



Queensland Murray-Darling Committee Inc.'s Submission on Arrow's Surat Gas Project EIS

14 June 2012

Submission to:

The Chief Executive
Attention: The EIS Coordinator (Surat Gas Project)
Statewide Environmental Assessments
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This submission is presented by the Chief Executive Officer, Geoff Penton, on behalf of the Queensland Murray-Darling Committee Inc. (QMDC). QMDC is a regional natural resource management (NRM) group that supports communities in the Queensland Murray-Darling Basin (QMDB) to sustainably manage their natural resources.

1.0 Background

QMDC's internal policy, *Mining and energy industry impacts on natural resources in the Queensland Murray-Darling Basin Policy Revised Final Draft 2011* (the QMDC Mining and Energy Policy) provides a framework for QMDC's submission on the Surat Gas Project (**See attached document**). This policy document has been prepared by the QMDC in consultation with those communities, organisations and stakeholders QMDC is working with in the region. It is currently being reviewed to reflect QMDC's growing knowledge on the CSG mining activities and infrastructure. The policy's purpose is twofold:

- to address the impacts of the mining and energy industry (the industry) on the Queensland Murray-Darling Basin's natural resources; and
- to provide a framework for best practice and policy decision-making, risk management and responses to the specific and cumulative impacts of the industry on the QMDB's natural resources.

QMDC has also identified the key risks posed by the Surat Gas Project (the Project) against the Regional NRM Plan targets.

Surat Gas project EIS

Submission



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The below named natural resource assets are identified as being at risk to the impacts caused by activities and infrastructure proposed by the Project:

- **Water (surface and groundwater)**
- **Vegetation & Biodiversity**
- **Land and soils**
- **Air**

2.0 General comments

Overall, QMDC submits that Arrow needs to reconsider QMDC's Mining and Energy Policy. QMDC has a heightened concern over areas where there is a convergence and overlapping of risks in the eastern portion of the development area (see attached Maps).

The Maps demonstrate an area where strategic cropping land occurs on floodplain and has underlying aquifers used for existing, allocated uses (Map 1) and is also an area of high biodiversity priority (Map 2).

Therefore in QMDC's view the Maps represent areas of risk that warrant a "no go zone" where minimisation and rehabilitation of risks is unlikely to mitigate all risks satisfactorily.

Given the proximity of a large portion of the Project to the Condamine River, QMDC would like to point out issues in our policy document pertaining to buffer zones of widths of up to 500m from major stream orders. QMDC also draws Arrow's attention to the total impact on GQAL and SCL (estimated 60% and 49% of the development area) and our concern that rehabilitation of cracking clay/vertisol soils has not previously been demonstrated. QMDC therefore argues that development on SCL and these soils should not be approved.

It is paramount to the region's environmental, social, cultural and economic well-being that the EIS considers both the cumulative impact of the mining and energy industry as a whole alongside the impact of individual site activities.

QMDC seeks more information from Arrow that demonstrates adequate protection for the natural resource assets of the QMDB. QMDC asserts "adequate protection" of the region's natural resource assets must be within determined threshold limits for those assets, and which also defines the point at which impacts on those assets are no longer acceptable. The prevention, management or mitigation of impacts, whether direct, indirect or offsite must safeguard the region's natural resources.

QMDC admits that it has not been able to make all the comments we would have liked to owing to running out of time to do so. Realistic consultation timeframes would have enabled a better analysis of all the reports provided and their co-relation to the text of the main report.

QMDC therefore offers the QMDC Mining and Energy Policy as a framework to address the EIS where specific comments have not been provided by QMDC.



3.0 Specific comments

3.1 Section 1.2.1 Location (p. 1-2)

Arrow's statement that project infrastructure will be located "throughout the project development area but not in towns" implies the impacts will be mitigated or managed effectively.

QMDC argues the project development area is in a rural area which by its very nature will have major impacts on households and businesses that do not typically operate from or within a "town".

3.1.1 Recommendations

- **That the EIS needs to identify the proximity between the proposed infrastructure and all household dwellings, businesses and other "sensitive receptors" throughout the entire development area.**
- **That the Project establishes safe buffer zones between infrastructure and "sensitive receptors" for all household dwellings, businesses and other "sensitive receptors" throughout the project development area.**

3.2 Section 1.2.2 Scope (p.1-4)

QMDC asserts the EIS is fundamentally flawed because it cannot present the specific details of the infrastructure and facilities required for the construction, operations and decommissioning stages of the Project. This detail is needed to be able to assess the total environmental impact. Are communication towers for example included as key components of the infrastructure? If not - why not? If so, what is their impact going to be on the natural resources and communities of the region (air quality, biodiversity, vegetation, soils, floodplain function, electromagnetic radiation etc)?

3.2.1 Recommendation

- **That the EIS provide all relevant information related to the infrastructure and facilities required for the construction, operations and decommissioning stages of the Project.**

3.3 Section 1.2.3 Project Phasing (p.1-5)

QMDC asserts the EIS needs to address more fully the impact that relying heavily on the influence of "energy market demand", commercial sales contracts and exploration information for the Project's rate of development and project phasing. Does this mean for example gas reinjection will become a normal practice because the market demand does not align with the production yield?

QMDC asserts all CSG companies must plan for sustainable production of CSG and that the operations proposed by Arrow must reflect a commitment to sustainable production, so excess production and gas reinjection is not necessary in the first instance.



It would seem the practice of gas reinjection is due to excessive or accelerated production beyond a company's capacity to manage the gas. This lack of gas management capacity puts at risk a State owned asset. Any trial or operation to reinject gas poses in QMDC's opinion an unacceptable threat to a public resource, namely the extracted gas. QMDC understands that CSG companies do not own the gas but that it is a public resource.

The disposal or storage of CSG resulting from interruptions or ramp up management whether creating or risking the creation of more contaminated sites also poses too high a risk. QMDC asserts that the EIS must provide information on whether Arrow intends to reinject gas as a means of safeguarding the domestic gas supply. This information is required because of the risks associated with subterranean gas leaking, uncontrolled gas flow to the surface, aquifer contamination, unwanted faulting, which may result in serious injury or fatality. QMDC do not support hydraulic fracturing as a practice including for mitigation of gas reinjection.

Best practice requires proven scientific and technical solutions that assure there are no new site specific or cumulative environmental and socio-economic impacts. Infrastructure and associated industrial operations associated with disposal of CSG should be defined against specific criteria and limitations that mitigate the risks associated with the storage, transport, destination, loss of an economic resource, and cumulative and long-term impacts.

QMDC to date has never seen any model conditions devised for gas reinjection nor has it been party to any public forums to educate the public or regional communities on the process. QMDC has been informed by DERM that other companies perform gas reinjection. The Queensland Government has not provided the public or regional communities or key stakeholders with any fact sheets on the practice therefore we are alarmed that this is currently being practiced.

3.3.1 Recommendation

- **That the EIS provide all relevant information related to the influence of "energy market demand", commercial sales contracts and exploration information for the Project's rate of development and project phasing.**
- **That all proposed gas reinjection pilot trials or operational activities require a full and accurate assessment of all minor and major risks to environment and human health and well-being including sustainable economic development of the region.**
- **That Arrow be required to produce independently peer reviewed scientific data to support all future applications to trial reinjection of gas whether it be a pilot study or any other gas reinjection activity.**
- **That a fully explained business case which includes a full cost analysis around the gas management practices that cause the need for storing excess gas in the first instance is provided by Arrow.**
- **That DERM make publically available information outlining where gas reinjection activities are currently occurring or are proposed to occur and all conditions associated with those gas reinjection activities or trials.**

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- That DERM make it publically known whether gas reinjection is a petroleum activity and what legislation holds jurisdiction over its practice.
- That section 310V of the EPA is upheld requiring Arrow to complete an EIS for all future proposed gas reinjection activities or trials.

3.4 Section 1.2.4 Project Considerations (p.1-5)

QMDC asserts the limitations of this EIS caused by the lack of specific detail offered by Arrow, seriously undermine the capacity for community to understand and assess the full environmental impact of the Project. This illustrates a serious flaw in the documentation provided by Arrow. Arrow's claim that technical studies conducted result in multi-criteria constraints that inform potential impacts if they were to occur in identified ecosystems and environments does not in QMDC's opinion illustrate appropriate application of the EIS process nor best scientific practice. These studies may address some issues arising from the uncertainty created by lack of knowledge of specific sites but they certainly do not "overcome" all issues. Arrow themselves identify that uncertainty about exact location of wells and infrastructure limits this EIS.

QMDC's supports a framework to inform site selection and manage potential impacts based on the commitment to "avoid highly sensitive ecosystems and environments". QMDC argues however the EIS fails to give QMDC the confidence that such a framework is being promoted in all the Project's proposed operations and activities. There is an assumption that each activity can be undertaken "in a similar manner" and with "appropriate environmental controls" without scientific site specific analysis. This illustrates to QMDC a lack of understanding that impacts on not so sensitive ecosystems may actually lead to an ecosystem becoming highly sensitive. One size fits all is a dangerous assumption.

QMDC argues that although adaptive management can play a positive role in environmental impact assessments and addressing cumulative impacts and subsequent environmental management, the methodology must be correctly and appropriately applied.

