact testing of the emissions at well sites and round our facilities. I think that information is now on the public register. It showed that by working around a well, for the duration that anyone is likely to be there, there were no health impacts.

3. **In regards to the environmental impact and farm management, are you classifying entry into properties under amenity? What about farm management issues? Farms are dangerous workplaces, there is a lot of risk.**

   There is no question we have made some mistakes but we have also done many things correctly although that obviously hasn't made the newspapers. We're absolutely committed to making sure that we get the administrative things correct such as notices of entry; those processes are followed as well as the real workability issues or amenities. We have to understand those things; for example we can't be out there in the field when you guys want to spray. That isn't something you necessarily know about three weeks before; it might come up in a matter of days. We haven't worked out all the answers yet but clearly we have an obligation as an employer to get our employees off that rig if you want to spray. We are focussing first of all on infrastructure and hopefully you'll see we have made some progress by listening to local people about the big infrastructure issues but the next level of detail is planning activities with people.

4. **According to the map with the red lines, is that the limit of the licences sought by Arrow in the Surat Basin? (see Figure 3 on Page 5)**

   It's the limit of the environmental licences we are seeking for the Surat Gas Project. We already have other acreage over which we're applying for exploration permits; however, in terms of the project area committed to the LNG project that's the limit. We are exploring and applying for more acreage but it's not for this project. If we do, we'd have to go through the same process we are doing now and a separate one at that.

   That red polygon you can see on the map is the extent of the Surat Gas Project area environmental impact study. Any gas extracted from within that area will be dedicated to the export project. We do hold more acreage that we are applying for west of here, for example, but if we wanted to develop that area we'd have to develop a separate EIS for it.

   There are three key approvals that we need to get. The first is the Petroleum Permit (Authority to Prospect) either to explore or develop. The next is the environmental authority, that's the area the red line shows. The third is obviously the landowner's agreement to access the land. There are a lot of other licences and permits we need to get, but those are the three big ones. So this process is about getting the environmental authority for the project and it will approve supply to that project. Unless you go through the entire process again no other area will be approved to supply it.

   Just one more thing, the area could potentially shrink, as we are still exploring the southern boundary and some of the eastern boundaries as well. So it won't get bigger than that but it could get smaller.

5. **You explained the process of the environmental impact study and you said this is what you have been doing from 2007-2011. Just from a layman's point of view, there are already 500 wells or something like that out there, where does that fit into the EIS?**

   There are two processes here. Gas development can be approved under level one or level two environmental authorities. You can actually apply to do a mini impact assessment to develop a small number of wells. For a long time, all the gas operators in this region were operating under that framework where they would bring on another ten wells, and then they might bring on a facility. They were effectively small assessment processes and approvals attached to them; they did not require an environmental impact statement to operate that number of wells.

   What became apparent when the LNG industry took an interest in coal seam gas was that it wasn't going to be a small, manageable, incremental change. The government determined that the scale of the project was such that it could not be assessed under that old process and that it needed to be assessed under an EIS. That is how Arrow's existing operations are currently permitted and licensed. It is also how the Dalby expansion project, the several hundred well expansion of the Dalby facility, was assessed and approved. Notwithstanding that, the Surat Gas Project looks at the impact of the expansion project, not in terms of seeking approval for it but considering how those existing wells, along with those proposed for the LNG project, will cumulatively affect the local area

   Every time we go through one of these assessments we end up with the latest conditions from the government. The environmental conditions we had when we built Daandine in 2006 allowed us to build evaporation ponds and didn't require us to manage floodplain work any differently to bush country work. But now, with all the changes, every time we propose new work new conditions are added on and we are subject to new requirements.

6. **Relating to your last slide, what does evapotranspiration mean?**

   Plants take water out of the ground to transpire, to produce CO_2; evaporation is essentially taking water from open water or from the ground. So the two of them together (evapotranspiration) means taking water out of the ground.

7. **Someone mentioned that when water is put through reverse osmosis treatment some minerals have to be added otherwise the water destroys the soil. What minerals have to be added?**

   For the water we use on the farm we've added calcium using two different chemicals at two different stages; one is calcium chloride and the other is calcium sulphate. Re the latter we added some powdered calcium sulphate at one stage, but the continuous process is the injection of calcium chloride to manage the sodium absorption ratio (SAR) of the water.

8. **Who directs what is put in? Is this usually the reason for the hardness of the water, the calcium?**

   Yes, it's normal water chemistry used by the town council. At government treatment plants, they will sometimes mix in some untreated water; we can't do that as we have a deficit in some minerals and an excess in others so we have to target what we add in.

9. With the stuff that's going into the irrigation, are you re-inventing the wheel?

The industry is new and the government has quite rightly imposed conditions to make sure we do it properly. We could cause damage if we didn't manage the remineralisation just as we might if we didn't manage the application of water to the paddock. Hopefully over time we will prove that we can manage it successfully and then conditions will be more consistent with how you use water on your land.

10. I have one more question. If you needed a cool drink today would you be prepared to have mineral-added RO Arrow water or Anna Bligh's recycled sewage?

I have drunk water out of our treated water dam and it is sweet pleasant water. I would much rather drink it than the town water here or in Brisbane.

11. When Lloyd was talking about his evaluation models he said that each of the companies is doing its own models and in the Arrow one the evaluation came out similar to the other companies. The sceptic in us would say that's no surprise. Then he said that the state government is also doing its own modelling as an overall position. Does each of the companies have to provide its own raw data to the government on a regular basis?

Yes, we've given DERM all the data that went into our model, all the observation and calibration data, estimates of hydraulic properties, pressure differences between aquifers. As a result it probably has a better data set than any individual company so we will see the model it comes up with, likely before the end of the year.

The latest information from QWC is that its model will be released early in 2012.

12. Where Arrow buys a property that has an allocation of Condamine alluvium water and you don't want the water, will those allocations be available?

In general our approach is to substitute existing allocations. So if we ended up buying a property that had an allocation from the Condamine Alluvium that might be one of the ways we achieve that substitution. We could stop pumping from that bore and make available the clean water we produce. We want to try to get the amount of extra water taken from the basin as minimal as possible. From feedback we've received everywhere, the last thing people want is for us to behave as if we have rights to the water over and above everyone else, and for us to pipe the water away from the basin. We're trying to do it so we're producing water so you won't have to; we want to get that water back into the system. The chance of us buying a lot of land where the Condamine Alluvium bores are is relatively low as we are mostly trying to buy land on the inside radius of our area of tenure and generally there isn't good alluvial groundwater there. In that country, near our Daandine project, it's 25,000ppm TDS in the upper aquifer – and that's no use for anything.

13. Are you planning on selling treated CSG water into the Nathan SunWater pipeline project that's going to be running from Dalby through Chinchilla and up to the Nathan dam?

We are looking at all our options. We are not considering taking water from down here in that direction. We may have a surplus of water in the northern area around Wandoan so may be

bringing water back into this area rather than taking it out. There is enough demand for water down here that we won't need to ship water up there from the Dalby area.

14. What quantity of salt residue will remain after the reverse osmosis (RO) process?

When it's initially treated it will be a 10-20% concentrated saline solution (and 80% clean water). We will use a range of technologies to crystallise that salt, some of which may involve circumstances where we now capture that remaining water e.g. thermal treatments where it comes off as steam. When we say that we want to minimise the net take for the volume of water, we will never be able to get 100% back as there will always be losses due to circumstances such as evaporation. It will be more in the range of 80-90% that we can recover.

15. You have quoted a lot of figures re your forecasted impact on water; will you be presenting the actual figures publicly?

Yes. We have the baseline bore assessment program at the moment collecting information from farmers' bores. We are also drilling our own groundwater monitoring bores in the upper aquifers as well as taking samples from the Walloon bores where we have our gas wells. All that information ends up on the public record.

16. Is there a threshold that the government sets i.e. if you have a large impact then something has to happen?

The trigger levels the government has set are 2m in an unconfined aquifer such as the Condamine and 5m in a confined aquifer.

17. There's lots of concern around the brine and salt crystals left over, what research is being done into what to do with that?

The technology required to process those salts exists already although there aren't any plants out there at the moment. We are having commercial discussions with people who can process that and turn it into a valuable product (for example glassmaking uses the types of things that are in salt). Australia is currently a net importer of salts so there is certainly a market. It's not all sodium chloride (table salt), there's also calcium, magnesium, all the carbonates.

18. My question is on the trigger thresholds and make-good; there is a trigger level of 2m in an unconfined aquifer but aquifers have been declining for the past 25 years. Now irrigators are taking up to a 50% cut in allocations so we hope we will see the levels increase in declining aquifers. How will we determine what 2m is in a very variable natural water level?

The trigger level sets off the second stage of assessment, known as the bore assessment. The Queensland Water Commission (QWC) will be making those predictions through its model that's currently under development, the results of which will be released either at the end of this year or early next year. Any bores predicted to have a drawdown in excess of that trigger level will have that second type of assessment undertaken which is a far more detailed assessment than the baseline assessment. If the bore has an impaired capacity as a result of petroleum activities, then the quantity of water will be replaced (made good) by Arrow.

19. So it's not really a straight 2m thing, it's more of a model prediction from the QWC than a process you go through in the make-good or access and compensation agreement?

Yes, it's a separate agreement, a make-good agreement. The QWC model will predict an area within which bores will be impacted by more than the trigger level; it's then incumbent upon that tenure-holder to go to those bore owners and work out whether that predicted drop will result in an impaired capacity in that bore. In a bore that has maybe 100m of available drawdown a 5m drop may not necessarily impair the capacity of that bore. Conversely, a bore that has only 6 or 7m of available drawdown may be significantly impacted by a 5m drop in head.

20. Of the bores you just mentioned that are expected to be impacted, are they only in the Walloon Coal Measures or also in the Condamine Alluvium?

For the first iteration of the model, i.e. the first impacted area prediction, it could potentially be that it is only in the Walloon Coal Measures, but it could be in any aquifer. We are predicting impacts in all the layers, as is the QWC.

21. Are there any assets other than roads and pipelines that are needed for your projects?

Yes, there are wells out in the field. The wellhead site is 70 x 70m but during normal operation that comes back down to just 10 x 10m. All those wells are connected up to each other and to the central processing facilities by two pipes – gas and water. Those pipes are made of high density polyethylene, thick strong plastic. The pipes range from four inches to two feet in diameter, they get bigger as you get closer to the facility. From there, the gas goes through a compressor station which takes the gas from about 10psi or 70 kilopascals (kPa) and discharges at about 1500psi. At the moment it goes to power stations, and in the future to the LNG plant, in high pressure steel pipelines. The water pipes go to an aggregation dam where all the water from the field is collected. It then gets treated by the RO treatment plant and there is an amendment plant as part of that where remineralisation happens. The reject goes off into brine ponds, and the good water goes to treated water dams where it can then be used for irrigation, town use and industrial supply. We also supply untreated water to a range of industrial and agricultural enterprises such as feedlots, power stations and coal mines.

22. How will you power your well sites? Will it be coming from the reticulated supply, or generated from your gas at site?

It will likely be generated from gas on site. Currently at the wells there is a generator that gets fed by the gas we produce. It might go towards reticulating power and in that case we would likely build a small power station at our integrated production facility and then run power out from there to the field.

23. So you say that you will require 70 x 70m for drilling then reduce it down to 10 x 10m but I understand that you will need to be there a number of times during the life of the project to do workovers etc. Is it correct that during those times it will be back to 70 x 70m??

Yes, every two to four years we will need to do a workover. During a workover much the same equipment will need to come to site as during the drilling but the effect is about half that of drilling operations. We have a number of technology trials going on to try to reduce the

number of workovers required. As you can imagine it is a significant cost for us, but also a significant imposition for you as the lease gets pushed back out to that big area. Compensation is always worked out on the larger size.

24. The Chinchilla well which had 30 seconds of fame on *60 Minutes* with all the water and gas coming out of it, how was the compensation situation worked out with that?

I'm not sure which well exactly you are talking about there, but I think you might be mixing up two different stories that were in the news. One of which was on *60 Minutes* where there was a landowner up Hopelands way who lit his bore up. His bore is into the Walloons, he's been pumping that bore for ten years and for the last five years he's been getting gas to surface. He's basically drilled himself a gas well. For 100 years they've known in that country that you can get gas from those wells.

The second one was our incident earlier in the year – Daandine 80 – there were some fairly impressive pictures of the water geyser. It was never on fire, there was never any risk of that happening because there was a lot of water coming out of the hole as well. We had an incident while running the pumping that caused that to happen. We regained control of that situation very quickly, unfortunately we didn't have the mud that we needed on site to make the water dense enough to do what we call 'kill' that well; when a well does that we inject heavier fluids into it which basically overcomes the gas pressure and settles it down. It took us a day or two to get the necessary muds to be able to do that.

We're compensating the landowner for any possible damage to that paddock. We're working through a range of options, one of which includes effectively swapping with him one of our paddocks on a farm we own next door for him to run his cattle on, while we make sure that his site is cleaned up properly.

25. Do you pay money for the compensation or swap land?

We definitely usually pay money, although it depends on the country. There are a couple of fixed amounts, so no matter what sort of country it is you get a fixed amount for your management time and the inconvenience of having to deal with us, and you get a fixed amount for you to spend to cover legal costs or other professional fees.

26. What do you pay as a yearly rental for mining on a property?

Yearly amounts for a production well range for $500 to $5000.

27. How much money are these wells making?

Our average well produces about 250gJ per day; we get about $500 per day. That's our selling price; on top of that we have many costs. Most of our domestic gas projects are out of the money at the moment due to the changes in environmental conditions – we don't make very much money if anything from them. Like any business we look at the rate of return – so we look at the costs of the infrastructure and how much we can sell the gas for. The returns we are getting are usually about 10-15%. Gas wells are quite different to say an oil well, which may produce huge quantities of oil. Each gas well produces about two petajoules (pJ) of gas, not a huge amount of money in value terms. That is why we need a large number of wells. There is a huge demand for energy around the world, and the export market pays a higher price, which is partly why the industry is developing how it is.

28. Why not pay a percentage of what your wells on a property earn? Why don't landowners own what is under the ground?

In Australia governments own what is under the ground. In the US there is also a large amount of land where the same applies but there are places there where you effectively own everything to the centre of the earth. In Australia that isn't the case, the Crown owns the resource, and we have to pay government a royalty to extract it. What we're trying to do is to add value for you in having us on your farm. We understand there are costs and impacts around infrastructure, around planning and activity and around the amenity, i.e. the quiet enjoyment of your farming lifestyle.

We know we are going to have to compensate for some of that. It's not about nickel and dimes; it's about making sure our compensation is fair across all the different land and farming types. Our calculation isn't about production; it is based on our impact on your land. It's about your land value and what it can produce. If we based our compensation on how much the wells produce then it could be unfair for some landowners as wells range from 1% to 100% different flow rates and we don't know what each well is going to flow until after we drill it. So if I came onto your place and drilled three wells and they were all bad wells and your neighbour had three good wells that would be inherently unfair because the impact on you is the same as the impact on your neighbour. That's why we compensate you based on a proportion of what your land is worth and a proportion of the productivity of your land.

29. Where will Arrow move to next?

We cannot move onto any area where another proponent holds tenure. We also will not be looking at moving east, as there is not much gas there.

CECIL PLAINS

Date:	26 October 2011	
Venue:	Cecil Plains Hall	
Presenters:	Tony Knight, Vice-President Exploration	Arrow Energy
	Darren Stevenson, Asset General Manager, South	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert, Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. How many pages do you anticipate the EIS to be?

We anticipate about 3000 pages and there's about another 3000 odd pages of specialist studies. When I set out on this process the Queensland Government said it didn't want any more than 13,000 page EISs, as it said it would be too much for people to digest. We've tried to ensure the EIS is addressing the really critical issues and of course those required by the Terms of Reference. We're trying to make it as succinct as possible so you can digest it relatively easily.

2. Is the community to be notified when you lodge it with the government in December, or do we have to wait until February before we actually know that it's coming?

You won't be notified when it goes to government for review as that is an internal procedure. When the government deems it suitable to go on public exhibition, there will be advertisements placed in all the regional papers and national papers such as *The Australian* alerting you to the fact that it's going on exhibition. Arrow will do a lot of work to make it known that it's going out. We have to make it available at all regional libraries to make sure it is on public display and that there is enough access to it. There's a lot of work being done to work out how we do that. The intent is to give everyone as much access as possible, not to make it difficult. We want to do more than is required to make it as accessible as possible, including publishing it on a website.

3. When the EIS document becomes public, do you anticipate there will be some sessions like this to walk people through the document and explain the conclusions you have arrived at?

Most definitely; there's a lot of planning already in place and the intention is that within a week or two of it going out we will be here with as many experts as possible to take you through the EIS. We'll explain the conclusions re the impacts, where to find the information, and explain the process of how to make a submission. One of the important things to note is that a letter of protest is not a submission as it's not asking us a question, it's making a statement. Instead, a submission should challenge the EIS and pose a question you want answered. We then have to respond to that.

4. Even though we are lay people, and our responses won't necessarily have a technical slant to them, will they be considered?

They will all be considered. Please don't underestimate the importance of lay responses. In this business I deal with scientists and engineers all the time, and quite often very simple lay

questions can be overlooked. Just ensure your submission is about something in the EIS, don't just say 'I don't like this project' as we can't respond to that. There's no silly question as far as I'm concerned.

5. **On your slide explaining the environmental framework, you talked about environmental values and desktop and field studies. What proportion of determining the environmental values of our farms and our communities is dedicated to a desktop study and what is actually ground truthed?**

   Can I address that in the agriculture presentation? Typically, environmental values do start being addressed in a desktop study. That's basically to ensure we understand all the literature on that subject. For example if you are talking about terrestrial flora and fauna, the scientists will review all the published literature on what is known about this region, search all the wildlife databases which record sightings and compile a picture of the environment. They then review that and determine the most significant areas or the ones we have the least understanding of, and then they will do their fieldwork based on that knowledge. The fieldwork tries to do two things, it tries to identify and verify. Where they feel there are deficiencies the focus of the field work will be to identify what might be there. Where they might doubt the integrity of the information, i.e. where things may have changed over time, they then target it for verification. I don't know how much you deal with regional ecosystems in your communities, but the mapping often doesn't reflect the reality of what is on the ground. We have to get that right, which is what the studies will do.

6. **There was a picture of a central gas processing facility at the end of the slideshow – is that typical of what we will see in this area?**

   That was a production facility which was a set of compressors (see *Figure 4 on page 6*). Yes, you will see them.

   There are probably six or eight of these facilities proposed for the area between Wandoan and Millmerran. They cover approximately a hectare in total and there will be six to eight of them spread over the whole region.

7. **I had a quick look on the Surat Gas Project website and saw that there are going to be about 7,500 wells, 49% of which will be on potential strategic cropping land (SCL), so does that mean 3,700 wells on SCL? How does that work?**

   If you look at the map, the better country is towards the inside rather than the outside of the curve. Geology and geography line up so that's also the shallowest wells for us. We expect our well spacing to get bigger as we go further into the good country so the density of wells will be more as we go deeper into grazing country. In terms of the 7,500 that's basically a few numbers multiplied as we don't have the full field development plans yet. It's fair to divide it in half but it won't be like that. There will be fewer wells on good arable country and more wells where the deeper coal is.

8. **In terms of the rehabilitation of the 70 x 70m footprint, does the EIS look at that size or the 10 x 10m site?**

   It's 70 x 70m during the project. It can't be 10 x 10m because we come back every few years to do a workover which involves the same gear you see during the drilling operation. In

practice it's about half the activities you do when drilling a well; you pull the pump out and put it back in. That process needs the full 70 x 70m and we plan around that.

9. What studies are there to show that in the long term the soil in the 70 x 70m grid can be rehabilitated?

One of our studies recommended which trials to do before it goes out onto the country, to make sure it will work. A lot of that work has already started. It won't be a trial and error process on your property as it will be trialled on Arrow properties.

10. The SCL slide before, you were talking about type one or type two impacts but you didn't specify what activities referred to. Will all the activities, right from the well activities to the central processing facilities, be considered type one?

Type one is diminished productivity, and that will principally relate to wells and gathering lines. Gathering lines are rehabilitated very soon after production, but you have diminished productivity for the period during which the land is disturbed and the period it takes to recover and be rehabilitated. The well is a longer proposition; it's there until depleted, and then filled in, capped and rehabilitated. It means diminished productivity as well as being there for a longer period.

Type two is about changed land use; development of the integrated production facility is so invasive that generally we can't rehabilitate it back to what it was, but we can get it back to grazing land for example. That's a long term enduring land use change. Development of those production facilities (field compression, central gas or integrated processing) are the types of activities contemplated under type two.

11. I just wanted to make a comment about the 3% figure. You said that 3% was the upper impact. I guess in some instances I would agree with that, however on my farm the 3% has a direct effect on the other 97% of my farm. So you can't say it would be just 3% that would be impacted on the black soil country.

What we understand is that 3% is the direct impact and physical disturbance. We recognise there will be indirect impacts; if you put a well in the middle of a paddock you are going to change headlands etc. which will create indirect impacts. We talk about that in the study but it cannot be quantified. We could paint the worst case scenario i.e. if we were to put a well in the middle of each paddock. However, that would be misleading as Arrow wouldn't be allowed to do it. You wouldn't let Arrow do it, government wouldn't allow it and Arrow doesn't want to do it anyway. The difficulty with the agriculture study is trying to give you a realistic understanding of what is likely to happen based on a lot of work with you and attention to some issues that have been talked about. But I do recognise it could affect the other 97%.

12. My other question is in regards to Section 805 of the *Petroleum and Gas Act* which deals with unreasonable interference. A whole host of things that you have listed in your presentation particularly affect the sort of farming here on the eastern side of the river. Do you keep that section of the Act in mind when you do the study? I would suggest a number of those things would fall into that category?

We are mindful of the Act. The process that I have responsibility for is the environmental assessment; while we have regard to legislation, the main issue is that we satisfy the EIS

Terms of Reference and assess impacts. The legislation you are talking about regulates the industry. When the government issues the environmental authority it will state how it wants to police the impacts and specify appropriate conditions.

13. What company did you employ to do the agriculture assessment? Was the information you have mostly from that company or was there some local input?

The impact assessment was done by a company called Gilbert and Sutherland based on the Gold Coast and Toowoomba with an office in North Queensland as well. We are damned if we do and damned if we don't when we do agricultural impact assessments. Ideally we'd like to use the people you use, because then we'll get absolute understanding of what happens out here but we've been pilloried in the past for using the guys you do. What we try to do is to find someone who really understands what we're dealing with out here and has knowledge of agricultural systems generally and also an understanding of the science around soils and things like that. We're trying to balance the science of what you do and the science of the landscape you are dealing with in terms of the agriculture. We made a lot of enquiries about relevant consultants in the region from people who worked here and the best we came up with was Gilbert and Sutherland. Has there been local consultation? No, but that's part of this process, why we're here today. However, Arrow's community committees form a part of this and this information was recently presented to the Intensively Farmed Land committee. The feeling I get from some of the feedback from that session is that we're not very far off the truth and that we have probably captured the majority of your issues. Gilbert and Sutherland have produced an 80 page report which will be published as part of the EIS.

14. So that report won't be available until the EIS is complete?

That is my understanding. It will definitely be released as part of the EIS.

15. With the pipelines and the easements, how deep are those pipelines and is machinery able to drive over them?

We have to design the depth of those pipelines to suit hazards in that location including the way you work your land, the sort of machinery you use, the size and weight of the machinery. The minimum depth is 750mm but our standard for cultivation is 1200mm and we'll put it lower if it needs to be, including if you use really big machinery or soil horizons dictate that it needs to be deeper. There's a code of practice under the *Petroleum and Gas (Production and Safety) Act 2004* which says we have to do that; we have to do a risk assessment, and then build it to withstand all reasonable expected activity over it.

16. With regard to medium and high pressure pipelines, are you talking of putting them down the road reserves or on the landholder's property adjacent to the road reserves? I've seen on your website that you require a 30m wide right-of-way to put your pipes in; wouldn't that be wider than the road reserve?

I wasn't talking about the high pressure pipelines; we showed some of the route for the high pressure pipeline in the presentation this morning. It will be more or less in a straight line and will cut across paddock boundaries, but we're trying to minimise that as much as we can; we're looking to divert it so that it has less of an impact on strategic cropping land. For the gathering system and the medium pressure pipelines it'll be in the location that has the least impact. So yes, we do need working space to put those pipelines in, and we understand that

there are planning laws which state what you can put inside the road reserve to manage overland flow and all of those things, so I don't have all the answers right now, but the pipeline will go in the spot where it has least impact.

17. **I'd hazard a guess that most roads have a power line along one side so you won't be able to use that side, and the other side will probably be too narrow. I'd suggest in most cases it will end up on the landholder's property and then you will need a right-of-way over the farm.**

    There won't be an easement for those.

18. **Well, you'll need a right-of-way which is a technical easement. There's a statement I'd like to make about the presentation. It's good to see you're undertaking this process to tell us what sort of a horror story we're potentially faced with, but we don't have those high and low point vents on our properties. How are they going to be powered? You have stated your preference for overhead power lines so we have to assume it's not just going to be a little wellhead, there are going to be power lines all over the place as well and perhaps these high and low point vents so I'd encourage everyone to have a really good look at what is going on their property because it's going to be a lot more than half a dozen wells.**

    I don't think it's reasonable to say that overhead power is our preference; it's one of the options. There's a significant advantage in getting the well down into that little box by changing the downhole pumps to an electric submersible pump; that means you don't need all that gear on the top as the drive and everything is down the hole. To make it worthwhile removing all that stuff you also want to remove the generator because that would be what has the biggest bulk and the most noise once you remove the top drive. To do that, you have to bring power to site. Now that might be overhead, it might be underground – we haven't made those decisions yet. We're investigating all those things, and we'll try to come up with what the best compromise is for each of the different features of the impacts, whether it's having the power there and how hard it is to come up with the best compromise possible.

19. **I was just looking at the timing: your wells will be operating for 18 to 19 years. I know that the *Petroleum and Gas Act* gives you the right not just to extract the gas, but also to store gas, brine and water. The pipeline has to be a dual run. Do you expect to be out of there in 18 or 19 years or do you expect that you will be using these rights under the Act to store gas or brine?**

    No, we don't expect to use those rights; our environmental conditions won't let us. The *P&G Act* allows us to do a range of things, but we don't have environmental conditions which narrow that down to the specific activities we're allowed to do and the way in which we must do them. For example, you might think we're going to bring water back and put it down the hole. We can't do that, we don't have the environmental licence to do it. The *P&G Act* might allow us to but we can't unless we have an environmental authority which licenses and conditions that specific activity.

20. **In regards to the high point vents – driving around here quite a few of them seem to dribble water, is it treated or raw water? I would suggest that this would be totally unacceptable on our sort of farm land. I see in the existing areas of development that there is a proliferation of warning signs. I've spent much of my farming career**

removing things that past farmers and graziers have erected, I would hope that you don't think that you'll have those things up every 100m or so?

If you see high points dripping water, please let us know. On some of our older fields you might see the high point vent come up and it has a vent to atmosphere. We're going through the fields at the moment and plumbing them back in to the water line. The gas comes out at the water line and gets pushed back into the gas line. Then there's a low point drain on a gas line and water might condense there and collect at the bottom. We can't just force it back in because the pressures are different; we have a collection tank and maybe a pump to automate it. Out in this country you will see fewer of those than you would see over at Kogan or Daandine in the undulating country. They are only needed where's there a reasonable change in elevation of the pipe – it's where it captures the gas or water because of that change in elevation.

In regards to warning signs, the minimum standard is that it must be inter-visible, meaning you can stand somewhere and see a sign in both directions. We know that those signs are a problem so we need to work out a way to achieve the same risk mitigation that those signs do. Those signs are really designed to go down a road so if you have council working along it, or Telstra or Ergon, they will know there is a pipeline there. With new mapping technology, there is a way to indicate presence electronically to assist workers and, perhaps, reduce need for signage.

21. **In terms of the sustainability of the Walloon Coal Measures aquifer, in about 2005 I believe there was a resources operation plan done by DNR on the Great Artesian Basin and the associated aquifers. The Walloon Coal Measures was one of those, and at the time there were some existing licencees requesting more water. We were told we would have to wait for the Arrow project to establish whether there would be any more water available. I think the existing licencees take about 4000mL out of that aquifer and I believe that coal seam gas is going to take an additional 40-45mL a year. Can you explain how you will ensure the existing licences are protected and that the viability of our businesses will be protected? There are a lot of people who rely on that aquifer, and without that water supply their businesses will no longer exist.**

That is a very significant issue. We can answer your question now, but later there will be presentations on how we will manage the water issues so are you happy to wait and then perhaps ask your question again if you feel that we have not adequately addressed this issue? (Questioner agreed).

22. **You said that the Slumberger Model has one square km cells on the x and y axis, and there are 15 horizontal units in the z axis. Are they equally spaced? Re 15 units over a 2.5 km depth, does that mean 2.5kms divided by 15, and each one is the same?**

No. Perhaps just to reiterate, in the presentation we generalised and said 120,000 cells, so I think 300 x 400, and it is not exactly that, it is more like 430 x 270, so that's in plan, 430 rows by 270 columns looking down on the top of that 120,000 cells 1km square in plan.

In the XY direction cells have a uniform size of 1000 by 1000m. However, in the z (vertical) direction layers vary in thickness according to the known thickness of the aquifers and aquitards. So they are not of uniform thickness.

The 15 model layers are of different thicknesses, where each thickness relates to a particular hydrogeological unit.

A computer model works by establishing a regular grid of cells over an area, with each cell containing a series of values. Each cell in this case is about one square kilometre in area, or one km by one km. We model all major geological layers in the basin, with values like thickness, depth, permeability etc - so that we can understand the geology and hydrogeology of a large area with precision.

23. Is the Condamine Alluvium captured in that?

The Condamine Alluvium is part of layer one which has three parts including the Condamine Alluvium and its overlying weathered formation or sediment. Slumberger looked at the CSIRO groundwater model and used that as a blueprint for putting the Condamine into the model.

24. What about calibration? You mentioned that those points you are able to calibrate successfully you are confident about and those that you can't are a bit of a mystery. Are you able to say what percentage of these points in the model you are able to calibrate successfully and what percentage you cannot?

I wouldn't be discussing points because we don't set parameters for all 1.8 million cells. There is never enough information to distinguish between here and there at the level of each individual cell so Schumberger might use the same properties for vertical and horizontal hydraulic conductivity over the whole area which is standard industry practice.

For example in representing the Gubberamunda formation it has the same properties so is it a mystery? No, we are still using the best available information that we can get as professionals, based on whatever we've been able to piece together from studies. The first source of information we would use is aquifer tests, you might hear them referred to as pumping tests or pump tests which is a bit of a misnomer because we are not really testing the pump, we are testing the aquifer.

In that kind of test, people drill a hole, install a pump in the hole, pump for a day, several days or even some tens of days and measure changes in piezometric head[1] in that hole and nearby observation ones, in order to infer the properties of that unit. Then you use those properties and extrapolate them over the region.

25. You did say there are some numbers in the model that you can calibrate successfully and some that you can't; I want to know, for every thousand numbers in the model, what percentage of those you calibrate successfully, and what percentage do you not know about or you can't calibrate successfully?

The first way to answer that is to say there are probably not thousands. There is a lot of detail in the geometry but the total number of parameters in the model are in the order of tens, so 30 or 40 or something like that. As a percentage, I can't answer that. We have different levels of confidence in all the model parameters. I know Arrow is investigating that and staff are probably chomping at the bit to answer it. First let me go to that next step of the influence of the different levels of the parameters on predictions at different places.

[1] Piezometric head is a measure of the pressure of groundwater.

I think the question you are asking is if the extent of uncertainty is acceptable for this level of model i.e. the level of model complexity we are talking about here in the EIS. Lloyd presented three levels of complexity that you can have and I think that is the question being answered through the review.

What I've said and will say is that I believe the Slumberger model is at least as good as the other models that are being prepared in this region and for other projects of this kind. I have no doubt that the model will get better.

We need to see predictions which quantify uncertainty at the time the EIS is finished. The company is on the right track, but I can't answer the question either.

26. You talked about volumes of water in the model, and St John suggested that water quality is important? Does the model account for quality as well as quantity?

The first answer is that it doesn't. It's just looking at volumes of water. There are questions that people ask about quality; models can be used to answer those questions. Although we are not modelling water quality as yet some of the studies we are doing will consider the geochemistry of the groundwater aquifers and what can happen if different waters mix. When we get the Arrow simulator, we can actually make up the models using groundwater modelling software, and start bringing in some of the geochemistry side of things.

27. I was interested in the model you put up showing the water balance and the 'ins' and 'outs', in particular the impacts for the Walloon Coal Measures, the Springbok, Hutton, Precipice and Condamine Alluvium. What I see is a hell of a lot going out, and not a hell of a lot coming in. When you talk about the recovery rates you are expecting there will be recovery of 40-50 in the Springbok as well as an impact of 40-50 initially;, Hutton and precipice seem to be the ones that are really going to be impacted yet your capacity to mitigate by reinjection into the Hutton appears to be limited due to the clay content. What happens if you cannot reinject, or it's not feasible; or if you can't find enough irrigators to take the virtual substitution water. What happens then? Are you constrained by the amount of water that you can take?

So the first question is about the water balance in the alluvium?

28. In all the aquifers…

The injection studies mean (while there is limit on the recharge rate in the Hutton) that for a particular bore, you can't get as much water down there in the same timeframe as you could for the Precipice i.e. you sometimes need to put in more bores to achieve the injection rate you need. So here we have a calculated leakage rate of 1.8gL per year coming out of the alluvium; we feel we can either substitute or manage it by re-injection or maybe a combination of both substitution and re-injection.

That's why there's a range of mitigation strategies, from substitution to re-injection to see how we put that much water into it.

In terms of the Hutton and Precipice, it will be a case of how many bores will it take to either inject that water or how many bores do you have to substitute for, to pull that water out.

29. I'm just wondering what would happen if you didn't have the capacity to do your virtual substitution? Can irrigators have confidence in the quality of that water?

We're confident that with the sustainable substitution approach there is sufficient demand for water significantly in excess of what we expect to produce. But if you look at impacts on individual farmers we might need to address those by a range of measures. We might need re-injection to support the fluid levels in your bore, it might be a by-product of treated water to your place, it may be a range of different ways of solving the particular problem. We have committed to uphold that obligation to fix that particular problem. That's why we are taking forward a number of options.

On the reinjection front we dug an exploration well and converted it to a reinjection trial well in the Precipice. The data we got from that in terms of its injectivity rates exceeded our initial expectations so it doesn't seem the science will be a problem for us, or demand.

30. Ideally you wouldn't want to put it down there would you? You wouldn't put it in the Precipice, that's not the plan is it?

We are considering reinjection into the Precipice because we might want to store water to manage the different production profiles across the life of the project.

31. So you might be putting it into the Precipice and then later pulling it out and giving it to the Condamine Alluvium?

That's right, it might be a part of the solution.

32. So when you answered my question earlier that you weren't going to use your rights under the *P&G Act* to store water, you perhaps are?

We don't have those rights at the moment; we do not have the right to reinject or store water under our environmental authorities. We do have those rights under the *Petroleum and Gas Act*, so you are quite correct about that, but for us to do the reinjection trial we need to make application to have our authority changed. Then we will need to present a mini-environmental impact study to get approval to do a trial. That trial will have certain monitoring conditions around it; after all that, if it is well managed and successful we might be granted the right to do it.

33. Are you expecting the water in the Precipice is going to be a similar quality to the water in the Condamine Alluvium?

No, we aren't. We believe we will have to work out the chemistry to ensure that if we use solutions like that we can deliver water suitable for specific uses.

34. It concerns me that you are not modelling the water chemistry, particularly in the Condamine Alluvium, when that was a fundamental part of John Hillier's argument.

We are on a journey and the first part of the modelling exercise is to model the hydraulics; you have to model the hydraulics before you can model water quality in the model. Simultaneously we have more and more data about water quality as we draw from our connectivity study between the two units.

35. The historical water level data for the Condamine Alluvium shows it is very cyclic, and has variations in the bore water levels of the order of the variations in Arrow's model. What are you validating it against? You really have to validate it using water chemistry.

There are data loggers from DERM in the Condamine. We've got some of that data, but you are right that geochemistry will give us the best answer to nail down focus points.

36. There is a shortage of monitoring bores, data from the bores, and its chemistry. The monitoring bores you are putting in to measure the transmissivity, are they in two dimensions as you have shown or will you have an array of them so that we will have a three-dimensional approach?

There will be a network of monitoring bores, including laterally and there will be a mixture of bores with vibrating wire piezometers[2] which you can set at several different levels. We might have eight of those through many different aquifers and we will have the traditional open bore as well from where we take water quality samples.

37. I've noted down a few things that concern me. We are talking about Arrow's activities but there are other players in this industry; surely we have to join up all the effects. Is that situation being addressed? Lloyd's model seems to only pertain to Arrow's situation which is only part of the problem.

The impact predictions we showed were a cumulative impact from the four major CSG producers based on our proposed field plan; plus we've added the currently available data on what they think they are going to extract. So that 450 megalitres a day we graphed, that was the combined total for the four producers. We also had another scenario which is just Arrow on its own.

38. I guess that partially answers the question. Obviously the object of the exercise here is to reduce the water table, therefore reducing the pressure, and it would appear from what you've said that after Arrow's finished this will all stabilise out in terms of water levels etc. If they are going to stabilise out, where is the water coming from? Is it coming from other aquifers, is it coming from the recharge or what? We are concerned about the Condamine Alluvium, we cannot have it being depleted.

What you see in the model is that when you depressurise the Walloon and reduce the water pressure, you change the Condamine Alluvium and other units above. Water leaks from the above unit down into the Walloons because the pressure gradient has to balance out upwards. In the Walloon some of that flattening out of the water levels is due to the seepage

[2] A piezometer is a well screened at a specific interval in which the water level is measured directly by lowering a measuring tape down the hole, while a vibrating wire piezometer (VWP) uses the resonance of a coil to measure water pressure and is placed in a hole filled with grout.

The water pressure exerts a pressure on the VWP through the grout and this is measured as an electrical signal in a cable that runs to the surface. The advantage of VWPs is that several VWPs can be placed in a grouted well at different levels and you can get information on water pressures in several aquifers from a single hole. Both are methods that have been used for a considerable period of time and are well understood in the groundwater and geotechnical industries.

from above and below aquifers as well as just pressure recharge from the left and right and all around.

You are right about why you get that cascading effect. This aquifer replenishes the Walloons which has another pressure gradient that draws down the aquifer above it, all the way up to the Condamine Alluvium. And that is what we see when we run the cumulative impact model, but with no mitigation measures. When we show you pressure recovery we are not saying it's all going to be fine, the pressure is all going to come back on its own. We know we need to work with the mitigation and substitution systems to hopefully prevent unpredicted impacts because it's obviously a lot easier to prevent something than it is to repair it afterwards.

In terms of geochemical studies, if we look at impacts in the Hutton and the Precipice, the Precipice does look a better injection target but we are aware that if we inject into the Hutton we might be able to buffer it against the Precipice and never have those impacts in the Precipice and above. There are all sorts of things that we are looking at.

39. When you talk about reinjection, I don't know how you are going to get it all back in again? Obviously some is going to disappear, quite a large proportion I would imagine. When it's 50, 60, 80 years down the track, what's going to happen to the Condamine Alluvium? Seepage will continue, you'll be gone and there'll be no reinjection.

We are moving from an impact predictor model to an aquifer simulator, where we are simulating all these scenarios. We have the initial data that says on average 1.8gL per year will be induced to leak out of the Condamine into the Walloons if we did nothing.

The question then becomes can we prevent the impact occurring during operations if we build in a series of mitigation measures where we substitute or inject into the Condamine. The next question is then how much of the response happens after the operational time; do we need to put more in there earlier to act as a buffer so that when the drawdown comes in later we get back to the starting point with no net loss. We are looking at all these questions.

40. With your mitigation measures and allocation substitution with RO water, I know other proponents are having trouble with it being considered a hazardous waste, so what permits do you need to allocate it and what testing is being done.

A number of permits are required. If we clean water up using the RO process, we then re-mineralise or 'amend' it. We need to add back the calcium or magnesium to get the SAR back into whack for agricultural purposes so half our treatment plants now have that. That ensures the water quality is suitable for agriculture. At the moment the RO plant at Theten is the only one where we are allowed to use the water for cultivation purposes.

There are a very great number of monitoring requirements and very tight specifications around water quality and what we do with it e.g. are we allowed to cultivate with it, how do we monitor groundwater, soil composition, all those sorts of things. If it is going into something that might end up for human consumption (e.g. one of the other companies puts it into the Condamine Weir) then we need to get an endorsement from the Office of Water Supply Regulator. It has something like 150 different tests to make sure Arrow meets both quality and composition standards.

41. On the re-use trials, how long have they been going and are they successful? Is it a viable option?

We haven't yet made the first water application. Hopefully, we intend to do that before Christmas, perhaps early December.

Is it going to be successful? We know the quality of the water; we know it's compatible with the groundwater and the overland flow water so we have no reason to believe it will be unsuccessful. What we need to prove is that we can manage the monitoring and the amendment process in a reliable fashion.

42. It seems to me that the approval for gas extraction has far outstripped the understanding of its impacts and what you need to do about them. It's happening over a huge area of Queensland, some of which has very valuable groundwater resources. Why wouldn't you develop up the knowledge before gas extraction occurs in some of those areas e.g. on the Condamine Alluvium? Why wouldn't you test some of your models and prove some of the theories around mitigation before you cause some of the impacts you seem to intend? And one other thing while I'm speaking, in some of the previous EIS approvals for companies to the west of us here, there was commentary around subsidence caused by the extraction of groundwater. Will subsidence be an issue in this region because of your extraction activities?

We plan to drill two wells at Kogan next year. I've drilled zero wells in my production fields this year. I actually have enough wells in my existing fields that I don't expect I'd have to do more than twenty wells over the entire Daandine Kogan area, maybe some in the western part of Tipton, before this project reaches approval in 2013 or 2014.

So there are another couple of years where we can collect more monitoring data. We've made the commitment we won't be going out onto the alluvium for some time and we stand by it. We'll be targeting country we know where the impacts are lower. So there is probably ten years of data to gather that we will be able to do before we embark on that drilling campaign.

I've been asked a number of times about subsidence. A photo-micrograph on the pore space was shown in the presentation. I think the porosity of the formation that you see is a single digit number, perhaps 1 to 2%. We're taking up the water in those pores.

The coal stays intact so there is no change in the physical structure of what is below the ground. In that sense the strength of the coal and the rocks above it is maintained. We are researching this via companies that work in the coal mining industry (where subsidence occurs) so it is something we are looking into.

43. Could we get some clarification about the water balance slide where you had the red and green arrows? I'm confused about the figures. On the left hand side with the recharge figures, there is a figure of 12-20 gigalitres per year, and then 36 gigalitres a year in year two? (See *Figure 5 on page 6*)

The references for those figures are down at the bottom of the slide; depending on what literature you read (from 2008 or 2010) that is the current variable estimate for recharge.

44. So you are suggesting that landholders have an unsustainable take-out at this stage?

Well, no, I'm not making any comments about that at all, just saying there is a certain amount of take out. We are going to do high level studies to build mitigation measures into our project to see if we need to use mitigation measures such as substitution or injection to change that balance.

45. From the data supplied, water balance is going to be negative in all the aquifers in the area, and any landholder who has a licence in any of those aquifers is going to be adversely affected. But we will all be affected in different ways depending on your activity and its location within the aquifer. So what process is Arrow going to use to resolve the problem with each licence holder or landholder?

I think you are referring to the 'make good' process. The way it will work is that the Queensland Water Commission (QWC) has been appointed to prepare an *Underground Water Impact Report* for the Surat Cumulative Management Area. It is also developing a groundwater model in which it will predict drawdowns in the same way that Arrow has done. The QWC will produce two predictions; the first will be predictions for each aquifer within the next three years and then for each aquifer there are also trigger levels.

So if it predicts in an aquifer that a trigger level will be reached, then that particular bore, or every bore within that particular area, has a bore assessment done. If that detailed assessment determines there will be an impaired capacity to that bore then the owner or user of that bore will not be able to take the same quantity of water as previously.

If that is the case, the tenure holder must enter into a 'make good' agreement with the owner of that bore; the agreement will provide details re how that same quantity and quality of water is maintained for the owner of that bore if impaired capacity occurs.

46. What are the legal requirements to do that?

It is legally enshrined in legislation so we are obliged to do it.

47. What about after you're gone? For how long are you required to do that?

As long as required.

48. You had a plan up which showed a drop in water levels in some areas on the western edge of half a metre to two and a half metres. Is that on the positive side? Could it be out by a factor of ten? (see Figure 6 on page 7)

These are the results of the predictions. A model is a simplification of reality so there is uncertainty in it and we try to conceptualise that uncertainty. What we have done so far is to undertake sensitivity analysis. The analysis shows that if we vary the parameters in the model and still maintain a reasonable calibration then we get about 60% difference in the answer. Therefore at the moment we think the lower end of the range is one metre and the higher end about four metres.

49. Just looking at the higher end of the range, and looking at the map, my feeling is that at a four metre fall there would be a lot of irrigators without water.

Yes, if this 2.5 metre contour area became four, and then this one (0.5) went up 60% to 0.8 you'd see an increased impact.

50. You are putting farms at risk with a 2.5 to 4 metre drop in water levels.

Yes, that is the prediction without any mitigation measures in place. Our aim is to avoid that.

51. I was wondering whether the Office of the Water Supply Regulator has any jurisdiction over the supply of water for stock and domestic purposes where it is used in the home and for human consumption? I'm talking about where there is treated CSG water that ends up in a home without having to go through a town water supply system, through some sort of substitution arrangement?

CSG water is classified as recycled water so it is automatically covered by the Office of the Water Supply Regulator, unless there is an exemption. Anything that would directly or indirectly augment a drinking water supply is captured by that.

52. Does that mean you'll take that into account for supply to homes?

It has to be, there is no way around it.

53. A question on the model: on this slide it talks about the potential uncertainty range. Back in May, we were told the model had a 60% degree of uncertainty. How do we interpret the uncertainty that you have in the model now, compared to 60% in May?

The May figure of 60% is still the number we are working on for the uncertainty analysis; it is taking us longer than we thought.

54. Today's slides: I think most of us are interested in taking some time to go through them. I've just arrived. Is it possible to get a copy of the presentation?

The presentation will be going up on the website (www.arrowenergy.com.au). For those people who can't download it easily we are happy to send out a hard copy. So whatever is easiest for the individual, just let us know.

As you know details of the question and answer session are taken down so you will all receive a copy of every meeting that is held as part of this round.

55. I have a comment on what you had to say about 'make good'. While what was said was entirely true, the 'make good' legislation as I understand it obligates the company to enter into an agreement. It doesn't obligate it to make good, to replicate what we already have in terms of the quality and quantity of our water supply. It obliges the company to enter into a make good agreement only. I'd suggest this is something totally different to what most people understand 'make good' to be.

Anyone who is in a position where they have to enter into that sort of negotiation seriously needs to take some legal advice.

You are right in terms of how the legislation is worded, but basically once agreement is reached it is then a document that has a legal meaning. So both sides are obligated to meet its conditions.

56. [Question directed to Cr Paul Antonio] Is the Council going to allow Arrow to lay pipelines down the side of the road, or is it going to lay them in our properties?

Paul Antonio: at this point in time I don't have the definitive answer to that. As you know, you and I have been working on an issue around the Nangwe rubbish dump. I'd suggest there is a bit of a gap between what I'm being told by our people and what you are being told. I think that council generally has a very strong view on CSG mining on good agricultural land, and its intrusion across the Condamine.

This isn't a unanimous view, but it is strongly held. We will do what we can to ensure we have appropriate measures in place before anything happens. In our planning meeting yesterday we took a number of steps around mining as a result of community pressure. I'd suggest to you that as far as our guys are concerned, they're definite on this. We have a view we need to have a lot more questions answered before we are comfortable with it as a council.

57. In the slide show before, we were talking about the effects Arrow is going to have on the farming industry. Just for interest's sake, ginning is going to go up $10 a bale. A percentage of that is wages as the ginners are paying to keep their people, to stop them going to work in the mines. We are already going to have to pay a premium this year to have Arrow and other miners in the area. It is already going to affect our bottom line to the tune of $5,000 to $10,000 this year.

I won't say we have a different approach, but the approach we are taking differs to some of the other companies in that we are trying to hire locals for our ongoing workforce. Yes there will be some wage pressures because of that but there are a bunch of other community benefits that aren't there if we had everyone live in camps, flying in and flying out, and taking all the money they earn out of the community.

At the construction stage though, we've heard that people don't want that short term impact in their local community. They'd rather see us build camps and then cope with the effects of a rapid influx of people separately. We like to employ people who live locally; it helps us keep wages down because there is a big difference between what someone gets paid when they are working on a two-on, two-off roster in camp to what they get paid with us, living in one of the towns around here.

The difference isn't the numbers that get quoted around; we are not paying operators $100,000 a year. I've heard that, from multiple people over the last few days. It is nothing like that, absolutely nothing like that.

58. It is costing us money already.

I appreciate that so we are going further than most of the other operators to try to address that issue.

59. If I can be very general re groundwater, we've got the Great Dividing Range as a source of recharge, and at the very opposite end of the spectrum we've got the Great Artesian Basin (GAB). In between the barriers are confined and unconfined aquifers some of

which have interception activities, some of which are proposed to have extra interception in the form of CSG.

We discussed water balance earlier. I actually look at it as water imbalance because we are going to change the current water balance. I realise that it is already modified and, to include a point that was briefly touched on, the system as we know it is now licensed. With time and experience the licences are being modified to make them sustainable. Not so long ago the Queensland Government legislated a GAB plan which made specific reference to the groundwater and it is actually zero. So water balance is very pertinent.

60. The further point I wanted to make is that we are making gains on the groundwater model; a couple of years ago it was suggested that there would be no impact. We're now heading towards defining an impact (whether or not we believe it) but it's a start. The focus is on that now and not salt from RO. I haven't heard of a plan to dispose of the salt which is a very significant part of the problem so I'd like to hear where you are up to with it.

In terms of issues like salt, the focus hasn't been removed. In fact we are working on it just as hard as the other issues, and continuing to refine what our approach might be. We don't have a project yet on a significantly large scale to engage a third party to be able to process that salt for a beneficial use which is our ultimate aim. There is a huge market for salt but it also requires us to work with other players to do that because none of us have enough salt on our own.

It is certainly a very high focus; it will be part of the EIS and will continue to be part of our management plans.

61. I commend Arrow Energy for the decision not to frac in the Dalby expansion area. In fact, given the growing community concern about fraccing, Arrow's decision not to frac has been held up as a very positive move.

I now draw your attention to this document which is an environmental authority for the Jordan Project Area. The principal holder is QGC, the joint holders are APLNG, Australian CBM and Arrow. For those of you who do not know, Australian CBM is a wholly owned subsidiary of Arrow Energy. Where a petroleum authority is held by two or more parties, those parties are referred to as joint holders.

This authority, approved on 26 July 2011, amongst other things gives the joint holders authority to drill 2000 CSG wells, of which 1700 will be fracced. Separate to this, I note a paragraph on page 19 of the EMP for ATP 676 for Arrow which states Arrow does not, and will not, utilise hydraulic fracturing techniques on ATP 676. Yet I see that sub-blocks D, W, X, and Y on block Brisbane 2528 on ATP 676 are included in the Jordan Project area. I also note that QGC's hydraulic fraccing risk assessment management plan of March 2011 says the following, and I quote: 'There will be an unknown percentage of wells outside the frac blocks that will be damaged during the drilling process and will require hydraulic fraccing to bypass this damage. Finally there will be some percentage of wells over the life of the field in both the fracced and non-fracced blocks that will benefit from re-fraccing."

My question is: can you please explain to me how Arrow, as a joint venture signatory to the Jordan Project area, has a contradictory stance to fraccing, and how the company reconciles the risks to both your shareholders and to the landholders in the areas which you operate as a joint holder. Further, can you please furnish me with a list of references and data that show the logic in your decision-making to accept an 85% frac rate in these areas as opposed to a 0% frac rate in the Dalby expansion area and part of ATP 676.

You might recall during the last round of community information sessions we travelled through the Surat Basin from Wandoan to Goondiwindi. We mentioned then that we had undertaken a land swap with BG or QGC in the ATP 676 area. The swap originated from about 2000/2001 as a commercial agreement between QGC and Arrow in what is called a farm-in arrangement, which is quite a common thing in the resource industry.

There were some different blocks of ground under ATP 676 which Arrow (or a subsidiary, Australian CBM) held as title holder. Under the farming arrangement QGC did some of the work in order to earn an interest in those blocks. This is quite a normal thing that goes on.

What we have ended up with ten years hence is a situation where we are inadvertent partners with QGC, even though there we have no alignment with it. So what we have done is set in place a legal arrangement which in effect was a land swap agreement. Arrow can't transfer the title to the ATP but it can have a commercial land swap arrangement which says QCG has 100% interest in that piece of land and Arrow will take 100% interest in the other piece, to get rid of the shared arrangement that was in place.

So we went from having a 50-50 arrangement here, and a 50-50 arrangement there. We said you take 100% of that, we'll take 100% of this and that makes it easy. That was step one.

Step two then is that QGC applies for a petroleum lease (PL) in its 100% area. If QGC decides to frac, Arrow has no control over that. We stand by the commitment that where we are doing the EIS in the Surat Gas Project area we will not frac. We haven't changed on that.

62. So you say in one document that you won't frac in ATP 676, yet in the Jordan Project authority which incorporates part of 676, there could be fraccing?

Only if it's done by QGC.

63. So it will be done by QGC, but as a joint holder do you have a commercial interest in that?

No, absolutely not.

64. Then why is your name here?

Perhaps we should do this over a map. The ATP provides the exploration right and we have title to that. The petroleum lease is the production document.

65. So you are allowing QGC potentially to frac where you have title rights?

The ATP will be converted to a PL held 100% by QGC. That little portion where you mentioned the sub-block numbers will be transferred to QGC, so that is its area.

66. Are you happy to have your name on that document knowing that you are a joint holder, and to publicly say you will not frac, but in this arrangement QGC will potentially frac those parts.

If the inference is that we are using QGC as a proxy to frac for us, that is incorrect. It is simply an arrangement that we've had in place to do a land swap which is quite common.

When the work occurs it won't happen under the ATP. You can't go into a production drilling program under an ATP, and you certainly can't drill 2000 wells. You have to have petroleum leases to do that, and those petroleum leases will have nothing to do with Arrow. It is a transitional paperwork thing. The actual work can't happen yet as Arrow's name is still on there. When it does happen, Arrow will have zero interest in that land.

67. Just before the break, there was a comment made regarding the community and Arrow's impact on it. That presupposes there is going to be a workforce in the area. What happens if the workforce isn't there? It is going to impact us, our rents, our mortgages, all that sort of stuff.

The comment was that the company wanted to source its workforce in the surrounding community, but that presupposes the workforce is actually there.

I probably should have said that what we would like is a locally-based workforce which will involve some recruitment from the local community. A great number of the people in my team have been sourced locally, but it will also involve bringing people in from other areas, and helping them become members of the local community.

So it wasn't so much that I want to have only people who are born and bred on the Downs it's more that I would like to have a workforce which spends its money here and brings up families here. They will probably end up coming from the coast, down south, or the west.

68. Yes, but that will still drastically impact on our communities because it means these people are going to need somewhere to live. Cecil Plains isn't a big town. It will impact quite dramatically on the living arrangements for most of us. What is the solution for that? Is there going to be specific housing built for them, or are we going to see the rents go through the roof so people like us can't afford to work here.

Higher rent is one of the impacts in the socio-economic part of the study. Before I returned to work in the Surat, I was working in the Bowen Basin; Moranbah rents are through the roof, so a four bedroom house up there can cost $1,500 to $3,000 a week.

Morally, Arrow can't let that happen here so it is investing in housing projects. We already have done so in Gladstone (the earliest acute impact will be there) to relieve that stress.

I don't expect we'll have hundreds of people moving to Cecil Plains. The workers I'm talking about are operations people who will have on going full time jobs. That's not going to be hundreds of people in Cecil. It might perhaps be 400 people in Dalby.

69. Prior to this meeting on Friday, I sent an email to Jan requesting an agenda so if there were some issues that weren't of interest I wouldn't attend those sessions because, like most others here I'm fairly busy.

She replied there wasn't an agenda available on the Friday. I re-sent the email yesterday, there was no reply. Surely a meeting like this would have an agenda prior to it, and that agenda would be available to any of us. I'm very disappointed that Jan failed to answer our request on Arrow's behalf.

That's a fair point…I think I responded on the Friday and said I'd get back to you Saturday, didn't I? Yes. I didn't get back because we didn't have an agenda by Saturday and then I've been out here since Sunday.

The difficulty with these presentations is that because of constantly increasing information becoming available it's a moving feast in that until almost the first moment of the presentation we don't always know the order of presentations. In fact, we made an amendment this morning, that's how difficult it is. We emphasised in both the newspaper advertisements and invitation letters that these sessions were going to include water and agriculture, which we saw right across the area as being vitally important.

But it's a fair comment, it's a fair criticism and I cop it. Please accept my apologies.

70. For some time now we've been interchanging, or exchanging, views with the Arrow people about potential effects on our farms, and I guess on one hand it's heartening to see that those things have been acknowledged but until today we haven't seen the answers to any of those things.

Will the EIS provide the answers that we're seeking on those potential impacts? Is that the process when the answers will be given?

Yes, the EIS is normally expected to answer those questions but I can't give you an answer today re the impact on agricultural productivity in the region i.e. how much will be lost.

We can't assess that to be honest; it's the same difficulty we're having with native vegetation. Arrow's intent is not to impact native vegetation, and to minimise the impact on your properties. I could paint you a hundred scenarios about what it might look like, but none of them would probably be close to the truth.

What we've tried to do in the EIS in relation to those matters, in particular agriculture, is say that we can give you an order of what the magnitude might look like. We felt it was then more important to ask what we wanted to achieve out of this. As I said earlier the environmental impact assessment is about two things: firstly identifying and assessing the impacts and secondly how to manage those impacts, which is probably the more important part for you, and government and regulatory authorities. There are two tests to do this.

The first is whether the project should proceed. I can't answer that question as it's what we call a societal question i.e. how your feedback influences politicians. It's ultimately what politicians think collectively on behalf of their constituencies that will determine whether this project proceeds or not.

The next matter is that we have to define mitigation objectives and measures which seek to protect environmental values. What you're looking for really embodies how they will be managed. We've given an indication of what the impact will be on an individual property but can't actually quantify it. I know that's a roundabout answer, but it's the reason we're struggling in that space. Does that help a bit?

71. Yes, it does. But I guess the vast majority of landholders are still grappling with the fact that Arrow has yet to provide concrete answers to our real issues. Sometimes those answers will have a dollar sign in front; sometimes there will be exclusion zones, and that sort of stuff.

It's a complex issue, because our farms are complex operations. They're different here to properties west of here. Somewhere along the line Arrow is going to have to actually answer those questions.

Can I perhaps take a little bit of latitude here and explain the lifecycle of a project? I'm not trying to be facetious here. The problem when we do an impact assessment is that it's the very start of the project. The project is progressively defined as it goes on in time, to the point where it's actually implemented.

Most times the impact assessment process is done early when we are looking for those really big impacts that can impact on whether the project should be built and, if it is, how?

So it's early in the piece and we can only do so much in helping you to understand what it means on your property. Later you'll have a better definition of what it means to your property because government will impose conditions on Arrow's operations on your property.

You'll get further definition when Arrow comes and talks to you. Then there's a further and subsequent parallel phase where it talks to you about compensation to deal with the impacts that can't be dealt with.

Unfortunately, it is a long process to get there; it's not one I can answer today. That's why we recognise this is a stressful process because it takes time for all those pieces of the jigsaw to come together to give you the ultimate answer. I know that's a roundabout answer but I hope through the EIS I can give you as much information as I can pull together. But I also recognise there are other pieces of the puzzle that will subsequently come.

72. One of the fears of the community is that once the EIS process is finished, and approval is given with or without conditions, it then loses its ability to have direct input into the shape of the proposal. Is that a legitimate fear?

If you ask me that personally, then my answer is no. The reason I say that is because if the government approve it, it doesn't mean it can proceed because Arrow then has to seek something like 400 permits and licences and conditions to actually be able to do anything.

As well as the high level documents that Darren spoke about i.e. the environmental authorities which set high level conditions, there are many other permits required. When government approves an EIS it's really saying to Arrow it is authorised to go to DERM and other agencies to obtain the necessary permits.

Now not all of those permits are subject to public involvement, some are just procedural but very heavily regulated re what's required and how they fit together. However, others do have input processes, and you'll find that a lot of the conditions which are applied to this project (like the earlier ones) will require consultation. So the door's not closed.

Typically, the process to get all those permits takes about a year or so to work through agencies and, in many instances, with the community. So the answer from my point of view is

that the door's not closed. Your ability to comment about the project in general is significantly reduced, but the door's not closed on how or when it happens.

73. Tony, when you were speaking this morning you mentioned work was happening around River Road. I have heard it mentioned that Arrow's been down there…can you explain to us what you are doing down there?

There were some old exploration wells that had been drilled, and we were going through the final step to rehabilitate them. You need to bring the drilling rig to the site, it runs a drawstring to the bottom of the hole that's been drilled, and it's cemented in stages. Then we cut the casing off below ground level, and rehabilitate the surface. That's what they're doing.

74. When was the well drilled? Was it a recent thing?

I don't have the dates but I can include them in the meeting summaries we send out.

There are 13 wells on River Road that were drilled between March 2007 and January 2012.

75. What has tweaked my curiosity is that I know there's a six month period or something along those lines under the environmental authority for rehabilitation. We obviously didn't see Arrow there six months ago so there's been considerable time lapse; is it a normal thing to leave a period of time before it's done?

We are actually converting some wells for groundwater monitoring. There are a number of wells we're doing the rehabilitation program across, and in some of those we installed a piezometer, which measures water pressure as part of the groundwater study. A number of the bores are kept open for that purpose. To some extent the weather also delayed us because we need to get access to land to do this activity. Those two things contributed to the delay.

76. So you are telling us it's been a long period of time?

Yes, the wells are secure and the gas can't escape because it is held by water pressure.

77. Is the water drawn down?

The water level is static, there's no production in the area so the water level there is a natural water level. We're not affecting it.

78. What about exchange between aquifers?

That's where we use the casing, and cementing, that we talked about previously. All the upper aquifers are encased and cemented off. We only drill into the Walloon Coal Measures.

79. The well had been there for ten years; is that an acceptable period of time?

I don't know about that well but certainly Arrow is a company that's been drilling wells since 2000. There's a legacy of wells that need rehabilitation works, and we're doing that now as part of a widespread program to ensure any of those wells that haven't been done in the past are now rehabilitated.

80. So there are a number of wells that could have been done in that period of time?

I don't know the time period, but certainly there are wells that have been left because the thinking back in the earlier days was that it's a good thing to have monitoring points around the field, even during production. That's why a lot of the wells were left open in anticipation they would be used for groundwater monitoring or for gas pressure. We don't do that anymore as we now drill dedicated monitoring bores for that purpose.

81. On the topic of drilling the wells, I have to confess my eyes were glazing over a year ago when you were telling us how you drill the wells and put the steel casing down. As a quick refresher, when you drill the well and you put the steel down, does the steel go all the way to the bottom of the well?

It's put down in stages, so it's a telescopic arrangement. When we drill the first section of the hole, it goes down to the bottom of that section, then we drill the next section and yes, casing goes down to the bottom of that section. In an exploration hole we case down to the Walloon Coals but in a production well there's casing all the way down.

82. With exploration holes, do they do the cement grouting thing around it or just for the production ones?

No, all the wells are cased and cemented.

83. They put the cement down the middle of the well; it has to get all the way to the bottom when it's forced out the sides, is that right?

Yes, like a syringe.

84. I'm concerned it's roughly about an inch thickness around the outside, is that right?

The annulus, yes.

85. What happens if the well is crooked? If the well is drilled a bit crookedly, and there's only one or two inches of cement on the side, then if the well is drilled crookedly any more than two inches the steel casing will be butted up against the soil. You can't force the cement there, so you're going to have holes, or exposed parts of the casing, or cement grouting. Is that true?

A lot of processes are put in place to make sure we drill vertical wells as there are problems with inclined wells, as you're pointing out. We also use centralisers to make sure the casing is held in the centre of the hole, for the reason you mentioned that if you keep a space between the casing and the bore hole itself, cement can get to the surface. This is a routine thing we do so part of the test of a successful cement job is that you get the cement back to surface. And we do that.

86. So it doesn't matter if the well's not drilled straight then?

Look, we drill straight wells. The rigs are designed to lock into place at 90 degrees, so you start it off straight. The way you configure what they call downhole assembly dictates how straight the well is. It's a very established practice to put in place the right measures to drill a straight hole.

87. Well, I'm a bit worried about that, Tony, because I've been on to the QDEX website and I've looked at a lot of well completion reports; so much so that I'm sick of it. Every single one of the wells that I looked at had one of those circular diagrams attached to it, and a data sheet attached to that. Every single well was crooked.

I will concede that over 300 or 600 metres, some of those wells were only a metre or two metres off the vertical, but I found one well that was 59 or 56 metres off the vertical. There are examples of 9 metres, 7, 53, 3.7, 38.7, 36, 6, 22.5 metres, 17.5 metres and so on. So you don't drill vertical wells.

There's one in there whose deviation I can't remember but it went out, came back in, went out and came back in, and while it was doing this it was going around it like a corkscrew, like a wormhole.

Some of these wells are as recent as 2009 so you don't drill vertical wells because these are for exploration and they don't go public until two and a half years later. But there's no such thing as a completely vertical well.

Yes, you're right. We do start vertically but the ability to keep it so decreases the deeper you go. You mentioned 300 or 600 metres…at that depth it might be a metre off which is the normal aim for the tolerance range. On the way down you can also strike formations that can cause it to deviate; that's not uncommon.

It doesn't matter with an exploration well as it has a short term life, and is then plugged.

It does matter in a production well so between the drilling process and bringing it into production; we run tools in the well (called a verticality log) which tells us how straight it is. If it's not straight, it may not be suitable as a production well. You cement it back up to a point and try again or, in some cases, you re-drill the whole thing. That also happens.

88. I'm going to have to get back onto the QDEX website and go through every single one. I won't look at the exploration ones but I'll go through and look at all the production ones because, I don't know about the rest of my community but to me personally those figures are extremely alarming.

You've been telling us for the last 18 months or so that you guarantee the integrity of your wells, and the way that they're drilled. Yet they have a little bit of steel that is a corrosive substance, and it's surrounded by some cement that I've got no confidence actually encases that well. You're drilling through our alluvium, and these things are as crooked as anything. My son could draw a straighter line.

I think that's overstating it because what's important is that we achieve a complete annulus of cement between the casing and the hole. A deviation of two degrees, of one degree, does not prevent us from doing that. In the Bowen Basin where we directionally drill, the wells bend by seven degrees every 30 metres. There's no problem getting cement around that curvature. The wells start vertically and end up horizontally, by design. The fact that the well was slightly bent, or even highly bent, does not change its integrity at all.

89. I'll just make a comment on that, Tony, before I ask my question. You're dealing with a sensitive community, and I hope you've identified that. You stated that Arrow drills straight holes when in fact it doesn't. So when you're asked that question, you have

the opportunity to say that Arrow doesn't because that builds trust. It's a bit like the fraccing issue; you're buying community acceptance when there's a bit of smoke and mirrors there.

My question is on the subsidence issue. You seem pretty confident on it so will you guarantee in any conduct and compensation agreements that there will not be subsidence?

That's subject to some work being done by subsidence experts. We will take their advice, their direction, and put in place appropriate measures based on that information. We're not experts on that issue which is why we use external consultants who are experts. Subsidence modelling and monitoring is extremely advanced because of the coal mining industry. We can use the expertise they've developed from a vast number of mining projects around the world.

90. It's just that it's a pretty critical issue because I don't think even Anna Bligh can make good if a farm drops by three or four metres.

With due respect, it's impossible to drop three or four metres. Even in a coal mining situation, where a long wall miner extracts three or four metres of coal, by the time that translates to the surface, it's not three or four metres, it's much, much less because there are both bulking and subsidence factors.

It's irrelevant here anyway because we're only taking out two percent of the volume of material in that coal seam. The coal seam structure doesn't change, it's only that little bit of water in those walls; the layer cake of coal seams and other formations that make up the stratigraphy of the area is still intact.

