

Central Queensland

Community information sessions 16-17 November 2011

Introduction

In November 2011 Arrow Energy held a series of community information sessions to discuss its coal seam gas exploration program in the Nagoorin Graben, Styx and Capricorn basins.

Questions and answers were captured by JTA Australia and are presented in this document. Questions varied across the three sessions; to ensure that valuable information is shared throughout the communities, these notes summarise the discussions across all sessions. The notes are based on written records and include paraphrasing. Since the sessions, some answers have been further refined for brevity, clarity and to include the most up to date and accurate information available.

The information sessions were held from 16-17 November 2011 at:

- Ubobo 16 November 2011
- Marlborough 17 November 2011
- Rockhampton 17 November 2011

How to read these notes

Questions and comments from the audience are in bold type. The unbolded responses are from Arrow staff. In some cases responses have been summarised. Additional information is included where a question could not be answered or to provide further context or explanation; this information is italicised following the answer.

If you have any further questions or comments about the project, the meeting notes or if you would like detailed maps of the exploration areas, please contact the project team:

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Acronyms

ATP	Authority to prospect
BTEX	benzene, toluene, ethylbenzene, and xylene
CSG	coal seam gas
DERM	Department of Environment and Resource Management
GAWB	Gladstone Area Water Board
EIS	Environmental impact statement
LNG	liquefied natural gas
RO	reverse osmosis
SIS	surface to in-seam (drilling)
TDS	total dissolved solids

Conversions

1 megalitre (ML) = 1,000,000 litres

1 megawatt (MW) = 1,000,000 watts

Legislation mentioned:

Environmental Protection Act 1994

Mineral Resources Act 1989

Coal Mining Safety and Health Act 1999

Environment Protection and Biodiversity Conservation Act 1999

UBOBO

Date:	16 November 2011	
Venue:	Ubobo Memorial Hall	
Presenters:	Carey Bradford, Exploration Manager – Southern Region	Arrow Energy
	Jeroen van Dillewijn, Manager, Water	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. I hear that Shell and Petro China are taking quite an interest in Arrow.

Shell and PetroChina now own Arrow; they bought it out in August last year.

2. My big worry there, is we've all heard how much disdain China has for our rules so what's the chance of it saying 'to hell with the safety rules, we're going to do it our way'?

PetroChina's revenues are in the order of six times what NSW makes. It's very proud of its brand and has an obligation to its shareholders to get these things right. I think you'll find that as a 50/50 joint partner PetroChina is also coming to grips with what it is like to work in Australia.

Standards in Arrow have improved since Shell and PetroChina came on board as they have oil field backgrounds. They bring a lot of technical expertise with them as well as financial resources. There's a huge amount of legislation that covers this industry and if we don't follow it government can shut us down.

There are many foreign owned companies that operate in Australia, and they all need to follow the laws and rules that apply here. They can't pick and choose, or use different standards, and this is particularly so in regard to safety rules which are very stringent in Australia.

3. Presuming you go ahead in the valley, what would you see as your contribution to social infrastructure in the immediate area, not in Gladstone?

There could potentially be a small power station which would create jobs for a small number of people, plus service run-offs to those sidings.

In terms of the broader EIS project, part of the EIS involves undertaking a social impact assessment which includes a social impact management plan. We're participating in forums about social housing and other issues from a social impact perspective.

In addition to that, we'll be continuing support of our social investment program. It's important to know that we are a couple of years away from our final investment decision in 2013 at which point available investment funds are likely to increase. But yes, we are involved in it already.

Arrow is very conscious about ensuring benefits are returned to the communities in which we operate. Elsewhere, where our project is more advanced, Arrow has various social initiatives including the Brighter Futures program that provides support for community initiatives linked to health, education and the environment. We will also implement various other initiatives and programs linked to our EIS and development programs.

4. One of you at the last meeting said I should talk to the company; see what they could contribute to our community organisation. Would there be money available for this area and not just Gladstone?

Yes, absolutely. Ubobo is one of our exploration sites. There is a pool of money designated for exploration sites, so we can look at possibilities here.

5. Is subsidence potentially an issue?

The short answer is – no. To explain more fully, it helps to visualise what the rocks look like. When we see a coal seam, it's actually representing a preserved swamp. As the deposition of sediment speeds up, silt is laid, then sand, then rubble.

When we look at the amount of water that we actually take out we generally reduce it by about 1%, which is fairly insignificant. The coal seam is like a sponge, any void space will eventually be refilled with water. In Australia there has been CSG extraction for 40 years and there's been no visible subsidence.

6. You explained the methods you're using to test out here. When it comes to actually putting in wells and while you're doing the testing, you said that you release the water to release the gas. Do you use any chemicals in that procedure as well?

We use a variety of drilling muds to assist in the process. Coal is such a very fragile reservoir and it's very easy to clog it up. So the types of drilling muds and fluids that we use are cellulose-based material, so very biodegradable - guar gum or xanthan gum which is an emulsifier used in mayonnaise and all sorts of food. Generally the stuff we use is food-grade and it's biodegradable so it doesn't damage the coal left there when we flush it out of the coal seam. We weight the well if the gas pressure is high, which means we essentially add a salt which is heavier and holds the gas and CSG water in place.

None of the products we use contain the BTEX group of chemicals (BTEX is an acronym for the group of chemicals benzene, toluene, ethylbenzene and xylene). Further, in the general course of producing coal seam gas we don't need to use any chemicals.

7. So is there anything that's likely to harm the water supply environmentally for the future?

We would expect our sphere of influence to be very minimal which is why we use the cellulose and biodegradable materials. We don't use toxic chemicals such as BTEX chemicals which a lot of people are concerned about.

Arrow, together with various other CSG companies, has been producing gas for a number of years, without need for use of chemicals, and without causing contamination to groundwater supplies.

8. Can you give a guarantee that the water won't be affected?

Well, I don't see what would be left there. We do all sorts of studies as part of exploration; I think our tests have been more than adequate.

(Jan Taylor) I understand that the words may worry you a little, but can I just say that if you asked Carey was the roof going to fall in tonight? He would be unable to guarantee that it wouldn't. That's not a criticism; the reality is he's a scientist; there is absolutely nothing that can be guaranteed or given as an absolute. But certainly in terms of what Arrow has said to you it does not use BTEX chemicals.

If we use the example of the way we produce coal seam gas elsewhere, then we can be sure that there is no mechanism to contaminate groundwater. We do drain water from coal seams, since that is a fundamental requirement to release the gas the coal contains. However, we isolate the coal seam and the water it contains from the surrounding strata and aquifers so there is no cross-exposure.

9. I think that's the one thing we want guaranteed.

As stated, Arrow doesn't use those BTEX chemicals that have been talked about a lot. Some of the chemicals that are used in North America are not even allowed to be used in Australia. Arrow's doing everything really well and quality control is an absolute essential.

10. Here we rely totally on underground water. My first question is where are you taking the water from? Do you use it for farming or for personal use? Is it from the same level as the coal seams?

Could you tell me what depth your water's coming from?

(Members of the audience suggest depths of 30m, 6-8m, and 16m)

Your water source does not come from the same depth from where Arrow would extract CSG. The depth of your water bores is generally shallower than where Arrow produces water and CSG which is generally between 400 and 800m. We cement our holes in place to stop any mixing of water into other aquifers.

There are regulations in place that require Arrow to measure whether the extraction of water is having an effect on groundwater levels.

The water that Arrow takes from coal seams is not for personal use, or indeed any other purpose. It is simply a necessary part of reducing water pressure in the coal seam which in turn releases the gas that the coal seam also contains. Our preference in terms of how this water is managed is to maintain the water balance in the region so that the water is not removed from the system entirely. It could be that by treating the water through reverse osmosis that we can use it to supplement irrigation water as is being trialled in the Surat Basin area now.

11. We'd like to know for sure that you won't affect our water.

The first issue is whether the drilling can affect your groundwater? No it won't because of the cemented strings. We cement the casing in place in each well to ensure the integrity of the well.

If at some point in time exploration is successful and we start drilling more wells, then we start modelling the groundwater system. We start modelling to see if there's any way that what's happening in those wells several hundred metres below could slowly start to affect the water in your levels over several years. That won't be likely to be contamination, but it might be that the draw down on those holes several hundred metres down might be enough to cause your groundwater levels to drop a little bit, and that's what we model. Generally that effect is reduced several orders of magnitude so if we reduce the pressure by a certain amount, e.g. a drop of 100 units, the effect that you'll see just below the surface will be something like one or two units. The government has a system in place where they check what we model to ensure that it's accurate. We're also obliged to monitor the situation by drilling wells, both above and below the coal seams, to make sure that we measure the

effects of what's happening to the groundwater levels. That's how we then make sure that we're not contaminating or affecting the pressure in the bores you have.

12. I wanted to ask about BTEX. The leaflet here says that Arrow does not use BTEX but these chemicals can be found in petroleum-based products such as greases.

The answer is that we don't use greases that contain BTEX, but in your car you may have grease that does. During our drilling processes we do not use anything that has BTEX in it. Even the greases we use are checked to make sure they do not contain any of those four elements. However, in the coal mining industry (which isn't our industry) you may find BTEX on occasion.

13. So how does it get down into the well?

We don't use grease that contains BTEX in excess of government mandated limits. Other industries such as the automobile industry are not as rigorous as the CSG industry and they may use BTEX chemicals in their products.

It is worth noting that benzene is very common in many man-made products. For example, it is present in cola drinks, and most people will inhale some each day from vehicle exhaust fumes. The exposure in our modern environment is much greater than the levels we see in coal seams.

14. My second question: if you go ahead and drill lots of wells in this area, what is our valley going to look like with the 70 x 70m pad, the dams etc? What infrastructure are you going to bring into this valley for us to look at every day and contaminate the air we breathe?

When the wells are drilled at the exploration stage there is a single 70 x 70m pad. When we finish drilling that gets rehabilitated and disappears. During exploration Arrow will not require a dam as it will not be producing water. The second phase is pilot testing when we would drill four or five wells in that general area. The size of the dam required during the pilot testing phase will depend on the nature of the coal and the water content in the coal seam.

In reality the impact of CSG at ground level is not obvious. The wells are spaced far apart, and are not large. The dams are not dissimilar to those used for other purposes. As to claims about contaminating the air - this cannot be caused by CSG, which is a non-toxic gas. In any case, the gas is at all times contained in the well or pipelines, hence gas does not enter the air.

15. What size is it?

It's not a straight-line equation that we use. There are very complex relationships between permeability, gas saturation and the amount of water. In the Bowen Basin, the size of our dams is about 100 x 100m or 50 x 50m; the size will be worked out when we understand what the reservoirs are, how much water is in there, and how saturated the coal is. When we go to full-scale production, there will be a 10 x 10m wellhead. There will be underground pipelines joined up to small compression stations. We have a few boxes containing motors producing electricity for the area. This is where people who have watched *Gaslands* turn around and say 'Arrow is polluting the air by sending noxious chemicals into the air'.

Shale gas and coal seam gas are two completely different industries. Shale gas has been cooked up for a long time underground. It's normally about 2km deep and contains higher

levels of hydrocarbons and condensates. CSG on the other hand is about 98% pure methane – the other 2% is made up of nitrogen and carbon dioxide.

(Comment) We understand that it is a cleaner burning fuel. What I find startling is all the other things that you do to the environment along the way to get to that point. It's really like burning coal; yes, there won't be the burning part so it's cleaner but I don't agree with the rest of it.

