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Arrow Energy Submission

Inquiry into the Management of the Murray Darling Basin Senate Standing Committee on Rural Affairs and Transport Management of the Murray-Darling Basin

August 2011

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1. Background on Arrow Energy

Arrow Energy is one of the largest integrated energy companies in Australia with five gas producing projects in the Surat and Bowen Basins and interests in three gas-fired power stations. Arrow Energy currently provides approximately 20 per cent of Queensland's gas and electric needs.

In 2010 Arrow Energy was acquired by Royal Dutch Shell and PetroChina in a 50/50 joint venture partnership. We are currently pursuing coal seam gas exploration activities across Queensland and northern New South Wales, and are delivering a major coal seam gas to liquefied natural gas project to meet an international demand for cleaner energy.

Arrow's key priorities are is the safety of our employees, contractors and those people living in the communities in which we operate and full regulatory compliance. Arrow has offices located in Brisbane, Gladstone, Moranbah and Dalby.

Tenements currently held by Arrow Energy in Queensland and New South Wales range from Exploration Licenses to Petroleum Leases with producing wells.

2. Terms of Reference relevant to this submission

"The committee will examine the economic, social and environmental impacts of mining coal seam gas on:

- *The sustainability of water aquifers and future water licensing arrangements;*
- *The property rights and values of landholders;*
- *The sustainability of prime agricultural land and Australia's food task;*
- *The social and economic benefits or otherwise for regional towns and the effective management of relationships between mining and other interests; and*
- *Other related matters including health impacts"*

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3. Overview

Coal seam gas now produces over 80% of all gas consumed domestically in Queensland. Arrow Energy has been in CSG development for more than a decade, and has been safely producing CSG since 2004. The company supplies approximately 20% of Qld's gas needs from our operations in the Surat and Bowen Basins.

If you live in Queensland, the chances are that the power in homes is derived from CSG. Arrow's gas supplies energy to up to 400,000 homes.

Arrow Energy has approximately 300 wells in the Bowen Basin and approximately the same number in the Surat Basin.

The Australian Coal Seam Gas industry is highly regulated under legislation at both Federal and State levels, has a strong safety record, and is an important part of the energy mix and energy security of Australia. It has the potential to underpin the Australian economy through the export of LNG to Australia's international trade partners, while providing a significant input into the domestic energy market.

Arrow Energy is committed to the continuous learning process that goes hand in hand with science and technology. Whilst it would be impossible for any company in any industry to wait until every study had been completed before embarking on a body of work, as we move forward through our projects' phases, Arrow Energy will continue to work with the community, industry and Government to further deepen and build that greater understanding into the developing project.

Additionally, we are also determined to continue to enhance our reputation, with the community, with industry and with the Government. Arrow Energy realises that we will touch upon many in the communities where we work. We want to establish and maintain existing good relations with people living in these communities and get the balance right between the social, environmental and economic aspects of our projects.
Whilst we recognise there is room for improvement, particularly in legacy dealings with a minority of land holders, we are committed to working together with the community, industry and Government. We are doing this - through a number of initiatives such as our land access rules, our committees, community consultation and information programs, and scientific modelling and studies – to ensure full regulatory compliance and coexistence, and to provide all stakeholders with a heightened level of reassurance and certainty.

Where Arrow Energy is undertaking exploratory operations, a significant amount of data is being acquired including information about aquifers, water pressure and interconnectivity. Banning or restricting exploration will be detrimental to the knowledge base and the understanding of these important issues. Conversely the understanding of groundwater

resources in the Surat Basin that will be developed through the monitoring and modelling Arrow Energy, and the CSG industry more broadly, will leave the Basin as one of the best understood groundwater resources in Australia. This represents an important legacy for future generations of farmers.

Arrow Energy believes that the current legislative regime – along with the continued engagement between government, the coal seam gas industry, landholders, local communities and other stakeholders – sets a sound framework to maintain and build on the successful co-existence of the various industries in not only the gas producing communities within the Murray Darling Basin but also the many gas producing communities outside its boundaries.