I'm not a farmer, but I've spent a lot of time talking to people in this community and others and we understand that on that flood plain the top profile of soil is critical. If this study showed there was going to be a catastrophic impact to it then we realise that would be a really, really big problem. It's not something that gets solved by us giving you ten grand or drilling your bore deeper. We take that issue very seriously which is why we're doing the study; once we have the results we'll deal with it appropriately.

91. So you'd consider something like that a knock-out for operations?

I don't know what the results of that study are going to be but we understand that it's a significant impact.

92. Given that your EIS is imminent and there's lots of work happening on it, we've all spent a lot of time in the last couple of years looking at flood plain issues but they don't seem to be getting any less. Has your company considered, through whatever means, relinquishing its tenure above the Condamine Alluvium?

In relation to your comment that *they don't seem to be getting any less* I was hoping that particularly after what I showed you today it demonstrated a willingness for us to understand and try to work through the issues.

It frustrates me that we aren't yet at the end of that process so I accept your frustration that we can't give you absolute answers. However, we are working through those issues and will continue to do so. Believe it or not but one of the positive things that comes out of these

sessions is that as we eliminate some concerns, others get raised so we'll go away and work on those. I doubt we'll ever turn up and there won't be any questions, but you know we are working on many issues.

93. So the gas reserves are such that you're not willing to make relinquishment a goodwill gesture?

There appears to be an economic gas field out there. Although we don't know the development costs we're working to understand what it'll cost to manage the impacts.

94. With reference again to that River Road exploration hole we questioned earlier, somewhat unfortunately but fittingly you used the word legacy to describe some of those earlier bores and the need to tidy up that work or finish it off.

As I understand the history from direct conversation with the landholder, he was approached in 2001; he was told the preferred site to drill the exploration well was immediately adjacent to his residence. The farmer rejected that, accepted a site somewhere else on the farm and a compensation agreement was reached.

It's been ten years since that compensation agreement was honoured by Arrow; it happened for the first two years and no further. There has been very poor communication about the results from that hole.

There's been no notification of access when Arrow inspected that hole …at least until very recently. One time recently the landholder saw lights at the site at night, went over to investigate, and found a couple of your staff members with a laptop at the exploration hole.

To close the hole off, formal access was required as it would look a bit obvious that something was happening with all the equipment required. The landholder then pointed out that Arrow hasn't been providing compensation under the agreement for the last eight years. It was then promptly fixed up in two days to achieve access.

I think the word legacy is somewhat fitting. We're dealing with things that come out of the woodwork time and time again. You just referred to your willingness and intent to work with landholder issues; none of this may be your personal fault but from our point of view Arrow the company hasn't worked for us.

The first time we were here we acknowledged very clearly and openly that there'd been a long history of Arrow in the region, and all sorts of things had been done that were not good. You've drawn on one example of that.

The commitment now is to fix up those things that need fixing and I hope you can see from these last four visits that we want to improve how we operate and engage with you.

I take on board the particulars about the recent events, and I'll follow up with our land and exploration managers to find out what's going on and then get back to you. What I'd like to convey is that we've got a job to do to fix up some of those legacy things left behind by the company, and that's what we're doing.

95. This well was drilled ten years ago, and it wasn't six months ago that someone was there after dark, in an unmarked vehicle. It's not on. Any wonder we still do not believe you.

A whole bunch of stuff is being fixed up. I'll put my hand up and admit there is stuff out there that I don't remember doing. I'm prepared to stand up and say it was my mistake but we are actually out there fixing things. I'm sure with the best intentions we'll still bugger stuff up in the future but we will fix it up.

96. The inference seems to be the exploration hole is a different matter, it's inconsequential in the overall project.

I appreciate that. We're now absolute that we cement the hole before we finish. That causes us an inconvenience sometimes when the geos might regret a monitoring kit hasn't been put down the well but we now know it has to be standard practice to cement the hole.

I've been advised by my guys that on the particular property I think you're referring to that perhaps the landholder wasn't reminded or forgot he had to submit an invoice for the compensation payment which is why it was late. But that said we're in the process of rectifying it with the landholder. With regards to the guy not accessing the property appropriately, that's absolutely correct. He did that, and that person no longer works for Arrow.

97. Does Arrow Energy use cavitation drilling?

No.

98. You don't? You do not intend to use cavitation drilling in this area?

No.

99. Why not?

We don't need to. Cavitation is a process where you drill a well out of a coal seam, and you basically inject air, at really high pressure, and let it go all of a sudden. You do that and you get fracturing. It's not fraccing as we know it, but that cavitation process creates a cavity in the ground. We don't use it because we don't need to now or in the future. It's the same reason why we don't use fraccing: the permeability of the coal is so high gas flows quite readily, it doesn't need any enhancement.

100. What is the average production of a single gas well in Queensland?

That's a hard one because there are so many variables… the depth of the coal, the gas content, the type of well, there is no simple average figure. Also a well produces a lot of gas early in its flow, and tails off over a long period. In my fields it ranges from about 100 gigajoules a day up to a bit less than 300 gigajoules a day.

101. Can you explain what a gigajoule is?

There are twenty gigajoules in a nine kilo gas bottle, or 100,000 standard cubic feet. So if you let the gas out at no pressure, it would fill up 100,000 standard cubic feet.

102. And that's in one day?

Yes. You might have heard much larger numbers from some of the other operators because with different technology you get different results. We know of CSG wells where they have fracced and cavitated that might be ten or twenty times that rate. I wish I had some.

103. After listening to Arrow's presentation this morning on both land and water issues, and their answers, and listening to landowners this evening and some of their issues, I wonder if we could have a show of hands who would allow Arrow on their property in its present form. Anyone who wants to can raise their hand...

That gives Arrow a fairly good indication of where it is at the moment. Thank you.

104. What's the gross value of production for one day?

Gross production value is $2 to $2.50 per gigajoule. Those wells which are at 100 gigajoules a day, we sell each gigajoule for between $2 and $2.50.

105. Do you use pressure grouting in your work constructing the wells so that you press your cement from the bottom up or from the top down to get greater well integrity?

The CSG wells we grout from the bottom to the top. With the process we mentioned before, we pump cement down inside the casing; it then goes up again between the casing and the wall of the hole.

The groundwater monitoring bores are constructed by the same rigs and drillers cement them in the same way.

106. Yes, is that a change? Have they recently changed the standard, or is there some new standard coming in?

No, it's the standard that Arrow has applied to the construction of those wells. They are done by the same building and completions team; it's the standard way of doing the project.

107. I've taken a fairly broad interest in this. I'm involved in the Surat Basin Corporation; I'm involved in the CSG Engagement Group. My wife and I come from an agricultural background and we drove down from Toowoomba today and crossed undoubtedly some of the most valuable agricultural land, not just in the Toowoomba Regional Council area, not just in Queensland, not just in Australia, but probably some of the most productive country in the world.

I think it's incumbent upon you to tell us just what price you are prepared to pay to actually operate on that land? Community feeling is strong, the risks are high. In my lifetime, and I'm only a pretty young bloke, I'm only in my 20s (if you believe that you'll believe anything). I've seen enormous land use change in this area. I've seen it go from grazing to farming to intensive farming, and I wouldn't be dreaming to suggest that it has a big role to play in feeding the world.

Are there alternative places for you to go? How determined are you to drill here? I represent the Toowoomba Regional Council and have been authorised by the mayor to say what I'm saying. We are extremely concerned about the move to extract CSG this

side of the Condamine River with the limited knowledge we have about CSG, about groundwater, and all those sort of things.

I understand there must be enormous economic pressure for you. I understand in talking to your CEO that you see this as your soft spot in terms of production. Quite frankly, I just wonder is it worth the effort? Is it really worth the effort? As I said previously, you are dealing with some of the best agricultural land in the world. And there are other places that you can go, not all that far from here.

Is it worth the effort? That's what we're here finding out. That's what we're exploring, it's why we're doing the groundwater work, land use etc. to see if there's a way. We've made a commitment that we won't develop east of the Condamine until we have sustainable means to remove the gas we know is under the ground there.

We're not there yet but have made progress. We've still got a bit of work to do, that's clearly acknowledged, so we have not made a firm decision either one way or the other.

We are currently developing gas in the Bowen Basin and doing other things but there is so much gas here it is worth the effort to see if there is a way to get it out. That's really what we're about. It's also why we're taking our time, we're still two years away from a final investment decision so there is a lot of time left to do the studies that are required.

Clearly we won't do things that jeopardise the livelihoods of hundreds and thousands of people. We're trying to find a way to co-exist. We think it's possible, and we're doing the work, but time will tell. We'll come back here every six months to keep you updated as to where it's going. If we can't prove there's a way that gives people confidence then we haven't succeeded in our challenge. But that's what we're about, it's getting that information to give people confidence.

You've heard a lot of science today, and that's what we'll keep presenting because science is all that we can work on. The science will dictate the way we can do things here.

108. In May I asked whether you guys would be able to provide us with water quality analysis of water that's been through the Arrow RO plant. Can we have it please?

Yes, we can do that.

109. When? I asked in May five months ago…I'm still waiting.

Can someone write that down? I'll get you something by the end of the week.

110. Thank you.

Sorry about that.

111. And can I have the lab reports from that?

Yes, that's what I'll get for you. Do you want the amended or unamended report?

112. I'll have everything, and I'll work it out for myself. I'm happy to take as much as you want to give.

It's basically in the public domain anyway. There's so much information from monitoring on Theten that there's no issue with us sharing that. We want to demonstrate it's safe and reliable.

113. Can you tell me, off the top of your head, what SAR you're aiming for?

The number is four.

114. Can you get it to less than two, because that's the groundwater SAR?

I'll get those answers for you, and get back to you.

As per DERM requirements, Arrow Energy is required to maintain a Sodium Absorption Ratio of 4.

115. In May I also asked a question regarding when you are handing back the tenures. The answer I got later on was 2045. Is that still the date?

In the presentation I talked about exploration results in the south, and I said that in ATP 679 we'll be giving back some ground there next year.

116. I wasn't here when you spoke this morning, Tony. In May, I think, Andrew came up to me and said 2045 was the answer to my question, and that you guys would be gone in 2045.

A petroleum lease has a 30 year life. I assume that's what he was referring to; if it was granted in 2015, then 2045 is correct.

117. That was just a leading question because at a recent Senate Inquiry in Canberra Heffernan asked all the CSG companies what happens about the monitoring when you guys are gone. So what happens in 2045, with groundwater monitoring? The companies responded that their responsibility for doing groundwater monitoring ends when they return their tenure to the state government. So what happens in 2045?

The way the *Water Act* works with the *Petroleum and Gas Act* our obligation continues for a period that will be determined…it doesn't rely on the tenure itself. There are other access arrangements etc. that can be made to ensure the ongoing monitoring is done until the government's satisfied that it's all right to cease doing it. But the liability, in terms of any impact, continues in perpetuity.

118. Can you email me the sections of the Act where it says that? Because you can download the transcripts of the Senate Inquiry and there, without fail, company after company said groundwater monitoring ends when the tenure is handed back. I remember reading what the QGC woman, Catherine Tanna, said. That's what she said.

I'm not sure what you're referring to about the Senate Inquiry but what I described is the legal situation.

119. The state government has also said it will pick up the slack for the monitoring after you guys have handed back your tenure. That scares me because you're a wholly owned subsidiary, and you've got wholly owned subsidiaries. The reason for these companies to be set up as wholly owned subsidiaries is to limit liabilities to the parent companies. It would be really nice for us to see Royal Dutch Shell and PetroChina send us letters giving us an assurance they are going to guarantee any impacts that may or may not eventuate in perpetuity. Can you pass that on to Andrew, to pass on to his bosses?

It'll be recorded.

120. Does anyone else want to ask questions because I've still got some more.

In relation to the SAR, we will be constrained in terms of what we produce in water quality as that will be determined by DERM. In many cases its idea differs from what you or I might think SAR should be; we'll just have to work with that.

121. I would hope at Theten they would want it to be less than six because government reports say that SAR ratios six and upwards will cause harm to these soils?

It is four.

122. You guys have been busy in the community recently and there's been a landowner, a neighbour of mine, who's been approached by Arrow Energy in the last couple of weeks. The timing of the approach is pretty interesting because I'm a member of the Central Downs Irrigators Group so I get to hear what goes on at the committee meetings. I'm aware you've been in discussions with the committee of the Central Downs Irrigators about putting down monitoring sites as you want to put some monitoring wells around an alluvial well to see if you can get any information.

At the same time as you're having those discussions, completely independently and without mentioning it to the irrigator group, you approached another landowner in the community about doing a different sort of monitoring.

I assume this is for the 300 monitoring wells. That alarms us as a community because you didn't mention it at the Central Downs group; the landowner said that whoever it was had a piece of paper from the Toowoomba Regional Council saying Arrow has its permission to come on and have a look around the site. I'm wondering if you'd be able to show us a copy of that letter from the council to Arrow.

Yes there are a couple of monitoring bores proposed for that site; they are completely unrelated to the study we're discussing with the Central Downs irrigators.

123. It's related to your activities on the pipeline? We don't understand.

So the question was about whether or not the Central Downs Irrigators…

124. No, the question was if we can see the letter from the Toowoomba Regional Council that was shown to the landowner at that first meeting.

I'm not aware of this letter so I'll undertake to find out more about it. None of my people here are familiar with it.

125. The problem is that the Toowoomba Regional Council is not familiar with this letter either. We've approached them and asked for a copy of the letter, but they can't find it.

All we can do is try to follow it up as no Arrow staff here know anything about it.

Internal investigations have revealed nothing regarding a possible letter from the Council. We note that such a 'Consent letter' from the Council does not align with the land access process. As part of this, the company would provide a notice of entry to the landholder, and the Council would not be involved in the process.

126. You had three Arrow people present at a Central Downs Irrigators committee meeting talking about groundwater monitoring and selecting sites for one type of groundwater monitoring analysis; wouldn't it have been prudent in that conversation to say that you were within two to three days of sending a land access officer to a member of this local community to discuss putting a well down into the Walloons and into the Hutton. It might be a different study, but it's still water monitoring. Wouldn't you have thought that that was a good idea?

The answer's been given. The reality is that no Arrow staff know what this is about but we will go back and check and, if necessary, talk to the recipient to find out what this is about.

Every time we do these sessions we give an update on what we're up to. We've said before that we're doing exploration works and where it's being done. What you referred to might just be a part of that activity. We said we'd put down bores, and we'd monitor. Perhaps that's all it is but I've said I'll check and come back with the answer.

127. Rubbish.

We've said we'll get back to you on the specifics of this one

128. I don't think it comes as a surprise to you that you guys have got a credibility problem in this room. The reasons for that are many and varied, and some go back a long way and some don't. If you expect the community to have confidence in what you're doing, and what it is that you propose to do here, you need to be up front about everything. To have two different groups of people running around doing things in relation to water monitoring is fraught with danger.

This is the sort of issue that it creates. As Chair of the Irrigator Group, when I get a local landowner ringing me up to say he's had an approach from Arrow to put down some monitoring holes and we don't know anything about it when only two days before you've been talking to us, it doesn't create a good look. I don't know if there's any ill intent meant by it, but if you're serious about shoring up credibility, you can't let things like that happen.

There was no ill intent. The land agent was out doing a job as part of a large program for water monitoring bores that we'd previously committed to. The timing is unfortunate but we've taken it as feedback that we need to brief community leaders like yourself on Arrow's broader program at the very least. Then when you receive that phone call you'll know what's happening.

I would add that there aren't two separate groups doing activities in relation to groundwater monitoring. It's a centralised activity but there is more than one person working on it.

The amount of work we have to do to execute the program is quite significant which means a lot of people are working on it. When we came to see you, and I was one of those people, we were very specific about what it was we were there to discuss. We didn't have all night and you didn't want us there all night, so we talked very specifically about the proposed study that we'd be doing. I thought it went quite well…and of course we are very happy to engage at any point in time about any of our work.

We will be doing a broader groundwater monitoring program, and we're out now trying to identify those sites for a 2012 works program.

129. On that topic, do you think it's wise to have your water monitoring site on a contaminated site?

That's the sort of information my guys are finding out as they go out and do these things. There are a lot of sites we have to understand e.g. potential sources of contamination pre-dating Arrow's activities; there is a whole range of things we need to understand.

Both desktop and field scoping will occur before we commit to a site. We discover unexpected information…it could be a grazing property and we find there was a dip there. The fact that it was a contaminated site goes into our assessment to determine if it's a suitable site or not.

It wasn't as if we went out looking for a contaminated site, we found it because of the thorough process we go through.

130. I understand that according to the *Environmental Protection Act* there's a timeframe within which you have to have your EIS submitted to government, is that right? Is it right that you've only got something like two years to submit it for the first time?

The timeframe is flexible but the process does take around that time. You can do it in a shorter timeframe but there are a lot of stages in that process. It could actually be extended well and truly outside our control as it will depend on the resources in government to analyse submissions as well as a whole range of other things.

131. I was talking about your initial one, this December. You seemed pretty keen to have it in to the state government by December, is there a deadline that you're trying to meet, in that initial submissions timeframe?

Yes, they're internal company deadlines. For us to take the steps needed to make a decision about whether we want to proceed with this project, we need to understand what the approval process might look like, what the costs of managing this project might look like, and we need to take all of that into consideration when the company makes a decision as to whether it wants to proceed with the project.

132. The question I'm asking is not about your internal timeframe but if there is something enshrined in law, like a section of the *EP Act* that says you've got one year, two years, to do this initial submission?

I don't believe so but remember Arrow is doing a voluntary EIS, not doing one where it's been asked to submit one.

133. I might be wrong, I thought it was two years. Maybe it's something a little bit further down the track, something which gives you more time.

I'm really troubled you're submitting it now as I understand the process takes several years to finalise which would give you time to further the studies you're doing. I would like to reinforce something that was said earlier on…there is so much that you do not know at this moment in time about what's happening on the flood plain. You mentioned that in regard to further research and going forward you need to look at faults and fissures.

We've got a massive fault out there and I understand we don't have a lot of data on it at this point in time so you will need to look at the connections between the hydrostatic units. If you remember that analysis has not yet been done for the fault, (the Cecil Plains syncline) and there is a big gap in the data regarding the interaction between the Condamine Alluvium and the intervening layers, where they're present, and the Walloon Coal Measures. Why on earth are you sending in the EIS now before you have the data and the answers?

You say you've got to find out where the no go zones are, and the maybe go zones, and the definitely go zones but without doing those analyses you will never know whether the Horrane Trough may be a no go zone.

Can I answer your question in a couple of ways? The EIS process tries to include as much detail as it can, but its purpose is not to define all the detail. A lot of that additional detail, as I said earlier, is contained in subsequent permits which go through their own approvals process.

What the EIS tries to do is assess, theoretically, the worst case. My job through the conduct of all the studies (including air and noise and, to some extent, water) is to try to present to you the worst case scenario. And how we determine that?

In the noise modelling the actual computer programs and algorithms or mathematical formulas used for the calculations have inbuilt conservatism. In other words they've already overestimated the impact. The meteorological model we built to inform that calculation is a very conservative worst case model, so there's another layer of conservatism. Then we add into that the full output of all the machinery, which would never occur in reality, and you get another level of conservatism.

In the EIS we're trying to present to you, the broader community and the government what is the worst case…in other words it will never be worse than this. How much less it will be depends on a lot of factors including mitigation measures, rehabilitation, etc. What the process is trying to do is ensure that what you're trying to comprehend and assess represents the worst case, not something much less. That's what the process is trying to do, and it's on

that basis that governments will make a decision as to whether they think the project should proceed.

There's another factor…what we call uncertainty. Another part of the process is to try to define uncertainty, and how that's dealt with. If we don't adequately describe it governments will impose conditions as you've seen with some of the other proponents. It's possible that Arrow will end up with similar conditions. However, where there is uncertainty and the proponent hasn't been able to describe that, government will do one of two things.

First, it may say to go back and do more studies before it will give the right to proceed, or it will build in a condition which says that until the company defines the uncertainty to a sufficient level to satisfy all the stakeholders, the project can't proceed without additional monitoring over a period of time.

I've been involved with numerous EIS processes, in equally concerned communities as yours, where that's been the government's response. Those projects haven't proceeded until those questions have been answered.

Does that go some way to answering your question? The timeframe is a notional two years but if you read the Act the Minister has discretion to vary that, and in two ways. He can say he wants extra studies (from those stipulated in the Terms of Reference) and the company has to accept it. In addition if the proponent's having difficulty with the project description (including any uncertainty) it can apply to the Minister for an extension. There isn't a statutory period, *per se*, of two years under the *EP Act.*

There are time limits on how long approvals can last. If Arrow was to get this project approved next year, there's a sunset clause on how long that approval stands before it would have to go back and do it again.

134. I've just got a statement to make in regards to a comment that Darren made earlier about the farm up on the screen. Darren said Arrow worked with Stuart on that to see how gas field development might play out on a flood plain. From our perspective, we undertook that study to inform our community how significant the impact is going to be. We didn't do it so much to work with you in order to help design a gas field, we did it to demonstrate to our community what we're in for.

I took quite some pains to try to say we haven't obtained out of this an agreed design for a gas field. There is no expectation that I'm going to turn up next week at Stuart's place and sign him up for that. I appreciate what you guys hope to get out of it but what we've obtained is an understanding of how things would look. We haven't worked out costs and nor do we have details about timing and workability.

My feeling is that what we've done so far is probably the easy bit; timing and workability around the farm is going to be a lot harder. There are still things that we need to sort out before we have any conversations about access. So I'll say it again, in no way did I seek to imply that anyone who's been involved has consented to anything with Arrow. It's purely a desktop exercise to inform us about what we need to do to manage the really obvious impacts… it's only just started.

135. I've got a question for you, Jan. After the last community consultation we received an email from Enhance wanting us to do a survey. Is it going to be conducting a survey after this one? I would suggest that perhaps it shouldn't, considering it was described in the email as independent when it isn't.

(Jan Taylor) I'm sorry, for starters it is not Enhance, it's Enhance Research which is a totally separate company. Are you talking about the fact that the husband of an Arrow staff member is a director of that second company? Do you really think that anyone with any intelligence at JTA is silly enough to put themselves in a situation where their integrity, as well as the integrity of the survey, is called into question? JTA chose the survey company on the basis of the best possible professional market research company.

136. I'm not saying that, Jan. All I'm saying is that the sole director of that company is an ex-high level State Labor Government employee, and he's married to someone you know. I'm not insinuating anything, I'm just making that statement, that for an email saying that this was an independent company, and when I googled the company, this comes up, it's clearly not independent.

I'm not inferring anything about this man's character at all, that's not the issue. The issue is that based on his previous job, and based on whom he might be married to, I wouldn't consider that company independent…regardless of whether he keeps his mouth shut at night, you know? Like, I could keep a secret from my husband, but that doesn't mean I'm independent.

(Jan Taylor) Do you understand what Enhance Research is? Do you understand that the gentleman in question is not a director of that company? Do you understand that the people who work for Enhance Research have nothing to do with him or his particular company (which is not the research company). In fact, the sole person within Enhance Research who did that survey is a gentleman called Gerd Haberkern who was not only totally independent but also the best professional market researcher available.

I have to say that I take exception to your comment because I don't bring anybody in unless I can be guaranteed of their independence and their integrity. It's my name here that's—

137. I've got something to say in regards to that. This is the second meeting now that we've attended where you've publicly attacked my family. And my husband is not a professional but you are. He is a person whose family, business and community is at risk by this company that you're here working for, and I think it's appalling behaviour. Yes, he calls out, and perhaps he shouldn't. But you're employed here to do a job, and name calling and derogatory statements are unacceptable. I'm just wanting to close with, and you might all think this is hilarious, Arrow Energy, but what I'm saying is the truth, and it's true to us.

This is a job for you guys, you get paid whatever you get paid, and you get your annual leave, and you get to go back to Brisbane and worry about what colour to paint the fence, but these are our lives that you're messing with here. There is no doubt that Arrow Energy continues not to have social acceptance in this community. You've never had a social licence to operate, you haven't got it now, and until you can work out how to operate on that flood plain without harming that water, and without compromising our ability to farm, you're not welcome.

But Jan, you won't be welcome in this community either if you continue to make personal remarks about my family. In November last year you commented that this is not a family reunion, because my husband and I were asking a lot of questions, and only today, when my husband called out, you said to him he doesn't know what he's talking about. Now that's just not on. And we will not tolerate that as a community any further.

We won't tolerate it from you, and I'm sorry, Arrow, you guys have a long way to go if you want us to come to the table and deal with you in a decent manner. You've confused our honesty, integrity and politeness with acceptance. You continue to lie to us, you continue to withhold information from us that courtesy would dictate you share, and this community says no to you for the foreseeable future.

(Jan Taylor) There is just one thing I will say. My response today should be put in context…I did say (you) don't know what you're talking about…but that was in direct response to his statement that I 'don't want to hear from the community'. At that stage, I had allowed unlimited questions; you and everyone else in this hall were encouraged to ask questions and were given the courtesy of a response. His comment to me was made five minutes after he arrived in the hall (when the question and answer session was well under way) and was a gross misrepresentation of the truth.

Arrow wants to hear from the community and the fact that we are still here at this time of day is absolute proof of that. That's all I'm going to say on it, because it's getting a bit too personal for my stomach and I have to say I don't appreciate it.

138. **Leisa, I just want to say that my comment is not an attack on your family. I'm merely saying that a JTA email said Enhance Research is doing an email survey, the company is independent, it won't be going to the government or to Arrow. But when I googled Enhance Research, I find this person is the sole director.**

(Leisa Elder) What Jan said is the absolute accurate answer, and I stand behind it. Anything you want to raise with me about my family, take it offline. But Jan has given you the answer, there is no connection. It's not worthwhile even raising the question. My husband was Deputy Premier of Queensland eleven years ago. Okay, I'm sorry this has ended on this note. I really am. You've been a fantastic audience, and I would like to thank you all very, very much.

(Jan Taylor) Thank you very much for having come here today. I'm sorry we've ended this way, it's unfortunate, but everyone's entitled to their opinion. I just hope that you will remain involved, that's the most important thing, because as we have made clear today this is an evolving story. You need to remain involved to be able to ask the questions, that really is vitally important.

So thank you all very much, I hope you get home before the storm, and I hope the rain is what you want. Thank you all very much.

139. **Thank you. If I may just say something very quickly, probably related to everything not on the science side as that's not me. I always make a comment related to lifestyle and family when I come. It concerns me that a lady I know a year ago said to me, oh, yes, we've got a couple of wells at our place. No problem at all. I saw her two weeks ago,**

and she said we now have twelve wells and a compression station. She said it is a living nightmare, men, trucks…sorry, it's not Arrow Energy, by the way, it's another company. Sorry, I need to start with that.

She said her little paradise is gone. I think I've counted 37 Arrow badges here, by the way. That scares me too, why are there so many here. But it is going to impact on us more than just environmentally because she has found just twelve wells on her property a living nightmare. It's a cultivation farm and her husband spends most of his time negotiating.

Can I say it's not fair to bring the experience of another company to this forum. We are not the other companies, we are Arrow.

140. **Well, as someone who's looking down the barrel of a shotgun, there are still many concerns whatever the company… and I publicly say it wasn't Arrow Energy, okay?**

CHINCHILLA

Date:	27 October 2011	
Venue:	Bulldog Park	
Presenters:	Tony Knight, Vice-President Exploration	Arrow Energy
	Darren Stevenson, Asset General Manager, South	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert , Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **I'd like to make a comment on the population projections where you say that Arrow's impact will be contained within the organic growth of the population in our area.**

   That might be so for Arrow but when we've got two other major companies here, plus the Solar Dawn and UCG projects and everything else going on at the moment the cumulative impact is going to be a lot, lot more than our organic growth.

   We have KPMG doing an affordable housing survey (well, actually a housing survey) for the whole of the Western Downs. And some of the very preliminary figures (so don't get too excited about them) show there is going to be a hell of a lot more growth than in the organic growth corridors as predicted by the Queensland Government.

   I totally agree with today's headline in the *Chinchilla News* that the impact on people out here who are forced to rent is absolutely horrendous. And there is a statement in there that the Council should be taking up the slack on this. Well, we are faced with a very hard philosophical question here as to whether it is Council's core business providing housing for people who can't afford to live anywhere else?

   I contend it is a state and federal government responsibility not that of local government because our only source of income at the moment is rates. If we are expected to pick up the slack for affordable housing for those in need rates will need to increase at least 25%, it could even be more.

   So we have a lot of problems. That's why I'd like to challenge you on your population predictions because I think the cumulative impact is going to be a lot more than is indicated there.

   I don't have a problem with that, Bill; you're right these are only Arrow's figures and I acknowledge there is a cumulative impact. We are required as the last major CSG proponent to look at the cumulative impacts. One of the difficulties we have is getting real data about what that impact might be. As you would know, the council and government is starting to develop working groups to try to pool all the information, as you said, to try to get a handle on what it means to this region in terms of the overall impact.

   As Darren will explain later, Arrow's intention is that the construction workforce for the big facilities will be in a camp so we won't be putting an accommodation demand on towns. So what we are looking at from Arrow's perspective, and I don't want to disagree with anything that you've said but these figures are about the operational workforce over 25 years, how it ramps up and where it gets housed.

There will be pressures in Chinchilla, Dalby and Millmerran because this is where the depots are going to be. Will all those people be housed here? It's difficult to answer because people will decide where they want to live. One of the difficulties with the social impact assessment is trying to predict human behaviour; the extent to which we try to measure it is to look at the worst case scenario and know it will be something less than that by distributing people around.

Take me and my colleagues as an example. I live 100kms from where I work, some of my colleagues live right in town and some don't. There will be natural distribution around. What we are trying to do is to get a feel for where the stresses will be. And you are right, the cumulative stress of Wandoan, CSG development etc. will put a lot of pressure on the region.

Arrow can only try to understand and assess that with government and the other proponents because there isn't the information in the public domain to inform that through the EIS.

2. **Will it be harmful in the long term to have houses within 225 metres of a wellhead? You've run scenarios on noise levels at 300 metres from each wellhead; if you're unfortunate enough to have a grid over your property of 700 square metres of wellheads you probably have a 50% potential of working within those gases no matter where you go. And you have nearly 100% potential of hearing one of those wells anywhere on your property. Is that correct or what you had on the overhead?**

Not strictly, no. Noise and air quality criteria are about long term exposure not what we call incidental or transient exposure. And the other thing that I hadn't put up there, and it's in all of the studies, are the emissions modelled over a year, every hour of the year, and sometimes down to minutes of an hour.

They're trying to simulate what will happen under all the atmospheric conditions throughout a year, through the seasons, given wind directions, etc. And what you are seeing reported there is the worst case. What I haven't put up there is how often that might occur. Typically what we see is what might be found on one or two occasions a year. But the way the assessment process works is that we are required to report what the worst case is; perhaps the frequency of that occurring should also be there. There's enormous conservatism built into these models.

What they're saying is that at 300m, if you had those atmospheric conditions, with that noise on that day, it would occur X times a year. In terms of concern about being around the equipment, your chances of exposure to it are very small. It's why DERM sets the guidelines that way i.e. to contain the exposure.

If we said it's going to occur 15, 20, or 40% of the year, that's a problem. Then we would have to go back and revisit the modelling, advise Arrow that it was unacceptable and it would have to reconsider what it was going to do because DERM has set a threshold of what is and isn't acceptable.

I gave an example a couple of days ago that a wellhead motor is a bit like your tractor and you're only going to get eddying etc occurring in very rare worst case conditions, typically for a very small part of the year, but that's what we're required to model. If you equate it to a pump down the back paddock with a diesel motor on it, or a tractor operating, that's what you're getting from the wellhead.

Facilities are different; they're operating 365 days a year, 24 hours a day, to pressurise the gas. The eddying that brings the gases down to ground level only occurs under worst case conditions for a small part of the year. Because they're such significant volumes, those instances are important in making sure that people are not exposed. Does that help you?

3. **Yes, but in one part of it you talk about a pump or something like that. I suffer from hearing loss but I can still hear my motors more than 700m away. So if I'm unfortunate enough to have a grid of 700m, no matter where I go on that property I can hear a noise.**

I'm not going to stand here and say you won't hear a noise. The noise guidelines are about protecting against sleep disturbance so they're generally set against night time background noise levels. It's not about what happens in the daytime because, as you said, you might be driving a tractor or harvesting so there'll be a lot more noise which is why the guidelines apply to the night when you're trying to sleep or enjoy the amenity of your area. It doesn't mean you can't hear them in the daytime as they will be background noise on very quiet days.

The idea is that you can go to sleep at night and not be disturbed by it, and you can work on your property during the day and not be disturbed to a point where the noise is a nuisance, that's the idea of DERM's noise guidelines. The Australian guidelines are based on World Health Organisation standards and a lot of research has been done by the WHO on what constitutes sleep disturbance.

We are doing a number of technical things as we know we can reduce both noise and emissions. If we can get electric submersible pumps to work, the noise from the top drive and the rods that drive the pump will be down the hole, removing one of the noise sources.

Another way to remove noise sources is to remove the generator so Arrow is considering that by doing trials using submersible pumps which we have done at one of our fields in the Bower Basin. There are some negative aspects to that as well because poles and wires can interfere with certain farming activities.

We need to go underground to able to achieve that as technically there are only certain distances that you can take some of that power to. Our major focus areas are to try to reduce noise and emissions so they are as low as they can be and improve the visual amenity of well sites. In mature fields around the world they look like that one in the box, there is no noise unless it's a really high producing oil field. Normally the noise will be similar to when you hear one of your bores flowing, i.e. practically no noise.

4. **You've talked about noise being both high and low, but you haven't put any decibel readings on it. Can we have some decibel readings for daytime and night time, please?**

Yes, we can share that information with you. I won't rattle them off my head because I'll inevitably get them wrong but if you come and talk to one of us afterwards we should be able to get you that. The key thing though is obviously noise levels change as you get closer or further away. Is 225 metres the number? Yes, that's where the noise level gets down to background plus three decibels (dB) whereas if you stand right next to the generator, it'll be much louder. But we can talk you through that.

5. With all the water you're drawing out, and what you're going to put back, what happens with all the salt that's left on top?

The remaining salt is removed through the reverse osmosis treatment process. We recover about 80% to 90% of usable water through that process which means 10 to 20% is left as a concentrated brine solution stored in really high integrity dams.

The way they're built now they have two layers of high density plastic. There's a seepage channel between the layers so you can tell if it's leaked; beneath that there's another seepage channel that drains into a pit. You can sample all those things. If there's an escape from the first seal you've still got that protective barrier. Beyond that, the dam is built with clay so is highly impermeable. Dam standards have increased significantly in the last few years.

Once we collect enough salt, we expect it to be reprocessed. It will be dried and existing technology applied for processing…the only thing missing is enough salt. At the moment the four large CSG proponents are talking to a couple of salt processors who could purify it once we have enough scale to make it valuable commercially. There's a big market as Australia is a net importer of salt; it isn't just sodium chloride or table salt, it also has magnesium and carbonates and other matters that make it attractive for industries like glassmaking.

6. I understand there's going to be something like 2,000 tonnes of salt extracted per day, not just by Arrow but by the whole industry…that's a lot of salt.

It is a lot of salt but the market requires even more. I'm not sure about the exact tonnage but it's not more than the salt market is. There are commercial technologies and a market for it.

7. It seems a lot of years between now and 2065. There will be a lot of thirsty cattle and people if it'll take until 2065 for even some of this water to be replaced naturally.

The modelling shown is without the return of the water that we extract back into the system. The commitment we've made before is that we'll work towards a sustainable solution, or as much as we can achieve, and we'll minimise the net take of water.

In most of our areas groundwater is used for other things. One of the options is for us to deliver water by pipe; the person now pumping groundwater stops doing so and takes our water instead. We call that substitution of allocations.

Reinjection is another alternative. We would take water of a quality that's not useful for many things; we will use our power to clean it and then add that in so there'll be a net increase in the amount of usable water during that period. That's our aim.

There will be some losses as we can't say 100% of the extracted water will end up back in the system because there'll be some evaporation while it sits in dams before and after being processed, and there'll be some evaporation and losses through that final process of crystallising the salt. The numbers you saw did not include us adding any of that water back into the system.

Over the next few months the modelling we do, to validate what we've done, will take it to the next level of detail. Then we will add in the extracted water for current water users.

It's important to remember the impact predictions don't include mitigation measures. You saw an illustration of how the system operates before you put in mitigation measures to depressurise the Walloons, causing leakage upwards and downwards. In terms of mitigation scenarios, there's more impact on the Hutton and the Precipice. However, if you're looking at substitution or injection as an option, it's obviously good if you could get that water into the Hutton; you certainly don't want that impact to transmit to the Precipice. And similarly if you can get it into an aquifer above the Walloons you can maybe stop and mitigate that impact further and allow the pressure to move. That's all part of the scenarios we're putting forward.

8. **The removal of the salt from the coal seams in an aquifer…obviously it's there for a reason. You're not putting it back. Does anyone know what the impact will be? You're re-injecting it in an aquifer above. What's going to happen with the coal seam?**

   One of the most important things you have to do when you inject water is match it to the water quality of the aquifer. If it comes out of the Walloons it gets treated and will then have to be amended to make it as least reactive as possible with the aquifers. That kind of technology has been used a lot overseas in the last 20 years, in both aquifer storage and recovery schemes. In the wet season they pump it down into the ground as extra storage for the dry season. There is an example I think from Des Moines in Iowa which has a city water supply of some 5.7 gigalitres of water stored for emergency supply[3].

   Again, it's a case of technology that's been used for a long time to manage those water quality issues. We know the studies we have to do…sorry, what was the second question?

9. **Pulling all this salt out will cause an imbalance. I wonder what it will be down the track. Does anyone know what's going to happen in the future? There might be other countries doing it; have they found anything that may impact us later on? I know it's a long way away but there are generations ahead of us who might be affected.**

   Again, I think it comes back to the same point i.e. the geochemistry is critical. If you match the water going back in, you minimise the amount of reaction. If you get it right there are no impacts because you don't allow any discrepancy to create a reaction. Again, looking overseas to some of the projects there, municipal water supply is used.

10. **What I meant was that you're not putting it back where you extracted it from. What's the difference? What's happening down there in the Walloons?**

    There will be an overall removal of salt from the Walloons but there will be a pressure recovery because pressure moves faster than the water. You will see pressure recovery in the Walloons because generally the recharge bed is from rainfall, so it tends to be a carbonate, bi-carbonate water and it picks up salt as it runs through the system over a long period of time. A lot of hydrochemistry and studies we're doing are to look exactly at all these issues re how long they take, and what are the hydrochemical reactions that are going to occur, not only over longer units but also between units.

[3] Des Moines Water Works (DMWW) has developed a series of Aquifer Storage and Recovery (ASR) wells along with several suburban water utilities that by the year 2020 will have the capacity of 15 millions of gallons per day (56.7 ML/d) and water storage of 1.5 billion gallons (5.7 GL) to offset peaking water use during traditionally high consumption periods on hot summer days. (Accessed Feb 2012, http://www.desmoinesmetro.com/regional-economic-development/site-selection/utilities/)

11. Would re-injection be on the edge of the water table or in the centre of it? Earlier you showed the Walloons have the potential for a drawdown of 70 metres. It seems to me that anyone on that outer edge who once had a bore would be in a fair bit of trouble.

So, when you re-inject, is it going to be on the edge or in the middle? If it's in the middle, the water's got to go uphill. If it's on the edge, you have the potential for it to go downhill.

We don't know the exact location yet. We do know the pressure impact from the injection well can travel tens of kilometres, so we may not need to put an injection well exactly where you want the pressure to come back; we can put the injection well here and it will propagate in all directions.

We won't be re-injecting back into the Walloons at the same time to maintain the pressure in there. We need to reduce that pressure for gas production. One of our options in the longer term, once the gas has drained out of that area, might be to re-inject water from the Walloons in a slightly different part of the basin. But we would not be re-injecting simultaneously with extraction because it would prevent gas coming out of the ground.

If you own a bore there, we're going to have to find an alternative solution if your bore is affected. It's likely that if your bore is nearby, or within our gas field, it would be affected; that's why we said before we'd have an obligation to bring the water to you in a pipe or some other method like that to 'make good'. So to be clear, we cannot do what we're trying to do without some impact during the gas production phase on the Walloon bores.

12. As a continuation of what you just said then, my mind's ticking over a bit. If you reckon you can't re-inject straight away into the Walloons, where are you going to put the water in the meantime?

Imagine we're on your place and you've got Walloon bores for stock and domestic use. We'll have to bring water to you that you would have had otherwise if we hadn't been pumping. We might store it temporarily in other aquifers.

As we said before, we might put it in the Hutton or the Precipice during that time and then be able to have water available until the natural recharge occurs. Or we might move it to another part of the basin where there's a more severe impact at the time.

There are a range of solutions although we haven't yet worked out exactly what's going to be required in every case. It's part of the modelling that's going on. However, if you had water then we have to make sure you still have it.

13. Reinjection is a good and positive thing but will beneficial use with treated CSG water become less important? Is the security of town water for farmers going to be of less priority than water injection?

The easiest way for me to answer that is to say our priority is sustainability and we will use different methods in different areas to achieve that. So in some areas the geology and the land use might say reinjection is the best solution.

In others, if it's out in farming land where there are heaps of people pumping water out of the alluvium, the solution there may well be substitution of allocations and beneficial use and we

deliver it in a pipe or re-inject it into the aquifer. So it's horses for courses but we have to make sure we get the right balance.

MILES

Date:	28 October 2011	
Venue:	Leichhardt Centre, Columboola Function Room	
Presenters:	John Eddington, Project Manager, Surat Gas Project	Arrow Energy
	Darren Stevenson, Asset General Manager, South	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **Arrow mentioned in its presentation the shallow coal you are relinquishing. At what sort of depths are you finding there's no gas?**

   It depends. In different parts of the basin it can vary, but generally there is no gas in coal less than 100m in the Surat Basin, and it gradually increases with depth from that point down.

2. **When you guys relinquish it, will there be open cut coal miners wanting it?**

   Yes - coal miners will push to dig deeper as coal prices and demand increases. While a few years ago people said 60m depth was the economic limit for open-cut mining of coal, it is now much deeper.

   What we're interested in often isn't very good for open cut, and we're also targeting different coal seams. Some of the existing coal mines are targeting seams that have far too much water and not enough gas to be interesting for us. We don't want to produce any unnecessary water so one of my goals is to produce as much gas for as little water as possible, which is good for everyone.

3. **Thanks. One of the things in John's speech, which was very good (thanks, John, very informative) was when he talked about 800-metre spacings. I saw a presentation a couple of years ago which was adamant that it was 900 metres. I ask this because QGC said 750 metres, Santos is 400 metres. One of the concerns I have is that companies use wider spacing but as production drops, they come in and fill in the gaps so in the future we'll see a lot more wells than anyone's talking about.**

   I agree that's a valid concern. A good analogy to the geology we have in the Surat Basin is the Powder River Basin in Montana and Wyoming in North America where they did a similar thing i.e. 800 metre spacing. That's approximate because it's never on a grid and we do have quite a bit of flexibility. That correlates to a 160-acre grid i.e. one well inside 160 acres. What they often started doing in those fields was putting wells in at 320 acres, or even bigger, then they might return and place what they call an in-fill well. We think it's highly unlikely at that 800-metre space that we'd be doing in-fill drilling. If anything, we'll be pushing our well spaces back rather than in.

4. **I was just wondering what's your average property size? If you're talking one well at 160, is it acres or hectares?**

   160 acres.

5. **What is the average size of the properties within your tenure?**

   It ranges. There are farming properties we're looking at now that are less than 1,000 acres so they can be less than 1,000 acres to something like 10,000 hectares so it's a really big range. Farms gets smaller as you go further east or on the upside of the shape, then the farms get bigger. As you get on the inside of the curve, you go from cultivation to cotton farming where a family can farm 10,000 acres of cotton, a really big enterprise. Farms are bigger in grazing country where the land is less productive. There's not really an average.

   I want to clarify something I said previously. We may come in with wider spacing than 160 acres and in-fill back to that. Do you know what I mean? We might put in a well every second or every third slot and then come back later on and drill the other wells.

6. **What concerns me is there are US examples where they've come down to 160 metre spacings. Everyone imagines that at 750, 800, 900m you can live amongst it. But if you come down to 160m, it would be horrific for those of us in residential areas.**

   There's not enough gas in that sort of space for us to pay for that many wells so the ideal is to have wells as far apart as you possibly can to recover that gas because it costs more money to have more wells yet you can only recover the same amount of gas. The advantage in putting more wells in is to get the gas out more quickly or if you've got really tight coal, which we don't have. As you go further west in the basin the capacity of the coal decreases so it's harder for the water and gas to travel through it, and that's one of the things that pushes us to close the space around it.

7. **So you still say you won't need to frac any of this at all?**

   We made a commitment we won't frac in the Surat Gas Project area. We're not finding any exploration results that make us regret that commitment.

8. **I'm just wondering if you can give us an idea of the timeframe for things to happen in this area? I know there are exploration wells under conduct and compensation agreements at the moment. Can you give us an idea of the timeframe?**

   I'll just bring up a map because it's easier to talk to that. (*See Figure 3 on page 5*)

   In our existing production area, the Tipton Field, Daandine and Kogan which are all partially developed, there's still a lot of spacing in that where we can put future wells; there's some exploration going on there, but most of it is about water management.

   That area there and this area right here between Miles and Wandoan is where we expect to start in 2013-2014 if the project is approved; it's where we expect the main construction and drilling programs would start.

   To get ready for that, we've done a large amount of exploration here. We're much earlier in the exploration and appraisal or pilot testing phase up in the Miles and Wandoan area and what's happening at the moment are five or six well pilots and a dam and maybe a pipeline connecting a number of pilots up.

   In these other areas, the Chinchilla-Hopeland area, or in the Millmerran or Goondiwindi blocks, it's mostly front end exploration where we're drilling chip and core holes to find out if

there is coal and if so how much gas is in it. We've started putting pilots down in the Millmerrran area and we hope to do some pilots out in the better country to obtain a good understanding of what the resource looks like out there.

9. **You spoke about Arrow's community involvement and John talked about the workforce coming in during the construction phase. I wondered whether you could expand on your plans to work with the community to develop your workforce from the local community via traineeships, apprenticeships, and that sort of thing both during construction and operations.**

   When we talk about operations it includes construction of drilling wells and pipelines. However, when John was talking about construction he was referring to the major facilities, big dams etc. Large companies will come in to help us build the big items but we'll also build up our own workforce and use locally based contractors to do wells, gathering lines and the operational stuff.

   The best example I can give is what we're doing in Dalby where we have a production area. We don't plan to have a production area anywhere else in the next few years but we have a range of different programs there. We tend to hire semi-skilled workers with oil and gas experience so we'll hire fitters, mechanics, even non-trades people and put them through a two and a half year program that we've developed internally to help people become competent to do those jobs.

   We also have a program with the Dalby State High School where we've got 15 trainees at the moment. Those kids are in grades 10, 11 and 12; they've elected to take some of their subjects as trade-based subjects. The school has invested a lot of money in facilities and those kids come out with a nationally recognised certificate in gas operations.

   We don't need to hire all those people at the moment so we're actually training more than we've got jobs for because the growth isn't there for the next couple of years. That's one of the things we're doing, building up that skills pool. Once we're ready and we've got some firm plans to move into other areas such as Miles and Chinchilla, we'll attempt to do similar things there.

   We don't just hire local farm hands and mechanics. We also hire a lot of people whom we encourage to move to town. So when we say local hire, we're not just trying to steal your workers so much as have people who become part of the community, spend their money in town, help justify expansion of hospitals and medical services and all those sorts of things.

10. **I was talking to Arrow about what happened last year with the release of water. Can you explain to me why the water had to be released?**

    Actually I think it was January this year (2011). I won't need to remind you that in December and January it rained a lot. One of the impacts of that was that our dams got full. We went into that summer with 200 days storage capacity available and in some areas that increased overnight by 20 days and the long-term forecast was for it to keep on raining, which it did.

    We discharged water that had been treated through the reverse osmosis process into a local creek. We had the authority to do it so that we didn't breach our dams. By discharging that clean water (from the RO plant) we could then lower the levels of all the dams so that if there

was another major storm surge we wouldn't have a loss of containment in any of those dams.

11. Are you reviewing the design of the dams now in light of that?

Not really. We think that emergency environmental discharges will be something that we need to rely on in extreme seasons like 2010/2011. It was probably the worst year in the last ten to fifteen years in terms of the intensity and duration of the wet season.

In such a case not only does the dam fill with rainwater but the opportunities for beneficial use of it cease. Normally the mines can't get enough of our water but their pits filled up so they couldn't use it. Farms were saturated so didn't want it. The range of off-take options stops in such extreme weather and the only really valid way of releasing that water if you have concerns about your dam integrity is into the environment.

The plus side is that when it's like that generally the receiving streams are so high and flowing so fast that the dilution of the water we add is very high and there are negligible environmental impacts. To be able to discharge like that we have to comply with the rules of the Office of Water Supply Regulator. It is the same agency and the same rules that govern the quality of drinking water so it's a very stringent and controlled process.

12. I never had the chance to catch up on the well explosion back in May? The thing that I'm curious about is the exclusion zone dictated by the police and the fire brigade. They later said it was an over-reaction and I could see that but I'm wondering, in a worst case scenario, what is the real safety zone?

It's within the 70 by 70m lease. I'm not trying to be defensive but it wasn't an explosion and the chances of it ever exploding were extremely low because there was so much water coming out of the gas. The gas pressure was forcing the water out of the hole but because there was so much water in the gas the chances of an explosion were very low. The gas is lighter than air and you could see from the pictures that it was going quite a ways into the air.

We do need to manage site safety; in that particular instance the landowner requested control of property access, so that was one of the reasons why it was done like that.

13. Thanks for that. I saw a lot of over-reaction, and two days later someone at Dalby was telling me they could still smell it so I had a lot of fun trying to explain it to them.

It wasn't a good thing, but it wasn't anywhere near as bad as it was portrayed.

Jan suggested I talk about the process we go through if something like that happens.

It's not unusual to get what's called a kick when you're doing a workover or completion. Something happens while you're pulling tubing which might cause a bit of a vacuum, it brings up a gas pocket, and some water comes to surface. That's not an entirely unusual thing and we're kitted up for that.

In that particular instance, the kick was obviously quite significant, and we didn't have the mud needed to kill it. The way we do it is to increase the density of the water that we pump back down the hole to increase the density so as to overcome the pressure of the gas in the reservoir, and then that forces the gas to stop flowing.

The mud is actually potassium chloride which is a relatively benign salt that we use to weight up the water. We didn't have the right amount of potassium chloride to do the job the way we wanted to, which was one quick kill shot. We tried a slow one, that didn't work. It took us about 24 hours, maybe 48, to get the gear and materials to do that and then it was solved.

Appendix B

Public Notice

Public Notice

Environmental Protection Act 1994 (EP Act) – Sections 51 and 52

Public notice of an Environmental Impact Statement (EIS) Proposed Surat Gas Project

Arrow Energy Pty Ltd (Arrow Energy) has prepared an environmental impact statement (EIS) for the Surat Gas Project. Arrow Energy proposes development of coal seam gas production wells and associated facilities within an area covering approximately 8600 square kilometres of petroleum tenures, extending from near Wandoan (in the north) to Dalby and Millmerran (in the east) and Goondiwindi (in the south). The project will complement Arrow Energy's existing gas field developments near Dalby.

The project covers all or part of Arrow Energy's petroleum leases 194,198, 230, 238, 252, 258, 260; petroleum lease applications 185, 253, 304, 305, 306, 307, 308; authorities to prospect 676, 683, 689, 810, part of 747; and parts of authority to prospect application 746. Areas excluded from the proposed project include the towns of Brigalow, Cecil Plains, Chinchilla, Columboola, Dalby, Macalister, Millmerran and Warra.

The project area is split into five resource areas for exploration and progressive development over approximately 35 years. Each of these areas would be supported by approximately 1500 production wells and an associated gas and water gathering network. Approximately 18 production facilities are likely to be required within the project area, including gas compressors, water storage and treatment plants and power generation plants. Buried high pressure gas pipelines would link the production facilities, which would ultimately be connected to the gas transmission network. Buried water pipelines would connect the production facilities with sites of beneficial water use.

At this early stage of development of the project, due to the progressive nature of coal seam gas development, Arrow Energy is unable to be specific about the locations of gas wells and associated infrastructure.

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

On 26 March 2010, the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) determined the proposed project to be a controlled action under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. The controlling provisions are sections 18 and 18A (listed threatened species and communities) and 20 and 20A (listed migratory species). The State's EIS process has been accredited under An Agreement Between The Commonwealth And The State Of Queensland Under Section 45 Of The *Environment Protection And Biodiversity Conservation Act 1999* Relating To Environmental Assessment (the Bilateral Agreement) for the purposes of the Commonwealth's assessment of the project under Part 8 of the EPBC Act.

The EIS will be available for review from **Monday 5 March 2012** and anyone may make a submission to the chief executive of the Department of Environment and Resource Management (DERM) about the EIS.

A copy of the EIS may be inspected at the following locations:

Department of Environment and
Resource Management
Business Centre
Level 3, 400 George Street
Brisbane QLD 4000

Department of Environment and
Resource Management
Business Centre
173 Hume Street
Toowoomba QLD 4350

Toowoomba Regional Council
Millmerran Service Centre
2–16 Campbell Street
Millmerran QLD 4357

Western Downs Regional Council
107 Drayton Street
Dalby QLD 4405

Western Downs Regional Council
Customer Service Centre
80–86 Heeney Street
Chinchilla QLD 4413

Cecil Plains Library
Taylor Street
Cecil Plains QLD 4407

Wandoan Visitor Information Centre
41 Royd Street
Wandoan QLD 4419

Miles Library
Dogwood Crossing @ Miles
Cnr Dawson and Murilla streets
Miles QLD 4415

Goondiwindi Regional Council Library
4–6 McLean Street
Goondiwindi QLD 4390

An electronic copy of the EIS can be obtained from Arrow Energy's website <www.arrowenergy.com.au>, or by contacting Arrow Energy on 1800 038 856 or emailing <suratgas@arrowenergy.com.au>.

Written comments in relation to the EIS are invited from any person within the submission period. The submission period starts on **Monday 5 March 2012 and ends on Thursday 31 May 2012**. Submissions should be addressed to:

The Chief Executive
Attention: The EIS Coordinator (Surat Gas Project)
Statewide Environmental Assessments
Department of Environment and Resource Management
GPO Box 2454
Level 8, 400 George St
BRISBANE QLD 4001
or by email to <eis@derm.qld.gov.au>.

The chief executive will accept all properly made submissions and may accept written submissions even if they are not properly made. A properly made submission is one that:

- is written
- is signed by or for each person who made the submission
- states the name and address of each signatory
- is made to the chief executive
- is received on or before the last day of the submission period.

Please note that it is a statutory requirement for all submissions to be forwarded to the proponent for consideration and for the proponent to provide a written response on the submissions to the Department of Environment and Resource Management.

For further information regarding the EIS process for this proposal, contact the EIS coordinator by calling 13 QGOV (13 74 68) or emailing <eis@derm.qld.gov.au>.

Public notice letter

12 March 2012

Ref: ENV12-056

<full Name/s>
<title – optional>
<address line 1>
<address line 2>

Dear Sir/Madam

SURAT GAS PROJECT – Public Notice for Environmental Impact Statement

Further to previous correspondence from Arrow Energy, please find attached the revised Environmental Impact Statement Notice for the Surat Gas Project Environmental Impact Statement (EIS), in accordance with Sections 51 and 52 of the *Environmental Protection Act 1994*. The Department of Environment and Resource Management (DERM) will publish this Notice in *The Australian, The Courier Mail* and selected local newspapers from Friday 16 March 2012.

The attached EIS Notice contains details regarding locations to view the EIS, how to obtain a copy of the EIS and where you can send any written comments.

Arrow Energy will also be undertaking detailed EIS Consultation Sessions during the consultation period, and will be notifying stakeholders and advertising these widely within the region.

You have been sent this Notice because you have been identified as an Interested or Affected Person in regard to the project under sections 38 and 41 of the *Environmental Protection Act 1994*. Arrow Energy has identified that you hold an interest in the Surat Gas Project development area, as outlined in the map overleaf.

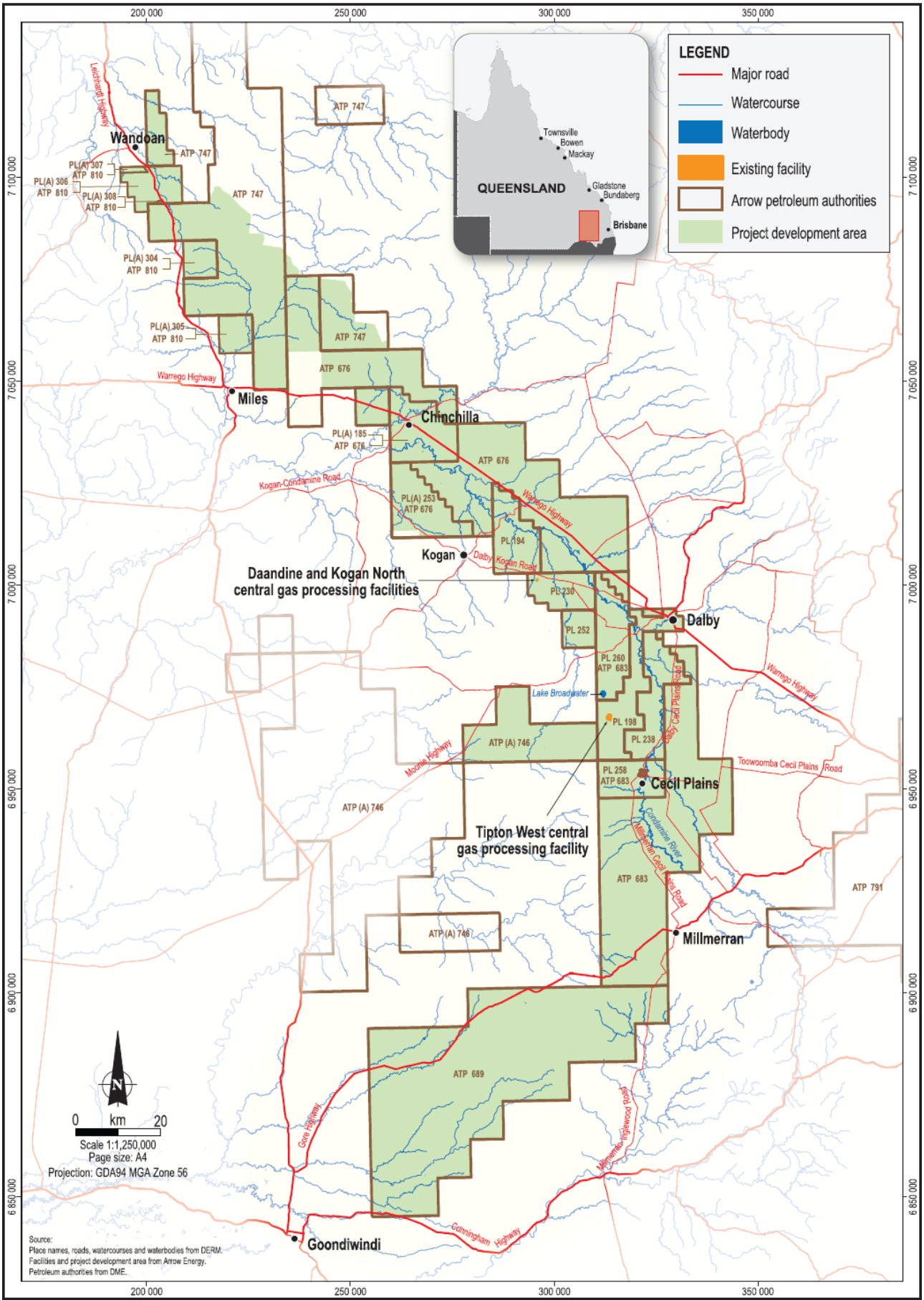
If you have any queries regarding the EIS process please contact the EIS Coordinator at DERM on 13 QGOV (13 74 68) or email eis@derm.qld.gov.au

If you have any queries regarding the Surat Gas Project, please contact the Arrow Energy project freecall number on 1800 038 856.

Regards,

Leisa Elder
Vice President – Community and Sustainable Development

T +61 7 3012 4000 F +61 7 3012 4001 ARROW ENERGY PTY LTD ABN 73 078 521 936 LEVEL 19, AM-60, 42-60 ALBERT STREET BRISBANE QLD 4000 GPO BOX 5262 BRISBANE QLD 4001 info@arrowenergy.com.au arrowenergy.com.au



coffey environments	Date: 11.11.2011 MXD: 7040AC_04_GIS005_v1_4 File Name: 7040_04_F01.01_GIS_GL	Arrow Energy Surat Gas Project	arrow energy go further	Surat Gas Project development area (including petroleum authorities)	Figure No: 1.1

Phase 6 Sample invitation letter

<Organisation>
<Address 1>
<Address 2>
<Suburb> <State> <Postcode>

3 April 2012

Dear Sir/Madam

An opportunity to talk to us about the Surat Gas Project EIS

You may be aware that Arrow Energy's Surat Gas Project environmental impact statement (EIS) has been released for public exhibition. During the exhibition period we will be providing opportunities for members of the community to meet with technical experts and Arrow representatives, to better understand the detail of the EIS and to have their questions answered.

We will be holding a series of EIS information sessions in the Surat Basin in late April. The sessions will commence with a guide to understanding the EIS and how community members can respond to it and will provide information on key areas of interest to the community including groundwater and agriculture. There will be question and answer sessions following the presentations and each session will end with an opportunity to speak one-on-one with members of the project team.

Community Information Sessions will be held:

- Monday 30 April – Thursday 10 May

Before and after the sessions in late April/early May we will also be holding two rounds of drop-in sessions to assist the community to better understand the EIS document. The drop-in sessions are opportunities to meet with technical experts in an informal setting to discuss the EIS and have your questions answered. There are no formal presentations at these sessions, so you can drop-in at a time that suits you, and have a one-to- one discussion about the EIS topics that interest you.

Drop in sessions will be held:

- Tuesday 17 April – Friday 20 April
- Tuesday 29 May – Friday 1 June

Details of the sessions are overleaf; all of the sessions are open to the whole community.

If you intend to attend the EIS information sessions we would greatly appreciate an RSVP to assist with catering. Feel free to pass this information on to anyone who may be interested

If you require any further information, please contact the project team on freecall **1800 038 856** or email **suratgas@arrowenergy.com.au**. The full EIS can be found on our website www.arrowenergy.com.au.

I do hope you will be able to attend one of the sessions.

Yours sincerely

Leisa Elder
Vice President, Community and Sustainable Development

Surat Gas Project informal drop-in sessions* April 2012

Location	Date	Time	Venue
Chinchilla	Tuesday 17 April	10.00am – 4.00pm	Committee Room, Chinchilla Council Building 80-88 Heeney St, Chinchilla
Millmerran	Wednesday 18 April	10.00am – 4.00pm	Foyer, Millmerran Community and Cultural Centre Walpole Street, Millmerran
Dalby	Thursday 19 April	10.00am – 4.00pm	Conference Room C, Myall Youth & Community Network Centre 28B Nicholson Street, Dalby
Toowoomba	Friday 20 April	10.00am – 4.00pm	Warrego Room, Burke & Wills 554 Ruthven Street, Toowoomba

***** *Note that these sessions will **not** include presentations, instead Arrow representatives and technical experts will be available to assist with enquiries about the EIS.*

Surat Gas Project EIS information sessions April-May 2012

Location	Date	Time	Venue
Millmerran	Monday 30 April	9.00am – 3.30pm presentation commences at 9.30am *9.00am – registration* *9.30am – EIS and how to respond* *11.15am – Water* *1.00pm – Agriculture* †	Community & Cultural Centre Walpole Street, Millmerran
Cecil Plains	Tuesday 1 May	9.00am – 3.30pm presentation commences at 9.30am *9.00am – registration* *9.30am – EIS and how to respond* *11.15am – Water* *1.00pm – Agriculture* †	Cecil Plains Hall Geraghty Street, Cecil Plains
Chinchilla	Wednesday 2 May	9.00am – 3.30pm presentation commences at 9.30am *9.00am – registration* *9.30am – EIS and how to respond* *11.15am – Water* *1.00pm – Agriculture* †	Bulldog Park Slessar Street, Chinchilla

Dalby	Thursday 3 May	9.00am – 3.30pm presentation commences at 9.30am *9.00am – registration* *9.30am – EIS and how to respond* *11.15am – Water* *1.00pm – Agriculture* †	ANZAC room, Dalby RSL 69 Drayton Street, Dalby
Miles	Tuesday 8 May	3.30pm – 6.30pm presentation commences at 4.00pm	Leichhardt Centre Corner Marian & Dawson Streets, Miles
Wandoan	Wednesday 9 May	9.00am – 12.00pm presentation commences at 9.30am	Wandoan Community and Cultural Centre, 6 Henderson Road, Wandoan
Goondiwindi	Thursday 10 May	9.00am – 12.00pm presentation commences at 9.30am	Goondiwindi Waggamba Community Cultural Centre Corner Russell & Short Streets, Goondiwindi

†*The above are indicative timeframes and are subject to change.*

Surat Gas Project informal drop-in sessions* May-June 2012

Location	Date	Time	Venue
Chinchilla	Tuesday 29 May	10.00am – 4.00pm	Committee Room, Chinchilla Council Building 80-88 Heeney St, Chinchilla
Millmerran	Wednesday 30 May	10.00am – 4.00pm	Foyer, Millmerran Community and Cultural Centre Walpole Street, Millmerran
Dalby	Thursday 31 May	10.00am – 4.00pm	Conference Room C, Myall Youth & Community Network Centre, 28B Nicholson Street, Dalby
Toowoomba	Friday 1 June	10.00am – 4.00pm	Warrego Room, Burke & Wills 554 Ruthven Street Toowoomba

***** *Note that these sessions will* ***not*** *include presentations, instead Arrow representatives and technical experts will be available to assist with enquiries about the EIS.*

Phase 6 Advertisement

COMMUNITY INFORMATION SESSIONS

FIND OUT MORE ABOUT SURAT GAS PROJECT EIS ›

Arrow Energy invites you to a community information session to update you about our Surat Gas Project Environmental Impact Statement (EIS) which was recently released for public submissions.

Come and speak one-on-one with the project team about the proposed project aimed at building on Arrow's existing domestic coal seam gas (CSG) operations in the Surat Basin to provide gas for both the domestic gas and liquefied natural gas (LNG) export markets.

INFORMAL DROP-IN SESSIONS:

Meet with Arrow technical experts in an informal setting to discuss the EIS and have your specific questions answered.

LOCATION	ROUND 1 DATE	ROUND 2 DATE	TIME	VENUE
Chinchilla	Tues 17 April	Tues 29 May	10am-4pm	Western Downs Regional Council, Chinchilla Customer Service Centre, 80-88 Heeney Street
Millmerran	Wed 18 April	Wed 30 May	10am-4pm	Millmerran Community and Cultural Centre, Walpole Street
Dalby	Thurs 19 April	Thurs 31 May	10am-4pm	Myall Youth & Community Network Centre, 28B Nicholson Street
Toowoomba	Fri 20 April	Fri 1 June	10am-4pm	Warrego Room, Burke & Wills Hotel, 554 Ruthven Street

COMMUNITY INFORMATION SESSIONS:

Hear formal presentations on the EIS, its independent technical studies and findings and key topics of interest to the community like groundwater and agriculture. A question and answer segment will follow presentations, plus the opportunity to speak one-on-one with technical experts and Arrow staff.

LOCATION	DATE	TIME	VENUE
Millmerran	Mon 30 April	9am-3pm 9.30am – EIS and how to respond 11.15am – Water 1pm – Agriculture	Millmerran Community and Cultural Centre, Walpole Street
Cecil Plains	Tues 1 May	9am-3.30pm 9.30am – EIS and how to respond 11.15am – Water 1pm – Agriculture	Cecil Plains Town Hall, Geraghty Street
Chinchilla	Wed 2 May	9am-3.30pm 9.30am – EIS and how to respond 11.15am – Water 1pm – Agriculture	Bulldog Park, Slessar Street
Dalby	Thurs 3 May	9am-3.30pm 9.30am – EIS and how to respond 11.15am – Water 1pm – Agriculture	Dalby RSL, Anzac Room, 69 Drayton Street
Miles	Tues 8 May	3.30-6.30pm	Leichhardt Centre, Cnr Marian and Dawson Streets
Wandoan	Wed 9 May	9am-12pm	Wandoan Community and Cultural Centre, 6 Henderson Road
Goondiwindi	Thurs 10 May	9am-12pm	Goondiwindi Waggamba Community Cultural Centre, Cnr Russell and Short Streets

To RSVP your attendance or find out more, contact the project team at:

Freecall 1800 038 856
Email suratgas@arrowenergy.com.au
Post Arrow Energy, Reply Paid 81 Hamilton Q 4007
Also visit www.arrowenergy.com.au/community

The EIS is available for public review from 16 March 2012 through to 14 June. The EIS can be downloaded from Arrow's website, viewed at the Department of Environment and Heritage Protection (formerly DERM) Toowoomba Customer Service Centre, Cecil Plains Library, Western Downs Regional Council Dalby and Chinchilla Customer Service Centres, Toowoomba Regional Council Millmerran Service Centre, Goondiwindi Library, Wandoan Library and Mile's Dogwood Crossing, or call 1800 038 856 to receive a free DVD copy.