There is no such thing as free energy; even solar or wind powered generation systems need metal and cement and transmission lines and maintenance which have their own environmental impact. CSG is relatively low impact, with the key issue of concerns about water being manageable.

16. Is there a set distance that you can place a production well from an aquifer?

If you mean the aquifers that you're using, then by definition we have to go through them to get down to the coal. However, by cementing the strings in place there is a number of barriers between our well and your aquifer and we can test that before we start using the well. If that barrier doesn't exist then it's a safety issue for us, too, so we can't use that well for production and we would have to redrill the well.

There is no 'set distance' as this will depend on the geology of an area, and in any case the design and construction of CSG wells is done in a way to isolate aquifers. Part of the work we do, both during exploration, and in our environmental impact assessment stages, is to understand the nature of aquifers and groundwater in a region, to make sure we can put in place measures to manage any impact we may cause.

17. So if there was an aquifer 500m away with pure water, you would drill close to it?

There can be aquifers at different intervals throughout the section above, and including, the coal seams that we might target for gas extraction. The key measure to safeguard these aquifers is in the use of casing and cementing procedures, which ensure our wells are isolated from their surroundings. We don't want to lose gas into the formation, nor do we want extra water coming into the well. These casing and cementing techniques are well established and are used around the world. For that reason we are confident that we will not impact shallow aquifers that may contain fresh water, as typically would occur with alluvial aquifers in river flats etc.

18. So you're saying that there is a safe distance, but it changes?

We need to differentiate between surface waters, like rivers and creeks, which have a specific separation distance, which is 100m, and aquifers, for which there is no specific separation distance.

Aquifers are complex in that they are part of the geological column (i.e. the layers of rock that exist below ground), and while many rock formations can hold some portion of water, the ability of water to move through or be released from these rock layers can vary greatly.

19. If your ponds get flooded, where does the water go?

There are government standards to ensure the location, design and operating water levels in the dams are appropriate. Arrow is required to report these levels to the Queensland Department of Environment and Resource Management (DERM) on a regular basis.

The dams are built large enough so that the water will not overflow. If the water in the dams exceeds the allowable limits, Arrow would have to stop production.

20. How can you guarantee that toxic water would not overflow from the dams?

We control where the water flows but it is important to clarify that the water produced is considered 'waste' because it is more saline than surface water so it cannot be put directly back into the ecosystem. As a result, Arrow treats this water and is looking into beneficial use opportunities for both the treated water and the salt that is produced through the treatment process.

The DERM standards require us to build dams large enough that they do not overflow. We are required to report the levels of those dams to DERM on a regular basis. If we see there's a risk of overflow at the start of the wet season, we actually halt production. We cannot continue producing if there's a threat that it might overflow, given the amount of rain expected. As the wet season progresses, we continue monitoring and if it's raining more than usual, we have to stop producing. We process the water so that it is clean and can be used for some beneficial use. Once we have processed the water, we can use it for irrigation, for example, which we have done in the Surat Basin, or for other uses rather than just leave it there and allow the dam to eventually fill up.

21. How is it processed...in a desalination plant?

There are several different ways of processing water. The most common method in Queensland is called reverse osmosis (RO). It reduces the salt content to bring the water within potable quality standards. There is a small amount of brine produced in this process which is the salty bit that's left over. What we are trying to do is find ways for that salt to be used. If the quantities of salt are not sufficient to make it commercially viable for a beneficial use then we would have to move the salt to a regulated landfill.

22. What is being done now about monitoring the dam that was built when Arrow started drilling in this area in 2004? What have you done with the waste fluids and has it overflowed into the river?

Arrow did not have all the information at hand to answer this question during the session and committed to coming back to the community with the additional information requested.

Arrow has not used this dam in relation to CSG activities, hence any water in it is from the surface, and most likely rainfall. That said, we are still responsible for this dam and will take measures to ensure that it is properly decommissioned and rehabilitated.

23. I don't think the last summary was sent out.

We sent copies to those for whom we had records. All the summaries are available on the Arrow website.

24. Our community depends on the underground water supply for personal use and agriculture. Why didn't you do any testing before you started so you know the underground water quality? When do you start testing that water?

There are several reasons. Firstly, we're not required by the conditions of our environmental authority or environmental law to test before we drill an exploration well. We are, however, required to test before we produce any water (as with a pilot well). Prior to this stage, Arrow will sample water from all the wells in the area which includes checking the water level and quality as a baseline.

The second, and main reason, is that the exploration stage is about getting information on both the geology and the hydrogeology (or groundwater system) in an area.

Further, due to the limited time and impact of our exploration activities we can be sure that there would be no impact on local groundwater systems. The practices we use in drilling exploration wells differ little to those used by water bore drillers, hence we are confident that our wells do not cause impact to groundwater.

25. During exploration drilling you removed quite a bit of toxic waste to our landfill.

The material produced from drilling a well, which consists primarily of fragments of ground up rock, is considered 'waste' but it is not toxic. Because it is considered a waste product, it has to be disposed of at a registered landfill site.

26. How many semi-trailers of waste do you remove per well?

On average, there would be at least a semi-trailer of waste per well.

27. That's not correct. I understand that you probably have three trailers of waste per well and you'll damage the roads.

The volume of material we remove from a well is roughly about 10 cubic metres or so. If we assume this material has a density of 2.5cc/gm, then that is about 25 tonnes – or one truckload. We would also use about 36-40 cubic metres of water, hence 2-3 truckloads of water. We often have to repair roads because of our heavy equipment. Arrow is also considering adopting a pitless style of drilling which will reduce the amount of waste produced. That is one of our big projects at the moment; to work out how we can improve that waste management stream.

Arrow will also work with local councils and provide financing to repair roads should the volume of traffic reach a level where it could potentially damage roads.

28. You haven't discussed with the community the fact that you are taking contaminated waste away from these exploration wells.

What they're calling contamination is the chloride level from the potassium chloride. Potassium chloride, better known as muriate of potash, is like a fertiliser in most cases.

Within six months we will have determined where we will be drilling. Until then we won't be putting pits in the ground, it will be captured in skips.

29. Where to?

It depends on the nature of the waste when we test it. If we use the right technology with centrifuges and equipment the brine can be reused and the waste which is actually clay can go to landfill and it could be put onto people's properties. We need to do testing and trialling to see what we get.

30. Who does the water testing?

We're required to do a number of tests and take identical samples which then get sent to two different labs. DERM has to undertake audits of our testing to make sure it's happy with it. DERM can also send a sample to a third lab to make sure the lab results are correct. f

31. Could we as a community ask for independent testing?

You'll see the results of our sampling and testing because we send you the results as well. You could then undertake to get another sample or you could take a sample yourself.

32. What's actually being tested? We don't know much about these things so we don't understand the results. It really comes down to who's done the test, what is being looked for, and I think the answer that you want.

When we come to your property we explain the process to make sure you're aware of how it will happen. We'll undertake to explain what the samples are and what the results mean. Everything is tested, even things that aren't relevant to us, and you actually see the results yourselves. We can explain what is interesting to us and what things are wrong. It will be your own water so you can see what that water looks like. As we test it in the future you can also check that the water hasn't changed.

33. If it's a small area, why not leave the exploration until you have a little more knowledge if there will be concrete wells going through our aquifers. Leave it there for now, and give it another 20 years. Let's see what happens everywhere else. You're saying it's small...

We do exploration to a point, then we work out how much gas is there. Our plans for this area are nothing like in the Bowen or Surat Basins.

Exploration does not automatically or directly lead to development. We want to understand what is here, and our initial impression is that the gas in this area might suit local power supply e.g. electricity generation for the local region and Gladstone.

34. Who's going to be responsible when the concrete cracks?

Shell has been drilling wells like this for around 140 years so we've got ample evidence internationally and in Australia to show that doesn't happen. Also, the leak path that you get from cement is at least less than the leak path that you get through the existing rock, because the rock does allow some leakage through. The risk is very small. To answer your question about concrete cracks, there's no fracking happening, so the concrete won't crack.

35. What about an earthquake? What about in the future in 50 to 100 years' time, are you going to be responsible for what happens?

Our responsibility continues after the project finishes.

Coal seam gas occurs in the earth at very low pressures, and is kept in place by the pressure of water acting on it. We need to pump out the water to release the gas. If we stop pumping, then the gas stops flowing. Hence once we cease production any remaining gas won't flow to surface. This is probably the most fundamental safeguard of all. However, we supplement it by securely cementing and sealing our wells. This cementing covers the entire length of the well, so there is no void space left, and therefore a solid plug is formed. The cement cannot suddenly disappear, even if there was to be an earthquake.

36. A farm without water is not much of a farm. My concern is that we're talking about exploration wells. When you're going to drill a well and take the gas out will it be a bigger hole?

Exploration wells are not production wells, they are different in several ways. For example, exploration wells are about four inches in diameter, which is too narrow to enable a pump to be inserted in it. By contrast, a production well is about six inches or more, which is big enough for a pump.

Legally we are not legally allowed to produce gas commercially at the exploration stage. To do that we need a petroleum lease, this in turn has various other requirements for grant. In short, we cannot simply convert an exploration hole into a production well.

37. Do you create a vacuum down there by taking all this gas out? Is that going to suck our water into that space?

No we do not create a vacuum but we do create a difference in water pressure, which drives water and gas toward the well.

However, the ability of water and gas to flow through rock and coal is complicated, due to the differing permeability of these different layers, and by the natural re-charge that occurs when water moves from one part of the system to another.

38. That's a bigger problem if all my water's gone.

It is possible for example that if Arrow was drawing water at 400m it could affect water at 100m. There could be some draw down. The government is developing rules about how we have to compensate you depending on the impact we have on your water.

That is the reason why we model and then monitor groundwater. The modelling lets us predict what might happen if we drain water from a coal seam, and the monitoring checks to see if it is actually happening as predicted. We can put in place measures to control or mitigate any likely impacts; in the worst case we could detect a change and if necessary stop production.

39. We don't want compensation; we want water.

We have to ensure that we do not affect your water supply. We enter into a 'make-good' agreement. The way it works is that if your water supply is affected, we are required to provide you with water that is at least as good as the water you currently have.

We are constantly updating our groundwater models with data we collect so we may note a change to your water bore before you notice it yourself. The government builds its own models to test ours, and if those models suggest there is a risk you might be affected then we are obliged to start making good before the impact has taken place. This can include installing a pump, drilling deeper, giving you our water when it is cleaned, providing water from another source, or financial compensation.

The government sets those rules and also enforces them if the company and the landholder are unable to reach agreement.

Arrow understands the importance of water. CSG water can be treated to provide a new, or substitute, source of water, and to reduce demand on other aquifers to let them recharge. There are positives that can be provided.

(Comment) It still seems a heck of a risk. When all the water has gone from the farms, the world is full of holes in the ground because of the value you're taking out. This is what worries me with mining generally. A crack in the cement or whatever the water's trickling through, it doesn't take much to let all the water out. It just seems to me that we want to be a lot more careful how you go about this to ensure that the water doesn't go. Forget about the compensation. If this doesn't work and there's no water, then where will we be?

