



# Surat Gas Project

**MILES/BELLEVUE**  
Area wide planning

3 NOVEMBER 2021



Safe Work. Strong Business.



# Why are we here today



Today we will introduce Arrow's proposed plans the Bellevue area.

- Our objectives are to:
  - discuss information relating to how Arrow works
  - share information on our proposed development (inc. maps)
  - seek your feedback on our draft plans
  - explain next steps, and how we would like to involve you in the process
  - encourage you to consider where infrastructure could be located on your property

Surat Gas Project  
(SGP)

Coexistence &  
Deviated  
Drilling

Area Wide  
Planning &  
Land Access

Groundwater &  
Subsidence

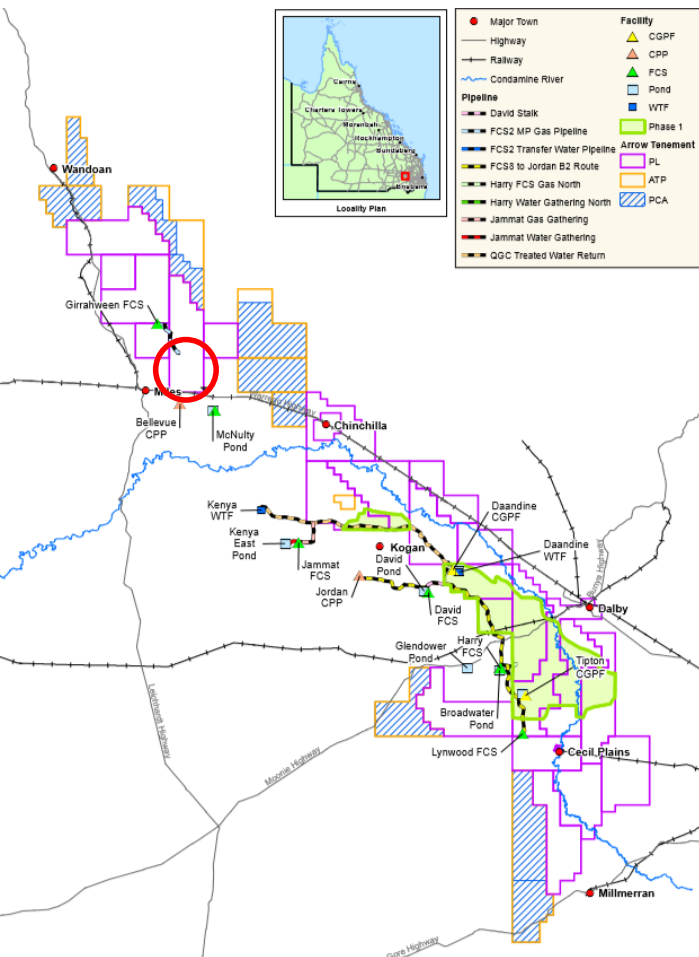
Drilling

Gathering,  
Construction &  
Rehabilitation



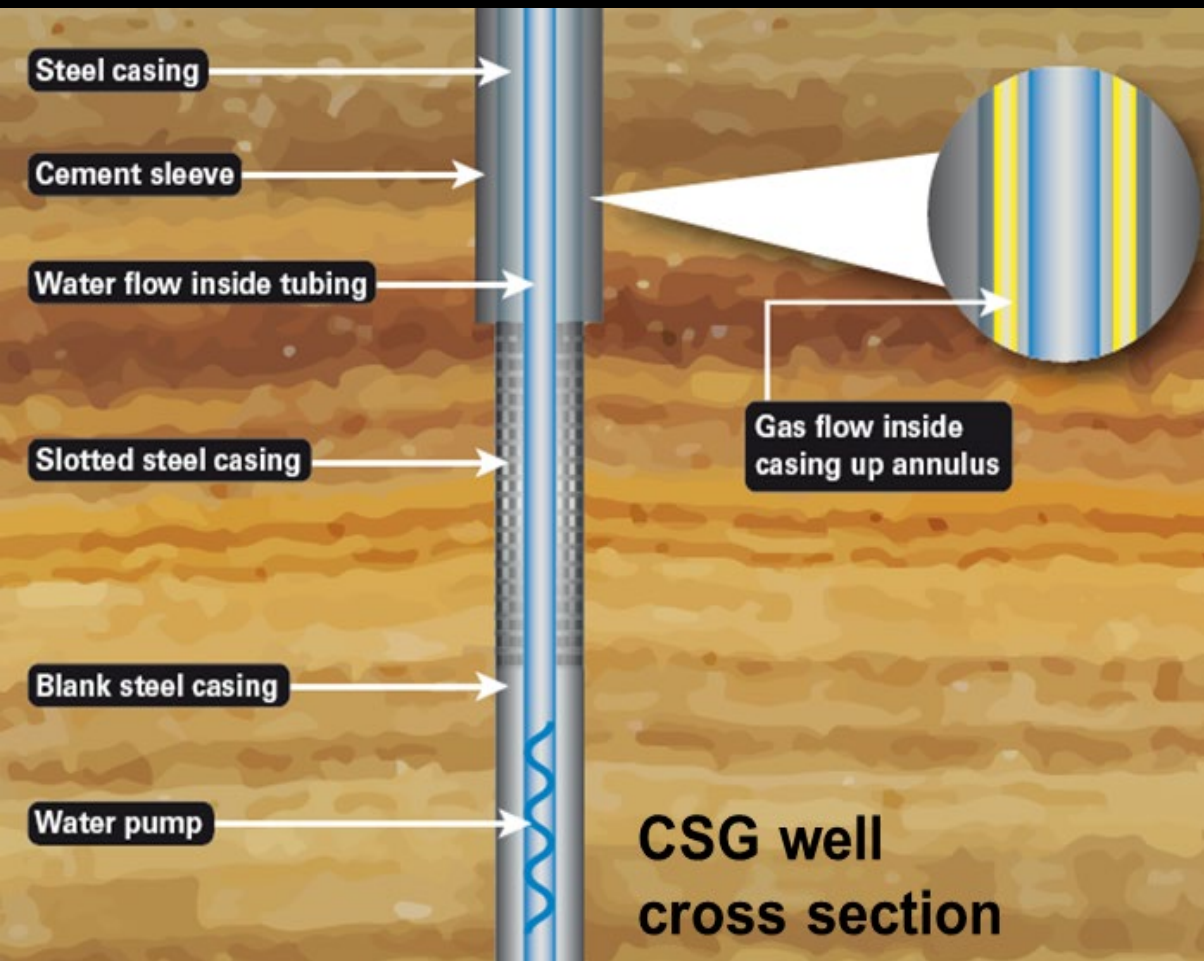
**Arrow's Surat Gas Project (SGP) is underpinned by the largest gas sales agreement on the east coast of Australia, with the Shell-QGC joint venture:**

- In April 2020, positive Financial Investment Decision (FID) for phase 1 of the 27-year project
- Construction commenced in late 2020
- Peak construction to occur between 2021-2025
- First gas in 2021