4. Water Aquifers

4.1 Well Integrity

Coal seam gas wells are designed specifically to prevent the cross-flow of water between geological layers. If wells could not be effectively isolated from aquifers, then there would be no viable means to release the gas in the coal seams. Zonal isolation by cemented casing is the method used in coal seam gas wells to isolate the gas-producing zone of the well from its surroundings. This is a proven technique used around the world. Well integrity is an essential part of the safe and successful operation of the coal seam gas industry. Arrow Energy's wells are regularly checked and inspected to ensure their integrity remains unaffected.

When wells are abandoned permanently, the completions will be removed, cement placed bottom to top and pressure tested to prove its integrity before separate cement plugs are placed across the inside of the casing to surface. We will draw on internationally used standards for abandonment.

4.2 Impact on aquifers

Arrow believes in the broad maintenance of an overall water balance in the groundwater systems across the region by reinjecting treated coal seam water either directly back into the aquifers, or else using it to substitute for existing allocations from aquifers such as the Condamine Alluvium.

Current water extraction by the entire CSG industry is less than 20GL per year. Future production from the 4 major CSG players is estimated at less than 150 GL/yr. The volumes that will be taken by the CSG industry will be in the same order of magnitude as what is currently taken from the Basin.

This presents the opportunity via substitution to go a significant way to successfully maintaining the current water balance of the Surat Basin. Arrow has developed a detailed groundwater model of the Surat basin, informed by geological information from over 10,000 bores and water level data from around 4,000 bores obtained from:

- Arrow bore information;
- Queensland Petroleum Exploration Database; and
- DERM Queensland Groundwater Database.

The model contains 15 geological layers, from the Condamine Alluvial aquifer to the Precipice Sandstone. These studies show a total industry cumulative impact on the Condamine Alluvium of a total localised area of one to four metres by 2065 (prior to taking into account mitigation measures such as a combination of reinjection and substitution of allocation).

- For example, by providing treated coal seam water in place of existing groundwater takes from the Condamine Alluvium, the current pressures on the groundwater supplies in the Alluvium will be reduced and facilitate preservation of the existing resource for future agricultural use.

- The predicted rate of change in the Alluvium is sufficiently slow (0.75 m per decade) to allow adaptive management of the impacts should they prove to be greater than modelled.

- For comparison's sake, current take to date has reduced the water level in the Condamine by more than 10 m over 40 years (source: Hillier 2010).

- There are also more than 40,000 registered non-coal seam water bores in the Surat Basin, including 2000 over the Condamine Alluvium alone. Installation of many of these, to less rigorous standards, has not destroyed this aquifer.

In summary, it is anticipated that the mitigation measures described above will ensure any localised impact on the Condamine Alluvium will be minimal.

The results of the groundwater modelling will be presented as part of the EIS and the model will be further developed on an ongoing basis with information from the Groundwater Monitoring Program (discussed below).

4.3 Groundwater Monitoring Program

Arrow is currently developing an extensive groundwater monitoring program. The objectives of the program are to:

- Undertake rigorous investigation and publicly-presentable information and improve understanding of the hydrogeology of the Surat Gas Project area (Project

Area). The Project Area is the defined area of our Environmental Impact Statement and from which we would anticipate producing gas from for the contract life of the Arrow LNG plant

- Identify impacts of coal seam gas activities at an early stage.
- Provide data for decision making and groundwater modelling.

The following scope of work will be undertaken to satisfy the objectives stated above:

- Characterise aquifer properties including connections to aquifers overlying and underlying the Walloon Subgroup (the Subgroup hosts the coal seams targeted by the Surat Gas Project),
- Improve Arrow's understanding of the geology of units overlying and underlying the Walloon Subgroup,
- Collect data on groundwater water pressure and quality in aquifers and aquitards within the Project area,
- Establish a network of groundwater monitoring sites, at sufficient density, using existing Government and private wells and installing additional groundwater monitoring wells, and
- Develop a regime of groundwater monitoring to fulfil Arrow's obligations under Queensland and Federal legislation and identify Project-related impacts including groundwater abstraction, water storage and water disposal or reuse.