- 40. You have been here since 2004 drilling. Today feels like the same spiel you gave us twelve months ago about exploration. Are you going to be clear and transparent to the community and let it know if you're going to actually get it out of the ground, because that's when you will really sneak up on us.**

We definitely have to do a pilot first. There was one small hole drilled and it was unsuccessful. In a couple of years' time we'll be a lot better placed to see where we're at. Drilling technology and its cost are constantly changing. We're drilling on a very small coil tube, it goes down and uses high pressure water. We have to look at the economics and work out whether we can get a return. There are big coal seams, they're quite tight, they've got a reasonable amount of gas but we have to make that gas flow.

We do not have firm plans for this area yet; this is simply a function of the fact that we are still exploring, and that we are more focussed on developments in the Bowen and Surat Basins. It is early stages, and as we find out more, and our plans start to develop, we will consult accordingly.

- 41. I was just wondering how long you leave the concrete down the wells. How long does that concrete sit there for?**

As we've said, drilling's nothing new. We've been doing it for over 100 years in the petroleum industry. There's nowhere really for it to go. Its tensile strength is generally better than the rocks around it.

- 42. After 99 years does the concrete break down?**

We know cement lasts many thousands of years... just consider ancient Roman and Greek structures.

- 43. Once the concrete breaks down, does that leave air pockets or anything like that?**

I honestly don't believe that the concrete is an issue. There will be no air pockets because there is nowhere for the rocks or cement to go.

(Comment) There's no way that concrete is going to last for that long. You're going to get cracks, and what comes through cracks, water or gas? You cannot guarantee this.

(Comment) You said earlier that the government's forced you to do things and that's a little bit scary. If you haven't had a look around lately, look at what the Queensland Government has let happen to Gladstone Harbour. That's scary.

Coal seam gas and coal seam water can usually only be released if they are pumped to surface. When the pumping stops, the flow of gas and water stops too.

- 44. You could probably get on side with a lot of farmers if you gave the potash away.**

The chloride that's involved with it is essentially fertiliser. We could look at that, however we need to have better technology, such as centrifuges and other equipment that will tell us how much fluid we had when we started the hole and ensure it's the same amount when we're finished.

- 45. When you do an EIS, are you doing an EIS just on gas or are you doing it on the area you're in, including farms, villages, lifestyle, schools, all those sorts of things, because they all come under that scenario.**

Yes, the EIS has to cover the whole environment including community, housing and environmental issues.

An EIS studies environmental, social and economic impacts.

46. So you consider whether your activities will be adverse to farming communities or farming land?

If your question is whether agriculture is captured in that process, the answer is yes. The impact it will have on agricultural land is assessed. The measures that are currently put in place to reduce that impact are assessed and presented to government, which decides if those mitigated impacts are acceptable.

It covers agriculture and groundwater, and more than that. It covers where dams are going to be built, invasion of privacy, the visual amenity of what these things look like, and the road transport required. It covers any impact it will have on rivers, on the atmosphere and noise pollution.

(Comment) This year we've had a tremendous wet season so the environment here is probably the best it's been for 30 years; we've got lots of wildlife. We're concerned that animals living here are going to be threatened by CSG activities.

We are bound by the same sorts of limitations on environmental disturbance as other industries. In most cases, due to the flexibility inherent in CSG, where we have some room to move in locating wells and infrastructure, we can, within reason, avoid sensitive areas and ecosystems.

47. If we sent a community delegation to meet the community in the Surat Basin, would we find happy people?

We haven't fully started operating the Surat Gas Project although we do have a number of small operations there at the moment. You'll probably find a mixture of people with a variety of emotions. I think you will find that the farmers and landowners we deal with on a daily basis understand the issues. I don't believe they all would say they are happy but we'd like to think they'd all say to you that we deal with them fairly and it is possible for us to co-exist.

48. For the EIS I assume you are operating under state guidelines. I heard the Federal Environment Minister say that he's trying to get the states to come up to federal environmental standards because they are much higher.

If it's a small operation such as what we're doing here now then we undertake an environmental impact assessment for the Queensland Government. That results in Arrow being given an environmental authority; if it becomes of national significance, the second process kicks in, which is the federal one that you're referring to and that requires an EIS. We have to submit the EIS to both the federal and state governments for them to assess it and put conditions on it. If they're not happy with what we say we will do, they tell us what more we're going to have to do in order to get project approval.

49. He was basically saying that at the federal level he thinks there is more that states should be doing and that he or his department was encouraging them to come into line with the federal standards.

That is a matter for government to resolve, and we can't comment. The Federal Government has avenues to consider environmental impacts in EISs via the *Environment Protection and Biodiversity Conservation Act*.

50. Will the Federal Government be interested here?

It depends on the process and what the trigger level is, but not necessarily if the project is very small and self-contained.

There are certain thresholds which trigger Federal Government involvement. It is too early to tell if those thresholds will be crossed.

51. Going back to water again; the drill sites appear to be right on the river?

The rule of 100 metres is new as previously the limit was 50m. The rules have changed a number of times since 2004.

52. That's still awfully close to the river.

As Carey pointed out, we're more often 500 metres away. The process is that an ecology assessment gets done and, depending on the watercourse, its size, ecological or environmental value, it will be determined how close we are allowed to it.

53. If we end up with the gas wells, where are the desalination plants going to be?

Typically you have one facility and small pipes which send the water into a central place; that's where the dam will be. For example, we will have one dam servicing about 100 wells. That dam and the treatment plant would be co-located and will generally not be located on good farming land.

The question is how to get the water we've processed and proven useful for agricultural purposes back to people who would like to use it. This option means that you're not taking the groundwater, so the groundwater levels in the shallow aquifers are going to be recharged by the rainfall and that takes care of some of the impact you are already having on the level of the aquifer and at least makes some good use of the water that we have extracted.

54. How do you extract the gas in your wells? Are you fracking?

It depends where we're working. It isn't a straight-line equation; it's a complicated relationship between the gas content and the gas saturation and permeability. In the Bowen Basin we generally have very tight coals. Down to about 400 or 500m we use what is called surface-to-in seam (SIS) drilling. We drill at an angle, curve the well down into the coal seam and drill along the coal seam about 1 kilometre.

However, at about 400 to 600m it starts to become uneconomical. We have started trialling some fracking in the Bowen Basin but we have yet to produce any gas that way. We intend to continue to trial some of that technology in the Bowen but we're also trialling different styles of drilling. A similar idea involves using tubing in a radial pattern.

We are not fracking in this area to date. We haven't determined the best production method to suit the coals in this area, but fracking could be an option. While we understand it causes a lot of concern, it is subject to very strict controls, and the way Arrow conducts fracking in the Bowen Basin is done in a way to minimise impacts. It is also important to note that there have been fracked wells in the Bowen Basin since the 1980's, and all the negative publicity around fracking has originated from overseas, not based on any Australian experience.

55. How long is the life of an average well?

Once again it's not a straight line equation, but for a production well typically 15 to 20 years. Wells initially produce quite high rates of gas then they taper off and continue to produce significant volumes of gas over time.

Exploration wells have a very short life measured in weeks or months. Pilot wells are active for longer periods, usually several years.

56. If it starts raining, you said you'll stop so the sludge pits don't flow over. What happens when we get a flood? Half the wells in this area are within the flood region.

This is why we are moving from using pits in the ground to having a pitless system next year.

57. Is there any requirement for mining companies after they take out an Authority to Prospect for them to notify or talk to the landholders who are within that area?

There are no guidelines requiring us to notify landowners when taking out an ATP. Depending on the level of activity we anticipate, we may contact landowners and undertake community consultation.

58. Apparently we are under an ATP but we didn't even know about it.

The only way you can really find out is to check out the interactive website that DEEDI runs called IRTM (mines.industry.qld.gov.au/.../interactive-resource-tenure-maps.htm); it shows all of them.

59. Is any of this area under the cropping land legislation?

I'm not sure about this area. We're very concerned about it in the Surat Basin because it takes up a large proportion of our project area, and we are working very closely with the farmers out there. We will find out the answer for you.

According to the SCL Trigger Map published by DERM there is a very narrow area along the Boyne River that is classed as SCL.

60. Where are the boreholes? Would it be possible to have a map showing where the boreholes are?

Yes, we can give that to you. We're also required by law to report all that information to government via maps, surveys etc. It is also available publicly on DEEDI's website (see above).

61. So we're talking about liquefied natural gas; it doesn't come out the ground in liquid form, does it?

No.

62. How is it meant to come out of the ground under its own pressure? You can hardly suck gas out of the ground?

No, we reduce the water level first because it won't necessarily flow otherwise. Most wells don't, so we pump the water out. Once the water goes and the pressure in the water reservoir in the coal seam is lowered the gas starts flowing by itself.

63. I'm worried most about the vacuum or the gap in the ground the water can go into because you're going to have good water seeping down there into a hole and just filling up the gaps in the coal.

We have a number of wells producing in both the Surat and Bowen Basins, and not one farmer or landowner has yet seen any impact on bores that we're aware of.

It will take time for that pressure to move but the water may eventually get there. Arrow is modelling these impacts, and so is DERM. We have estimated that a 200m draw down in the coal seam would result in a two metre drop in the shallow surface aquifer in 50 years' time. It won't all make its way down there because there are a lot of different directions to fill that gap and it takes a very, very long time to fill it because those layers of clay are not very permeable. They aren't impermeable, but they're not very permeable. In the meantime there's recharge coming through from the rain and of course there's also water coming from other aquifers and filling that gap which is why that overall pressure impact on the shallow aquifer is much smaller than the pressure impact that you'll see further down.

64. I come from Monto, a very important little place, 70 or 80 kilometres over the hill. Does Arrow Energy have the right to do exploration drilling in the Monto area? And if so, are you drilling there at present?

We do hold tenure near Monto – ATP687, which was granted in July last year. However, we haven't done any work there to date.

The website mentioned previously provides the detail on that ATP.

(Comment) I was at a cattle sale in Monto today and was told there are a couple of companies in the area right now drilling for something. I can understand the worry these people have with water. We live in the best country in the world, but it's one of the driest continents on earth, and you can't eat coal or gas so I can understand that people need to be concerned with water.

65. How do you check on your dams if it's flooding?

To prevent us from finding out at the last moment, we check our dams on a regular basis, generally monthly, and we will be checking well before the wet season.

66. Quite often the river comes up before we even know it.

River flooding is a different matter; you can't build a dam somewhere that a river can flood into. We monitor the rainfall and how much space we have left in our dam. We monitor rain forecasts and predicted water levels and if it started to threaten we would check more often. As I said, the government requires us to keep our dams well below the flooding point. The dams have to be a certain number of metres below that point before the wet season starts.

67. In 1974 the dam wasn't as high as it is now. If the water comes as high as it did in 1974 it will flood.

It can. The law says you're allowed to put water into the river if it is flowing on a certain level. There is also a relief valve built into the dams so treated water can be released into the river if necessary. If that happens, it will never be the produced (saline) water dam; it will always be a treated water dam that we would release.

If an emergency does arise and we simply can't do anything else with the water, then the treated water can go into the river under emergency conditions set by DERM. DERM has the right to give permission to discharge treated water into the river as long as we reach the dilution factor. If it's at the stage where there is flooding, then the amount of water that we are putting in, compared with the amount of water that is moving through, is very small.

(Comment from Gladstone Area Water Board representative) This is a priority for the water board; its authority ensures the quality and quantity of water in Lake Awoonga. GAWB monitors the quality of the water in the lake at various locations. Around Lake Awoonga there are two restricted areas including restricted area 44, where no mining activities are allowed. There are also sub-blocks around restricted area 196 where mining activity is restricted and can only happen with the consent of the water board. Arrow Energy is beyond the limits of the restricted areas.