Adaptive management must not be used as a substitute for committing to specific mitigation measures in order to cover a situation where Arrow is not sure how to mitigate a negative environmental impact, but commits to finding the technology or science in the future, if a problem arises. Additionally, it must not be used to attempt to reduce uncertainty with respect to likely significant adverse environmental effects.

Accordingly, if it is uncertain whether a significant adverse environmental effect from a development will occur, adaptive management cannot be asserted to, if there is a significant impact, so that Arrow will adapt to deal with it. As well, it cannot be used to attempt to reduce uncertainty regarding proposed mitigation measures nor be used as to "offset" to the precautionary principle. The precautionary principle requires that when faced with uncertainty regulators should act in precautionary manner. Adaptive management and the precautionary principle play distinct roles.



“Uncertainty” in the context of the Project relates to the understanding that no matter how much scientific evidence and other information to conclude, for example, that a mitigation technique will successfully mitigate adverse effects, there are unknowns owing to the complexities of ecosystems and our inability to completely predict future events. These unknowns could prove that our predictions about mitigation success were incorrect and therefore the best advice should be to adopt the precautionary principle and not proceed with the development.

If, for example, Arrow has not undertaken baseline assessments of environmental values in potential operational areas prior to the commencement of operations, then Arrow is further limited in their knowledge of the nature and severity of impacts. Indeed Arrow has publicly admitted that for some environmental values, baseline assessments were not made prior to development. Arrow therefore have only a very limited knowledge of the nature and severity of impacts across the Project area, undermining QMDC’s and the community’s confidence that Arrow has the capacity to develop, implement and design environmental controls based on best available science and technical data.

With the predicted 40,000 holes to be drilled in Queensland, 7,500 production wells in the QMDB for the Surat Gas Project it is urgent that the cumulative impacts and risks are quantified, for example, to groundwater quantity associated with aquifer and aquaclude integrity being compromised by drilling, fracking and repatriation activities. This type of information needs to be accounted for in Arrow’s modelling and reporting on aquifers and water sources. QMDC is most concerned that the sensitivity assigned to the Condamine Alluvium Aquifer in this EIS has been understated because Arrow have incorrectly identified the environmental value of the groundwater natural resource asset.

In areas where the controversial fracking process is used, there is serious and unquantified risk of groundwater being contaminated, either by fracking fluids, by saline associated water contaminated with the chemicals naturally present in the coal seam entering a freshwater aquifer, and / or by the gas itself. Fracking presents as one of those “unknowns” or areas of “uncertainty” where QMDC believes the precautionary principle should be applied and fracking not permitted.

By identifying not only risks but also thresholds or proximity to thresholds that influence ecosystem vulnerability provides Arrow greater opportunities to make better decisions. QMDC urges the EIS Coordinator to promote resilience-based decision making processes by requiring Arrow as part of this EIS to define a set of principles to assist with "building resilience and sustainability" which consolidate the precautionary principle, adaptive management, and local knowledge-based management practices approaches.

3.4.1 Recommendation

- **That the EIS identify all environmental values within the Project development area and that they must be properly described, to avoid underestimating impacts and to assure environmental mitigation, management and rehabilitation controls are appropriate in planning and design.**

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3.5 Section 1.3.1 Planning and Design Objectives (p.1-8)

QMDC fails to see how the international energy market demand safeguards Australia's domestic gas supply" when the drive for CSG companies is profit not sustainable yields. Additionally what is meant by safeguarding domestic gas supplies for "many years"? How is that many being measured and what safeguards are being referred to – are they costs, are they NRM outcomes?

QMDC therefore assert, that any risk assessment, and preventative measures offered by Arrow to safeguard domestic gas supply, are an accurate consideration of all risks minor and major to the environment and human health and well-being including the region's economic sustainable development.

3.5.1 Recommendation

- **That Arrow, assess all risks minor and major to the environment and human health and well-being including the region's economic sustainable development and describe fully the preventative measures Arrow proposes to safeguard domestic gas supply.**

3.6 Section 1.4.2 Dalby Expansion Project (p.1-12)

QMDC supports the consideration of the Dalby Expansion project as part of this EIS because of the need to address the Project's overall cumulative impact.

3.7 Section 2.1.4 Authority to Prospect (p.2-2)

It is unclear from the EIS whether the progression of tenure applications will impact on the estimated final number of wells of 7500. QMDC believes that this needs to be clarified.

3.8 Section 2.3 Additional Key Permits and Approvals (p.2-7)

QMDC is concerned by the number of additional key permits and approvals required and the compliance obligations attached to those permits and approvals as well. Clearly the monitoring that is required to assess Arrow's compliance and both site specific and the cumulative impact of the Project is extensive. How will this level of monitoring be resourced to deal with all associated matters?

3.9 Section 2.5.1 Planning Framework (p.2-10)

QMDC congratulates Arrow for taking into consideration the QMDC Mining and Energy policy. This policy however has been revised since 2009 in an attempt to keep up with the development of the CSG industry. There are a number of key changes to the QMDC Mining and Energy policy that would require Arrow to revisit if they are serious in their consideration of key planning policies.

QMDC notes, that the Regional NRM Plan, was not considered by Arrow and is missing from Table 2.3. QMDC suggests that this Plan is an invaluable tool for Arrow to consider because of the strategic direction that NRM Plans offer CSG companies in their project and field planning.

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Due consideration of the Regional NRM Plan would have provided Arrow the opportunity to develop the Project and engage in future planning that supports the coordinated delivery of natural resource management in Queensland.

QMDC submits that the EIS does not demonstrate a comprehensive understanding of the potential impacts of the Project in relation to the impact on the region's natural resources and other assets as identified in the Regional NRM Plan and the regional communities' aspiration's for these assets.

The Regional NRM Plan provides a framework that is available to Arrow to improve the management and condition of the natural resources in the project development area. A Regional NRM Plan if integral to Arrow's environmental responsiveness will help to align any future associated *Environmental Management Plans* (EMP) to regional resource conditions and aspirational targets and support the actions of the regional communities to reach those targets.

Regional NRM Plans because they integrate with other regional planning activities such as the draft Regional Vegetation Management Plans (RVMP), Water Resource Plans and other regional planning instruments enable Arrow to invest in natural resource planning processes enabling more comprehensive NRM outcomes.

Additionally QMDC and other NRM organizations are key regional stakeholders and if involved and considered by Arrow's project, field and environmental planners will provide Arrow the opportunity to adopt best practices based on invaluable landholder and NRM experience and technical expertise.

QMDC submits that the EIS neglects to fully consider and take into account the strategic direction regional NRM Plans offer Arrow and the CSG industry in their project and field planning. Due consideration would have provided Arrow with the opportunity to consider its EIS in a manner that supports the coordinated delivery of natural resource management.

3.9.1 Recommendations

- **That the EIS demonstrate how it will align its environmental management goals to the Regional NRM Plan.**
- **That should DERM not require Arrow to reconsider the EIS then DERM's decision manages changes in land use and environmental management planning and practices, by requiring stringent conditions for Arrow to:**
 - **protect and conserve regional and catchment environmental values;**
 - **undertake activities to arrest degradation and rehabilitate degraded areas. (This needs to include rehabilitation of soils, protection of aquifers and groundwater resources, restoration of aquatic and terrestrial ecosystem connectivity fragmented by mining and associated infrastructure);**
 - **adopt climate change adaptation strategies; and**
 - **adopt sustainable gas production practices.**



3.10 Section 3.1.1 International Demand (pp.3-1; 3-2)

QMDC believes Arrow needs to provide more robust discussion on “international demand” and “market failure”, and provide research data that analyses the manner that market forces influence decisions, both in a negative and positive way, on CSG production at a local, regional, and national level. QMDC argues the term ‘market failure’ should include economists’ failure to value environmental and ecosystem services in their measurement of GDP and business profits? What impact on the region’s communities and natural resource assets does placing more importance on the economy than the natural or social capital have?

Arrow claims that coal seam gas is a less carbon-intensive energy technology than conventional coal as per *Table 3.1 Greenhouse gas emissions per GJ of fuel combined*. QMDC asserts that this Table and its purported findings ignore current intelligence on the relative emissions of coal seam gas versus conventional coal when whole of life cycle analyses are conducted. QMDC is concerned that the EIS fails to provide relevant and current research that report that total emissions for coal seam gas are very similar to coal if whole of life cycle emissions including fugitive emissions are accounted for.

Arrow must address carbon emissions and carbon offsets based on CSG mining life-cycle emissions (including direct, fugitive and downstream) when considering energy production and environmental sustainability. An assessment of carbon emissions and the carbon offsets required need to ensure that interactions between terrestrial carbon disturbance and coal seam gas production can be managed or mitigated for example by:

- reduction in the rate of deforestation and land degradation;
- development of carbon sequestration projects in forestry and agriculture;
- promoting energy efficiency;
- development of alternative and renewable energy sources;
- reduction in solid and liquid waste;
- shifting to low emission transportation modes;
- adopting optimal mining surface disturbance practices;
- soil and biomass storage, and
- advancing reclamation best practices.