The information obtained in the groundwater monitoring program will further inform Arrow's understanding of the groundwater system, and through incorporation of this information into the groundwater model, will continually improve the certainty in modelling outcomes.

5. Water Licensing/ Management of Water

In a lot of cases the extracted coal seam water is not immediately suitable for community use or farming / irrigation purposes generally because it has a higher salt content than would be acceptable for irrigation or potable water. The coal seam gas industry is developing technical solutions to ensure that extracted water can be used in a beneficial manner – such as through substitution of existing groundwater allocations(after treatment through a reverse osmosis plant),and/or re-injection. This will benefit the farmers and communities in which Arrow Energy operates and will ensure that the impact of water extraction is minimal as well as actively helping the positive management of the GAB resource.

Arrow has developed a detailed water management strategy, taking into account the concerns raised by stakeholders, to address key concerns regarding management of coal seam water. Arrow is currently working with key stakeholders (including Government), to develop processes and detailed management plans to allow implementation of the water management strategy. Key aspects of the Water Management Strategy include:

use of groundwater or potable water, and Arrow's approach is not to enable new industries in the area that would be otherwise not feasible without our water.

Note: All untreated coal seam gas water, and the brine stream, are stored in lined dams, with specific groundwater monitoring requirements. The dams are designed and constructed in accordance with guidelines published by DERM.

5.1 Arrow Beneficial Use Project

Arrow holds an approval to beneficially use treated coal seam gas water for irrigation on the 'Theten' property in the Surat Basin. This approval was sought by Arrow for the purpose of gathering information on the irrigation of treated coal seam water, and demonstrating that treated coal seam water can be used sustainably for irrigation purposes. Completing the approval process has also given Arrow the opportunity to further understand the framework for beneficial use approvals and the operating conditions that will be required to facilitate this water use in the future.

5.2 Management of Salt

Arrow has committed to removing salt from the landscape. The salt will be stored in dedicated facilities, and throughout its lifecycle will be managed in a safe and environmentally appropriate manner. Arrow is currently undertaking work to investigate potential beneficial uses of salt, including:

- Crystallisation for use in industrial process; and
- Use of brine in the chemicals industry.

Research is also being conducted on the viability of reinjecting brine into aquifers with high salinity. At a minimum, Arrow will remove the salt and dispose to an approved and regulated landfill.

6. Property Rights and Values of Landholders

Arrow Energy aims to build long-term positive working relationships with all landholders. We understand that these relationships take time to develop and we are increasing our capacity to better meet landholder needs now and in the future. Arrow Energy is committed to working closely with landholders to ensure our work practices minimise impacts on land and existing agricultural activities. Australian laws regarding ownership of the land surface and resources below the surface have been in place for over 100 years.

Arrow accepts that our development activities have an impact on landholders, and understand that the land is both the landholder's home and their livelihood. Arrow recognises that our development plans need to consider:

- **Substitution of groundwater entitlements for irrigation and urban supply** – Arrow's preferred solution for coal seam water use in the Surat Basin is the supply of treated coal seam water to landholders with existing large scale irrigation operations supported by groundwater extraction entitlements from sources such as the Condamine Alluvium. Under a framework currently being established with the State Government and key landholders, Arrow would supply water equivalent to the landholder's entitlement on the proviso that they do not take groundwater under their existing groundwater allocations. In this way Arrow provides a substitute for the existing allocations and thereby reduces direct use of existing groundwater resources and facilitates the natural recharge of local aquifers over an extended period of time (for as long as the coal seam water is supplied). Arrow believes this method of water use gives effect to the same outcomes as injection (discussed below), which the State Government supports as 'virtual recharge'.

- **Demand for irrigation water is seasonal and depends not only the cropping requirements but also on the availability of storage and the prevailing climatic conditions** (i.e. dry season or wet season, or La Nina or El Nino cycle). Shallow aquifer injection or Managed Aquifer Recharge (MAR) is being investigated as a potential solution to manage seasonal variations and aquifer recharge. A similar process is being explored to supply urban centres with treated coal seam water to enable aquifers to recharge in the local area.