(Comment) I'd like to thank Arrow for coming along today. You guys have been digging around here for a few years now. You must have some indication of what there is and what effect that's going to have on this community. You will also have some idea of population increase and traffic movements over a five year period. Can you give any indication of what that will be?

We're not sure about development in this area, but if there is gas here it probably won't be enough to justify a pipeline to send it through to Gladstone.

The development I can envisage for the area would be a small 15 to 20 megawatt power station, not much bigger than you'd have in a truck, but it would be converted to run on gas. It's not very big and would fit on a tennis court. We would probably need about 30-odd wells and would need to add a handful of wells every year. We would probably need 3-4 well field staff, a couple of people to control the gas flow through the pipelines and so on, and a couple of maintenance people. There aren't massive amounts of gas here so it would be a fairly modest sort of operation.

68. We can't take heavy vehicles in this area. What kind of heavy vehicle movements would there be through this area?

We need to enter negotiations with council to provide money to repair any potential damage that we do, that's required of us by legislation.

The amount of truck traffic varies depending on the stage of a development. Obviously there is more in construction, but this tapers off once the field is established. In general, the nature of the gas resource here suggests that a large scale development is not warranted, which means that the level of activity would be correspondingly lighter.

69. We've just travelled up from New South Wales up the back along the Newell Highway through Goondiwindi and other areas where a lot of gas development is occurring. There are a lot of trucks and we saw the impact on the roads. What guarantee do you have that the government doesn't get the money from you to improve that area, but it doesn't spend it here but down in Brisbane and the south-east corner.

I wouldn't say the Goondiwindi area is particularly representative because it was hard hit during the flooding earlier this year and there is significant roadwork going on because of that.

We can't direct where state or local government spend money they receive through royalties, rates or other sources. In our experience, we note that councils and governments generally try to achieve a balance between the needs of the many, and to spread spending fairly.

(Comment) It doesn't matter how much money the government takes, there's no guarantee that it's going to come back to this area. I saw huge amounts of heavy

vehicles going along there carrying parts, oil wells and dongas. That's a lot of extra heavy traffic.

70. During the last session you had told us you would provide us with the notes from the session but we didn't receive them.

JTA did provide them to those for whom it had contact details. In any case, the notes from this session and previous sessions will also be available on Arrow's website.

Please ring 1800 038 856 if you would like a hard copy of the notes from the first community information session held in October 2010 in case your copy went astray.

71. If we as a community don't want this here, can we stop it?

There are legislative rights that enable a gas company to go to the Land Court and seek mediation. We haven't yet sought mediation with anyone and when you're starting a business relationship with someone that will last for 20-odd years, the best way to start that certainly isn't through going to court and forcing your way onto someone's land.

MARLBOROUGH

Date:	17 November 2011	
Venue:	Marlborough Hall	
Presenters:	Carey Bradford, Exploration Manager – Southern Region	Arrow Energy
	Jeroen van Dillewijn, Manager, Water	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. If you find gas in the Styx Basin here and the pipeline is going down west of Marlborough, would you pump it into that pipeline near Gladstone?

No, the sorts of things that we envision in this area, in the Nagoorin and Styx Basins, would be small-scale domestic power generation because there isn't sufficient gas to pipe it.

2. Isn't it true that Arrow Energy told us at the last meeting that you didn't use fracking?

You would have been told that in the context of the Surat Gas Project area in the Surat Basin where Arrow has made public commitments not to use fracking.

Arrow is trialling fracking in the Bowen Basin, and may need to elsewhere in the future. The fracking process is much maligned and not well understood. Arrow firmly believes that fracking is a good and safe technique. We have reduced the number of chemicals we use, and those we do use do not contain BTEX compounds, and are generally the same sort of chemicals that many of us would have access to in our day to day lives e.g. pool chlorine.

3. So you use fracking, even though we were told you didn't?

Tony Knight made it clear last year that there would be no fracking in the Surat Basin project area but he didn't exclude that as a possibility elsewhere. So the Surat Basin is a definite no but in terms of the other areas, Tony didn't have an answer then because Arrow is still considering the technology. We can only definitively say no to those portions of the Surat Basin that occur in the Surat Gas Project area.

4. Have you released water three times into the Isaac River in breach of state and federal legislation?

We did release water in the rain and flood period from December to January when there were a number of releases. It wasn't breaching state legislation because we had asked the state government to give us permission to do that for some time; we had warned government we would need to start putting water into the Isaac River, if only to prevent our dams from overflowing and that water from entering the river anyway. The government wasn't able to process the request quickly enough since it was during the Christmas to early New Year period.

5. Does that mean your dams weren't big enough?

It means the flood was so extreme it was a particularly unusual and unforeseen event. We had already done work to prove that the small amount of water we might put into the river, with a dilution factor of 400 or more compared to the amount of water that's coming down the river in a flood situation, would not do any damage to the environment. It then took DERM some time to process Arrow's application, and eventually give us permission; the permission came late. We decided we couldn't afford to take the risk that the dam would breach, so we decided to start doing it in a controlled fashion. We informed DERM that that

was going to be the case; it then took DERM another month and a half before it finally gave us permission to do what we'd already been doing.

6. So that's a yes to breaches of the legislation.

A strict view would say yes, but a pragmatic view would say what we did was reasonable and logical, and not out of line with approvals given to other resource industry operators.

7. How many litres of water do you use for each well that you drill and is that water potable or non-potable?

It depends on what we're drilling and how we're drilling. Currently we probably use about 60,000 litres of water out of a dam or similar [which preferably is potable]. We are currently trialling European technology, similar to what is used in Norway, which integrates sediment tanks with centrifuges and produces a solid waste that is generally non-toxic, and this allows us to reuse the water many times over. Ideally we would have something such as a 15,000 litre holding tank and use that water again, removing very fine low gravity solids. We are looking at doing it in the Surat Basin by mid next year. All of that will be pitless, all will be low impact and all of it will be multiple use.

8. Our council refuses to provide us with public water, so what does Arrow Energy think about that? You're wasting good potable water, directly from communities out there who have no access to public water.

We are expected to comply with the legislation which requires us to use potable water. I'm not sure where the water came from in that particular case.

We only have very limited need for use of water. We don't claim to understand why council would limit access to water, but would imagine it is to do with the overall volume that is being requested.

9. Can you provide us with a way to clean up our town water to potable standards as part of your focus on the community and the environment?

What's the issue with the town water?

10. It's non-potable. The council refuses to provide us with potable water as supply comes from a creek on an unfenced property; cattle can go there and do whatever they want.

That would be something we could look at.

11. You said in your presentation you'll spread your wells over several kilometres. Why do you need permits for every house block in Ogmore (which has been confirmed by the state government)? You're not drilling on my backyard.

That isn't correct...we will not drill in house blocks.

Arrow imposes a minimum distance for its activities away from houses, and also does not site wells in small lot holdings which clearly would be too intrusive. We locate wells and other infrastructure in large blocks, where they can be located away from people.

12. It's been confirmed with the state government, I've confirmed it.

You will have to give me those details because I'm not aware of that.

13. You don't know which permits you have to drill and where?

(Jan Taylor) Carey is the exploration manager and as far as he is aware there are in fact no permits in Ogmore. If that's incorrect what we will undertake to do is update you on that when we forward the meeting summaries.

There are no 'drilling permits' relating to Ogmore township. As we said before, we locate our wells away from occupied dwellings and houses. The state government may have confirmed that an exploration authority exists over a certain area, including Ogmore, but that does not automatically mean we plan to drill in your backyard. We are reasonable people and would not contemplate such a thing.

- 14. My biggest worry for the release into the Isaac River is that if you release waste which is toxic into our area, where there's not a lot of water to displace it, what warning would we get that you're going to do this? I say this because you are actually releasing without permission in the first place, so you've got to look, case by case, at how parts of the river flood. I see 3.6 megalitres as quite a lot.**

Everything we release is from the natural environment so it is no more or less toxic than anything else you may find in nature. We also need to put in perspective that any release we made was in a high level flood event where massive volumes of water were passing down the river. The relative proportion of water released by us was dwarfed by the overall flow volume.

- 15. Isn't that a bit of a risk to their health; people swimming in the river for example?**

Not at all, the releases were only made during high level flood events when swimming would have been impossible and life endangering.

At flood time, the dilution factor was a factor of 400 or more.

- 16. I'll stop you there, because you said it was unpredictable. You said it was unpredictable, the weather caused you to release it in the first place.**

I don't believe that's what I said. A flood event is predictable within reason. Clearly a flood is also accompanied by excess rainfall and it is the rainfall that is our biggest problem since it fills our dams. It makes sense to release excess water during flood periods since the water is diluted even before it leaves the dam, and once in the river system it is massively diluted. It is also very quickly transported out of the river system.

In other words, the unpredictable flood?

Correct.

Thank you.

- 17. I'm not interested in the legislation, I'm interested in the health of the people. It's a simple question, yes or no. If you go into the Styx River Basin where there's a very small flow of water into Ogmore, if you release poison or whatever you release into that, will people be informed before you do it or will you do it because you want to, without informing anybody? I am concerned for the safety of the people.**

The way the legislation works, the way dams are built...we inform the landholder where it's happening, we inform DERM and local councils; that's the number of people who are informed when it happens. This is what I was trying to say a moment ago around the legislation.

Legislation puts controls in place to prevent us from doing things which are going to be dangerous. The legislation also allows for an emergency release when the weather is unusually wet and, because it may happen, there are also controls in place for that. That is what we were trying to do with the government, warning it ahead of time that as a result of heavy rainfall we were going to be in that unusual situation. We then did a normal analysis to prove there was absolutely no danger to health which was later confirmed when it gave us permission to do it. It just took DERM about two months to process that information and send it back. There was a dangerous situation and we couldn't afford an uncontrolled release which would have done more damage to the environment, not just to the river itself. We decided we had to start releasing to the river. At the moment the Flood Commission of Inquiry is looking at our releases as well as the DERM processes to decide what should have been done, as well as the correct process for the future. We did the analysis to prove there was no damage to the environment; we did inform the landholder, DERM and the local council.

Arrow rejects the suggestion it puts poison into the environment. Arrow does not use poisons, and the vast majority of material, whether it is water or otherwise, is from the natural environment.

18. Why didn't you inform people right down the river?

Firstly, it's not a requirement under legislation. Secondly, there can be no logical reason to raise false concern about an issue.

Let's put this in context; there is a major flood event occurring with massive amounts of water passing down the river, yet somehow anything we may add to the water may cause a major problem for any one individual landowner. That doesn't make sense.

I'll finish by saying I think you're being a bit gung-ho saying it's not in the legislation.

Well the legislation is there to protect you and we are following that legislation.

Well you said it is not in the legislation to inform some of the people downstream.

I did and that's correct.

19. My problem is that you're the one releasing the water, not the government. I'm sorry to be so critical but when people's health and lives are at risk you have to tell them.

We're talking about water that has a little bit of salt in it, it's not poison as you suggest. The reason we have legislation is to ensure people's protection and those protections are more than ample. I don't believe people downstream of the river are in any danger in any way.

It is too much to say that we are putting people's lives or health at risk, that is just not true.