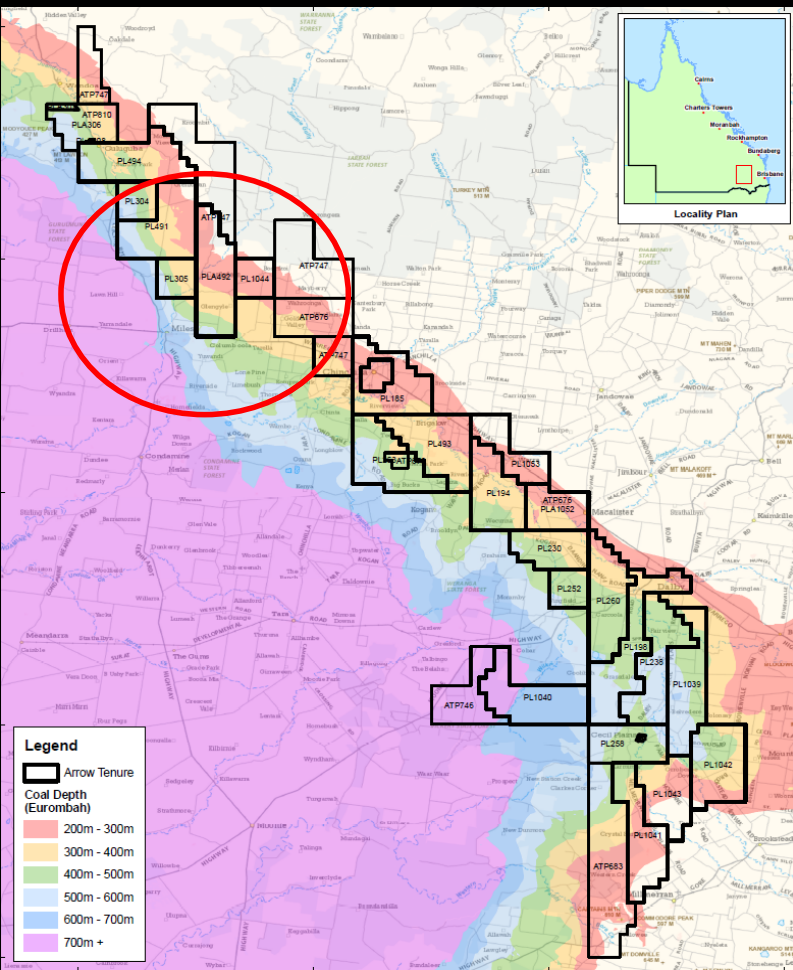
- Expansion north of current operations at Daandine, to Tipton:
  - Drilling of 600+ wells and construction of associated gathering and infrastructure commenced in late 2020
  - Arrow will continue using Daandine and Tipton compression facilities; upgrade at Tipton to extend its operating life
- New on and off-tenure gas/water pipelines to Shell-QGC facilities
- Upgrades to Arrow's water treatment facilities
- A beneficial use network to substitute Condamine Alluvium groundwater allocations (in Arrow's area of greatest predicted drawdown)





## Unconventional gas

- Trapped in coal, not sandstone, by large volumes of water that must be released first, and treated
- Mix of shallow (300m) and deep (1.5km+) vertical, deviated and horizontal wells and well pads
- Gas and water flow up the well to the surface separately
- Wells are constructed to isolate coal seams from groundwater aquifers



- Coal seam depths are shallower to the east.
- Shallower coals have lower gas content but greater permeability, so the gas flows better.
- Coal depth influences well type:
  - shallower coals – single vertical wells
  - deeper coal seams – single vertical wells or deviated wells from multi-well pads of up to eight wells.
- Average surface spacing between well sites ranges:
  - ~800m (single vertical wells)
  - up to 2km (for multi-well pads).



## Coal depth and well type

- Coexistence commitments on Intensively Farmed Land (IFL) includes:
  - multi-well pads on IFL, where geology allows (unless negotiated) results in 50-75% smaller footprint.
  - average well site surface spacing not less than 800m.
  - pads located in paddock boundaries and less productive areas .
  - gathering lines buried deep enough for future land use.
- Typically, Multi-well pads on IFL area where coal depth is greater than 400m.
- Arrow's deviated drilling practices have been shaped by engagement with stakeholders over the last 8 years.
- Deviated wells are a fundamental part of Arrow's ability to coexist with the agricultural industry, reducing surface footprint and providing greater flexibility to accommodate farming systems.
- The majority of wells in this area are deviated wells on multi-well pads.







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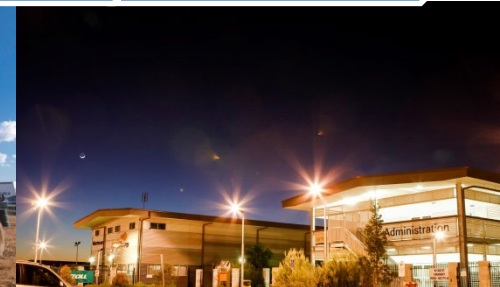
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# Arrow's commitments to Surat Basin landholders

(current as of 13/8/21)

## IN ACTION



### Historical Deviated wells

- All landholders notified
- Detailed maps with as-built diagrams, location, depth, and trajectory of wells
- Wells logged in Dial Before You Dig and communications fixed



### Insurance Deed Poll

- Protects farm insurance cover by indemnifying landowners for public liability associated with deviated wells as per CCAs