- **Injection-** Deep aquifer injection is being investigated as a means of mitigating any potential future impacts on adjacent aquifers caused by the extraction of coal seam water. Several trials are planned over an extended period of time (one to five years) to determine the technical feasibility of deep injection and to provide further information to aid design and cost development. Injection opportunities are limited within the Surat Gas Project area, and therefore it is only considered as a partial solution for mitigation if the trials prove to be technically and economically feasible.

- **Contingency management** - to cater for extremely wet seasons or during unforeseen events Arrow will apply for licences to discharge treated water to watercourses. Such discharges are only contemplated as a contingency measure for when other preferred disposal options are not available. It is envisaged that these emergency events will coincide with wet weather and high flow events where the watercourse provides an appropriate dilution regime to minimise impact on the environment.

- **Industrial Use -** Arrow is continually seeking opportunities to increase the volume of untreated and treated coal seam water utilised for industrial use. Opportunities will be evaluated on a case by case basis and will form a significant part of the water management strategy. Existing uses of coal seam water produced from Arrow's domestic activities will continue, including coal washing, power station cooling and agriculture. Supplying water to industrial users is intended to avoid

- Where we place our infrastructure
- When and for how long (amount and timing of site access)
- How we conduct our drilling and construction activities

Arrow has already discussed with its communities that it will not enforce confidentiality in its compensation agreements. We listened to our community's concerns on this issue and we acted to change this approx 6 months ago. Arrow's compensation (as required by law) is based on:

- Impact on operations and amenity (eg Tracks, land use, number of trips, construction time, disturbance, loss of profit etc)
- Change in value and/or use of land
- Legal, valuation and accountant advice
- Landowners time

On compensation, the historical average amounts for production wells across the production agreements are as follows –

South Production wells

Upfront payments

Per production well $1000 - $3800 per well

Management time $500 (one off payment)

Approximately $3000 for professional fees (one off payment)

Ongoing payment

$500 - $2500 per year per well

Northern Production wells

Upfront payments

Per production well $1000 - $5700 per well

Management time $500 (one off payment)

Approximately $3000 for professional fees (one off payment)

Ongoing payment

$500 - $2500 per year per well

To run our substantial domestic business, we have 360 agreements in place with our land holders in the Bowen and Surat Basins – and in our exploration basins – in the Nagoorin, Styx and Capricorn Basins. In the Surat Basin, we have 241 agreements in place with 180 in negotiation and a further 200 – 250 to be negotiated in 2012. Over the Condamine flood plains, in ATP 683, we have 38 agreements in place, a further 29 in negotiation and 24 agreements to commence. In the Bowen Bain, we have 119 agreements in place with a further 40 in negotiation and 100 to 120 agreements to be negotiated in 2012. Importantly to us – in

terms of our real desire to have long term relationships with our land holders, Arrow has no land access cases before the Land Court.

Arrow has implemented a set of land access rules.(Appendix 1) The land access rules establishes clear, concise and non-negotiable rules for all employees, contractors and personnel to abide by when wishing to access any private property across all Arrow Energy operations and activities. Across the Group **we are driving** intend to achieve a culture of full compliance with these rules. These rules reflect feedback we have received from landholders as to how they value their land and guide us in how we operate on private property.

Arrow has clearly heard landholders request that CSG companies "add value" rather than just compensate for impacts (nil sum game). Arrow understands that this may mean something different to individual landholders and has asked key landholder representatives to qualify what the term 'added value' looks like. Arrow has committed to providing a compensation framework that ensures consistency and fairness in our negotiations with landholders.

Arrow Energy has operated safely in Queensland for over a decade, and there is no evidence in this period of property market changes related to the Coal Seam Gas industry. Where Arrow Energy operates directly on a landholder's property, compensation for this work is agreed between Arrow Energy and the landholder.

7. Sustainability of Prime Agricultural Land

Arrow recognises that strategic cropping land is an important natural resource identified by soil, climatic and landscape features that make it highly suitable for crop production. These key features exist within areas of the Surat Basin.