20. Do you use any hazardous chemicals in the extraction or transport of the gas?

No, production gas wells simply pump naturally occurring water to surface. We don't add or do anything to gas in order to transport it.

21. You said the only hazardous chemicals you use are in fracking. What about your vehicles, the trucks, the exploration transportation; don't they run on diesel which is harmful to the atmosphere?

Yes, we use the same motor transportation fluids that most Australians use.

Don't try and get around it. I want a commitment from Arrow Energy that all responses to all questions will be provided to us.

That's already been said.

- 22. Don't forget this legislation comes from the same government which gave us a carbon tax when it told us no carbon tax.**

That is not correct; the carbon tax is from the Commonwealth while environmental regulation is by the state. I think it unfair to selectively criticise legislation we don't like since there is all sorts of legislation, most of which is to our very great benefit.

- 23. I noticed when you showed us the map of the Styx River that you have five to six drill sites in a low-lying area that's very close to our sands. Are there small dams there that are holding water that you brought to the surface for exploration work at those sites?**

There are currently two sites we drilled this year that still hold water but they will be recapped in the next two to three weeks.

- 24. We're in flood country; it all floods across the top level and there is silt in the waterways and our sound. It's not just a river, it's a sensitive ecological system out there in the sound. It supports recreational and professional fishermen, a turtle habitat and dugongs, so the area is significant. If the rains come early and flood those dams, what's to stop them taking the chemicals into our waterways and sound?**

If we do develop in this area and start producing water and gas then the ways we prevent the issues we discussed earlier from happening again are the same. The water would be treated so the dam doesn't fill up and flood. That treated water can be used in a number of ways including agricultural application. The treated water is monitored to ensure it is the same quality as the river it goes into so it cannot do any damage to the downstream ecology. We do those tests and so do third parties.

With regard to wildlife issues we had a session yesterday in Gladstone which targetted environmental and wildlife preservation groups. If you would like to come in future please let us know. One of the matters raised by a lady from one of the care groups was that Arrow has an advantage in being so far behind the other CSG companies re project deadlines that the care groups will have time to plan ahead. She pointed out that with some of the other companies the first time she knew there were wildlife issues was when she had to start rescuing and caring for them. With Arrow the relationships are in place, nothing will happen for several years, and it's being sorted out early in the process. This is how Arrow prefers to do it.

The only water storages we use are the small ground pits we use during exploration. These contain a relatively tiny volume of water that could not, even in the worst case, result in any damage to the broader ecosystem of the region. If we did move to develop in this area we would manage our water, our dams and our water gathering infrastructure to ensure there was no risk to the environment, or at least no greater risk than from any other industry.

- 25. I just wanted to ask about property and access rights of farmers. At what stage do the property owners lose their rights to the land? If we don't want you on our property, do we have to say no upfront and not let you come on the property at all or**

do we have a say about the amount of time, so after a while we can say we're not happy with you, pack your bags?

Property owners do not lose their rights due to anything that Arrow has power over. Only the government has 'compulsory acquisition' rights and it uses those only very sparingly. Arrow, like all other CSG companies, fully acknowledges that it must work on private property, and is bound to enter into 'conduct and compensation agreements' with landowners to do so.

We do have rights to refer matters to Land Court but in the vast majority of cases we don't as it is not our preferred method to start a relationship with a landowner by going to court.

26. That's nice up front, but once your foot is in the door we can't turf you out, we can't say get out.

Everything we do is by agreement with the landowner, it isn't a matter of forcing our way on to land.

27. I understand you were fined \$40,000 for breaching the law on a property in the Surat Basin many times over two years; what sort of relationship did you have with him?

Actually we get along reasonably well with that landowner. The breaches were quite technical and legal, and had already been corrected before the action was taken, but nonetheless the breach had occurred.

28. My next question is about access to people's property. You said you'll be bringing drilling rigs and vehicles on to people's property and building roads; will you be putting in washdown surfaces to protect people's land from weeds and that sort of thing?

Yes, we already do washdowns. In the Surat Basin it hasn't been a problem for us because the road infrastructure means we don't need to cross multiple properties but in the Bowen Basin we are starting to see the need for it so we've bought a couple of mobile washdown units to trial them. In those cases where we have multiple properties and one's clean, one's dirty, we would set up a washdown station.

29. It's one thing to say that this property has rat's tail grass and this one's clean, but trying to keep it clean is an ongoing thing. You might say a property has giant rat's tail grass, there's some in the back paddock. But that doesn't mean it's not already under a management system; whether the property is clean or not, those measures have to be used, because we're working all the time to keep our land clean.

If you bring up those concerns at the start, it can be written into your compensation agreement that we need to put those things in place. We're happy to do that.

30. You were saying coal seam gas is a clean burning gas, and it's 40% cleaner than ordinary coal; is that right?

There's some debate on the subject. Let's move away from actual emissions in terms of volumes first, because that's a separate issue. When it actually burns, the equation is CH₄ (methane) plus O₂ (oxygen) which gives you H₂O (water) plus CO₂ (carbon dioxide). It's a fairly simple reaction, there's no soot put into the air. There's little to no sulphur, there's little to no nitric oxide emissions compared to petrol, diesel or coal. When we look at the life cycle of an LNG project including transport of the LNG to China, it can be between 40 to 70% more efficient based on work done by Worley Parsons (which has been discredited by the Greens because the work was done for CSG companies). Some of the other research

brought up by people uses wild and vague assumptions based on the shale gas industry which suggests that it's different. It's a tough one, but it does burn extremely cleanly and it can make a great deal of difference to people living in the third world.

- 31. I obtained the following information from the same place 'it's cleaner when burned, but when it's unburnt it's 20 times more polluting than carbon dioxide'. So what are the chances of it leaking into the atmosphere because we're hearing that across the coal seam gas industry 3.6% to 7.9% of wells have gas leaks?**

If any well is leaking it has to be reported to DERM straight away as there's a very stringent monitoring system now. That means the number of wells leaking is much less now. Potentially in the past it might have been as high as you said but that's definitely not the case today. Consider solar panels - to make them you need to use nitrogen and trifluoride which is 16,000 times more greenhouse-effective than CO₂ but the manufacturers admit to losing 2% in making solar panels. Nothing is for free. It's just one of those things where we can only do the best that we can, although the industry is striving for perfection.

- 32. I got this from a paper written in February 2011 by a Dr Maryanne Lloyd-Smith and a Dr Senjac. They said that anything over a 3% leak across the industry means you are no longer a green business.**

That's actually based on shale gas when they do horizontal fracking, a far different process. They pump down to 3km beneath the earth and then they float back all that water because the shaft doesn't actually make any water. In that process they actually lose a substantial amount of gas. But an estimate of 3% can, will, and should be challenged, because it's just that, it's an estimate. It's not based on any fact, it's not based on any science, it is a guess.

- 33. Suggestion made that one of Arrow's land agents explain the process Arrow goes through with landholders in order to access their properties.**

I think people need to understand that the land liaison roles we undertake with individual landholders are property-specific. We will come and talk to you prior to any access so that you understand the entirety of the process. We will engage with you regarding all of your concerns. We will look at all the potential ways we can minimise any impact on your property and your operations. That's what we take back to Arrow before we even progress to discussions about conduct and compensation agreements. The first thing we do is make sure you are fully conversant with our requirements and we talk about your property specifically. These community information sessions are great so that people can obtain a company overview and learn about the CSG industry. Dave's our land liaison operator for the Styx River area and he will come to you and talk specifically about what's proposed for your property, what impact it may have, how to minimise those impacts and go through the full process of what your rights are. In relation to the legislation which gives us the right to access your land, yes we can give you a notice of entry to do some preliminary investigative activities which will have no impact on your property. We might do cultural heritage and environmental surveys to ensure we're not going to impact on the environment or our history, then we will talk to the landowner about what we can and can't do.

- 34. Is it then too late for us to say stop?**

Well no, at all times you have the right to say no but under the legislation we have the right to come. There is a process for us to go against your wishes regarding access and the end of the line is to go to court but Arrow has never done that. Under the legislation we are

obligated to fund reasonable legal costs to enable you to assess the contracts and the compensation. We can issue a notice of intention to negotiate that starts the clock ticking from a legal point of view and we have twenty business days to reach an agreement. We've never done it that quickly yet as we always allow landowners as much time as they want to fit into their schedule and Arrow's.

If we can't come to an agreement within those twenty business days that then allows us, or you as a landowner if you aren't happy with the situation, to initiate what is called a mediation or an alternative dispute resolution process which gives us another twenty business days to appoint someone independent of both parties to try to resolve our differences. If we can't come to an agreement in that period of time then either party can lodge a claim in the Land Court. In ten business days we are entitled to come on and undertake our activities or resolve the situation. But we would prefer to do it by consensus rather than confrontation because it's better to have a working relationship between parties rather than a confrontational one.

35. You said that legislation from the state government is on your side and there is supposedly legislation that is meant to protect us; we already know our government is a pro-CSG government.

We are bound to operate within the guidelines or the rules that are set and we are trying to do that in consultation and consensus with the community. We're not going to come in and barrel down your gate; it's better for us to have a positive relationship and explain to you what we're doing and when we're doing it. Technically I guess we can do that, but we can't do anything beyond preliminary activities until such time as we have an agreed conduct and compensation agreement in place. We can do all our investigations, but we can't drill a single hole until everybody is in agreement.

36. So it's a case of landholders beware and it's up to us to say we want our facilities.

From our perspective, Arrow has all that stuff in place anyway. We have pest, weed and washdown policies in place. We wash down all our vehicles. If people want certified washdowns, we'll provide those for all our vehicles every time we come onto your property. We can do that, it's all part of the agreement. And that's what the property-specific consultation process is all about. Whether you have weeds or not, we still manage it the same as if you have. We don't want any more weeds.

37. If you get a good production well operating near Ogmore, what is the lifespan of that well? Is the gas renewable? Does it regenerate or does it have a lifespan?

Generally wells have a 15 to 20 year lifespan.

38. As I already said, I checked with the state government and you have legal right to come onto my house block and every house block in Ogmore. I'm telling you now, I'm not interested in compensation. I didn't move to Ogmore to have some drilling mob in my backyard drilling or putting a well in or whatever. You are not welcome on my property and I am saying that here to put it on the public record. There's a guy who has moved into Ogmore; he has a sign on his property, keep out or a .303, and I concur with that.

If our tenement extends across a town, it doesn't mean we want to work there. The way tenements or blocks are distributed is via a large chunk of area. Regardless of whether the tenement includes Ogmore, we would not drill in the backyard of your house.

- 39. There's supposed to be a plan for a shiploading facility off the Styx River in the Broad Sound. Common sense tells you we've got both energy resources and nickel in the area so this is an ideal spot for a nickel refinery and all sorts of other refineries. Could somebody give a comment about the future of this area? And give a definite yes or no whether this is going to turn into Gladstone or not?**

I think that's the sort of question you need to ask your state or federal government representatives. However, the infrastructure required would be humungous and I think at the moment they're trying to concentrate everything in Gladstone. Don't forget there's been recent legislation, or talk about it, where the state government is looking at having a minimum kilometre distance between any exploration and towns. It will be up to local governments to determine whether they want minimum distance or not.