Find out more online at
www.**arrowenergy**.com.au
BRISBANE DALBY MORANBAH GLADSTONE

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Phase 6 General presentation

ARROW ENERGY

SURAT GAS PROJECT

April 30 – May 10

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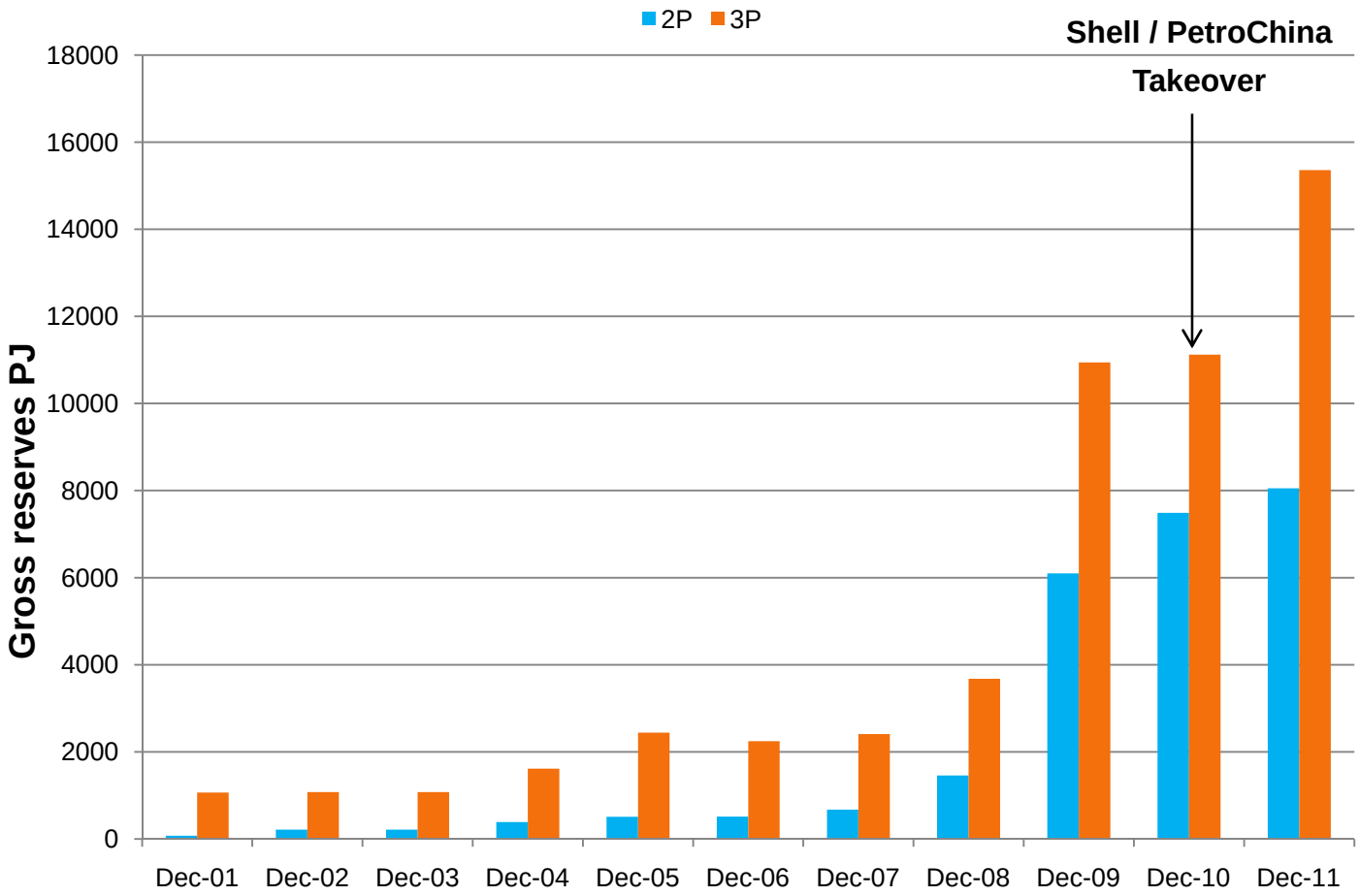
SURAT GAS PROJECT

TODAY'S AGENDA

- Welcome and introductions
- Arrow Energy update
- Field Development update
- Surat Gas Project Environmental Impact Statement (EIS) overview
- Groundwater
- Agriculture and amenity

ARROW ENERGY

THE HISTORY



Staff numbers	
2007	212
2010	432
2011	700
2012 *	1200

*Dec 2012

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CURRENT OPERATIONS

- Commenced gas production in 2004
- 1100 wells – 600 producing
- Providing energy to 400,000 homes

Domestic - Surat Basin

- Tipton
- Daandine
- Kogan
- Stratheden

Domestic - Bowen Basin

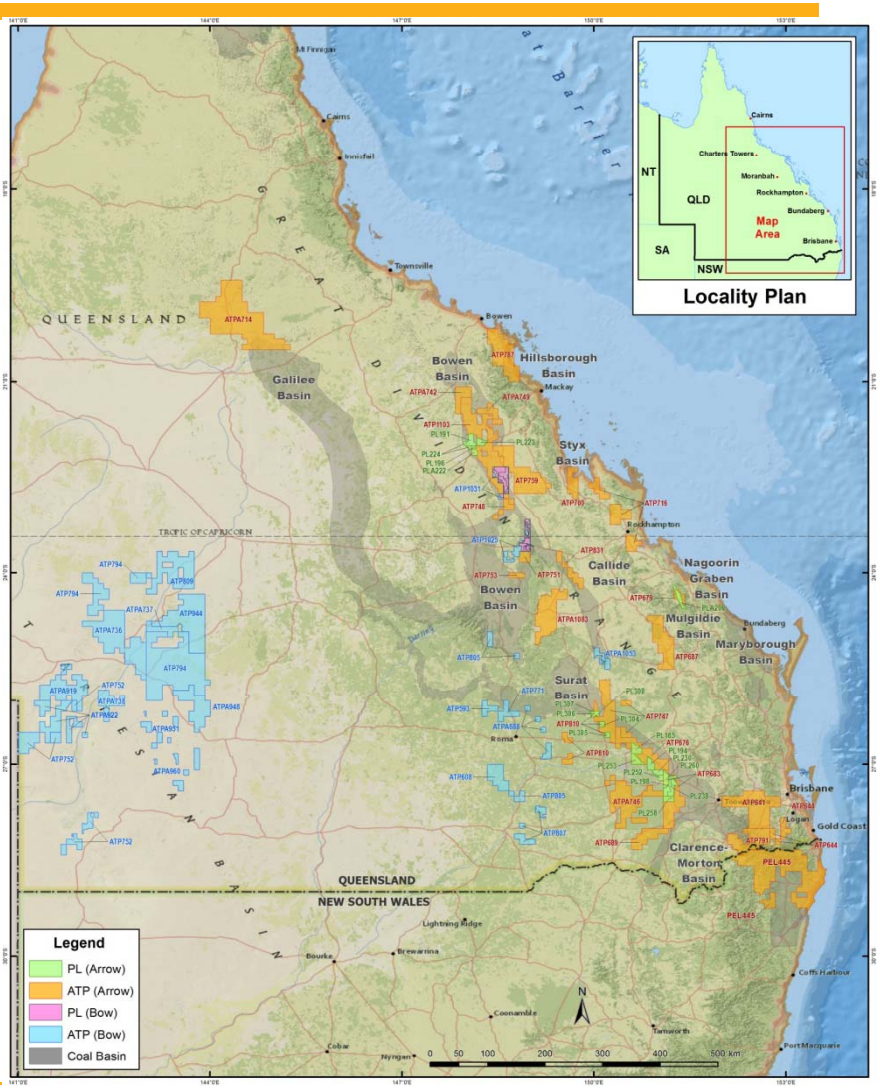
- Moranbah Gas Project

Arrow LNG

- Surat Gas Project
- Bowen Gas Project
- Arrow Surat Pipeline
- Arrow Bowen Pipeline
- Arrow LNG Plant

Power supply

- Braemar 1, Braemar 2 (100%),Yabulu, Daandine, Moranbah, Swanbank



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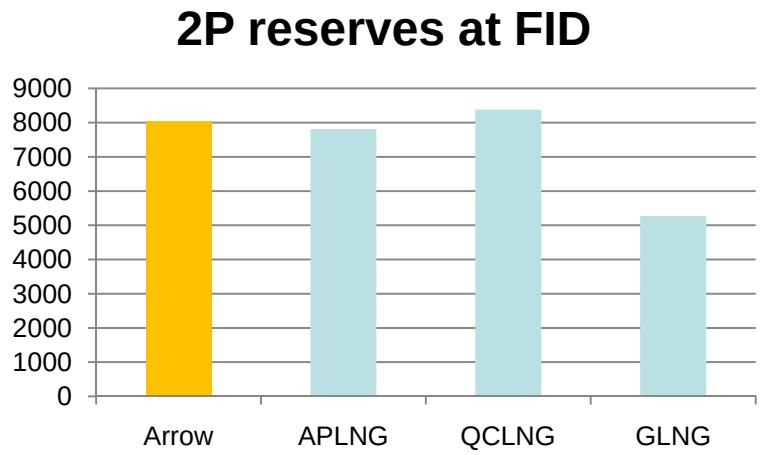
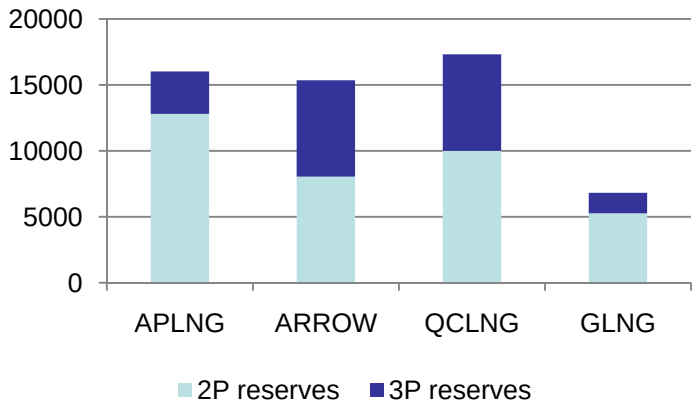
PROGRESS UPDATE

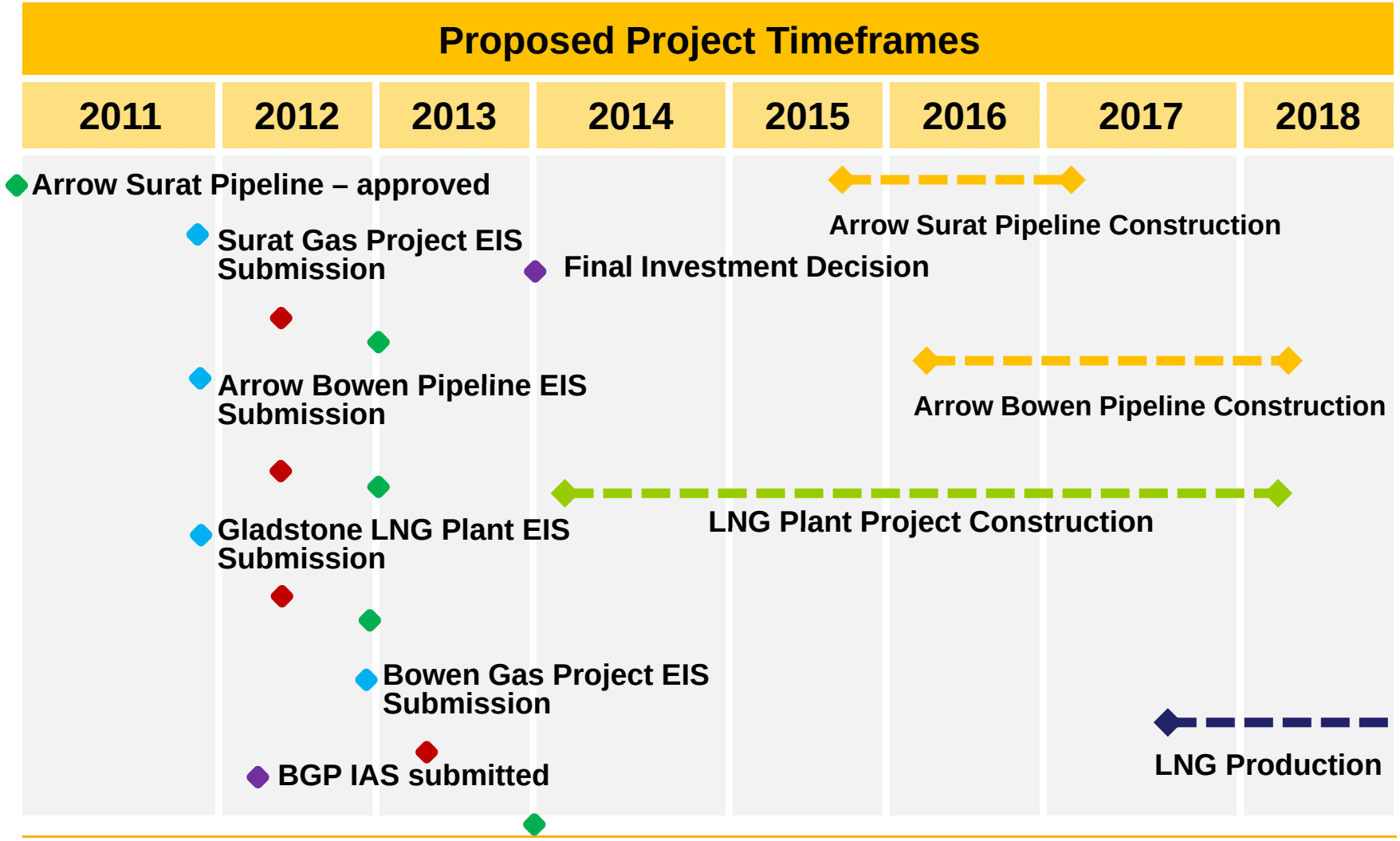
- Gas Sales: 100% of LNG sold
- Reserves: 8000PJ – equal to or greater than other proponents when FID was taken
- Budget: $1-Billion approved to spend in 2012
- Staffing: Large single accommodation contract in Brisbane (13 floors) signed in March. New accommodation for Moranbah and Dalby
- EIS Approvals
  - Arrow Surat Pipeline – approved in 2010
  - LNG Plant, Surat Gas Project and Bowen Pipeline out for public consultation
  - Bowen Gas Project – IAS submitted
- Land Access: 476 agreements in place; 270 underway in 2012; no cases before Land Court
- FEED readiness review underway, LNG Construction tender end 2012





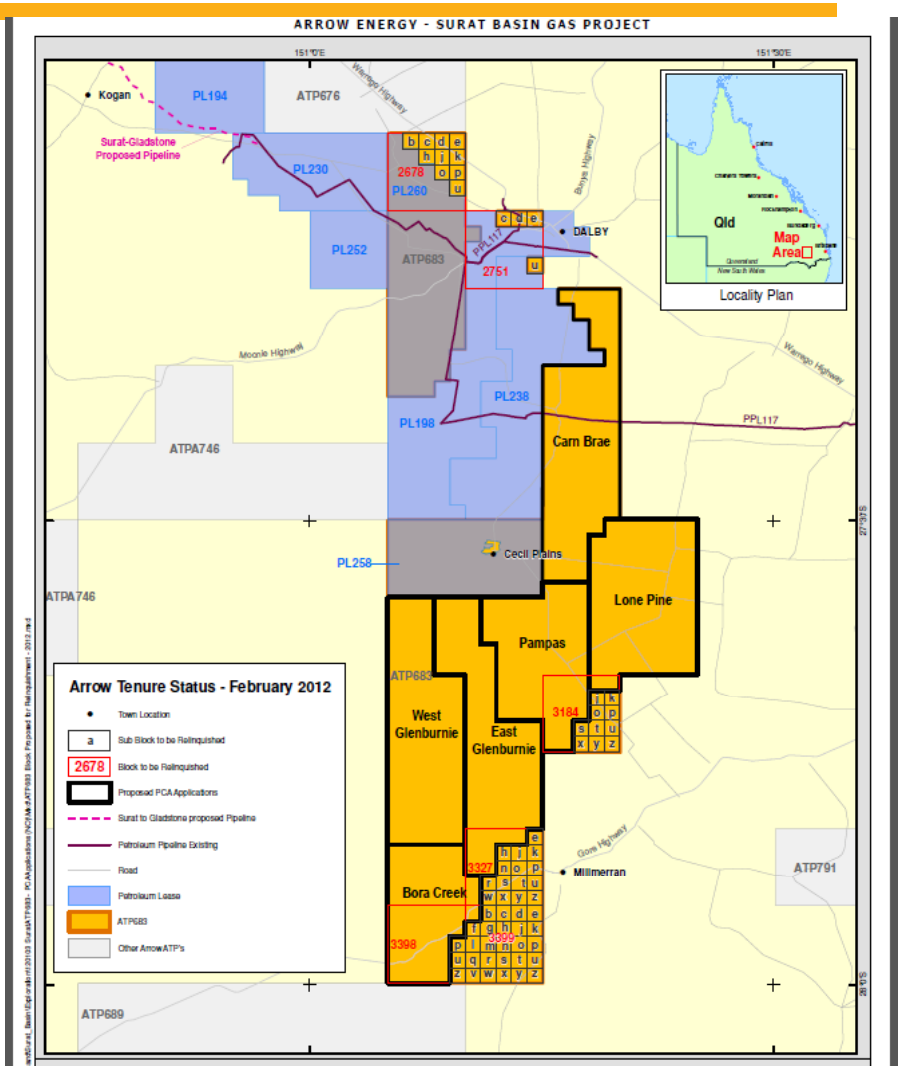
ARROW ENERGY

EIS APPROVALS – STATUS



ARROW ENERGY
APPROACH TO SCL

- Strategic Cropping Land (SCL) lies over just **15%** of Arrow's total tenure
- **ATP 683** has SCL over the eastern portion (Condamine Floodplain)
- This area contains a significant amount of gas reserves
- ATP 683 is the subject of best practice **tenure management & technology trials** to demonstrate co-existence
- Last week, Arrow informed **700 properties** of its intent to relinquish those properties from the tenure, to give more certainty to the community
- Arrow previously excised the town of **Cecil Plains** from the ATP in Nov 2010



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ARROW ENERGY

APPROACH TO SCL - ACCESS

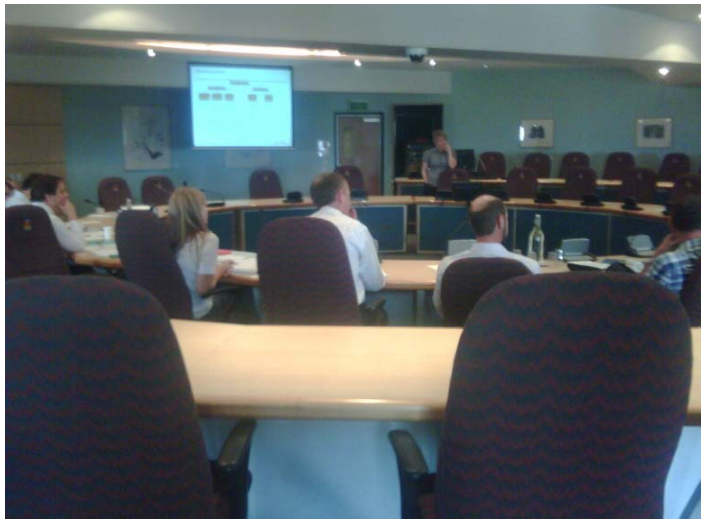
- **95** agreements in place (ATP 683)
- access to **16** black soil properties for exploration & drilling trials and water monitoring & research
- 11 agreements in negotiation
- 11 agreements to commence
- Access and safety inductions tailored to intensively farmed land
- Single contact for all land holders
- Restricted personnel access – potential electronic access;
- i.d. permits for black soil
- Privacy provision at discretion of landholder (option to make public)
- New all-terrain vehicles to reduce impact in wet weather

ARROW ENERGY

APPROACH TO SCL – EXPLORATION

Exploration & Appraisal

- Pitless drilling trials have commenced
- SCL specific project management including dedicated rig and crew
- Infrastructure trials – pipeline and power reticulation
- Detailed feasibility assessment of Substitution of Allocation scheme
- New mobile wash down units
- No fraccing on ATP 683 (or existing Surat Gas Project area)
- Worked through Arrow Committees with landholders, Local/State Govts USQ, NGOs



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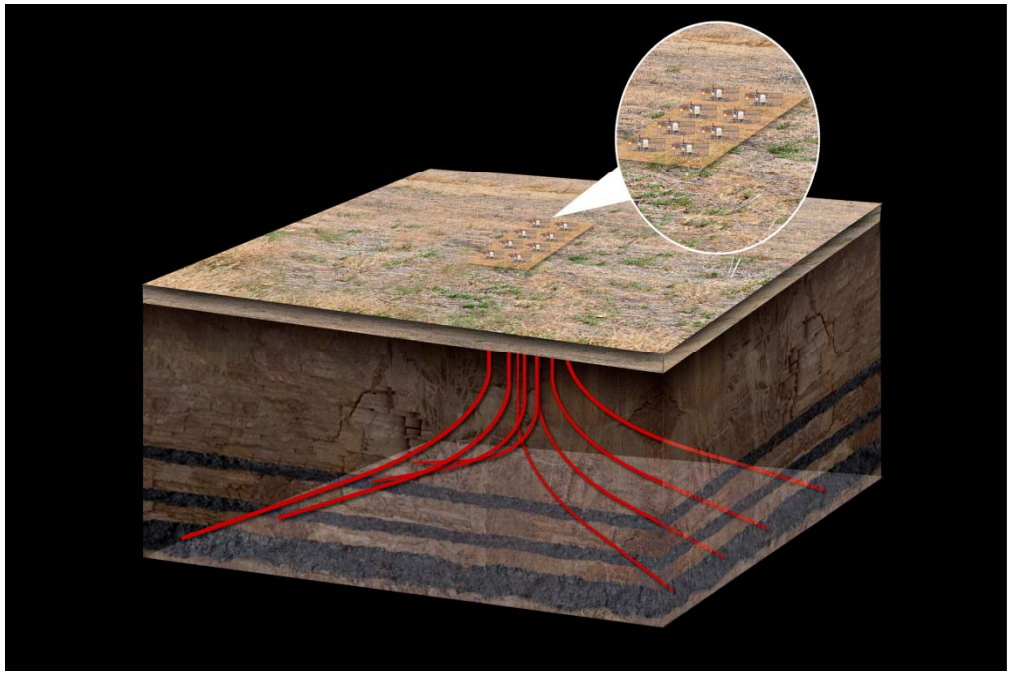
APPROACH TO SCL – FIELD DEVELOPMENT

Field Development

- Evaluating drilling of up to 8 wells from a single well pad to reduce footprint and associated infrastructure
- Increased well spacing (160 to 320 acres (0.8km to 1.5km))
- Flexibility in well locations
- Studying ways to reduce gathering system pipe diameter and potential for alternative construction method - plow (not trench) smaller gathering pipe to preserve soil profile
- 3 existing field development case studies with farmers on SCL (various farming practices)



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ARROW ENERGY

WATER MANAGEMENT

Produced Water

- Arrow – **25 GL** per year (750 GL total)
- CSG Industry - **125 GL** per year
- Existing farmers - **124 GL** per year

- GAB impact of CSG industry's total drawdown represents **0.004%** of water in the GAB (1/25,000th of 65M GL) *before* mitigation

- Local impacts - working with landholders to substitute their Govt licensed water allocations from GAB; plus other regional options

- First supply agreement being finalised to use 50% of current water production from Tipton

- Arrow has commenced a central research centre and farm *Theten* to showcase CSG water for irrigation over 370 – 1300 ha of crops

- 70 – 100 water monitoring bores planned in the Surat in 2012 as part of a $75M water research program

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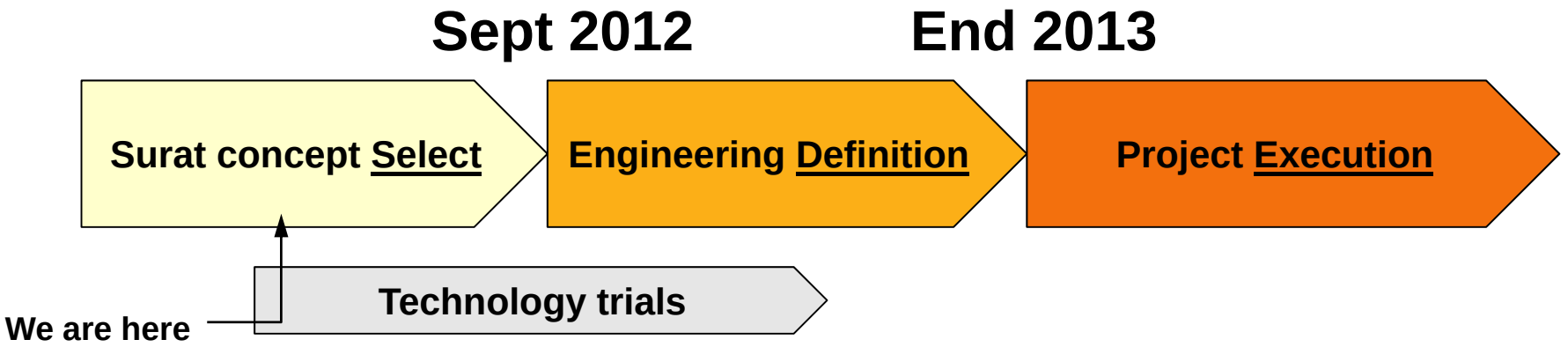
ARROW ENERGY

SURAT GAS PROJECT TIMELINE



- During concept Select, Arrow engineers are studying the best high level design for:
  - Well types, well spacing and artificial lift
  - Gas and water gathering flow lines to centralised facilities
  - The number, approximate locations and capacity of centralised production facilities
  - How to power centralised facilities and wells
  - The development sequence

- At the end of this stage, we will have an integrated view of how the above designs work together as a system

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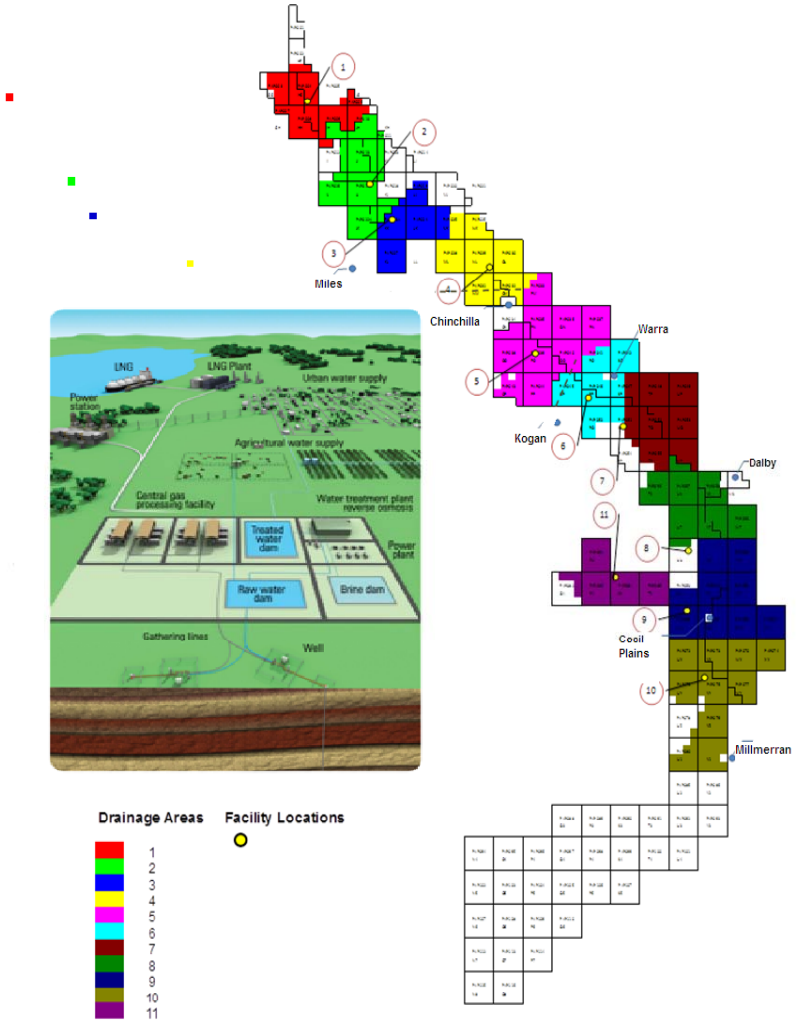
ARROW ENERGY

INDICATIVE CENTRAL GAS PROCESSING FACILITIES



- We expect to have centralised gas production facilities (CGPFs) processing gas from wells.
- Indicative feed areas (shown in colours opposite) are based on:
  - the maximum distance gas can be drawn from wells
  - good drainage characteristics, taking into account the terrain
- Each CGPF has processing and compression equipment

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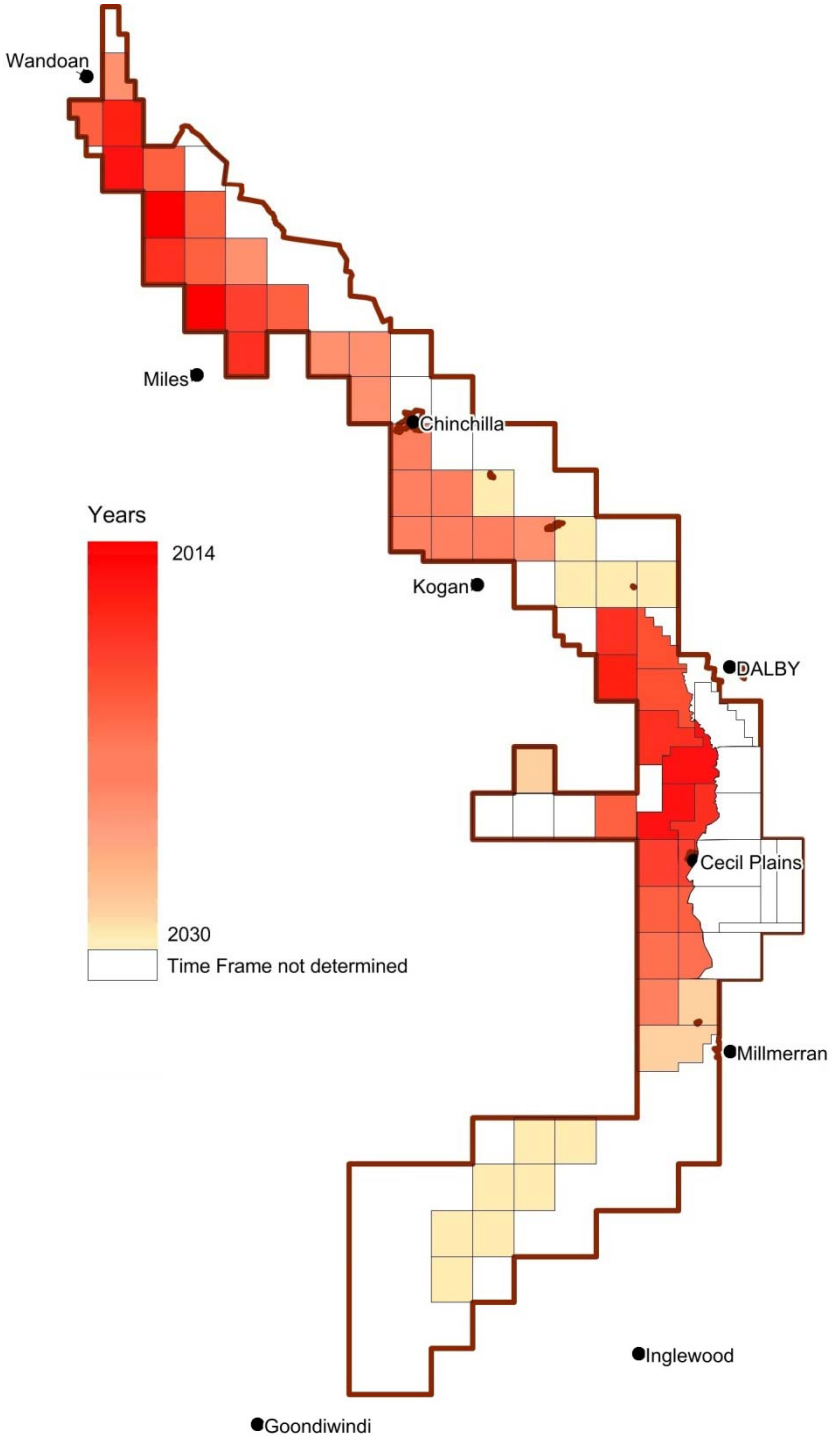
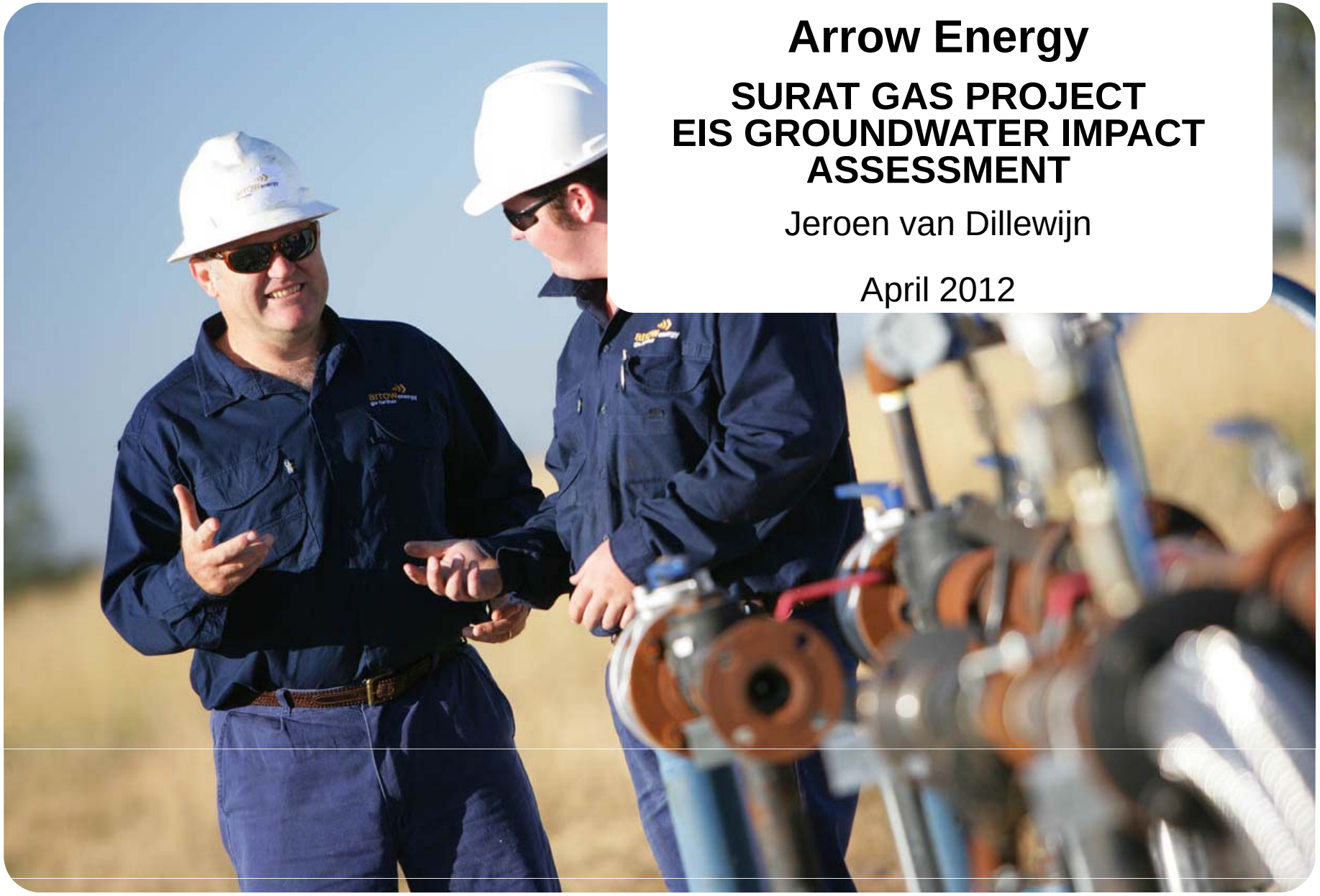
ARROW ENERGY
QUESTIONS

SURAT GAS PROJECT
DEVELOPMENT AREAS AND TIMING

- Target area for development between 2013 and 2023:
  - ~ 2,000 wells
- Production wells:
  - ~ 15 wells in next 12 months



Phase 6 Groundwater impact assessment presentation



Arrow Energy

SURAT GAS PROJECT
EIS GROUNDWATER IMPACT ASSESSMENT

Jeroen van Dillewijn

April 2012

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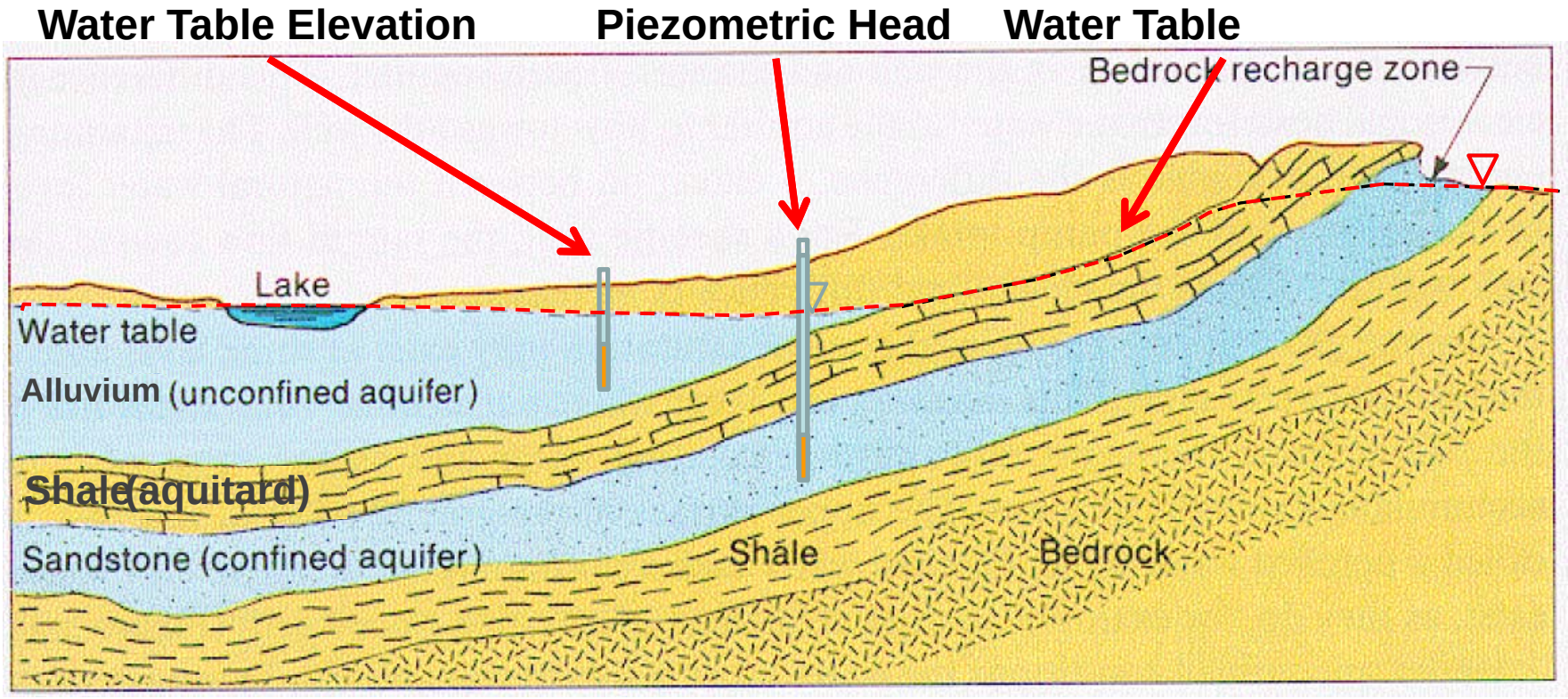
ARROW ENERGY

FIRST A REFRESHER...

- Groundwater occurs in **pores and fractures** in rock and soil.
- **Aquifers** are layers that transmit groundwater, mainly horizontally.
- **Aquitards** impede the movement of groundwater and flow mainly vertical.
- Groundwater flow is driven by differences in **head**, which is a measure of potential energy.
- The rate of flow of groundwater is controlled by **hydraulic conductivity**, which can be different in different directions.

ARROW ENERGY

AQUIFERS, AQUITARDS, PRESSURE, HEAD



Groundwater flows due to differences in “head”

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ARROW ENERGY
KEY USES AND ISSUES

Groundwater is required for:

- Consumptive or productive uses (agriculture/aquaculture/mining)
- Biological integrity of groundwater dependent ecosystems (springs)
- Support to areas of cultural and spiritual importance (springs/wetlands)

Potential Impacts to groundwater systems include:

- Groundwater drawdown (reduced availability and/or flows)
- Land subsidence induced by drawdown
- Groundwater contamination

ARROW ENERGY

ENVIRONMENTAL IMPACTS

Groundwater environmental values (defined by legislation) are:

- Ecological values
- Biological integrity
- Potential uses (consumptive/productive)
- Cultural and spiritual values

Sensitivity of groundwater systems defined by:

- Conservation status (ecology, biological integrity, uses, cultural values)
- Rarity of occurrence, abundance or distribution of system
- Resilience to change (permeability and porosity)
- Hydrogeological processes (recharge and discharge mechanisms)
- Rehabilitation potential (rebound and recovery)

ARROW ENERGY
GROUNDWATER SYSTEMS

Shallow groundwater system (*moderate sensitivity*)

- Condamine Alluvium (up to 150 m thick)

Intermediate groundwater system (*moderate sensitivity*)

- Kumbarilla Beds comprising Mooga, Gubberamunda and Springbok sandstones (100 to 200 m thick)

Coal seam gas groundwater system (*low sensitivity*)

- Walloon Coal Measures (100 to 500 m thick)

Deep groundwater system (*high sensitivity*)

- Hutton Sandstone/Marburg Subgroup (120 to 180 m thick)
- Precipice Sandstone (50 to 100 m thick)

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ARROW ENERGY
POTENTIAL IMPACTS

Direct impacts

- Walloon Coal Measures groundwater systems
- Depressurisation of aquifers (extraction of groundwater)
- Reduced supply to existing and future groundwater users
- Contamination of shallow aquifers by leaks, spills and seepage
- Contamination of groundwater systems by incorrect or incomplete well installation

Indirect impacts

- Depressurisation of adjacent aquifers caused by inter-aquifer flows
- Reduced supply to existing and future groundwater users
- Reduced flows to groundwater dependent ecosystems
- Land subsidence

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PREDICTING IMPACTS (GROUNDWATER MODELLING)

Groundwater (numerical) modelling

- Undertaken by Schlumberger Water Services
- Peer reviewed by Lloyd Townley
- Explained in previous consultation sessions

Three scenarios modelled

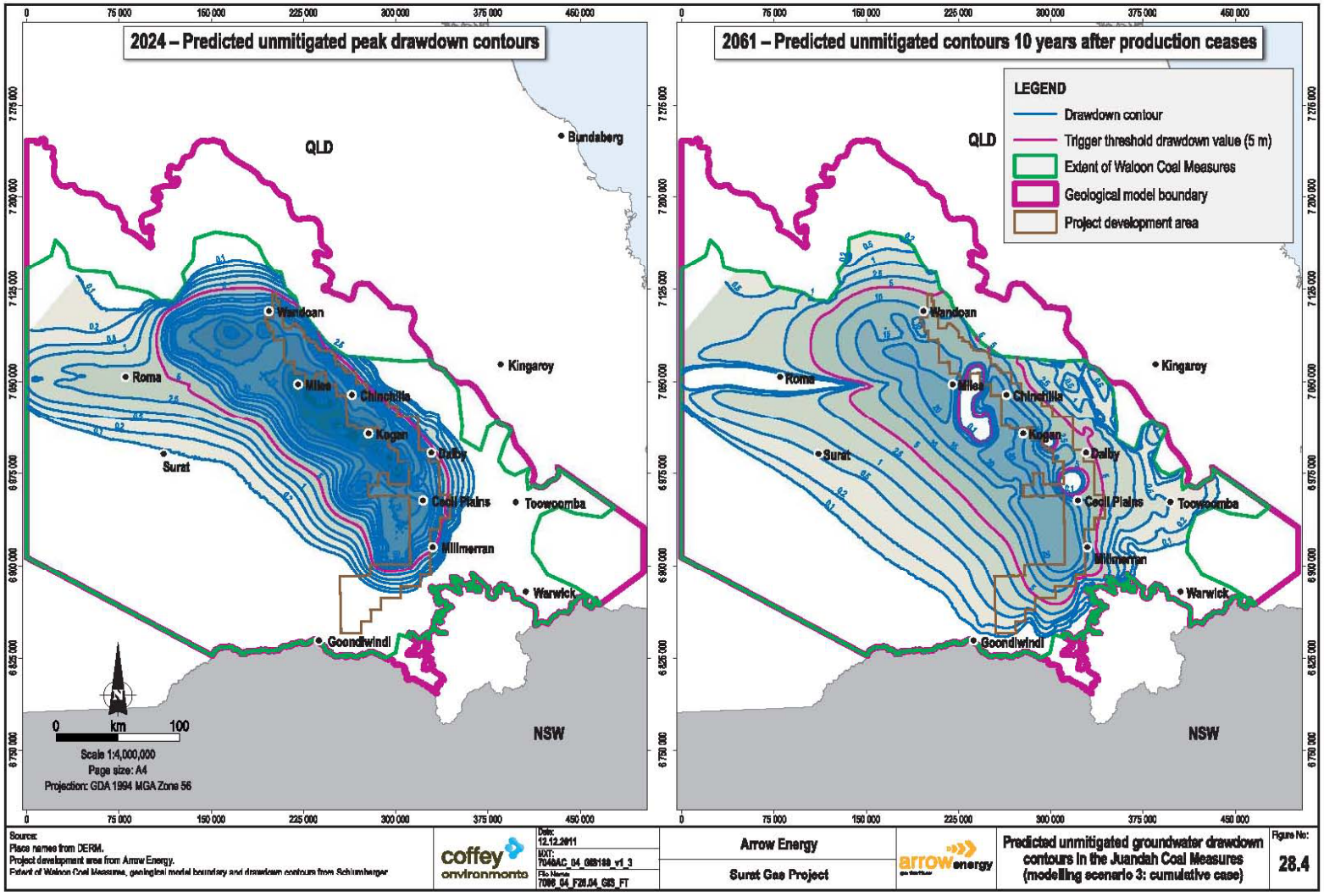
- Arrow only (Scenario 1)
- Arrow, Queensland Gas Company (QGC) and Santos (Scenario 2)
- Arrow, Queensland Gas Company (QGC), Santos and Origin Energy (Scenario 3 cumulative impact)

Assumes 30 year project life and 20 year recovery period

Model calibrated using existing data

PREDICTED DRAWDOWN IN WALLOON COAL MEASURES

UNMITIGATED CUMULATIVE IMPACT



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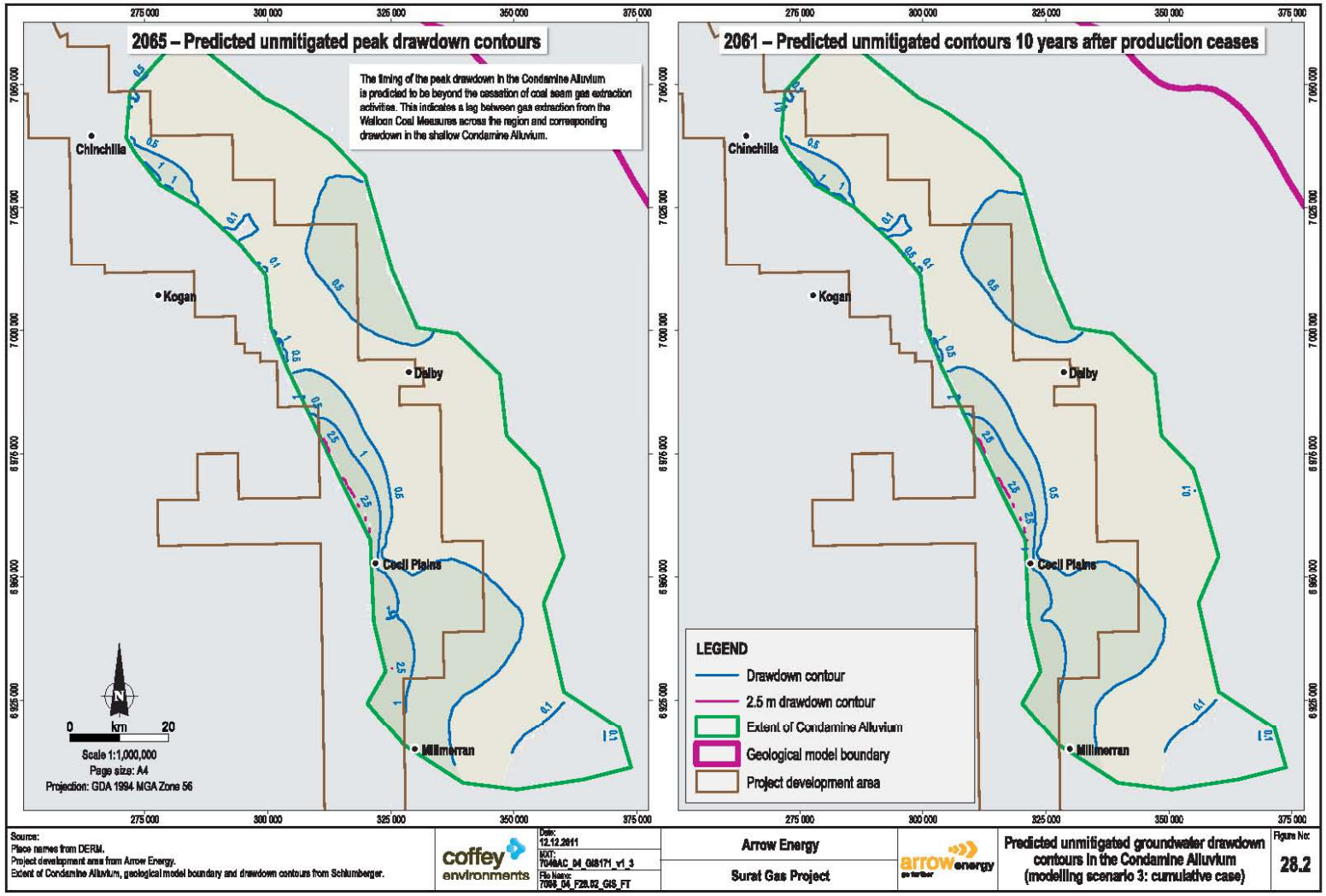
PREDICTED DRAWDOWN IN CONDAMINE ALLUVIUM

UNMITIGATED CUMULATIVE IMPACT (SHALLOW AQUIFERS)



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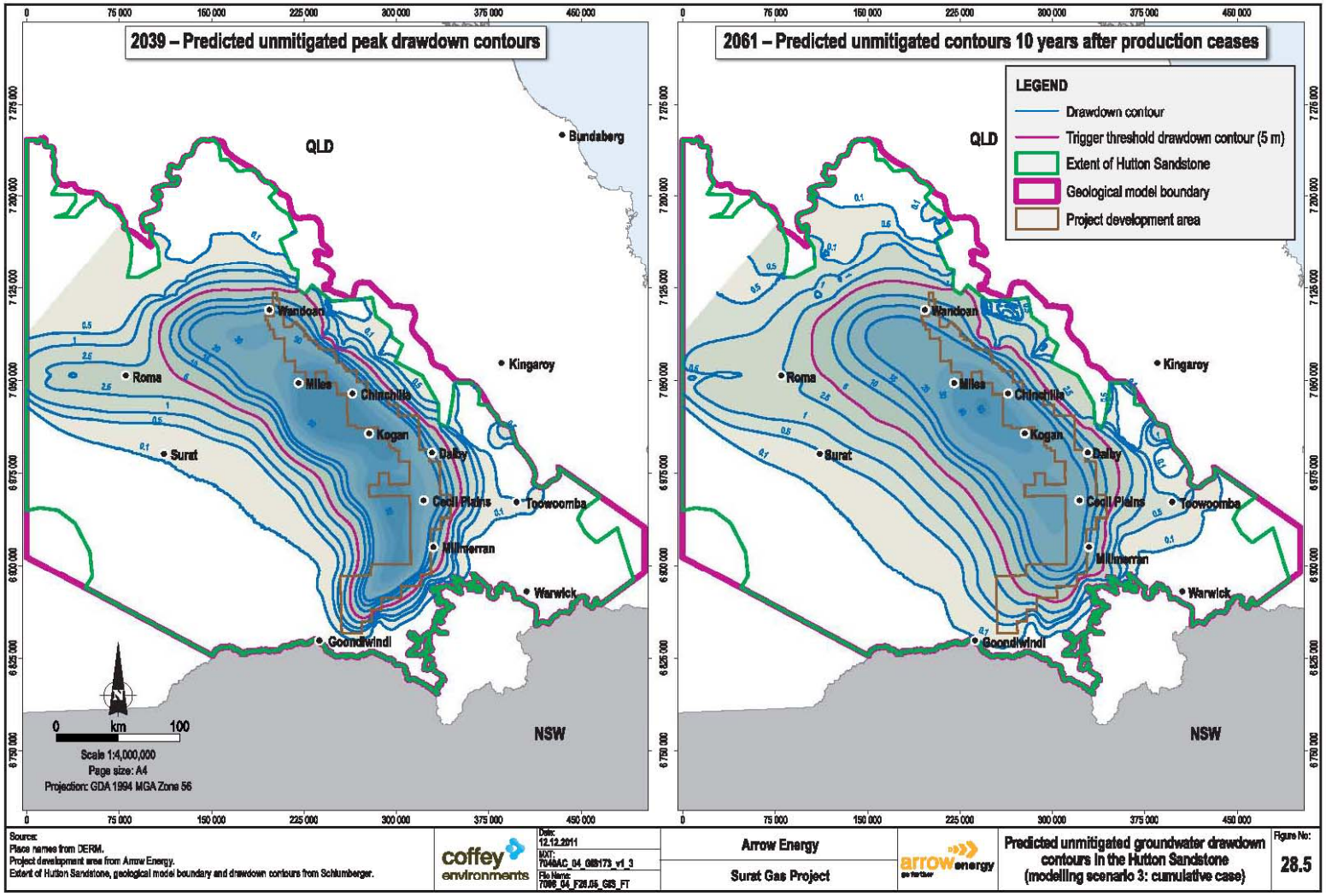
PREDICTED DRAWDOWN IN HUTTON SANDSTONE

UNMITIGATED CUMULATIVE IMPACT (DEEP AQUIFERS)



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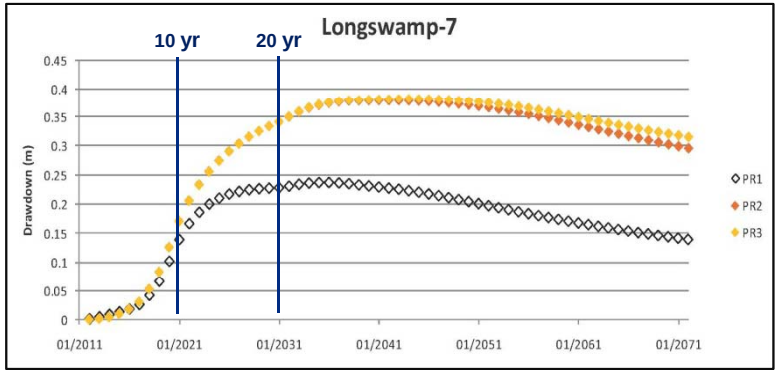
PREDICTED (UNMITIGATED) DRAWDOWN

ARROW ONLY SCENARIO

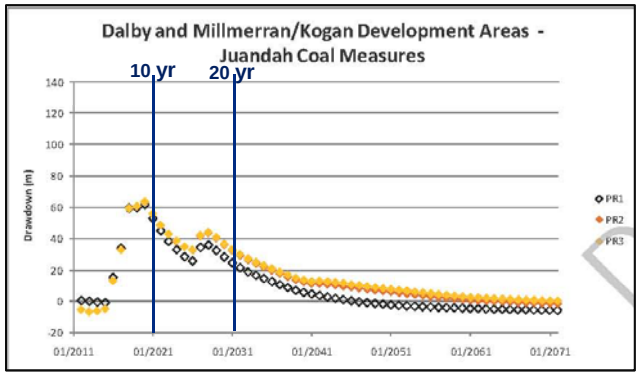
Groundwater system	Predicted drawdown (Arrow only)	Predicted drawdown (Cumulative)	Drawdown and recovery period
Shallow groundwater system *Condamine Alluvium*	Greater than 0.1m to less than 1m	2.5m	Maximum drawdown in 2059 Longer recovery beyond 2071
Intermediate groundwater system *Kumbarilla Beds*	30m	60m	Maximum drawdown in 2029 Significant recovery by 2061
Coal seam gas groundwater system *Walloon Coal Measures*	50m to greater than 75m	Greater than 75m	Maximum drawdown in 2024 Significant recovery by 2061
Deep groundwater system *Hutton Sandstone/Marbug Subgroup* *Precipice Sandstone*	20m to 30m 10m to 15m	75m	Maximum drawdown between 2027 and 2042 Significant recovery by 2061

PREDICTED DRAWDOWN HYDROGRAPHS

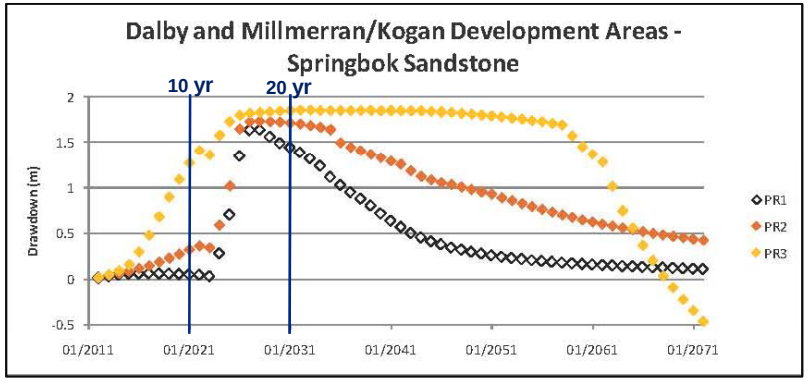
SHALLOW, INTERMEDIATE, DEEP AND COAL SEAM GAS



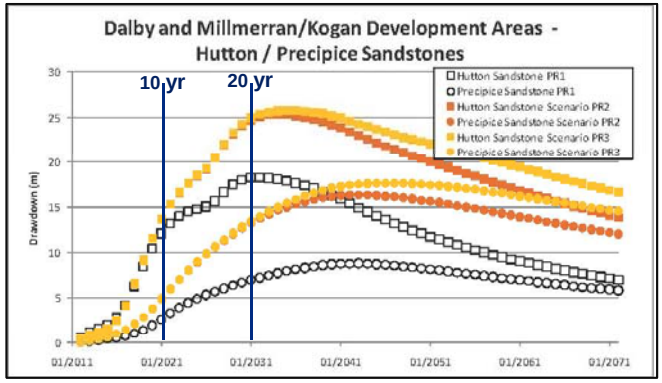
Shallow groundwater system
Condamine Alluvium



Coal seam gas groundwater system
Walloon Coal Measures



Intermediate groundwater systems
Kumbarilla Beds (Springbok Sandstone)



Deep groundwater systems
Hutton Sandstone/Precipice Sandstone

Source: Schlumberger Water Services

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MANAGEMENT MEASURES

Adaptive management framework

- Dynamic behaviour of groundwater systems
- Groundwater monitoring
- Refinement of groundwater models - improve predictability of impacts
- Develop appropriate responses

Queensland Water Commission

- Surat Cumulative Management Area
- Independent modelling using all available information
- Cumulative underground water impact reports
  - Establish make good provisions
  - Define monitoring programs (aquifers/springs)
  - Impose strategy to mitigate impacts on springs (Springs Impact Management Strategy)

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MITIGATION AND MANAGEMENT MEASURES

Statutory Obligations

- "Make good"
- Baseline assessments

Proposed management measures

- Coal seam gas water management strategy
- Groundwater monitoring program (connectivity/drawdown/water quality)
- Bore & Baseline assessment for third party bores (impaired capacity)
- Well integrity management system (*Code of Practice for Constructing and Abandoning Coal Seam Gas Wells in Queensland (DEEDI, 2011)*)
- Injection into aquifers
- Substitution of groundwater allocations

Investigations

- Groundwater system connectivity
- ALOS surveys to monitor regional subsidence

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GROUNDWATER MONITORING

Arrow has completed:

- **35** monitoring bores in the Condamine alluvium
- **9** bores to monitor the effect of groundwater abstraction associated with CSG including bores:
  - to collect data on aquifer connectivity at new pilots;
  - installed into the Hutton and Precipice aquifers of the GAB
- **29** bores to monitor CSG associated infrastructure

Arrow has plans to install further bores:

- to monitor aquifers above and below coal seams; and
- investigate the degree of hydraulic connection between the Condamine Alluvium and Walloon Coal Measures

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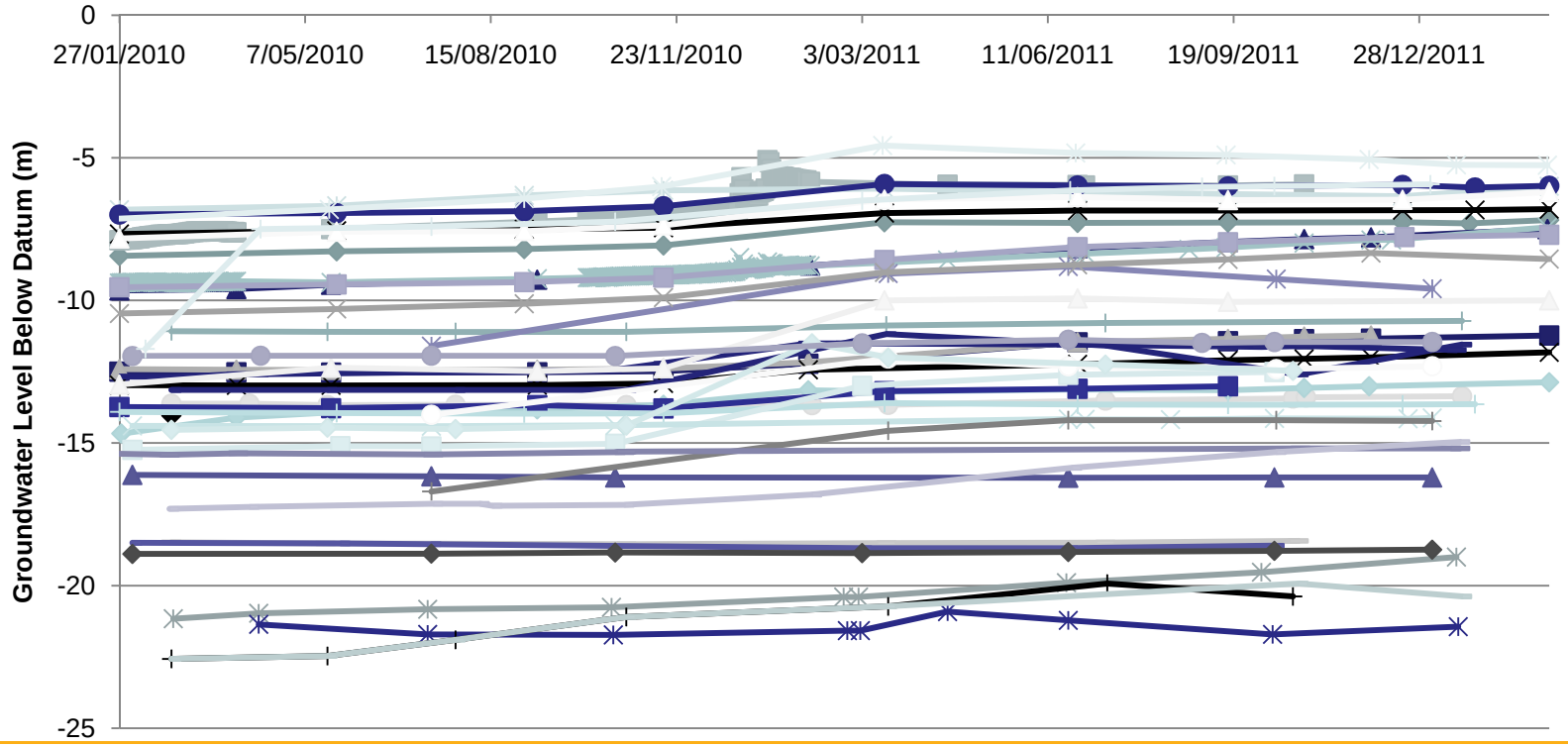
CONDAMINE ALLUVIUM RECHARGE FROM 2010-2011 FLOODS

- In 2010-2011 the Condamine was subject to substantial flood events.
- From the DERM Groundwater Bore Database an initial 82 bores in the Condamine with water level data through this period were identified.
- Monitoring data from bores through this period has been assessed to understand more about the behaviour of the groundwater in the Condamine.



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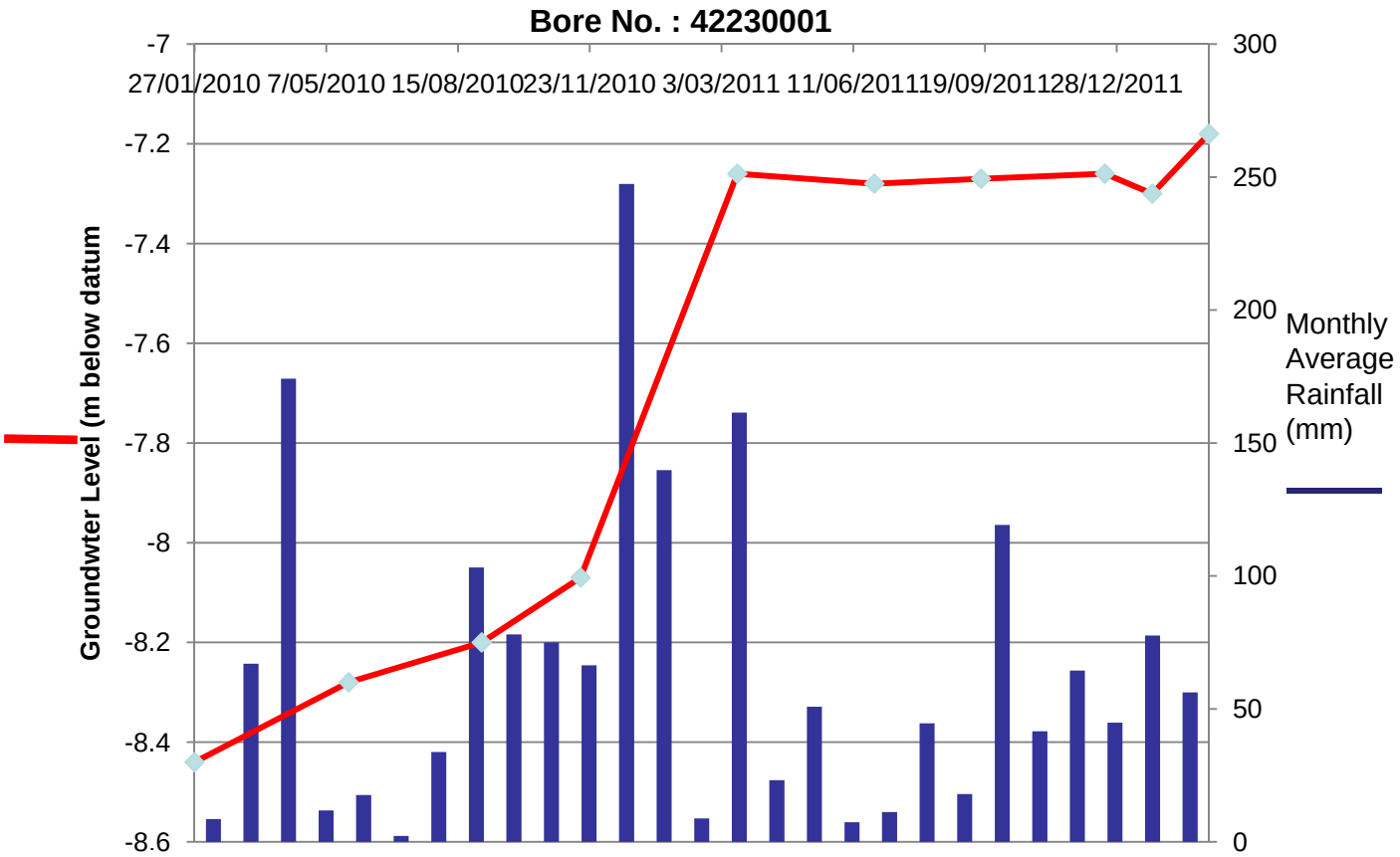
CONDAMINE ALLUVIUM RECHARGE FROM 2010-2011 FLOODS

Much of this data showed groundwater levels increasing over the flood period as shown in a typical bore hydrograph below.