### Improved Area Wide Planning (AWP)

- Early and ongoing transparent engagement about potential location of deviated wells



### Subsidence Baseline Pack

- Property-specific baseline data
- Provides transparency on any gradient changes (subsidence) over time
- To be provided to all with deviated wells (and more broadly in the future)
- Bi-annual LiDAR data acquisition for monitoring will be shared



### Entry Notices

- Provided for all historical deviated wells beneath properties
- Includes maps, Deed Poll, Subsidence Baseline Pack, Notice of Intention to Drill and Code of Practice for construction and abandonment of bores in Queensland
- To be provided where landholders agreements are not in place

## IN DEVELOPMENT



### Enhanced Water Monitoring and Management Plan (WMMP)

- Enhanced commitments on: monitoring, impact identification and how subsidence would be addressed
- Feedback to be sought from Arrow's Community Committees
- Re-submission of WMMP to Commonwealth Government for approval



### Commitment to Surat Basin landholders on future compensable impacts

- Details include how Arrow will work respectfully and transparently with landholders, how any impacts will be addressed (including subsidence)



### Working with GasFields Commission, AgForce, Queensland Farmers Federation, APPEA, Community Committees and the regulator to fully understand, and address landholder concerns



### A template for a *Voluntary Deviated Wells Agreement* with landholder (for consultation with peak bodies)

- Including commitments on any future compensable impacts



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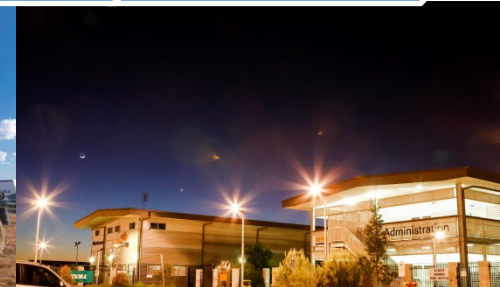
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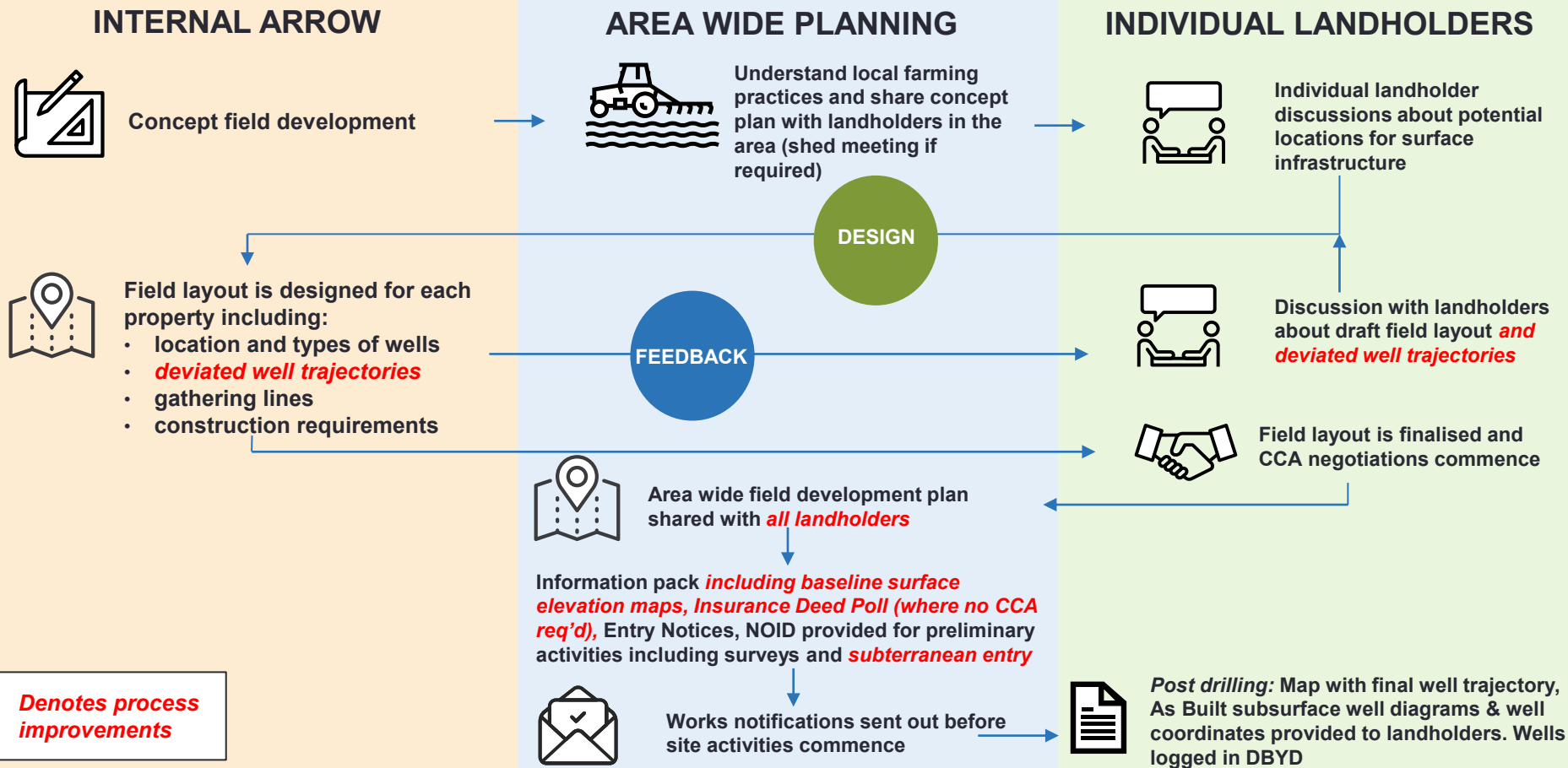
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- Meet with landholders in the area to look at placement of infrastructure and to understand local issues.
- Work directly with landholders to map areas around their property that may be appropriate to host Arrow infrastructure.
- Understand landholder subsurface requirements.
- Use this information to develop a 'Concept' layout.
- Present the 'Concept' layer, including indicative deviated well paths, to landholders to obtain feedback and refine the layout.
- Scout the proposed layout with a surveyor, construction representative and landholder if they are available. Information from scouting is used to update the 'Concept' layout.
- This is a reiterative process that benefits from landholder involvement.