Fugitive emissions are recognized as resulting from the following sources:

- Point Sources
- Equipment Leaks
- Open Vats and Mixing
- Storage Tanks
- Wastewater Treatment
- Emissions from Cooling Towers
- Maintenance Operations
- Vehicle Movement and Exhaust
- Liquid Spills
- Storage Piles
- Bulk Materials Handling and Unit Operations
- Loading and Unloading of Vehicles

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- Painting
- Equipment Cleaning and Solvent Degreasing
- Surface Coating
- Abrasive Blasting
- Asphalt Paving
- Construction and Demolition
- Welding
- Open Area Wind Erosion

3.10.1 Recommendations

- **That Arrow provide independently peer reviewed research data that analyses international demand and the manner that market forces influence decisions, both in a negative and positive way, on CSG production at a local, regional, and national level.**
- **That Arrow provide independently peer reviewed research data that analyses what the impact on the region's communities and natural resource assets are when more importance is placed on the economy than on the natural or social capital.**
- **That Arrow must produce independently peer reviewed scientific data to accurately compare whole of life cycle comparisons and the relative merits of coal seam gas and coal with regard to greenhouse gas emissions and thereby comply with Queensland and Australian Government energy policies and legislation.**

3.11 Section 3.1.2 Australian Gas Resources (p.3-4)

QMDC asserts that by examining gas resources and reserves growth without examining the other natural resources associated with that gas is unacceptable. It paints a biased picture that promotes an economic driven science in a silo ignoring the principles and values associated with ecological sustainable development.

Arrow's identification of demand drivers fails to address issues associated with the "social licence to operate".

3.12 Section 3.2.2 Production Capacity of the Project Development Area (p.3-9)

Arrow's identification of "production capacity" fails to address issues associated with its "social licence to operate".

3.13 Section 3.2.3 Use of the Project Development Area Resource (p.3-12)

QMDC is concerned that a number of issues e.g. energy demand management, climate change impacts, environmental impacts have not been considered fully to give credibility to Arrow's statement that Australia's gas resources are sufficient to sustain both a domestic and export industry, and therefore the Project will contribute to supplying adequate supplies of domestic and export gas.

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Without a full analysis of other associated issues, Arrow is providing a biased picture that promotes information in a silo ignoring the principles and values associated with ecological sustainable development.

3.14 Section 3.3 Policy Framework (p.3-14)

QMDC asserts that the EIS fails to address other key energy policy drivers and has selected only those that promote economic development.

3.15 Section 3.4 Environmental and Social Impacts of Not Proceeding (p.3-16)

QMDC asserts a more detail is needed to fully consider environmental and social impacts especially with regards to an economic analysis and the impacts on natural and social capital.

3.16 Section 3.5 Summary of Project Need (p.3-17)

QMDC is not convinced by this summary that there is clearly a need for the Project.

3.17 Section 4.1 Physical and Natural Environment (p.4-1)

QMDC notes that throughout the EIS Arrow refers to how agriculture has led to significant modification of the environment. While this is true it seems Arrow relies on this to justify further modification by the CSG industry and more specifically the Project. QMDC believes because of the historical impact agriculture has had on the region's physical and natural environment, precaution should be encouraged with regards to further modification and impact by new developments and industry to ensure the cumulative impacts do not push ecosystems and natural resources over their threshold limits.

3.18 Section 4.1.3 Water Resources (p.4-5)

As per the discussion above Arrow refers to how agriculture in some areas has led to either "moderate" or "high level" modification of water resources. Again it seems Arrow relies on this to justify further modification by the CSG industry and more specifically the Project.

QMDC asserts the description of the water resources in the project development area fails to recognise the complexity and interconnectedness of those water resources and their catchments.

3.19 Section 4.1.4 Terrestrial and Aquatic Ecology (p.4-11)

Similar to the above comments QMDC asserts the description of the terrestrial and aquatic ecology in the project development area is inadequate.

3.20 Section 4.2 Social Environment (p.4-11)

As the above comments QMDC asserts the description of the social environment is inadequate.



3.21 Section 4.2.1 History of Settlement (p.4-12)

Again QMDC asserts the description of the history of settlement in the Darling Downs is inadequate.

3.22 Section 4.3.3 Major Projects (p.4-19)

Arrow's statement that 'a number of communities in the region' are benefiting from the development of energy resources needs to be supported by real data and research which compares both positive and negative impacts of the mining and energy industry on local communities. This statement shows a lack of appreciation of the huge impacts local communities are suffering from in terms of housing, social service provision, roading and transport, waste management, labour shortages etc.

3.22.1 Recommendation

- **That Arrow identify what communities have benefitted and how.**

3.23 Section 5.2.1 Production Wells (pp.5-6; 5-8)

QMDC finds the information offered by Arrow to describe the number, spacing and density of the Project's production wells confusing. It is unclear whether in-fill wells may be drilled only where initial well spacing is 1500 metres or whether it is possible for in-fill wells to be drilled on an 800 metre spacing. QMDC is concerned that in-filling is going to cause significant impacts especially if there are environmental, social and existing land use constraints to well spacing which necessitate a well spacing of 1500m.

3.23.1 Recommendations

- **That Arrow clarify all calculations and explain why an indicative range has been provided for an 800 metre grid well spacing, when the calculations equate to a 65 hectare or 160 acre spacing.**
- **That Arrow disclose whether the range estimates provided are taking in to account other infrastructure or rights of way.**
- **That Arrow disclose its intention to carry out in-filling on a range of well spacings from 800 metres to 1500 metres, or on wider well spacings.**
- **That in-filling is prohibited where there are environmental, social and existing land use constraints relevant to proposed production well spacing.**

3.24 Section 5.2.4 Water Treatment and Storage Facilities (p.5-14)

QMDC asserts the Project's proposed water treatment and storage facilities in context of the amount of CSG water production and the likely impacts on both human communities and natural ecosystems do not offer any real or concrete solution to the region. Proposed uses of the CSG water are still reliant on storage dams and finding end users for the water and the investigation and evaluation of "new and emerging technologies".



3.25 Section 5.2.5 Power Generation Facilities (p.5-18)

QMDC is concerned that a full assessment has not been carried out to evaluate the impacts associated with Arrow's demand on electricity and other energy sources.

The Project's electricity demands will impact on the current electricity infrastructure and by association, current users of this infrastructure in the project development area. Additionally if Arrow considers the demands on fuel to be significant, then this is also likely to impact on other users of these resources.

3.25.1 Recommendation

- **That Arrow fully assess how the Project's demand for electricity and other energy sources will impact on these resources, associated infrastructure and other users of the resources.**

3.26 Section 5.2.7 Supporting Infrastructure and Logistics (p.5-20)

QMDC argues that because supporting infrastructure will occur over "a large and diverse area" estimations related to that infrastructure need to provide not only sufficient detail but also accurate estimations of , for example the aggregate volume required, the amount of potable water needed etc.

QMDC is concerned that the aggregate volumes that have been estimated for the foundations of all of the production facilities have been substantially underestimated. Increases in these volumes are likely to place pressure on the region's existing borrow pits and quarries, other users of those resources, and transportation and road infrastructure. If estimations are incorrect, the Road Impact Assessment (Appendix M) will be also inaccurate and not provide a true picture of how the Project's supporting infrastructure and logistics will impact on the region's resources and communities.

Arrow states that the construction camps will accommodate between 200 and 350 personnel (Table 5.12) and include a range of facilities to accommodate this number of personnel. QMDC is concerned that the full impact of both construction camps and small mobile camps is not being fully assessed especially if these camps are not located on land owned by Arrow.

QMDC is aware that CSG companies already operating in the region are having a major impact on town water supplies. In light of the impacts identified by Arrow they are going to have on groundwater bores it is important to understand how town water supplies are also going to be affected.

3.26.1 Recommendations

- **That Arrow recalculate aggregate volumes required for all of the production facilities.**
- **That Arrow fully assess the location, proximity and capacity of existing borrow pits and quarries, the location, proximity and capacity of new or potential borrow pits and quarries and the impact on the resource and other users of these resources.**

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- That Arrow update the road impact assessment after completing the above assessments especially a revision of heavy vehicle movements relating to the transport of aggregate.
- That Arrow provide more detail on the full impact of construction camps including small mobile camps.
- That Arrow provide a full assessment of the impact of using town water supplies for its source of potable water.

3.27 Section 5.3.1 Sequence and Rate of Development (p.5-27)

QMDC does not accept that for the purposes of an EIS, assumptions based on a measurement that has no scientific grounding, namely 12-km. Arrow's statement that "production facility locations were assumed to be located somewhere within a 12-km radius that allowed flexibility for environmental and land use constraints" is most concerning especially if the region is striving for decisions based on best available science.

3.28 Section 5.3.2 Ramp-up Period Conceptual Gas Management (p.5-27)

Is gas reinjection going to be considered as part of gas management during ramp-up period? See earlier comments at 3.3 of this submission.

3.29 Section 5.5.1 Production Wells (pp.5-34; 5-35)

QMDC asserts Arrow must demonstrate how it will prevent adverse impacts caused by direct disturbance to, or extraction from, groundwater flow systems by:

- Not permitting activities where the impacts are not known or understood where the environmental or human health risks are high.
- Not causing interconnectivity between groundwater flow systems.
- Only permitting well stimulation or hydraulic fracturing (fracking) in coal measures where it can be guaranteed interconnectivity between aquifers and aquatards (aquicludes) resulting from the fractures in the coal seams and their surrounds will not occur.
- Not permitting activities where there are known impacts to stock and domestic or irrigation supplies.
- Not permitting activities that may, or will cause an impact to the groundwater quality, quantity and pressures in the Great Artesian Basin.
- Not permitting the use of radioactive tracer beads or chemicals for well stimulation or hydraulic fracturing (fracking) where they may pose significant hazards to humans or other organisms, including the potential for bioaccumulation.