> *"The best cropping land, defined as strategic cropping land, is a finite resource that must be conserved and managed for the longer term. As a general aim, planning and approval powers should be used to protect such land from those developments that lead to its permanent alienation or diminished productivity." (Protecting Queensland's strategic cropping land: A policy framework, Queensland Department of Resource Management August 2010)*

The Queensland Government has released mapping of strategic cropping land (SCL) areas, however on the ground assessments against defined criteria are required to determine actual SCL areas. Based on the Government's SCL mapping, the potential SCL covers approximately

49% of the Surat Gas Project area. With regard to Arrow's overall tenure to supply the Arrow LNG project, the policy has a smaller impact in the Bowen Basin.

It is very important to note that the determination of SCL does not include a strict interpretation of land use (ie. many of these areas will not be intensively farmed, and may only be used for grazing purposes is some cases).

In 2010, after listening to landholders, Arrow made a range of commitments in regards to development on Intensively Farmed Land. (Appendix 2)

7.1 Intensively Farmed Land

Intensively farmed land (IFL) is a term developed by Arrow to reflect agricultural areas on sensitive soils (ie. black soils, and similar high value soils) that are currently intensively farmed (ie. irrigated, cropped or other intensive agricultural enterprise), where relatively minor changes to the landform can have a disproportionate impact on the productivity of the land.

From this definition of IFL, it is very important to note the following points:

- Some areas that are defined as potential SCL or SCL, will also be defined as IFL (but not all SCL will be considered IFL, as it may not currently be intensively farmed);
- Some areas that are not defined as potential SCL or SCL, may be defined as IFL;
- Black soil areas, where intensively farmed are consider IFL;

7.2 Stakeholder Concerns About CSG Development on IFL

In addition to the potential impacts on aquifers, management of coal seam gas water, and the management of salt, the other key concerns of stakeholders is the permanent alienation and/or diminished productivity of IFL as a result of CSG development, physical footprint of CSG development on IFL impacting agricultural productivity, and alteration of overland flows.

7.3 What is Arrow Doing to Address Stakeholder Concerns?

Arrow believes that through appropriate consultation with landholders and broader communities and CSG development planning, both IFL and CSG developments can co-exist without causing permanent alienation or diminished productivity from IFL. Arrow is committed to working with all stakeholders, and implementing our development plans in a manner that ensures this objective is realised.

SCL regulations in Queensland will define and protect intensively farmed land, helping to put in place a framework for sustainable co-existence between the farming and Coal Seam Gas industries.

Arrow has committed to a range of measures to minimise impacts on IFL, including :

- No development in intensively farmed land until stakeholder concerns have been properly addressed;
- No construction of dams for coal seam water or brine on intensively farmed land;
- Investigate opportunities to minimize the footprint of CSG Development on strategic cropping land;
- Use of surface tanks not pits when drilling production wells on black soils;
- No hydraulic fracturing (fraccing) in the Surat Gas Project area;
- Development of a robust groundwater monitoring regime;
- Removal of produced salt from the landscape (at a minimum, Arrow will remove the salt and dispose to an approved and regulated landfill);
- Construction of 'fit for purpose' dams to Government standards;
- Prompt response to bore owners who report a reduced water supply;
- Location of wells and infrastructure away from homes and in consultation with landholders (minimum 200m);
- That we will consult with individual landholders on how Arrow can work with them to design our CSG development on their land, whilst minimizing any impacts;
- Commencing a development case study on an intensively farmed property with landholder assistance (refer IFL Committee below); and
- Subject to approval, conduct a trial of developing both CSG infrastructure and intensive agriculture on a farm owned by Arrow.