## Landholder operations

- Arrow will understand your farming operation, including:
  - types of equipment and machinery
  - farming system
  - future plans
  - constraints i.e. water
  - landholder conditions

## Site assessment

- The proposed layout is walked and assessed by a qualified team of professionals including:
  - Ecologist
  - Archaeologist
  - Traditional Owners
  - Surveyor
  - Land Liaison Officer
  - Survey Lead
- Survey map provided to landholder to confirm assessment areas and inform the Conduct and Compensation Agreement (CCA)
- Landholder involvement throughout the process is encouraged



### Valuation

- Arrow engage a registered valuer to do an onsite valuation of the property

### Conduct and Compensation Agreement (CCA)

- Once all those steps are complete, Arrow will draft a CCA detailing all proposed activities, including a compensation offer
- Landholder can review the CCA and seek professional advice to negotiate CCA in good faith

**Arrow may offer other agreements where applicable.**



# Nuisance mitigation

## **Planning:** Noise measurement and modelling

- Well pad placement
- Well pad orientation and design

## **Construction:**

- Use of noise attenuation on plant and machinery
- Scheduling of work activities
- Short term alternative arrangement agreements

## **Drilling:**

- Lighting is required short term during 24hr drilling, after which it is removed and only returned for well work overs
- Arrow's Land Liaison Officers will work with the drilling department to review lighting set up and adjust angles when required, working so that lights orientated to minimise light spill

## **Operation:**

- Attenuation on gensets
- Use of acoustic canopies
- Monitoring and maintaining equipment
- Adjusting genset power load and/or gas flow rates







## 12 Land Access Rules



01

Only Enter a property with the approval of your supervisor who has cleared access with the Access Department.



02

Only conduct activities that are approved within the access conditions.



03

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



04

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



05

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



06

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



07

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



08

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



09

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



10

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



11

Only Land Liaison Officers are permitted to discuss activities and access conditions with the landholder.