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Drilling fluids appear to be an exception to being treated - is that because it is a cocktail of chemicals that render it impossible to treat?

QMDC understands that all of the water and associated muddy water that are used for drilling are by-products (Drilling by-products include drilling fluids (muds), drill cuttings, and wash water) from the drilling process. If these are collected, and the “muddy water” is put through a treatment to separate the solid materials in order for the water and solids to be disposed of separately - to what degree is the water to be treated and what volume of both the water and solids are to be disposed for this Project?

QMDC asserts that the treatment and disposal may greatly depend on the CSG company and what is negotiated with the landholder (in the way of re-use of by-products). No separation or treatment, for example, may occur and the by-product directly sprayed to the receiving land (via trucks with spray rigs much like water spraying).

QMDC asserts that use and management of drilling fluids need further consideration.

According to Origin “There are no specific regulations governing drilling by-product management in Australia”.

The lack of specific legislation around disposal of drilling by-products from gas and oil industry means that new disposal methods will be open to interpretation of various non-specific legislation and guidelines. This opens the industry to self-regulation, the intention of a CSG company may be to set a high standard of environmental protection, however other companies may not perform to the same corporate standard leaving the environment open to potential harm.

Where chemicals or other substances are used during the drilling process (chemicals or salt may be used), this would be inappropriate, for example, for land-spraying and should be regulated accordingly, or that the by-products are treated to a suitable standard prior to disposal via any means.

Bentonite and polymers used in the drilling process may be natural substances, however they are specifically used to manipulate the behaviour of soils (e.g. increase fluid viscosity, inhibit clay and shale swelling and sticking, and flocculate drilled solids (Zvomuya et al. 2008)). What issues would this cause to receiving soils in the disposal process?

QMDC notes that there is no measurement or discussion of radioactive substances such as radioactive tracer beads or strontium, which could be expected. An assessment of the drilling fluids in the drilling mud needs to include all chemicals and substances used.

The EIS’s risk assessment must fully assess the “potential toxicity” of drilling fluids.

QMDC has been informed that the following chemicals that may be components of drilling fluids are either hazardous (*) or are in some cases hazardous:



- Viscosifiers - Increase viscosity of mud to suspend cuttings - PAC R, (Cellulose derivative) Bentonite, AUSGEL (bentonite 1302-78-9 >98 polyacrylamide*)
- Bactericides/biocides - Prevent biodegradation of organic additives. Control or eliminate the bacteria in the water storage tanks - Bleach and green-cide (Glutaraldehyde*)
- Corrosion inhibitors - Prevent corrosion of drill string by formation acids and acid gases - zinc carbonate (products of degradation are more toxic.)
- Defoamers - Reduce mud foaming - Defoam-X (Glycol Blend 60-100 % - no CAS*)
- Emulsifiers and de-emulsifiers - Facilitate formation of stable dispersion of insoluble liquids in water phase of mud. De-emulsifier used to break emulsions- Versamul® (Fatty acids derivatives 40 - 80 Petroleum distillates, hydro-treated light 64742-47-8 20 – 60, Polyamide*)
- Lubricants - Reduce torque and drag on the drill string – Idlube (??), Lube 100 (Polyether polyol 100 %)
- Surfactants/Foaming agents - Facilitate formation of stable dispersion of insoluble liquids in water phase of mud - Drilling detergent (???)
- Shale control inhibitors - Control hydration of shales that causes swelling and dispersion of shale, collapsing the wellbore wall - IDCAP (polymeric shale inhibitor – NO MSD Provided on web) - Polyplus, (Anionic polyacrylamide 20 – 40, Petroleum distillates, hydrotreated light 64742-47-8 -20 – 40%*)
- Acrylamide -The International Agency for Research on Cancer (IARC) has designated acrylamide a Group 2A (probably carcinogenic to humans). This designation was based on sufficient evidence in experimental animals for the carcinogenicity of acrylamide (IARC Vol. 60, 1994, p. 389).The National Toxicology Program (NTP) classifies acrylamide as "reasonably anticipated to be a human carcinogen" based on sufficient evidence of carcinogenicity in experimental animals (10th Annual Report on Carcinogens, 2002). Acrylamide is a possible mutagen (promotes a mutation (change in chemistry of a gene)) (IARC Vol. 60, 1994, p. 389).
- Polymer stabilisers - Prevent degradation of polymers to maintain fluid properties.- Sodium sulfite (Very hazardous*)
- Breakers -Reduce the viscosity of the drilling mud by breaking down long chain emulsifier molecules into shorter molecules - Chembreak (citric acid plus enzymes)

Drilling by-products may therefore present an environmental and health risk as a consequence of the additives (i.e. individual components) introduced into the drilling mud and the chemical composition of cuttings.

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Environmental hazards associated with drilling by-products include potentially toxic additives, salt compounds, heavy metals, hydrocarbons, pH-control additives, and total suspended solids (TSS) include:

- Salt compounds. Salt compounds from the drilling fluid and the cuttings can inhibit plant growth by disrupting the ability of plants to uptake water. Increased salt concentration in fresh water can also be toxic to fish, plants, and other aquatic organisms (Bright and Addison, 2002; Arthur and Leuterman, 1992).
- Heavy metals. Heavy metals from both the drilling fluid and the formation tend to react with drill solids and clays and are not very mobile in the environment. They will not biodegrade and in some instances bioaccumulate and be passed up the food chain causing health problems, such as birth defects (Arthur and Leuterman, 1992).
- Organic wastes. Organic wastes such as petroleum hydrocarbons can increase oxygen demand load on streams and rivers and carry diseases (Arthur and Leuterman, 1992).
- Acids and Bases. Acids and bases (used for pH-control) can be detrimental to biota. pH shock from improperly disposed drilling wastes, whether liquid or solids, will disrupt ecosystems immediately (Arthur and Leuterman, 1992).
- Total suspended solids. Total suspended solids can impact receiving surface water by reducing the amount and the quality of available light necessary for plant growth. This additional loading also affects the fauna through mechanical toxicity. The increase suspended solids contain organic fractions which, as they degrade, diminish the surrounding waters of oxygen (Arthur and Leuterman, 1992).

The most common human health hazards associated with drilling fluids is contact dermatitis (International Petroleum Industry Environmental Conservation Association (IPIECA), 2009). However, drilling muds (or fluids) may present a range of other health hazards depending on the exposure pathway.

- Skin Contact. Upon skin contact to drilling fluids, the skin may become irritated. The symptoms and the seriousness of the condition vary and are dependent on the type and length of exposure to the drilling fluid and the susceptibility of the individual (IPIECA 2009).
- Skin irritation can be associated with petroleum hydrocarbons, which may be present in the drilling fluid. In addition, several drilling fluid additives may have irritant, corrosive or sensitising properties (IPIECA 2009). For example, zinc bromide is corrosive whilst a polyamine emulsifier may have sensitising properties.

The contact dermatitis hazards associated with known additives used by CSG companies are as follows:

- AUS-GEL is believed to cause minor irritation.

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- Biocides are known to be corrosive to the skin. Brief contact causes irritation whilst chemical burns can occur if not promptly removed. Staining is also a concern with long-term exposure.
- Skin contact with PAC-R is not expected to cause prolonged or significant irritation. It is not expected to be harmful to internal organs if absorbed through the skin.
- Drilling operations often involve the circulation of drilling fluids in an open system at elevated temperatures with agitation that can result in the inhalation of a combination of vapours, aerosols, or dust above the sump (IPIECA 2009).

The main inhalation risks associated with the additives used by are:

- Prolonged inhalation of silica dust related to Aus-Gel has been known to cause silicosis and other effects.
- Biocide inhalation may cause severe irritation of the nose, throat, and respiratory tract. Repeated, or prolonged, exposure may cause productive cough, running nose, bronchopneumonia, pulmonary edema, and reduction of pulmonary function. Aspiration into the lungs may occur during ingestion or vomiting, resulting in lung injury (chemical pneumonia).
- Inhalation of PAC R dust may produce mechanical irritation to the mucous membranes of the eyes, nose, throat, and upper respiratory tract.

Specific drilling fluid additives may be corrosive or irritating to the eyes (IPIECA 2009). Common hazards associated with the additives used are:

- AUS-GEL, which may cause mechanical eye irritation if dust is excessive.
- Biocides, which can be extremely corrosive and contact with eyes will cause conjunctivitis (redness and swelling of conjunctiva). Severe corneal injury may occur, with possible permanent impairment of vision.
- PAC R is not expected to cause prolonged or significant eye irritation. The material is dusty and may cause mechanical irritation and scratch the surface of the eye.

Drilling fluids are not intended for ingestion and consequently it is considered an unlikely risk compared to other routes of exposure. Some additives; however, do present a health hazard. The health effects that may arise from ingestion of the drilling fluids are:

- The health effects associated with ingestion of AUS-GEL are unknown.
- Biocide causes severe burning and pain in the mouth, throat and abdomen. Vomiting, diarrhoea and perforation of the esophagus and stomach lining may occur.
- PACR is not expected to be harmful if swallowed.

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QMDC asserts that the information on impacts (informal hazard assessment), does not attempt to look at possible exposure to stock, native fauna, or humans.