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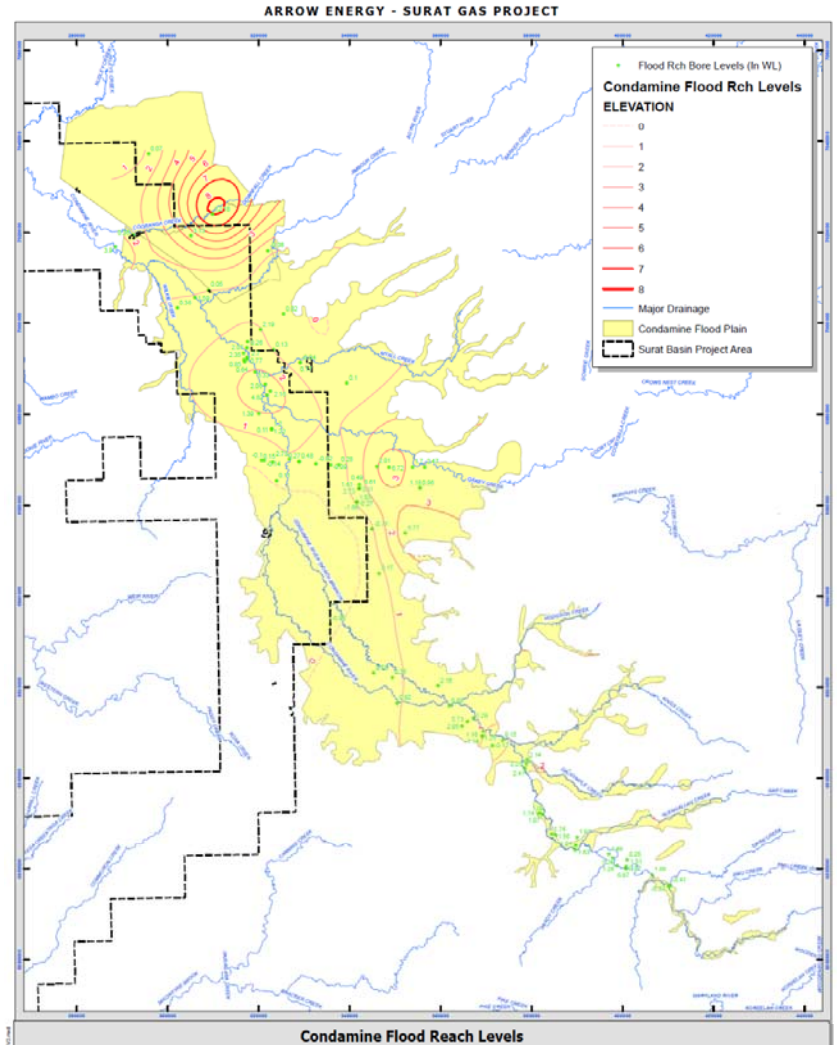
CONDAMINE ALLUVIUM RECHARGE FROM 2010-2011 FLOODS

Summary Data

- 136 Data points
- Mean increase in water level 1.8m



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ONGOING STUDIES

Injection Studies:

- Tipton-153 showed good permeability in the Precipice Sandstone but low permeability in the Hutton Sandstone;
- The well will be perforated in the Precipice and groundwater samples will be collected;
- A 30-day production test from Tipton-153 is planned;
- An assessment of the risk of undertaking an injection trial in a new well will be completed.
- Subject to government approval, a 6-month injection test is planned for the new injection well;
- At least one other well will be used for monitoring the trial injection
- The source of water for the injection trial will be treated water from the Tipton RO plant site. The chemistry of the injected water will be adjusted to match the chemistry of the water in the Precipice Sandstone

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ONGOING STUDIES

Connectivity Studies

- Four sites have progressed - additional locations sought;
- Will study groundwater pressure and quality where;
  - CSG abstraction has/will occur;
  - Agricultural abstraction takes place; and
  - Historical abstraction has resulted in drawdown.
- Will include drilling of new monitoring bores with aim to core through base of alluvium.

Modelling

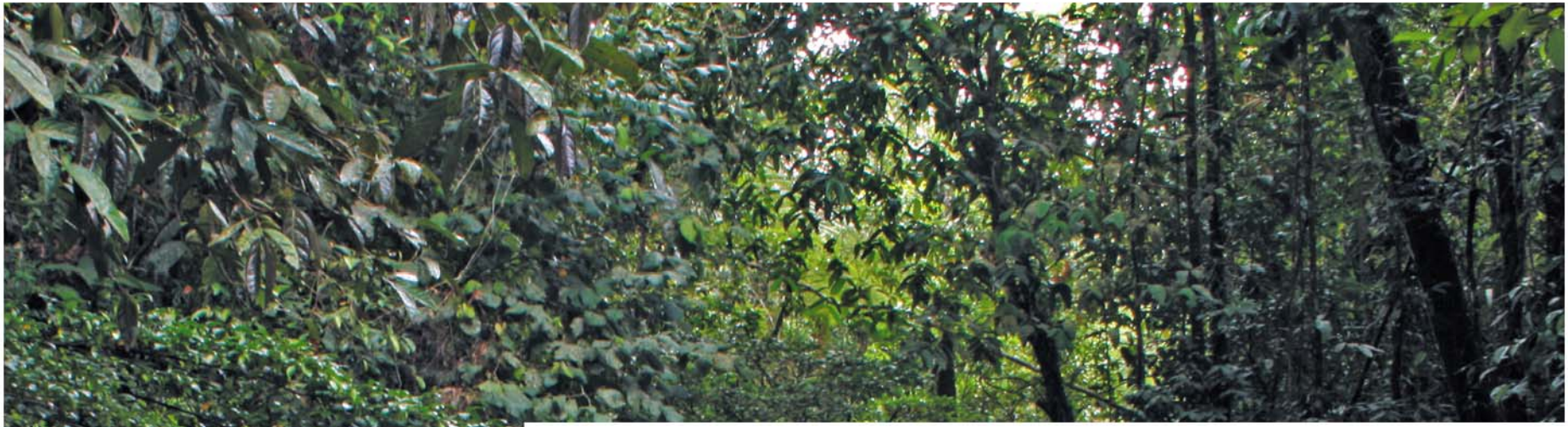
- Model refinement and analysis progressing

Questions and Answers

Freecall: 1800 038 856

Email: info@arrowenergy.com.au

Phase 6 Air, noise, vibration and agriculture impact assessment presentation



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Surat Gas Project
Environmental Impact Statement
30 April to 10 May 2012

Outline

- Air quality impact assessment
- Noise and vibration impact assessment
- Agriculture impact assessment

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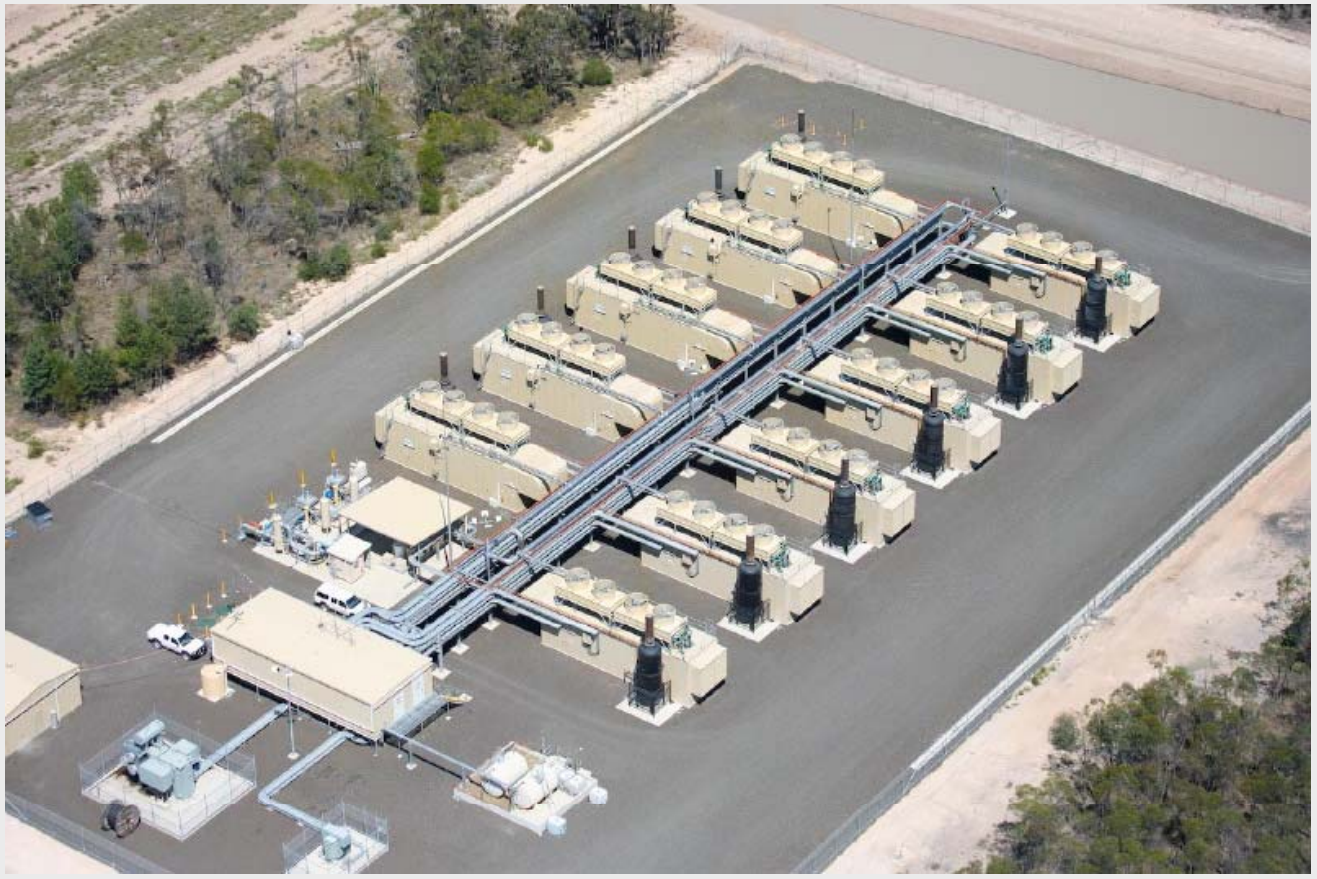
Air Quality and Noise and Vibration Impact Assessments



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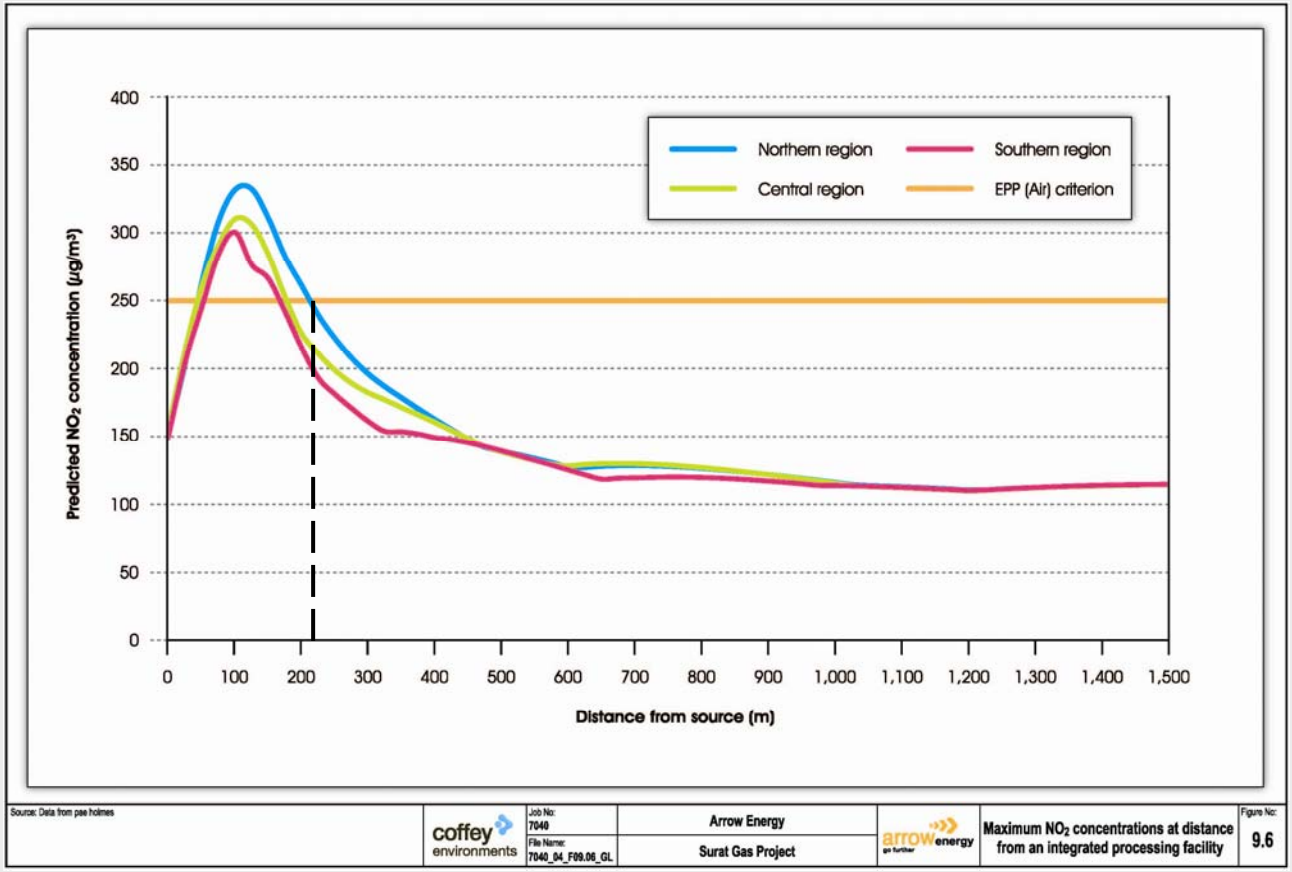
Emission sources and impact assessment scenarios

- Air emission sources
  - Production facilities (gas turbines exhausts, flares)
  - Well head infrastructure (gas engine exhausts)
- Noise and vibration sources
  - Production facilities (compressors, gas turbines)
  - Well head infrastructure (gas engines)
  - Vehicles, plant and equipment
- Impact assessment
  - Worst-case meteorological conditions (three regions)
  - Peak development (2020) and typical installations modelled
  - Impact assessed at sensitive receptors (houses, hospitals, etc)

Predicted ground level concentrations (NO_2)
Integrated processing facility



- Key indicators are oxides of nitrogen (NO_2) and ozone (O_3)
- No exceedences at regional level (NO_2 / O_3)
- Ground level concentrations of NO_2 achieved at 175 m to 225 m

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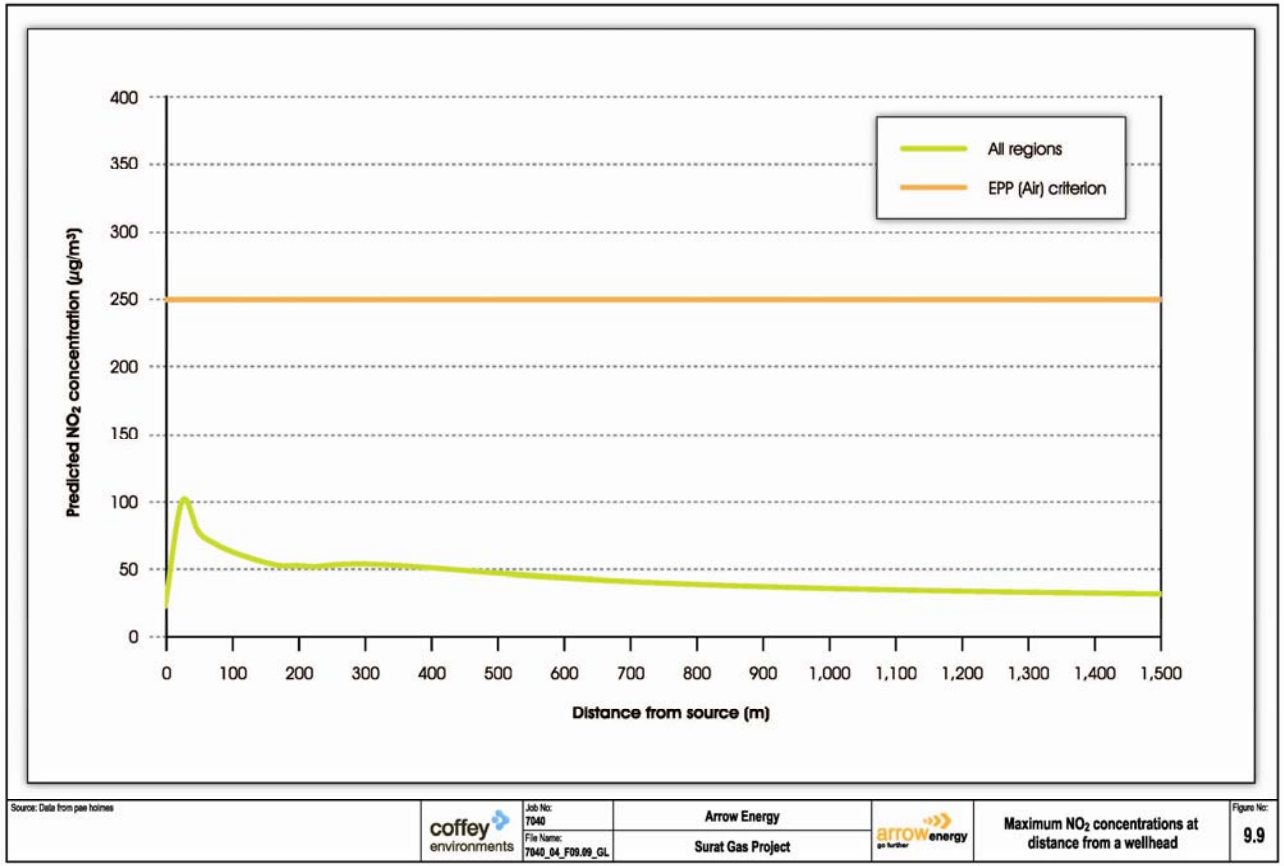
Predicted ground level concentrations (NO_2) Production well



Ground level concentrations of NO_2 not exceeded

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Noise criteria at sensitive receptors and findings

Time Period		Short-term Noise Event	Medium-term Noise Event	Long-term Noise Event
7.00 am to 6.00 pm	Day	45 dB(A)	43 dB(A)	40 dB(A)
6.00 pm to 10.00 pm	Evening	40 dB(A)	38 dB(A)	35 dB(A)
10.00 pm to 6.00 am	Night	28 dB(A)	28 dB(A)	28 dB(A)
6.00 am to 7.00 am	Morning	40 dB(A)	38 dB(A)	35 dB(A)

- Background noise levels 19 dB(A) to 34 dB(A)
- Production wells: unmitigated 300 m, mitigated 80 m
- Integrated processing facility: unmitigated 5 km, mitigated 1 km
- Vibration below threshold for human detection / no structural damage

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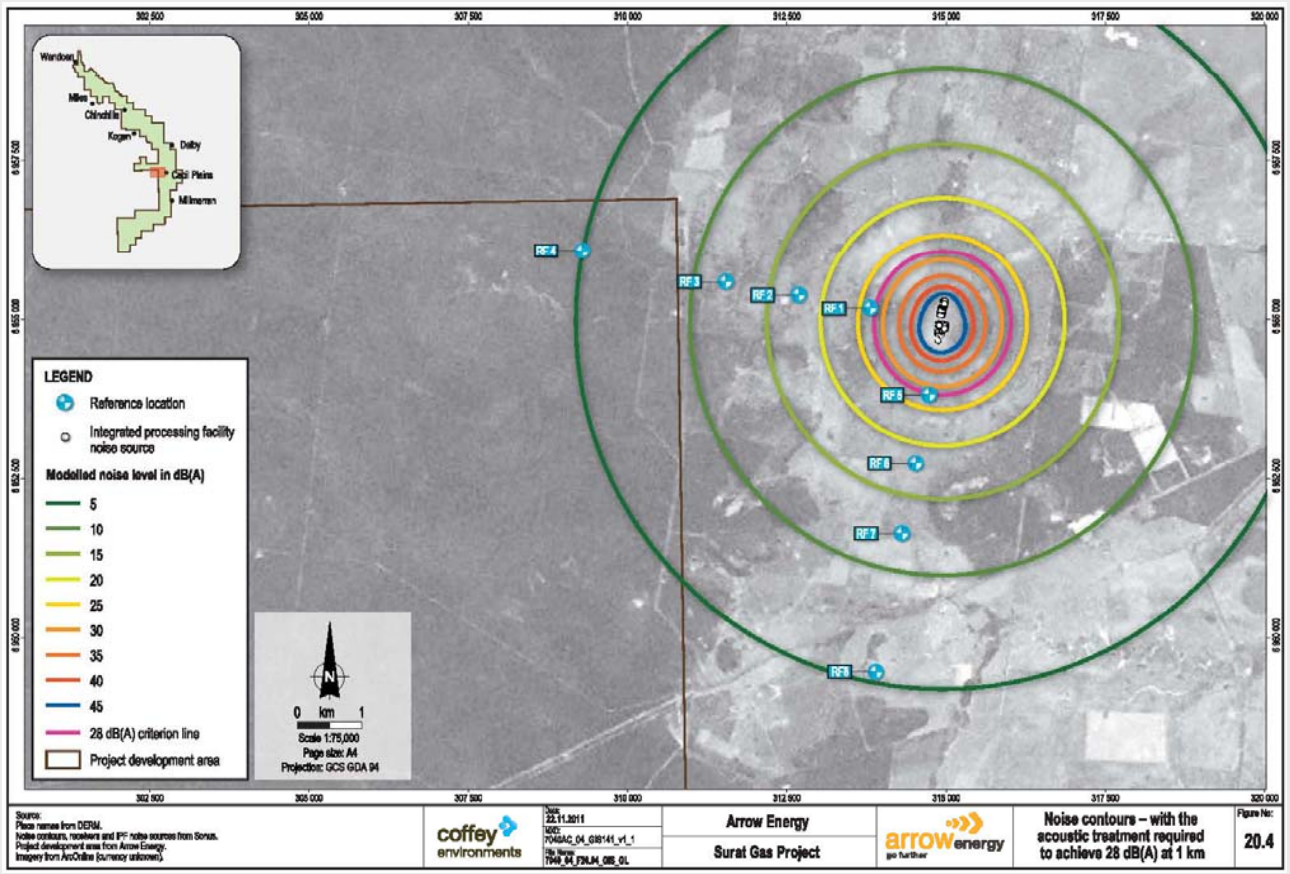
Noise propagation contours (Integrated processing facility)



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Agriculture impact assessment

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Planning policies and legislation

- Good Quality Agricultural Land (GQAL)
  - Class A and B (cropping land)
  - Class C (grazing land)
- Strategic Cropping Land Act 2011 (enacted January 2012)
  - Trigger maps define potential SCL
  - Zonal criteria used to defined SCL at property level
  - Zonal criteria include slope, rockiness, gilgai microrelief, soil depth, drainage, soil pH, chloride content and soil water storage
  - Eastern Darling Downs and Western Cropping zones

Agricultural enterprises

Intensive farming operation (feedlot) and dryland broadacre cropping

Intensively farmed land (irrigated broadacre cropping)

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Impacts to agricultural enterprises

- Sensitivity intrinsic to each property
  - Unique and with individual challenges
  - Tolerance to change varies
- Magnitude of impact
  - Disruption to farming activities
  - Constraints on future development
  - Disturbance of soils / availability of water
- Significance of impact
  - Extent to which activities can be integrated
  - Success of rehabilitation

Potential impacts of CSG development

- Loss of arable land
- Crop yield (productivity)
  - Disturbance of soils
    - Inverted soil horizons, breakdown of soil structure
    - Compaction
  - Farm workability
    - Headlands, cultivation islands and controlled traffic runs
    - Irrigation infrastructure (head ditches, tail drains, booms)
    - Inconvenience of working around CSG infrastructure

Potential impacts of CSG development cont'd

- Farm management
  - Operating overheads including management of CSG activities
  - Coordination of activities (spraying and withholding periods)
- Amenity
  - Contractors and employees entering and working on properties
  - Disruption to lifestyle
  - Noise
  - Dust
  - Visual impact of CSG infrastructure

Potential impacts of CSG development cont'd

- Project development area – 8,600 km^2 (860,000 ha)
  - GQAL 59%
  - Potential SCL 49%
- To be developed on land to be purchased by Arrow
  - Integrated processing facilities (~223 ha per facility)
  - Central gas processing facilities (~18 ha per facility)
  - Field compression facilities (~0.50 ha per facility)
- Production wells and gathering systems
  - 2-3 % of typical 160 acre (~65 ha) production spacing during construction i.e., ~1.95 ha per 65 ha production area

Lasting (residual) impacts

The majority of impacts are temporary in nature, during construction and rehabilitation, however some may be lasting in nature:

- Changed operations (reduction of cultivated/irrigated area)
  - Installation of coal seam gas infrastructure
  - Ability to develop or modify farm plan
- Potential for diminished productivity
  - Unsuccessful rehabilitation (soil structure, surface relief)
  - Effects may not be known for some time
- Changed land use
  - Rehabilitation of production facility sites to sustainable land use e.g., grazing land

Lasting (residual) impacts cont'd

Example of unsuccessful rehabilitation

Example of successful rehabilitation

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Lasting (residual) impacts cont'd

Roma-Brisbane Pipeline – Warrego Highway

Roma-Brisbane Pipeline near Gatton

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Conclusions and recommendations

- Plan development to integrate with farming practices, including:
  - A. Design and planning objectives
    - Twelve objectives aimed to design out impacts where possible
  - B. Specific mitigation and management measures
    - Accepted practice
  - C. Rehabilitation trials
    - Techniques and treatments to return land to former use/productivity
  - D. Develop assessment method for productivity
    - To measure success of rehabilitation
  - E. Rehabilitation of soils fundamental to long-term productivity

Questions

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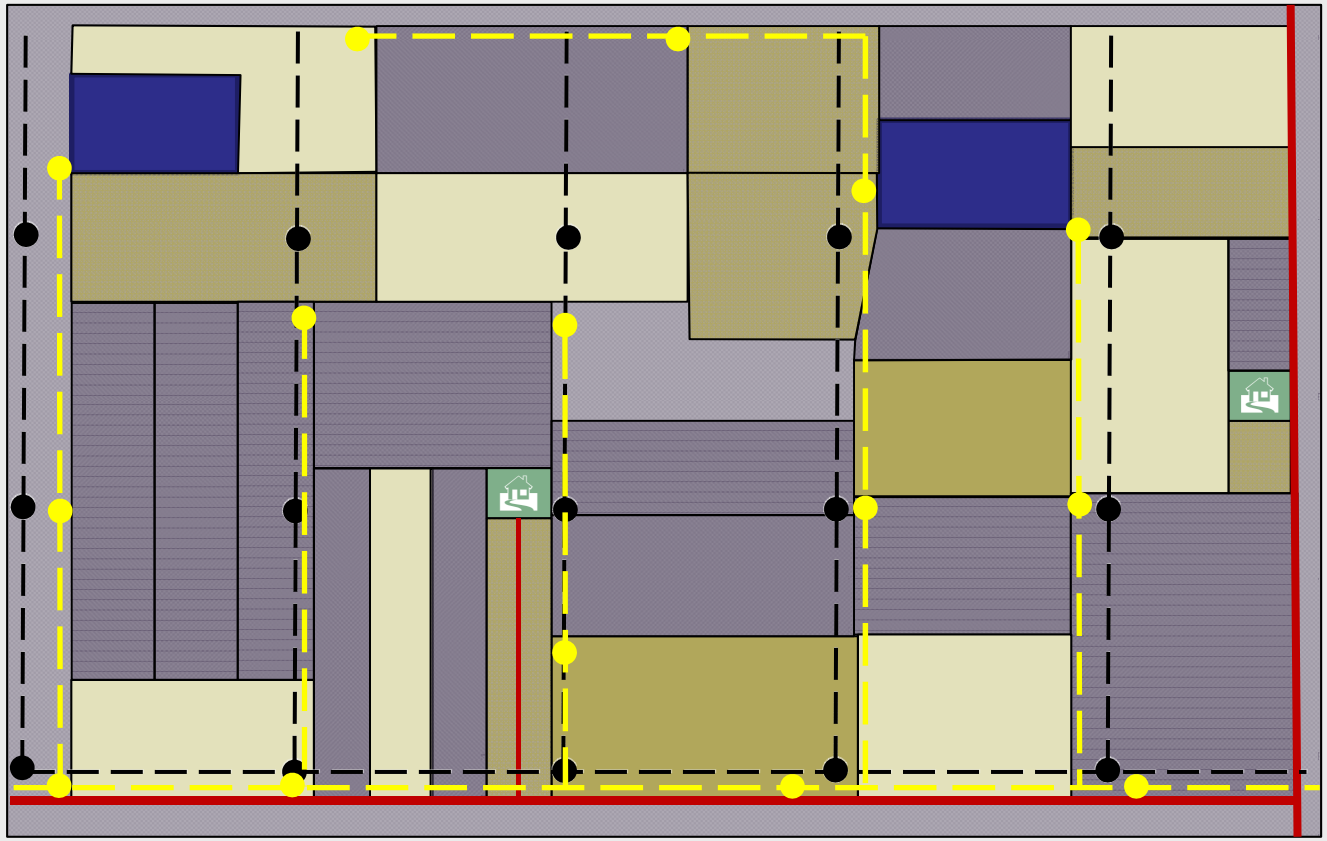
Flexibility in production well siting (conceptual arrangement)



- More wells; shorter production period
- Less wells; longer production period
- Multiple wells per pad

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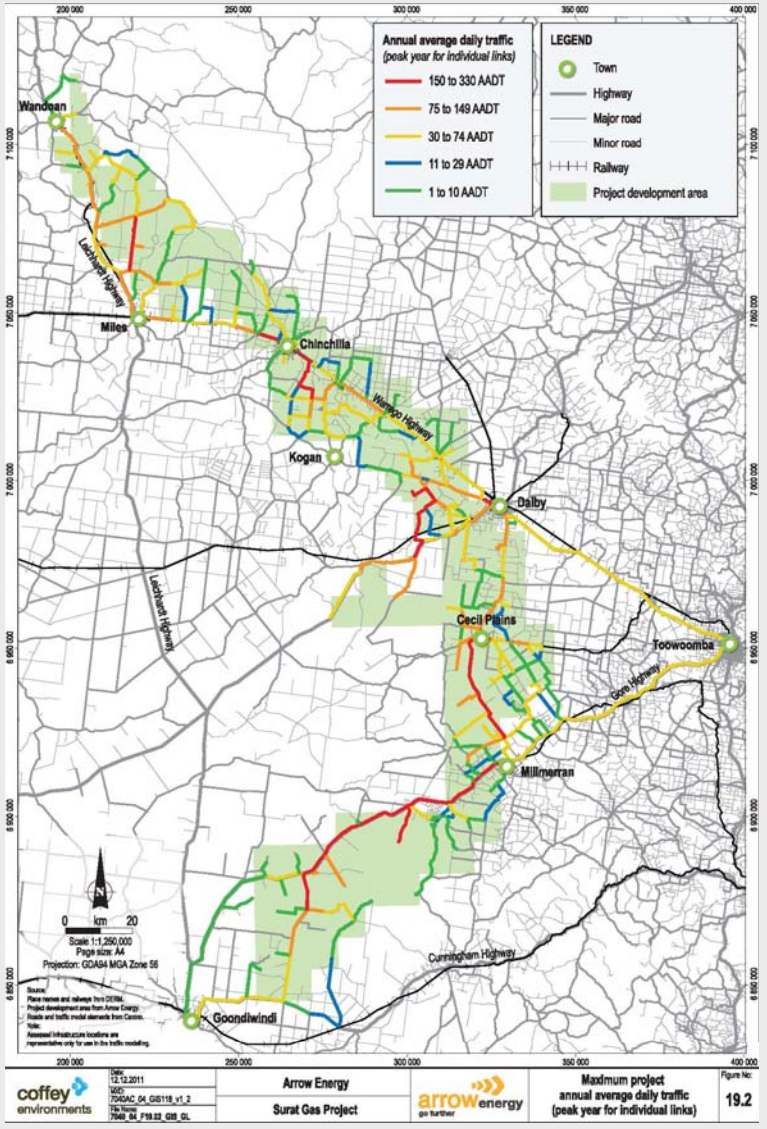
Roads and traffic

- Project generated traffic
  - Consistent with predicted growth
  - Average ~100 vpd; peak 330 vpd
  - Localised impacts
- Cumulative impacts
  - Warrego Highway
  - Chinchilla – Tara Road
  - Dalby – Kogan Road
  - Kogan – Condamine Road
  - Moonie Highway



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Production well footprints

- Establishment footprint
  - ~ 75 m by 75 m (~0.5 ha)
- Operation footprint
  - 10 m by 10 m
- Workover footprint
  - ~70 m by 70 m (~0.5 ha)

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Phase 6 Summary of question and answer session

Surat Gas Project

Community information sessions 30 April – 10 May 2012

Introduction

In late April and early May 2012 Arrow Energy (Arrow) held a series of community information sessions to provide an update on the Surat Gas Project, and to communicate the findings of, and the proposed strategies for, the associated Environmental Impact Statement (EIS). Questions and answers from those sessions were captured by JTA Australia and are presented in this document.

The purpose of these meeting notes is to reflect the questions asked and answers provided during the community meetings. While the notes include some paraphrasing and summarising; every effort has been made to preserve the integrity of the discussions.

Questions varied across the seven sessions. To ensure that valuable information is shared amongst the communities of the Surat Basin, these notes contain questions and answers asked across all sessions.

The Surat Gas Project community information sessions were held from 30 April to 10 May 2012 at:

- Millmerran, 30 April
- Cecil Plains, 1 May
- Chinchilla, 2 May
- Dalby, 3 May
- Miles 8 May
- Wandoan, 9 May
- Goondiwindi, 10 May

Copies of the presentations given at the April/May community information sessions are available on the Arrow Energy website at **www.arrowenergy.com.au**.

How to read these notes

Questions and comments from the audience are in bold type. The unbolded responses are from Arrow staff. In some cases responses have been summarised. In others, additional information is included to provide further context or explanation; this information is italicised following the answer.

Please note any references made to a final investment decision (FID) are based on the premise that Arrow is aiming to present a FID submission to its parent companies by late 2013. This date has not changed. The FID is taken by Arrow's parent companies, Shell and PetroChina, considering a range of factors.

If you have questions or comments about the project or these meeting notes, please contact the project team during working hours on:

freecall 1800 038 856
email: suratgas@arrowenergy.com.au
post: Surat Gas Project, Reply Paid 81 Hamilton QLD 4007

Acronyms

ALOS	Advanced land observing satellite
ATP	Authority to prospect
CGPF	Central gas processing facility
CSG	coal seam gas
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	decibel
DEEDI	Department of Employment, Economic Development and Innovation
DEHP	Department of Environment and Heritage Protection
DERM	Department of Environment and Resource Management
DNR	Department of Natural Resources
EA	environmental authority
EIS	environmental impact statement
EMP	environmental management plan
FID	final investment decision
GAB	Great Artesian Basin
GJ	gigajoules
KCB	Klohn Crippen Bergen Ltd.
kPa	kilopascals
LNG	liquefied natural gas
NVD	National vendor declaration
PJ	petajoules
PL	petroleum lease
psi	pounds per square inch
QWC	Queensland Water Commission
RO	reverse osmosis
SAR	sodium absorption ratio
SCL	Strategic cropping land
TDS	total dissolved solids
TRC	Toowoomba Regional Council

Conversions
1 megalitre (ML) = 1,000,000 litres
1 gigalitre (GL) = 1,000,000,000 litres

Legislation mentioned:
Commonwealth Environment Protection Biodiversity Conservation Act 1999
Environmental Protection Act 1994
Petroleum and Gas (Production and Safety) Act 2004
Mineral Resources Act 1989
Strategic Cropping Land Act 2011
Water Act 2000
Water Supply (Safety & Reliability) Act 2008

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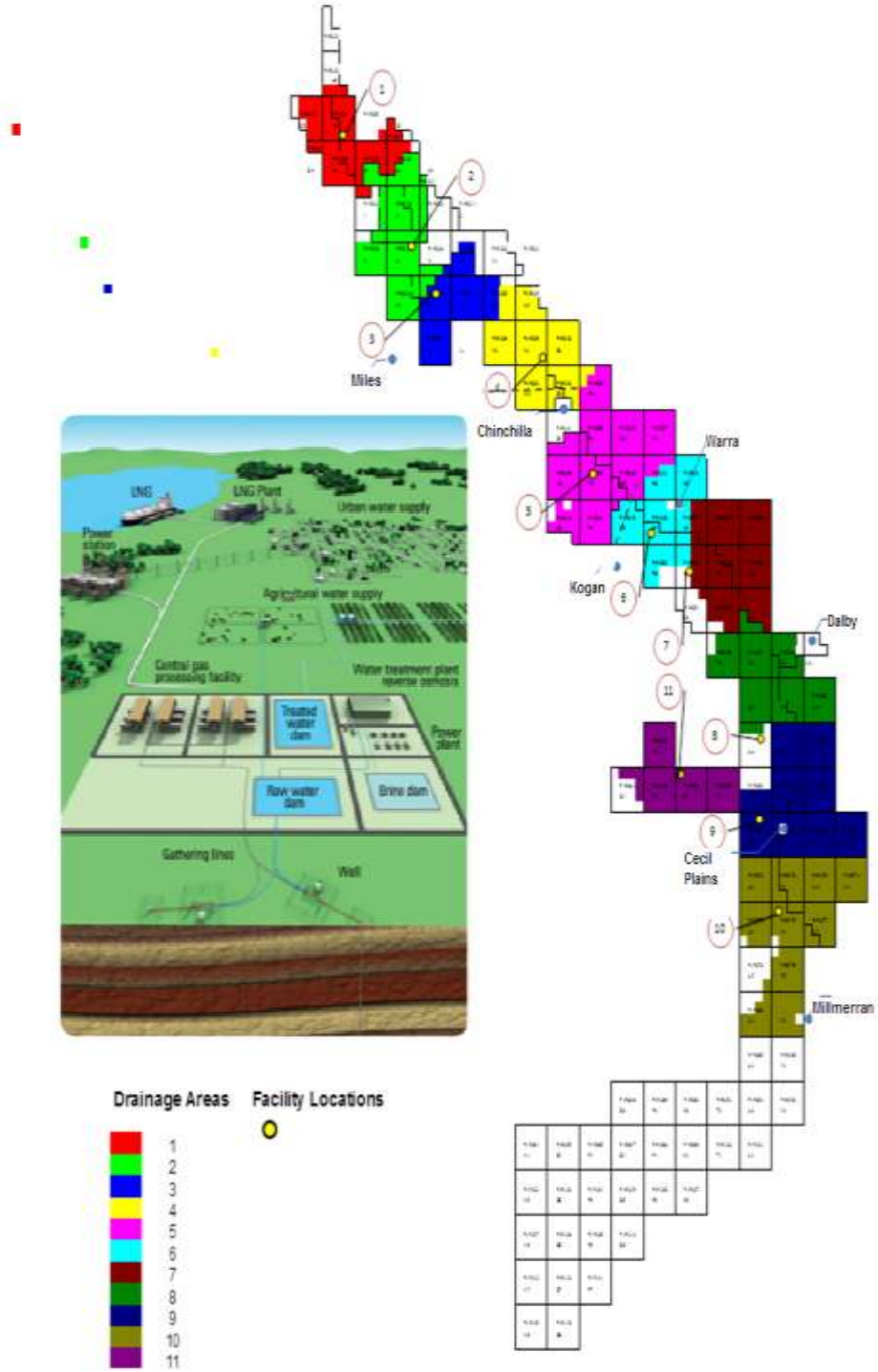

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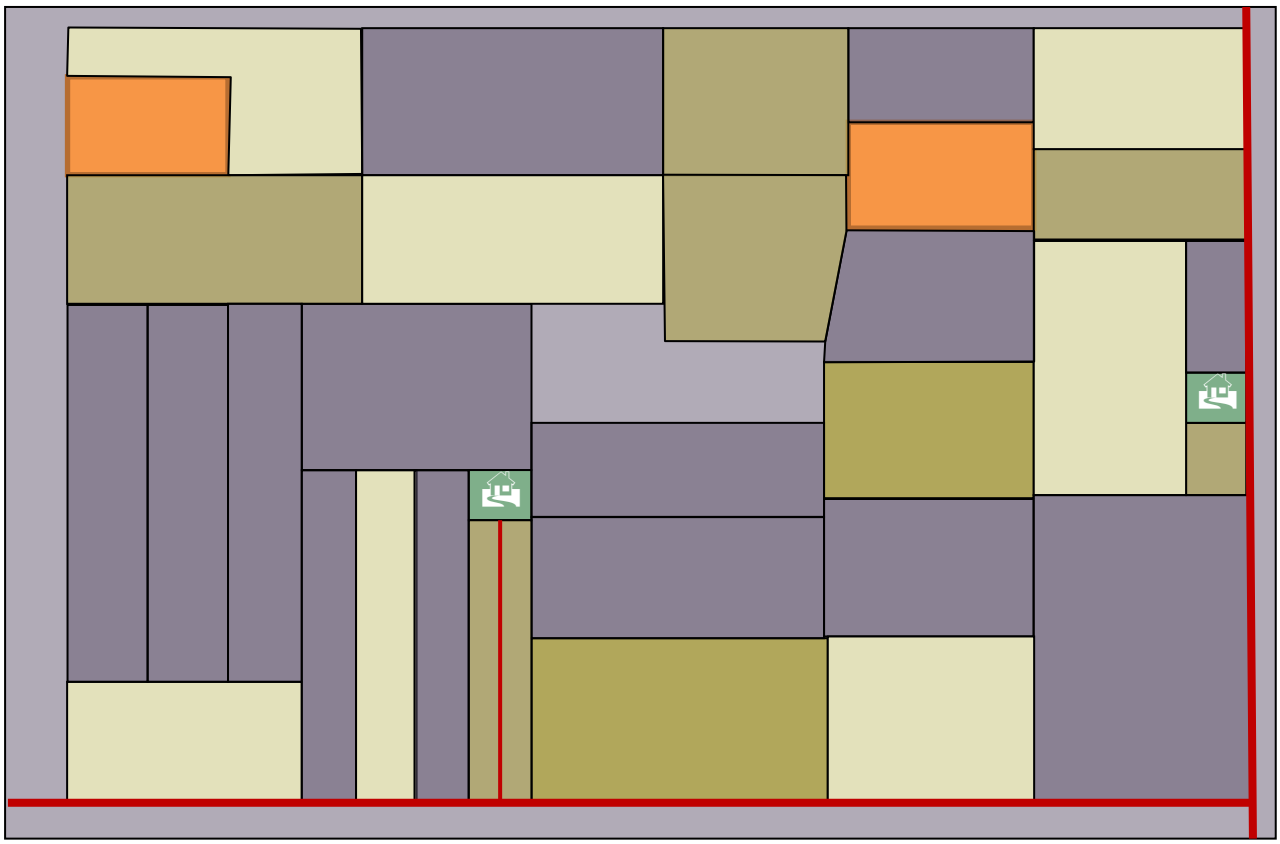

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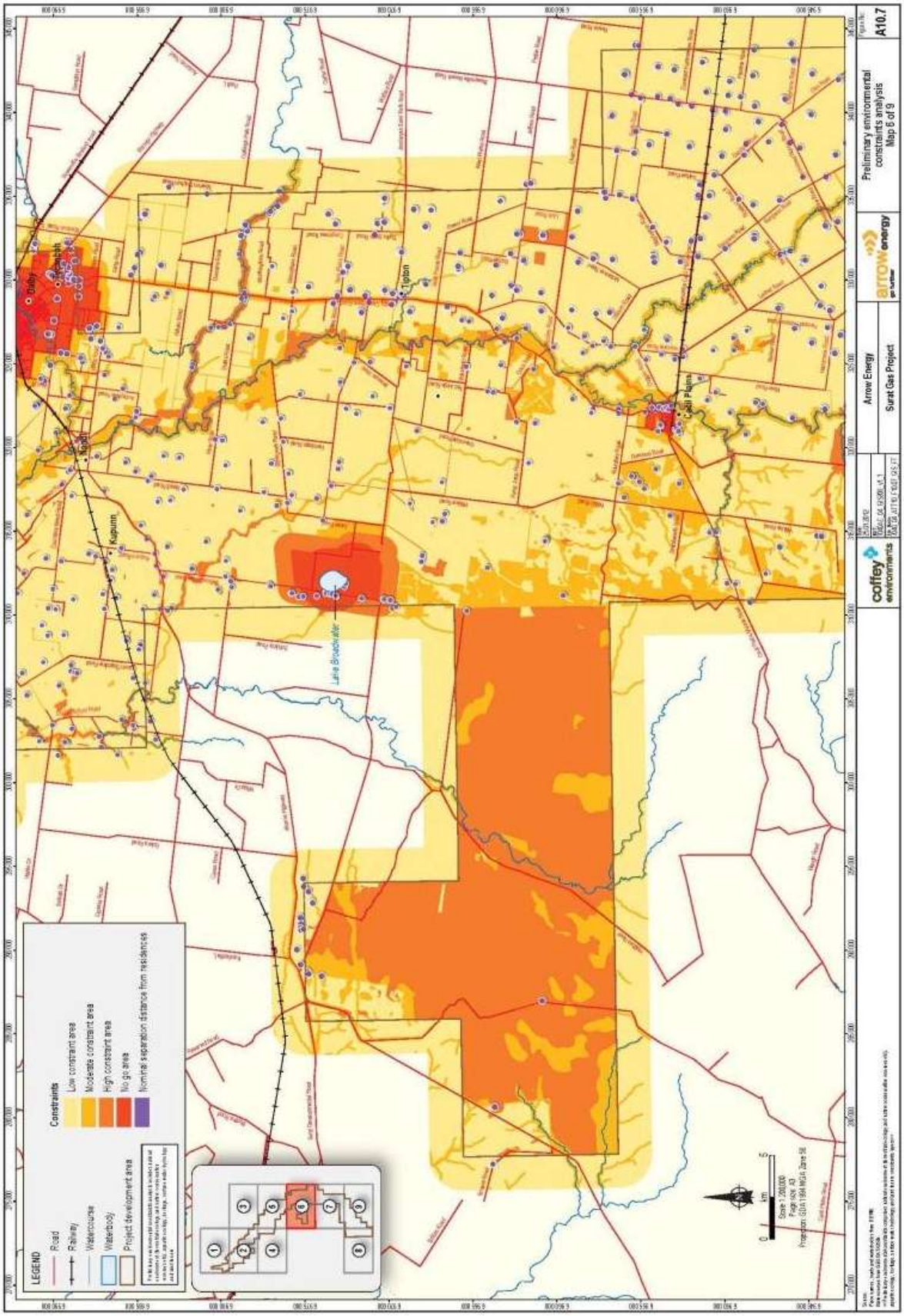

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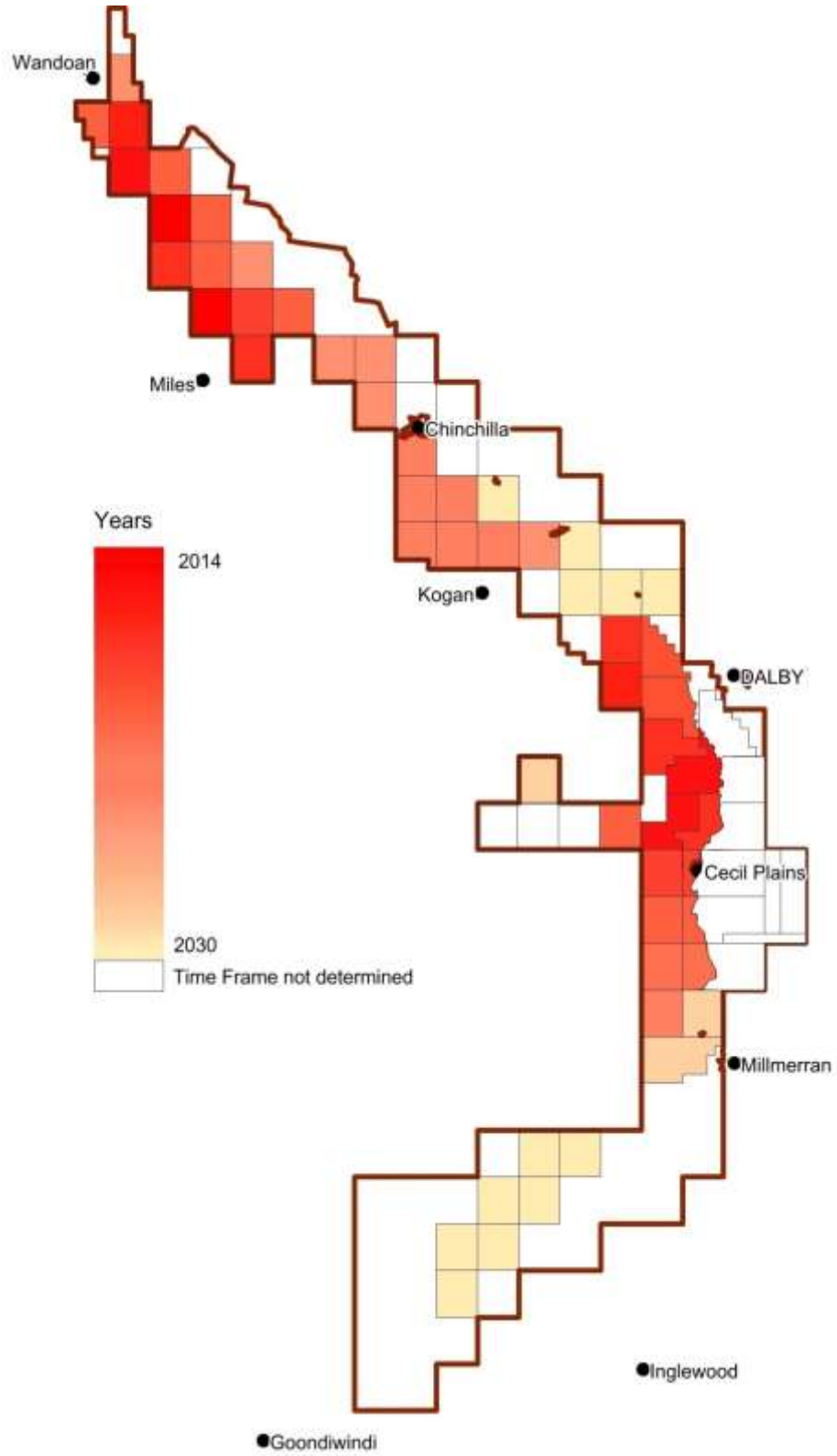

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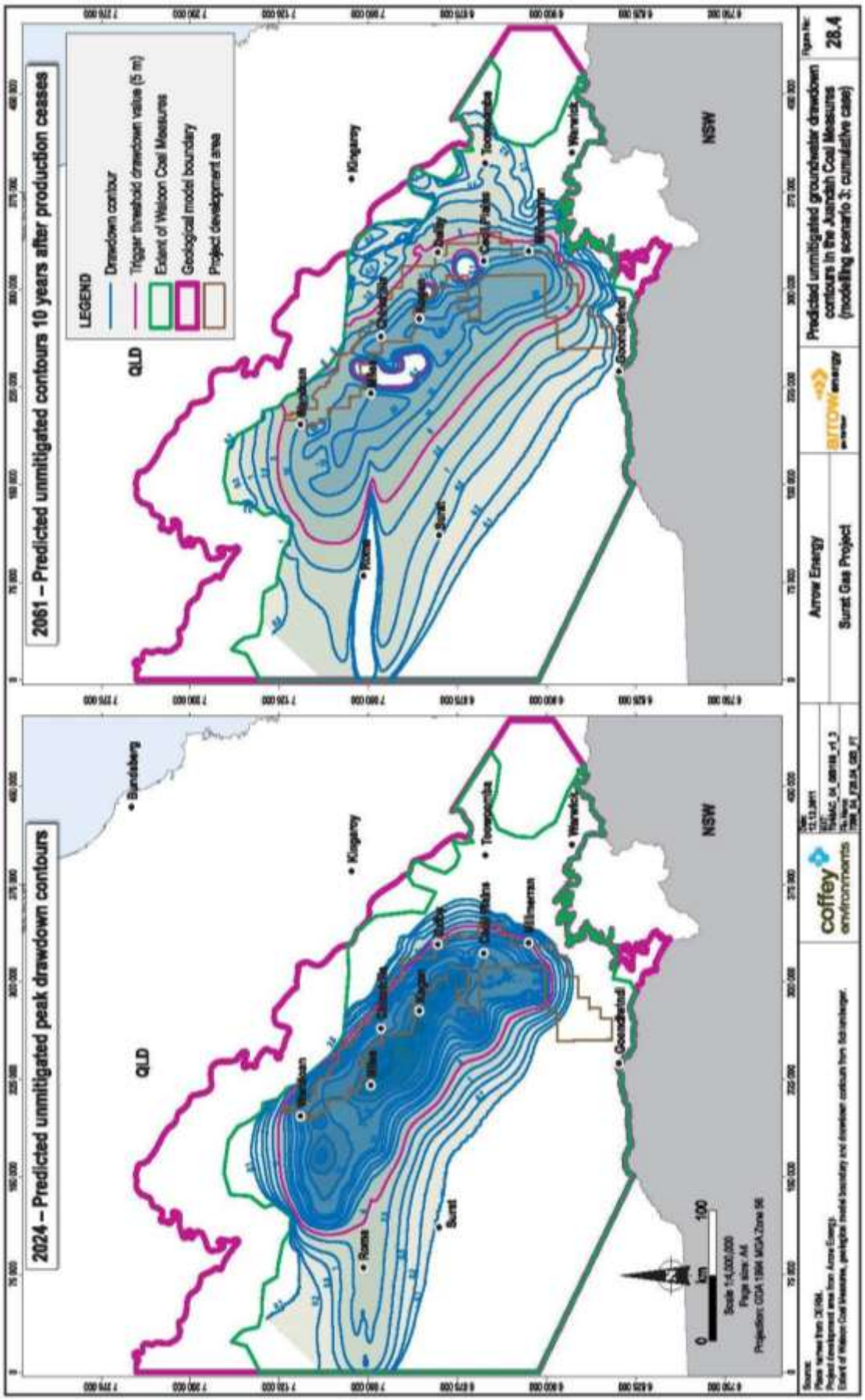

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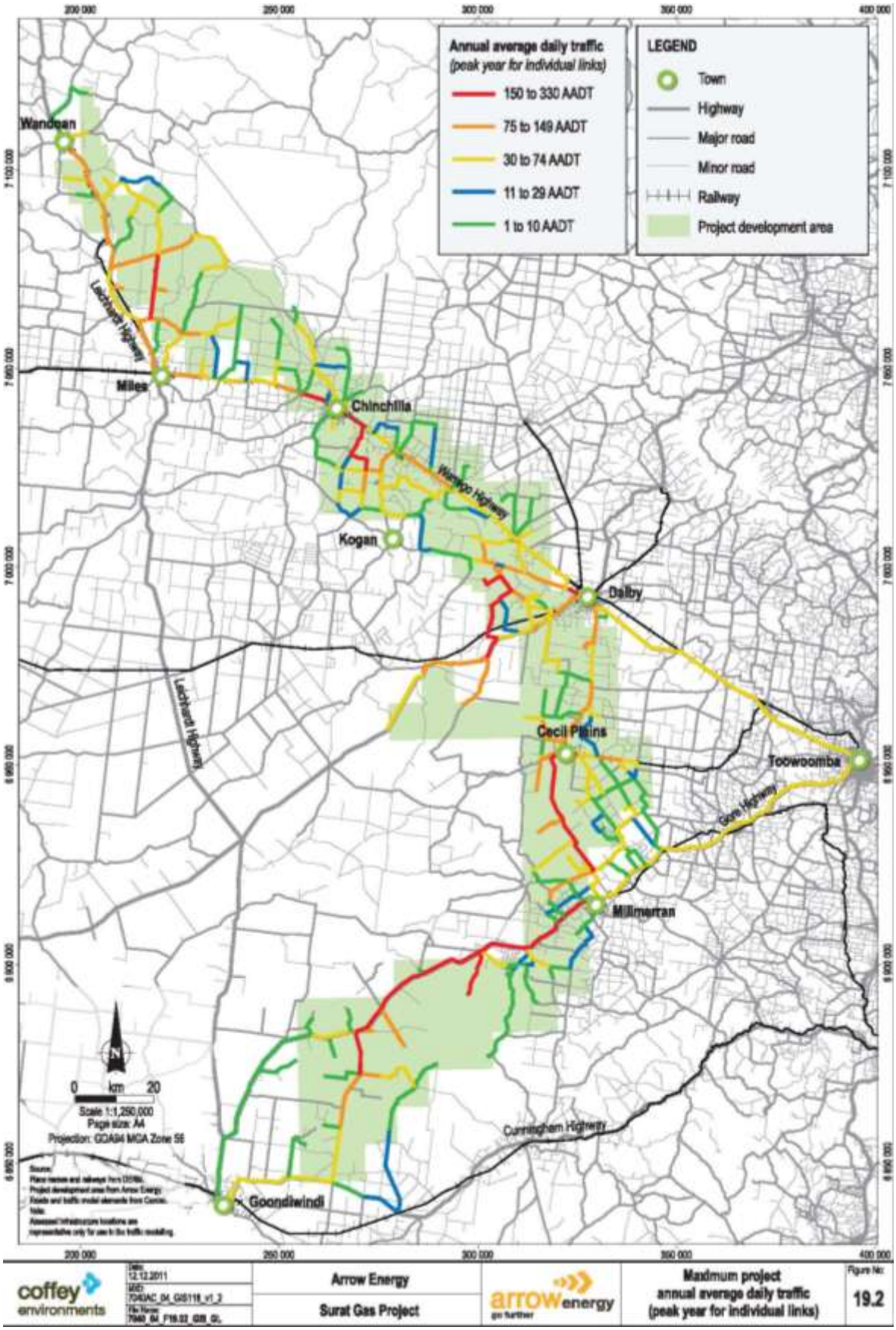

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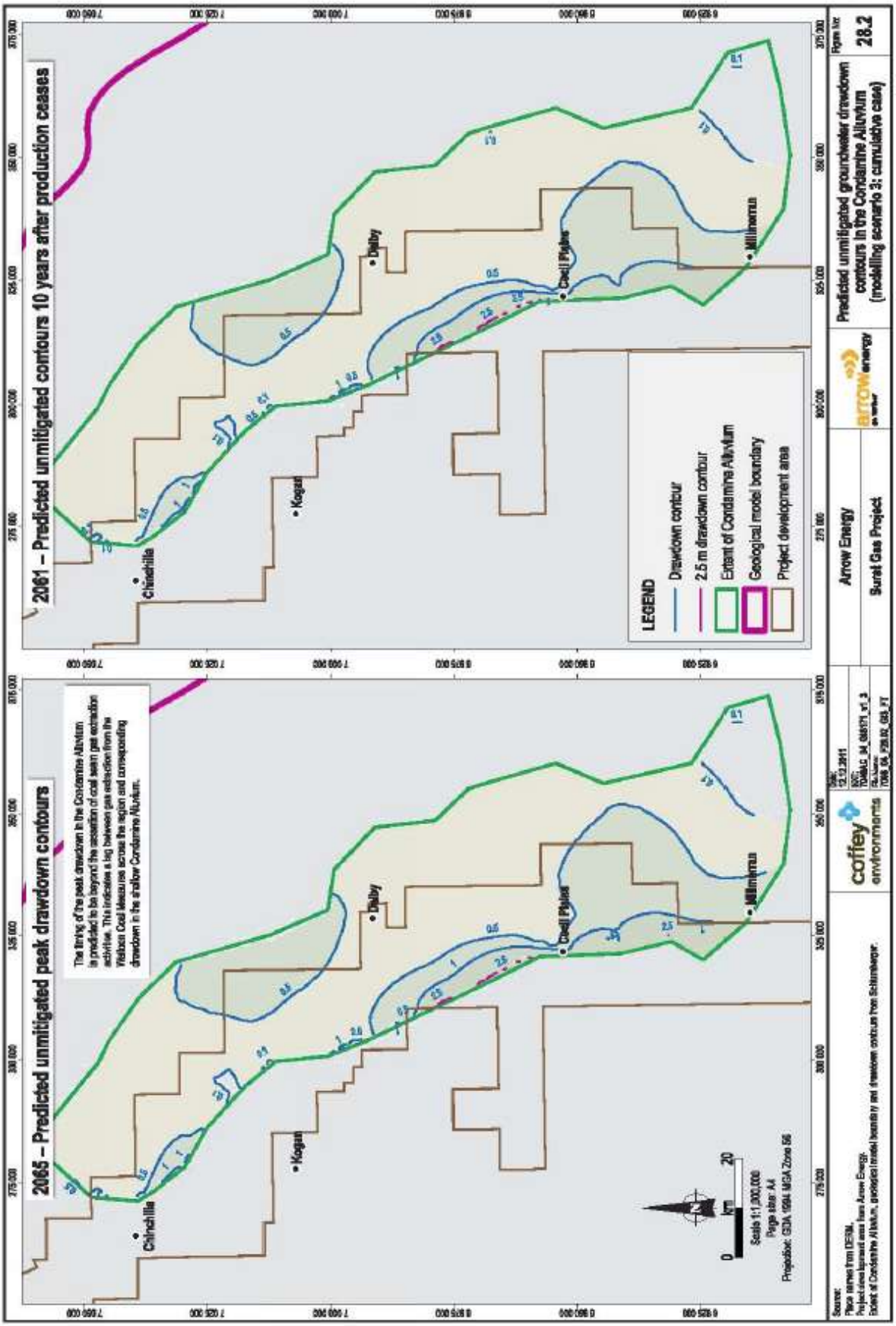

Figure 10 – Predicted Unmitigated Drawdown

Groundwater system	Predicted drawdown (Arrow only)	Predicted drawdown (Cumulative)	Drawdown and recovery period
Shallow groundwater system *Condamine Alluvium*	Greater than 0.1m to less than 1m	2.5m	Maximum drawdown in 2059 Longer recovery beyond 2071
Intermediate groundwater system *Kumbarilla Beds*	30m	60m	Maximum drawdown in 2029 Significant recovery by 2061
Coal seam gas groundwater system *Walloon Coal Measures*	50m to greater than 75m	Greater than 75m	Maximum drawdown in 2024 Significant recovery by 2061
Deep groundwater system *Hutton Sandstone/Marbug Subgroup* *Precipice Sandstone*	20m to 30m 10m to 15m	75m	Maximum drawdown between 2027 and 2042 Significant recovery by 2061

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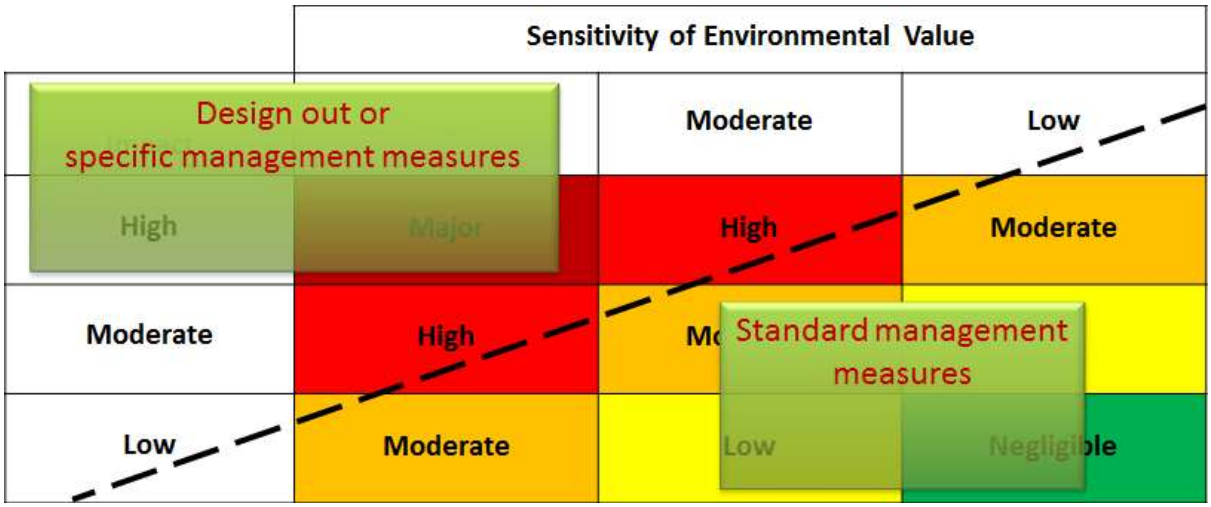

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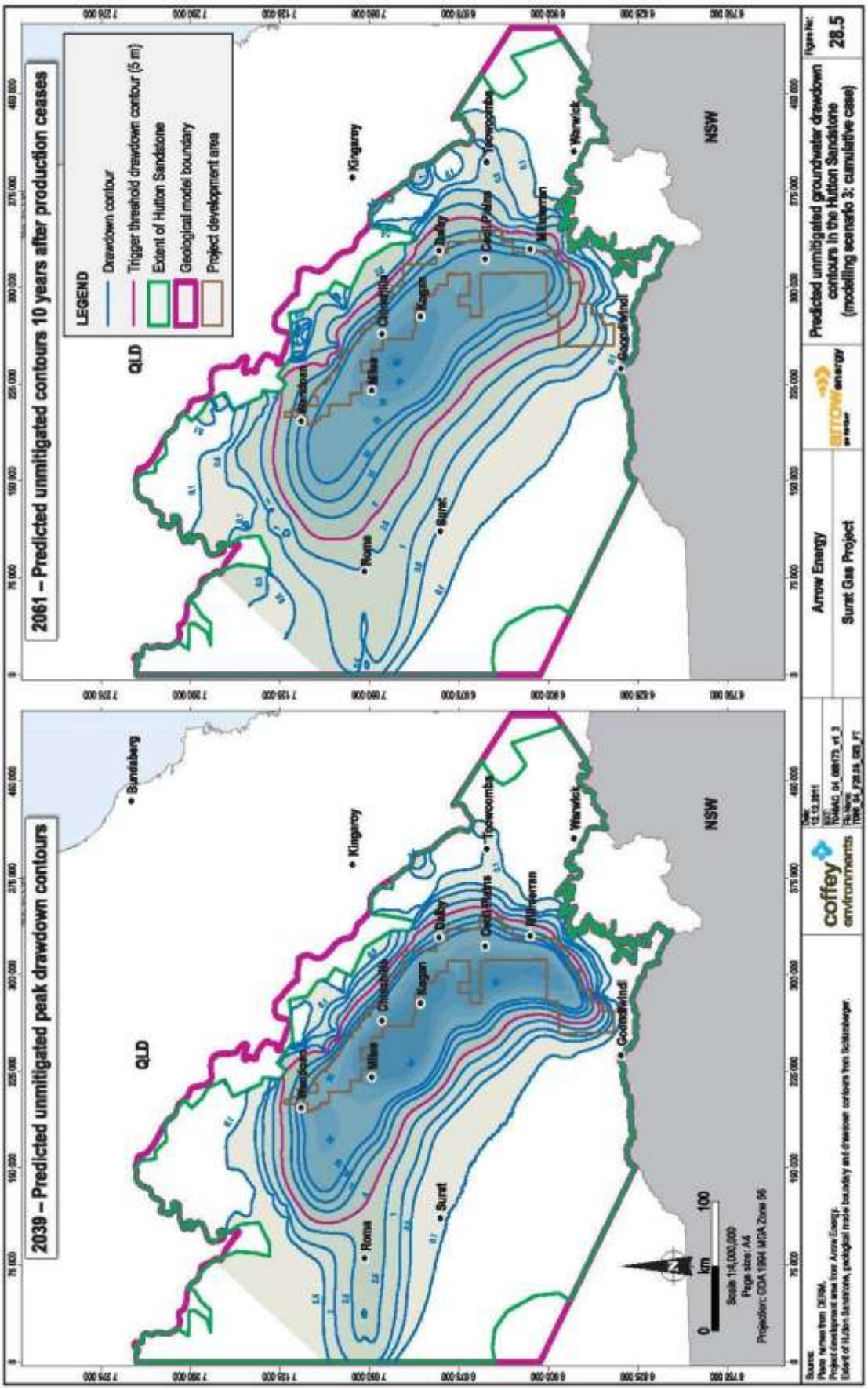

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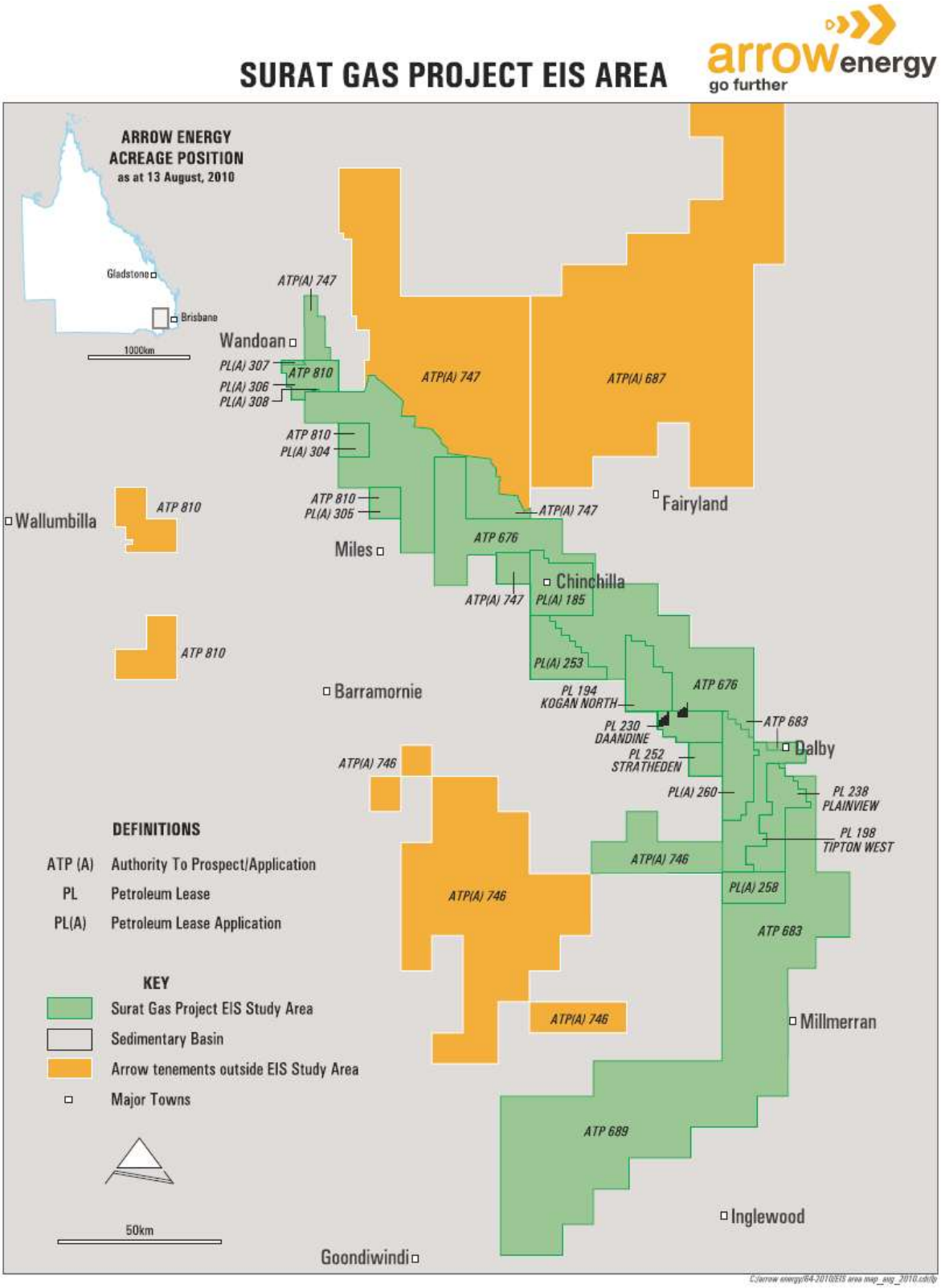

MILLMERRAN

Date:	30 April 2012	
Venue:	Millmerran Community and Cultural Centre, Walpole Street	
Presenters:	Tony Knight, Vice-President Exploration	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert , Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **Tony, you showed a slide which had the major facilities on the western side of the project, does that include both the gas compressor stations and the water treatment stations? (see Figure 1 on page 3)**

   It does. The biggest compression station is at the start of the pipeline because you've got to compress that gas a lot to get it into the pipeline to Gladstone. There are a number of other compression stations over the field, so the gas comes from the well and is compressed to a certain level to get it to the start of the pipeline. So yes, it includes the smaller compressor station and the water treatment facilities.