- 40. You were saying saline water coming out of the wells is quite safe; it's basically just salty and does have some contaminants that you remove. Is that right?**

The water is roughly a fifth as saline as sea water in most of the Surat Basin, and it's roughly a tenth as saline as sea water in the Bowen Basin. It's about 70% sodium chloride which is normal table salt but it does contain some carbonates or soda ash which can be removed by processing. It also contains small amounts of magnesium and a few other minerals. Like any naturally occurring water, there is a spread of minerals.

- 41. I understand that this water contains carcinogens and heavy metals, and if you were fracking in the area, there would be fracking chemicals in it as well. Once it's been treated and the heavy metals, carcinogens or whatever have been removed, then that is toxic waste; where will that be disposed of?**

The quantities of those things are so difficult to measure that we often don't see them at all.

There are far more carcinogens all around us every day, in cigarette smoke, vehicle exhaust fumes, even in soft drink, than we would ever see naturally occurring in coal seam gas water. Any water we produce to surface would at all times be fully contained and managed through proper treatment and/or disposal processes. Any disposal would need to be handled by an appropriate disposal site.

- 42. What will you do with that?**

There's different ways of dealing with it. The simplest way, especially if it's in small quantities, is to bring it to landfill. That means you capsule it and take it to a registered landfill that only stores that one substance. That's how it is dealt with by industry. For example, any industry that makes salt for use (e.g. table salt) would have a small amount of waste salt left which it would send to landfill, and the quantities of that are far higher than anything we would produce.

- 43. So it would be taken away from the land.**

That's correct, it goes to a registered landfill and those landfills already exist. If the quantities are high enough (as they are in the Surat) then we'd rather process it and produce decent salt that you can actually sell and use. That does require much larger quantities than are available here in the Styx Basin.

- 44. I'm not a landowner but I'd like to ask some questions for the information of landowners so they might learn a bit more from you. Earlier you talked about government scrutiny and monitoring. I'd be interested to know how much of a role**

DERM plays in the actual scrutiny and monitoring of your sites, and how much do you depend on self-regulation?

There are a large number of things that we're required to monitor. The way the process works is that if we want to develop land we obtain an environmental authority which specifies all the things that we need to measure or monitor and all the things we need to sample. We usually do more monitoring than DERM requires. The requirements of the department are already very specific and I think very comprehensive. I don't believe there's anything that hasn't been covered. We have rules that are far stricter than needed to manage this sort of water.

45. So that's self-regulation; you're doing it, you're not having regular check-ups?

Sorry, I missed that part of the question. Yes, there is external scrutiny. We are audited at least annually and sometimes more often by various parts of DERM. It checks different aspects of what we monitor, whether it's around water, noise or air emissions, whatever it may be.

(Comment) So I go back to the point, most of this is dependent on the role that you play as a producer and the standards you keep. With respect, what I'm going to say is that in my 30 years around Central Queensland, I haven't found too many companies that live up to what they say, but we'll leave it at that.

46. Could you explain to everyone here whether you will be using gasification in the area?

No, Arrow will not be doing that. Coal seam gas is very different to underground coal gasification (UCG). The big problems at Kingaroy were to do with UCG.

47. On the issue of compensation, I'd like to put a scenario to you where you have a landowner who is prepared to have a discussion with you, talk about compensation, and you come to an agreement, then you have another landowner who is being a little bit difficult. How do you determine the level of compensation across the whole project, and are you in the habit of paying some landowners more than others so that you can get your outcome?

The compensation is worked out on a consistent basis. We've just gone through a total review of compensation across our business and the formula has now been calculated under the basis of the minimum requirements of government, plus a considerable additional component on top of that. Of course, each person is entitled to bring their own assessment and valuation. You can have your own valuer do an assessment and if the two figures vary significantly, then we go into mediation to determine the agreed valuation. We've gone through quite a comprehensive valuation process and analysis to make sure that what we are offering is well above the entitlements in the legislation.

48. You didn't really answer my question. Would you pay some landowners what they agree to and then pay more to those who are more difficult? I'm aware of very large sums that have been paid to more difficult landowners.

No, that's not the way we do business.

49. I wouldn't mind knowing if the land agents come from a farming background.

(Dave Peace) I'm from a farm in Victoria and I've worked in the dairy and pig industries, retail, electricity, wholesale organic fruit and vegetables and also in some consultation around building site access over a period of about 30 odd years.

(Ross Graham) We've got a team of probably a dozen people that are going to be based in Moranbah for some time. The team has just expanded, and one of the critical criteria is an understanding of the land and knowledge of farming operations, as well as some knowledge of the CSG industry so that we can work out how they fit together. I have a cattle property in Queensland, and I come from a rural background as well. I've also come from a corporate business background. However, all our land people do and will have a rural background and farming knowledge.

- 50. I think it's good to hear that Arrow is trying to get standard compensation and I'd like to know whether that applies to all landholders, even if some landholders take it and fight it and make it more. I think the confidentiality agreement in the contract should be removed because friendships have been broken because someone has signed it, believing everything that's been told to them, and then later, maybe six months down the track, they find out a neighbour has managed to more than double the compensation. I just don't like the confidentiality clause.**

I appreciate what you're saying. We are more than happy to remove confidentiality clauses from our agreements and are not fussed either way. That's something that government suggested to people to protect them. We use a standard compensation and conduct agreement that is issued by the government and then we put an annexure to it which has property-specific issues on it. While we are saying that the compensation is the same for everybody, every property is different and every impact varies. We may have done 20, 30 or 50 wells on one property; that landowner is probably going to get more compensation than someone with one or two wells on a property. The compensation amount will be determined both on a well by well and a disturbance basis. Disturbance is probably the biggest issue as it determines the impact. If we have more wells, the impact is going to be greater so the disturbance will be different. On a per well basis (and on the type of well) the management fees we pay for landowner time are based on a consistent formula for all parties.

This was a big issue in the Surat Basin nearly six months ago and it resulted in the rules changing completely. Arrow no longer asks for confidentiality, it's entirely up to you.

- 51. The Premier said some time ago that populations of a thousand or more will be protected by a buffer zone, but populations of fewer than that do not have the same protection, so it's open slather basically for places with fewer than a thousand people.**

It's the absolute responsibility of a local council to decide what's in and what's out; it's nothing to do with the state government. The council will determine if it wants the whole council area protected or not. If you go on the website, there's a lot of detail on that proposed legislation.

There have been quite a few updates recently and certain councils have now declared that they don't want any part of their area protected.

Further information on the legislation can be found at:

<http://mines.industry.qld.gov.au/mining/exploration-urban-living-balance.htm>

(Comment) I've taken over some of the sites where there will be production; to me it is like a small village with a car parking lot alongside it, there are so many cars. At night it lights the place up like a city. I'm concerned because you are going to do it on my small property which I think is going to be very impacted, and I think it's the second phase you're going to do there. There's going to be a lot of equipment, my place is only small and I think it's going to impact me a great deal. That is one of my concerns and I will talk to Dave (*Land Liaison Officer*) about that.

52. Another question is how much of your production is going to be sent to China, and is there going to be much left for Australia?

We have significant gas reserves. We probably need about seven trillion cubic feet over the life of each train; the figures I quoted before were substantially more than that. Also we're fairly confident that within the next year or two the government will actually ask for a domestic gas reserve. We haven't talked about the Bowen Basin and the amounts of gas there, but it's substantially more than what we were talking about before, probably 200 to 400 trillion cubic feet, so Queensland does have some enormous gas reserves. I don't think it's something that we need to be too concerned about at this stage.

53. One of my biggest concerns is local water. Can you guarantee that my water is not going to be affected by a future operation. My water is at about 30 feet. Don't talk about Surat or any other place. I'm talking about the Styx Basin only and the type of extraction you're going to do here. Water is our life blood, we are solely dependent on underground water. There's no way in the world you'll guarantee that you're not going to contaminate that water. Is that the case?

We are very conscious of the importance of water to the livelihood of farmers and graziers. We take many measures to safeguard water sources, from the way we drill and case our wells, to the way we isolate and contain produced water, to the way we treat and dispose of water. At all times we take measures to ensure that the shallow aquifers which are so valuable are safeguarded. We want the gas from much deeper sources so we don't need to touch the shallower aquifers.

I cannot guarantee there will never be any impacts but, typically, once you've drawn the pressure down in the coal, the aquifers above will react to some extent and the aquifers above that will react a little bit less so by the time it gets to the surface the amount of reaction is so small that we can't measure it. But we will be measuring it from before we even start producing right through to when we leave, to see how it's going. Again I refer to legislation; government does do things to protect you. It ensures that we are modelling in a way that meets its standards and it also checks what we model. It checks what we monitor to confirm our models are predicting properly, and in some cases it will build its own models to confirm ours. If government models predict there will be impacts, we're required to make good on that impact, to compensate you or provide you with an alternative source of water even before any impacts happen.

54. Do outside organisations come in and do tests, independent tests, to prove that your testing and quality assurance is sound and above board?

That can and does happen. We're obliged to show you the results of that sampling. If you as a landholder don't like what we're doing, you don't like the results that we're showing you, you can have that analysis done yourself.

In some circumstances, with prior agreement by both parties, Arrow may pay for the tests.

- 55. Gladstone has come under the spotlight recently in relation to all the tributaries and rivers that run into the ocean and impact on the Barrier Reef. The World Heritage organisation has come to Australia from Sweden to check out Gladstone and all the effects there, because it feels there's something not right. Does World Heritage have the power to impact on your business and shut down the plant you're going to build in Gladstone? Recently it shut down Orica plants in New South Wales. Is that going to happen, could that be the same with your business?**

UNESCO does not have power to do that, only the state government does, which would have been the case with Orica, although I'm not familiar with the details of that issue. In terms of Queensland and the Gladstone Harbour, part of that does fall within a World Heritage area and as a result of that the Federal Government must ensure that minimum standards are kept.

- 56. Water can be a big problem up here if we don't have a good season. Would you want a lot of water?**

We don't use water from the creek, we don't have the allocation to take any water out of any creeks and rivers. What we do instead is obtain water from licensed water suppliers, for example the Gladstone Council. That's what we use for our construction activities. If we start to produce water of our own and treat it, then we are allowed to use our own treated water for those same construction activities, but we're not allowed to take it out of the river.

- 57. My observation is that I've been travelling around Central Queensland for about 30 years now. I see a few companies come into the area and I see ratepayers suffering because of the damage that's been done to the roads. As somebody said, once you've carried 10,000 tonnes on a particular road or a road network you're required to make a contribution. Personally, as far as I'm concerned, the damage is done and it's landowner rates that are used to get the darn thing fixed up after 10,000 tonne goes over it. I think that's something you guys need to look at.**

Under the *Petroleum and Gas Act* we are bound to enter into an agreement with local council once our truck traffic exceeds 10,000 tonnes per year under what is known as 'notifiable road use'. This is a mechanism for us to reimburse council for road maintenance.

- 58. You talk about benefits to local communities. I've been working on this for about 15 months now, and I'm really disgusted with the attitude of companies when they come into an area and promise they're going to do certain works. As soon as they get the first bit of coal out of the ground, or the first gas bottles full, they forget about what they said; personnel change or they say 'I didn't say that', people change at the top, people change at the bottom. Would you guys be prepared to look at a community agreement where you sit down with this community and agree to put certain things in the area, or do certain things over a period of time and make that agreement part of the EIS process?**

There are various things we do to give reassurance to the communities in which we work. Firstly, the EIS process provides a comprehensive study of, and proposes management systems for, potential environmental impacts. Secondly, we have made binding commitments elsewhere that we stand by, as evidenced by our public commitments in the Surat Basin. Thirdly, we establish community committees in areas we develop, to provide a

means for issues to be discussed and resolved. We believe that these measures are the best way to get local people involved and to work through issues.