QMDC argues that no effective risk assessment has been carried out. Additionally QMDC argues a step is missing in the risk management process in relation to NRM and best practices, namely an assessment to whether the cumulative impact of the risks are too high to allow specific drilling fluid disposal methods to proceed.

Arrow at the very least when they ask the question “What is Risk?” should seriously consider the cumulative impacts and risks associated with the disposal of drilling fluids, which include spatial extent impacts – those which occur over an area; spatial intensity impacts – when a location is impacted on by the activities of multiple sites; simple temporal impacts when impacts have a specific time of commencement and a measured form over time; offset temporal impacts when multiple simple temporal impacts are superimposed upon one-another over time; linked triggered impacts when one impact, either by its occurrence or by reaching a threshold level, triggers another impact that would not otherwise have occurred. The second impact is the triggered impact.

3.29.1 Recommendations

- **That the EIS provide sufficient data on ecotoxicity/bioaccumulation risks, potential for environmental contamination (e.g. soil residues, pollution of air and water) with persistent heavy metals, salt, hazardous drilling fluids and other contaminants such as radioactive substances.**
- **That section 310V of the EPA is upheld requiring Arrow to complete an EIS for all future landspraying whether drilling activities or trials.**

3.30 Section 5.5.3 Production Facilities (pp.5-39; 5-40)

QMDC asserts the proposed erosion control measures should aim to avoid discharge of sediment-laden water to local watercourses rather than just merely limiting discharge to those watercourses.

Additionally QMDC is concerned by the recognised potential for soil loss especially if production facilities are constructed on GQAL or SCL or cracking soils.

QMDC is concerned by the reference to “radioactive wastes from integrity testing”. It is unclear if this waste is part of Arrow’s fracking process and the use of radioactive tracer beads.

3.30.1 Recommendations

- **That Arrow revises its erosion control measures to guarantee no sediment enters local watercourses.**
- **That Arrow are not permitted to operate in areas where soil loss will have impacts on GQAL, SCL or cracking clay/vertisol soils.**



- **That Arrow disclose all details pertaining to their radioactive waste and how they propose to manage that waste.**

3.31 Section 5.5.4 Water Treatment and Storage Facilities (p.5-40)

QMDC is concerned that Arrow is relying on dams to store CSG water (treated, untreated and brine). The EIS fails to fully assess the ongoing liability and cumulative impact these dams create in respect of increasing the contaminated sites in the region, the risks associated with flooding and other climate change impacts, leakage, salinity impacts etc.

3.32 Section 5.5.5 Power Generation Facilities (p.5-40)

QMDC is concerned by the lack of detail Arrow has provided throughout the EIS on power generation facilities.

3.33 Section 5.5.6 High-pressure Gas Pipelines (p.5-41)

QMDC notes that these pipelines “may have to cross roads, pipelines, railway tracks, utilities and/or watercourses. Without definitive details on the actual sites, QMDC is concerned by the number of intersecting barriers the pipelines may be both impacting on and be impacted by. This is likely to increase the risks associated with the construction of the pipelines. QMDC believes this warrants greater investigation especially with regards to flow diversion and the need to divert half of a major watercourse during construction.

QMDC also notes that some boreholes may not be cased for horizontal directional drilling purposes. Arrow has not provided detail on why this is unnecessary and what risks may be attached to such a practice.

3.34 Section 5.5.8 Construction Workforce and Accommodation (pp.5-44 to 5-49)

QMDC argues all workforce issues need to be revisited in light of the cumulative impacts being felt in Queensland, nationally and internationally with regards to availability of skills, labour and impacts on local businesses and communities and other industries. Current issues are only beginning to be realised in relation to the scale of their impact including the long term the health and well-being of individuals in the mining workforce and impacts on their families. See also *5.6.8 Operations Workforce and Accommodation* at p.5-57 and *5.7.8 Decommissioning Workforce and Accommodation* at p.5-63.

3.35 Section 5.6.1 Production Wells (p.5-49)

QMDC supports remote operating and monitoring of wells, however the EIS fails to provide sufficient data to outline what monitoring is being done to assure the integrity of aquifers is not compromised, that there is no contamination of aquifers, no leaking of fugitive emissions etc. The only monitoring proposed is for “pressure and water flow rates”.

It is noted “regular visits” to production wells will be conducted by field operators and maintenance personnel but only according to the EIS “to inspect and maintain surface facilities”. QMDC is not sure what this means in terms of the monitoring issues QMDC raises in the above paragraph.



QMDC is also unclear what “flushing” is with regards to downhole pipe maintenance and whether chemicals will be used to aid this flushing.

The process of a well workover is also not explained to give details on how long the process takes, what disruptions to farming activities are likely, what are well workover drilling fluids, what risks to the receiving environment are there, where and how will the waste be managed etc.

The EIS also refers to a “small safety exclusion zone” without offering detail re footprint size, reasons for its existence, is it danger to stock and humans because of machinery, noise, chemical use?

3.35.1 Recommendations

- **That Arrow’s monitoring regime assess aquifer integrity and interconnectedness and aquifer contamination.**
- **That Arrow provide details regarding the flushing process and identify risks and impacts to the receiving environment**
- **That Arrow provide a full assessment of the need for and the impacts of the small safety exclusion zone including any Work Health & Safety requirements regarding access to wellheads**

3.36 Section 5.6.2 Gas and Water Gathering Pipelines (p.5-51)

QMDC asserts that all waste must be accounted for. QMDC is concerned that fugitive emissions are not considered as waste products. Additionally what is in the sludge associated with pigging wastes?

3.36.1 Recommendations

- **That Arrow account for all waste volumes and their impacts that are likely to result from the maintenance of gas and water gathering pipelines including fugitive emissions.**
- **That Arrow provide information on how accumulated water will be captured and managed? Will this water allowed to infiltrate soils? If so, what are the impacts on environmental values on soil, agriculture, and groundwater?**
- **That Arrow disclose what contaminants are present in pigging waste sludge and how they will manage pigging waste including the sludge.**
- **That all relevant Appendices be rewritten to account for these volumes and their impacts? Appendix C, D, E, F, G, O.**
- **That Arrow fully disclose its monitoring and maintenance operations for vents, valves and drains.**

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3.37 Section 5.6.3 Production Facilities (p.5-51)

QMDC asserts that facilities that operate for 30 years 24 hours a day and 7 days a week will have a major impact on any “sensitive receptors”, agricultural businesses, towns, residences, and other human dwellings or services, regional ecosystem and their biodiversity existing in close proximity to those production facilities.

In QMDC’s opinion the EIS fails to fully consider the cumulative impact that this Project and all other production facilities of other mining companies, also proposing to operate for 30 or more years, 24 hours a day, 7 days a week.

3.37.1 Recommendation

- **That a full cumulative impact assessment be carried out on the impact of such operations in the region.**

3.38 Section 5.6.4 Coal Seam Gas Water and Brine Management (p.5-52)

QMDC believes that it is unacceptable that the Project be allowed to proceed without offering any real future solution for CSG water and brine management. All of Arrow’s proposals hinge on unknown factors or unproven technologies or future research yet to be conducted. Additionally CSG companies seem keen to pursue options which shift legal responsibility for this management on to 3rd parties, most likely to be farmers seeking water for irrigation and agricultural purposes and who are eager to mitigate the ravages of drought on their businesses.

QMDC submits that the limitation of water resources must be recognised within an environmental best practice planning framework. CSG water is not an opportunity without inherent risks and impacts. To date appropriate solutions for the reuse of CSG water are not scientifically or technically proven and indeed much of that water may end up creating contaminated sites. A full cost environmental accounting of CSG water disposal requires social and economic issues to be addressed. The re-injection of associated CSG water, for example, into aquifers must be supported by peer reviewed scientific data and regional certainty so there will be no impact to receiving or other connected aquifers; and requires independent monitoring and assessments of this practice.

Arrow’s planning for the project development area must address disposal of CSG water “by-products”. Infrastructure and associated industrial operations associated with disposal of “by-products” should be defined against specific criteria and limitations that mitigate the risks associated with the storage, transport, destination, and cumulative and long-term impacts of such volumes of water.

This EIS must consider whether the region’s communities are prepared to have an accumulation of contaminated sites or “stockpiles” of by-product to be dealt with once a future solution is found or washed away in floods or untreated CSG water released for emergency disposal? QMDC deems it unacceptable for CSG water to be washed away in floods or released to the wider environment for emergency disposal.

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3.39 Section 5.7 Decommissioning and Rehabilitation (p.5-61)

QMDC asserts that current EAs require as one of the criteria for successful rehabilitation that disturbed lands be returned to “their previous use and suitability class”. In this EIS, Arrow however proposes as part of final rehabilitation to return the disturbed land “to as near as possible” to the predisturbed state. In QMDC’s opinion this illustrates that Arrow believe that it is acceptable that only an attempt is necessary to fulfil their obligation to rehabilitate to a predisturbed state. QMDC views this as a flawed approach by Arrow to decommissioning and rehabilitation especially in respect of the estimated 60% GQAL and 49% SCL the Project will impact upon.

The below impacts will or may be caused by the Project:

- Erosion due to soil type
- Alienation of potential strategic cropping land
- Land contamination
- Conflicting land use

Soil management requires the CSG industry to view the soil as a finite resource and not a receiving medium for a whole range of toxic substances. Arrow identifies a large number of activities that have the potential to cause land contamination.