2. **The smaller compression stations, the ones in your EIS, they take up about two hectares?**

   Yes, about half a hectare and we call them field compression stations; essentially the objective of those is to take the gas from well pressure up to medium pressure to take it to a large compression facility where we actually compress it to transmission pressure, and then pop it in the Arrow Surat pipeline to Gladstone.

3. **We had concerns that we expressed at a recent meeting about the black soil. Will there be quite a few gravel roads in the black soil? I know you were intending to reduce the number of wells but it's certainly going to have an impact on farming practices because of GPS tracking, the size of the paddocks and so on.**

   We're acutely aware of the sensitivity of those things such as laser levelled fields, flood irrigation etc. We understand the impact that a raised road or use of gravel will have in that area. We're working to get right how we can access a well but not have impact on what we call intensively farmed land. That's why we work with the committee (the Arrow Intensively Farmed Land Committee). The guys on that committee are cotton farmers in the main, and we're working with them to understand how we can put wells in the ground and operate the field but not have a dramatic impact on the other use of that land.

4. **Is there a noise problem with the pumping station? Someone said you could hear the noise from 10km away but maybe that was an exaggeration.**

   Noise is definitely something we consider. If you introduce a new noise into a landscape, you'll always hear it because it's not what you're used to. You've got used to the noises around you; even though CSG facilities are not loud, they are different so you do notice them. Noise regulations require we meet certain criteria at certain distances so we avoid sleep disturbance. The distance is around a couple of hundred metres from wells, and

around about a kilometre from processing facilities; that's the distance where we meet the criteria. This doesn't mean you won't hear the noise during the day, it means that it won't be at such a level that it will disturb your sleep.

(Comment) It probably can't be worse than the jet planes that fly over at the moment!

5. **You say that CSG water will go to replace water that irrigators are already using. At whose cost will that water reach the preferred irrigators, and do the water pipelines come under the same EIS?**

   That's what we need to go through with government in figuring out how all that fits together; we're doing that as part of the investigation of the substitution of allocations scheme. It's complex; the idea is simple, but implementing it is not. You obviously already have entitlements to take ground water which has value so we have to make sure it works.

   Pipelines to return the water would be an additional piece of work for us. That's why we're doing the trials, studies and assessments now, to figure it out. We're investigating whether we want to pump the water back to a central point, or treat it and return it to where it came from; we need to understand the mechanics for that process.

   It's probably important to add that while we don't talk specifically about pipelines going from the water treatment facilities back to farms for example, the type of impacts we expect are the same as for the pipelines we talk about which take the water from the well there back to the treatment facility. You'd be looking at similar types of impacts and similar types of construction methodologies and rehabilitation.

6. **My question is for Tony. In relation to the extraction of water from the underground water table, you stated before that it would have no effect because you're going to draw water from underground, put it through a reverse osmosis (RO) plant and then deliver it back to an irrigator who would substitute it for water that he would normally take out of the alluvial aquifer. I think you just conveniently forgot that you're talking about two different aquifers here; you're going to take the water out of one aquifer, the Walloon. How are you going to protect the existing licence holders who rely on the Alluvium water given you indicated the drawdown might be up to a hundred metres, a huge amount of water out of Walloon?**

   Good question...I'll ask St John, our hydro-geologist, to answer it

   Those large impact figures are without mitigation offsets so they would only have that impact if we did nothing. That's obviously not the case as we'll act to offset those drawdowns.

   In the EIS process we assume these impacts are going to happen. If you say we're going to pull the water pressure down in the Walloon coal measures by a hundred odd metres, obviously landholders are going to have their bores in the top hundred or two hundred metres of that unit. With a pump you would expect to see at the time that the water level will come down, and that bore would go dry. The management measures to try to avoid that, or to deal with that, are an absolute priority. Water being pumped from the CSG wells could be treated and supplied to those people in the interim while the water level is down. Then we look at methods such as substitution or injection, and look at the water balance to see how long that water level will stay down, how long it will take to return, and at what point do we

stop supplying water. We also talked about looking at the field development plan and possible modification perhaps to allow that water level to come back to different areas over time. A raft of management measures such as piping water to people, substituting water, injecting water, are all being looked at to deal with these issues.

7. **I can understand that while you're extracting water and putting it through an RO plant you could possibly redirect some of that water to a user but it seems to me that there's a huge amount of risk and uncertainty unknown about the future. You guys will be gone in thirty years or so; what happens once you stop extracting water and being able to supply it, and users have wells that are probably dry or at the very best have reduced water quality and capacity?**

   If you look at a scenario where substitution didn't bring water levels back, and staging a field development plan didn't allow recovery to come back at different times, the other option that we're looking at and trialling is deep injection. If the water is going to take longer to come back, we need to provide a supply of water to the people in the Walloon Coal Measures. One of the options we're looking at is deep injection down into the Precipice Sandstone and essentially banking water there. Those people will then be given access to it and it would be a case of Arrow providing the bore to that water supply. There is a whole raft of options for management measures there which we're working through to decide on the final plan.

8. **It seems to me that things like deep injections are relatively unproven aren't they? You don't know if you can do it so are you going to start de-watering the aquifer before you know if these compensation measures will work. It's a very high risk strategy.**

   We are progressing technology trials for injecting into the Precipice. It's not a new technology, injection and aquifer technologies around injecting water into aquifers and recovering it to balance water supplies have been undertaken for decades in the US. We've taken an interest in some of that information for our injection trials.

9. **Will you guarantee the users of Walloon Coal Water that their existing bore capacities will continue and that somehow you'll find a way of substituting or guaranteeing water supply to those people?**

   I guarantee that we're going to work our hardest to look at it. There are injection trials and a plan of inter-related technologies and staging before we can say there's a final guarantee.

10. **That's not a guarantee; you're just saying you'll have a look at it and if it works out, well and good.**

    We are in the process. We haven't done the technology trials here specifically so I can't stand in front of you now and give you that guarantee. The statutory requirements are that we must have a make good agreement. The Queensland Water Commission (QWC) will be coming out with an impact report in the next month or so; a direct outcome will be a list of potentially impacted bore owners that companies must have make good agreements with before anything happens. The make good agreements must show we have thought about water capacity issues including proven technologies, which is why we're looking at injection technologies. However, I understand your point as I can't stand here now and say that we have the entire concept down pat.

11. You talked about subsidence, has Arrow thought about what make good provisions it would have if long-term monitoring shows that subsidence occurs?

The technology that has been most effective in mitigating subsidence in aquifers has been injection so that would have to be the front-runner. If you're looking at changes to infrastructure, you're obviously looking at rehabilitation if that occurs. But having said that, based on the history of the area and the reports of subsidence, looking at the radar interferometry will give us a good handle on how much has happened historically and what we can expect moving forward.

12. We're looking a long way into the future for some of those effects; you'll be gone in thirty years, and some of those effects are going to be after that. Unless your measures work out, the make good's only as good as that.

That's why we didn't run a model for several hundred years after the end of the project, because we're aware that it's obviously not a project that can be completed if you can't manage impacts within that timeframe. The best way to deal with impacts is to minimise them as much as possible, hopefully before they happen. When we start looking at substitution, it's not a case of waiting until 2065 for the Condamine impact and then starting a substitution program. That needs to be started up front to build a buffer against the impact so you can draw down against it.

13. Can you tell me if you've done any planning for what's going to happen to the salt that you settle out in the brine ponds?

One option, [which is not our preferred option] in the EIS is to take the salt to a landfill site. Under this option we'll solidify it and transport it to a registered landfill. Our preferred option, and the option we are doing most work on at the moment is around how we can beneficially use the salt, and there's a range of options associated with chemical manufacturing and the like that we're looking at. We're talking to the other CSG proponents around whether we can all put our salt together and use it for a beneficial use.

Let me just clarify the landfill and what that means. It's not encapsulation on our site; it's a purpose-built solid waste landfill that is independently regulated by the Queensland Government. So we're talking about taking it off site to a third party landfill that's regulated. We should repeat though, that landfill is not our preferred option. Instead, putting the salt to beneficial use is our preferred option, and we are working with other parties on this front.

14. You were talking about the shallow monitoring bores in the Condamine Alluvium and I gather that they're mostly around the irrigation project. Are those bores representative of the Condamine Alluvium areas that are likely to be impacted?

No, those monitoring bores are specifically around the irrigation project to monitor impacts on it. We will need to pick up more monitoring bores in and around the impacted areas.

15. You talk about monitoring the water levels, are you monitoring the water quality in those bores as well?

Yes, the program has both bore level monitoring from open bores and from electronic monitoring devices in cemented bores as well as open bores for water quality data..

16. Are you going to be talking at all about the Queensland Water Commission (QWC) document that's coming out shortly?

We haven't seen it yet.

17. Can you give us a bit of a run down on its impact and how it's going to work? I know you don't know the outcome yet.

The expectation is that the report will provide its own predictions for the impacts as well as predictions for the heaviest impact if aquifers exceed bore trigger thresholds. It should have contours of the Condamine Alluvium where impacts are greater than two metres and the combined aquifer impacts i.e. areas where impacts are greater than five metres (but without any mitigation in place). From that, the QWC will be expected to provide us with an area where we have responsibility to make good; all the bores within that bore-trigger threshold will become our responsibility. We will need to put make good agreements in place, and we also expect the QWC to advise us on what it sees as an appropriate ground water monitoring system for both water levels and quality.

18. How does it know where you're going to drill the bores so it can do the modelling?

We gave it our field development plan, like the EIS field development plan. It requested all our data i.e. where we were proposing to have our gas fields, the flow rates for those gas fields, depth of bores, all the data about our model, the data we used in building our model; it can then assimilate our data with the data from the other three proponents.

19. Given that the aquifers we're dealing with are currently being used, and there are three other major gas producers in the area already, how will Arrow monitor in a way to give us confidence the mitigation methods you're using are going to be effective?

Arrow is drilling a large number of water monitoring bores for the express purpose of monitoring water levels, both now ahead of production and while the groundwater models are being developed, and in the longer term to check on our predictions and to allow for mitigation in case it is needed. In simple terms we are putting in place a robust monitoring system to provide real evidence of any changes across the entire region. This will allow us to see changes as they occur, and to respond if necessary.

20. No, monitoring the impact you're having.

A lot of the monitoring program is about water level monitoring data from bores in the Walloons, and electronic monitoring of water levels below. However, we'll also be looking at the pressure data in our fields so we will be able to use our historical production data to help us predict how aquifers react, how the water flows through them, and then use that as the basis of the picture moving forward. So we use not only water monitoring data but also production monitoring data.

21. So the data given to the QWC was not specific site data where things are being planned because in the previous session you were saying you were unsure of where and when those impacts will be? I'm just trying to distinguish between those two data sets if that's okay?

Our model is built with grid cells that are 1km by 1km which is currently the highest resolution in our model for 120,000 square kilometres. We might have several bores in one cell and not another so what we did with the model was package up a number of those. We assigned the field development plan to pods of wells so it was an overlapping area where we didn't have to put in specific, precise co-ordinates. Those 180-190 pods built up through the arc of our tenements to establish the field development plan's impacts.

That's also based on what the indicative plan was at the time; obviously as time goes on that will develop and be further refined as well.

22. Has the ground water monitoring got quality in it or is it just quantity?

It's just water level and water fluxes because we are some way yet from getting water quality. We really need to have our hydraulic model, our water flow model, more refined before we start putting another layer of complexity into it in terms of water quality. Certainly once we get to the point where we can have an aquifer simulator then we can put in the salinity data of the aquifers, and we can start looking at how that might work.

23. What might be the time before you're at that level...years?

We're hoping for a model rebuild in the second half of the year so six, twelve, eighteen months perhaps. Modelling is a linear process; it tends to be a bit iterative.

24. I'd like to know what FID is? Because you use acronyms all the time, it might be useful for these presentations not to use as many acronyms.

Sorry, we do try to avoid acronyms. FID is Final Investment Decision, the point at which Arrow makes its final investment decisions on whether it wants to go ahead with the project. It's the point at which Arrow needs to have a good degree of certainty about the project.

Another is FEED - essentially Front End Engineering Design which is when you are going through the design process. Initially you do a concept design which is essentially getting your thoughts together of what you might want to build. FEED is the next level of design where you go into the design in some level of detail. It's not the final design from which you do your engineering plans but it's the next level of conceptual design That's the process we'll be heading into later this year with our field development in the Surat; it's a process we're just coming to the end of for our LNG plant on Curtis Island.

25. In relation to subsidence, have you got a record of that over in America and other places? I guess it depends a lot on the geology. I know there's terrible subsidence in an underground mine, it wasn't supposed to happen. But they eventually ended up buying them a property

Subsidence is a product of geology. I'm not an expert but I have the advantage of experience working on several projects with this issue. The brown coal beds in Gippsland are effectively an unconsolidated geology which is very permeable and soft. The State Electricity Commission has been pumping water out of those aquifers for over 40 years now and they have had quite significant settlement. It's largely a product of the fact that you have removed the structure from the overlying material.

What's happened in the Latrobe Valley is different to the long wall effect because it's been gradual over a long period of time. Most people wouldn't even know it's happened, apart from the few farms where the bores have dried up as a result of the de-watering operations. Rivers haven't turned uphill or anything like that because the whole valley has dropped down. Someone once said to me that it's like when you put your hand gently on a balloon stretched across a basin and gently push your palm into it, it deforms slightly. Up here the coal is basically a form of rock so it's self-supporting; it's not like in Gippsland where it's compressible. You will only see subsidence in cases such as long wall mining where they actually create a cavity for something to fall into. Here, they're just taking the water out, they're not actually changing the supporting structure, so you're unlikely to see anything like you get in the Latrobe valley or other parts of the world.

While we're looking at that satellite data for the last few years we can see what has happened historically. Just bear in mind that the amount of water stored in these coal seams is about 2% of their total volume. We're taking out a really small amount of water, the coal is still intact, and we're not interfering with it at all. There's not much of a mechanism for that coal seam to be compressed too far; it will only lose 2% of its current volume.

I'm not sure if you're familiar with the process of a long wall mine but it's a device about 200m wide and about three to four metres high which has two large cutting wheels that move up and down the face. It takes out all the coal and behind that long wall miner the roof collapses in; that's a huge difference where you're dropping rocks in behind you as you go. In contrast we're taking a pretty small amount of water.

26. You talk about subsidence. I'd like to know if you apply those same techniques to your existing gas fields, and have you detected any effects?

That's what the radar interferometry will cover [this technique refers to data acquisition from satellites, which has extremely fine resolution, down to millimetre scale]. There is data from the last ten years which is being collated; we expect to find out the answer to that.

27. In terms of quality, potentially some of your wellheads will be flooded if you have wells down on the floodplain. What procedures are available when the floods come to maintain or access them? What do you do?

That's already happened to us in the Bowen Basin; the water doesn't damage the wells at all. We can control them remotely so we can shut the wells down if we need to from the office. What the water does do is prevent us from getting to the well so there is a lack of access. We visit the well to check it every so often, but once we shut it down it's safe so nothing would happen to the well.

These wells are incredibly robust; they're over-designed in engineering terms. The pressure ratings on the valves and casings are very durable. We haven't had any ill effects from flooding in terms of safety; ongoing operations are a problem, but that's just our problem, no one else's.

28. Someone said this morning that 70 to 100 monitoring bores are planned this year, but if the Queensland Water Commission (QWC) says we need you to put in 15, are you going to go with the 70 to 100, or the 15?

Our drilling campaigns are planned for 12-18 months in advance, so that would go ahead. What we'd try to do if the QWC nominated fewer (which is hard to imagine as it would probably ask for more), is that we'd rationalise what it wants with our planning. Hopefully it wants something that's not too far away from our planning so we can come to an agreement.

29. **I was wondering what you think about an article that Peter Garth wrote about the nature of vertosols and the concerns that soil scientists have with development on these soils, particularly in terms of the shrinking nature of those soils and the massive forces from it. Is there potential for pipeline rupture if the gas pipeline goes through? So far we've seen a lot of CSG water spills, what contingencies do you have for dealing with those scenarios?**

    The question is how does the gas pipeline infrastructure behave in vertosol or dermosol soils or cracking clays? Cracking clays do heave and shrink throughout the year and can do so quite dramatically. How do you maintain the integrity of gas pipelines when they're buried in the ground...is that right?

    Yes.

    It's an accepted issue as it's been known about for a long time. What we do typically is bury them deep enough. As farmers who've worked on it know, cracking clay can heave a fence post out of the ground. If you get extreme conditions such as drought and then heavy rain you'll get a lot of movement so if you bury water pipes or gas pipes too close to the surface potentially they will heave out of the ground.

    Companies like Arrow generally work out the level they need to go down to in order to reduce the stresses on the infrastructure; however, typically they bury them deeper. Within pipeline risk assessments, Arrow will determine whether there is an unacceptable risk; it can increase the wall diameter of the pipes to withstand any of the stresses that might occur but are not overcome by burying them deeper. It's common practice to bury them deeper and there are a lot of pipelines built through Gilgai country more extreme than you see here which are based on the principle of burying them deeper.

    That was the first part of your question; the second part was spills. I'm not sure if that relates to leaking pipelines, or does it relate to...?

    Any spills.

    All spills are dealt with in the same way i.e. there has to be a response. As Tony said about the brine and main raw water storage dams, there's a whole lot of ground water monitoring bores going around those. They look for spills and monitor them; the primary method is to monitor for them. The other is to maintain infrastructure at the surface and with buried pipelines it's to choose the right materials and pipeline wall thickness to avoid any leaks.

30. **On the spills we've seen so far, and I'm not saying just Arrow but any of the companies, have not known how to respond to them and remediate. They're focussed on the heavy metal guidelines but that's not the issue; the issue is the salinity of the soil after the water spill. I wonder whether you have processes for dealing with a saline spill, more so than any other contamination issue?**

I think the first thing we should say on this topic is that the water we bring to surface, water from the coal seams, is not different to the water that has been brought to the surface from many water bores across this region for many decades. That water has been used for stock and other agricultural purposes for many years, so we shouldn't overstate its potential for harm, which has obviously been well and truly tested long before our industry arrived. Secondly, we are bound by very strict regulations which require us to take a variety of actions in the event of a major spill, such as sampling, remediation and so on. We can't afford to have lots of spills, for various reasons, and we spend a lot of time and effort to avoid them in the first place.

It's an issue and will be worked through. So honestly I can't answer that question now, unless someone else can? It's an issue being worked through but the primary mitigation for a lot of that is to design the right process and equipment not to create spills in the first place.

31. That slide you had up before with the grid with all the wells on it, I'd like to see what that property looked like after putting in all your roads and the rest of your infrastructure. (see Figure 2 on page 4)

I might invite Tony to comment on that as access isn't required to all the wells all the time; a lot of them would need only existing access. That's why they were moved to the side of paddocks where you might have your own existing access and the intention as I understand it is not to put in permanent tracks.

(Tony Knight) Yes, as much as possible we'll try to locate the infrastructure using existing tracks and access rather than put new tracks in.

32. What about corridors where pipelines and things go? Can farmers still work over the top of those?

Most definitely, and that was the purpose for showing you that slide. It's a horticultural farm where they've been working over that pipeline for 30 years. The only limitations on working over gas pipelines are driving fence posts into them or excavating over them. When a pipeline is designed to be put in the ground, there's a risk assessment which looks at the land use, and then it's buried to reflect the land use. If you go up north of Wandoan, up into some of that country still being developed, blade ploughing is used basically to run back over cleared Brigalow. It's basically a big wing keel type thing, like the boat that won the America's Cup; it's pulled through about a metre and a half down, and rips the root systems of all the regrowth. Blade ploughing and pipelines don't really go together so where that is done the risk assessment was that we should bury the pipeline deeper to below the depth of the blade plough. When the pipelines are designed they're intended to respond to the land use above them, whether it's deepening the trench or strengthening the pipeline. The aim is to maintain the normal range of activities you can do over the top of it, but as I said earlier, neither driving posts into it, nor excavating it.

33. I still think there's going to have to be a certain number of roads on some farms and for small properties I think it's going to be quite an inconvenience to the landowner.

Yes, I don't disagree with you. There will be a process on each property that works out the road network on the property; can it be utilised; and how can the wells be rationalised to use it. That's the process that has to be worked through. Ultimately that will determine the

significance of impact on the property. Our experience in talking to people throughout this process is that it will vary between properties. I can't say to you all properties will be least impacted, or most impacted. It will vary between properties.

34. Can I just clarify, Barton, in relation to transmission pipelines you can put them down a long way without a problem? What about the feeder pipelines from the wells to the facilities and things like that? Are you talking about putting them a long way down?

Yes, in terms of the design of the gathering system for both water and gas, you will be looking at variable depths to allow regular cultivation over them. Our requirements under the *Petroleum and Gas Act* are to design and install gathering lines the same way as for transmission pipelines; we have to go through the same risk assessment and get the same feedback from farmers in terms of their activities as well as any other people who might be working in that area who we might impact upon.

35. I notice you're going to put monitoring wells around the major facilities; what baseline information will be collected before that in terms of things such as soil quality because potentially the greatest impact is going to be, or could be, around those processing facilities.

I can't say exactly what information will be collected but Arrow accepts that one of the longer lasting residual impacts of this type of development will be at the integrated processing facilities, simply because you need big pads to build the facilities on and that will involve excavation of some of the soils to get a stable base on which to build the pad.

So this is what we call an engineered pad; it's usually developed by excavating the top soil and part of the sub soil, bringing in the stabilised clay, or the engineered clay fill, building a pad, putting hard sand on the top and then setting the foundations into that. In some cases it can be more invasive to try to reinstate the soil horizon after 30-40 years and pull all that out than it is to put a light coating of soil back over and put it into grazing use. So the answer is that at this stage we haven't yet developed that process.

36. My concern around the dams in particular is that there will be an aerosol processor with salty brine water being blown off possibly around the area of these facilities. What baselines are there to judge the impacts of that happening over time? That land can potentially be sterilised into the future and vegetation such as you've shown there killed over time so the baseline assessments have to be there to judge the change over time.

At this stage we haven't done that.

37. Are you thinking of using mains electricity rather than gas turbines at any of these integrated production facilities?

The EIS considers two scenarios for power supply. The base case at the moment is for what we call *at site generation*, or *at site supply.* Taking the case of a production well, its power is provided by the gas-powered V8 motor. A production facility has gas fired engines, or gas turbine driven generators. That's the base case, it's what all the air, noise and greenhouse modelling has been done on.

There is a scenario Arrow is considering which is partial replacement of on-site generation with grid power. That would involve developing a substation with the integrated processing facilities into which you would bring high voltage supply (about 132,000 or 275,000 volts). From there it would be distributed to the facility itself, to power it and all the compressors, and then out to the central gas processing facilities and possibly the field compression facilities and, depending on proximity to the integrated processing facility, to some of the production wells around there. That is being worked through in the FEED process that's about to get underway, and through what the *concept select* process which Tony alluded to in his earlier presentation. That's being worked through now as to the appropriate mix and the efficiencies which can be gained from each. However, I think it's fair to say there'll be a mixture of both because when you look at the project development area some sites can be more readily serviced than others.

38. When you decommission the bore, what's the process of decommissioning? What do you actually do?

There are two types of bores we drill - exploration and production. Exploration bores only have a short life, a few weeks or a month or so. When we finish drilling and testing samples, we fill them with cement from bottom to top with the rig. It's the same basic process for the production well which has a longer life. At the end of its production life we remove the down hole pump, fill it with cement from bottom to top, and cut off the casing below the ground. We excavate around the casing down to one and a half or two metres, cut off the casing, weld a cap on top, and back fill it. What you end up with is a steel casing full of cement, cut off below ground level then back filled on top.

39. How do you stop the casing rusting out over so many years?

The casing is very durable and is not in an oxidising environment. It's below ground and is not exposed to oxygen to cause the rust anyway. It should remain pretty intact down there.

40. What's the long term potential for the pipelines once the fields are finished with them, and they're no longer sending gas?

The pipelines will stay in the ground. Do you mean the high pressure transmission ones?

41. Yes, what will happen with the gas and water collection pipelines?

There are standard decommissioning procedures with pipelines in terms of cleaning them and there are several options around how to leave them in the ground. It's possible to fill them with an inert substance, completely purge them and then essentially decommission them by cutting off any above ground infrastructure below ground and rehabilitating it. Just leaving the pipelines in the ground is pretty standard practice in the pipeline industry.

42. Just a little question, for each field compression facility, you've got an area 0.5 of a hectare, what's the actual area that is impacted during construction for each wellhead. The field compression facility is a wellhead, isn't it?

The wellhead is about a 70 by 80 metre pad. A field compression facility is like a very small compressor station, and it's the 0.5 of a hectare paddock.

43. So that 0.5 of a hectare includes the construction space?

Yes. Think of the field compression facility as like a big container here, established on the site. It's a modularised compressor.

44. And does that have a little subfloor, something holding water there?

There's no water in the compression facilities.

45. There's no water...but it goes off through the collection network?

Yes, the water bypasses the field compression. Field compression is about bringing the gas up to a pressure to transport it a further distance.

46. Would there be some water produced with the compression?

There can be a very small amount of water entrained with the gas, or released by condensation. Our major compression facilities have a system to capture and isolate this water. The process is well tried and proven.

47. In the negotiations with landholders, you talked about existing layouts. Are landholders able to include their future layouts? Do future layouts come into your negotiations e.g. landholders' five year plan?

The short answer is yes. If we're putting in a production well that's got a life of fifteen or twenty years we have to think over that timeframe. We need to think about how our activity might impact on something in five years.

I'm involved in Arrow's IFL Committee and obviously one of the issues we talk about is intensively farmed land. We have talked about changing technology, recognising that farming technologies people are using today have changed a lot in the last ten years and are expected to change a lot in the next ten years. We look at how we would manage that with a field development on somebody's farm, also what people's future farm plans are and how we could plan to recognise those. So they're two issues that have been talked about at length in that committee.

CECIL PLAINS

Date:	1 May 2012	
Venue:	Cecil Plains Hall	
Presenters:	Tony Knight, Vice-President - Exploration	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert , Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **You've been trying to access people about commercial interests meanwhile your own consultant can't put our houses on a map. How can we trust you, you don't even go out and ground truth. You are not listening to the community, you come out here and tell us what you think we want to hear. You are not welcome.**

   It's a process that takes time.

2. **It's not a process. We've had a gutful. This has consumed our lives. You want to protect Lake Broadwater yet you are willing to tear up black soil country. You must be delusional if you can see a gas field east of here.**

   We're here today to talk through the environmental impact study process.

3. **It's a flawed process. Have you read your own document? It's full of misrepresentations that you've given to our community. You've only given us 30 days to respond to this; we've got no time. You can't even get our houses on the map, it's ridiculous.**

   You said you want to respond to questions that are put here but I've never received a response from anybody about questions I've had with any of these projects; I've never had any response from anybody. I put in a question and I have never received anything, only we received a letter saying it has gone ahead or it has been thought about. I've never received an answer to a question or a written response and I am sure there are many, many people here who have put in responses to a lot of these projects and have never received an answer to a question.

   I can only answer from the interaction I have with Arrow. The questions asked that raise issues around the EIS process come through Arrow to us and then we answer. And as you know, all the questions that are raised in these sessions are recorded.

4. **Out of all the projects there have been 50 or 60 submissions against them. Nobody has received any correspondence directly back regarding questions. We all get the shits with generalised questions and answers but in relation to submissions made on these projects to DERM, nobody receives any correspondence directly back with answers to questions that have been posed. That's what we're asking for.**

   I can't speak for government with regard to a submission to DERM (or DEHP as it is now). If you write to government, it's out of our hands. Arrow can't be held accountable for its response or lack of response.

5. Yes, the government's responsible supposedly.

True.

In relation to the EIS, the process is that once you've made the submission to government, government will provide copies of those submissions to Arrow. Arrow will then take those submissions and it has to do what is called a supplementary report to the EIS. Where we need to respond to those submissions we will do so within that report. You won't receive a letter back, but you will get access to a copy of the supplementary report which will have responses to all submissions made within the EIS process. I can't talk about what's happened in the past, but that's the process that we are required to go through for the EIS.

6. Wouldn't it make sense for you as a company which receives these questions from DERM to then respond to the people who have the problem? Wouldn't that be sensible in a business sense?

In terms of the statutory process that we are in, one of the requirements is for us to respond to submissions in the form of a supplementary report to the EIS. You will be able to see your submission and how it is being dealt with in that supplementary report. If you wanted to contact Arrow and have a discussion about how we've dealt with your submissions and the issues that you raise, we'd be happy to have that discussion.

There are two levels of response. There's the EIS response which Gerard described. Then there are Arrow's other contact points and when you make contact with us through those we should respond. There are people here whose job it is to take those queries to the appropriate internal people to provide the requested information. That's what we've done for quite some time. If something's lost in translation between government and us, we are not getting the question you have asked of us. If you ask us directly, we'll respond directly.

7. Barton, you went through the risk assessment process but you've a group of people who are unhappy their houses weren't identified. But that's just one of the deficiencies I see. How can you run that process when you haven't identified all the impacts?

The other thing, while I've got the microphone, is that you make a great play of Arrow's published commitments. Two comments and a question about public commitments; they are Arrow's commitments, they suit Arrow's agenda and, as we've all experienced in this community, they change to suit Arrow's agenda. So unless they are actual conditions they hold no weight. The other thing is that when you read those published commitments they are full of phrases like *if possible* or *where practicable*; there are no definites, they can be changed. That gives us no comfort in the published commitments actually dealing with our issues.

Okay I will try to work my way through matters. If you can bear with me I can explain the house issue. Yes it's important we know where the houses are but it's not important to the impact assessment and I'll explain why. As I explained in previous sessions we don't know exactly where the facilities are going to be. What we've done as I'll explain later this afternoon is that we've modelled typical facilities under worst case scenarios. The reason for that is to understand the area of impact around those facilities in terms of noise, air, and a whole lot of other issues e.g. traffic. What that then allows us to do is say this is effectively

the zone of impact or the zone of influence of those facilities, wherever they're put. What we then do with Arrow (and this is a progressive thing because as I said this field is going to be developed over the next twenty years, not tomorrow) is to work through each of the areas and ground truth them. For the Dalby expansion project, we've ground truthed all the houses through there because that's where they are immediately building in the next five to ten years. So we do have an accurate understanding of the houses there and that will grow over time as we move out to other areas. Once we understand where the houses are then the constraints mapping kicks in; it provides advice around the distances separating infrastructure from those houses. It's through that planning process where Arrow will try to move infrastructure away.

8. **Is that a guarantee? Arrow has already made a commitment in this hall that there won't be any infrastructure east of the river so why don't you put the houses in now because the EIS covers that area.**

   The EIS will be out of date in three years' time because there will be people who have built new houses, there will be new developments on your properties, so the important thing…

9. **The decision's already made mate.**

   I understand what you are saying.

10. **The regulator doesn't know that there are people living there.**

    What I am trying to explain to you is that if I went out tomorrow and spent four weeks ground truthing the whole of the project development area it would not inform you any more tomorrow than what we know today because the potential impact of the facility site would still be the same i.e. Arrow would be designing it, or seeking to design it, to avoid the houses wherever they are.

11. **Well it won't be designed if it doesn't get approved, that's what we're saying. We're not talking about the facilities we're talking about the location of well infrastructure. More importantly we're saying that putting all the houses on the map now would show to this community that the EIS is an accurate document and that you guys know what you are doing. What we have now is a situation where coincidentally you have the single most significant gas reserve in any tenure within the project area, and every house within a ten kilometre radius, or between Watsons Road in the North and Snake Gully Road in the South is missing, right across that resource. We understand that once you go out and start the planning you'll pick up those homesteads but our concern right now is those houses have been left off after the information about them has already been provided to you by the community; we've supplied maps to you with them on. The issue today is that the community continues to have a lack of confidence in Arrow Energy because it can't identify environmental values; the houses are just one example. If it can't identify houses on the map, how can we have any confidence Arrow can correctly identify other environmental values?**

    Let's not just get bogged down on the house issue. When I read the EIS agricultural report, there are a host of unidentified impacts, so my question is how are you dealing with the significance of the impacts in your risk management matrix if you haven't identified the impacts in the study to start with?

I understand your comment; can I perhaps ask that we leave that discussion to this afternoon?

12. No tell us now.

Well I'll answer it now, but there's a lot of context around it. There's a presentation on agriculture after lunch, so I am happy to talk about it now or we can wait until after lunch when I provide some of the context, it's up to you?

Graham's indicated that he'd be happy to wait until after lunch, so perhaps can I just go back to one point about the houses. We estimate it's probably 80% accurate.

13. 20% mate, that's all you've got on there.

Well, let's agree to disagree on that. What that tells you and the way we interpret…

14. Are we all living in the creek?

(see Figure 3 on page 5)

What we are trying to interpret is the density of settlement so that has informed a lot of the comments that Tony made earlier about the preference to locate the production facilities to the west and you can see why. If you look at that diagram, you can see why going to the west is preferable to being east of the Condamine with production facilities. We mightn't have every house on there, but we can see settlement patterns. We do know it's densely settled when you get east of the Condamine, it's reflected in the map even though it may not be 100% accurate. The whole purpose of putting up that matrix and talking about what's above and below the line is that it shows us things that should be addressed. This information was fed into Arrow two years ago and it is informing the planning. You have not seen all of it yet, that's playing out as Tony said through the processes he detailed, but that's how the EIS has approached this issue.

15. What about the published commitments?

I didn't intend to make a big thing of that, I guess the point I wanted to make around commitments was that you don't usually see that level of commitment in an EIS and you can take from that what you will. The thing about making commitments like that is the regulators do take those into consideration in setting the conditions of the project.

16. Yes that's what worries us. If the regulator would make them a condition that would be different but history has shown us that the regulator defers to the company.

I can't comment on that.

17. Well we've got the evidence, hard evidence, of that; you say you don't influence government; you've got to be joking.

My question's along the same line, to a certain degree. Tony spoke about pitless drilling in his presentation. But that is only for exploration wells and it took 18 months to finally do one. Most of Tony's presentation spoke about *hoping* and *studying*. Now we're looking at an EIS covering our farms; it did say a lot about studying, looking at, and hoping. But it's pretty hard for us to understand what's going to happen on our

farms from this EIS when Arrow's still studying and hoping and doing desktop studies. I know for a fact that you haven't been on any of our farms when you did the environmental study so it's very hard for us to understand why you cannot come onto farms, talk to some of the landholders and do a study on how you are going to mine our farms.

My question to you, Barton, is can you tell me truthfully if Arrow can work on this Strategic Cropping Land country? When you look at the EIS Arrow is looking at it, studying, strategy etc. It says it is going to look at rehabilitating the sites but we haven't seen any of that yet. In this EIS Arrow says what it is going to do but can't prove it. There's very little in this EIS which can actually prove that Arrow knows what it's doing so that's the question for you Barton?

Tony, I am afraid your word doesn't carry a lot of weight with me after the last meeting we had in Dalby so the question was to Barton please.

I want to correct you on the drilling issue. Pitless drilling is a drilling technique, it doesn't matter if it's exploration, production, whatever. That technology is applicable to any sort of drilling that we do.

Thanks Tony. The answer to your question is that with most impacts on projects, it comes down to how they are managed. I am not about to stand here and give you guarantees, I can't do that. What I can say to you is that we recognise we've captured about maybe 60% or more of the impacts that we understand will, or might be, realised on your properties but that is not conclusive. Today Stuart pointed out another impact to me that we had overlooked in the EIS. Does that change how we would manage it? Not necessarily. It's something added that needs to be factored in and I will talk a bit more about that this afternoon. Can Arrow operate on black soil country? Yes, it can operate on black soil country with the right controls. I'll show you a photo in my presentation this afternoon of this very type of activity on black soil.

18. On half a volleyball court?

No it's not on half a volleyball court.

19. Are you going to take all your equipment onto that half a volleyball court?

The point I am trying to make is about appropriate management. A lot of people have concerns about what is appropriate management and how it works. If you want to ask my personal opinion from my experience working on a lot of these projects around Australia, the thing that affects the effectiveness of management, the single thing that is most effective in ensuring the outcomes you want delivered, is supervision.

20. 24/7, at $100 an hour?

It's not a cost to you, it's a cost on Arrow to ensure that it provides appropriate supervision and Tony's already alluded to that.

Oh rubbish!

Stuart asked me if it can be managed and I'm saying yes it can. I also am saying that the key factors in how effective it will be are the management and supervision levels.

21. I'd just like to ask the Arrow people and Barton what experience have you had with the land, agriculture, farming, cattle, livestock in the last five years? Have any of you chaps had that experience?

I'll answer that; I'll start.

22. No, hang on, I want everybody to say yes or no. Have you had experience?

(Barton) I have.

23. How much?

I was born and bred in the Victorian High Country so although I lived in town I have been living with graziers all my life. I have friends… just bear with me, you asked me a question, let me answer it please. I have friends who are broad acre croppers in Western Victoria. I have worked on EIS processes on everything from intensive farming operations to intensively farmed land in areas that are similar to this, not the same as this, it has its unique characteristics. I've worked with people on those farms; I have worked with agronomists. I don't have an intimate understanding of your exact situation, but I would like to suggest that I understand some of the issues and concerns that you have, so that's me personally and I will leave it up to the others.

I think I can probably answer on behalf of people here, we are not…

24. No, not on behalf, I want…

I guess I can answer because we are scientists, we are technical people, and we're not from a farming background.

25. Well I'll put it to you this way, if you're not off the land, and you don't know anything about farming or livestock and that we have to produce clean, green livestock. How the hell can you come and talk to us about something you know nothing about?

We don't claim to have that expertise, that's why we use people that do…

26. Yes but you're doing these EISs and telling us what's good for us but you don't come out and see what would suit us. You come and do these EISs which I've had a fair bit to do with over the last few years and I have even written submissions.

Pitless drilling was not a preferred option for the company 18 months ago...now it is? You're all saying every company is the same. I haven't met one yet that can stand up and tell the truth and I've had a lot to do with them. I've had three projects, infrastructure projects of significance, going out through my place and they were all designed without my knowledge. Nobody knew and that includes the people doing the EISs.

Anyone can write an EIS, all you've got to do is know what the answer is and you work back from there. We saw that only the other night on TV when a mining company said that the land was of poor quality. That's the biggest lot of bullshit you

have ever heard and that's what we get from the people doing these EISs, they don't know what they are talking about. They don't see how we work, and the conditions under which we work. You might know the mining industry but you don't know agriculture. You're coming onto our land, we are not going onto yours and it's about time you fellows realised that. It's our land, not yours; I don't have any problem with gas companies because I won't let the bastards on!

27. **You speak about the significance of certain factors that will affect us and you talk about noise. How can you put a factor on something that is already zero? When I go to sleep at night I hear nothing, that's why I live where I live, I like peace and quiet. How can you change a zero and say something else because it's zero, it's nothing. When we all go home tonight and we go to sleep, we hear nothing. It's why we don't live in the city. I am not sure where you are all staying tonight but if it's out here somewhere, you listen to how quiet it is and you'll realise what I'm talking about.**

    I know exactly what you are talking about and I will answer it in part now but I'm going to give a presentation on noise after lunch. Yes you will hear things, it will change. The Queensland Government tests are based on World Health Organisation (WHO) Guidelines which are designed to ensure the noise doesn't result in what we call sleep disturbance. The guideline has been in place for a long time and is based on research and development around the world into what constitutes sleep disturbance and the like. It's not based on a whim or something that's plucked out of the air. The government's noise guidelines are based around ensuring you are not subject to sleep disturbance and it's based on the WHO's measure of that.

    So yes you will hear things, it will change when you live in a rural environment.

28. **Well we don't want it.**

    You say the government has set this up. The government all live down in bloody Brisbane, they don't live out here, same as the mining company. The mine managers don't live out here where the mines are, they live in Brisbane or somewhere down on the Gold Coast, and you're trying to tell us what's good for us. You come out here and tell all us what's good for our business and you don't know anything about it. I invite the person who makes the rules on noise levels to come and sleep in my house and realise how quiet it is, that's why I live where I live.

29. **G'day. I work here in Cecil Plains. I have been to quite a few of these meetings. I've tried not to sit on the sidelines, I've tried to listen and think. There's one fundamental question I have that I cannot answer and ask you to please answer. If what you propose is so good why are you not doing it on government land commonly known as Crown land?**

    There's a simple answer to that...we can only go where the coal basins are i.e. where the gas is. Unfortunately that's below private property in most cases. There are certain areas of state forests where we might be able to work but that's only a small portion of the area in the region.

30. **Sorry is that the Red Zone you were talking about on the map? Is there no gas there?**

(see Figure 3 on page 5)

No, the Red Zone to the west of here is a highly constrained area.

31. What is it?

It's State Forest and it's highly constrained because it will require special management measures to work in there. I'll explain to you later this afternoon that special management measures will be required to operate on strategic cropping land in the same way. It's no different; the only areas that are excluded, or are no-go areas, are the towns because of Arrow's commitment not to develop in or near towns and national parks which are protected under specific legislation.

32. With respect to the old pipelines out through the Yuleba State Forest can I ask the same question that gentleman asked you? I think that the government should revisit access to State Forests because the Yuleba Creek State Forest of 200,000 acres west of where I live has been traversed by old pipelines for years and you can see how quickly that area was cleared and how quickly it comes back. They are constantly trying to suppress the seasonal regrowth across there and it's obvious that when the infrastructure reached its use by date that forest would just sweep over the top of it and then 20 or 30 years later you would never know there had been gas infrastructure there. If there are gas reserves beneath these areas that's where the focus should be, not on this fragile, highly productive agricultural land. The government needs to relook at it.

In the three to four years I have been working here and, being an old truckie by trade, I know there is more Crown land than people think. If you came via Toowoomba today as soon as you left the Range country you were basically following a disused railway line which is at the heart of everyone's concern here. Somebody's grandfather built the line, we have let it go to where it is today. If that area is within the area you are looking at, why aren't you doing what these people asked for three years ago, a moratorium, and do it on that land?

Yes on a small scale you are right, if there is a rail easement or an area that doesn't cause as much impact then we should go there.

33. I've about three questions but the first one only requires a one syllable answer. With regard to the commitments you've made, would Arrow be opposed to having those commitments enshrined as conditions in the environmental authority? Yes or no?

We don't create the environmental authority. That's…

34. I know you don't create the environmental authority but you have input into the conditions on the environmental authority. That is true because when members of the public have an opportunity to write an internal review request they can only do it on conditions that haven't been agreed to by the proponent and the administering authority.

It's not a yes or no answer in that the environmental authority can only contain certain things, so it has to operate within the *Environmental Protection (EP) Act* and there are only certain things within the Act that can be conditioned by way of an environmental authority.

35. So you'd be happy for those commitments to be conditioned by DERM (*now called DEHP*)?

They wouldn't be captured by the Environmental Authority because of the regulatory framework.

36. My next question or statement is on what Stuart was talking about and considering information that both Tony and Barton presented. Tony you said pitless drilling trials were underway, your company was looking at doing infrastructure, pipeline and power reticulation trials, and that you were looking at doing, or are doing, a detailed feasibility assessment of substitution of allocations. So you have lots of trials going on or planning to be done.

My statement Barton is that I find there to be a fatal flaw in this project. If Arrow is currently doing trials or planning to do trials to determine if its activities can successfully co-exist with our current land use without impacting on the environmental values we require to use our land successfully, how can you say that you can identify the environmental values, constraint and management measures and the extended operating procedures? You can't do any of that until these trials have been completed because you don't know yet whether those trials are going to be successful. Do you understand what I am saying?

I understand exactly but you said 'won't impact on the environmental values' and the very first point I made in this presentation was that all projects have impacts. We are not saying that Arrow's activities will not impact on environmental values, they will.

37. Then why aren't you saying that you are going to change our environment forever?

That's probably just a poor choice of wording on my part then**.**

38. Everyone in this room is of the opinion that with the thousands of years of collective experience in the room your industry and this company you represent cannot successfully co-exist with our current land use. Getting back to your matrix, you said the low constraint parts of your map were basically industrial land and when you said that I thought probably some industrial site on some crappy country at the end of some town. But you were talking about our part of the world when you said that. I still believe it to be a fundamental flaw and I think it's probably not so much with the project but it's with the legislation because unfortunately land use and agricultural productivity are not captured in the *EP Act* and that's where we fall through the cracks. My last comment is that I gather you don't have any land on black soil yet because I am deeply distressed you are using private properties in this area or similar areas to ours to act as guinea pigs for all these trials.

I think that just reflects not everyone perhaps shares your view. There are other opinions out there. That's why those people are willing to let us trial these things. We've said to you before that you know we want to demonstrate that we can work and co-exist on the black soil country and that's the way to do it. There are people out there who are willing to give us that opportunity to see how we can do it. It's a different viewpoint and that's the simple reality of it.

39. Do you have conduct and compensation agreements with those people?

Yes, that's a requirement any time we access private property.

40. These property owners, have they signed a conduct and compensation agreement?

Yes.

41. Does the company that presented at the intensive land committee have a conduct and compensation agreement with you?

We're working on that but we haven't done any trials there yet. We're telling you in advance what we're proposing to do.

42. Mate, you presented to an intensive land committee in Dalby last week misrepresenting the company you have a commercial arrangement with. All you are doing is opening it up to be the first blockade in the floodplains, which isn't fair to the company.

We have not made any misrepresentation on that topic. We told the committees what we were up to, we showed...

43. Why don't you show us the report you issued to them.

I am not sure what report you mean.

44. The presentation you gave.

All we showed was the proposed location for the…

45. You're slinking around…

No we're not. Many of you know who they are, that's where it's proposed to drill two exploration wells.

46. And you have a signed conduct and compensation agreement with them?

We are getting that in place now but they don't share the view that we are hearing today.

47. No, because their business is not farming.

I think FKG Farming Enterprises is farming.

48. It's not their core business. We are farmers, we make our livings on farms, they do not make their living on farms.

I think this has to be a discussion where FKG is also present.

50. My question relates to the first presentation. Tony mentioned you weren't going to pump the CSG-produced water into the ocean. I was curious because I've read in the EIS that you were investigating an ocean outpour; that's contradictory to your statement, can you just clarify that for me please?

Until we get an approval to undertake any of the options we've proposed and any options that we're still looking further into and for which we're undertaking more technical feasibility studies, we can't conclusively say we're doing one option over another. We can certainly list out what our preferences are, but the responsibility that we have in the EIS is to identify all the potential options we might be pursuing. It doesn't mean that we would do them all but certainly our preference is not to take the water to the ocean.

51. But you will investigate it as an option?

It's still raised as a potential option in the EIS because it's available to us should we choose to go down that path in the future. At this stage we're not proposing to do so.

52. This is just a question to Tony, a general thing about the EIS process. Firstly I just want to ask you a few quick little yes/no questions to see if we agree or we don't. Do you agree that the EIS is an important document?

Yes.

53. Do you also agree that since it covers Wandoan to Goondiwindi the land use over that whole area is very different and diverse?

Yes.

54. Reading through the EIS, quite a few things pop up. Some of the maps date back to 1998 which I think is a bit old. There's a table here where you are using average yields in the Darling Downs region from 1989 to 1996; again very, very old. So if we both agree this is important and the area it covers is very diverse why is the EIS not written per land use, why is it so generalised?

That's not actually a question for Tony in that Tony hasn't been closely involved in the EIS.

55. He's the head of the company, he's here on behalf of the company and he keeps saying…

If you want to understand the EIS data and the reasons for it being there, you need to talk to the people who have undertaken the EIS and that would be Barton.

56. Well I am just saying there's a pretty picture here of a typical agricultural block within the whole area and there's a fellow sitting on a four wheel drive with cattle and lots of trees around him...that's not a typical area! So someone is sitting in government thinking that's what it looks like out there, yes tick it off. You can't give someone a generalised document and ask them to make an informed decision, it just won't happen.

The nature of the EIS is that it's not there to make an informed decision about a particular land parcel…

57. No but it's a general thing that ticks this project off.

It is a stage in the process, but it's not an approval for us to undertake the project so we may get an approval for the EIS, we may not. That approval will have conditions attached to it.

58. But isn't the EIS, all 6,000 pages, isn't it the primary document DERM will use?

No it's not. The EIS is a statutory process which requires Arrow to address certain information which is what we've done. The next step in the process is a completely separate statutory process which is to get all approvals, including an environmental authority. That's when the more detailed assessment of location-specific impacts comes into it after the EIS.

59. Wouldn't you provide all the information to the administering authority for it to set the conditions? If it's not the EIS…

We'll cross that bridge when we come to it but we're working on the information now and are continuing to gather more information around the areas we hope to work in.

60. But isn't this our last opportunity to make some sort of comment on the information you are giving to the government?

This is your opportunity to input to the EIS, you'll have further opportunities in the future to input into the project.

61. I have three questions, one to St John and two to Tony. The planet we draw our livelihood from is constantly shifting. With the information you have what would a seismic event do to that information given that three to four weeks ago, South Australia had a 6.1 seismic event up in the north?

So the question was what would a seismic event do to the information?

62. That's right, as well as what you have under the ground and what we know about water moving between the different water levels.

I could probably talk in general terms about what could happen to ground water during a seismic event. I am not a seismologist or a geologist but I believe what you see in the aquifers are oscillations in water due to the pressure of sea water levels going up and down. I can't remember off the top of my head if that is going to make a significant change over a long period of time to ground water levels in that area. What we see and know about is compression of aquifers and the changes in water level. Down that way in South Australia there is an alluvial aquifer with some confined aquifers under it; water levels in the confined aquifer can be used as a type of weighing scale for the aquifer above because as it rains a lot into that aquifer above there are pressure increases in the aquifer below, so you can expect those kind of responses I'd imagine for the seismic events as well.

63. Tony I'd just like to thank you for your presentation earlier. Last time I spoke at a meeting like this, I put a suggestion to you about using radial drilling etc. which you seem to have adopted. However, it's ludicrous to think that going from 800 to 1500m is a huge improvement. My question firstly is that as we have drilling machines in Australia capable of doing 14km or more, what's to stop you from using two holes 28km apart, then drilling sideways and meeting in the middle and potentially getting your wellheads 14, 28, 30km apart?

That's ok in off shore drilling where there is massive…

64. This is on shore, Tony, it's happening in the centre of Australia as we speak.

One issue is that the size of the rigs used for that drilling is different i.e. much, much bigger because of the distances being drilled. The real issue is the geology of coal when you've got separate coal seams and we want to drill through a number of coal seams that are stacked vertically. That's why an inclined well with a sub-vertical component is important. Horizontal wells can be part of the solution but they are not the entire solution. We're definitely looking at horizontal drilling but it's not a simple answer.

65. At an earlier meeting you answered a question about a technical difficulty you had at Dalby with enhanced evaporation, could you enlighten us on the technical difficulty?

I am not sure what that refers to...

66. You were the man who gave the answer at the time.

I honestly don't know what that issue was. I don't work in the Dalby area but we can take that question on notice.

Arrow does not use "enhanced evaporation", and in any case this technique is not preferred by government. It is not relevant to discussion of our future activities

This issue is also addressed in the response to Question 70 below.

67. Could I suggest that at the time because of the enhanced evaporation you were putting salt into the air and killing conifers within a 20km radius?

I honestly can't answer the question; it's not my area of knowledge and business. Although I'm not sure what you're referring to, we haven't been undertaking enhanced evaporation.

68. Yes you were in the early stages in the area where you were. I believe you are not there now because of that technical difficulty, and those are Tony's words verbatim.

So you're talking about seven, eight years ago?

69. No, I haven't been coming to meetings that long.

I mean in terms of the experience with evaporation?

70. Whenever it was, yes.

It was well before my time and that of most Arrow people. There were some evaporation trials which used turbo boosters that you've probably seen across the mining industry. As I understand it Arrow did have some spray drift at the time which is why it decided that wouldn't be the technique to take forward. If that's what you're referring to that's probably the answer you are looking for. It was discontinued many, many years ago.

71. In relation to your water presentation can you show us how you have been monitoring and checking the levels and different inputs from different events and everything else over a period of time? The one thing I consider lacking is its basis. If you base it on the worst case scenario what if something happens that exceeds all possible scenarios you've taken into consideration? What are your fail-safes? Do you close down your drilling, do you stop everything and hope that everything comes good or what? What do you do?

There's a framework in place where we will be conditioned around our impacts on ground water just as the other opponents have been around other impacts on ground water. That will be based primarily on the work the Queensland Water Commission has done as compared to what we put into our EIS. That is something both the Federal and Queensland Governments will give us conditions around; in the past those conditions have included everything from what the make good arrangements might be and mitigation measures right through until when we stop production; we'll have to comply with those. It will be a very open process in terms of all of the data that's collected and how it is communicated.

72. In other words you don't know?

The EIS makes it clear there are a number of ways we are looking at to minimise potential impacts or offsetting whatever those impacts may be. We haven't extended our model out to several hundred years like the other proponents did because we believe that we will be addressing a lot of those issues upfront rather than waiting for them to occur and then resolving them. We'll know how we are going with that over time as we will be monitoring right through the project; if there are any indications that some things are behaving differently to what we expect, then that's when we need to take some alternative steps.

73. Which is what my question was, what are those fail safes?

They are outlined in the EIS and St John has presented on some of them; there's a range of options from injection right through to shutting wells in particular areas. It may include other types of arrangements, but we have outlined a lot of those in the EIS.

74. Shutting down your wells or our wells?

It would be our wells and perhaps even the wells of other companies, it depends where and how excessive the impact is.

75. And how long do you think it will actually be before you realise that something is going to happen or will you wait until the event?

Arrow has in place an early detection regime for that purpose which has been put in place by government to ensure that not too much time elapses before we know about it.

76. Define early detection for something you haven't anticipated, something that is beyond the worst possible scenario because you really don't know.

I guess it depends on the rate of change of movements. If we're looking at an aquifer's pressure signal we will have made a prediction for it with the idea that these processes take decades to occur. If we see a small movement away from the prediction, then that's when we need to go back and look at our models and recalibrate them or see why they're not working. Perhaps we can also then start looking at the performance of substitution and injection, wells might need to be shut in, maybe even some specific drilling in that area if there's something that's operating in a way other than as we predicted it.

77. So basically you've got your models right? I realise there's not a whole lot else you can do, but it still doesn't answer the fact that if something you haven't modelled comes along you won't necessarily be able to pick it up quickly and be able to stop it.

I guess you are talking short term events that happen really quickly? Seismic?

78. Not necessarily seismic, but something like that.

In terms of groundwater flow modelling, we see the outcome by pumping from lots of different wells placed throughout the system. One of the things we're doing in the current iteration of the model is reducing Arrow's grid size in the Condamine; the original model was a one kilometre grid size and we have reduced that down to a 250m grid size.

As we do that we put in more refined data so it depends partly on how much data there is. There is a lot of data on the Condamine because of work done by CSIRO, DERM and KCB (Klohn Crippen Berger Ltd). With other aquifers like the Kumbarillas there's less data to populate a finer and finer grid size because they go down further. If something does start happening in an area with a small amount of data, there has to be an investigation to work it out but in areas where there's a lot of data it's a case of refining the model.

79. I saw on one of your presentations that you said the Kumbarilla probably looked set to respond by 2061. Is that based on everything going wrong with your modelling prediction?

No, not everything recovers to where it does in that model as it is an impact assessment model. It's drawn out to impact as a project comes on; we took it a couple of decades past the end of the proposed project life to see what the natural effect for recovery of water levels would be if a system is operating with just rainfall recharge and groundwater flow, but without any mitigation measures and management measures. Obviously it is over decades so we did that because we wanted to be able to say to ourselves this is too long, if we want to have a successful project we want to be able to deal with these issues up front.

80. You mentioned that in your presentation the very well regarded and highly independent and professionally competent Queensland Water Commission (QWC) is going to morph into Jeff Seeney's gas and land commission. Might I say I have absolute faith in Mary Boydell as she has met very high eligibility criteria which includes no conflicts of interest. From my investigations in this matter, I believe that the CSG Unit which currently operates under the very independent and highly professional QWC is going to be retained within it. I would hope so because Mr Randall Cox has been a very independent leader of that unit and I would hate to see it being compromised by being transferred to Jeff Seeney's rather dubious land and gas commission. Perhaps you might be able to clarify and ease my concerns in that regard?

So the first question is if the gas fields and land commission are going to be under QWC or under…

81. No the inference in your slide was that it would be the GasFields (formerly the Queensland Water) Commission. I would hope you are 100% incorrect in that description?

What we're trying to say is our understanding is that it will become part of that commission. It's a government decision not ours.

82. Well my understanding is that the QWC under Mary Boydell will continue and that the CSG Unit, under the independent water commission, will stay within that independent commission but I may be disappointed to find out otherwise.

As I understand it the GasFields Commission will be a subset. Mr Cotter is here today; perhaps you can approach him to clarify.

83. The specific question I'd like to raise with you is the matter of reinjection trials. They have been on and off over a number of years that I've been involved in this debate and it's obviously on again. But where there's been significant reinjection in the United States and more recently in the United Kingdom, there's also been high pressure reinjection of their fraccing fluid, the massive amounts of fraccing fluids that they are trying to get rid of over there. It has caused seismic activity and that's been agreed to by the numerous government bodies over there. In your EIS are you dealing with the seismic risk that has become apparent overseas?

I understand the EIS addresses injection trials. Injection isn't the same as a high pressure injection system because it's a long term, decades-long, injection system; however, the risk assessment will cover issues such as the fracture pressure of the overlying, confining unit, and it will look at that because it will have to calculate the fracturing pressure and make sure it stays 10-20% below that pressure.

84. Tony, you still persist with that (I won't call it a mistruth, but it's a sliver of the truth) about the 0.004% impact on the Great Artesian Basin (GAB). That would be true if the CSG impact was over the whole GAB but it's not. It's in a very small portion of the Basin and where we sit here in this hall is in an area of it called the Eastern Downs Management Unit. GAB has a legislative resource operations plan and it dictates who can take water and how much. When that plan was formed there was a document called the Hydrological Framework which was put together by a lot of people who understand far more about groundwater than I do. I want to quote to you a couple of portions out of that Hydrological Framework document and it relates to part of the world where we sit currently. It says: *'the current demand is one of competition and likely developing interference with associated potential supply loss. Against this background development and take will largely come at the expense of progressive storage depletion and head decline. The approval of additional entitlement would clearly impact negatively under these circumstances'.*

That was talking about people who had applied for extra entitlement; we've a couple of very prominent users quite close to here who were part of that process and they declined that extra entitlement because of this information. In other words the Basin is already over allocated. If we don't do something about that, we are going to see head depletion and aquifer storage problems. Yet you're asking us to believe we can come along on top of all this with your CSG take and it's not going to have any effect, only this small percentage. That's false and misleading; it may work on stupid politicians, it may work on the unsuspecting public who don't understand the real issues about groundwater allocations, but for those of us here who have lived with groundwater regulations and lived within the confines of allocations all our lives, it's deeply disturbing. It's divisive, and you should stop it because if the CSG industry

was as squeaky clean as you'd like us to believe in this area, you wouldn't need to resort to those types of tactics. It undermines your credibility.

We hear media claims we're going to 'break' the GAB. I've seen that sort of terminology used. My point with that 0.004% is saying that the GAB's massive. It covers a large portion of Queensland, and if you put in context the CSG area we're talking about it's quite small. That's my point in regard to the whole of the GAB. I think I also said in the presentation that there will be local impacts which are much greater. I am not disagreeing with your point, I am not saying that impacts here are only 0.004%. The work St John has presented shows our impact predictions are different in different aquifers; Carolyn also talked about proposed measures to maintain the integrity and levels of those aquifers. I am not trying to say there is no impact on the aquifers here. I realise that intense development in a smaller area has a big impact; we acknowledge that and it's what the groundwater model and the mitigation measures and monitoring program are all about. It's trying to ensure we can put back that water so it doesn't leave the system; it's why we like the substitution of allocations scheme, so we can return that water back to where it came from.

85. St John, your statements in the EIS surrounding the makeup of your model is a little concerning and I will quote. It says '*the model is based on an approximate development sequence including an approximation of the number of production wells likely to be installed, the likely volumes of gas and water to be removed and an estimate of the likely timing of development.'* Then it says '*this information constitutes Arrow's conceptual design.'* To my way of thinking, that's a whole lot of *likelys*, *estimates* and *approximations*. It's hard to have a whole lot of confidence in the outcome of your model when these are the words used to describe your model.

One other thing before I give up the microphone...in your cross sectional representation of the Condamine Alluvium or of the Basin where the Condamine Alluvium sits, you show the western portion of the alluvium with quite a degree of separation from the Walloon Coal Measures. It could be some hundred metres in the extreme western portion but when you go east from that and when you go east from here on the flood plain, the alluvium is incised into the Walloon Coal Measures. In your EIS, you say that the separating strata is, or may be, absent yet your model seems to show that dewatering the Walloons has a greater impact where we have the most separation and a lesser impact where we have no separation. I can't work out how that can be.

So the first point about the field development plan is that there are lots of *likelys* and other such words in it because that field development plan is prepared at a fairly early stage. I will be upfront about the fact that this isn't final as it is missing the modelling over time. As we hone in on the final project, and relinquish land that is currently in the project area, there will be water we thought we would be taking in our current model that isn't there at the moment. What we're seeing, and what we tend to see with models versus projects, is that as you refine them you tend to go from something larger to something smaller so you refine them to get closer and closer to the truth but usually you find that you hone in on it. Maybe it's not where you think when you come to it, maybe if it's towards the other end of the spectrum you come up or if it's lower in the spectrum you move and come down but it's generally somewhere within your starting parameters. I understand that language could be concerning

in terms of not giving you a lot of certainty with what's going to happen, but it's there because it's the broad estimate before things are refined down.

86. What you need to understand is that we exist on entitlement from that water source; those sorts of words don't appear on our allocations. We've just had to stump up for new meters; not because we didn't have them, but because the Department deemed that the old ones weren't accurate anymore so we had to pay for new meters. There are no *likelys*, there are no *approximations*; you're meddling with our livelihoods when you use those sort of words. It creates a degree of uncertainty and mistrust of what you're saying by using those types of words.

All I can say is that as the infrastructure expands and is refined, and the engineering design comes along, we will be refining our predictions. In citing the example of the metering on your bores, it's a fixed point that is known and established. What we're saying is that we're still in the process of refining our plans. We can't be specific yet to an XYZ coordinate on the ground for everything. We are getting closer to that point but it's normal practice in scientific circles to be very conservative. You never make a definitive statement because science by its nature, finds it very hard to be definitive for every case. Scientists will always say words like *approximately, at best estimate* etc.

87. What is your current prediction?

The area that we draw down to in the current model for the Condamine prediction is a maximum impact of 6m from a prediction of 2.5m up to 6m.

88. By squeezing in your area like you just said where you abandon some areas you are not going to pump isn't that going to put pressure on this area which means your trampoline effect will actually get deeper and harder and last longer by concentrating more in this area?

No you'll be pumping less water overall.

89. Yes but if you're concentrating your pumping more into this area instead of having it spread further out, you're concentrating more which makes the trampoline effect even worse does it not for this area?

Well no, there would be pumping rates in blocks, so there wouldn't be a huge difference between the pumping rates. It's not that you are increasing pumping rates here to compensate for a pumping rate you are losing there. You are pumping at a rate that brings the water level down to get the gas off. You don't have to do it harder here because you are not doing it over there.

The simple answer to this is that you can't squeeze any more gas out of any one area as there's only so much in the ground.

90. Your EIS statement specifically said it's built on 800 metre stations between pumps but then it says there are infills which could come every 200 metres. Is that your worst case scenario, 200 metre well sites?