59. I just think community groups have got to be involved all the way so they can have some trust and respect for what's happening in an area. Reference groups set up by the companies don't work, because they're controlled by the company.

You'd be aware that most companies don't bother talking to communities when they are in that preliminary exploration phase; they wait until they have decided to go ahead through the EIS. This is a long way before that point. Arrow tends to be much more pro-active in talking to the community, we can't do it properly otherwise.

60. I just think it's time that companies were fair dinkum with communities and landowners. During communication with landowners as part of the exploration process when you set up the agreement, do the conditions also apply when you actually go to the drilling stage and for your network of gas lines? Does the same agreement apply?

We'll have an additional agreement for the exploration phase. If we drill one well on your property, then agreement is reached once that well is drilled. If we want to come in and do more work then another agreement may have to be reached.

There are two stages of activities. The exploration stage is what Carey has been mainly talking about today i.e. our chip and core wells and our pilot wells and appraisal wells. They are done under our authority to prospect (ATP), which only allows us to do exploration activities. Once we've proved up the gas fields to show there's sufficient gas to move the project forward, then we make application for petroleum leases. Once they are granted we can undertake the extraction of gas for commercial purposes which will require totally different agreements. So in the initial stages, we have exploration agreements under the ATP, and in the secondary stage when we move into production the agreements will be developed under a petroleum lease.

61. So there are two separate agreements?

Yes.

ROCKHAMPTON

Date:	17 November 2011	
Venue:	Rockonia Parish Hall, St Anthony's School	
Presenters:	Carey Bradford, Exploration Manager – Southern Region	Arrow Energy
	Jeroen van Dillewijn, Manager, Water	Arrow Energy
Facilitator:	Jan Taylor, Principal	JTA Australia

1. We're one of the unfortunate people who are in the pipeline path. I understood that we were dealing with Bow Energy, not Arrow.

Bow Energy is a different company to Arrow Energy but we are looking to buy it out. If we were to buy out Bow Energy I'm not sure its pipeline would proceed. The Arrow pipeline will definitely be proceeding if we get all our environment approvals. If it was Bow Energy that you were dealing with, then it has nothing to do with us.

2. Will your pipeline run the same route?

We are not familiar with any plans Bow may have had for a pipeline in this region.

We have identified a route for our 'Arrow Bowen Pipeline' as we call it, and one of the reasons we are here is to inform people about it.

(Comment) Arrow Energy intends to put a one metre pipeline across Old Bombandy, a property we have on the Isaac River fronting the Fitzroy Development Road near Middlemount. As reported in the *Morning Bulletin* on 9 November 2011, Arrow Energy (without any environmental permit) pumped contaminated liquids into the Isaac River upstream from our property. How long until we found that out? Contaminated liquids are heavier than water and this contamination settles on the bottom of the river and permeates the sand. We pump water out of this sand for many thousands of cattle. There are always some cattle deaths but it is very difficult to prove the cause of death or sickness. Arrow has the right from the Queensland Government, who are hungry for money, to come onto our property and do whatever is needed to get its way.

This morning I was woken by a call from Arrow at 6.06am on my mobile. I did not take the call after being woken up; I value my personal time and do not want business calls out of hours when there is no life threatening event. I do have business hours.

I also used to value private freehold property but this is no more with government allowing access in my case to three mining companies and two gas pipeline companies. They are coming in droves and I have been advised there will be a 700-man camp on our boundary. With all the vehicles and equipment coming and going we are concerned about plant pests that will be brought onto our land, particularly Rat's Tail grass which is a curse. Sure the government has laws regarding washing down vehicles and equipment, but it also has laws against stealing, break and enter, murder and rape and you know laws do not stop these crimes.

The victim here will not be an individual as with other crimes but the landowner and future production of food from this land. Companies have already contaminated surface water and who knows what they have done with underground water supplies. Why is Rockhampton water so high in salt and who knows whatever else? Arrow is here to tell you what they want to tell you but do not believe everything that's said.

On its brochure it says it is concerned and its highest priority is ensuring safety and the environment. Then it contaminates the Isaac River; it doesn't make sense, it's just lies.

Arrow puts it on paper and makes it glossy and most people believe it. The brochure *Working with Landholders* says that when determining the location of equipment and wells, all aspects of the property are considered in consultation with the landholder. Well, we have been told that you are putting the pipeline through our Leucaena paddock; leucaena is a tree we plant for fat cattle feed. It lasts about 50 years, and you are putting the pipeline straight through the middle. We also have a property where the pipeline will go straight through our water basin, so there goes our water when you put a pipe through both sides to let the water out. These issues are my issues with Arrow.

3. Are the dams located where the wells are or where the production site is?

With respect to the dams they will generally be located where the water handling and treatment facility is to be built. There will be a number of wells in the production scenario with gathering lines for each of those wells travelling to a central location, and that's where the water will be fed into a treatment facility which is likely to have various dams for produced and treated water and so on. Those dams are all built above the flood plain as per the DERM guidelines to prevent flooding from breaching the walls of the dam, otherwise we wouldn't be allowed to build the dam in the first place.

4. Why didn't you use the corridor the Queensland Government has already provided for all the infrastructure going north to south instead of the Arrow pipeline corridor which goes through Gracemere? Arrow's pipeline is running straight through the west side of Gracemere. There's already a corridor that runs down to Gladstone Harbour which has been put in place for this type of thing but Arrow is doing a straight line pipeline running through people's properties. There are development areas out there that are going to lose value. My other question is why is the corridor 300 metres wide?

The corridor isn't 300 metres wide. Initially there'll be a zone 300m wide to do the EIS studies inside it. The actual easement itself, where a pipeline would run, would end up being around 30m wide. We are looking at the best route, but we need to be mindful of risks such as flooding, and part of the corridor is, we suspect, prone to flooding, which is not ideal.

5. Who made that decision?

Arrow Energy has commissioned studies into the pipeline route, and the environmental impact studies that go with it. We decided, based upon assessment of the most optimal route, where to locate the pipeline.

6. Why aren't you using the government's corridor?

I don't know who surveyed that corridor but the problem we've got with it is that the last 20 or 30 kilometres of the corridor goes into flood prone areas, which you would have noticed there back around Christmas time (2010).

7. Your economic assessment is going to affect people's properties. You're more concerned about the economic aspect than you are with impacts on the community.

My understanding is that there is potential for compensation.

We try to choose the route that is the best compromise between environmental and community constraints. At this early stage of route selection the economics are not the biggest driver, it is these other factors that determine the best route.

- 8. Your easement runs through a proposed industrial estate which is going to take away considerable valuable land. From both the Rockhampton Regional Council's perspective and from a landholder perspective it is a very considerable concern within the community. Is there going to be any further investigation done by Arrow or is it just going to rely on the decision that it won't use the dedicated line between Stanwell and Gracemere? There is also a corridor the government has resumed between Biloela and Gladstone and all the LNG companies are using that. I'd like to know why you see a difference between that and the areas resumed between Stanwell and Gladstone.**

You might be aware that we've already had discussions with council regarding that industrial area. Our engineer has come to an agreement with council but I don't think it's set in concrete. What we've now got through that area from Boongary Road to the Capricorn Highway is a fairly large drainage ditch. It's only picking up the water from Boongary Road; I don't believe it starts any further back. We're proposing to run the pipeline in the bottom of the ditch, and put ramps all the way down so that it doesn't impact on the integrity of the pipeline. This way it doesn't take any of the usable and valuable industrial land that's in that area. That's the best solution we've been able to come up with and yet still retain the direction in which we want to go. It's an extra thirteen kilometres to go around that way. Wherever possible we try to minimise any impact, but that doesn't mean we won't have any impact at all.

- 9. Did you or did you not pollute the Isaac River?**

Back in December there were a number of times that we had an emergency discharge from our dams into the Isaac River.

So you did pollute the river?

Let's talk about the word 'pollution'. In advance of the discharge we went to the trouble of understanding how much water we'd be putting in versus how much water was coming down the river as a result of the rainfall, what dilution factor the rainfall would have, and what impact it would have on the environment. All the information was sent to DERM before we started to discharge and we showed that our dilution factor was so high that any damage to the environment was insignificant. As a result of the case we put to DERM it later approved all discharges. In other words, it was aware of the discharges beforehand and came back later with formal approval for those discharges.

- 10. So you did pollute the river. You talk about consulting with landholders and instead you're going through their Leucaena paddock. It's a dictatorship as far as I'm concerned. You're putting it there and that's it. You do what you like and forget about conservation.**

With reference to the 'pollution' or the water itself, the water we discharged was only very slightly saline. We're not talking about a toxic substance, it's simply water that comes out of the ground and it's a bit more saline than the water you drink. It's not as fresh as creek water would be, but it's not incredibly saline. It's much less saline than seawater.

In regard to your issue of the Arrow pipeline going right through the Leucaena paddock, there are a number of processes that we have to undertake before any development activity. We have to get permission to access land so we have to reach agreement with the landholder before we can do so.

- 11. Arrow wants to go through a Leucaena paddock but the landholder wants Arrow to go around it. My other issue is plant pests. I believe there should be no removal costs for us. I'd like to see a trust fund set up so that if any of these plant pests turn up within five years of your finishing we will be compensated and the plants removed at your cost. We need a trust fund, not some government guarantee.**

It is something we can put to Arrow management as an idea for it to follow up. However, if there is an issue with weeds Arrow is responsible for returning the land to its original state, so it becomes Arrow's responsibility.

- 12. Could you please explain more about hydraulic fracturing or fraccing because potentially it has a huge impact on not just the area where you are drilling for gas, but also on the groundwater which many of these people rely on to feed their stock and to make a living. What sort of guarantees does Arrow give in relation to cross-contamination of the aquifers?**

The innovative technology I was talking about was surface to in-seam drilling. We drill on an angle for about a kilometre horizontally through the coal seam, intersect a vertical well and then extract the gas that way. This method works by exposing a lot of the well bore to the coal seam and works down to about 600 to 800 metres. From the 600 to 800 metre mark we have to look at alternative technologies so we are trialling hydraulic fracturing in the Bowen Basin. We're also trialling other technologies which includes running a coiled tube down the hole, going out a couple of hundred metres into the coal seam then coming back and doing it again

Hydraulic fracturing involves pumping water, and possibly some gels, down the hole at high pressure which then fractures the coal seams in a radius of about 100 metres around it. Sand is then injected into the coal seam to hold open the fractures that we've created so we can extract the gas.

Fraccing is very limited in the area it fractures. The coal seams we target must be deeper than about 300 metres, and generally far deeper, whereas the aquifers that landowners draw water from are typically very shallow (generally less than 100m deep). Hence there is a large vertical separation between shallow aquifers and coal seams that are fracced. Secondly, the wells we drill are cased and cemented so as to isolate shallow aquifers from the deeper coals. This method is very effective and is used around the world. Thirdly, the fraccing products, the chemicals, are not unusual, and in most cases break down readily in the environment, so they have a short lifespan. We use things like guar gum, which can be bought at a normal shop. We are confident that we don't contaminate aquifers.