In accordance with the Strategic Cropping Land Policy if considered “relevant development” Arrow’s proposed development should avoid locating or impacting on strategic cropping land (SCL). Unless Arrow can demonstrate “exceptional circumstances” it will not be allowed to develop on strategic cropping land unless “the site can be fully restored to strategic cropping land condition”.

QMDC submits that thorough and detailed rehabilitation research programmes have not yet demonstrated that mining prime agricultural land is only a temporary cessation to agricultural production and that disturbed landscapes and soils can be reconstructed to pre-mine capability and productivity.

QMDC is therefore concerned that because of the number of activities proposed in this EIS that either involve major soil movement, long term storage ponds or facilities or have inherent contamination risks then should the land associated with this EIS be deemed strategic cropping land it will not be able to be reinstated or fully restored to strategic cropping land condition. The development would therefore permanently alienate rather than temporarily diminish productivity which would then require Arrow to demonstrate that there is no other site than on strategic cropping land or for the Minister to declare the project to be “Excepted Development”.

QMDC submits that in order to return the soil close to its original state (and cropping potential), entire soil profiles would have to be cut into layers and then stockpiled separately and replaced, in order, after mining. Mixing of the soil profile is likely to result in depression of crop yields due to the increased salinity and exchangeable sodium percentage in the upper layers. Additionally, the stockpiling of soil, which would be necessitated because of the restraints of the mining process, would result in organic matter breakdown in the surface layer and in the dispersion and erosion of the subsoil layers. If Arrow stockpiled a pile of topsoil for 10 years, most of it would be anaerobic. It would lose its biology and structure.

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Arrow's proposed facilities because they are situated in flood prone areas means that flooding poses the risk of further damage to stockpiles.

The potential impacts of the project development area on the cropping soils could include a reduction in the yield potential of the reinstated soil, loss or reduction of underground water supplies and dust impacts on surrounding crops.

The risk is that development because it is likely to occur within existing and/or proposed food production areas will result in a fragmented landscape with inadequate buffers. Failure to protect agricultural areas will impact on landscape features that support agricultural systems, resulting in either complete losses of agricultural uses on affected lands or diminished productivity.

QMDC submits that by focussing on existing land use the opportunity to secure strategic cropping areas that will prove invaluable as climate refugia for cropping in the future is being overlooked.

Protecting SCL and associated soils requires addressing the need to protect water. If land achieves the versatile cropping land classification it is because of access to groundwater as well as cropping reliability etc.

DERM must decide whether a minimum impact to SCL is acceptable and when an impact on water supporting SCL will trigger the proposed SCL Policy's intent to protect SCL.

This EIS assumes Arrow's proposed infrastructure has a footprint of temporary impact. This assumption requires the EIS to clearly identify what area of land or size of footprint triggers the indicator that productivity has been temporarily diminished. At what point does volume and configuration impact on productivity? Configuration relates to intensity of production and is as important as total, for example, if a property is to have 50 to 100 gas wells, access tracks, pipelines, waste water holding ponds etc the impact area could be considerable. Does lot size make a difference? Clearly farming activities are affected by size, whether high intensity or low intensity.

3.39.1 Recommendation

- **That Arrow not be allowed to proceed until they conduct rehabilitation trials on cracking clay/vertisol soils and SCL and prove that all disturbed lands can be returned to their previous use and suitability class.**
- **That rehabilitation is only considered successful where the disturbed lands have the same or better productive capacity as they did prior to disturbance.**
- **That if successful rehabilitation of cracking clay/vertisol soils and SCL is not possible, then project development activities must be prohibited in these areas.**

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3.40 Section 5.7.10 Financial Assurance (p.5-64)

QMDC does not support the “commercial-in-confidence nature of financial assurance” so that proponents do not have to disclose what that assurance is. QMDC submits that regional communities need to be assured Arrow can fulfill this obligation adequately. Will, for example, Arrow’s financial assurance take into consideration the impacts of climate change and variability on the project? Will it factor in possible impacts caused by economic recession, both local and global? Will it address global crises such as world food shortages etc?

3.40.1 Recommendations

- **That Arrow should fully disclose the details of their financial assurance.**
- **Alternatively, if the fiscal amount of Arrow’s assurance is deemed confidential, then Arrow should provide a disclosure and full description of the operational activities it proposes financial assurance for.**

3.41 Section 6. Public and Stakeholder Consultation (p.6-1)

Community engagement, disclosure of information and public consultation must meet community expectations for a more enduring and direct role in the planning, decision-making and implementation of natural resource policies and activities as they relate to CSG projects.

QMDC asserts this process still needs improving to ensure timely and adequate notification of proposed developments, particularly to individual landholders, local governments and communities where the development and associated developments have the potential to impact on the planning and resourcing of supporting infrastructure, services and land use e.g. farming, Industrial and residential zoning, waste management, sewerage management, roads, infrastructure, services (health, police, schools), airports, and emergency services.

QMDC submits that public engagement that is timely, meaningful and relevant and conducted appropriately for each stakeholder will encourage and facilitate active public consultation. This also includes public notification and consultation for EISs and any proposed changes to EAs or EMPs.

NRM organisations are well placed to strongly represent their catchments, and achieve policy and legislative positions that balance developments with sustainable NRM. QMDC would therefore assert the opportunity for regional communities and organisations to assist DERM’s Petroleum and Gas Unit, both the policy and assessment arms, with EIS and EA application assessments, drafting model conditions and broader policy should be supported by DERM. NRM expertise and regional networks provide an invaluable opportunity to facilitate and engage the region’s communities in the current and long term sustainable management of the region’s natural resources.



3.41.1 Recommendations

- **DERM to create trigger maps which highlight to proponents of development key stakeholders potentially affected by the EIS and its associated EA activities or who have an interest in the region or area likely to experience some kind of impact e.g. Regional NRM organisations, Landcare groups, Catchment Management Associations, conservation groups, peak industry organisations, local government, key community groups etc. CSG companies would then be obligated to notify these identified stakeholders of their EA applications.**
- **That QMDC and the Petroleum Gas Unit meet to explore how the Unit and QMDC can coordinate a consultation process that better engages NRM organisations and the communities and stakeholders they represent and or service.**
- **That DERM initiate a discussion paper or public forums that seek input from the public and regional communities on the mining and energy industry and how community consultation can be best facilitated with in a regional partnership and collaborative process to determine best industry practices within Queensland's catchment areas and regions.**

3.42 Section 7. Impact Assessment Method (pp.7-1 to 7-14)

QMDC asserts the technical assessments and methodology supporting the information offered by Arrow and Coffey Environments need to be independently peer reviewed as the technical specialists engaged in producing this section where they did not adopt statutory environmental values for areas where they were not provided defined their own values, albeit based on their experience or claimed accepted practice.

3.43 Section 7.2.3 Significance of an Impact (p.7-8)

The EIS needs to indicate how many years a study needs to be carried out before it can be ascertained the significance of an impact is. QMDC argues that appropriate design responses are not the only option available to Arrow to address impacts, indeed avoiding development in a specific area or outside buffer zones may be more appropriate than a design response.

3.44 Section 7.2.4 Application of Significance Assessment Method (p.7-9)

QMDC asserts an independent peer review needs to be conducted to assess the findings of the technical studies relied upon.

3.45 Section 8. Environmental Framework (p.8-1)

QMDC asserts that the reasons offered for uncertainty undermine the purpose of the EIS. The details or information not provided by Arrow are absolutely essential because of the area that the Project resides within and the significant impacts on social and environmental values both site specific and cumulative that the Project will have.

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Describing impacts as “typical” minimises the significant impact they may have on, for example, regional ecosystems, or individual fish species, or farming businesses, or human health, or air quality and so forth.

The region’s communities seek certainty where it is warranted such as an EIS assessment of a major CSG mining project in a world re-known agricultural area and accept uncertainty where it occurs because of lack of scientific knowledge.

3.46 Section 8.2 Environmental Values (p.8-2)

The environmental framework approach promoted by this EIS requires not only the accurate identification of environmental values but also a full consideration of the Project’s impact on those values. An accurate identification will enable Arrow to assign levels of sensitivity to those values and then apply an appropriate level of environmental constraint.

If, however, Arrow has failed to accurately identify the environmental values, then the environmental framework that Arrow uses to inform its project development on becomes flawed, resulting in inappropriate development and/or the application of inappropriate environmental management controls.

QMDC is concerned that if environmental values have been incorrectly identified and technical reports and assessments have not been independently peer reviewed, impacts on groundwater systems, existing land users, “sensitive receptors”, regional ecosystems etc are being underestimated or ignored.

3.46.1 Recommendations

- **That Arrow must accurately describe all environmental values in the project development area.**
- **That when all environmental values have been accurately identified and technical reports relied upon independently peer reviewed, the environmental impact assessment be amended to reflect new data/analysis or information.**

3.47 Section 8.4.1 Method (p.8-3)

QMDC appreciates the difficulties surrounding the most appropriate methodology to be used to assess cumulative impacts, however QMDC does not believe the cumulative constraints analyses captures all relevant information. Arrow need to be guided by government as to how to capture this information and what information is being sought.

3.48 Section 9.2.1 Baseline Study Method (p.9-3)

Arrow admits they have not undertaken specific background air quality monitoring over the project development area. Origin also and ambient air quality has been established by analysing the Toowoomba and Flinders View monitoring stations, 45km and 135km east.