I haven't read that in there…

91. It's in your EIS, you should know this stuff, we are farmers and we are expected to know this. You are standing up there, you should know this stuff.

The issue of well spacing comes down to the timing. You can have a few hundred wells over a long period of time extracting gas; the more wells, the more quickly you get the gas.

It relates to the development sequence where you've got the shades of red going right across the whole project development area in terms of how it develops. The Arrow advice to us was that it will start to focus in areas which it will develop and then you get infill in blocks, not infill between the wells. Those highlighted areas up around Wandoan and Dalby are the early work and then you'll see the infill occurring across the whole area, that's what is meant in the EIS.

The question relates to if you have the Condamine Alluvium sitting here and the impacts are occurring on this western side, not necessarily where that major contact area with the Walloon Coal Measures is. If you look at the structure of the underlying layers in our geological model, this western edge is underweighed by a lot more of the Kumbarilla and Walloon Sandstones so what we think is happening is that pressure is migrating upwards into the sandstones because those are more permeable, it's actually transmitting them along through that area. This is one of the things you learn when you are doing these kinds of studies; you start with a basic idea of what the situation is, you do your modelling and find out maybe it isn't, then you need to go and test other areas too. I guess that's the process we go through to understand more and more about the system.

92. So what you're saying is that it's a major source of recharge for the Condamine Alluvium?

It's probably a source of discharge of the Condamine Alluvium.

93. That doesn't make sense, you're telling us a lot of bloody crap. How can we believe you when you say probably or maybe? When we go to the bank manager, we've got to be able to say what we definitely are going to do. We don't say maybe or probably. We've got to give him a definitive answer but you're giving us maybe and probably.

What we've done in response to that is we've identified it as an area we need to further understand.

94. You don't know what the outcome is going to be because you are mucking around with our environment. It's our environment, not yours.

We have planned a study into the connectivity. What we need to do is to understand the geology and better understand how it interacts. We've had extensive discussions about…

95. And you've got 6,000 thousand pages of bloody crap because you don't have any bloody facts, because you don't know.

I'll take that as a statement. Most people in this room understand the work we are doing to try to improve everybody's knowledge and it will be of value to everybody; it's work we want to share with everyone.

If the industry does get up, the legacy we'd like to leave behind is that this will be the best understood groundwater system in the world. There will be a lot of information known about this that we don't know now. We've had a lot of conversations about trying to improve our understanding and the way to do that is to work with people in the area who have the knowledge. We will do some more drilling to understand what the geological structures are and to understand what that interconnectivity looks like. We are very committed to doing that.

96. **You are only telling us half the story, the good part. It's like when you come on the property to drill, you're going to drill one test bore but that's only to get on the property. Then you want to go over there and do another one and then over there and do another one. You are doing the same thing here, you are only telling us half the story.**

That's not how we approach our access arrangements.

97. **You do, you are all the same.**

No it's not but that's fine, we'll move on.

98. **I have a quick comment. You've heard from a number of people today a number of times and there's a reason for that. They are very passionate and articulate about what they do. I just want to say that hundreds of us support them in what they do, so I wouldn't like you to think there are only a few people agitating or asking questions. There are hundreds of people behind these very articulate and passionate people who are agreeing with what they say.**

Can I just say that's a given. These people are here to listen and they understand that.

99. **I want to emphasise something said before about the 0.004% of the GAB. Can you tell us what percentage of the Walloon Coal Measures is going to be drawn down by your project or by all proponents in the Surat Basin? That's a more realistic and meaningful figure, particularly in light of the fact there are people in this room who have allocations from the Walloons as well. I think that's pretty important to find out.**

Tony Burke's group said a couple of years ago there would be drawdowns in the order of hundreds of metres and that recovery would take hundreds of years. That's the sort of data that's more appreciated. It's like saying Cecil Plains takes up 0000.001% of Australia, that's meaningless isn't it?

I think in the slide St John showed there were different aquifers, with different impacts listed against them, so we are not saying that it's a trigger impact in one aquifer that applies to all.

100. **I did take note of that slide and I also noticed that the Walloons were not considered high sensitivity despite the fact they are receiving the immediate impact. The Huttons and the Marburgs were considered high sensitivity but the Walloons and the Condamine Alluvium which was previously mentioned as being one of the top ten aquifers in Australia (I'm assuming in terms of its importance or usage), were only moderate.**

I'm assuming you are still contacting landholders for the baseline groundwater stuff to feed into the QWC, is that still happening? Are landholders still being approached for the monitoring system that is supposed to be happening throughout the Surat Basin? This is a suggestion, and obviously the QWC or whatever it is now, would have to be agreeable and you guys would as well. Considering the recent deterioration in the relationship between Arrow Energy and this community over recent weeks and months, and the fact that landholders have been approached over that time to feed into the model, they have been saying no because of the deteriorating relationship.

I was wondering if Arrow would be opposed to the idea of an independent third party coming in and doing that baseline analysis so landholders didn't have to have Arrow on their properties doing it so it was a mutually beneficial solution to all parties concerned, landholders, you guys as the proponent and the state government?

The reality is we have a huge number of these assessments to do and on most occasions we are engaging third parties to do them for us. We have an obligation to do them so the land access arrangements are Arrow's arrangements and it would always be present while that's being done, regardless of whether there is a third party there or not. For those done so far, the landholder has been there and participated so it's quite an open process. The landholder receives all the information, the third party signs and certifies that everything is accurate and that the right thing has been done. We have complete faith in the people we're using. Because of the quantity of work, we'll be using a number of different contractors.

101. **The contractors are not the problem but we have heard reports from landholders who have invited companies to come on to do these baseline groundwater assessments and the individuals from the companies have taken the opportunity to rubberneck and look around the property as well. It's a worry you don't have confidence in the contractors to allow them on properties without an Arrow representative being present?**

We have obligations under the legislation so we have land liaison officers who will accompany them and in most cases we will also have an Arrow technical person. I can't speak to your comments about the other companies so I'm only talking about how Arrow will do it.

102. **Well I was being polite; it was Arrow I was referring to.**

I have a concern about the comments on the science, the assumptions, the trials and the case studies, all those things that have been done but there is no definite layout at the moment, is that correct? My concern is that we only get to make a submission on the assumptions; we won't get to make a submission on the facts when they are established.

I guess it comes back to the answer I gave earlier which was that this isn't the only opportunity you have for input. Following on from this exercise we have to obtain all our licences and approvals so you will have opportunities then. Arrow also intends to continue engaging and working closely with those people whose properties we will be on to work up the detail, not just coming and surprising people and then going ahead.

103. So what will our opportunities be in the future to make submissions?

Across our project we've still got a number of Authorities to Prospect (ATPs). As you know we are just undertaking exploration on a large part of the tenure; we have to go through a specific process if we are going to be able to get a Petroleum Lease (PL) to produce there. Now that's a long application process with a lot of things feeding into it; one of those will be the Environmental Authority (EA) which will require public notification. The same process you've been going through with a couple of other EAs will be available to you.

104. But isn't the Surat Basin project under a single EA?

It still goes through the same process so even though it will be an amended Environmental Authority it will include new activities of a scale which the government would say requires public consultation.

105. So the results of all the case studies and that sort of stuff will be made public through those environmental management plans and things like that?

Where they've been completed and where they are relevant to that particular project, yes. But we have other mechanisms of engagement for communication as well. Even the amendments to the Environmental Authorities may be incremental over time as the project develops; we won't be doing everything in one area across the project tenure at the same time, it will be incremental over 20 years or so and will be changing.

106. Yes but won't there be a risk the government will deem the increments are small enough that public submissions are not required?

It's not about the scale because it will understand what the scale is, it's about how the authorities are conditioned.

107. You are going to amend the Dalby Expansion Project (DXP) is that right?

Yes. As you know, the conditions don't actually say what you can and can't do in terms of a well, but they do say how you can go about it, where you can't go, what management practices you need to have in place. It's all of those things that the EA will contain and therefore will apply to wherever we do that activity. The environmental constraints or the values in those areas will change depending on where we go so the EA shouldn't be too specific in its level of detail, it's about how to manage it. It's supposed to be a measurable performance or outcome based condition rather than being overly prescriptive and saying 'in this paddock you can only do this or this', it's just the way the regime works.

108. I came here thinking the EIS is what we have to comment on. Can you tell me exactly what this EIS is for? Basically we've come in here thinking we've got to read these 7,000 pages, comment on what is a very generalised document. It's missing a lot of data and contains a lot of old data in it but we still have to comment on it. The whole time we've been here today you are saying Arrow is testing, trying, doing new things still. How can we comment when it's not in this document and down the track we might not be allowed to actually comment? You say we will be, but that's not 100%.

The EIS is at a point in time. It's a statutory process and is done at the very early stages of a project. What it does is evaluates the environment we plan to work within if the project does

go ahead. At that point in time there is only a certain amount of information available about how the project will look, the size and scale of what it may be, and over time we will improve on that information. The EIS is really to flag the potential options we may undertake in terms of how we construct our facilities, the different combinations of those, their size, emissions, noise. It sets out to define what the landscape looks like in broad terms, recognising the different types of land around as well as the different types of land practices that people currently are using on their properties. It's supposed to identify potential impacts and ways of mitigating them, and they will vary depending on where we operate. In many cases, as Barton says, it will be highly constrained. We will have a whole range of constraints on us but in some areas it will be business as usual in terms of how it's generally done. The EIS is a document that you have the opportunity to comment on; I'd encourage you to do so because it will mean issues of concern are then understood by Arrow and can be addressed. It will give the government information it can consider in future applications as well even though it doesn't have to. The follow-on applications will actually include more detail around what it is we plan to do at the time; that will be part of the PL applications in terms of our work programs or development plans and also the environment authority details.

109. But isn't this Environmental Impact Statement saying what your impacts will be on the environment? If you are still testing and trying to find what the impact is then it's not in this document so we can't comment on it.

The testing is to minimise the impacts; we've identified them so what we are now doing is try to work out better ways of managing them and minimising what those impacts might look like. It's not that we don't know what the impacts will be, it's more that we are looking to improve on the way we manage them.

110. If this is a very generalised document, how do you distinguish what the impact is going to be on black soil to what it is on a cattle plain?

The EIS process is the government's formal process to allow a project to go to its detailed approval process.

111. And that's what I am saying, if it's generalised how can it make that decision?

It's generalised but there is a lot of specific information in it in terms of understanding impacts. We don't necessarily need exact locations etc. to understand impacts and a lot of the work that Arrow has talked about today is ongoing. Recommendations have come out of the EIS so when you read it you will see recommendations for further work to be done to better understand issues to inform mitigation measures. Through that process we'll be reporting on that work through the supplementary report to the EIS. When you see conditions of approval that come out of an EIS process, should we get there, you will see conditions that will require Arrow to produce other reports and management plans. If you look at some of the EIS approvals for the other proponents there is a lot of work that has to be done before they commence work; Arrow will have similar requirements which will feed into the future approvals process as well.

112. So you are guaranteeing that we can comment on this and then make other comments down the track once you know all the data, all the definites? We will then have another opportunity?

Yes, through the process Carolyn was talking about, through the *EP Act.*

113. Can you guarantee we will get another chance?

Under the *EP Act,* there is a requirement for us to publicly notify amendments to any EAs we plan to do for this project, so yes you will get another chance.

114. So why hasn't it happened on current projects where there've been amendments?

I think two prime examples are ATP 683 and the Dalby expansion project which did happen. We haven't done it since the one you're contesting at the moment but it's happened.

115. That was changed in April last year wasn't it? The conditions are very specific.

The only changed condition was in relation to an error the government had made and it was covered by an administrative amendment. We weren't involved in that process, it was just re-issued.

116. No there was a very specific condition in one of those documents that was taken out regarding the level of water in a holding pond; 85% of the water in a dam had to leave the dam within a three month period. That condition was removed and we were not notified.

That condition is something that has been changed across all the companies. It was a misrepresentation of their policy that was impractical and impossible to implement so it was changed as an administrative amendment.

117. But we were not notified. You said when there are amendments made to the EAs…

Amendments that are substantial in nature…

118. Recategorisation of a holding pond to an evaporation pond is a fairly substantial amendment.

What we have is a system under the *EP Act* which has certain things that must be considered by DEHP. It has a decision-making committee which can determine if minor applications don't have to go to public notification. An administrative amendment doesn't go through that process but if we were to apply for an amendment to our EA, it goes to that decision-making committee.

119. So we may or may not be informed, depending on whoever is doing the decision making, as to whether it's critical enough that the public needs to know about it.

I think as you've made clear the Department would think it was in the public interest.

120. Well I would have thought that re-categorising holding ponds to go to a reverse osmosis (RO) plant, then re-categorising back to an evaporation dam, is supposed…

That's not what that condition did.

121. Yes it did.

I'll agree to disagree with you.

122. By not requiring you to remove 85% of the water from that dam it means you can leave it there longer which effectively gives you an evaporation pond so this whole phase out of evaporation ponds is complete nonsense.

In regards to our ability to comment further, if this project becomes a project of 'state significance' after the EIS is approved, we will not get the opportunity to comment further.

That declaration precedes an EIS so it won't come to that. We never went down the path of a state significant project.

123. Can I ask why you've done that? It would save the community the nightmare of having internal reviews to work out why you haven't gone for significant project status?

There was a mechanism available to people under the *EP Act;* we didn't see any reason not to use that.

124. You can't enforce it.

It's essentially that there are two ways of doing the process and we opted to go down this path. The feedback I've had from this community is that you are happy we went this way because it gives you a lot more involvement so I'm pleased that was the case.

125. You mentioned a 6m fall in our aquifer as a worst case scenario and I think as farmers we have to accept that will happen. Just in the last ten years, probably at a cost of hundreds of millions of dollars, we have made this aquifer sustainable. A 6m fall in that aquifer will mean I won't have water for my house and I wouldn't be the only farmer in that situation. A lot of farmers in this room would not have any water for their house, for spraying or doing other commercial activities on their farms, they would lose that. To put it in context, if you live in Brisbane and your house water is switched off because someone wants to wash coal in Wivenhoe Dam that would be the same thing. I think it is very, very lax of Arrow to say that a 6m fall is the worst case scenario; you're going to say you'll do trials and reinjection, but those trials have not worked yet. But you are forecasting six metre falls so we have no confidence in what Arrow is telling us because we are just seeing the demise of our capital asset.

The 6m prediction is estimated for 2065, that's how long it takes. It's not going to happen suddenly, it won't happen tomorrow. In that time we can do injection trials, we can better understand the system to put management measures and technologies in place to prevent that happening.

126. Do you think I should notify my bank that my asset is being eroded by 2065? Oh don't worry, Arrow will make good!

The interesting part is that you are going to reinject but the water production from your wells peaks within 18 months according to all the information I have received and then it declines rapidly. So you are going to have a big production of water from your wells to reinject and in 2065 we're going to see our worst case scenario. But by then you won't be producing water anymore, so if reinjection doesn't work (and no one says it can or can't) the make good provision isn't going to work so we will be left high and dry.

The water will be available throughout the project and the idea is that the potential drawdown is offset by substitution or injection providing a buffer against that impact. I can certainly see your point.

127. **I'd like to tell these people here in Cecil Plains what's happened out where I am at Miles. I've had three years' experience out there with CSG companies around me. With other people out there we wrote a submission on the EIS. Before that submission there was only one holding pond in the area. Before the EIS was approved, QGC bought a property two blocks up the creek from me and came along and pegged out three holding ponds or dams. But they are not holding ponds, they call them transfer dams because they put water in before they pipe it. It's the same thing, it's an evaporation pond. I got onto DERM and it came out on some other issues because the company was building in melon hole country which runs into my place and had no provision for stopping any chemicals or run-offs running into my place.**

    I took the DERM guy out and showed him these things that were pegged out because I'd done a bit of research myself. So DERM contacted QGC and a few weeks later a fellow came along and said 'I've come to re-survey some dams, these ones are in the wrong place'. Now that was all rubbish, they were all done by the surveyor with all the pegs, measurements and everything on them but they weren't in the EIS. How much has been left out of this EIS?

    You were talking about projects of state significance. I have three of those that were going to go through my place and they reckon they are the be all and end all; none of those have gone through my place, they've gone around me. Don't believe anything that these people tell you because they are all rubbish. They just walk over people like cockroaches, making you sign things you don't have to sign. It's about time you people came out and told the truth. As I've said to you, you are only telling half the story, the good side; you are not telling the bad side.

    You have made your point. We are here today to talk to the community about the EIS process, explaining how it works, explaining the inputs and mechanisms that are in place, the management systems we've used. Arrow is not QGC, it is not fair to say here today in an Arrow forum that what happened with QGC is what we would do, that's simply not fair.

    The EIS is a study to identify potential impacts and measures to manage those impacts. It is not a development plan. Once the EIS is in place, we will understand the constraints we have to work within and then we can start to put our plans in place on the ground. Arrow looks at where the impacts are, and the types of things we can do. As Carolyn said, what Arrow does in one area will be different in another, it has to be fit for purpose. The EIS process really is looking at the volume of impacts at this stage and how we might manage them. We will then be able to refine infrastructure and operating practices suitable for different parts of the Basin in which we work.

128. **But you are talking about what Arrow wants, not what we want. You're not talking about that, it's all about what Arrow wants. When QGC had its EIS approved, it barely had the ink dry on it and QGC added an amendment so it could get these other things in.**

Caroline said that the EIS is a point in time. We are talking about a 20 year development plans and things will change over that time. Everything changes over time. What QGC did is no different to what you would do in your own case, you would change plans over the years. But you understand my point, today is not about QGC.

129. You are all the same.

We are not all the same.

130. I have to ask the question we've been beating around the bush. You represent a company called Arrow; the truth is it is owned by a Chinese company. In that country you don't have freedom of speech, the right to vote, certainly no free media. You're coming here and allowing that country to access a resource. Many farmers and I here are Australian citizens but we can't access any more water to grow crops. We try to farm in a sustainable manner. You are representing this Chinese company which has a dubious record in how it acts in its own country; it has access to our resources, unlimited power it seems. Now I hope to be proven wrong. How do you feel when you can take as much water as you want from the Artesian Basin and we as farmers and citizens don't have that right? How can you justify that to everyone here, that's the guts of the matter?

Thanks for that, there are two issues that I will touch on. Arrow is owned by Shell and PetroChina 50/50 so it is privately owned. Arrow is not listed on the stock exchange but Shell and PetroChina are…

131. PetroChina is not listed on the stock exchange I notice.

They are investors. They are bringing in funds to develop a business here. It's a simple commercial arrangement like any other company, Toyota, Boeing whose products come in from overseas.

Clarification: PetroChina is listed on at least three stock exchanges: Hong Kong, New York and Shanghai.

132. They are not going to screw our environment and take our resources.

Let me finish on water, you touched on it. I am confident that with the work being done here Arrow is putting in the right legwork, the right scientific rigour to see if development can occur without an impact on your water. As I've said before, if Arrow can't convince itself or government that it can manage those impacts, then we won't do them. Arrow is not trying to destroy the environment, it's here today to try to describe what it does; it's studying the impacts and looking at potential management measures.

I am comfortable we are doing the right work. We're not at the end of the line yet, we haven't reached the decision point with the project so we are still running through that but I am confident that we're applying the right level of rigour, science and fact-finding. Through exploration we are gathering real information out of the ground to give ourselves the best chance of that happening. I am not saying it's a 100% slam-dunk outcome.

133. St John, were all the figures you gave in your presentation pertaining only to Arrow's effect on the underground water or the total CSG industry?

The maps up there were for our estimate of the entire take from the CSG industry. The table had a column for Arrow's impact, and a column for the cumulative impacts.

134. I was fascinated to hear you say you wanted to do a study in the Tipton area and you've all been talking about future drawn down effects. Last year I gave Tony Knight detailed information about an irrigation production bore that as far as I'm concerned has been ruined by the gas that has been taken from the Grassdale area. It went from 40,000psi to about 12 or 13. I've never heard back from him and yet here you are talking about wanting to do a study on Tipton. We also found out when we did this investigation that there were no local test bores around there. People on the river have lost their windmill water, their household water already, so if you want to do a study on Tipton you had better start with that production bore.

Arrow is taking steps to undertake bore assessments and implement make good agreements with the 15 bore owners identified in the QWC Underground water impact report as being within the Immediately Affected Area.

135. Barton, you were talking about one site measured for noise. If you have a thousand of these things going full power does it still work the same?

It works the same. Those wells are over 800m apart. As you can see the noise naturally attenuates at 300m so they will never add together to create a bigger noise.

136. What about under different conditions? Can you have some conditions and the noise will spread.

That's why they monitor under different meteorological conditions over a year to get long-term averages. You'll see in the specialist report there is a wind rose which tells you the percentage of time the wind is coming from a certain direction. The models are run from all directions for the whole year.

Those worst-case meteorological conditions occur on only a very limited number of times a year. The other thing you need to remember is there are some very substantial levels of conservatism build into the model so what you actually experience will be less than what you see here, and that has been proven by experience on many projects. Right from the outset we are required to model worst-case.

137. What are the background noise levels based on? What about at night time?

The government sets rating background levels; it's a process the government comes up with to set a benchmark level and then says a developer like Arrow can go 3dB above that. So it's 25dB plus 3 which is 28dB. You and I can't perceive a 1dB change in noise. The first time you notice a change is at about 3dB. So if we measured a noise of 28dB in this room and then measured at 29.5dB we wouldn't be able to tell the difference but if we measured at 31 or 32dB we'd be able to tell the difference.

138. What's the lowest you can monitor? 19dB?

I can't answer that but there are limits on what can be monitored. The noise consultant did provide information in the technical study about what the measuring limits were.

People do get accustomed to noise. Where I live in Brisbane there's a lot of background noise – alarms, ambulances etc. I've tuned out to that even though where I come from in regional Victoria is very quiet. I'm used to living in a very quiet environment so it surprised me when I moved to Brisbane on a regular basis that I've become adapted to the noise there. You adjust naturally. I'm not saying you should accept the noise only that people do assimilate to the noise.

139. You're coming into our environment and disrupting us.

What I'm saying is that scientific authorities advised the government and have determined that is the level which will protect your sleep and your wellbeing.

We modelled the typical production facility, and 1km was found to be the point at which we reached 28dB.

140. What about when there is inversion?

That's why it's modelled when there is inversion and breeze. The specialists apply management measures and attenuation and model it again to see how it changes. Either it meets the criteria or it doesn't. If it doesn't meet the criteria then we have to apply more attenuation, more soundproofing.

Distance is an important factor which will be considered in planning. It's a combination of applying the appropriate treatments and distance to manage it. The noise assessment looks at the full tonal spectrum of noise i.e. it looks at all noise frequencies. Higher frequency noise attenuates more quickly than low frequency noise so the guidelines for the assessment of noise for CSG gas activities required the entire spectrum to be monitored.

141. My question is about the substitution of allocations as a mitigation measure in the long term. Some of the wording in the EIS concerns me a little. It says that Arrow has commenced discussions with relevant regulatory bodies regarding the appropriate legislative framework that would facilitate this CSG management strategy and it's expected that third party users will accept legal responsibility for the impacts of their use of water. As allocation holders from the Condamine Alluvium, some of that wording leaves us feeling a little nervous. Does commencing discussions with relevant regulatory bodies mean we are going to be forced to use this water? Will we actually have our groundwater entitlements fiddled with to accommodate Arrow's disposal of CSG water? What are the legal and practical risks and responsibilities we'll assume for any impacts from the use of this water?

There are a few elements to that one.

There is a lot of science and research around water quality and soil types and how they have to match very well to be able to sustainably hold water. There has been a lot of angst amongst regulators and others around whether it is sustainable to use CSG water which has been treated and amended. Irrigators such as yourselves are already regulated; you know how to manage your water, you know how to apply those regulations. There shouldn't be any additional framework that will question your ability or imply any additional liabilities or impacts to soils as a result of your continuing to operate.

The framework we've been talking about would be voluntary so if you choose to opt into that scheme you would be welcome but it wouldn't be mandatory. We are telling government we wouldn't want any existing rights of bore owners to be put at risk; we do not want to be involved with taking allocations away from users. If the government wanted some degree of comfort around how a substitution arrangement would be regulated in the sense of the user leaving it in the ground, it's basically an arrangement between the user and Arrow. It may be leasing your bore for the time of the agreement to supply water and Arrow would be liable for maintaining the bore. If Arrow didn't have enough water in that time to ensure you have your allocation it would actually take water from the bore instead of giving you CSG treated water.

142. You talk about substituting existing water allocations. How will substituting surface water mitigate the impacts?

It will allow more groundwater in the Condamine Alluvium to stay in the ground, and let it recover from many, many years of over-allocation and over production. If we supply water to irrigators at surface, it simply allows them to use that water without needing to draw down the Condamine Alluvium.

Additional Information: the process is not to substitute surface water. We are looking at a true substitution of groundwater to minimise potential impacts to the Condamine Alluvium from CSG activities.

143. You made some points that don't exactly line up with what it says in the EIS in regards to well spacing.

Essentially infill drilling is very unlikely. We have had to identify every potential activity across the tenure area as part of the broad assessment but it is not economical for Arrow to drill more wells than it needs. If there is drilling at that sort of spacing essentially there's no project as it's not economically viable to do so.

144. So you wouldn't object to a condition in the EIS that there be no infill drilling on strategic cropping land?

It wouldn't necessarily be a condition in the EIS. The conditions are more around how things should be done and if they can be done. This comes back to the framework we have and the approach we take to it i.e. a site-by-site assessment.

145. Can you put it in writing that there will be no infill wells?

We're talking about a big area here – Wandoan through to Millmerran. There is different geology, different areas we'll have to work in through that whole region so we won't put that in writing. However, we will comply with the EA conditions and good practice but we're not going to put in writing matters that are very hard to quantify in the first place.

146. In regards to that Gatton pipeline you showed, around home some landholders are being harassed by QGC, and now it wants landholders to stop driving over high and medium pressure pipelines unless they are overlaid with a certain thickness of gravel. A weight restriction has been placed on vehicles that can cross i.e. QGC doesn't want a grain road-train going across it other than across a specially prepared thoroughfare across the pipe. The scenario you showed there at Gatton probably wouldn't apply in a broad-scale grain-growing production area where there are heavy tractors and road-

trains full of grain, not according to QGC anyway. Does Arrow require those restrictions if it doesn't use cheap Chinese pipes or have wells that don't break down and corrode?

Obviously Arrow is not QGC so I can't comment on what it's doing. But the question is whether you can operate and drive equipment over a pipeline. Yes you can. Pipelines are designed based on risk assessment under the Australian Code AS2885. Part of that risk assessment requires that the land use be considered. When Arrow puts in high-pressure pipelines it looks at every land use along the pipeline route. That determines two things, the type of pipe or wall thickness, and the depth of burial.

Yesterday someone raised the issue of Gilagi, cracking clays heaving pipes out of the ground. The risk assessment will identify the potential for this so pipes will be buried deeply so they won't become exposed to cracking and heaving shrinking clays. The risk assessment works to ensure land use over the pipe can continue with two exceptions. You can't drive things into the pipe and you can't excavate over it. Those are the two key restrictions that might change the way you can operate on your property. If you are excavating a big pipeline to carry irrigation around your property you will need to talk to Arrow about how to work with its pipeline. It doesn't mean that you won't be able to cross it or go under it, but you will need to work with Arrow to make sure you do it safely.

147. **I have a scenario – QGC must have laid its pipes too shallow in the first place and now it is saying to a landholder he can only drive across it at a certain point where QGC will build it up with a reinforced gravel road. That made that particular landholder unhappy; the same one is now being told by QGC that it wants to put its 42 inch pipe right underneath his centre pivot paddock. He's not really happy about that idea given the potential subsidence over that big pipeline; he's having a hell of a battle with QGC and it doesn't want to shift the 42 inch pipe so there's a standoff there. This is a guy who co-operated with QGC from day one. So I hope Arrow learns from some of the experiences I've related here today because they are an ongoing source of considerable angst and bad will between landholders and gas companies.**

Can I respond and say that we are learning from those experiences. Arrow is not QGC and does not want to adopt any of its alleged bad practices. But things like that feedback are good because it helps us make sure we don't make the same mistake; that's one of the benefits of being the last of the four proponents because we can learn from other's mistakes and make sure we don't repeat them. In terms of land use, that's a discussion that occurs prior to us thinking about putting a pipe in the ground. We need to understand what the use of the land is and what plans there are for it so if we need to put in a heavy wall pipe and bury it deep that can be done upfront.

148. **What will be the maximum weight we can cross these pipelines because things change within practices. We might want to bring a dozer or road train of grain through; what is the actual maximum weight that can cut across these pipelines?**

Unfortunately we don't have our pipeline experts here because that's a detailed technical question. It will depend on the depth of burial, the type of soil, the thickness of the pipe, things like that. There's not just one standard thickness of the pipe, one standard burial the whole way. I can get back to you on that, but I can't answer it now.

See additional information added under question 158.

149. We are talking about a black soil floodplain where the soil structure doesn't vary too much across that floodplain. I thought that would be something you had investigated before you decided to put pipes down.

No, the pipelines we're putting in are primarily on the west side, on the grazing and forested type of country. The only pipelines we are contemplating putting in on the east side would be plastic gathering pipes which are low pressure.

150. We still have to travel across those.

Yes and we will have detailed information on that once we have specific plans.

151. It's important for us to know there are restrictions on agriculture and other activities over your pipeline.

Yes, the two restrictions Barton talked about were excavating and pile driving.

152. Yes but we're just talking about driving.

That's not a limitation. If we plan up front and design the pipeline to suit an activity then that's not a problem.

153. Do you have any pipelines buried now where you are limiting landholder activities over that pipeline?

We only have the one major pipeline which runs from our Moranbah production facility in the Bowen Basin so that's not relevant to here.

154. I am talking about every single piece of buried infrastructure you've got in the ground. You've got more than one pipeline, you've got gathering lines be they low or high pressure everywhere. Do you currently limit landholder activities over any of your buried infrastructure?

If landholders want to do some deep ripping we discuss that with them before we put the pipeline in.

155. We're not asking about deep ripping, we want to know if we can drive across the pipes.

Most of our infrastructure is currently on grazing land and there is no restriction at the moment on driving over the buried infrastructure.

156. At the moment, you haven't done the work, you have no data...

There are no restrictions currently around driving over buried infrastructure.

157. Just say you don't know.

We haven't put any restrictions on…

158. Yes you don't know.

We want to give you the right answer. What I'm saying is we're not the pipeline experts but to my knowledge there are no restrictions in place on any of the pipelines Arrow has in this area or anywhere else. However, we'll get back to you on that with additional information.

Additional information: every location is different and every farm has different activities. Pipelines can be designed to suit the needs of the individual property. As such, restrictions or the design of a pipeline to remove restrictions will need to be part of the discussion closer to the time of installation of the pipeline. Any concerns of other land users should be raised at that time. Activities such as excavation or driving fence posts directly over the pipeline are restricted to protect the integrity of the pipeline and maintain safety.

Comment - It's a very important issue for us and you can see how fired up we are. You thought they were all asleep, didn't you? The load limits on these pipelines have to be upfront so when anyone rocks up to a pipeline there's a notice nominating the load limits on that particular soil.

159. Tony, your EIS says you allow normal cultivation activities. Now we do a host of things on our farm that Arrow wouldn't describe as normal cultivation activities. We want to know what restrictions there will be on those things that fall outside normal cultivation activities.

The risk assessments we have to do now are more than we had to do before. We have to get everyone to respond with the types of activities they carry out on their land, the types of machinery they use and the types of ground disturbance there might be.

160. But these things change. When we started, picking machinery could weigh seven or eight tonnes, now it weighs 38 tonnes, a whole host of things change. How can we be sure that in future you won't place restrictions on what might be allowable now? Will you change your pipelines to suit what we might want to do in the future or are they there forever?

Pipelines are designed to be there forever. What we'd have to do is make sure that they could withstand any potential future uses.

161. I'd like to know if this whole shebang does go ahead do we have a choice of what depth we want the pipeline buried. Are we allowed to say that we want to drive a 100 tonne vehicle across there and will you comply with our request or will you say Arrow is going to put it three foot deep and then throw a bit of dirt over it?

The answer is that we will comply if it's a fair and reasonable request. That's what we do when we have the conversation with you about the Conduct and Compensation Agreement. If you say you are going to drive a space shuttle launcher across there, that's not going to happen but if you say you're going to drive a dozer across there then that's a likely scenario.

162. So we can cross that anywhere on our farm?

It's a conversation that will vary farm by farm so we would have to do it site-by-site.

163. But that's what everyone's saying, things are going to change over time so we need to know now.

There's not a simple answer. All I can say is that we talk to landholders in different regions about the expectations on maximum potential load. We can design the pipeline accordingly, both the location and the construction. We are saying we can respond to the particular issues on any one property and we can design accordingly; that's a conversation we have on an individual landholder basis because it varies across the region.

164. My question was about pipeline markers. Is there any scope for extending them any further apart or using other technology to mark them other than the signs we see now?

There is a code about distances between markers for the big high pressure transmission pipelines. I have to come back to you on the exact distances but usually it's a certain distance or at a significant change in direction. On most of the high pressure transmission line projects I've been on, in agricultural areas they do them on fence lines and the like, but we will come back in terms of the detail behind that.

Additional information: pipeline markers must be visible from one marker to the next, or where there is a change in the pipeline route. There is no specific distance, and they can be spaced out quite widely if the countryside allows.

165. What about between the wells?

It's based on a risk assessment in terms of the pipes between wells so we'll do a risk assessment looking at the risks associated with people potentially accessing that pipe and then we'll look at what is required in terms of signage.

166. Do you make good for the whole of the community or just properties?

In this area it's basically dealt with by the QWC. In its underground water impacts report it will delegate who is responsible for certain areas. Arrow may therefore be responsible for people who are not on our tenure; it may be on someone else's tenure or may not even be on any CSG tenure. So yes we are responsible for doing that and we will.

167. So it will be for the whole community, as long as it's in your tenure?

It doesn't need to be on our tenure. If the impacts are in the area we're designated to look after, we look after it.

168. If we've got no water, what type of things would you do to make good?

The previous arrangements we've talked through are some simple things like deepening pumps through to alternative supplies as compensation. It very much depends on where it's located and what type of supply it is. As soon as we have an indication that there may be an impact on your water supply (and that will come about through the underground water impact report to be published by the QWC) when the triggers of five metres for the confined aquifers and two metres for the unconfined ones are triggered we come and do a water assessment with you and enter into a make good agreement immediately. In that agreement we discuss what the potential options may be, understand the depth of your bore and what type of impact there may be. We then come up with something that we both agree are the potential options to be implemented so if there is subsequently a problem there is an agreement in place as to how we tackle that make good.

169. How long will this take? How long is the process? Like if we're out of water, are you going to be there the next day to sort it out?

We shouldn't be in a situation where that sneaks up on us. With everything that's in place we would know it was going to happen and we would already have had some discussions with you. For instance, the Walloon Coal Measures are the first discussions we're having because that's where we'd expect to see the first impacts. Arrow will start that from next year.

170. In an earlier meeting you guys suggested you wouldn't come near Cecil Plains until 2023. At the same meeting you also said if there were more than 90% of us unwilling to sign agreements with you that you would walk away. Do you still stand by that?

I don't think that's what we said.

171. You said if you couldn't get agreement from more than 90% of us, you'd walk away.

We're committed to working in this area, that's our starting point. We will do everything we can e.g. the studies, the research, the demonstrations that show we can work in this area. We talked about our preferred approach to access to land which is to negotiate and reach agreement. But we do have rights which we reserve.

It was just a comment you guys made and I was wondering whether you were going to stand by it, that's all.

172. Someone said before that sometimes with the gathering lines the gas is going to go to a field compression facility but the water will go straight to the water treatment plant. Does that mean we could then potentially have two different pipeline paths through our property going in different directions, depending on whether one's going to a field compression facility (but can't make it all the way into the central compression one) and then another one for water going straight to a water treatment plant?

No, the lines will be in the same trench where possible. As Tony said, the lines go together and gas and water lines will always be put in together. There won't be a full water treatment facility at the central gas processing facility. You'll have ten central gas processing facilities (CGPF) with about two or three water transfer systems, each CGPF has a small pumping station that takes the water to the treatment facility.

173. Is that the same for the field compression facilities because sometimes it doesn't go straight to the main gas facility, it can't quite make it there without having to be boosted through a field compression facility? Does that mean that there's going to be a water transfer system going into a field booster station?

Yes we will have a few booster stations.

174. And they are about the size of a shipping container?

Yes.

175. So the compressor is a shipping container, there's the other pipeline infrastructure for the gas and then there's a water transmitter as well?

Yes.

176. My question is in regards to strategic cropping land (SCL) legislation and the timing of the Terms of Reference for this project. I have heard it said that Arrow's Surat Gas Project isn't captured by the strategic cropping land legislation because of the timing of your terms of reference and I was wondering if someone could comment.

The Terms of Reference don't cover SCL; it's a separate statutory process and Act of its own. The transitional arrangement in the *Strategic Cropping Land Act* basically says if Terms of Reference were approved by a certain date then the Act would not apply to the process. That said, it does apply to any changes or amendments to tenure, grants of tenure, EAs etc. Despite the fact it didn't apply to the original EIS process as soon as we try to amend our EA or apply for the additional PLs and EAs, it's triggered.

177. I was interested in your mock-up of the farm schematic and how you might dig wells that would create maximum interference but then you could move them to places to minimise or decrease the interference. Aren't you assuming that farm layout would stay the same? Wherever I stand on my farm now it looks different to what it looked five years ago, and different again to what it was ten years ago. We are sometimes forced to make changes for a number of reasons, exposure to government regulation of environmental things like water runoff or pesticide application but more likely through our reduced access to water entitlements we've had to change how we do things. That pressure doesn't look like easing any time soon, so we're going to have to change again, probably in the form of overhead irrigators.

Under your second scenario if you move those wells somewhere else to accommodate existing practice, and we then need to change that practice, which industry will yield? Will the gas industry pull out some wells and dig up buried infrastructure to enable us to stay in business or are we expected to stay the way we are to accommodate the life of the gas industry? How will that process work?

There is no simple answer I can give you now. It will depend what your plans are for your property and your neighbour's. All we can do is try to locate wells where they will be out of the way regardless of any changes. That will be our approach but I can't give you a rock solid answer as to how we will do it on your place, or any other place. It will be site-specific and will depend on the owner's plans for the property as well as a whole host of things. All we can say is that the schematic is just a concept that shows we are flexible in regards to where our wells can go. The precise location would need to be agreed.

Comment - That's another one you haven't thought of is it?

178. Tony is there any notion that the gas industry will yield to agriculture or is it all going to be the other way?

We can say there is flexibility in us giving way to agriculture to make the fit. We are trying to have a co-existence model here; we are not trying to have it one or the other way, we are trying to have both but to minimise our impact on your properties in this area.

179. I am also interested in some of the commentary in the EIS and particularly in the agricultural impact statement or expert report. It talks about developing in times of

fallow or times when we are actually not doing business. That sounds simple and it will probably work on a grazing property or a dry land cropping regime but it's totally impractical on the floodplain around Cecil Plains here. I am unsure how you can develop on a farm that is an integrated system; your activities on one part of my farm can influence what happens on the rest of it. It's not just the impact on 2%, in fact that's a critical area because it impacts on the other 98%. I can't see how this industry could develop east of Cecil Plains without your actually buying out the production of those farm units during your development phase.

You know we are working to try to understand how to work in the area. I don't have a text book answer but what we're trying to do with the committees and trials is to see how it can be possible. I am not saying we have the answers here, but we've got some more time to try to get it right.

180. Tony, if I listen carefully to your answer to the 2023 question, and the 95% acceptance, correct me if I'm wrong but it seemed to me that your answer was that most of those things are off the table now?

We should address the 2023 issue. What we tried to do a number of meetings ago was give people some sense of roughly where we would start developing in the region from Wandoan to Millmerran. The logic was to expand around the Tipton area where we've already got a footprint and in the area around Miles and Wandoan. We hadn't put a timeframe on the Condamine but it didn't mean it wasn't there at some time. If you recall, we made a commitment about addressing concerns before we considered development in that area. So we just hadn't put a timeframe on the Condamine.

This is what we are talking about *(see Figure 4 –* Indicative Development Timeframes page 6). We showed this figure some time ago in the context of trying to explain to the community across the region our initial development scheduling. You can see there is a gradation timeframe which shows the area around our Tipton field and expanding north and south from there. You can see here the white area 'timeframe not determined'. We understand the issues trying to develop east of the Condamine; we made a commitment not to do that development until we can address the concerns in that area. That's why we haven't determined the timeframes and it's why we are doing the current work, the trials and testing out here to try to find a suitable timeframe for this area.

181. We are not inventing the 2023 thing, you guys said it.

This is the map we showed and there may be a difference of interpretation but this is what we used.

182. The statement was that if our gas reserves are good enough, there is no need to go east of Cecil Plains until 2023.

We will have to differ on that point. What I'm saying here is that that was an indicative schedule which didn't put a timeframe to east of the Condamine. We acknowledged that it required a different approach and that's still our position.

183. Tony, we have a record of what you actually said and what you are saying now is somewhat different to the record, but anyway. I'll say one more thing before I sit

down and shut up. We've just had a local government election in this region; all of us here were probably here last year on two occasions when the Mayor Elect spoke in this hall and made certain statements about development east of the Condamine River. He was also prominent in his election advertising campaign in repeating those things, basically saying any council he led would strongly resist at this stage any development east of the Condamine River for a number of very good reasons.

Cr Antonio was elected with an overwhelming mandate I would have thought. Arrow would be wise to take into account that's an indication of how the community feels about it. It's not just a few irate people who have a vast amount of experience in this. I can't for the life of me work out how the two industries can co-exist. Will you take those sorts of public indicators on board in your deliberations about this matter?

We do...this is the fifth time we have been in this hall. We've heard you loudly and clearly and we are here again today. We heard Paul Antonio last year. We do the work the government asked for in the studies, we submit matters for its approval; it determines whether we go or don't go in this area and we'll have to abide by that decision. What Arrow is doing is what any company would do in trying to develop its business and we are using the proper processes and methods to do that. I understand about Toowoomba Regional Council and understand that Mayor Elect Antonio has voiced the concerns of the community. That's what we are trying to address with this process today and in other ways.

184. Can you tell me the extent of the intended buffer along the river?

The buffer along the river is dictated by the environmental sensitivity that DERM has set for water courses. You will find in the EIS that it's 100 metres and also limits petroleum activities of certain types. It doesn't exclude them so you can still run pipelines across rivers etc. but it does limit production facilities and other infrastructure.

185. You told us how much water you are going to suck out of the Walloons, can you tell us how much salt you are going to bring up?

We have made some estimates in the EIS; I can't recall the figure right off the top of my head but you can see there's a water balance in the EIS which shows peak and average production from the field in totality. Then it shows how that breaks down into water to be treated or the remaining salt content. The salt might go to a registered and regulated landfill facility but it won't be buried out here or it could go to a facility for what we call 'selected salt precipitation' where it converts brine into soda ash or sodium chloride (NaCl) for industrial uses or chemical manufacturing. That water balance is in the EIS and indicates how it breaks down in tonnes over the life of the project.

186. How much?

The EIS assumes the salt waste will be trucked to Swanbank and buried as landfill. Using the figures of an assumed 4.5 tonnes per megalitre of produced water and assuming an average of 22 gigalitres and a maximum of 43 gigalitres, it's somewhere between 90,000 and 190,000 tonnes of salt going to Swanbank to be buried.

I have spoken with Bryan about this map here. It's not the map that's in the EIS, so we'll go with the EIS one. It shows a red area to the east of Cecil Plains in PL258. It

doesn't have white for the rest of the area in Cecil Plains; it's a nice peachy colour. When the EIS talks about the mitigation and management protocols for agricultural change, it talks about the Intensively Farmed Land Committee and the Community Reference Group as being part of that management and mitigation process.

I went onto Arrow's website last night to see what I could find out and there were minutes of those meetings on that website. I noticed that the last meetings posted for the IFL Committee were April 2011. The other one is a little bit more current, I think it's February 2012, but there has been a meeting since then so my question is could the missing minutes from those committee meetings be placed on the website as soon as possible so that we can scrutinise them as part of our submission process please?

We can do that.

187. **On a personal level I'd like to ask the Arrow employees what commitment they have, have they signed a 20 year contract to be with Arrow? When we let you on to our land it's a lifetime commitment.**

No we are employees; it's not a long term contact. Next year the final investment decision takes place; if for whatever reason the company decides not to proceed it wouldn't want a whole lot of employees hanging around for the next 20 years just doing nothing.

188. **I think the point is, Tony, you are asking us to sign a lifetime commitment but you are not willing to sign.**

What I'm saying is that we can't.

189. **Sorry we can't either...we don't want you here.**

CHINCHILLA

Date:	2 May 2012	
Venue:	Bulldog Park, Chinchilla	
Presenters:	Tony Knight, Vice-President Exploration	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert , Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **Tony, how many joules are there in a petajoule?**

   It's a number like 10^{15}.

2. **As you know, I went to the session yesterday and I've a few more questions today. There's one about stormwater and contaminants running off disturbed areas and into watercourses and waterways, or even out into the melon hole country into surface water. I've got about six questions here, so I'll go through them one at a time.**

   I'd like a hundred per cent guarantee that you will not let any contaminants or stormwater run-off any disturbed area into any watercourses or any water.

   So stormwater run-off?

3. **Yes, from any disturbed area into any water - that includes well sites and roads but mainly from well sites...and that includes sumps and whatever.**

   As you know it's regulated through the environmental authority and you will have seen quite a few mitigation measures presented in the EIS. We are not allowed any run-off from any water contaminated by petroleum facilities or activities which means any disturbance we create needs to have sediment and erosion control structures to minimise any run-off.

4. **Including bunding?**

   Yes, bunding and the like to make sure it doesn't occur. That's something which at the moment is a very big focus of the environment department; it's doing a lot of audits around operations at the moment to make sure there is no run-off. It's a very important issue and we do recognise it.

5. **Okay now...pits and drilling. I know you say you've got this pitless drilling but that's not the case at the moment. I think there are others in the room here who will back me up on the fact that you do use pits when you're drilling and that's been a big concern for quite a number of years. It's not necessary; it should all go into containers. It should not go on the ground at any place so that it can flow into any water.**

   Yes, that's why we're moving to pitless drilling so we'd agree there's an industry change occurring.

6. **Yes, but you're doing it at the moment.**

Yes.

7. **You're using pits at the moment.**

   Yes but we're trialling pitless drilling now. There's a…

8. **Well, why are you still using pits?**

   It's because we're still trialling the pitless technology. There are a number of parts to it and we've got to make sure they work properly, then we'll move across to…

9. **But why can't you put it into containers? Why do you have to put it into pits in the ground?**

   That's just been the practice for many, many years.

10. **But why hasn't it changed?**

    It is changing. That's what I'm saying; it is changing and we're in the change process now.

11. **It should have changed already. I brought this up 18 months ago.**

    Yes I'd say we've been working on this now for a year.

12. **You know there's no need for it. You should be putting it into containers and taking it away.**

    I'm saying that we are in the process of doing that now.

13. **Taking water from creeks and dams, what's your policy on that?**

    You mean for construction?

14. **For drilling...any water from creeks or dams, for that matter.**

    What we do is that we source our water from people with entitlements. So we don't just pull up at a creek or a dam or whatever and just take the water. There has to be a formal process in place, and there is a legislative framework within which we work.

15. **I think there are people in this room here who'll back me up and say Arrow you've been taking water out of creeks where you have no entitlement.**

    I don't believe that's the case; we're not allowed to. Also, I know most of your experience is not necessarily with Arrow.

16. **I beg your pardon?**

    Locally, most of the experience isn't with Arrow but there is a process in place…

17. **In this instance I'm talking about Arrow. It's drilling up Ryalls Road above the mine and has been pumping water out of the creeks.**

    There are a couple of areas we've taken water like that but we have a water allocation or a permit from government to do so.

Comment - Well, you didn't have it in this case, and there are others in the room here that'll back it up.

18. Bio-security and washdowns, what's your practice on that?

Again we have a procedure in place where vehicles have to be washed down and there's a declaration certificate that goes with it. So if vehicles are going from one area to another and there's potential to transport any weed seeds or other pests, then the vehicles must have a washdown. There are specific obligations based on landholder agreements as well which can dictate when those washdowns must occur. So we have a very, very strong procedure in place at the moment.

19. And who does those washdowns?

They can done either by Arrow staff who are experienced in doing it or they can be done by a third party, but generally they're done internally.

20. Well, do you realise that unless those certificates or whatever you write out are done by somebody who is accredited to write them out, it is not legal for those vehicles to come onto a property? In my case, I nominate the person who will wash down your vehicles and I have to have a certificate from that person every time your vehicle comes onto my property. Every time it leaves, it'll be deemed dirty.

That's not actually how it works; there isn't actually an accredited…

21. Well, that's how it is.

Well, actually there's not…

22. Because you're coming onto our land you have to abide by our rules, not yours. I've checked this out and it's got to be done by an accredited person who has to sign a statutory declaration to say the vehicle has been washed down thoroughly.

In terms of the accredited wash down you've referred to, there isn't actually a process to accredit people for a washdown. There is no recognised third party provider which is certified or accredited to provide that service. It's done by a person who is trained and experienced in doing that sort of work and they must sign the statutory declaration. The people we have doing that work are more than capable of signing a statutory declaration which carries as much weight as having somebody external do it who may not in fact be qualified.

23. Have they been trained first?

Yes, they will have been trained.

We have used third parties where they've been nominated and that comes down to what's been agreed with the landholder as the landholder can dictate when, what, where and how things are done on the property.

24. Righto. Soil-borne stock diseases...what procedures do you have to mitigate the possible transport of those diseases from one property to another?

It's the same process we have for the washdown and it also applies when we're bringing in our loads of gravel, soil or other construction materials; they have to be certified or declared as being clean, so it's the same process, the same procedure.

25. Yes, but what I mean is that if you go onto one property and then come from there onto mine, how do I know that you haven't been in contact with some soil-borne diseases?

Again we have to disclose that to you so you need to have that declaration provided. Every time we enter your property you will receive that declaration. That's the process we have in place.

26. Now another issue which I think is a pretty valid one, and there are a lot of other people around here with the same opinion now, is before any of your employees or anybody can come on my property I want to see a police check on all those employees plus a blue card before they come onto my property. Have you done anything in the past about that?

We haven't, but we'll take that one as a statement.

27. That'd be a stipulation if you were to come onto my property i.e. all your employees, including you, would have to have a police check. I'll leave it at that.

But there's another thing that I'll bring up now. National Vendor Declarations (NVDs) and chemicals...what do you do to protect stock from possible contamination when you come onto a person's grazing property?

You're worried about the chemicals we might bring on? That cattle might eat them or they get sprayed?

28. Well, they could be spilt on anything, and then the cattle lick the ground.

There are a whole lot of processes we have in place to select the chemicals we use in the first place to make sure wherever possible that they aren't toxic, that they're managed properly when they're transported and stored onsite, and when they're used. If they are spilt, there's a clean-up process. At all times we look after the products we use.

29. Yes but have they been approved by the DPI?

We'll provide a Material Safety Data Sheet (MSDS) for any chemical we use. It will depend on what chemical you're talking about.

30. No, but have they been approved by the DPI?

Well, it'll be specific to the ones we're talking about.

31. Does that mean any chemicals you bring onto the property?

We can look at what chemicals we use. I'm not sure what the DPI process is.

Additional information: any chemicals Arrow brought on to a property would only be used for purposes related to petroleum activities, and be carefully managed. DPI is not the relevant

regulatory authority, everything we do is managed in accordance with our environmental authority and Environmental Management Plans.

32. Well, you're coming onto our property...

I do understand.

33. When we sell stock we have to sign a statutory declaration that there's no chemical contamination. You're supposed to give us a full list of all the chemicals you might bring onto our properties. We then have to send it to DPI to get it verified as to whether it can be brought onto our property or not.

What we do is provide the landholder with a copy of all the material safety data sheets for any chemicals we use. All the information about those chemicals is provided to the landholder; that's a requirement and it will be done.

34. It's no use your wanting to come on today and presenting me with a certificate today.

No, that's done at the initial stage when we come and talk to you and go through the arrangements for the compensation agreement. We have all that dialogue very early with you so that you're clear about our future activities and what we bring on site – that's an important process.

35. But it's got to be on a daily basis. Whatever vehicle comes on that day, you've got to know what chemicals are brought with it.

Yes, and we will have that dialogue with you about the specific arrangements you can have with us about how we enter and operate on your property.

36. The earlier person was talking about the statutory declaration. That's a declaration we have to sign when we sell our stock guaranteeing that it is free of any chemical contamination. If we can't supply that then it could be cause for anyone who buys our stock to have them destroyed or rejected for the food chain; then we also have to assume liability for any losses those people incur. The worst case scenario is that I sell a beast contaminated with lead or something like that; it's then found in a container of beef in Japan. The Japanese go crazy about it, refuse to pay Teys for the container of beef and then if Teys can trace it back to me I'm sued because I put a contaminated beast in the container. So we assume legal liability in a statutory declaration form for the clean, green health of the stock that we produce which is the context in which the earlier question was raised.

I understand that...

37. We have a serious legal liability...it could put the whole beef industry out of business overnight.

We recognise that. It's something we're aware of.

38. I'll deal with that more perhaps in the agricultural section this afternoon. A question I'd like to address to Tony is about the final investment decision (FID) which is not until the end of 2013. I've noticed that because the spot price of gas is down to $2 a megajoule, there are rock bottom prices in the gas industry as a result of

overproduction worldwide. *The Australian* on the weekend said that QGC is considering not building one of the trains in Gladstone because ConocoPhillips wants to exploit excess gas production in the US as the spot price is down to $2 a megajoule. I've worked out that your reserves are still only worth a measly 16 thousand million dollars even at $2 a megajoule. Given increasing world production will this ongoing low spot price for gas have an impact on your FID?

No, not at all. That's why I pointed out earlier all the gas we produce has effectively been sold to our parent companies, Shell and PetroChina, so we're not trying to sell on the open market. Our gas sales and pricing are secure and independent from the spot market.

I'm sure the shareholders in PetroChina would feel much more secure.

39. **A point that I'd like to bring to your attention was my impression yesterday that there were still a lot of unanswered questions for those people at Cecil Plains and yet you've been dealing with them longer than you've been dealing with any of these other groups. In fact there are still a lot of unresolved issues across Australia given that 8,000 people rallied in Sydney yesterday expressing their concerns about CSG in New South Wales. I just make that as a comment to give context to this meeting today in that while you're doing your best to allay our fears not all the issues have been resolved.**

Just a word of response, we're here to try to give you more information which is the process we've been following for a number of years and it's not over yet. So yes, we're not saying we have all the answers today but we'll roll those out over time.

40. **I'm out Burncluith way? One of my properties is under your tenement; luckily my other two are not. Last year we had somebody who was contracted by the Queensland Government come out checking the bores in the Burncluith Pelican area. They wanted to test their depth, their drawdown and their flow, and this was all to do with the aquifers you CSG people take water from. Bores in our area have dried out in the past but they were probably in confined aquifers. There were 16 years of dry weather when the creeks were not running properly; that's why they went dry.**

The Great Artesian Basin goes right up into the Gulf of Carpentaria and some people say they're probably filled from the rivers of New Guinea...who knows? The government contractor told me that to claim any compensation I have to be testing my water every week? I spent $30,000 putting a bore down and you're not going to drill in this area until 2020. Who's going to pay my costs to check my bore every week? I've got enough things to do without checking the flow and checking whether it's drawn down. I've got enough work to do but apparently I have to do that to claim compensation. I think that's quite unfair because the bore is 20 minutes' drive away. It's an hour a week I'd be spending, then the time to test my bore for something that might or might not happen.

Somebody was issued a big licence down near the Condamine River and we had to put two more lengths of pipe down because my drawdown went from six lengths to eight, and this is years ago when somebody put a bore in for a feedlot. That bore was put in really before records began; it's been drawing at six lengths of pipe, now we're down to eight, and that happened after somebody got a licence. I'm just trying to

work out how am I going to get compensated for doing all this when it might be for nothing?

You don't have an obligation to check your bore every week. When you talk about compensation, I assume you're referring to the make good provisions of the *Water Act* which say that if there is an impact Arrow is liable to make good. We don't rely on you checking your bore every week. In the area we're talking about, the Surat Cumulative Management Area managed by the Queensland Water Commission (QWC), it is modelling the impacts it predicts will be in that area.

For a consolidated aquifer like the one you referred to, if the Commission predicts there'll be a drawdown of five metres or more we need to come and talk to you to make sure that we've had the discussions around make good and what the potential options may be for us to provide water to you should you be affected. Those discussions become an agreement that is locked in place well before you should experience any of those impacts. We also have our own groundwater monitoring programs in our testing regime which will be in place for the sole purpose of detecting any changes as they occur. The expectation isn't for you to do that and you shouldn't have to do that to be claiming compensation. It's not how the framework works, the important thing is the baseline that's established and the predictions that are made will be used for that.

41. Yes, well I guess the biggest problem is if it's you taking the water or somebody else? My bore is eight kilometres east of your tenement so who will be liable if it is affected?

Regardless of whether it's on our tenure or not, we still have the same obligation as it's not constrained by the boundaries of the tenure. If we impact on your bore and it's not on our lease, we still have the same legal obligation; the same agreements will be put in place.

42. I'm just trying to work out how. So if my bore drops, I come to you and say 'you've taken my water'. Do you understand what I mean?

We shouldn't get to the point where you experience that without having us come and see you first but if you do experience something like that, yes, you should come and see us. You can report it to us, report it to the environment department or report it to the QWC. Whichever channel you decide to go to, it will come back to us and then we will do what we need to do to make sure that we engage with you and we rectify anything for which we have responsibility.

43. So the process is that if I have to go down more lengths of pipe into the aquifer, then I go to Toowoomba and see the water fellows, and they look into it – is that how we do it?

You can do that although if it's due to us you can deal directly with us and the cost of deepening your bore or pump will be a cost to Arrow. That's how the framework works and that's what the agreement will also say.

44. So what those men were telling me last year was incorrect?

A lot of the guys are technical operational guys who don't really deal with the legislative framework. It's probably fair to say that it's often hard for them to understand the detail and

how it works but in fact it does work this way and there are some government fact sheets here which will outline what I've told you.

45. The reason why I was concerned is we're eight kilometres out of your tenure and I couldn't see how I could prove anybody took anything. I mean, I have trouble proving who took my stock if they disappear and they're a visible thing.

That's all got to be figured out, so we'd have to investigate the cause. I think you mentioned that a feedlot put in a deep bore and took water which impacted your bore. We need to understand the local impacts and if we've caused it. If we did, then it's our problem but if it's a situation like the feedlot then obviously that's not something we can fix.

46. But that happened 20-odd years ago?

Arrow would investigate it to develop an understanding into what's going on.

47. And it's stayed at that level of eight lengths now for the last 20-odd years.

But I think that should be good news, you don't have to make those three trips every week.

48. So everything inside that five metre line which is the red line there triggers make good provisions? (see Figure 5 on page 7)

Absolutely.

49. And as you go inside that line to where it changes in colour to a lighter blue, you were saying the biggest drawdown is 120...

The prediction I think was around 130.

50. So the point you guys are trying to sell is that unlike some other CSG companies who are happy to wait until 2065 before there's remediation by natural methods, you're investigating procedures whereby you can reinject or whatever and bring forward the restoration of the water levels in those areas back to something more acceptable. Is that the point you're trying to make?

That's right, what we'd like to get to is a process where we can minimise unacceptable impacts. I mean it's an extractive industry, so there can't be a situation where there's no impact, but Arrow's aim is to say what it can do with this water to reach a position where it's not an unacceptable impact.

51. How are you going to make good for all those bores?

That's a process we're working on now. We've taken the output from this model and done another iteration of it by adding complexity to the model to try to refine our predictions while we're doing this work. We look at the DERM bore database for the Walloon Coal Measures to see how many bores are recorded in the database and try to get a handle on how many bores there are in that area. Then we work out when those impacts appear; there are bores towards the east, then further west and getting a bit deeper. They have different distances from the primary impact area so the question becomes when do we think those bore levels will drop? What make good measures can we put in place? In the short term that becomes a question of do we pipe water to those people when their water level drops?

We treat the water we're pulling out of the ground by putting it through a reverse osmosis (RO) treatment plant to maximise the amount of usable water we can put back. The question then becomes does that go back as an injection into the deep aquifers e.g. the Precipice, and do we drill a bore to that aquifer where we've put the water or do we put it into other aquifers sitting above like the Springbok.

We're currently working on the first lot of injection trials on the Precipice. There's a raft of measures from piping water to someone deepening their bore. If they're in an area close to this five metre contour, maybe it's a case of just deepening the pump.

52. Where does that area extend from? What towns are we talking about?

We've got Wandoan up here in the North.

53. Yes but the northern extremity and the southern extremity, what towns are they?

Millmerran and Wandoan.

54. And how far west would that be?

You've got Roma out here and I think Miles, Chinchilla and Dalby.

55. You see I have a nice little bore in there which flows at 9,000 litres an hour. It's perfect water, 33 degrees, perfect to shower in. Even Clive Palmer would use it for his very expensive scotch. And I'd hate to think that you couldn't make good.

Me too.

56. I would be very cranky.

I can understand that.

57. In twenty years' time, when all your bores are developed the water you're pumping out around Miles and Chinchilla could be affecting those people down at Millmerran, lowering their water table so the water you pump out is really an entitlement of the Millmerran landholders who already have restricted irrigation licences.

The primary source of the water causing the drawdown here is in this area, and it's just due to the rate of ground water flow under the ground. The ground water moves fairly slowly so it isn't going to move from here to here in twenty years. If you're looking at the recharge beds here, and the rate of ground water movement from this side to the other side, we could be talking several hundred thousand years.

58. So the water around Miles is not connected to the water at Millmerran?

It's all part of the same aquifer but the rate of movement is such that if I was to put a bore down over here and move five kilometres away, and then start pumping I can have a cone of depression that's sucking water in here but it may not affect your bore. So while it's in the same aquifer, the radius of influence of a pumping well can only extend so far. The primary effect in this area is from the bores here. This is one of the things we looked at in the EIS where we tried to produce a worst case scenario as we try to narrow down our confines after that. As Tony was saying earlier, Arrow has relinquished ground down in the southern area,

and a lot of it is probably not going to be developed so the final area of impact will be reduced. We're trying to start off with the worst case and if we think we can balance it then we'll get more confidence as we move forward.

59. Is that the cumulative scenario?

Yes, it is.

60. It's scenario three, that's a relief. I was worried that it might have been just Arrow's impact and QGC and Origin would have been down to minus 500 feet or something. So the worst case scenario for the cumulative management model is 130 metres.

In our prediction, yes.

61. What's going to happen when the QWC comes out with its first report, will it have similar figures to this? Or don't you know?

We haven't seen its published report yet as it's not due for a couple of weeks. Arrow was in discussions with the Commission when it was preparing the report. As it's entitled to do under the Act, the QWC issued us a notice for most of the information we had like our model files, field data etc. The other CSG companies were given notices and provided information as well, so the QWC now has a model containing all that information and in a couple of weeks we'll see what its predictions are.

62. Does the QWC have sources of data other than what you people have used?

Yes it does. We squeezed all the publicly available databases and literature for as much as we could. We also had our own data but the other companies at that time had data we couldn't access. We now have data sharing agreements coming into place so we can share our data and build more refined models together. But yes, the QWC had more data for its model so whether it's the same or different, it will tell us a lot about how good these predictions are.

63. So you might have to revise those?

It's possible that in the supplementary EIS we will put in further modelling and more results. It'll be interesting to see what the QWC comes up with. When you look at these large models, there are probably areas of similarity because we have the same conceptualisation system. There may be areas where we have differences because there are different conceptualisations of the system but modelling is an iterative process where you learn from each model.

64. I live about 20km south of Miles and saw a coal company rep in my area. I asked him why he was there when it's all CSG. His response was that his coal company wouldn't be there for about thirty or forty years. I then asked him how he was going to get long wall coal when there was so much water there. His response was that there would be no water there when the gas was finished. That's what he said, there'll be no water because it will all be taken out. Who do we believe?

There's been a lot of confusion about dewatering versus depressurisation. When we were first out here some people thought the coals were going to be dried out; but you don't need

to dry out the coals to get the gas. It's like opening a carbonated water bottle, you reduce the pressure and the gas comes off. Because we're reducing pressure a lot of the water comes from the expansion of the water during that depressurisation. I can understand your confusion; you're getting different messages from different people.

65. What are make good clauses?

The QWC (or the part that's been working on CSG, which I think is going to be called the GasFields Commission) has responsibility for the Surat Cumulative Management Area which covers all the CSG operations in the Surat Basin, and the southern part of the Bowen Basin. The QWC has done its own independent modelling which is coming out in a couple of weeks. Under its remit from government it is responsible for producing what's called the *Underground Water Impact Report* which will produce maps similar to these – well we hope they'll be similar. They will produce maps of impacts in the aquifers and will identify which areas particular tenure holders or companies are responsible for. We'll be assigned an area including the bores in our tenures as well as outside them for which we have to make good if there are impacts.

The QWC's model will nominate potential impacts are and it will identify which company is responsible. If it's in our tenure then we will obviously have responsibility but if the impacts extend outside our tenure it will tell us which areas we also have responsibility for. We then have to put make good agreements in place prior to those impacts happening so the Report will give predictions for three years' time, and a peak impact at any time.

66. If you aren't within that area and experience a drop in water can you report that?

Yes certainly. If you experience a change in water level greater than the bore trigger thresholds, or a change in water quality (it's not just water level, it's water quality as well) and you think it's the local CSG company you can go to the QWC, report it and then it's the company's responsibility to show what's happened.

67. What will they do – go into the Hutton?

It depends, it's a complex intermix of answers. There isn't a single answer for any single bore because we have very shallow bores in the Condamine in some areas, bores a hundred or two hundred metres deep in the East, in the sandstones, and in some of the coal measures down to 900 to 1,000m deep like in the Hutton and Precipice bores.

In terms of making good, if you're in the Hutton and Precipice, and you've a bore that has an 800 or 900m water column in it because it's so deep; if that water level drops by 50-75 metres over a couple of decades we'd have a make good agreement in place that says we will put a new pump at a deeper level or we'll extend your pump down to make sure that you get the same flow rate coming out of that aquifer.

68. I've had a ten metre drop already.

If you've had that sort of drop already and you're on an Arrow tenure you can come directly to us, QWC or DERM. We can start putting make good agreements in place and deal with the issue before it gets even worse if we are the source. If you have experienced a drop in water level already, you don't have to wait for the QWC Report. At a minimum if I were you, I'd ring the QWC and tell them what has happened. Are you on Arrow tenure?

69. One half of my land is on Arrow and the other half is on Origin.

And the bore's on which one?

70. Arrow.

If it's on Arrow tenure, we can talk to you afterwards.

71. If that bore gets contaminated, or in the worst case scenario if those aquifers get contaminated, how are you going to provide water for stock in those areas in the middle of summer before they start dying? You've probably only got four or five hours before those animals start dying. Who's going to take responsibility for that? You could have thousands of cattle die in the middle of summer in a matter of hours because of a contamination.

That's where the whole adaptive management framework comes in because, as you saw, ground water moves slowly, so we see impacts coming through from aquifers leaking. If you say it's an issue of one aquifer leaking into another and becoming more salty, that's a process that is going to take decades. So we predict the rate at which that's going to happen and have monitoring in place so that it's not just a case of waiting for people's bores to change water quality or level and then responding to it. It's a case of establishing monitoring systems early so they're almost like sentry systems. They start closest to where you are and move out so you can see the impacts coming in. You can see if they are following the desired trends i.e. are the mitigation measures working? You can see those things coming so you are actually ahead of the game. You don't want to be in a position where you are not looking for these things.

72. What about what happened up near Kingaroy?

That's underground coal gasification which is a different process from CSG.

73. Those people didn't have any water.

It's a different process where they're injecting oxygen down into the coal, combusting it underground and then withdrawing the gases they want from the underground coal gasification.

74. St John, is there any estimate (perhaps for 2020) how many farm, domestic, stock and irrigation wells within the five metre drawdown range will come on line needing make good provisions? How many farms are likely to be affected? On your predictions you say we're going to go below the five metres in three years' time. Can people put their hands up now because we believe 5,000 farm wells will need make good action in the next three years; we'd like you to get to ours first. I can see people lining up as it could be a massive logistical operation if there are going to be 5,000 farms in any particular year needing make good provisions. Do you have any idea how many farms per year are going to come online needing make good provisions?

The first data we'll be working on for that will be QWC's predictions in two weeks; its *Underground Water Impact Report* will produce impact predictions telling us those bores which might be affected in three years' time. That's the data we'll work from. We've been doing model refinements, looking at landholder bores and divvying them up into aquifers.