- 13. There is a distinct difference between cement and concrete; which one is Arrow using?**

Arrow uses a specialised slurry with potash. We don't use aggregate (concrete) because it can't be pumped. We put a sheath around the hole which has about the same strength as the rocks around it.

14. And what about cross-contamination?

We use multiple layers of cement casing. We then test the well before we begin production to understand if there is some hydraulic variance to see if the cement is working. We also keep geophysical logs to check the tensile strength of the cement behind the casing. That's how we know the strength of the cement is often greater than the rocks around it. We wouldn't be able to put the well into production nor operate the well safely if there was any chance that the gas could move up into other aquifers. We have to have the cement in place for safety and to stop the water from moving up and down.

The other thing that protects against cross-contamination is the fact that we'll be drawing down on those coal seams, which means there will be a pressure differential that will make the water want to come into the coal seams and not the other way around. That means there's very little water in the coal seam that makes its way up into your aquifers. Finally what we do before we bring on any production is a number of monitoring wells, in and around our production area, right down to the coal and even past the coal seam and the aquifers that you access. This gives us a starting point for measuring the water quality and pressure of aquifers before we begin producing. We then go on to monitor that pressure and quality over time so that we can see whether there is any contamination or if any of that pressure is having an impact on the water from the aquifers going into those coal seams to fill that gap. That's how we can prove there's no cross-contamination.

15. So does Arrow guarantee against cross-contamination? What do you do if there is any?

The government has legislation in place to protect you from that. We are required to do the monitoring I just described. If it goes further than that, if there's any evidence that over time things are changing to the extent that there might be a future problem, then we are required in advance of that point being reached to start 'making good' as in the legislation.

16. How do you make good if there is cross-contamination?

We're obliged to provide you with an alternative water source of equal quality and quantity of what you had before. There are various ways of doing that. For example, the water that we bring to the surface can be treated.

17. What is your method to get rid of the contaminants?

We treat the water. We're already doing that in the Surat Basin where the water has a salinity level of about 5,000 total dissolved solids (TDS), which is approximately a sixth or a fifth of the salinity of sea water (about 30,000 TDS) so it's not as saline as sea water. We treat it close to drinking water quality (80% to 90% of the water, depending on how effective the method is). That water can become drinkable water or water that can be used for agriculture. The remaining 10%-20% has about the same salinity as sea water. The simplest thing that can be done at a minimum with that water is to let it evaporate, and then transfer the salt to landfill. The salt is mostly sodium chloride.

It is the same technique used by salt producers who need to treat their salt and get rid of the contaminants. Their waste goes to a landfill and our salt will go to the same landfill.

18. AgForce estimates that CSG companies will produce 50 million tonnes of salt over the next 30 years.

That's correct. In the Surat Basin, the quantities of water are much larger than the quantities in this area or the Bowen Basin and as a result the quantities are becoming large enough to allow us to process the salt and have it sold as table salt. We can also use the water to produce a number of other products. We have carbonates in our water which could allow us to produce things like sodium bicarbonate and potash or soda ash. The problem is you need a vast quantity of that water and brine to be able to do it. Our brine isn't saline enough to make that an obvious choice.

In the United States there are places where the water coming out of the ground is so saline they can consider it. At the moment two other LNG companies and Arrow are looking at the option of combining all the brine we produce to see if it's enough to justify building a plant to process the table salt and sodium bicarbonate and potash products. At the moment we have to treat it as a waste so we need legislation to allow us to process it so that we are able to sell it. If that can be done then it may be a viable opportunity. I personally think that it's likely to happen because if we can combine forces, quantities and scale should be big enough to justify the undertaking.

19. Would Arrow consider re-injecting the water into the coal seam?

That is also an alternative. It depends on where you are, geologically speaking. At the moment one of the other LNG companies does inject its brine. It treats its water in the way I've described and injects the brine stream back into the ground. It can do this because it has found a formation at about 1100 metres depth which doesn't have fresh water in it. The quality of the water that's in the formation already is saltier than the treated water being pumped back in. It's fractured, which means it's a very old formation. We have that formation underneath us all across Australia but at different depths and you need to be able to physically inject it into that formation. In the area where that LNG company works it's possible but we haven't yet proven if it would work in our case. Personally I'd prefer we process the water and salt and get some beneficial use out of it by producing usable salts.

The only difference between this water and what you drink is that it has slightly more of the same sorts of minerals. It's currently used by many towns here that take the water out of the ground. We get higher concentrations but it's the same stuff, all we need to do is reduce those concentrations to be able to use it.

20. A lot of this process brings up natural and BTEX chemicals and a whole raft of contaminants other than saline and salt, so how do you deal with that?

We test all our dam water and all produced water in areas like the Surat Basin for benzene, toluene, ethylbenzene, and xylene (BTEX) and we are yet to find any water in our dams that shows any BTEX at all.

The amounts of naturally occurring benzene are miniscule and far, far less than we would find in our man-made environment. For example, if you breathe in petrol fumes, exhaust fumes or cigarette smoke, you will get far more benzene than you ever would from a natural source. We also have treatment facilities such as reverse osmosis that can purify water and remove virtually all potential contaminants.

- 21. I understand that you're going to go down what we call pipeline alley, from Midgee down to the east side of the railway line. Is that where it's going to come?**

Yes, that's the corridor.

- 22. What are you going to do with the easements that we've been told you've already bought that hug the major power line that goes down? Are you going to ever build on them? I spoke to Arrow in Brisbane a matter of months ago and at that stage they didn't know what they were going to do.**

The government has bought the corridor or easement down there, we haven't bought any easements at this stage as far as I'm aware.

- 23. Where has government bought that?**

The Stanwell Corridor

- 24. No, this one is from Midgee further south.**

That one runs right the way through to the Gladstone corridor.

- 25. Originally it was going to follow the power line out.**

We will have to look at a map to work out exactly where you are referring to; I'm not aware of it.

- 26. If you're going to buy Bow Energy does that mean we'll have three pipelines within two kilometres of our place? Bow has already done an environmental scan on our place, so I don't know where it's up to.**

If we buy Bow Energy then any plan it had for a pipeline would be scrapped, and we would only proceed with our Arrow Bowen Pipeline. So a takeover of Bow would, if anything, reduce the potential number of pipelines.

- 27. What does it cost in layman's terms to run the pipeline for one kilometre on flat ground?**

A ballpark figure is about a million dollars per kilometre.

- 28. Is it correct that your pipeline will run for 600km from way out there down to Gladstone?**

I'm not quite sure where that figure came from.

It's closer to 500km for the trunk line, but then there are other branch lines and so on, so the all-up figure is higher.

Comment: you're worried about an extra 13 kilometres of pipeline in a corridor that's already there, that wouldn't upset anybody. You would have most of the people on side, except for Paul Harris, on whose property you're going to be playing. I can't understand your thoughts, you're talking bugger all. You guys should go back and have a good look at yourselves.

Comment: the whole idea of the pipeline coming through Gracemere is starting to meet with a fair bit of opposition at the moment. I'm one of the people that are opposed to it, especially since we've learnt there is a corridor that the government's already provided. One of the reasons is that the timing is just wrong. If you'd been here twenty years ago, you wouldn't have had that opposition but now Gracemere is

growing at a huge rate westwards, both residentially and industrially, and most of the blocks that you're going through are only small blocks.

People haven't got large enough acreages to give a small amount up. We have no idea what the compensation's going to be like. We presume if it's anything like government compensation, it won't be very much. Our real fear is that some people are holding onto a piece of land they think is very likely to be developed in the next two years. But if a pipeline goes through it, it will no longer have the same value. They'll lose a tremendous amount of value which I'm sure they won't pick up with compensation.

I don't know when the process of compensation will start to happen. It may not be for quite a few years until this pipeline is finalised. So from my point of view and all the other residents, we really want you to consider the government easement rather than our area. Thank you.

29. What sort of coal reserves are you looking for to make a well feasible and what volume of water do you pump out for your average-sized well?

We look to recover about 2-4 petajoules of gas per well which is enough to pay off the cost of the well and the operating cost etc. The amount of water we produce depends on the geology of the area e.g. coal in the Surat Basin produces about ten times more water than the Bowen. Also, the amount of water varies over time, starting off at a high rate and then diminishing quite quickly to fairly low levels.

30. I'm interested in the remark you made before about the Styx area which is pretty close to my property. It worries me you are in that area and my property is covered by Waratah Exploration. Is there any chance that Arrow can come over the same area?

Yes, it is possible to have what is known as 'overlapping tenure', where a coal company holds tenure under the *Petroleum and Gas (Production and Safety) Act*. This is quite common in the Bowen Basin and can occur wherever there is coal given that there is a common interest in coal between coal mining and coal seam gas.

31. Can Waratah or another mining company take gas at the same time as mining coal?

Yes, within certain limitations. Coal miners have a right to drain gas for the purposes of safe and efficient mining. In most cases they are not allowed to commercialise gas, which means to sell it off their mining lease (whether in raw form or as electricity) and they can only use it on site which some mines such as Moranbah North and Grasstree do. In general though, coal miners only drain enough gas to allow mining, and they are not strongly focused on using the gas for any productive purpose.

A lot of the technology that we're using has been adapted from the coal miners so we can work together. We're encouraged to enter into coordination agreements to do so, and the carbon tax is a big incentive for those guys to work together with us. They can get mining and petroleum leases and do that sort of work for themselves. If we had tenure, they would enter into negotiations with us, but we will not hold them up from mining coal. Conversely, they can actually encroach on our business more than we'd like sometimes.

32. I believe you need to seriously look at, and make a decision about, the levels, layers, path of the pipeline and get back to this group of people here. Also, as a suggestion, you have two different types of people here; you have one lot of people who are

getting a pipeline through their place, and the others are getting their properties drilled. You should have two different meetings; each to address one specific lot of problems. Does that make sense?

Yes. This meeting is about drilling, but we can take away your questions around pipelines and make sure they get answered.

Pipeline-specific information sessions will be held in a number of centres (including Gracemere because of comments made during this session) in April.

- 33. Only the pipeline concerns us, which is why we're here. We've heard all the scientific stuff about drilling holes which we thought was just a red herring, but obviously that was the main topic. So we've had to sit through that to ask questions about the pipeline. Are you going to have a meeting about pipelines and access? There should be a meeting in the pipeline area.**

Arrow's policy is to update local communities of the full range of activities, which in this region is mainly exploration drilling and the pipeline. We believed that we could cover both, but it is evident that there is a high level of interest in the pipeline so we will put more effort into that in a future session, and decide whether it warrants its own session (*and a decision has now been made to hold a session in Gracemere on 19 April*).

I think that's the really important thing that's come out of tonight because when we were here last year the pipeline was not an issue. The irony is that we had a pipeline guy with us then but tonight when it's become an issue we don't have one here. But, as Carey said, every single comment that's been made here tonight about the pipeline will go back to Brisbane.

- 34. We have a formal group called the Kalapa District Pipeline Group. We've got sixteen families involved in it and share the same solicitors. If other people want to get in contact with us they can. If anybody else wants to form a group we can help them out.**

Note the email address for the group is moon@tpg.com.au

I believe there are three test holes around Rockhampton. I know one is at Yaamba. Can I ask where the other two are and at what stage?

Yes, we have done three test holes this year. One was at Herbert Creek, north of Rockhampton, another one was in Yaamba, between Rockhampton and Herbert Creek, and the other one south at Casuarina.