QMDC is concerned that there is therefore no baseline by which air quality can be measured to address current and potential impacts on human and flora and fauna health.



QMDC submits that regional air quality issues must be assessed in relation to the cumulative impact of:

- all Arrow's operations within the project development area;
- all operations of the energy and mining industries in the region; and
- all operations of agriculture and other industries in the region.

QMDC believes a peer review of the Chemical Transport Model and the findings relied upon by Arrow is required.

The conceptual locations used for wellheads and production facilities are in QMDC's opinion are not adequate for an EIS process.

3.48.1 Recommendation

- **That the Surat Basin and other key rural areas within regional Queensland must be supplied air quality monitoring stations as a matter of urgency.**
- **That specific baseline air quality monitoring over the project development area is conducted.**
- **That Arrow be required to assess venting and flaring CSG against an air quality objective determined by the appropriate government body.**

3.49 Section 9.4.4 Emission Rates (pp.9-19; 9-20)

QMDC is not convinced without site specific data being provided that "natural airshed processes" are likely to disperse NOx emissions from wellheads and production facilities.

3.50 Section 9.5 Environmental Protection Objectives (p.9-20)

The exceedences identified in Table 9.8 are substantially above statutory guidelines and standards. QMDC asserts the EIS needs to identify what impact these exceedences will have on local, regional and national air quality.

3.51 Section 9.6 Avoidance, Mitigation and Management Measures (p.9-21)

QMDC argues that the primary action needed to be taken by Arrow is to ensure its production facilities do not produce the identified exceedences in the first place.

3.52 Section 9.7 Residual Impacts (p.9-21)

QMDC does not accept the mitigation action of separating distances from sensitive receptors as the most appropriate action. The exceedence should not occur in the first instance especially if production facilities will be operating for 30 years, 24 hours a day, 7 days a week.



3.53 Section 10. Greenhouse Gas Emissions (p.10-1)

Queensland has been identified as the fastest growing and most energy intensive state in Australia. Additionally more harmful greenhouse gases (GHG) are produced per person in Queensland than any other state with approximately 43 tonnes of greenhouse gas emissions per capita (2010). The activities required to fully support the Project will require a large consumption of energy and will result in increased GHG emissions.

Arrow's intentions to reduce GHG emissions from the generation of CSG recognize the impact of the Project on the environment.

QMDC is concerned that estimates of GHG emissions and the comparison of annual Scope 1 and 2 emissions with Global, Australian and Queensland emissions illustrated in Table 10.4 are being used as the relevant metric for determining environmental harm.

QMDC believes that the comparison of annual Scope 1 and 2 emissions with Global, Australian and Queensland emissions in Table 10.4 of the EIS is not sufficient to accurately address issues pertaining to GHG emissions.

QMDC asserts that a more appropriate assessment of the significance of the emissions, should be by way of assessing the contribution they would make towards exceeding the internationally agreed target of remaining below 2°C warming. Meinshausen et al. posit that the remaining 'budget' of global emissions to have reasonable chance (80%) of remaining below 2°C warming is approximately 529 GtCO₂ between 2011 and 2050¹.

This would therefore indicate that the emissions from the Project will devour approximately 0.16% of the world's remaining budget to stay below a 2°C warming. The IPCC Working Group I report (2007) noted that in order to achieve keeping global warming below 2°C requires global CO₂-e concentrations to remain below 450ppm (See Table 10.8 of that Report).

QMDC asserts that Arrow must address in the EIS their responsibility for the Project's proportional contribution to the global impacts of 2°C warming, namely, 0.16% of all of the impacts of climate change at that level. This includes the Project measuring Scope 3 emissions.

Issues relevant to the potential irreversible and significant level of harm, particularly on areas of high conservation value, in QMDC's opinion require the Project's GHG emissions and climate change impacts to be assessed as being able to cause "serious environmental harm".

QMDC submit that Arrow should be required to better summarise global and varied impacts by dividing the total economic costs of climate change by the quantity of emissions required to cause those costs to ascertain a social analysis of the costs of carbon.

¹ Meinshausen, M., N. Meinshausen, W. Hare, S. C. B. Raper, K. Frieler, R. Knutti, D. J. Frame and M. R. Allen (2009). "Greenhouse-gas emission targets for limiting global warming to 2°C." *Nature* 458(7242): 1158 as updated for an expert report to the Queensland Land Court available at www.envlaw.com.au/wandoan.



QMDC notes that a comprehensive review by Richard Tol found social costs of carbon through climate change to be \$30/tonne rising 2% each year.² If, that level, is applied to the total cumulative emissions from the Project, (843 million tonnes of CO₂-e) this would produce an economic impact of approximately \$35billion. This amount clearly outweighs the \$1.66billion the Project is estimated to benefit to the Queensland economy.³

QMDC believes that on the information available in the EIS the Project will expand global emissions of greenhouse gasses by 843 million tonnes CO₂-e. QMDC is alarmed that this will occur at a time in the world's history when emissions have already exceeded the resilience of the atmosphere to cope.

From the information provided by Arrow it is likely that the Project's emissions will not only intensify the current harms caused by climate change but will be a major contributor (0.16% of the world's remaining budget) to pushing global thresholds and the resilience of the atmosphere towards 2°C, which Australia has agreed internationally should be avoided.

QMDC is therefore concerned that the EIS fails to provide all relevant information on GHG emissions, namely it fails to:

- provide calculations of cumulative Scope 1, 2 and 3 emissions for the life of the Project;
- assess the resilience of the environment to receive further emissions;
- describe the significance of the impact of cumulative emissions by reference to 350ppm and 450ppm resilience thresholds;
- describe the cumulative impacts caused by the Project; and
- assess the proportional contribution of the Project's cumulative emissions to the impacts of climate change, including an assessment of the social cost of carbon.

3.53.1 Recommendation

- **That Arrow should not be permitted to proceed until it corrects the reporting deficiencies identified above and can demonstrate that 100% of the emissions from the Project can be safely and permanently sequestered.**

3.54 Section 10.6.3 Operations (p.10-9)

QMDC commends Arrow's recognition that there is the potential for Arrow to realize savings in energy costs and associated GHG emissions through energy efficiency improvements. However QMDC would suggest their action needs to move from a mere consideration to a commitment to an actual energy efficiency program especially by examining how they can lessen their demand of energy from the grid and better utilize solar power.

² Richard Tol, 'On the Uncertainty About the Total Economic Impact of Climate Change' (2012) *Environmental Resource Economics*

³ Table 5.8 of the Report.



QMDC submits the implementation of an environmental re-vegetation offset program to offset GHG emissions masks the fact that construction clearing may disturb terrestrial vegetation corridors, cause scouring and erosion of river banks. The biodiversity condition and ecological health of native vegetation in priority catchments must be maintained or improved regardless of the need for GHG emission offsets.

3.54.1 Recommendations

- **That the EIS demonstrate other energy sources available to Arrow and demonstrate how they can carry out their operations so that there is not an increase demand on the region's existing electricity grid.**
- **That the EIS demonstrates how renewable energy technology should be a fundamental component of Arrow's production facilities and other Project infrastructure and how it will inform Arrow's climate change response.**
- **That the EIS describe a GHG vegetation offset programme separate to a vegetation clearance offset programme.**

3.55 Section 12 Geology, Landform and Soils (pp.12-1 to 12-44)

QMDC submits the following general comments related to **Appendix E Geology, Landform and Soils**:

:

- **Impact assessments** do not identify or state whether there are areas that might be too severely impacted to warrant development at all ie a "no go" area.
- **Mitigation measures** are too general. There is no feedback mechanism that relates soil reporting and detailed technical assessments to potential impacts and mitigation measures.
- **Detailed soils investigation** appears to be superficial given the size of the study area. Authors appear to rely on Land Resource Area (LRA) interpretation mainly. It should be noted that LRA s are comprised of a number of soil types not just one, there are differences in features of these soils within the LRA and these have not been accounted for.
- **Impacts on 60% GQAL and 49% SCL** it is not clear from either the soils impact assessment or the agricultural report how the impacts on these high quality lands are proposed to be managed so that they will be restored to their former designation.
- **The sensitivity analysis** is innovative and presented well in Table 4.3 of Appendix E, however the question remains are there areas that are too sensitive for development and what are the specific mitigation measures to be applied.
- **Soil analyses and chemical analyses results** in Appendix C show little connection between any constraints identified here with site specific impact assessment.

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3.56 Section 13 Agriculture (p.13-1)

QMDC submits the following general comments related to **Appendix F Agriculture Report**:

The report identifies potential impacts but lacks site specificity. On p.67 of the *Agriculture Report* four broad impact areas have been identified but not expanded in terms of location, severity and extent.

3.57 Section 23.3.1 Currently Identified Aboriginal Parties (p.23-4)

QMDC acknowledges the Traditional Owner groups with registered claims with the Native Title Tribunal and whose Country the Project is situated in the project development area. QMDC also recognizes those Traditional Owners who do not have a registered claim with the Native Title Tribunal and those Aboriginal people that have strong historical connections to the Surat Basin.

QMDC submits that Arrow has restricted itself to an exclusive Aboriginal consultation which denies some Aboriginal communities and Traditional Owner groups to exercise their unique and special relationship (physical and spiritual) with their Country. If the Aboriginal communities and Traditional Owners in whose Country the project development area lies are to have a more meaningful involvement in the future decision-making, planning and management of the region's natural resources then their voices must be recognized by Arrow.