Activities that Arrow is currently progressing that will help inform how to minimise potential impacts from CSG development on SCL include:

- Development of a dedicated team to manage drilling activities on IFL. This will include specialised drill rigs and crews, that will be specifically trained in working on IFL;
- Implementation of ***time-lapse photography*** to demonstrate the lifecycle of activities on a Site, and to allow Arrow to review activities and identify opportunities for improvement;
- Commencement of up to three separate ***case studies*** on different properties/enterprise types in intensively farmed land areas. Case studies will involve working directly with landholders to design a CSG development on their land that allows both the farming enterprise and CSG development to coexist, with minimal impacts on the farming enterprise. Learning from these case studies will inform Arrow's development plans, and demonstrate our commitment to minimising our impacts on farming enterprises;
- Development of ***Standard Operating Procedures (SoP)*** for exploration and development activities on intensively farmed land, which will address key issues raised by landholders relating to potential impacts on IFL and detail how Arrow's works will be undertaken on IFL. A detailed SoP addressing exploration chip and core holes, has been developed by Arrow in consultation with the Arrow IFL Committee. A draft SoP addressing gathering line construction has also been developed, and is currently undergoing consultation with the committee;

- A range of exploration, drilling and development ***trials*** of techniques to assist in minimising impacts on IFL:
    - Trial exploration chip/core hole on non intensively farmed black soil, to demonstrate the work procedures developed in the SoP for Exploration Chip and Core holes on IFL (as discussed above);
    - Trial of implementing surface pits to manage drilling muds during the drilling process to eliminate the need to excavate pits with IFL areas; and
    - Trial of constructing and restoring a transmission pipeline within black soils to demonstrate how pipelines can be constructed with soils being removed and replaced in layers to maintain the existing surface profiles, and rehabilitated, to minimise impacts on farming enterprises.

Finally, Arrow is currently investigating a range of opportunities to further minimise any potential impact on SCL, including:

- Studying methods to minimise impacts and maintain the soil profile for gathering system pipelines:
    - Fully understand soil types in the region;
    - Minimising gathering system pipe diameters;
    - Use plowing rather than trenching; and
    - Burial to 1.5m depth.
- Investigating the opportunity to increase well spacing from our current estimate of 160 acre spacing to a larger spacing (up to 320 acre or greater) to minimise physical footprint on SCL;
- Investigating the technical feasibility of alternative drilling technologies, such as directional drilling to access coal measures, to potentially reduce the overall number of wells required and minimise footprint on SCL;
- Investigating the opportunity to replace drilling multiple individual wells on SCL with drilling multiple wells from one drill pad to reduce the number of individual well pads and hence minimize the physical footprint on SCL;
- Investigating opportunities to minimise gathering system pipe diameters and alternative options to direct trenching of the gathering systems, such as plowing pipe in, or horizontal directional drilling in extremely sensitive areas.

8. Social and Economic Benefits for Regional Towns and the Effective Management of Relationships Between Mining and Other Interests

The coal seam gas industry as a whole is expected to provide Queensland with around 18,000 direct and indirect jobs in the coming decade. For example, the Arrow Liquefied Natural Gas Plant project in Gladstone is expected to create up to 3,500 jobs during the peak construction period. The coal seam gas industry is expected to bring over $66 billion of investment to Queensland alone.

Social and economic benefits are already being delivered to regional communities. In the Surat and Bowen Basins, Arrow already directly employs over 250 people. To ensure that

companies have a skilled workforce for these significant works, the coal seam gas industry has put in place scholarships and training programs in local communities, which will provide school leavers and other community members with new skills, experience and job opportunities.

Additionally the coal seam gas industry is already investing in the communities in which we operate. For example, Arrow Energy's Brighter Futures programme provides funding for key community facilities, based on our focus of Health & Safety, Education, and Environment.

The compensation agreed between landholders and coal seam gas companies can provide a useful guaranteed income stream, which is not affected by fluctuations that impact upon the farming industry. The significant revenue flowing to both the Federal and State governments will provide additional benefits to regions across the country, including communities where Coal Seam Gas companies are operating.