We're still working through that so I can't give you a number but we know we're going to get that from QWC in a couple of weeks. We're running through the available databases on the bores and seeing which ones are in the footprint of a particular aquifer. We then have to go through and check those bores against whether they really are in that aquifer, because one of the things we've found with the database is that about 25% of the data is really good, you can pick a bore and it will have all the details telling you exactly where it is. With other bores, you might get the depth of the bore and that's it; it doesn't tell you anything about where it is. We've had to go through the data several times to hone in on the actual number in a particular aquifer.

75. Would you recommend applying for make good provisions right from the start in terms of business opportunities?

Well if we're looking at make good options which include drilling new wells, deepening bores, deepening pumps, it might be a good time to buy a few shares in those companies.

76. Could be a growth industry!

It could be.

77. Do the Walloons have a recharge area?

Yes…

78. Where does it recharge? You're taking the water out of it; is it going to end up like the fellow over here said, there'll be no water left and you can get the coal out of it afterwards. I'm a bit inclined to think that way.

It's not the case that there'll be no water in it; the field development plans require a pressure that brings the water down to just above the top of the coal. The predictions indicate there will be water in the Walloons although will that water pressure up near the surface be lowered. There are a number of outcrop and sub crop areas of the Walloon Coal Measures (generally on the eastern side of the Condamine in areas that have been dissected) so those are recharge areas for the Walloons and probably significant ones as it is rainfall recharge. We know there is the connection between the Condamine Alluvium and the Walloons because if you look at the water levels in the Condamine and the Walloons you can see areas along the length of the Condamine where the water levels are higher than in the Walloons which suggests water is recharging down into the Walloons. In other areas the Walloon pressure is higher than the Condamine so that won't be such a large recharge area.

Those are probably the two main recharge areas. We've made estimates in our model of recharge rates but we're refining those in our further modelling. We started off with four or five recharge areas in the EIS model; we're refining those to give us better predictions.

79. I have a question about what you classify as recharge. In this area around Pelican and Burncluith it takes anything up to five years for that creek water to get down into the aquifers. I don't know how you come to these judgements about Condamine and the likes because it's just not accurate. I don't know why you tell people these things when they're just not true? With the ground water in this area it takes about five years from Charlie's Creek, Rocky Creek and the like. That's the estimate so I don't know where you get your information from.

You're talking about deep drainage recharge?

80. Yes recharge.

There's some deep drainage recharge through the clays; in other areas where it's more alluvial and permeable the recharge is faster. That was one of the interesting things we saw from looking at the response to the Condamine in the 2010/2011 floods; the data from that showed an average 1.8 metre increase in water levels across the Condamine. That's not the only recharge; obviously you're right in relation to those clay areas, that deep drainage process takes a long time, tens of years. I think it was the CSIRO Sustainability Model of the Condamine, or the KCB one, that used a structure in the Condamine of sheet wash and alluvium to model those recharge rates.

Clarification: in sandy permeable areas recharge can be relatively fast (in groundwater terms), in clay areas deep drainage recharge occurs slowly over years. However, as its ongoing recharge is still occurring i.e. infiltration from five to ten years ago may be seeping through clays to groundwater now. Current infiltration will take years to travel through, while recharge is still ongoing at varying rates.

The KCB water balance assessment of the Condamine Alluvium undertaken for the Qld Government estimated recharge in the Condamine as:

- *Recharge of 2.5-5.1 ML/annum/Km2 via Streambed Recharge*
- *Recharge of 0.3 ML/annum/Km2 via Rainfall Recharge*
- *Recharge of 0.1 ML/annum/Km2 from irrigation deep drainage recharge indicating the relative amount of recharge via different mechanisms.*

The recharge system is complex and not yet fully known in intimate detail e.g. factors such as the amount of recharge that gets to the shallow aquifer and the time lag between infiltration and recharge reaching the water table and the variability of this throughout the Condamine between alluvial tributary, sheetwash and alluvial areas. And the appropriateness of scaling from testing at point locations to extrapolation across large areas requires consideration. Arrow is undertaking monitoring at both detailed scale and through broad geochemical assessment to understand these issues.

81. My question is in regards to bacteria in the aquifers. I asked about this previously and you said there are bacteria in there, which I knew previously anyway. I'm trying to find out what species it is, and is it controllable by antibiotics? And if something that's been down there for hundreds of thousands of years, what effect will it have if it comes up?

My understanding of what quality testing has been done is in relation to Sulphate Reducing Bacteria (SRBs) and micro-organisms that will potentially affect infrastructure e.g. pipes.

82. So there's no effect on live stock or humans or anything like that?

They will be removed 100% through the water treatment process.

83. Can you guarantee that? Because we can't trust mining companies.

Yes, I can. They will be 100% removed through the reverse osmosis (RO) process.

Right, I'll take your word for it for the time being.

84. Can you guarantee that all bacteria will be removed by the RO membranes you use?

Yes that's correct.

85. No exceptions?

Only if there's an integrity issue with the membranes which we'll pick up on very quickly and shut it down.

86. So if there's going to be an RO plant built and water reinjected with added minerals and salts to bring it back to what was originally taken out, what's going to happen to the brine that comes out of the RO process? This seems to be an ongoing question to which I haven't received an answer.

Currently there's an enormous amount of work going on in relation to brine disposal and management. The current base case will be *selective salt precipitation*, so we'll be producing a sodium chloride product. That is still in the options phase so it has yet to be determined, but the base case is to produce a viable product.

The EIS presents a couple of options. It says that our base case in the EIS for the brine is disposal to a land fill. And when we say land fill, we're not talking about land fill in the dams where it is, we're talking about taking the salt and removing it to a waste facility independently regulated by the Queensland Government.

The salt precipitation is about looking for a beneficial re-use for the salt so it's about considering how we can make it into a resource whether it's salt precipitation for chemical manufacture or whether it's common table salt, they're the options we're looking at.

87. I asked about that subject last time. Your EIS says that Arrow alone is producing 25 gigalitres (with all the other proponents, that's 125 gigalitres) but Arrow's water alone is estimated to produce between 90,000 and 190,000 tonnes of salt a year. Is that correct?

Yes that's correct.

88. That's 90,000 to 190,000 tonnes of crystalline salts. And it's not all Sodium Chloride (NaCl) as you know because there's sodium, chlorine, bicarbonate, magnesium, etc. It is a mixture of salts, not just sodium chloride. So let's say the figure is about 140,000 tonnes on average. I estimate that is 3000 B-doubles of salt to be transported to a landfill from Arrow's operation alone. So if you want to extrapolate that to all the proponents, you're probably looking at five times that, so 15,000 B-doubles carting salt to landfills. Now if that doesn't cause an impact on roads, I'm not here. It's a massive issue that has not been resolved. People have been finding beneficial uses for this stuff ever since I've been involved in the debate and I don't think they're any closer. I would like to know, in the absence of a plant, even if you do get a beneficial use, how's this stuff going to be carted out of here on these roads. You take your life in your hands at the moment, Tony, on these roads. In fact people think twice about

driving to Brisbane. I'm a great Reds rugby supporter and I used to go down there regularly. Now I think twice about the hassle of driving down and back because the traffic is impossible and you take your life in your hands, you really do. It is not only impacting on the roads, it's starting to impact on our lifestyle as to when and how often we want to travel. It's a real issue, it just adds to the stress, I can tell you.

There are a few issues you touched on. Don't be under the misapprehension we don't understand the significance of the salt and brine issue. As Brad's outlined, there's a lot of work going on. Our preferred solution is to make use of that salt and create another product from it but the important thing is that we are working towards a solution on that front.

You also talked about roads, transport and access which, as you know, is a separate topic but I do see how they link together in terms of transport, not just salt, in this particular case because there are pipes and other equipment to move as well. That's part of the studies we are doing on the roads and across the region. It's not just us, the government's conscious of this too. I want to be clear we haven't overlooked the salt issue. It's not new, there's a lot of work going on. The numbers are large, but everything about this project is large. The scale is huge but the solutions, the investment and the work we're doing are also huge. We believe we're a match for this challenge that we have. It appears overwhelming but it's not.

(See Figure 6 on page 8) The roads marked in red are those carrying the biggest volumes of traffic. The traffic study looked at the composition of the traffic and it that basically breaks down into light and heavy vehicles. The heavy trucks carrying equipment and pipes would be the ones you are concerned about. But they include trucks carrying the salt because they were identified as a large traffic load.

There was a set of calculations done based on the worst-case production of brine and salt, using no salt precipitations (as using selective salt precipitation reduces the volume considerably). We assumed worst-case where the ponds have to be dug out and the salt carried away to a registered landfill somewhere else. The assumption was that that landfill was at Swanbank, near Ipswich. It doesn't all happen at once, those ponds are designed to carry the volume for quite a long time. So retiring those ponds begins to occur around ten years before the end of a facility, and progressively from there on. When you look at the profile of the traffic it amounts to about four to six B-double movements a day when Arrow starts to clear out those ponds and takes the salt to a registered landfill. It's not thousands of trucks, it's in the order of hundreds over a year based on the volume of salt, what a B-double can carry and the period of time over which it needs to be moved. When you consider that the production facilities are spread out over the whole project area, and come online progressively over the 30 years or at least over the first 15 years as they ramp up to full production. They are then progressively retired as the ponds reach capacity and that will happen over a long period of time. We won't get to a point where we suddenly have to clean out all the ponds, so the volume of traffic will be spread over 10-15 years. That 190,000 is across the whole project, it's not per facility. When you consider it's a lesser volume and from parts of the project development area at different times, the equation we worked out gives four to six truck movements per day when Arrow begins to clean out those ponds.

89. So that's just Arrow?

Yes but if you say a similar scenario exists for the other players in the region, then it will be four times that so it might go up to 16 to 24 trucks a day.

90. A few years ago we were told there wouldn't be any more of these evaporation ponds.

They're not evaporation ponds.

91. No they're transfer dams, it's the same thing.

They are…

92. You've only changed the name. They're the same thing.

No they're not. Evaporation ponds are where you put the water, the produced water, and then you let it evaporate and it leaves the salt.

93. Do you put covers over all those dams?

This is a concentrate, a heavy solution. It's the brine concentrate from the RO plant so it will solidify in the base of the pond progressively.

94. What about the ponds holding the water before it goes into the RO plant?

You're raising the issue about whether they're aggregation or evaporation dams. There will be natural losses through evaporation, you can't avoid that, but we won't be covering the dams. In all our fields the water will be gathered, sent to a central processing facility where there'll be the feed water dam, the treated water dam and the brine stream. That's the way they'll be managed, they won't be evaporation dams. We're in the process now of installing new infrastructure on the way to making that happen.

As you pointed out earlier, the issue then is what is the cumulative effect across all the projects? That's what this list of roads down the bottom is. We did an assessment of the Arrow effect and then we looked at what the other projects would do to the road network. Where you see the red lines on that map is where the traffic is going to become concentrated as a consequence of Arrow's development. You are more familiar with the local road network than I am but I think you'll find most of the roads highlighted there are listed because of the cumulative effect. These are the roads that are going to experience localised congestion and an increase in traffic as a consequence of all the projects. The reason for identifying those roads through the study is because they are the roads which are now the focus of the cumulative assessment with the Department of Transport and Main Roads (DTMR) as to what has to be done over the next ten to twenty years to make sure these roads don't reach a point where you can't operate your business as well.

95. How come the Warrego Highway isn't in red on the map?

That's because it's the Arrow only scenario there on the right *(See Figure 6 on page 8)*. I apologise I don't have a map here for the cumulative solution. The reason it's not in red is that Arrow's traffic, because of the project's development, is distributed off earlier. Arrow's development is down the bottom here in the Tipton area and as you've seen in the diagrams Tony put up earlier, a lot of the early development is around moving out from Tipton and Kogan and those areas. So the traffic is turning off at Dalby and heading south west, it's not running to the north. It's only when traffic goes to the north-west, up into the Chinchilla,

Miles, Wandoan area, that you start to see congestion on those roads, or increased traffic as a result of Arrow's activities. But as you know, QGC, Santos and Origin are operating here now and they're creating traffic issues at present which (as it shows in the bottom) will be contributed to by Arrow. These roads are the ones expected to experience the greatest increase in traffic, and therefore issues around safety as well.

96. I'm a third-generation family farmer. I only own 1,000 acres, but it's in 25 paddocks and well-watered. It's predominantly Brigalow to Brigalow melon holes. I want to follow up a couple of things brought up earlier about National Vendor Declarations (NVDs) for stock and vehicle washdowns. You can wash a vehicle down here and you can do a good job. You can get a certificate and come out to my place. But the tyre grooves can have sand burr by the time you get onto my place. The running boards could also pick up African love grass from along the highway. If you now come onto my place I can get those two weeds. With all this well development, it appears you'll have a gravel road linking your wells?

Quite likely, but can I answer some of those other issues before you keep going?

97. Yes.

In relation to coming onto your property, there will be one-on-one arrangements with each landholder. In many cases that will also involve us leaving our vehicles outside the gate and using clean vehicles you're happy with just for traversing the property. Part of our policy is that any time we do leave a sealed road e.g. we've gone onto dirt roads and areas where you can pick up weeds, a wash down is required. But there is the option also to use only clean vehicles that are used only on your site. Those vehicles don't leave the site until it's time to go again.

98. So you've got an employee in a four wheel drive running a trap line once a week to check the wells. Is he going to have a portable wash down to come onto my place, then a portable wash down to go into the neighbour's and then a portable wash down to come back into my place before he leaves?

It wouldn't work like that. Obviously there wouldn't be a truck with a portable wash-down following them around when they're just going in to check on wells. What they need to ensure is that their vehicles are clean each and every time they enter, and they need to give you that certification. So they may not go directly from one property to the next. It's a matter of what they're doing that day, how they plan it out, and how they manage it. Those arrangements have to be in place and they're agreed with you as the landholder. There is a statutory process to go through which they have to demonstrate they've met.

99. You've got your heavy trucks and you're building a gravel road to connect your well heads. That truck is ten kilometres up the road. You get your load of gravel from the pit, it comes down a public road with African love grass on it. It comes into my place and it dumps the load, and it goes again?

As I said earlier, if that's the case we need to put some management practices in place to manage that field properly. That's the sort of thing you'll be talking about with the land liaison officers early on in relation to our proposed activities and how we go about them, and appropriate mechanisms we put in place to make sure you're protected. It's our obligation.

100. I think that's a lot of bull. I cannot see any way it'll work. We've got resource companies working in our area now, and it is a joke. It looks terribly good on paper, right? But it's a joke when it comes to keeping my place, a third-generation place, weed-free. It is nothing but a joke.

What we aim is not to expose your property to any greater exposure than you have currently. If you drive on that public road between that place and your place, and it's not an issue for your vehicle then we would treat it as the same. Where it is an issue, we will treat it differently. We've also been talking to DERM about the procedures we have in place, and it has confirmed Arrow is the only company with the extent of such procedures in place. The processes are robust and Arrow has and will implement them, we're very committed to doing that. We can't afford to infest your place.

The EIS does mention that if we introduce pests we must remove them from the property. That's already in place now as it was before the EIS because it's our obligation to do so.

101. So you'll get them off my property at your cost.

If we introduce them, yes. We absolutely have to.

102. Now we come to the NVDs. I've been to a stack of meetings, and we can't get any guarantee where we are with this National Vendor Declaration for stock. If you go back to Kingaroy, fair enough the government shut down the plant and all the rest of it. I do believe the stock was looked after. But wasn't the poor landowner tied up for about three months while the company, DERM and DPI fought it out? In other words, they were sitting with stock they wanted to sell but were landed with them.

We did talk about that one earlier. Underground coal gasification is a very different industry and contamination potential is very different to CSG. Arrow has recognised this issue and has had experience in it. We've had one landowner who was concerned his stock were exposed to contaminants from a drilling mud pond. We undertook to have those animals tested, we did that, and there was no issue. But we absolutely acknowledge this is a very important issue, not just for stock, but also for organic farmers who need to maintain their status so there is a whole range of things that needs to be considered and protected.

103. If you test the animals and they're contaminated with your chemicals, are you going to take the onus on clearing our name with the NVDs, and recompense me for the damage done to my name and property? Is that right?

The extent of what we would do in relation to NVDs is not something I've looked into. Under the legislation we are responsible if we've had an impact on your business so we have to compensate for that.

104. And you would put that in writing in any agreement?

My name is Julian and I'm the Land Manager. My guys are the ones who go out and negotiate agreements with landholders. We have a number of agreements in the Bowen Basin with landholders who have large cattle businesses. The issues you're talking about are definitely very similar to the ones up in the Bowen in the sense that they have European Union etc. accreditation for meat. On a number of occasions we've put into our agreements the list of chemicals that would be taken onto land. Every time we bring something on, we

have those discussions with the landholders. Currently we're talking to one of the accreditation groups about being able to spread a particular chemical on the property as it has the potential to impact on those accreditations so we're going through that process. It's a chemical that makes roads a bit firmer. It's based on termite excretions, from what I understand, so that comes as an added benefit not only for us but also for landholders in using their roads. We're going through that with the chemical company at the moment so we do understand the accreditation issue and make sure we have those discussions with the landholders. Here in the Surat where landholders have concerns about bio-security, we've set up bio-security cleaning stations outside properties. Before our vehicles went into the feedlot they were all cleaned. So it is something we definitely recognise and understand its importance.

105. Roughly how often would you be visiting that feedlot?

We put that station outside the feedlot. It was a condition of entry that every vehicle had to be cleaned before it entered the property. It held up our drilling operation for about a week while we made sure we got the right equipment there as per the landholder's requirements to be able to do it properly, so it was in order.

106. My question is on the strategic cropping land. Could someone enlighten me on its relationship to heavy and fairly dense Brigalow melon holes, or as you Mexicans call them 'Gilgai'. From the different EIS maps I've read, I'd probably fit into a Class B soil.

On good quality agricultural land, you're probably right. You might fit into Class B which is partial cropping land, from what you've explained about your property.

107. Well, I do crop.

Class A is full cropping land so as you said you're probably sitting on Class B good quality agricultural land. The way we'll determine if some or all of your property is strategic cropping land (SCL) will be how the property is assessed against SCL criteria. I don't have the criteria with me but if you look at the regulation on the website you'll see that you're in the Western Downs zone of the two that cover the area. To satisfy SCL criteria you need to have a certain Gilgai micro-relief. It will be a percentage of the property or a paddock of it on the property. If you've a paddock that's perhaps 70-80% Gilgai micro-relief it may not be classified as SCL. If you've got a nice, clean paddock with no rock and it meets those soil depths and criteria, then very likely it will be SCL. Probably the best indication you have without a formal assessment is to look at those criteria. You'll need instruments to know soil chloride content and things like that. You'll see from the perspective of rockiness and Gilgai micro-relief, there's a percentage of a property or a paddock that can't exceed that soil chloride content. The way the criteria work from my understanding is that if you don't meet one criterion then you're not SCL. You must meet all of them. If for instance you meet all the other parameters, but your Gilgai micro-relief was so bad you exceeded the limit set for it, then you wouldn't be SCL.

108. I'd just be that good quality agriculture land?

Correct.

109. What is Arrow's policy then for putting a well in a heavily melon hole paddock of Brigalow soil where it's even difficult to put a water pipe in. A massive bed will have to be built as well as a massive bund constructed around the well for safety purposes. I don't know how you can bury a pipe in ground that's like this. We developed it when I was about 14 and it was so bad the shearer plough used to jump around and come up into the crawler tractor, and you had to push it back again.

I understand what you mean. I've flown over this country so I know exactly what you're saying. Gilgai does present an engineering challenge but it's not insurmountable. We've a lot of pipelines and flow lines that go through Gilgai country. It translates into the burial depth because the risk to the pipes from the Gilgai is by virtue of its shape, size, etc. Arrow will bury the pipe down below the depth at which the Gilgai and the shrinking/expanding can cause problems. That's common pipeline practice throughout Australia. There are numerous photos I could show you of pipelines going through severe Gilgai micro-relief up in the Bowen and elsewhere. They overcome it by generally burying the pipeline deeper and it will be similar for wells. The well is a vertical hole so it's not going to be exposed to the same stresses as a pipe laid in the ground. As the clay heaves and shrinks, it's generally moving up and down in a vertical plane as opposed to the pipe where it's lateral which is why Arrow will bury it deeper to overcome the stresses the cracking clays apply to the pipe. There are proven and tested methods for building CSG and gas infrastructure generally in Gilgai country.

110. Can Arrow bury the pipe and return two feet of black soil back on the top?

Yes, it can. The photos I put up earlier shows that it can be done. *(See Figure 7 and 8 on page 9).* That wasn't Gilgai country near Gatton; it was black soil floodplain. But the same applies because it's how you separate the soils as you bring them out. You remove the organic layer and topsoil separately, and then you separate out the subsoil below that. When you lay the pipe you put the subsoil in first, compact it back as best you can, and then bring in the topsoil on top of it. You treat the topsoil, as I said, on the basis of the advice received and the standard measures for deep ripping, harrowing and cultivation to get the soil structure back functioning, as well as the organic and biologic processes functioning. Then you sow it, and if necessary fertilise it to bring back the productivity. So yes, it can be done.

Gilgai country is a bit more difficult. As you know, the melon holes will reappear so you'll have some diminished productivity there because of that but you'll be dealing with that on a daily basis anyway.

111. Can you go through vegetation that's marked 'red'?

(See Figure 3 on page 5). That comes up highly constrained on here. As I explained earlier, it doesn't preclude putting pipelines or gas wells through it. The constraint maps are designed to avoid that where possible but they can still be put through it with specific management measures. If we clear Brigalow out here, there is a moratorium on it under the Commonwealth *Environment Protection Biodiversity Conservation Act*. It's also listed in Queensland. If we clear any Brigalow we have to do an offset so must replace it with an equivalent amount. In the case of the Commonwealth it's a multiplier of ten so if Arrow clears

or degrades one hectare of Brigalow it will have to find ten hectares of Brigalow as restoration. That means there's an incentive for Arrow to try to avoid clearing Brigalow.

112. When you offset what does that mean?

Basically, you can't use Crown land. Generally what happens when we look for offsets is we'll purchase degraded land from a farmer who doesn't want it, or is interested in getting out of the farming game. This is usually partially cleared country because the maximum value you get from an offset is in bringing something back. You can't just take a bare paddock like the football pitch out here and plant it out in Brigalow. You can, but it takes a long time to accrue the value under the offset strategy whereas if Arrow buys a bit of country where the Brigalow has been pushed over and for economic reasons the farmer decided not to develop it, if Arrow buys out that country and lets the Brigalow come back and helps it by keeping the weeds and cattle etc. out, you will get recovery not only of the Brigalow, but of the ecosystem. In a quicker timeframe you'll achieve the benchmarks for achieving an offset. As you can appreciate, there are costs associated with that. Arrow can find and buy a property; inject money into it; control exclusion of threatening processes like cattle and feral animals, pigs, things like that. Then Arrow has to manage it for a period of time until DERM agrees that it meets what is called 'remnant status' or it has achieved some semblance of what's been taken away when the Brigalow was cleared. It's a costly, time consuming process. The reason it's highly constrained on the maps is because it encourages Arrow to look elsewhere; it doesn't want to incur those costs if it doesn't have to.

113. What was your area in square kilometres? It was 8,000-something, was it?

8,600 square kilometres.

114. How many wells were you going to put down in that total area?

7,500.

115. So that's one well roughly per square kilometre.

Correct, very roughly, yes.

116. So you're saying 800 metres apart?

Arrow has indicated it needs to develop about 7,500 wells in that area to achieve the production it wants over the life of the project. Earlier I spoke about the 2,500 to 3,000 wells achieving sustainable production. Concerns were raised in some of the previous sessions that there will be a massive drilling campaign to put 7,500 wells in and then it's going to stay at that. That's not the case. Arrow will ramp up to 2,500 to 3,000 wells to achieve sustainable production; some of those wells will retire as they exhaust the gas resource, and Arrow will then bring on other wells. But over the life of the 35-year project, you're going to have 7,500 wells drilled; it doesn't mean they'll all be operating at the same time. You will have some areas being developed as other areas are being retired.

117. That means if you live in that coloured bit going down there, and you own at least a square kilometre, you'll have a well on your place. Is that right?

Not definitely, but yes potentially. The reason, as was indicated earlier today, the 800m is the conceptual well pattern to achieve the output. As Tony explained, investigations are indicating that might be up to 1,500m.

118. With that new system with one well every 800m.

Yes, that and also proving up the gas resource. You may find that there's a lot less wealth.

119. That means you could be on the neighbour's property but take the gas from underneath my place and I get no compensation. Do you understand what I'm saying?

I understand what you're saying. Unfortunately in Australia you and I don't own rights to the stuff below the ground, the government does.

120. I understand that. If we're going to be compensated, can you compensate us now instead of 30 years' time? I'll be dead then so I would like the compensation now, not in 2065, so I can go to the Gold Coast. You understand we're being told that production will end in 2060, and it will peak in 2030, is that right?

It will be 2020.

121. Oh, well, I'm not dead yet, but you know what I mean? We're having all the scares now so I almost think you should start compensating now while you are scaring us?

One of the dilemmas of trying to explain this type of development which is different to a mine or a power station that sits in a fixed spot is that it's like a construction period extending for twenty years instead of four (e.g. the LNG plants on Curtis Island will be built in four years so all the impact associated with its construction will be over in four years). The construction impacts for the Surat Gas Project extend over a much longer period of time, right up through 2020 and beyond. However, they are small incremental impacts. It's not 7,000 wells in five years, there'll be incremental small development over a period of time. The peak of development is going to be the concurrent development of facilities. You might see a facility being developed in the Chinchilla area at the same time one's being developed down near Millmerran for instance so you'll have two facilities being developed at once, possibly in geographically different areas. When we spoke earlier about the road network and the CSG impacts on it I got some reaction to the comment I made last year when I said the overall Arrow traffic for the project is within the growth predictions of normal traffic growth in the area. That's because it's spread over such a long period of time and is geographically diverse through that huge area you see there. So the traffic's not being concentrated in one area or in a short period of time, it spans a long period of time.

122. I'm told I have an area for a possible three wells. If that's going to happen in my lifetime I'd like it to be over and done with now. I could enjoy the benefits of how much you're going to pay me per well, considering Telstra pays $6,000 a year for a fibre-optic tower and the showgrounds have been offered $6,000 a year with increments for a 10x10 metre spot. You fellows are going to be real good to me!

My question really arose out of the fact that last night after that big meeting at Cecil Plains, Mr Morgan and I went to a meeting at Columboola with 25 people. When I walked in and looked at their faces, I saw they were pretty distressed. They're having real problems with a particular company, QGC. I had been asked to come along that

night to deal with some complaints that I will tell you about. QGC said it was coming. At 4:00pm it advised it couldn't come.

There were a few people in particular who I estimated were getting very close to depression. I know a little bit about depression, as does Mr Morgan, because we've both suffered from it. Being a vet I can look at animals and tell when they're crook. As a relatively intelligent human being who has had depression, I'm getting pretty good at picking it in people's faces as well. Last night, it stalked that room. One lady in particular with 1,000 acres has a 42-inch QGC pipeline that's been laid out across her property supposedly for twelve weeks but it's now going to be there for twelve months. It has gutted her enterprise. It has wrecked her fences so dingos have entered the property and killed 130 sheep. Some of her cattle have walked off but she can't get any satisfaction. She was at her wit's end when she came there last night. She was hoping to talk to QGC and it didn't even show. That is why many landholders in this area despise CSG companies now. I know Arrow is trying to do a lot better but that's the backdrop to the environment you're working in. I was tired when I went to that meeting but when I came away I was fired up and angry. I can't walk away from that sort of situation and it's why I'm going to continue to be involved in this debate.

Mr Morgan, who decided on a change of life after experiencing depression, wants to do something for this problem that stalks rural Australia. Depression does stalk it, it's there all the time. Methuen went back to the University of New England to study psychology to try to understand how to help rural populations. He came up with this survey with his professor and his supervisor, world-renowned statisticians in measuring social phenomena and sociology. I know the effort he's put into this and then in the Australian, APPEA comes out and bags it via tricky-Ricky Wilkinson who's not worth feeding in my view. I don't know why APPEA pays him $500,000 a year to lead it nowhere. APPEA comes out and bags a highly credible academic exercise by someone who wants to do something about rural Australia. The CSG industry has to do a lot better than that if it thinks it is going to engage with rural Australia for the next 30 years. We have a life sentence, like a forced marriage. There are laws against it in every country in the world, but it's being reintroduced here. It's a forced marriage, and you marriage partners are going to have to lift your game because there are going to be divorces if you don't. There is a severe social impact, Barton, and you agreed with me when I raised it with you. I hope you know what I'm saying and I hope you do something about it.

We understand as much as we can but we're not from here so we're not trying to say we have your depth of understanding. That's one of the reasons we come out here and talk to the community. We've done this a number of times, it's a regular event, and we're committed to keeping these going. But this is just one way to contact us and for you to learn who Arrow is. You get to know the likes of Barton and the Arrow people around the room. The land officers are also here...you can start to know these people by name. The boss of the land team is here. There are different people here you can meet and understand what they do.

However, we recognise there are other issues in regional Queensland and Australia e.g. commodity prices, fuel costs etc. Within the bounds of what we can influence, we're not saying we've got it right but it's why we're out here. That's why we're doing these studies.

DALBY

Date:	3 May 2012	
Venue:	Dalby RSL	
Presenters:	Andrew Faulkner, CEO	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	St John Herbert, Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **Thank you for those presentations. At present, we are dealing with the EIS approvals process and I'd like to understand how our submissions are handled by government and by Arrow, and what response the submitter gets to his submission and also what input the community has after the EIS approval through the planning and design phase and the construction and operation phase.**

   In other words, how does the whole process work over the next few years from today to a well being constructed on my property? Perhaps you could explain that to us?

   After 14 June all the submissions presented to DERM (*now called DEHP*) are provided to Arrow and to the consultants, Coffey. We will look through those submissions to see what concerns, comments and issues are raised in them.

   Typically they will fall into three categories:

   - submissions where people simply haven't been able to find the information in the EIS; we will respond to these by saying where it is located and that we believe this answers your question or your concern.
   - issues where people have struggled perhaps to understand the science or the information that's provided; we will provide some clarity around that and explain what the EIS is saying.
   - submissions which will raise questions that may not have been addressed in the EIS; we will work through those questions and determine whether they have been picked up in some of the other work that's going on through this process, or whether we need to actually bring them into the impact assessment and assess the impacts associated with that issue.

   A supplementary report needs to be prepared after the EIS. It deals with what we call information gaps; if you look at the recommendations and conclusions chapter of the EIS you'll find that we noted some information gaps and said there is ongoing work in these areas.

   We have sufficient detail to understand the impacts, what they mean and their significance, however, the impact management required will need some further investigation.

   So the supplementary report will respond to this ongoing work, it will respond to the submissions in the three ways that I've discussed, and it will deal with one other aspect. If Arrow has changed its project description between when we submitted the EIS for your

comment and now, we will report that and whether it triggers what we call a material change in the impact assessment. In other words, is the change that Arrow has proposed within the bounds the EIS has identified as the scale of the likely impacts or is it new and therefore requires more assessment? If it requires more assessment, we will do it and it will be reported in the supplementary report.

So as we've said, the first phase is the very broad impact assessment level where we potentially identify all the project activities. The next phase, assuming Arrow has received in-principle approval to go to the next stage, is obtaining its licences, environmental authorities and those sorts of things.

So we continue to do the work that we currently do with our existing projects, where we have to engage with each landholder individually, and go through the licencing process. It is at the environmental authority application stage where the detailed impact assessment work will be done on each property where we'll be working. That's when we actually engage with you about any special requirements, any special environmental values you might have at the same time.

Those environmental authority applications will be subject to public notification which will be the time for people to have further formal feedback into that process. We will continue to have the existing engagement forums, our community sessions like this, and other means of communicating with the broader community about the project as it develops.

2. **Thanks Barton and Andrew. It's good to hear that you relinquished 700 properties under ATP683. Firstly do those properties still go through the EIS, are they in the EIS boundary or are they totally out of it?**

   And, secondly, what are you doing about the tenures to the north such as ATP676 that have Strategic Cropping Land? Are you going through a similar process there and if so when is that going to happen?

   I'll just answer the very first part of your question. (See figure 13 on page 13). The EIS assessed all the green area so everything in that area, whether it's been now relinquished or not, was covered by the EIS. We will update that in the supplementary report to show the areas originally covered in the EIS that have now been excluded. The impact assessment you see covers the totality of that green area.

3. **So a lot of the focus was about ATP683 which was to the south of Dalby. What about those areas to the north? Will they go through the same process for the relinquishment of properties? Is there a timeframe for that or is it just a case of wait and see?**

   Some of the Arrow team have been drilling exploration wells in the area you are referring to, so it's around the Warrego Highway. If you look at that green polygon on the diagram (see figure 13 on page 13), it defines Arrow's arc of tenements which stretch from Wandoan in the north to Goondiwindi in the south. They sit on the easterly boundary of the Surat Basin.

   There's a certain point at which the coal doesn't hold enough gas to be viable for us. That's what we are trying to pin down which is why we're able to give back the ground that we did under ATP683. In September this year there's a date for us to meet where we'll do the same

sort of thing in ATP676 which is that area to the north-west of here. It's an ongoing campaign of exploration work and you'll see the results of that later this year.

4. **I do think Arrow has (well, NR&M made sure they did) tightened up on its drilling. I think there was a lot of damage done out there initially, I've got a report to prove it. One of the big problems I feel with what you're doing is that you're not offering landholders enough money.**

   The amount of money you are offering equates to three weeks' wages of some of your top staff. You expect to drive all over the land for that. What you are offering is probably one load of fuel coming in for the next month or two. You are spending all this money, you are doing all these sorts of things, but you are just not offering the farmers enough money. I think you should be offering at least five or ten times as much as you are offering.

   We try to be fair in our compensation to landowners for work that we do. There's a process we go through to figure out the impacts and what we regard as a fair compensation amount. We look at the type of land that it is, the uses of that land, how long we're there for, the activities that we're conducting, that sort of thing.

   We have to be consistent over the region so that we are not favouring one person over the other; we've got to be fair across the areas we operate in; that's our basic approach. I take your comment on board and your feelings about the level of compensation, but we do try to link the compensation we pay to land value and to make sure you are not out of pocket as a starting point.

   We have also raised as a discussion point the concept of compensating beyond our impacts, but that's a conversation we haven't had yet. It's something we talk about in our committees, for example, as an idea about where you're heading in terms of making it a more attractive proposition. That will differ for different people and different operations across the regions in which we operate. That's a work in progress but as I said we will take on board your comments today as an indication of the sentiment out there.

5. **You're just not offering enough money, especially on good cropping land, because it's worth at least ten times what you are offering.**

   Regarding the controls in place can I ask Arrow the management measures for its drilling contractors and if they reflect your land access rules?

   The land access rules apply to all staff and contractors, we apply them equally. Those rules are intended to be in effect in regards to the way our people operate and represent us. We are very conscious of the behaviour of contractors because in effect they are our people so we have to ensure they behave properly. We are very uniform in our application of those rules. If people don't adhere to our land access rules we have a disciplinary process; staff and contractors who don't adhere to our rules don't work for Arrow.

6. **When you were speaking about the significance and the environmental sensitivity of things, you mention flora and fauna, farming, water and a few other things but you didn't actually say the words house or home, although you did follow through with that later on when you and said that the purple dots were people's homes. I really**

think that a man's house is his castle; one of the main things to be considered is whether these wells and everything else are happening close to a home. I don't live in the country but I would imagine people do so because they want peace and quiet. I think it is very important that the proximity of homes to drilling etc. is avoided and in that sensitivity section you mentioned there needs to be at least something about a house or a home.

Thank you. There is reference to them, although in the impact assessment they are called sensitive receptors. We don't just refer to them as houses because from an impact assessment point of view they are classified as sensitive receptors along with hospitals, kindergartens, nursing homes etc. In terms of how we deal with that in the impact assessment, it's recognised in a number of ways. It's recognised through the socio-economic impact assessment which looked at what I think you are alluding to i.e. people's livelihoods, their homes, their place where they go at night and seek some refuge. The socio-economic impact assessment has dealt with that. It's worth noting that it's not just loss of services and things like access to doctors, education etc. which you would expect, but it was also identified that as your community suddenly experiences this growth the anxiety associated with it and the uncertainty are high social impacts of this development. We also deal with sensitive receptors in the air quality and noise sections, so the whole assessment around air and noise is all about sensitive receptors.

7. **As a councillor, one of the things I hear most is that it's the effect on the home and the close surrounding area.**

   Yes, we understand that. We have undertaken not to drill within 200 metres of a household. Barton will talk through what that means in terms of noise and attenuation measures later on but we also have one-on-one negotiations with landholders about how and when we access their properties and the issues that relate to the disturbance you are talking about.

8. **I am actually quite intrigued as to know (after pouring over the maps and EIS) why you don't have sensitive receptors on your own properties marked e.g. the houses that your employees occupy on your farms are not shown on the map. I would have thought you were as sensitive to your employees as you are to your neighbours.**

   I'll let Arrow speak to its relationship with its employees and how it protects them. The sensitive receptors you see there are only the first pass. It has been raised in the last couple of days that we don't have all the houses on the map. The reason we don't is because there is a process by which we identify houses; the mapping you see there is based on two sources at the moment. Government mapping is picking up about 80% of the houses but there have been a lot of new houses built, possibly houses on Arrow properties. We're in the process of ground truthing the whole of the project development area in terms of where the houses are; we do that by a combination of satellite imagery and high resolution imagery and then ground truthing where we drive around the public road network and try to resolve (if we can't work it out from the satellite imagery) whether it's a house or a shed for example. The intent is that this year Arrow will have accurate locations of where all the houses are, including on its own properties because the guidelines don't differentiate between them.

   There is no difference between Arrow employees and anyone else, so if there is anything missing we'll ensure it is captured.

9. **Re the 200 metres, it might sound a lot but when you are out on a property 200 metres is not a big distance. You talk about the amenity value of our properties, there's visual, there's noise, there's activity. 200 metres is not far from a person's home; if you want to gain a social licence and acceptance in this community you have to consider giving people a bit more space around their properties so they have the view they have treasured all their life and can see their farm without gas fields or strangers operating on their properties. It's something you have to take serious note of...people want more space around their properties for the privacy they have enjoyed in the past. When we hear we are only compensated for out-of-pocket expenses losing that visual aspect and security is a big cost to us. We've had those in the past and I think you must take that on board they are important issues for our community.**

   I might just respond on the 200 metres because obviously it's a sensitive issue. There is no mandated number as to how close Arrow should drill; it created the 200 metres as a minimum. We'll take on board your comments so that if we need to get in close to a house we would have to put other measures in place, that's fully understood. Don't think that you will be seeing rigs with noise and light all around the place in close proximity to houses. We are just trying to put some dimensions around it, but we absolutely understand tthe concerns from people living in those houses when we are working nearby.

10. **It just sounds to us as though you want every last drop of gas that's in the ground. We operate our businesses to be part of the environment and we've got trees which we could have cleared in the past but we didn't. We enjoy and protect our environment and I think you've got to take on board that you may not be able to access every drop of gas.**

    When you talk about that 30 year project and the 20 year recovery, will there be total recovery in 20 years, including the five metre drop and impact of between 20 to 24m.

    In that prediction for the 30 year project life of the Arrow-only scenario there is a drawdown, a reduction in pressure in water levels in those aquifers. In the model simulation there are no injection or substitution measures, it looks at what the impact is going to be and how does it recover under natural conditions. We see that from just natural recharge and natural pressure recovery in the aquifer (there's pressure around where we work) those water levels do start to come back but not all the way. It's almost like if you're standing on a trampoline and you put a high stress on it but it's a saggy trampoline so it's not going to come all the way back on its own, it will sit somewhere down here. That's why that 20 year prediction is those five metre contours, those red lines. The peak will come up a bit but that five metre contour hasn't changed so the whole area greater than five metres hasn't changed significantly. If you ran that model for 1,000 years, you'd probably find everything would come back to all the levels. I could stand here and say in 1,000 years everything will be great, but there is no point to that.

11. **Our concern is where that water comes from to get back into balance. Is it going to drain the Condamine and/or other shallow aquifers which are being used for stock and domestic water around the Surat Basin.**

    If you look at the Walloon Coal Measures and take out the average Arrow production of 25 gigalitres, doing that over the couple of decades of the project will cause impacts to the

aquifers above and below including the Condamine. So for the Condamine we know the drawdown is equivalent to a two gigalitres a year flux (that's our current prediction); if from that 25Gl we take two and put them in there every year for that period we feel we can mitigate that impact.

We also now have to look at the fluxes between each aquifer so we can say if it's 25 from here, ten from this one, five from that one, can we take ten of ours and put it in here, five there, can we put stuff underneath? We're trying to make a water balance if you like. It's an extractive process so we can't make it zero impact. We have to work out how we can minimise that impact and is that impact acceptable. There are ways of doing that.

Because we have varying water production over time, we also have a peak in water production upfront and then our water production slows off. However, our impacts are coming the other way so we have to decide what we are going to do with this water here. But we need it now and that's where these injection trials come in. Over in the US, injection has been used for a couple of decades and there are more than 50 operational injection sites in the US. What some of them do over an annual cycle is take water and pump it down into an aquifer in the wet season when there's a lot of water and a lot of run off; then in the drought periods they pull it out. So they deal with their imbalance in water supply and demand by storing it in these aquifers underground; that's one of the benefits of the injection trial. If we can take our water supply and put it down somewhere deeper like the Precipice, we can then bank it away to use later. Or if we see that someone in an aquifer up here, in a coal measure aquifer which is going to be depressurised significantly and is going to run out of water, we can then, in consultation with the regulators, move an allocation there, drill them a bore to that because we've put the water there. It's a complex four dimensional puzzle of flow rates spatially because substitution, while it works well in the Condamine, is not going to work as well further north so for injection good targets will be set up here. Further south we know the Precipice fades out so it will be a different aquifer; the time when that water comes in and when it's needed, that's the work that's being undertaken at the moment.

12. **Thank you...you were talking about the Advanced Land Observing Satellite (ALOS) surveys in relation to subsidence and there's a lot of data out there. Has there been any subsidence from extraction in the Condamine to date and how does Arrow account for wet and dry soils because the expansion of the soils is quite great?**

    I haven't seen the results of the ALOS survey but as an unconsolidated gravel sand aquifer it would be a lot more susceptible to subsidence than the rock ones. The ALOS surveys won't be able to tell why ground deformation has occurred, only how much of it has occurred. What we'll need to look at is overlaying that data with other data such as changes in water level, soil chemistry and soil types. We can overlay those and see if we can work out why it's happening.

13. **I've a feedlot next to your Daandine and Kogan North leases and you've recently installed a monitoring bore out there. Not the sort of monitoring bore you're talking about here. If you look for groundwater monitoring bores on the government website there are very few of them and they haven't been there for very long. I think your modelling is in the right direction and certainly consistent with what the other companies are showing. We are all waiting of course for the Queensland Water Commission (QWC) model to have the results independently verified.**

I know the fellows in the Condamine Alluvium are going to keep you up to the task so I'll worry about the others like the Kumbarilla, Walloons and the Huttons. We've got QGC out there drilling already and if you'd have been at the meeting it held yesterday you'd know that one guy's lost a 15 megalitre a year allocation already and he can't get QGC to come and investigate it.

If you take the Kumbarilla beds, there are lots of lifestyle people out there and they are the source of our employment and our friends and neighbours. The only water they've got available to them other than rainwater is from the ground, from the Kumbarilla beds and the Walloon Coal measures; you won't get an allocation out of the Hutton as it's been over allocated. You can't get an allocation from the Walloons because it's gone to the gas company. So what are you going to do to compensate for the 60m drawdown in the Kumbarilla? That's 60m from probably 40m down anyway, so how are you going to compensate for that? How are you going to compensate for 75m of drawdown in the Walloons and 75m in the Hutton in areas where there's not even a power supply? All the gas companies should be looking at putting in a rural water and power supply as a means of compensating this community.

I guess you've made a few statements there. The concern that you raise from yesterday's meeting relates specifically to QGC and we don't have any details on that so can't comment on it. In relation to make good provisions and allocations, there are a number of discussions happening with DERM (*now called DEHP*) as you would probably know around this particular issue, specifically for those people taking water from the Walloons. There is an understanding that some of the measures that we take in terms of injection may offset allocations in other aquifers so deepening some of the bores into the other aquifers may in fact be an option that we can take. But when you are talking about stock and domestic bores they don't need an allocation so it's okay for those bores to be deepened to another aquifer.

14. **But the water won't be there.**

    It depends, it varies greatly across the region and the thickness of those aquifers is quite different and won't necessarily impact everybody in the same way.

    It's worth remembering that a Hutton bore which is 900m deep in some places has an 800 to 900m water column. If you pull that down by a peak of 75m, there is still water above the top of the Hutton, above the confining layer in that bore, so you have the potential to add a stage to that bore to overcome the extra lift you have to take.

15. **Yes but who pays for it? Who pays for the pumping power?**

    Arrow has a responsibility to make good.

16. **No, no, you've got it all wrong. You want to hear from the community but my point is that nobody is listening and that was the point that was made yesterday, nobody is listening. To put a monitoring bore down 70m and one 7m deep beside a bore when I've already got one down to 143m and another one at 160m is a joke. You need to hear from people and I hope the government is listening.**

We do listen to people and we have heard that. If we've had an impact on someone's water supply Arrow has an obligation to make good and it's at our cost. Bore deepening or changes to any infrastructure that you need for that is Arrow's responsibility.

There are a number of different layers that we want to get data from. As St John mentioned there are 15 different hydrostatic graphic units in the Basin, so the 7 and 70m that you mentioned is to collect data from those. We are targeting those units in the area where your property is; in the future we will also undertake baseline assessments and we hope that in some cases we can come to an agreement where we can use some of those existing bores for monitoring purposes. It's not the case that we would monitor in every location, every aquifer, we're establishing a monitoring network and the network St John presented shows those that have been installed in the last six months, and included in the nine that were listed are two bores that are on your property.

17. **I'm an engineer and a great believer in modelling. I can do groundwater modelling myself and take great confidence in your modelling. You know the result, you don't have to monitor, Arrow can go and make plans to make good right now, that's my point.**

    The regulatory process around that is reliant on the QWC Underground *Water Impact Report* to be released. It identifies the areas where the trigger threshold is predicted to be exceeded; more detailed assessments of bores in that area will be undertaken and the need to put make good measures in place for those will be determined on a case by case basis. I would have to disagree with relying solely on modelling as that's not a practice that Arrow would follow. We would expect that all the modelling is verified by monitoring and purpose-constructed monitoring. You say your bores are down to 140 metres but we also want to get data from other units; we will put a dedicated network in for that purpose.

18. **We are also next to the Kogan North and Daandine Fields although on the opposite end. To say we are an unhappy landholder is probably a gross understatement, but my question in regards to your presentation is if the Kogan North field has been pumping water for eight years...is that correct St John?**

    Sorry I'm not exactly sure.

19. **I can confirm that for you so I'm wondering what change you've seen in your base monitoring levels for the aquifers in that area since 2004?**

    Sorry, I can't quote those off the top of my head. We have seen changes in water levels in those aquifers; hydrographs of changes in those water levels are in the technical chapter of our groundwater modelling report in the EIS.

20. **For those eight years?**

    I can't remember the exact hydrograph but I think all that data does go from 2005.

21. **So it was 2005, but they started actually pumping in 2004.**

    I can't remember the exact date, I'd have to go back and look at the EIS, I can do that with you and we can look for that data.

Clarification: data depends on whether this question was in reference to the Kogan North Production Field or the original Kogan North Pilot.

Kogan North Production:

First water produced to surface in production process was June 2005 - field still running.

Kogan North five well pilot:

Started: 21/12/2002

Completed: 22/3/2005

22. **Like a lot of other people in this room I know full well you can't accurately model something that you can't measure. From previous discussions with Arrow Energy it's my understanding that the aquifers weren't measured before drilling commenced in that area so I am wondering how you can accurately monitor it if you don't have a baseline level of those aquifers before you even started work.**

    Accurately model it?

23. **Yes or accurate measurements, aren't you measuring the aquifers in that area now?**

    There was production data from the model which I talked about; that transient data is in our modelling report in the EIS groundwater chapter. We were also able to use some of the pressure data from the wells so there has been monitoring and I can actually pull that out for you.

24. **But you are not sure what change it showed?**

    Sorry, no I can't remember it off the top of my head.

25. **Looking at your graph there I thought the rate of change can be quite significant over the first years, first decade, maybe two decades, is that right?**

    Yes.

26. **Well as we're eight years into it I was just wondering what it showed.**

    The domestic production is a lot smaller than the export proposal from which those numbers come. I am afraid I can't remember the numbers but I am more than happy to pull them out of the chapter and go through it with you.

27. **But you have done some baseline studies from several years back?**

    There are around a dozen reservoir monitoring bores installed into the coal, including around Kogan North field. The results from those bores were used in the calibration of the model so whatever those results showed were used to construct the model.

28. **Is your EIS based on the Arrow-only scenario, not the cumulative one.**

    The EIS has three scenarios so we provide predictions for Arrow-only, a cumulative one, and one that is mid case.

29. So the mitigation actions are for all three scenarios?

Yes.

30. I noticed also that the three map scenarios aren't in your handouts or in your EIS; I had a quick look then. Are they going to be published?

I believe they are in Appendix G the Groundwater Technical chapter.

31. I just had a look and they are not actually in the Groundwater Chapter.

They might not be in the summary chapter, but they are in the technical report.

32. Okay. Lastly just out of curiosity, you're saying Arrow by itself is only going to drop the Condamine Alluvium by 0.1 to 1m and the cumulative impact is going to be 2.5m. Where are those two metres coming from?

It's the cumulative effect of adding depressurisation signals from the other players which are generally west of us; there's a cumulative add-on effect.

33. So there is definitely movement between the aquifers because they wouldn't have a lot of Condamine Alluvium on their tenement?

That's right, their pressure signal is going to migrate either up through the Walloon Coal Measures or maybe up through some of the sandstones. Then our pressure signals come through into the Walloons and that's where that connection is so important to understand how the pressure comes through.

Just to clarify the point about the cumulative maps, you may have been looking at the Groundwater Chapter; there's a separate chapter in the EIS for the cumulative assessment so those particular figures are in the cumulative assessment chapter which we can show you afterwards.

34. I'd like to know what the mad rush is to get all this gas? Anyone who follows commodity markets will know that gas is at its lowest price in ten years. There are a lot of companies in the US cutting down on production because they can't make any money out of it. What are we going to do for our future generations? In 50, 100 years' time, that gas will still be there, why is there such a mad rush to get it out now?

There is a huge international demand for gas and that's what's driving this. If you take Japan for example it has shut down all but one of its nuclear reactors so it is after energy. Likewise in other parts of the world they are after energy, that's what inherently is driving this. Queensland has a lot of gas sitting in the ground, far more than what Queensland uses and could ever use in many hundreds of years. That's why there's this 'rush'. Yes I understand it's all happening at once and I guess CSG is a relatively new energy source that's been developed; in combination with this international demand it is driving the four companies. In terms of the price, Arrow is not exposed to the spot market or the sales market for gas. The owners of Arrow will take all the gas it produces, so we're immune from the ups and downs of the gas price. You are right about the US, the gas price is very low there due to the Shale gas boom there but here our gas sales are secure.

We understand more generally your concerns about us trying to set up a gas business on private properties in farming areas., We're acutely aware of that which is why we have sessions like this. It's why we are doing environmental impact studies, we're doing trials to look at how we can minimise our impact. We're not rushing; Andrew said this morning Arrow is not rushing ahead with this, we're the last of the four proponents. We haven't taken a Final Investment Decision (FID) yet but it is not the once and for all decision point. If we say we're not ready FID can move although we are aiming for a decision next year. But we haven't reached that point yet so Arrow is not rushing ahead. It is taking its time to get it right.

35. **Just a question on the background noise and noise generated by infrastructure, how does wind speed and direction impact on that? We all know that some nights you hear noises and other nights you don't. Obviously wind carries vibrations so are your calculations taken on a still night ...or if something's 300m away on a still night and it's at 28 decibels, what happens when the wind is blowing directly towards your house. Is it still 28 decibels or could it be higher?**

    What they do with the background noise is they monitor it over several days, typically over four to five 5 days and then again a month or so later. That's in accordance with the guidelines from the Queensland Government about how you measure noise, particularly background noise. The reason is you are going to get a range of conditions over the four days, morning, noon and night and ideally you are going to experience a different set of conditions when you come back. Wind speed is recorded at the same time, and then they discount all noise that was subject to wind speed above a certain level. That's to strip out the noise, because wind masks noise. If you get a windy day, you're going to hear less noise than you will on a day when you have the inversion and very gentle breeze because the wind breaks up the sound waves so you can't hear it as well. The times you are going to hear it most are when you have very quiet conditions. The background noise monitoring goes through a process of analysis where they strip out anything that could be masking it with the aim of getting back to the true background noise.

36. **But if you have a well 300m from your house and the noise is 28 decibels when the wind is blowing towards your house is it likely to be say 48 decibels just because of the wind carrying the vibration towards your house?**

    When you get that gentle breeze you will get the maximum amplification carrying the noise from the source to the house. If it's windier it will actually break down more quickly. With a gentle breeze you have the ideal conditions for noise to be preserved as it gets to the house so that's why they model under those conditions, it's the worst case you will get.

37. **When you were presenting before lunch, you talked about compliance with state government regulations. Those regulations obviously address the type of property you're talking about now, farming land in a very quiet rural area. Is that correct?**

    Yes that's correct. Those values I had up there, they are built up from the background measured where you live. The way the noise guidelines are developed, they're based on a very quiet background. If you're in a city, there would be different guidelines.

38. **Are you sure it takes in this area? It is very, very quiet,**

    It does...we recognise how quiet it is.

39. In the EIS you mentioned the various committees that are negotiating or in discussion with Arrow. The intensively farmed land (IFL) group etc, I'm just wondering what the spirit was like in those groups, including the irrigation groups, and whether you're actually coming to any conclusions that may assist people like me in their submissions. I'm an agricultural consultant who has been working in the Cecil Plains/Brookstead area for 29 years and my sons are now involved in the business. So I have a very strong interest in maintaining the farming integrity in that area. I haven't been part of those committees but would like your comments on it.

I will answer that only in part and invite Arrow to comment on its views of the success of the committees. I have presented the findings you see today to the IFL Committee. I presented it to them last year, and they were presented in an update we gave to the EIS earlier this year. Those findings have been presented again today. On each occasion, my company, Coffey Environments, which is undertaking the impact assessment for Arrow, has invited comment from anyone in the community as to any inaccuracies or omissions. To date the feedback has been that there are some subtle things we've missed, some management issues around things like the fact that the cotton bales are out now on the roads and the headlands so if you had a well there, you couldn't access it. There've been some issues like that raised but to my knowledge there hasn't been any disagreement with the key impacts, the key properties, the key concerns that I've listed up there today. Arrow can comment on the other part.

I mentioned to you previously that Arrow is doing some physical demonstrations. It's always been the plan with the IFL Committee that we would start with the core hole and pitless drilling trials and proceed to ones more centered around production-type trials. There has been some discussion at the IFL committee as to the appropriateness of the Gilbert and Sutherland report and whether it missed some of the concerns that were raised. The IFL farmers have tabled a list of other concerns that we are now working through. We're looking for feedback from them and also from Arrow to see who the appropriate people are to address those concerns and to get agreement from the rest of the community that those concerns have been addressed appropriately.

I think the question was more around the sentiment in those committees. Just for your information there are two committees, the Arrow Surat Community Reference Group (ASCRG) and, the Arrow Intensively Farmed Land Committee (IFL). I'm on the first one, the ASCRG, and Jonny is on the other. Members include Ian Hayllor as a representative of the Basin Sustainability Alliance, people from AgForce, the University of Southern Queensland, Cotton Australia etc. Those committees meet about every two months and probably have different dynamics.

The IFL Committee is obviously focused on a particular aspect of Arrow's development and interactions with farming; the other committee is looking more regionally across the scope of our development and the issues around impacts on the community at a higher level. Its members also include landowners who have knowledge of strategic cropping land as well as irrigated broad acre type farming as well. The sentiment on the ASCRG is, I think, quite constructive; there have been good discussions and Ian may want to respond to that. The IFL Committee is generally quite constructive although it has on it landowners whose farms we would potentially be looking at operating on, so for them it's very close to home. We have made great progress in developing standard operating procedures with their help and this

wouldn't have happened if there hadn't been a good tenor in the committee. By the same token, there is recognition from both sides that we still have work to do to address some of the concerns. We know we need to address those concerns and we're grateful for the forum to be able to capture and address them.

40. Are there any interim reports from those committees as to progress so that our submissions on the EIS are better informed?

The minutes of those committee meetings are put up on the Arrow website so you can read them, consider progress and if you have any questions you're always welcome to contact Arrow or some of the committee members you know to obtain their opinions as well.

41. My question is about the flood plain and the impacts of infrastructure, your roads, and when you go off the flood plain for your major infrastructure. As we saw 12-18 months ago, a lot of areas are flood prone so what assessment do you go through to ensure there is minimal impact on the natural flows across the flood plain to avoid the potential for erosion from a change of water direction or its speeding up. So my question is what are the infrastructure impacts on flood flows?

That issue is recognised but we can't assess the impact because we don't yet have a layout of tracks and wells to be able to say where the water might be diverted. However, Arrow's intention is not to build the infrastructure in a way that causes diversion or impedance of flows because what came out loudly and clearly in this was soil/water content and the fact that the seasonal and overland flows are so critical to that. The feedback we've given Arrow, which is recognised in the objectives, is that it cannot impede overland flows in the way it develops. It's up to Arrow to design the access with you to ensure that whatever Arrow does on your farm, it doesn't upset that hydrologic regime and cause erosion or cause a part of your farm not to have access to overland flows. That's how it was addressed through the EIS.

42. You talked about air quality but you had nothing in there for dust; how are you looking at mitigating dust, especially during the construction phase? In the construction phase, we're going to have a lot of traffic going past houses because that's generally where the access is?

We do model dust in impact assessment but we generally model it when we're dealing with mines and big haul roads where there's traffic all the time. What you'll find is you get a cigar shape along the road where you will get, depending on the surface of the road and the weather, a pattern of how far the dust will travel before it naturally drops out and doesn't become a nuisance. That is sometimes informative for mines, as they have massive haul roads but it's not informative for construction traffic because it's one of those issues that falls below the line where you have standard watering measures, surface treatments that can reduce the dust down, or gravelling. I know there's an issue around gravel on black soils but there are various treatments and watering that can be used during construction in particular to keep dust down so it doesn't become a nuisance and doesn't become an issue for crops or people. In the standard management controls, you will see directions from the consultants to Arrow around watering and dust suppression and that's how it's typically dealt with. I know Arrow is trialling some surfactants on roads to try to stop dust development.

43. I guess it comes down to traffic management in a sense because a lot of people's houses are just off the main road and that would be the main access point normally into the place. So you're going to have the gravel going into that place, past the house or sheds or into their rainwater supply and, secondly, wherever you then go with the wells and construction you have to look at the topographical consequences in regards to the gravel. I'm gathering you would have to gravel anyway because you need that all-weather access?

I will let Arrow comment on access; however, the other thing Arrow can do is impose speed limits as part of those land access agreements. We know speed is a factor in dust generation from other projects we've done. If you allow vehicles to drive along at high speed, you're going to get a lot more dust than if you slow them right down. It depends on the conditions, but generally speaking there is a relationship there.

In practice we often construct an alternative entrance with the landowner's agreement and it would be the main entry for all activities, whether it's for the well field or for construction. That's normally sited away from the homestead and from the sheds and the farm.

44. The other question is with the lines going from the wells to your processing plants if you are taking them a fair distance across flood plains will you be using the road reserve for that or will you be using people's properties?

It's definitely an option that is open to us, and depending on the layout and where the facilities are it may be the most appropriate option. It's a lot easier to get single access along one road reserve than to go through several properties. It really depends on the layout of those particular wells and where the facilities are located in relation to them.

45. If Arrow is moving east to west, especially to the north anyway, it's going directly with the flow of the water so it will have to get everything really perfect to ensure any flow does not speed up along there.

That has been highlighted in terms of the direction of flow and pipelines by the IFL Committee.

46. In the EIS Arrow seems to be favouring electrical powering of the wellheads; is that correct? Construction would include having to negotiate with Ergon Energy or whoever is the provider at the time to see if there's enough infrastructure there to power that as well as the farming operations? I'm assuming that these electrical pumps at the wellheads are sufficiently robust to be able to kick back in after the power returns. In summer we get a lot of electrical storms and pumps and other equipment on farms are continually being switched off and having to be restarted; irrigation systems kick up again, sometimes several times in one night. How robust are these electrical pumping systems, will they keep operating when they've been switched off?

The EIS considers two powering options and the base case is self-generation or at-site generation. That would be the wellhead motor which generates the power at the wellhead; at the production facilities it would be gas turbine generators or gas engine-driven generators so the power is generated at the site. The EIS also considers an option of partial or percentage use of grid power. If that were the case you would see a power line brought into

an integrated processing facility from the Powerlink network because of the voltages required, a substation at the integrated processing facility and then power distributed out to the central gas processing facility and possibly some wells. That's still being worked through, and it's why the EIS carries both those options. In relation to the latter part of your question, I will hand over to Tony.

I'm not the expert on this topic but with the pumps that we use the drives above ground and the pumps below ground are very robust, very well tried and tested not just here in Queensland but around the world. They are very durable pieces of gear. They have been through all sorts of weather events around the world, lightning strikes, power outages, and are designed to handle those things. In the Bowen basin where we also work we have a wet season with a lot of lightning strikes so I don't doubt there's lots of lightning around here too at times. It doesn't worry the wells at all.

47. Is the power going to be above or below ground?

We're looking at the whole power reticulation strategy or approach now. The power to our major facilities (i.e. the processing plants) would be above ground. There are options we're looking at for power to the wells e.g. whether we generate electricity with gas onsite or whether we take power from the grid to the well. Depending on the specific site, we'll look at whether it's above or below ground; we haven't got a single answer across the whole field yet.

48. You mentioned 500 baseline bore assessments in the presentation. How will you decide which 500 bores will be assessed? When will the assessments be done as it seems that nothing has been done up to now. Why would you bother on strategic cropping land if you can't go there? If you are closer to the river, are you less likely to have infrastructure on your property?

We have to do an assessment of all bores within a 2km radius of our activities. Even if we are not doing any work on a particular piece of land the groundwater could still potentially be affected e.g. on strategic cropping land, so we still need to do those baseline assessments. Arrow has some assessments already. The baseline assessment plans have been approved by government. We have contacted landholders in the area and we are currently scheduling the assessments as we know where the 500 bores are. If you have not been contacted, or are not identified in that 500, we may still assess your bore at some stage as it just means you are not in the priority area currently, but may be affected later as the project develops. Over time all bores which potentially could be affected will be assessed although that could be ten years down the track. We will try to get as many assessed upfront as early as possible; it is a very large body of work to complete.

In regards to restrictions around rivers, the legal distance from the river to development is 100m but it can be more depending on the specific location.

MILES

Date:	8 May 2012	
Venue:	Leichhardt Centre, Miles	
Presenters:	Carolyn Collins, General Manager Environment and Water	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	Jeroen van Dillewijn, Water Manager	Arrow Energy
	St John Herbert , Groundwater Modelling Coordinator	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **What is the actual drawdown of your worst case scenario? *(see Figure 5 on page 7)***

   It's 550 metres and it's not very visible on the slides; apologies for that. Wherever there's colour, there'll be at least a five metre drop, and as you get closer to the middle of that dark blue area, that's where that impact is highest. That will be around the 150 metre mark. If we look at the slide to the right, you'll see that that dark blue has become less blue, and that simply means that we've reduced it to about 75 metres or so in a period. That continues to relax so it continues to improve after that.

2. **To confirm, is the one on the left after ten years.**

   It's in 2024. Our operations will start in 2016, around about eight years after that is our worst point.

3. **What is it now?**

   At the moment in this area there's no impact whatsoever that we can measure.

4. **No, but you haven't started yet.**

   You mean what level is the groundwater? It's about 40m below, but it varies a little bit. So it's not exactly 40m everywhere. It's in that order of magnitude; between 30 and 50m below the surface.

   By the way remember this is the impact of all the industry and it's a worst case picture. Just as a comparison, this is our prediction for the Condamine Alluvium *(see Figure 9 on page 10)*. If you look at this map, you'll actually see that we don't even have Miles on this map, so this is really just the area more or less around Dalby. The worst case we have there is about a two and a half metre drop. So what you see is that in the shallow aquifers the impact is nowhere near as bad as it is in the coal seams. We predicted that towards the western edge of that Alluvium, which are the soils with the sand below the river, the impact's about two and a half metres, and that's the worst case view, if you like.

   Then looking at the right, which is very similar, there's only about a three or four year difference between those two. The reason is the peak in that aquifer comes much later. Remember that the peak in the coal measures was eight years from now or eight years from the start of operations whereas the peak of the impact in the Condamine will be around about 2060. In other words, in about 45 years from now will be when it's the worst case from the activities that we're doing now.

Again, the worst case assumption is based on if we don't do anything to counteract it so I'll come back to the sort of things we could do to make that impact smaller. Another aquifer is the Great Artesian Basin so this is one of the aquifers below the coal measures, and a similar sort of a picture. I believe that the impact is about 40 to 50m in the worst case on the left. There again the peak is much greater than it is in the coal measures; around about the 2038 mark. Again it relaxes slowly and it's slightly better by 2061. So the basic message is that in the coal measures the drop will be quick because we're drawing water directly out of them. In the sands above and below the impacts will takes some time, but after a while that situation will improve as a result of rainwater recharge and the other aquifers flowing into them, then those levels will come back up.

5. **When you're saying that they'll come back, how do you know they're going to come back to how they were before? How do you know you haven't compressed them completely? How do we know we're going to still have some water there when you fellows go?**

   First of all it comes back quite slowly and it takes a long time to come back all the way to where it might be. It may take in the order of 100 or 200 years to come back all the way to where it should be.

6. **How do you know that it is going to come back to where it was?**

   I'll show you an example of what rainfall recharge can do and an example of how we know that it does come back, and can measure it. I'll show you why it's so important that we do all of that measurement as part of the commitments that we make in the EIS so that we can monitor what's going on to prove what we predict is real. The modelling itself is about how systems move back and forth. There are plenty of examples worldwide that this is how these systems work.

   (See Figure 10 on page 11). Let me first summarise though what the overall impacts are before I go into what we can do about it. This is a summary of some of those numbers you saw before. This is the end case so this is the 2061 timeframe i.e. after 50 years. The first column tells us what the drawdown will be as a result of our activities, and the second column is the impact of the total industry. All the pictures I showed you were the total industry examples. I mentioned that the deepest drawdown was around 150m in the coal measures. If you look at that second column and look at the CSG you'll see by 2061 it's reduced to 75m. That's the amount of bounce-back it has in that timeframe. In the deeper systems it's 20 to 30m in the Hutton and 75m across the total industry. Then the shallow aquifer, the Condamine, is 2.5m.

   This is an example of the sort of data that we collect; in this case in the Condamine Alluvium. Before we were just measuring flood impacts. As a result of the drawdown that the agricultural industry has placed on the Condamine, levels have dropped in the area between Dalby and Cecil Plains especially. The data isn't easy to analyse but you can see that in the period between January 2010 and the end of 2011, there was some data for almost all the monitored wells showing an increase in the levels in those wells. It's not a huge increase. As I said, these things take time but the average is about 1.8 metres. Just a flood event can recharge an aquifer. We're talking about two years' worth of rainfall - a lot of rainfall - so a

heavy rainfall period has a similar positive impact just as the impact we predict is in the negative. That gives you a way of showing how we can measure the impact on aquifers.

7. **Those details that you've given are more about the Condamine Alluvium down near Dalby. That recharge and the flood events that we've had wouldn't have the same effect on the Walloon Coal Measures that you're talking about.**

   You're absolutely right, yes.

8. **Do you have any idea (obviously the big impact is going to be in the Walloon measures) how many current registered bores or users will be affected by that huge drawdown?**

   Well, it depends on which piece of acreage you take. If you look at our tenure I think we're in the order of somewhere between 300 and 400 bores. It also depends on us going out to all those properties which is something that we do as a matter of course - those are the baseline assessments that we must carry out to see how many bores will really be impacted but the registered number is somewhere between 300 and 400.

   We expect we'll probably find about 20% more out there when we actually go out and survey all the wells because not all the wells are necessarily captured in the database.