Mechanisms aimed at involving Aboriginal people in cultural heritage and natural resource management within the Surat Basin will need to accommodate, in an appropriate way, the dispersed locations of the Traditional Owners and those with historical interest.

Nations with association to Country within the Border Rivers and Maranoa-Balonne catchments include:

- Barunggam;
- Bidjara;
- Bigambul;
- Gungarri;
- Kambuwal;
- Kamilaroi/Goomeroi;
- Kooma; and
- Mandandanji.

QMDC submits that Arrow and the whole of the CSG industry have not to date created effective mechanisms for Aboriginal involvement in the planning and management of culturally significant sites and natural resources affected by CSG operations.

QMDC submits that the Regional Caring for Country Plan (the Caring for Country Plan) is a mechanism available to Origin that delivers vision and direction for the planning and management of Aboriginal cultural resources throughout the region. It recognizes the need

to protect important cultural, ecological, social and economic values in the region. It also represents the strategies and a framework to care for Country.

The Caring for Country Plan was prepared by QMDC in partnership with Aboriginal communities from the Maranoa-Balonne and Queensland Border Rivers catchments. The Caring for Country Plan has been developed as a key supporting document to the NRM Plan, to clearly highlight the cultural and natural resource management aspirations and goals of Aboriginal communities in the region and to provide further detailed direction to the NRM Plan. As a key supporting document to the NRM Plan, strategies have been developed that Arrow can take and implement with the likes of QMDC and/or other partnering organizations.

3.57.1 Recommendations

- **That because there is a larger number of Aboriginal people and specific communities affected within the project development area Arrow should identify these Aboriginal people and communities and take into account their interests through direct consultation.**
- **That Origin improve their involvement of Traditional Owners and Aboriginal people in cultural heritage planning and implementation by adopting appropriate engagement mechanisms such as the Regional Caring for Country Plan.**

3.58 Section 27.1 Impact Assessment Summary (p.27-1)

QMDC asserts priority landscape scale regional ecosystems should be maintained or improved so that ecological processes and ecosystem linkages are increased in extent and abundance at priority catchment scales.

QMDC submits that the decline in populations of 'at risk' flora and fauna species must be prevented. Native fauna are territorial and cannot simply move to another area if disturbed by noise, dust etc. The EIS must demonstrate scientific understanding of the importance of remnant vegetation and the habitat requirements of native fauna by preventing further fragmentation or destruction of ecosystem corridors. It should not be assumed fauna can be removed to another ecosystem if found where vegetation is to be cleared and that birds will simply fly away to somewhere else if disturbed by noise, dust etc. The EIS must demonstrate scientific understanding of the importance of remnant vegetation and preventing further fragmentation or destruction of ecosystem corridors.

QMDC submits that destroying habitat before equivalent habitat has been restored increases the risk of species extinction. Additionally, species need time to colonise a restored habitat, and too frequent a turnover of habitat may increase the risk of species extinction.

QMDC posits that the long term conservation of biodiversity and the well-being of the region's communities depend upon both the protection of natural assets and maintaining the integrity of the ecological processes that sustain them. A focus on process recognizes that ecosystems are temporally and spatially dynamic and that the components of ecosystems

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interact in complex and diverse ways that contribute to, and sustain biodiversity. Processes may also act as selective forces to which particular species are constantly adapting.

QMDC argues that the siting of a telecommunication tower, for example, in an area mapped as an Environmentally Sensitive Area (ESA) fails to understand the significance of the established buffer zone. Modification or destruction of ecological processes are in practice, often irreversible and an ecosystem will not necessarily rehabilitate to its prior function.

In QMDC's opinion the EIS fails to respond adequately to the complexities in the ways in which threats affect ecological processes and regional ecosystems. For example:

- Impacts may occur far from the location of the initial threat or disturbance.
- Threats that affect one species may have cascading effects on other species.
- Environmental responses to a threat are not necessarily directly proportional to the level of threat (ie a linear response). Non-linear responses mean there are critical thresholds where small increments of change can result in dramatic shifts in the state of the system.
- There is often a time delay, from days to decades, between alteration to an ecological process and its full effects on biodiversity.
- Threats may have a combined impact greater than their independent effects.
- Complexities in interrelationships among species and chance environmental variation may mean that often there will be uncertainty about the effects of a particular threat on processes.

QMDC recognizes the value of the terrestrial and aquatic ecology studies already conducted in the development area. QMDC believes further study is required to ascertain which processes have the greatest influence in this area, their role, the spatial extent over which they operate, the kinds of threats that are limiting their function. This will assist the EIS to direct its management strategies where it will have the greatest impact and be most cost effective for Arrow.

A fundamental tenet of regional ecosystems is recognition of the interaction between pattern and process. The identification and management of locations directly associated with a specific process is a practical way for Arrow to protect regional ecological processes. Examples in the project development area may include:

- Protecting floodplains adjacent to river channels to maintain lateral hydrological connectivity and the ecological benefits of periodic flooding.
- Maintaining continuous vegetation along elevational gradients to enhance opportunities for altitudinal migration or range shifts in a changing climate.
- Protecting key wetlands & natural springs along the migration paths of waterbirds as critical stops for refueling.
- Maintaining riparian vegetation to promote interactions between terrestrial and freshwater systems.
- Protecting small ephemeral streams and wetlands to aid the re-establishment of ecological process in restoration.

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QMDC asserts that in relation to the infrastructure mapping and ESAs and Regional Ecosystems and regrowth these are not adequately addressed in the EIS. QMDC submits that there would be scope to adapt the planning for the associated infrastructure to avoid impacts on environmentally sensitive areas as mapped.

There is no independently peer reviewed evidence or information provided that outlines what potential impacts may be. Additionally no attempts by Arrow have been made to demonstrate or guarantee no impact.

The establishment of buffer zones to protect natural resources should not be undermined. QMDC asserts the buffer zone around Lake Broadwater, for example, should be 2km not 200m.

QMDC acknowledges that there may be an increase in costs to Arrow as a consequence of development at an alternative site. QMDC asserts however that DERM should not support any more development within the ESA when viable alternatives exist. In all cases buffer zones protecting a Vulnerable Ecosystem should limit development. Additionally buffer zones protecting an Of Concern or Least Concern ecosystem require Arrow to consider offsets. QMDC asserts the EIS must demonstrate how the Project will protect ESAs, regardless of the effect of cost on a company's profits.

The preparation of technical reports should include an evaluation of alternative forms of development, and significant weight should be given to those strategies which minimise the impacts on natural resources. Due consideration should be given to the protection of ESAs and waterways. The siting of Project infrastructure should aim to avoid potential land use conflicts and long term impacts on regional ecosystems.

3.58.1 Recommendations

- **That the EIS demonstrate that the siting of the Project's facilities and any associated infrastructure will impact on high-conservation areas and remain outside appropriate buffer zones.**
- **That the EIS map out land for habitat connectivity to allow species to move as climate zones change.**
- **That DERM identify to Arrow the processes that are most important in sustaining the regional ecosystems (terrestrial and aquatic) and species in the project development area.**
- **That the EIS describes what long term monitoring programme Arrow will use to measure environmental change and generate information on:**
 - **The direction and magnitude of change(taking into account natural fluctuation)**
 - **The rate of change**
 - **The pattern of the change response**

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3.59 Section 27.2 Additional Studies (p.27-7)

QMDC submits that although DERM as the regulator plays the “last card” on “acceptable risk”, initial determinations are not the prerogative of a private CSG company nor any scientific researchers it pays to conduct research both with commercial interests in the outcome.

It is common practice that company based risk assessments, are frequently deemed confidential, do not incorporate regional NRM targets, do not respect local knowledge, depend too much on economic modeling which lacks peer review or environmental and social application and do not advocate a community participatory process or a precautionary approach.

The scientific reports relied upon by Arrow for the EIS weaken the intentions of the *Environmental Protection Act* by merely suggesting “preventative measures” which are based on a limited scope to address risks associated with potential impacts.

If the primary objective of the *Environmental Protection Act* is to improve the total quality of life, both now and in the future by maintaining ecological processes on which life depends then in relation to the EIS the science and technical expertise relied upon should be as a matter of routine independently peer reviewed in order to provide the best available science and knowledge to protect, public health, aquifers, waterway, soils, biodiversity etc.

3.59.1 Recommendations

- **That all technical reports and science used to support the EIS be independently peer reviewed.**

3.60 Section 28.2 Assessment Method (p.28-2)

The EIS must address the cumulative impacts the new development and associated operations will have on specific sites as a whole, for example, the impacts on the ephemeral nature of relevant watercourses, the quality and quantity of groundwater, the ongoing fragmentation caused by the development on the terrestrial ecosystems, residual risks from gas and water treatment by-products, accelerated consumption of a finite non-renewable resource etc. and the social, economic and environmental stresses caused by the construction and operation of associated infrastructure. It must also address the impacts caused by the whole of the CSG industry on the Great Artesian Basin, on the total air quality of the region, on the soils of the region and so forth.

3.60.1 Recommendations

That a cumulative impact assessment be done to illustrate the totality of impact caused by the total footprint of the proposed Project, of Arrow’s existing operations in the Surat Basin, and of the whole CSG industry in Queensland.