Arrow has been actively engaging with the community on the issues associated with development on IFL through a range of forums, including:

8.1 Arrow Surat Community Reference Group

The Arrow Surat Community Reference Group provides a consultative forum and consists of spokespeople from the Basin Sustainability Alliance, Future Food Queensland, Cotton Australia and Central Downs Irrigators; six Arrow staff members; a representative from the Australian Petroleum Production and Exploration Association (APPEA); Department of Environment and Resource Management (DERM); Department of Employment, Economic Development and Innovation (DEEDI); Regional Council delegates; and a University of Southern Queensland representative. The forum provides the opportunity to communicate progress on issues, effectively identify and work through community issues, including potential impact on aquifers, management of CSG water and salt and workforce.

8.2 Arrow Intensively Farmed Land Committee

The Arrow Intensively Farmed Land Committee was formed to provide a consultative forum that, with regard to Arrow's development of a CSG resource on intensively farmed land within its tenements in the Surat Basin. The Committee contains both representatives of Arrow and various landholders representing different agricultural enterprises on intensively farmed land. The forum provides the opportunity to effectively identify issues, and provide feedback, and to collaboratively review opportunities for co-existence for CSG development on intensively farmed land.

8.3 Community Consultation

Community Consultation regarding Arrow Energy's proposed CSG development in the Surat Basin commenced in November 2009, has continued in June and November 2010, and May

2011. In the 12 months to June 2011, Arrow has consulted with more than 1200 landholders and community residents in the Surat Basin. Each round of consultation has involved community presentations in seven towns throughout the Surat basin (Wandoan, Miles, Chinchilla, Dalby, Cecil Plans, Millmerran and Goondiwindi). Arrow has committed to continue to regularly update the community on our proposed development, and consider the issues raised by the community at all stages of our development planning.

The May 2011 round of community consultation also involved three Water Workshops, which included a groundwater education presentation, presentation of Arrow's Water Management Strategy, and preliminary results from our groundwater modelling.

8.4 Irrigator Groups

Arrow Energy also has regular communication with the key irrigator representatives in the vicinity of our existing operations. We are currently working with the Central Downs Irrigators Group, the Basin Sustainability Alliance and Future Foods to investigate the best means of implementing Arrow's water management strategy, with the agreed objective of sustaining the water balance within the area Arrow operates.

8.5 Other Forums

Arrow Energy is represented on the CSG Surat Engagement Group (CSGSEG) was established in early 2011 to provide a forum for state government Directors-General and local government Mayors, Queensland Water Commission, CSG industry, Agforce, Cotton Australia, Basin Sustainability Alliance, landholders, APPEA and the Queensland Resources Council to identify and resolve key concerns relating to the CSG industry.

Arrow Energy is also represented on two further CSGSEG sub-committees which have been established - a water working group and a land access working group - to discuss detailed solutions to recommend to the CSGSEG. These committees collaboratively action decisions from the CSGSEG, and address emerging issues for consideration by the CSGSEG.

9 Health impacts

The coal seam gas industry has to conform to extremely strict health and safety regulations, and Arrow Energy's priority is the safety of its staff, the local community and the environment. We have done extensive testing of the gas properties and our emissions to show our coal seam gas operations are safe.

Arrow Energy is currently unaware of any specific health impacts related to the extraction of coal seam gas. Arrow is legislatively required to comply with strict emission standards relating to all emission sources, such as air emissions and water discharges. These emission standards

are enforced through Queensland legislation and our environmental approvals, and are based on scientific research to protect human health and the environment.

10 Summary

Arrow Energy is committed to the co-existence of food, fibre and energy. This submission outlines ways we are working towards coexistence. It also outlines programs of work we are undertaking to fully understand the nature and extent of any impacts the industry may have on communities, and to set in place appropriate mechanisms to avoid, manage or otherwise minimise our impacts. In terms of intensively farmed land and groundwater, we believe that our foot print above ground, and our impacts below ground, can be managed so as to provide for coexistence, and long term sustainability of farming across our project area.

The sustainability of water aquifers and future water licensing arrangements

Arrow contends that aquifers across the Surat Basin will, through application of solid science and best practice operations, not be adversely impacted by CSG activities. This assurance can be made with knowledge that with use of adaptive management systems, there will be time to respond, to either modify or cease any activities that are shown to pose, or threaten to pose, adverse material impact on aquifers. Further, Arrow is confident that its approach of maintaining the "water balance" in the region also serves as the ideal model to ensure the regional sustainability of aquifers and the important agricultural industries which they serve. Arrow is confident that its basic approach to maintaining the water balance, principally via the "substitution" of water entitlements concept, and operating within a commercially based framework, provide the right balance between maintenance of environmental water levels and wise consumption levels.