9. **The bores rose 1.2m or so over the last two years but 30 years ago we had the same rain and that was it! So if it's going to be dropping, if your statistics are relying on that 2010/11 data or even if you're not relying on it but it's a guide, then we'll all just sit around till 2041 and go "By God, he was right."**

   Fair comment. I should go back to one point which is that the different aquifers recharge at different rates. You're absolutely right; the recharge is in one direction. In another direction, if you have a few years of drought, it'll go the other direction. That's what this chart is trying to show. It's more than once every 30 years, however, because it's still rainfall that counts, not just flood events. As you can see, it goes up and down. I'm not pretending that the impact that we have won't be an overall negative impact that we should do something about. That's exactly what we are saying. Our impact will have a negative impact of two and a half metres, whatever the rainfall is.

10. **But will you slow down your extractions if it's dry?**

    No, I don't think we will. We'll try to keep monitoring over time to see what the overall impact is. As I am about to explain, what we're also trying to do is rather than just leave the system to go dry, we're going to try to find ways of putting water back into the system. The method that we most prefer is to treat the water we're taking out of the coal measures and make it available to people who are taking it out of the ground now. While we are supplying water to those people they would stop taking it out of the ground. This means that rather than the current balance, which is rainfall versus extraction, all you'll have is rainfall coming in and any impacts that we have coming out. But you'll stop the farming extraction from being an additional drain on the system. That's what we call substitution of allocations.

    Since we've got this water coming out of the ground and we're obliged to treat it, we'll be willing to give it to you and ask you to stop taking it out of the ground yourselves so that we'll actually have a positive net impact on that. The beauty of that is the impact happens the

minute you stop taking, rather than waiting the 50 years it will take the CSG to actually have an impact. We'll be solving the problem proactively which is what we would like to do. It won't solve the problem in the Walloons as we can't put that amount of water back in even if we substitute those bores. It wouldn't make any sense because then we'd be re-pressurising the very thing we're trying to depressurise to get gas out. It will allow us to take care of the aquifers above, especially the Condamine which is the shallowest one.

11. What if you're extracting from the other aquifers?

That applies to all the aquifers except for the Walloons as we can't put water back in there. We could substitute water if that was what you wanted but the one thing that will happen is the impact will stay high for some time. So substituting there will be more difficult, but it can be arranged. It really will depend on what you want as well. There are a number of things we can do. We can compensate you directly or we can provide an alternative water source.

12. You keep talking about the compensation. I'm wondering what timeline you have in mind...from the moment when our bores are affected? For example a 15,000 head feedlot which requires a large amount of water, how long would it take you to actually put in place something to compensate for the water to keep a 15,000 head feedlot going before all the cattle are dead? You know, you talk about compensation, but I don't think there's not much understanding of the undertaking that you're going to need to provide this water for somebody's operations.

As part of the 'concept select' work we're doing just that. We're trying to figure out how long it will take. The way the system should work, and I think will work, is why the Queensland Water Commission is involved to provide a third party objective view of where it stands.

The Commission will make a prediction of when it thinks your bore will be affected. I'm supposed to organise that make good deal with you before the impact becomes more than a five metre drop. Now, you can have a debate about when the five metre drop will happen, also about whether that will be enough for your bore to suffer. Remember that if your bore is in a slightly deeper aquifer, the groundwater level is typically several hundred metres above the top of the reservoir. So the five metre drop should not impact on you unless it's a question of reducing or lowering your pump.

As soon as that prediction is made and the expectation is that the five metres will happen within three years, I'm to make that deal with you even before it's happened as a guarantee that your business is not affected. Does that make sense?

13. It does make sense. The five metres sounds good, but you have a worst case scenario of 150m in some areas you know.

I know. But the point that I'm making is that we're obliged to come to you before the five metres is reached, let alone 150m. In the case of the Walloon Coal Measures you're right, the drop will almost certainly mean doing something very different than just deepening a bore but the obligation still sits with us to provide you with an alternative. If you want water rather than money, then you have a right to get it.

14. You've got all the wells and pipelines in place and you're saying 'Righto, we're only here for 40 years or whatever, and then in 200 years' time she's all back to hunky dory

again'. You're not going to do any extraction through the dry years. Well, as it replenishes, the boys are just going to get back into it again, aren't they? So really when the water level drops down, that's where it's going to stay for eternity because the bores will just keep going won't they?

It depends on whether there are extractions in that zone or not. So it's a simple maths sum if you think about it and the model doesn't do anything other than math. If you're extracting more than the rainfall then you're absolutely right; that level will stay exactly as low as it is. In the deeper aquifers that's not the case, however. In other words, based on what we've modelled we believe the rainfall exceeds the amount of extraction and it depends on each layer. In the shallower layers like the Condamine, I think the extraction level is probably at least as much as the rainfall recharge will be.

In that case there is an issue anyway whether we're here or not. What we're trying to do is monitor it both before we have an impact and while we're having an impact to show what our impact is and our obligation to compensate for that. If you let us put water back into the system indirectly through substitution, then I think there's a bit of a win-win. In other words, you guys benefit both because we help to recharge an aquifer that's been drained beyond what rainfall can recharge and at the same time we're already putting water in as insurance against the moment when our impact occurs. That cannot happen in the Walloons when we're obliged to provide an alternative water source. Does that answer the question?

15. **Well, no, not really. If you're going to keep taking it and you're going to lower the deeper ones, I'm saying you've the infrastructure in place to keep lowering it. As it keeps replenishing over the years, you'll still maintain your operation, won't you?**

    No, that isn't quite how it will work. We don't want to produce water; we're in it to produce gas. The reason we take water out is only so that we can reduce the pressure in those coal seams to allow the gas to escape. Once the gas is gone, we'll stop extracting because there's nothing in it for us. We don't want to keep pulling that water out; that doesn't do us any good. Once we produce gas to the extent that it's economically feasible, we go away. That's when that water will start replenishing.

16. **How long does it take the gas to get back to where it was?**

    The gas won't come back. Rainfall replenishes the water, but it will not replenish the gas as it comes from the coal. So the coal generates that over millions of years. Well, over hundreds of thousands of years at least. Once that gas is gone, it's gone for good.

17. **A lot of what's in the cumulative impacts chapter is roughly similar to what I read in the Water Group's report to the Federal Minister and Geoscience Australia's 2010 report, except for the recovery of the system. You're saying 2061, 20 years or so. I mean they're saying centuries and the Water Group says up to a thousand years in some parts of the Great Artesian Basin. Now, if they're right and you're wrong, where does that leave the make good provisions for people who are losing their water or lose their water 40 or 50 years from now long after you've gone?**

    First of all I think the numbers are consistent because we're not saying it's recovered fully by 2061. What we've done is predicted how much recovery you'll have by 2061. My statement is that it will continue to recover. But you're absolutely right, the recovery is very slow. Again

remembering this is a worst case, I'm not pretending that it won't take hundreds of years to recover in some places. But what we can do is provide those users of water with alternative sources in such a way they won't suffer and also that the system eventually will recuperate. The question is where is the impact and how big is it? We're talking worst case; I don't think it will be this bad. If you allow us to substitute back in, it will be even better than that. But there will always be some residual impact; I don't dispute that.

18. **In the year 2080 when these guys' grandkids are running the farm, where do they get their water?**

    Well, if it's an alternative source of water, our preference is to drill into deeper reservoirs. The impacts there may be up to 50 or 75m, but that's still well above the level at which the sand occurs. So that Hutton Sandstone, for example, you hit the first sandstone at about 500 metres. That means that even when the groundwater level drops to what it is now at about 50 metres to about 225m, it's still well above the sand. If I drill a well deeper than what you currently have into that deeper zone, there's no reason why you can't keep taking water from there forever, just like the current licence allows you to do for the Walloons.

    That's our preferred solution. If it doesn't work for you or Arrow there is an alternative which is to truck it from somewhere else or provide another water source and lay pipelines; that's also something we're looking at in case it's the preferred solution. There's a lot of water down in the ground that no one accesses because it's simply too deep or too uneconomic to reach. If we give you that water, that water is still around. The percentage we quoted earlier of 0.0004 indicates that the amount of water is vast; the problem is getting at it. That's why those shallow aquifers are much more valuable to use as it's cheaper to get there than the deeper ones. The deeper ones are the ones where we could drill wells down there for you.

19. **There was a question asked before that I didn't think was quite answered; you've got a third of your project, the recovery of the water and heaps of those water problems are going to occur after you have left. How long are you saying that Arrow will be responsible to compensate people for water after the project is finished? Who's going to compensate our kids?**

    If we do it right, the compensation will happen before the impact. In other words, you will have a guaranteed water supply if that's what the compensation entails, or whatever other form the compensation might take, before it happens. We're responsible for as long as it takes, that's simply a matter of legislation.

20. **Do you have a working knowledge of the Great Artesian Basin?**

    A working knowledge, yes.

21. **Okay so you reckon the Great Artesian water i.e. the water that comes up out of the Great Artesian Basin, comes out of sand. It doesn't come from holes in the ground like great caverns; is that right?**

    That's correct, yes.

22. **Well, how come all the bore drains aren't filled up with sand?**

    Sorry?

23. I mean the bore drains. You said you've got a working knowledge; you know how artesian water works.

Correct.

24. Okay, have you seen it work?

I'm not sure I follow the question, so maybe my working knowledge of the system is different.

25. The artesian water comes up by itself under pressure into a pipe, then into a drain, and runs off down through the paddock. How come all the bore drains aren't filled up with sand if it's coming out of sandstone?

Fair enough. Let me try to divide that into steps and hope I can explain it properly. I'm sure you'll hold me to it if I don't. First of all in this area of the Surat Basin I don't believe there are many artesian wells anymore. If you recall the picture I showed at the beginning the head pressure you have is higher than the flood plain. If it was, the water would come up by itself and that would have been the case a hundred years, maybe a hundred and fifty years ago when people first started drilling wells and started using the water. At that point the head would have been positive, in other words the recharge up in the mountains would have pushed the water out of the wells and therefore you would have had it flow by itself.

I don't believe that happens in many places in the Surat Basin anymore which means that the net water level is no longer higher than the ground being farmed. In fact, in many places it's 30, 40 or 50 metres below as a result of the activities of people on the land, and that's a simple fact. Farmers have already been draining more than the rainfall has recharged. The water down below is still in rocks so that doesn't change. It's in sand mostly and a very little bit of those aquitards and clays. It's still in the little pores of all that rock, and there's a vast amount of it below. There is still water there; it's just that we have used more of it than has recharged. That's how I could best answer the question; does that make sense?

26. While you're continually sucking it out of those aquifers down underneath, you're de-charging. You're de-charging; you're taking water away from that Great Artesian Basin (GAB). In a hundred thousand years from now, are we still going to have water in that Artesian Basin? Are those people down in New South Wales still going to be able to rely on GAB as the only water supply for their stock?

The answer is yes, because I can measure how much water I'm going to take out in 20 years and it's going to be a fraction of what we have taken out of the ground in the last 150 years. We'll stop taking it out of the ground as soon as we have our gas and depart. We can finitely calculate the impact we are likely to have just as we've calculated it for you. It's much, much less than one per cent.

27. And the lady just asked what you're going to do in 30 years' time. You just said you're going to leave.

I said that we would go but we will compensate current users for the small amount they're presently using, and even that is a small amount of the total volume that's down there. So I didn't say that I was going to compensate by putting everything back into the ground but said I was going to compensate by ensuring you have an alternate supply that's as good or better than it was before.

28. And the next time we get a drought you're going to make good with all the water?

No Arrow will make good for the water it impacts and that's why Arrow does the monitoring to make sure of the size of the impact.

29. So you'll compensate her feedlot, but not the rest of it? Who's going to water those hundreds of thousands of head of cattle?

What I'm saying is that's why we monitor it before we even arrive to later see if we're the ones having an impact. If those groundwater levels go down as a result of our activities, we'll know about it and we'll be obliged to compensate you for that impact.

30. I imagine it's pretty tough, gentlemen, to handle these kind of meetings in your position. I happen to be just a short distance out of Miles and I have one of those lovely bores that actually flow out of the ground running at about 45 to 50 pound. I know quite a number of other people that have them as well. One of my bores has recently started to lose a lot of pressure. We use it for crop spraying and it's become a damned nuisance to us and we're looking around to see who we can sort that out with, but it doesn't look very promising.

I think what you're missing is there's been an effort here in the last 20 years that everyone knows about. There's been a Commonwealth/State/farmer partnership of 40, 40, 20 to cap the bores right across the GAB. The reason we capped the bores was to look after the GAB because it was getting out of hand with the tiny bit of water running down bore drains.

What you guys are proposing is taking away the water from these communities for the duration of time, certainly till you and I are both dead. I really think there's no answer you can give me. I know where you're at with this as a company. I think that our communities have got to think really seriously about what we're doing here and that we've got to work out how we're going to deal with it. We need to hold our councillors and our councils to account. We need to hold our State and Federal Governments to account. This is a change in our environments, in our lifestyles. It is huge and we haven't properly come to terms with it.

I can't believe you can stand here and tell me there's a possibility you'll knock up to 150 metres off the top and we've just got to go away and smile. You must be going to stick a pump on my bore for the duration of time. You've got to be kidding me. It's not even going to happen. You're just going to pack up and go. I know what will happen. I know what the legislation will look like. So look I could go on. I'm really concerned. You'll have a tough time selling this to us, but I just want everybody to remember this community has made a really serious effort to cap our systems so that we look after the Basin, and in the last few years we've made a complete U-turn and I really don't understand that. Thank you.

You're saying there's only that coal seam where you're operating now, so there's no coal down low or anything else that you'll be hunting for later on down the track?

Not in this part of the world, no. Those coal seams aren't a single layer; they are a 300m thick sequence of sands, clays and coals, very thin coal layers, but a large number of them.

That's the package of coal seams that we'll be accessing. We call it the Walloon Coal Measures and it encompasses that entire layer. The aquifers above and below it are the ones that are either above or below that 300m thick sequence. And no, there are no coals further down. There are some very small coals in some of the aquifers above and below, but not enough to make them viable.

31. How can we send anything to DERM? DERM is dead.

It's DERM's parent now.

32. What's the name now?

The Department of Environment, Heritage and Planning, DEHP, but the address shown in the published notice and on the fact sheets will definitely get to the right party, irrespective of the departmental change.

33. Previous EISs that have been done by other companies like Origin and QGC, do they also show this sort of drawdown into the water level or is that something that this EIS is starting to show?

The drawdown in water levels has been reported in all the EISs. One of the issues with Arrow being the last developer or CSG proponent to propose a development is that we've had to assess the impact for all the other projects. If you go back to Santos when it did its EIS it was the first cab off the rank. The only cumulative impact Santos had to deal with was Xstrata's mining and those types of activities. When QGC/BG came along, they then had to deal with not only Xstrata but also Santos's drawdown as well. Origin came along and it had to deal with all of those. Arrow now has to deal with the cumulative drawdown of all proponents in the region. That's the same for roads, social impacts, the whole lot.

34. So if something like that was lethal to a project like this, there's already been permission given to do the others. In relation to the cumulative effect where does it stand when something like this – to my mind this is just an unbelievable thing that's going to impact on a lot of people. And how will it affect the ones that have been given the go ahead or that people hadn't known about?

Well, it has no effect. Their EISs have been approved; they've advanced with applied conditions of approval as well as permitting. They've got their permits and as you know they're now starting to construct. What has come in across the top of that, as Jeroen explained, is that the Queensland Water Commission (QWC) has identified that no individual proponent can manage this effectively and therefore there needs to be an integrated understanding and solution for what's actually happening.

The Arrow modelling that's been done will most closely mirror what you see in the Commission Report because they're both done a cumulative impact assessment effectively. What the Arrow modelling and work that's been done has shown, is that in Arrow's opinion it is manageable and in the view of the specialists who did the impact assessment, it's manageable. Now the QWC will come in across the top of that and Arrow and the other proponents will be requested by law to input to that process.

That's an established process that's been done in other parts of Australia where you have similar significant drawdowns of water within a basin or a region, and in all cases it ultimately

ends up in a government-facilitated regional groundwater monitoring forum that looks at what the actual data is saying, when the predicted impacts will occur and how to manage that (and there are various mechanisms to do so). It's not a new phenomenon.

35. **It seems to me that most of the discussion this afternoon has revolved around modelling. Modelling's only as good as the assumptions that underlie it. For example, with the recharge model, it would depend on what period of rainfall you used in your underlying assumption and how accurate that's going to be. In this district, the lowest decade of rainfall is somewhere from about 1912 to 1922, far lower than the 1990s. So if you've got a model based on an even worse case scenario using the1990s, you're likely to come unstuck because it doesn't reflect historic rainfall patterns.**

    The other thing about this area is that it's caught up in the Murray-Darling Basin and the legislation covering it. If you've got a flaw, an unexpected flaw, based on incorrect assumptions (and we assert your assumptions are flawed) then people in this area may be forced to look at damming creeks etc. That would bring them in conflict with the Murray-Darling legislation which could leave them with a High Court challenge under section 100 of the Constitution which says that the Federal Government cannot deny a resident reasonable use of water for environment and irrigation. We could come to a state scenario where the Murray-Darling Act gets challenged under s.51 because its preamble says that section does not override the Constitution. If your modelling isn't accurate I think that somewhere in the future it is going to be one real mess. Who unscrambles that egg?

    You're exactly right; a model is only as good as its assumptions. The EIS process makes two important assumptions; the first is that we adopt the worst case. In other words, we attempt to understand what the worst case is by assuming inputs that don't look at rainfall as a moderating effect on the aquifers although we know any rainfall events are beneficial for recharge.

    We make a whole lot of assumptions that look at the worst case; the reason for that is we can, with a reasonable level of confidence, say it won't be any worse. The other thing we do in cases like groundwater where it's both particularly topical and an issue where there are some uncertainties, is we have it peer reviewed. The model's parameters were peer reviewed by Dr Lloyd Townley who's considered one of the foremost hydro-geologists in Australia.

36. **The question was that if your modelling breaks down because the underlying assumptions are wrong then people in this region caught up in the Murray-Darling fiasco are forced to look for groundwater as an alternative. Who fronts up with the money for the High Court challenge to the Murray-Darling legislation?**

    Well, I can't really answer that. As I said, a lot of effort has gone into ensuring the assumptions are not only right but are also ones any reasonable person in the industry would make. That's the best we can do. Now, if they fall down or they're proven in time to be inadequate, then obviously there's a range of recourse people might choose to take.

37. **You might be going to deal with this in the next session, so if you are don't bother answering. But that thing you put up there with the very high to low graph is in the EIS anyway in various places. You indicated if you go into the top left-hand corner**

you enter a very high risk area where you can't do the development unless you can mitigate the impacts. When I read the Arrow EIS I didn't see any area in it that was described as having a high risk-factor.

I'm just wondering what you've got to do to be in the high risk area. Surely good quality agricultural land on the Condamine floodplain which produces some of the best crops in Australia using the Condamine Alluvium water for irrigation is high risk country. And those cracking clay soils which are highly susceptible to salt and where they use highly scientific cropping methods and they're absolutely precise and don't cater easily for roads, pipelines and gas wells. Wouldn't you consider putting gas infrastructure onto that sort of property a high-risk activity.

If I can ask you to bear with me, the presentation I'll give after the break goes into considerable detail about how we determine the significance of that and I think you'll find we do recognise it.

38. **And high risk?**

    Yes.

    Yes, I'll wait.

39. **I'm just wondering isn't it still a matter of debate among the hydrologists, scientists and water scientists just where the recharge for the Artesian Basin is coming from? My understanding is that it's still being debated.**

    There is always debate in the scientific community. There are a number of mechanisms that were identified through the EIS process by the impact assessment on how the aquifers charge and recharge. The Artesian Basin recharges off the Great Dividing Range. There are some small anomalies that Arrow has identified in its work on the interconnection with those aquifers. Some of the ongoing investigations are to understand how those anomalies work and whether the interconnections and recharge mechanisms are what we think they are.

40. **I thought one particular view was that New Guinea played some part?**

    We heard that theory in other sessions last week but I can't comment on it. It's a vast system related to the interconnecting geology.

41. **In thousands of years?**

    Yes, in thousands of years.

42. **Was the vibration measured at the compressor station?**

    Correct.

43. **I know people who are seven kilometres away from compressor stations (with no noise mitigation) who complain about the noise at night. Not noise, vibration. It goes right through their body. They complain about it incessantly.**

    That's probably more correctly termed low frequency noise as opposed to vibration. Vibrations are shockwaves through the ground.

44. So what are the standards for low frequency noise?

They're published in the EIS. I'm sorry I can't reel them off the top of my head but you'll find in the EIS that the equipment does meet the low frequency requirements.

45. Why would they be hearing it at seven kilometres?

I've heard that phenomenon before. I've heard of it occasionally at longer distances than that but it probably relates to an alignment of a lot of factors. The experience I've had on other projects is that it sometimes relates to equipment not being quite in tune or running properly. And so you get aberrations where people pick up that noise at a distance.

46. Mate, are you going to fight us tooth and nail like the mine does down here on this noise problem?

Sorry, fight you tooth and nail?

47. Yeah, on the noise problem, like the mine does down here, has done for 18 months. Are you going to fight us on it?

Isn't it abiding by its conditions?

48. Are you going to be the same?

Well I can't comment on that as I'm not Arrow. It will have to describe how it's going to operate. The environmental authority sets out noise limits, and if you feel they're not being met, there are processes and mechanisms through DEHP to have that issue addressed.

49. Well we've provided it with the information. On the same subject there is a mine down there and has been for over 18 months, and we still haven't got anywhere. Is Arrow going to be the same? Will you fight us tooth and nail?

Essentially we're doing impact assessments now. We don't yet have the approvals to undertake the project but when we do there'll be conditions which we must meet. The approvals will also outline a range of options around working with the affected parties as well if there are some unintended consequences of our activities there. We will comply with any conditions that are issued and if we can't then we need to take additional steps in terms of attenuation or other measures to make sure that we don't affect you adversely.

50. Just let me get this clear now, those noise levels that you had up there. They were from the compressors is that right?

No they are noises in the atmosphere.

51. I've got a little four horsepower generator that's a kilometre and a half away. I'll tell you what, during the night you can hear that like nothing on earth. As soon as the wind goes away, the noise will go, then as soon as the wind comes up, the noise comes to you.

I'm not saying you won't hear the noise. Everyone has a different sensitivity to noise and, as you said, there are conditions where you will hear noise. There are development guidelines for assessing noise and you can see that even if you take into account the three decibels,

(it's a bit harder to relate the measure to the actual deemed value) there is a difference that some people will detect on occasion. When the noise impact assessment is done long term weather predictions are done (including 365 days of data, 24 hours a day in hourly increments). They look at the times of the year when those conditions might eventuate, when there is an inversion i.e. a gentle breeze, when you will hear the noise...not at a level above 28 decibels but you will hear the noise. That's what we call worst case. Technically we find that occurs about five to ten per cent of the year. The rest of the time it's either too noisy, or there's other activity going on that will mask the noise. So there's a percentage of the year when you will hear things. It doesn't generally occur all at once. It might occur, as you said yourself, for a few minutes or a few hours. Then you won't hear it until it comes back perhaps in a few months but you will hear it. We're not saying you won't hear the compressor station, there will be occasions when those conditions align and you will hear the noise. The regulations require that Arrow ensure that that noise, when you do hear it, is not above 28 decibels.

52. Who came up with the criteria?

The Queensland Government; there's a set of processes by which the noise standards are set throughout Australia, formed in part by World Health Organisation (WHO) research. Then the Australian Government and the various state governments adopt levels based on their own and Australia-wide research to establish the levels.

53. And it differs for every sector? As in the building sector...mining, agriculture?

Yes. What you'll see are the guidelines set for this type of industry. Different environments have different guidelines, but these are the noise control guidelines for development in regional Queensland.

54. Is that for the CSG industry?

Well there's additional work being done, there's a guideline being published on how to measure and model noise in the CSG industry, but this is basically developed on development within what we call a rural environment. It's taking into account the very low background noise you experience in the first place as opposed to people at Ipswich or Brisbane.

55. Yes but is it specifically designed for the CSG industry?

No.

56. No...so this could broaden out hypothetically into other industries?

Yes, it could. It could be applied to mining operations and other ventures. If you get a big commercial production plant here, it would apply to that because it's a noise guideline that applies to a rural environment irrespective of the type of development.

57. Why do these motors have to run 24 hours a day? Why can't they be turned off at night?

I might let Arrow answer that question. Basically, it relates to the time and amount of water they need to lift.

58. And will they run all over Christmas, all over Easter and all over Anzac Day?

As you know Arrow has a range of activities from drilling and exploration right through to production. When we get to the production phase and we turn the wells on, they will be running 24 hours a day therefore you need to have the compression stations and all the other infrastructure running to maintain that. That's the reason why they run every day. The CSG industry is different to conventional gas. It is not easy just to close a well and then start it up again in six or twelve months or three years later. Amongst other problems the wells will re-pressurise. It's an industry that's designed to continue running unless you decide you're actually going to shut a well and abandon it.

59. Over holiday periods when we have friends or relatives come to stay at our house, it's not very nice to have a motor running at night, and people come to you the next morning and say 'I didn't get any sleep'. We have no control over that. No control whatsoever. I think consideration should be given to it.

I take exception to the six to ten evening thing up there. Everybody in this room lives on properties. We all know at 6 o'clock at night there's hardly a sound at all. That's the time when we sit down to have a beer, when all's gone quiet. The birds have even stopped singing, they're nesting down for the night and there's not a 40 decibel reading anywhere. I take extreme exception to that 40 decibel reading.

Perhaps that is something you could put in your submission.

60. That would be a city decibel level, that one, a city or a town but nothing to do with us. How do you measure the area? How do you get to the wells? And how do you get to the gathering lines? Is it 75 x 75m or 10 x 10m?

A well is 75 x 75m because that's the construction footprint. That's rehabilitated back to 10 x 10m for operations, then for the workover they need to expand it out again. The well goes through periods of partial re-use of land. The gathering lines, once they're trenched or ploughed in, they don't need to be surfaced so they have a construction impact of around 20m right of way for the length of the system. Then when it's finished it's rehabilitated.

61. That right of way persists doesn't it, all the way through the line?

Yes, the right to have the facilities there and to operate them

62. ...**And to service and operate them?**

But once it's rehabilitated it can be used for the pre-existing land use. It's recognised through the process that there are some residual impacts that are long lasting and may not be effectively managed. They relate to things like changed operations. If the gas well is inserted into a cultivation paddock, even if it's on the side as you would have seen in the EIS, it will involve some rearrangement of the ploughing or the cultivation runs, and so that will be a long term impact until the well is decommissioned and removed, and the land returned.

There's the ability to develop and modify the farm plan. There's also the potential for diminished productivity; in other words, if the property is not successfully rehabilitated you will see some diminished productivity across the right of way. We recognise the effects may

take some time to reveal themselves which is why in the EIS one of the management measures is periodic monitoring until it's agreed with the landowner that previous or agreed land use has been re-established. This last one is in relation to the production facility, particularly the integrated processing facilities where (because they are quite substantial developments i.e. engineered clay pads) we can take all the equipment away, we can take out the padding, but we might find that we can't take it back to arable land, and therefore it will become grazing land. That might be a long term effect of the project.

63. My question is more aimed at wanting an answer not so much to the rehabilitation because I know there's good rehabilitation and bad rehabilitation but just what Arrow's rights are. A well might be rehabilitated back to 10 x 10m but isn't it true Arrow can then come back any number of times through the project life to re-size it back to 75 x 75m because it's always got that right of way, including on the pipeline corridor?

It really comes to the agreement reached with the landholder, and the way those activities are described. If the explanation of the activities is that we're drilling one well, we'll be there for a certain amount of time with 75 x75 and then at a point in time will reduce it to 10 x 10m. If there's no option in that agreement to return and workover that well or anything like that, Arrow would have to return and renegotiate if it wanted to do anything else. It's the description of the activities that dictates what can be done

64. With your access do you have to specify whether you have right of way at 75 x 75m or 10 x 10m?

So how wide, for how long and is Arrow allowed to revisit? Those things would be covered in the agreement. The EIS talks about three periods; the establishment period which is 75 x 75m, the operational period, which is 10 x 10m, and then the workover period, which goes back to about 70 x 70m.

65. Getting away from the farming for a bit, what about forests? How are you going to rehabilitate forests?

In the same way we do in other circumstances once we remove the activity. We certainly don't want trees growing over gas pipelines because we don't want root invasion. Arrow will usually allow ground cover species to re-colonise the easement. If necessary it is slashed and will self-generate. If it doesn't then usually it's assisted with some plantings. Basically we re-establish the ground cover, and eventually when it's decommissioned we encourage trees back.

66. Do you have a time line on that?

Do you mean in terms of when it comes back to ground cover?

67. No, back to its original condition.

Arrow will achieve the guidelines around reinstatement of native vegetation. We talk about a period to achieve what is called remnant status which is when the government deems the number of trees and structure have reached sufficient maturity to be self-sustaining and will then move on to full maturity. That's usually measured in five or tens of years but the actual maturity of the eco-system might be a hundred years. Some of the eco systems out here

take a hundred years plus to actually reach maturity. The point is that Arrow, in rehabilitating the area, has reached a point where it will continue to function and be self-supporting and mature over time.

68. I'll be long dead then.

Most of the projects I've worked on are in the same boat.

69. Regarding the easement is it true that once those easements go in Arrow can return and use them whenever it likes?

That's correct. An easement entitles the asset owner to occupy the land and to maintain the asset.

70. And the landholder doesn't really have any option but to allow the easement to go in?

It's by negotiation. As Carolyn has pointed out, the process moving forward is that Arrow will conceptualise its field layout, and where it would like the wells. Then there is a process of negotiation with the landowner on how those wells might be moved or rearranged on the property to reduce the impacts on the property and how the flow lines or gathering systems might be laid on the property to reduce the impacts on the property. There's a whole process that you as a landowner will work through with Arrow to try to reduce those impacts on your property in laying out the wells.

Arrow has given some examples of how that might happen and there's an example in the agriculture fact sheet on how wells can be moved around. Arrow is looking at multi-well pads which might remove the need for five wells; instead of having five wells and gathering systems on your property, you have one well pad, albeit larger, and one set of gathering lines out from that well pad. There are a whole lot of things that are being worked through to try to reduce the impact on agricultural land.

71. I think this question relates to Arrow. Just today I heard that a landholder had a contract to sell his land and when the final search was done he discovered Arrow had a type of caveat over that land allowing it to eventually buy it. The landholder had absolutely no idea.

There's not really enough detail there to understand what you're actually asking, but obviously if there is a concern we're quite happy to talk to that particular landholder if you want to refer him through to us. It does sound very unusual in terms of what you were describing. We're happy to talk to landholders if they're concerned about us, we do encourage them to give us a call.

72. Does Arrow make it a habit of taking water from anywhere, or are there specific places it has to take water from?

I had this question the other day as well. We have an obligation, just as anybody else does, to take water from either water service providers or people who are entitled to give us water. We can't just pull up anywhere and take water. The same rules apply to us as they do to anybody.

73. And you've never taken water from anywhere else?

I don't believe so. I don't know historically, before these rules were in place, whether Arrow did or didn't, but in recent times the practice is that we don't.

74. What do you call recent times?

Three years...that's how long I've been in the organisation.

75. When Joe asked the question in Chinchilla and you said you definitely don't take water from other sources, he told you that somebody in the room could verify it. Is that right?

He said he believed there were cases where we had.

76. Do you want evidence of that?

If you want to talk to us afterwards, certainly we're quite happy to engage with you.

77. That truck was taking water from the stock route on Ryalls Road and it was taking water for Arrow because that's the drill site the driver was working for.

That is an Arrow drill site but I'm sorry I don't have the specifics around that.

78. Well you should have, because I contacted DERM about that, and it should have already been on to you.

We have a lot of dealings with DERM and also obtain a lot of licences from it in terms of taking water.

79. I don't think this was licensed. It came out of a creek, a little baby creek on Ryalls Road on the stock route.

We have had some approvals to take water from creeks as we have from landholders themselves. Again, I don't know about this specific case but I'm quite happy to talk to you about it if you'd like to do so.

80. Well I'm just saying you reckon it doesn't happen – there it is, it's happened.

Again, you don't know the specifics of what's involved in that project either, so…

81. Yes, I do – they were stealing water from the creek! I took those photos, it was on my place.

I think the point Carolyn was making was that there may have been some approvals given. She can't say without more detail.

82. There weren't any approvals. The bloke who was doing it was openly nasty.

I'm not sure, but you need to talk to Carolyn about the specifics later. It's really not the place to do it from five rows away.

83. The saline water that you are pumping from the wells and then containing in the rim tanks, does the EIS address what will happen to it after you purify it with your reverse osmosis, does it address the residue?

The answer is yes. We're looking at different ways of dealing effectively with the left over salt or brine. We've got treated water which we would like to substitute for existing use. You're absolutely right, roughly 10% remains of brine which of course is more saline than the original water was, roughly five to ten times more saline.

What we're trying to work towards in Surat together with two of the other CSG companies is to build a processing plant that actually processes the salt so we can sell it. There will always be some residue, and that will then go into landfill. If that doesn't come off, in other words if we don't manage to agree to do that, our default case (which is the worst case in the EIS) is that we bring all of it to landfill at the end of the project. So starting roughly 20 years from now we would start bringing that brine across to Ipswich to a landfill facility there.

84. It's near Ipswich?

Yes, Swanbank is the regulated waste facility we've chosen. It's called mono-cell disposal because you don't dump it with all the other land fill, you create a separate cell which only contains the brine residue; that's regulated as are all other salt facilities across Australia.

Additional information: Arrow has now committed to not transporting salt to Swanbank.

WANDOAN

Date:	9 May 2012	
Venue:	Wandoan Community and Cultural Centre, 6 Henderson Road, Wandoan	
Presenters:	Tony Knight, Vice-President Exploration	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
	Jeroen van Dillewijn, Water Manager	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. **I want to be clear. You're talking about a 20 year recovery and water comes back into the coal measures in that period of time? Some national bodies are talking about centuries for that recovery.**

   What I tried to show is what happens if we currently assume that in all these aquifers the amount of water farmers are taking out of the ground is the same as the amount of rainfall going in. We're assuming a balance. For some aquifers there is a suggestion that maybe there is less recharge happening than extraction. In the Condamine we suspect that it's the other way round i.e. landholders are taking a little more out than the rainfall is putting back. Those are the trends that we are trying to measure and those organisations are not always able to agree.

   If we stress the system more of that rainfall makes its way down. That recovery is indicating if there is a balance now then that recharge will happen as per our model. How much recharge you will see over 20 years is what you see in the model. We could run the model for another hundred or thousand years but you're quite right, you never really reach the exact same point. Of course a lot of other things may change in that time, including how landholders extract water from the system. What we're trying to show is that if we allow for the fact there's a balance now this is the net incremental impact we will have at given points in time.

2. **So within 20 years there will be a substantial recovery of the Huttons and the Walloons?**

   Yes. As you saw, the recovery is fastest in the Walloons, slower in the Hutton and slower still in the Condamine by virtue of the fact that it's further away from the pressure impact.

3. **Could you tell us what happens to the salt and how much there is?**

   There are estimates of the amount of salt, and it will depend a bit on the average water quality. Currently we don't have good data on water quality across the whole region, but as we drill more monitoring wells and gather more data we will have a better idea. On average the salinity is around 5000 parts per million (ppm). This translates to about 4,500kg per million litres of water extracted. At our average production of 25gL that results in about 125,000 tonnes of salt produced.

   In regards to what we do with it, Arrow is still in consultation with a number of its industry partners to see if it can find a way of dealing with the salt beneficially (i.e. to find another use for it). If we manage to do that, and it's all about scale, we will be processing the salt to sell it for industrial use mainly but even potentially for table salt. It all depends on the quantities

available as even those 125,000 tonnes per year may not be enough to allow us to compete with the guys who produce salt from seawater as seawater is so much more saline than the water we will be producing. If that doesn't work, our default or worst-case scenario is outlined in the EIS and would involve allowing water to sit in evaporation ponds so that the water evaporates away and then sending the salt to registered or regulated landfills.

4. **Where would the landfill be?**

   The landfill that we have nominated is near Swanbank as we know it would take it so it is a possible solution. It could be sent elsewhere if that makes more sense but there is no suitable landfill here so it will definitely be taken out of the Surat area. If we take this option we would only be landfilling quantities that are not too dissimilar to the amount of waste salt that is produced by companies which produce salt from seawater.

   Additional information: Arrow has now committed to not transporting salt to Swanbank.

5. **I did a calculation which meant there would be around 4,500 B-doubles full of salt going between here and Swanbank.**

   In the traffic study we looked at the issue of what the impact of the transport of the salt would be on the roads. The CSG development takes 30 years to reach its peak; by the time Arrow is getting towards the end of the project some of the facilities will be retiring so the cleaning out of the ponds and the salt removal would start about 10-15 years before the end of the project. What you will then have is salt being moved from the Surat to landfill over about a 20 year period. When you look at that it equates to about four to six B-doubles per day when the salt is being moved. It won't be all from one area, the facilities are spread right across the region so those four to six B-doubles per day will be spread across the area.

6. **125,000 tonnes per year? In the EIS it said up to 190,000 tonnes?**

   That's correct, at peak. We have modelled the worst-case in the EIS. The data is not in for the whole field yet and may be less, so we're assuming a worst case scenario. When you work that out, along with the period over which it has to be moved, it equates to around four to six B-double movements per day. That still adds up to a few thousand truck movements over a year.

7. **That seems like a terrible thing to do with our landfills, filling them full of salt.**

   If Arrow sells the salt it still has to move it.

8. **But that's just not going to happen. It's produced cheaper out on the coast, hundreds of thousands of tonnes per year.**

   That's true, although it's not just table salt that we would produce. There are also more valuable salts which could be sold.

9. **How many conduct and compensation agreements (CCAs) do you have to get signed? I think you said 660 have already been signed, but how many more do you need signed?**

   I don't have that information to hand, but I think the timeframe is important here. There is quite a long timeframe for this project so we're not trying to get them all in place on day one;

it's something that will happen over 20-25 years. There will probably be around 1200-1500, but not multiple thousands. Bear in mind that a lot of our gas will come from the Bowen Basin; property holdings there are much larger so we're a bit different from other proponents in that too.

10. **But you hold some of the most closely settled areas too.**

    Yes, so it's a mix. They average out between the Bowen and the Surat so we don't need to have 10,000 access agreements in place for example.

11. **In regards to noise monitoring I've heard from some of the companies (incidentally I deal with twelve of them) that ground noise varies enormously from site to site. On one of our places there is virtually no existing noise whereas where the pumping stations are going to be we've got a feed-lot with tractors and things running continually. Will your noise be monitored above the noise we make? The aggregate of our noise and yours could exceed the acceptable level, is that right?**

    That's correct. Noise is additive but not in the strict sense so if you add 19 decibels to a 34 decibel noise source you don't get 53; but it does have an additive effect so it might be 22 or 23. The purpose of this was to establish the background noise and then that's included in the modelling to demonstrate that we can meet the 28 decibels limit. So the modelling takes into account what will be added to the background noise by the CSG facilities. This is based on typical modelling and is a requirement under the Environmental Authority process. Arrow will have to physically measure the noise once it develops a facility to ensure it complies. If it doesn't, Arrow will need to apply more noise attenuation to the facility to achieve the 28dB. So irrespective of what's happening out there now, when Arrow develops the facility it will have to demonstrate the criteria has been met; it will take into account the feedlot and other things that are happening. Does that adequately answer your question?

12. **Yes, I'm fairly happy with it but I'm finding it a little difficult to come to terms with how much actual noise one, two, three, four or five of these compressors will make.**

    Arrow's project is not to have what we call inline compression. Arrow's proposal is to have compression at these facilities, that's where the gas will be compressed and then there will be no compression all the way to Gladstone.

13. **Nowhere in the world have we seen 42 inch pipes so this is a new ballgame to Australia, Queensland and our backyard. There's a little bit of scepticism on just what the effect will be. I'm on the Queensland Government's gas consultative committee and there are so many things that just don't come out even in a presentation like this.**

    My friend over here might have a requirement to have markers along the pipeline eight feet high so he doesn't gallop into them with his horse. If you put it on my place where I'm growing wheat or sorghum and I've got spray equipment etc. well that might be a different story. There are so many things we don't really know because the companies and the landholders are still learning really because none of us have a mental picture of what it will look like. I guess that's where I have such a lack of affinity with the Drew Huttons of the world, I believe we've got to cooperate or we'll never get an end result...strictly a comment.

I understand and hope through these forums we can try to help you visualise and understand a bit better what it's going to look like. I know Arrow has arranged site inspections for some of its infrastructure for the people down around Dalby so they can get a feel for what it actually looks like. One of the things that I've learnt that seeing is believing. It does help to visualise whether you are working on a mine, a pipeline, power line etc. what it actually looks like, and what it means to build one.

14. **This question isn't specifically about the presentation but generically about your operations in Wandoan, not Condamine or Miles, but Wandoan. Firstly, how many employees do you currently have in the Wandoan area? And by that I mean in a 50km radius of Wandoan.**

    We have no employees here; our current operations are domestic gas supply and managing fields close to Dalby so our base at the moment is there. Come the commencement of the project, we will look at developing other bases across the area in towns where we might operate. So today there's no one in Wandoan, or within a 50km radius, except for exploration crews which are usually between three and six people and they do not stay long.

15. **At peak construction in this area what is the projected personnel?**

    What the EIS reports is that Arrow's intention at present is to locate the bulk of its workforce with the integrated production facility when it's built so the camp will be with the facility. There will be three or four facilities from the top of the tenement to the north of here and then as you move back down towards Chinchilla. Across that 150 kilometres there will be three or four facilities; over time there'll be construction camps at each of those major facilities (or perhaps one camp for two facilities depending on how close they are together) so you'll have about five to six hundred workers at a camp for that facility once the site is chosen. That's the model around what the construction workforce will be. You've got your drilling crews on top of that, around four to six people per rig. Then there'll be the operational workforce and the EIS indicates it will be largely located in Millmerran, Dalby and Chinchilla although there may be smaller depots in places like Wandoan and further south. That's the workforce distribution as we understand it at this point in time.

16. **My interest is what the social impact on the town will be from the personnel if a camp was to be placed north of Wandoan here. Has a site been selected in the Wandoan area as yet?**

    No.

17. **If that camp was selected north of the town, the only sort of ballpark figure we could be anticipating is possibly 500 people in that one camp?**

    Yes that's right. I'm guessing the camp would be south of town because we'd want to locate it midway between where we're developing. North of Wandoan is outside our area so it would be south but we haven't determined exactly where. As Barton said, a camp will be constructed at the same location as our processing facilities; there are about ten of those spread from here through to Millmerran and in the area between here and Chinchilla there are about three or four of them. We would locate the camp near those processing facilities and they would have a pretty short life of a couple of years.

18. Do you provide all the services or are you still heavily reliant on the town?

The camps are largely self-sufficient but there would be contract services for food deliveries and supply, cleaning services, water, sanitation, laundry, all those things. There'd be help and support through Arrow's contract and procurement functions for local suppliers or those who need to step up their capacity. If something just doesn't exist in this area then we'd have to find providers or maybe bring them in somehow. I guess that's a level of planning we haven't got down to on an area basis at this stage.

GOONDIWINDI

Date:	10 May 2012	
Venue:	Goondiwindi Waggamba Community Cultural Centre, Cnr Russell & Short Streets	
Presenters:	Tony Knight, Vice President Exploration	Arrow Energy
	Carolyn Collins, General Manager Environment and Water	Arrow Energy
	Barton Napier, Senior Principal	Coffey Environments
Facilitator:	Jan Taylor, Principal	JTA Australia

1. What is fraccing?

'Fraccing' is an abbreviation for the term hydraulic fracturing. It's a way to artificially enhance the permeability of the coal seam. The permeability is what allows the gas to flow through the coal; sometimes the coal doesn't allow the gas to flow so people have worked out ways to increase it artificially. Very briefly, what happens is you drill a hole or a well into a coal seam, you then pump water down at incredibly high pressure such that it fractures the coal in a radius around the well of about 100 to 200m into the coal seam. You then pump sand down into the cracks to keep them open. Effectively that's what hydraulic fracturing means, it allows the gas to migrate from the cracks back to the well and the surface.

2. **How do you pick where that line is on the risk matrix between high and low risk?** ***(See Figure 11 on page 11)***

We might have an ecosystem whose sensitivity could be very high because it's intact, nearly pristine, and it's holding a threatened species or endangered community. We can look at what the magnitude of the impact would be. Obviously if it's high, and the area is highly sensitive it's going to be a major impact. Therefore we would probably avoid that; we would design the process so it's not affected, and you can do that in various ways. An example is the McIntyre River here; if there was a reach of that in a pristine state, Arrow could trench across it to put a pipeline in and affect the ecosystem or it could drill under it in a horizontal direction and avoid the impact on the ecosystem. That's what I mean when I talk about designing-out. It all feeds into addressing how you deal with the uncertainty associated with where and when.

3. I can see a slight adjustment of that line can have a major effect on the percentage of high in the lower section to where we've got that line at the moment. Does that mean the percentage of high in the standard management measures is lower because of where that line is positioned?

Yes, they don't go into the bottom. This line is basically saying that if it's moderate, low or negligible, these apply. If it's high or major, these apply. We don't try to split highs across the line. I guess I should have drawn a staggered line. If it's high or major it needs to be designed out through specific management tools. If it's below the line we deal with it procedurally. When we see the impact assessment by a specialist reports a high impact we know it's above the line and needs specific management. If it's moderate we know we're dealing with a procedural environmental control.

4. **Tony, at the start there, can you clarify your comment that the area which will be affected is 40 km north-west of Goondiwindi and by 2013 there should be an announcement as to whether it will go ahead? Is that the only area where Arrow has an interest in this council's region?**

   That's correct; the closest point now is 40 km north-west of Goondiwindi.

5. **So those landholders in the area will know at the end of 2013 if Arrow is to continue in the area and, if not, will you be handing that tenement back to the government?**

   Well that area is still an exploration tenure so we're doing exploration work there. If that tells us the area is not so good we'll give the whole thing back but if we find there is a portion that we want to keep, we'll convert it to a Petroleum Lease which would be defined next year.

6. **When you were talking about water management you said Arrow does purchase properties or land; is it your intention to try to purchase land in that area?**

   We would buy the land for those processing facilities we talked about because they are quite big; there are a couple of hundred hectares required for those facilities. We will buy that land because the facilities are long term i.e. with a 20 year life. There would be about ten of those across the region from Wandoan to Millmerran.

7. **You mentioned you're going to use the water you produce but you said in other areas you've used the water on properties that you've bought. I guess the question is how do you use the water? Do you intend to buy properties to use that water on?**

   No, we have two properties we own where we are trialling use of our treated water. It's a research-type activity to confirm there are no ill effects on crops that are grown or on the land itself but it's not our intention to buy properties or use water for farming activities.

8. **I was wondering about the risk analysis in the EIS and how much attention has been given to council roads. We're hearing about the massive activity two hours to the north, similar to two hours to the south. Operators other than you are significantly impacting on the availability and safety of roads, maintenance required, and road maintenance systems. Does that impact statement take into account the other companies in the area? Or were you referring purely to Arrow activities?**

   It does take it into account. One of the things you will find in the Arrow EIS which you won't see in any of the others preceding it is that we have to do a cumulative impact assessment as part of the EIS. Arrow has had to look at the cumulative impact of all the other activities in the region on the flora, fauna, roads, community, everything. There is a specific section in the EIS called cumulative impacts; if you read the road section it's referring to Arrow only but if you go to the cumulative impact assessment it talks about what happens when the road networks will be subject to all the projects about which we can get information.

   We looked at the EISs from the other three CSG proponents, and from Xstrata. Their road data was used by the traffic engineers to model the overall impact on the road network. What we see in the cumulative impact section is that there are a number of roads, more into the top of the area than here, that are going to experience some high volumes of traffic as a consequence of all the projects. As the cumulative impact assessment says, there's a

process now that must be worked through with council, the Department of Transport and Main Roads (DTMR) to decide how we are going to deal with those roads.

9. **Does that cumulative impact account for agriculture? We've a massive agricultural area here that relies on the road system as we've a failed rail system. Are agricultural movements included in that cumulative section?**

   Yes it's represented in the background traffic data used. The traffic counts ideally reflect what's happening in the agriculture sector as well as normal transport activity in the region. The specialists apply to that a predicted growth, based on DTMR and council data on traffic growth. On top of that they applied Arrow, Origin, BG and Xstrata as well as some of the rail projects.

10. **The other question I have is about reinjection but you probably need a couple of hours to try to explain that to everyone, so I'll leave it for you to describe later on if you like. There are a lot of concerns out there about it.**

    I just want to understand the concerns you have as there are opposing viewpoints. For some communities all they want to see is reinjection because they believe it's going to have a long term benefit in restoring the aquifers. Then there are others who do not want to see it go forward at all, so there is a mixed reaction. Basically, we're looking at injection as a means of mitigating some of the impacts. If you look at the Precipice Sandstone for instance where we have people who use water from the Walloon Coal Measures, we know it will be impacted by our activities. If we inject into the Precipice this may make an additional allocation available from it into which we could deepen existing bores as an alternative water supply for them to provide them with that security into the future. From that perspective, it's a positive thing in terms of managing the water and making sure people don't lose their water supply.

    There are other options that we might be looking at e.g. injection into the Condamine Alluvium is something that government and certainly people in that community would like to see. It's a trial that we're considering doing. Our preference obviously is to bring that water to the surface, treat it, and supply it to a third party who actually has a current allocation from the Alluvium. That is easier than trying to mess with that whole system and bring it back in, with somebody else taking it out again.

    That's a much more straightforward way to go. By providing it to them, they would leave their allocation in the ground and that way it could naturally recharge over the time of the project in that particular layout. There are a number of reasons why we want to do it, and government at this point in time is mandating that companies demonstrate it's not feasible before they can entertain any other option of managing their water. It's becoming more and more difficult not to go down that path.

11. **I just think we don't have enough information about whether it's harmful or not. Is it good, is it bad?**

    Injection has been done around the world for many, many years so it's not a new technology…

12. **That doesn't mean to say it is right. You said before that some communities want it, some don't. All I'm saying is the people haven't enough information to know in**

layman's terms what the harm is. If you take water here then put it back it sounds feasible but what harm is being done, that's the question?

That's why you need to do the trials, to gather more information about the site-specific geology and other factors. If it's done properly, which we believe it can be, there should be no risk.

13. **I'm confused. What water are we injecting back? Are we injecting back treated water? Obviously when you treat the water, you get good and bad water is that right?**

    That's right.

14. **At the moment the bad water sits in settling ponds?**

    You get two separate streams; the treated water which would be used for injection and the concentrated brine stream which contains the salts and other elements taken from the water. The brine is held in a storage dam and the plan is to beneficially use that salt stream for an enhanced crystallisation process which produces commercial salts such as table salt or soda ash for which there are currently huge markets. That's how we plan to deal with the brine stream; for the treated water stream, we're looking at options including injection but also supply for third parties as well.

15. **So what you are talking about injecting at the moment is the good water?**

    Yes.

16. **What I'd really like to know is what is going to happen with the bad water? What's your plan for it?**

    That's the brine stream I just mentioned where we want to have an enhanced evaporation process as part of the salt production process. It could be either a thermal or heat process which would make the crystallisation of the salt accelerate over time so that we can generate the salt, remove it from the site, and preferably use a commercial arrangement to make industrial salt which we can sell to the market. It's probably not a business that Arrow can do itself; we're talking with the other proponents at the moment about attracting a company to do the chemical treatment and deal with the salts in that manner. I think that's the best opportunity for the four CSG companies to collaborate in terms of managing some of the impacts.

17. **What is happening with the salt at the moment?**

    At our treatment plants, it's going into a dam containing just the brine stream so it is concentrating in that dam while we're investigating these other options.

18. **And are those dams sealed or open.**

    There have been new standards in place for the last 12 to 18 months, so they are properly lined dams, they have polyethylene (PE) liners in them and they also have leakage detection systems. The standards required for the CSG industry in terms of dam structure, and particularly for a brine storage dam, are far above what's required for any other industry. The specifications are very, very high.

19. **I have a similar question about the salts. I'm a bit concerned that over the time of your 20 or 30 year drilling program the volumes of these salts are going to be substantial. It seems to me that you want to take them somewhere, and crystallise and sell them. We're talking hundreds of thousands of tonnes are we not? That's a lot of salt.**

    That's right.

20. **You could supply the world with salt by the sound of it. It just concerns me where this crystallised stuff is going to be stored. In terms of the industrial salt and soda ash market, what if the market drops and there is no more market for industrial salt, what happens then?**

    I don't think that would occur. There are a lot of manufacturing processes that currently utilise those products. That won't change for a long time and there's quite a large international market as well. Australia currently imports a lot of products that we could be making locally if the salt was available. We do have a base case presented in the EIS for the removal of salt from the landscape and transported to a regulated landfill site i.e. a facility purpose-built for storing salt but that will only occur if we can't do something better with it..

21. **Where's the facility?**

    There are some facilities that will take it now but in the future additional facilities may be needed. That's another business opportunity a company would take up at that point in time.

22. **How big a waste water dam do you need to satisfy an area like that, and how quickly does it evaporate? I just can't get my head around getting rid of all this brine.**

    The size depends very much on the facilities, and right now I can only speak from the basis of the impact assessment. They're not sized on the assumption they are going to be there as evaporation dams. In addition you need to make an assumption about the storage capacity the dam needs to have for a buffer period. If we have a shut-down period for the plant we still need to be able to produce water. There will be wet weather events and that needs to be accommodated in your design as well. The dams aren't small, we're not hiding that. But because we are planning to use the water and salt beneficially, the size of those dams isn't as large as they could otherwise have been. We will not continue to build new dams throughout the project life as we're not doing anything with water so that allows us to minimise the footprint. I'll ask Barton to talk about the basis of the impact assessment but also some of the concerns about the salt and its transport as I heard earlier some concerns expressed around that.

    The EIS assumes that an integrated processing facility where the water treatment takes place will have between three and four dams. They will be what we call raw water dams as that's the water brought up from the wells to liberate the gas and get it flowing. The water from those dams will be run through the reverse osmosis (RO) plant and into two streams one of which is the pure water stream from the RO plant which is treated water for injection, substitution or other uses. Then there's the brine stream which goes into a brine dam. Depending on the yield, because not all the wells produce the same volumes and yield, there may be one or two dams. Probably more often than not there will be two brine dams to enable them to cycle between the two dams over the life of that facility. If the processes that

Carolyn has outlined in terms of processing the salt and using it beneficially are not available, then about ten years before the end of the facility we will start to remove the salt from the dam. It will be trucked; the case that's put in the EIS is to the registered landfill at Swanbank, where they will build what we call a mono-cell which is only for salt. That's the default case.

23. Does Swanbank know about this?

Well there's a registered landfill at Swanbank now.

24. But do people who live in the area know?

We have to get a permit to dump into it. It's currently taking all the hazardous materials from around the Brisbane region and hinterland. So far as I'm aware every capital city has one or several. Melbourne's facility is at Lindhurst and Swanbank is where the facility is in this region. That's what we would assume would be the default case, as Swanbank could take that volume of salt. We have about 125,000 tonnes a year for the whole of the development area so that is ten-odd facilities. The EIS has considered that about ten years before closure Arrow will start to remove the salt if it hasn't already been removed and treated through some other process. That equates to about four to six B-double truck movements a day from across the whole project development area in that last ten to fifteen year period. Because those facilities are dotted right through that arc, it will only be from some of them periodically and as I said that equates to about four to six B-double movements per day heading down to Swanbank.

Additional information: Arrow has now committed to not transporting salt to Swanbank.

25. Is that just Arrow?

Yes, so if you wanted to loosely multiply it by four you might have up to 24 to 30 truck movements for all the companies. I can't comment on what their proposals were, but that's Arrow's. The reason we looked at that was to work out how it contributes to the traffic load through that period as construction will be finished so the traffic peak will have reduced. There will then be an artificial traffic peak when we're removing the salt, if that's indeed what happens. Again, the EIS is trying to look at the worst case. If we adopt the option to have it treated and used beneficially, then you won't have that scenario.

26. The question I had was the actual drawdown in the aquifer? A lot of the properties west of here rely very much on the Great Artesian Basin (GAB) for their farm and domestic water supply. The drawdown you've shown is a huge depth. Fifteen to twenty years ago the state government had us cap our flowing bores because we were losing pressures in them. That pressure hasn't returned to the level where it was previously. You're saying it's going to recover when you stop doing it. But what happens if it doesn't recover? Are you going to continue to assist those people with water? If we don't have artesian water west of here there won't be any agriculture.

Yes, we're obligated to ensure you have supply well beyond our project if we have an effect on your bore. We're responsible for whatever time it takes.

27. When we capped our bores, they were testing it and taking samples. They used to say that water was basically taken from the dinosaur era as that's how long it took for that

water to reach there and come up. It could be hundreds of thousands of years until it comes back again.

There are still a lot of people researching and understanding the GAB in its entirety; what we are looking at is a subset of that, feeding into the other work that is being done as well. We will continue to improve our understanding of how that works, and how the systems migrate over time.

28. **If we consider there are existing landowner bores in pretty much all the aquifers that you've mentioned there, you're going to depressurise whole zones around those. There is obviously going to be a hell of a lot more gas coming into your wells and those of landowners. How do you handle that, is it all worked out somehow?**

    The primary area that would happen is in the Walloon Coal Measures because even as a landholder producing water from the Measures over time, you will create basically a gas well. There have been people throughout the region who have experienced that for quite a long time. It's a phenomenon we're aware of and that's where we need to make sure that any make good arrangements recognise the current levels. If we've impacted on them, we need to establish that your bores are deep enough so you're not getting that gas. We also need to establish if there's another way of mitigating or making-good that supply to you, either by going into another aquifer or obtaining a surface supply of water or a compensatory measure; there are a number of ways we can make sure you are protected in terms of supply. The best option has to be agreed one-on-one with the person who owns the bore. We don't ignore the fact it can depressurise and gas can come up, particularly for the Walloons. It's our plan to understand that as well.

29. **In terms of Arrow's performance in the past I'm curious if Arrow has any outstanding compliance issues or obligations under environmental authorities?**

    The short answer is no, although there is always a 'but'. If you have any understanding of how the environmental management framework works, conditions are changed frequently. When Arrow is given a new environmental authority, there are no transitional provisions, and theoretically they apply immediately. But there will always be a point in time where there's something like a management plan which wasn't there on the day that the new requirement came in so technically that's a non-compliance However, we work them through with the environment department so they understand some changes cannot be made overnight. Apart from matters like that there is nothing outstanding.

30. **I've got a heap of questions on the road thing but it might be easier if you just go back to that slide because it appears to me that you've totally neglected the border region i.e. the cross border issue with the extension coming through Narrabri. Two years ago our agricultural producers in the west estimated that a B-double would have to leave every forty five minutes to move the amount of wheat required for one year.**

    Yes, I understand what you're saying and that probably is a deficiency…

31. **I'm concerned there's no mention of any of the roads in our district here. Our Barwon, Leichhardt, Gore and Cunningham highways are severely impacted with road transport issues.**

This is also an issue in Gladstone where Arrow will have its LNG plant. One of the issues Arrow is considering is revisiting its logistics on how it moves materials into the region (the base case is by road). You know the sort of volumes that will occur there over that period of time so there are various options being considered. As Carolyn pointed out, the CSG proponents are getting together to deal with the salt; perhaps it might be better to pipe the brine rather than truck it. I know Arrow is looking at that as it's a possible option to take the bulk of its cargo off the road network.

32. **They've just rejected a second range crossing for Toowoomba although the range was closed for about four or five hours earlier this week. What a ridiculous situation.**

    That's understood. We're frequently asked what we are doing about this. Arrow's neither the road authority nor health or education provider in Queensland. However, within the social impact management plan and the traffic impact or management studies Arrow has committed to provide the government with its data as soon as possible so that government has it in advance and hopefully it can facilitate government planning for service provision.

33. **I live west of the Leichhardt Highway on a farming property. I'd have expected an immediate impact on our road from perhaps Origin or Arrow but my biggest issue is with the Artesian Basin water extraction. Carolyn mentioned more monitoring bores that the Queensland government has installed in the last twenty-five years. We've been asking it to monitor bores to measure pressure loss and salinity and other things so I guess that's great. But to whom does Arrow report the results of its monitoring? Is it only internally or does it have to report to government or to the Great Artesian Basin (GAB) authority or to whom?**

    There are a number of bores put in for different purposes, some of which are a requirement of the Queensland Water Commission. We collect all of the information into one database and we agreed previously to making that information available and sharing it. It's important for everybody to really understand what's going on there and for that information to be available.

34. **Is that for government?**

    Yes, to government. We're maintaining all that information and making it publicly available. We will be developing interactive software to make sure it's available and accessible.

35. **Will there be anything on the Arrow website?**

    We haven't got that far. If there's a tool that is interactive it will be web-based and something that we could provide.

36. **If it's something that's going to be so technical probably only government water people are ever going to be able to understand it anyway. But putting it on the website would be great although it's not us that will be looking at and understanding it.**

    It's interesting when we go out and do a lot of these sessions and talk to people who are living and breathing agricultural businesses that rely on bore water supply, they're actually very well informed about how these systems work and have a lot of technical knowledge. So there are a lot of people in the community who it will be very meaningful to and others not so

much. The challenge for us is to make sure that what we provide is something that can be easily digested by anybody.

37. **Can I ask another question while Carolyn's there? I don't understand your make good provision. The GAB is mysterious to so many scientists. No one can ever tell us the recharge time, indeed they don't even know where the recharge areas are. If these gas wells are permeating various aquifers and pressures and the levels of water are dropping how will you make good when in twenty or thirty years Arrow Energy is going to be gone. You're going to have to make good for ever for the loss of water pressure and levels of water and I don't understand how you can do that.**

    We do have to make good for the duration of that impact so we need to find a solution. Make good is about offsetting impacts or relieving impacts to particular users. We won't necessarily have impacts on everyone in your area. It's about understanding where that's going to occur. If you start to think about the volume of water we will extract over the life of the project while those numbers might sound large, when you put it in the context of the entire Basin (and more specifically around the Surat Basin and components of that) then it's not really that significant. We're not actually de-watering any of the aquifers.

38. **But they don't really know where the water is. They don't know how much water is in there for a start. They can't tell you. In regards to our bore it's piped to twenty-seven users where it used to service three. If our bore pressure goes down sixty metres, how do you qualify the impacts of that? I just don't understand how you quantify the impacts to twenty-seven different users now.**

    There's now quite a bit more known about some of these things than people appreciate. But that's the other reason for installing more monitoring bores so we can understand the geology and different sequences and understand what those pressure differentials are to improve our modelling and our understanding of the extent of the impacts as they might occur. We don't want to be in a position where we're suddenly finding you've got an impact when we could be out talking to you and working through any issues and concerns and maybe changing the way that we're developing our field in response to what we're seeing out there. All that early work, understanding and researching and doing all those things as we go along will help us manage it before it becomes a real issue.

39. **I think what we're probably concerned about out west of here is the cumulative impact of all your operations, yours and the others, ten years out. We don't know that yet.**

    If I was in your shoes I'd be equally concerned because it is something that is generally quite poorly understood. There is a lot of work to do to ensure we can continue to improve our understanding and also implement the knowledge we do have, and use that to improve the way we develop the project and the way we manage those impacts or prevent them from occurring.

40. **I hope your research brings greater knowledge because we've been telling governments what's happening for years and we get told there's little known about it. Hopefully your research will open up more possibilities for us on the land too.**

    Because of the CSG industry and the focus that's now been placed on the Great Artesian Basin in general, but more specifically the more localised area that we are operating in and

may impact, there will be so much knowledge gained through the process of volume monitoring over the next couple of decades that it should be a very well understood groundwater system.

41. Every time we pull a bore up we make note of the depth of the water and the amount and things like that. We've got hundreds of years of information amongst the lot of us and yet government continues to say it knows better.

That's something we found difficult as well i.e. getting hold of the information. DERM (*now DEHP*) has more information than we've been able to use and it hasn't released it all because it believes some of it is actually confidential to the landholders. Hopefully that data sharing is something we can improve on over time as we come around to do our base line assessments. In areas where we haven't done a lot of work with landholders (because we're new to the area for instance) we can start to gather more local knowledge and learn from that as well. People like yourself have voluntarily come up and said 'I've got all this data and information can I send it to you'? For us that's a really valuable thing. The more information we get the better off we are.

This diagram might help answer your question *(see Figure 12 on page 12)*. It's in the EIS and is the cumulative impact of all the groundwater drawdown by Arrow and the other three proponents, so it's trying to reflect what it would be for all of them. This is in the Precipice in the Great Artesian Basin systems; as it says up here the peak drawdown occurs in 2039, about fifteen years after Arrow starts developing. As you can see it's quite discoloured; the brown area is the project development area, then you can see the discolouration and the reason it's biased towards the west is because that's the effect of the neighbouring tenements with Origin, BG and Santos. That line is the five metre drawdown trigger that QWC has specified for this aquifer system. Once the drawdown goes beyond five metres, as Carolyn's explained, Arrow has to make good. The intent of the QWC report that's coming out next week is to provide predictions three years ahead of any impact occurring so Arrow can start make good arrangements three years in advance of it actually being realised. As I said, it's going to take nearly fifteen years for it to reach five metres in this area.

42. That's our recharge area?

No, for this one the recharge is here on the Great Dividing Range.

43. So where do you draw most of your water out of our recharge area?

That's taken into account in the modelling.

44. You don't think taking water out of our recharge zone is going to affect our bores?

I'm not saying it's not going to affect them. What the model is showing is that the effect will be right out to here by 2039. The important aspect is the extent of the effect; if you look at the values Carolyn put up earlier it's around thirty to forty metres, but when you're out on this western edge it's less than a five metre trigger. In 2061, potentially twenty years after operations have stopped you can see the contours are relaxing as the water starts to rebound. And that's for all developments.

45. I'm very sceptical of that.

There've been a number of people who've raised that same concern but this model is the closest you'll see to what QWC will probably bring out next week because it will model everyone's impacts. Arrow has been the last and has had to model everyone's impact; QWC is doing the same thing; it's modelling all the impacts and has a much more expansive data set. In a couple of weeks' time you'll see how closely QWC reflect this.

46. **Interestingly those diagrams just stop at the river; our aquifer here in town or around this district (particularly north Goondiwindi) has sandstones that flow under the river. When those New South Wales people irrigating from the Great Artesian Basin, which they've been allowed to do for the last ten or fifteen years, turn on their centre pivots and draw water out of that aquifer on the south side, it actually affects our bore pressures to the north of Goondiwindi. Those are the people who are going to lose their water pressure for years because of the extraction effect on the New South Wales side, and yet that map conveniently just stops at the Queensland border. It doesn't show any impacts in New South Wales.**

    The reason is that this is based on geological structures. If you look at the geographical information system, the first part of the groundwater impact assessment was to identify the geological structures with which the aquifers are associated. So that area of the modelling domain which is way out here was considered to be representative and encompassing all the structures that would be affected by Arrow's operations. It's not saying it's not here but in terms of the structures Arrow's operations will impact that model boundary was chosen on to be outside of those. It wasn't intended to cut them off, but to be outside of the structures Arrow will impact on.

    It's also important to note that the drawdown case we're looking at here is for the deep aquifers; you're basically talking about irrigation from the alluvium or the consolidated aquifers which are the shallow ones.

    It does very much depend on the aquifer you're characterising. The model is made up of a number of layers and has been built on the basis of those geological forms from ten thousand wells or bores across the region. The thickness of these aquifers varies greatly across the region, but the model has built into it the different permeability, or those characteristics which allow us to produce these predictions. The reason they stop in certain areas isn't because we choose to stop it there but purely the impact it has on the particular aquifer in that location.

47. **I understand why you stop at the border I'm just suspicious that the impacts will actually extend into New South Wales?**

    If we were to show the Condamine Alluvium, for example, and the predicted drawdown there, the cumulative impacts for the western-most portion of the Condamine are where we expect the peak to be. Over time we see how that basically recovers as well. Because it's the Alluvium, because it has a lot more recharge, it's an unconsolidated aquifer which behaves quite differently to some of the others that are modelled. The way we would manage the impacts on that are quite different to the way we would manage the impacts on some of the other aquifers. We particularly focussed on where the water is a resource, so they will be key areas we will be monitoring much more closely as people such as you

heavily rely on it. We need to understand more about characterising those and how the water moves, and basically getting trends over time to see what may or may not happen.

48. So it might be Origin we should be more worried about, not Arrow?

Quite possibly...when the QWC Report comes out it would be worth having a good look at your particular area. I'm assuming it does go out as far as where you are so we will start to ask questions about that. The QWC will be coming out to do some information sessions in the next month or so. It will be a great opportunity for you to obtain a better understanding.