The property rights and values of landholders

Arrow has publically and frequently acknowledged that its business is founded on working on private property, and that those properties are often the home, livelihood and heritage of those who live upon them. The maintenance of property rights and values is therefore essential. In this regard Arrow has implemented management control systems to ensure that the basic rights of property owners are maintained (via our "Land Access Rules"). Further, we are seeking to fully establish a "compensation beyond impacts" system of landholder compensation, so as to ensure that the proposition to property owners includes an incentive component to co-exist with CSG. Arrow has also dropped the requirement for a confidentiality clause in compensation agreements, but includes it if the landholder wants it.

The sustainability of prime agricultural land and Australia's food task

Arrow believes that both agricultural activities and CSG developments can co-exist without causing permanent alienation or diminished productivity from intensively farmed land. Through appropriate consultation with landholders and broader communities, Arrow has developed a range of measures to minimise impacts on intensively farmed land and is

committed to working with landholders and other stakeholders to ensure this objective is realised.

The social and economic benefits or otherwise for regional towns and the effective management of relationships between mining and other interests

The coal seam gas industry as a whole is expected to provide Queensland with around 18,000 direct and indirect jobs in the coming decade and investment of over $66 billion in Queensland alone. The significant revenue flowing to both the Federal and State governments will provide additional benefits to regions across the country, including communities where Coal Seam Gas companies are operating.

Arrow has been actively engaging with the community on the issues associated with development on IFL through a range of forums, including:

- Coal Seam Gas Surat Engagement Group
- Arrow Surat Community Reference Group
- Arrow Intensively Farmed Land Committee
- Community Consultation
- Irrigator Groups

12 Land Access Rules

01

Only enter a property with the approval of your supervisor, who has cleared access with the landholder.

02

Only conduct activities that are approved within the access conditions.

03

Follow the directions of the landholders. Report any directions that are not within the access conditions.

04

Report landholder discussions, complaints or incidents to your supervisor or Land Liaison Officer.

05

Carry personal and vehicle identification showing that you are an employee or contractor of Arrow.

06

Keep sites tidy, ensure all rubbish is removed from site.

07

Do not interfere with the landholder's property, equipment or operations. Use approved tracks and laydown areas. Drive at less than 10kph within 200m of buildings. Leave gates as signed or found.

08

Do not take firearms, weapons, animals, illicit drugs or alcohol onto the property.

09

Do not light fires unless authorised. Smoking is only permitted in the designated locations.

10

Do not enter a site during or after wet weather without consent of the Land Liaison Officer (who has cleared access with the landholder) except in the case of a declared emergency.

11

Do not negotiate with landholders. Only Land Liaison Officers are permitted to negotiate activities and access conditions.

12

Do not threaten or pressure landholders or other people on the property.

Failure to comply with any Land Access Rules may result in disciplinary action.

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OUR COMMITMENTS TO YOU

- Improved community and landholder engagement
- An open and honest dialogue about issues and opportunities with our stakeholders
- Engagement with landholders at least six to 12 months prior to production drilling
- Adoption of a standard approach to compensation and land access
- No development in intensely farmed areas until concerns are properly addressed
- No construction of dams for coal seam gas water or brine on intensively farmed areas
- Use of surface tanks, not pits, when drilling production wells on black soil
- Development of a robust groundwater monitoring regime
- Prompt response to bore owners who report a reduced water supply
- Construction of 'fit for purpose' dams to government standards
- Removal of produced salt from the landscape
- Working with regional communities to maximise community benefits and opportunities for local businesses
- Location of wells and infrastructure away from homes in consultation with landholders (minimum 200 metres)
- No hydraulic fracturing (fracing) in the area of the Surat Gas Project

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