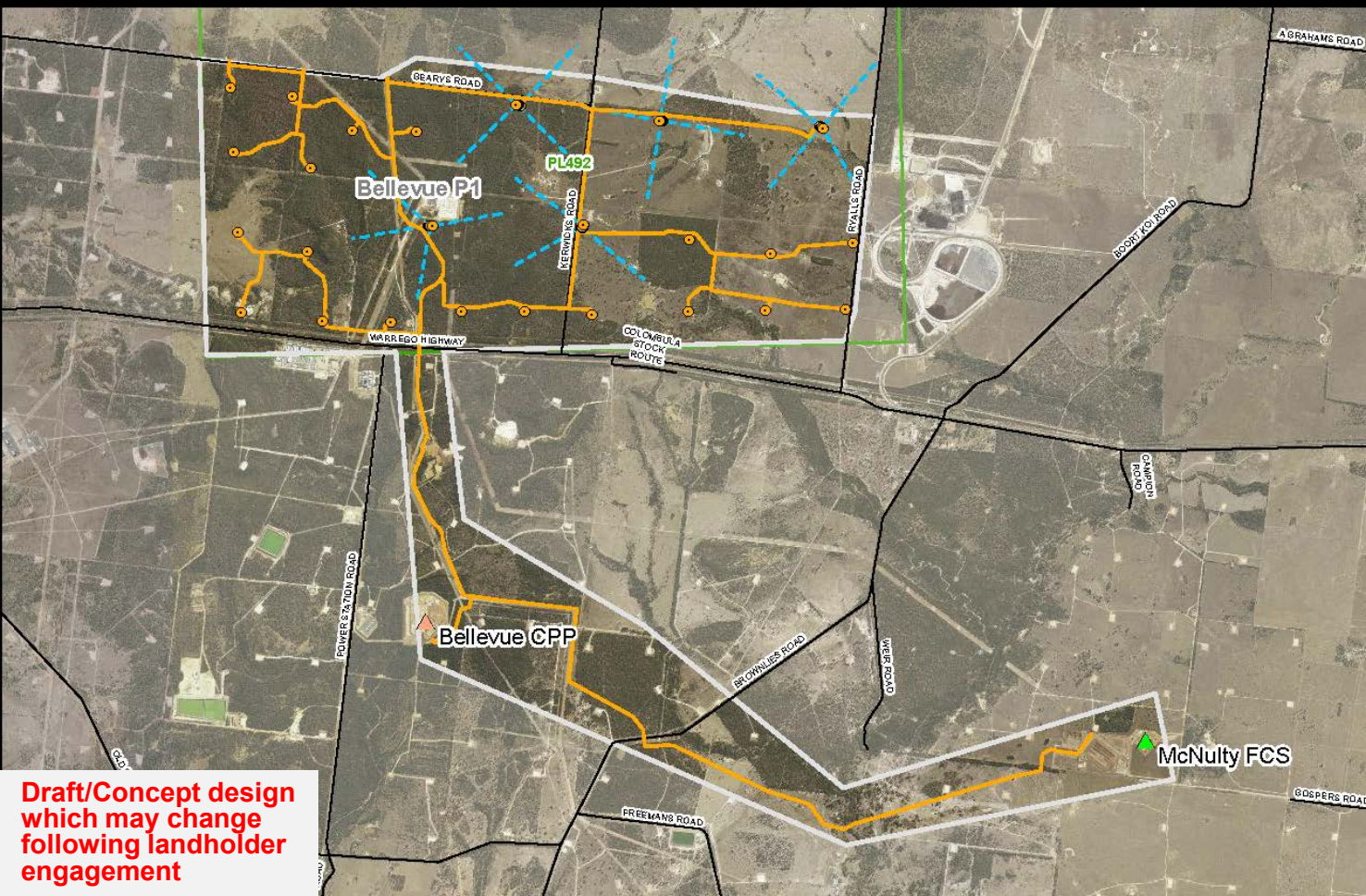


12

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

- We have 12 mandatory Land Access Rules that govern how all staff and contractors behave on your property.
- Failure to comply may result in disciplinary action, dismissal or termination of contract.
- Property-specific rules and requirements are captured in the Landholder Conditions.
- Landholder Conditions are formulated with the LLO to assist Arrow to plan around farming operations and conduct on your farm.



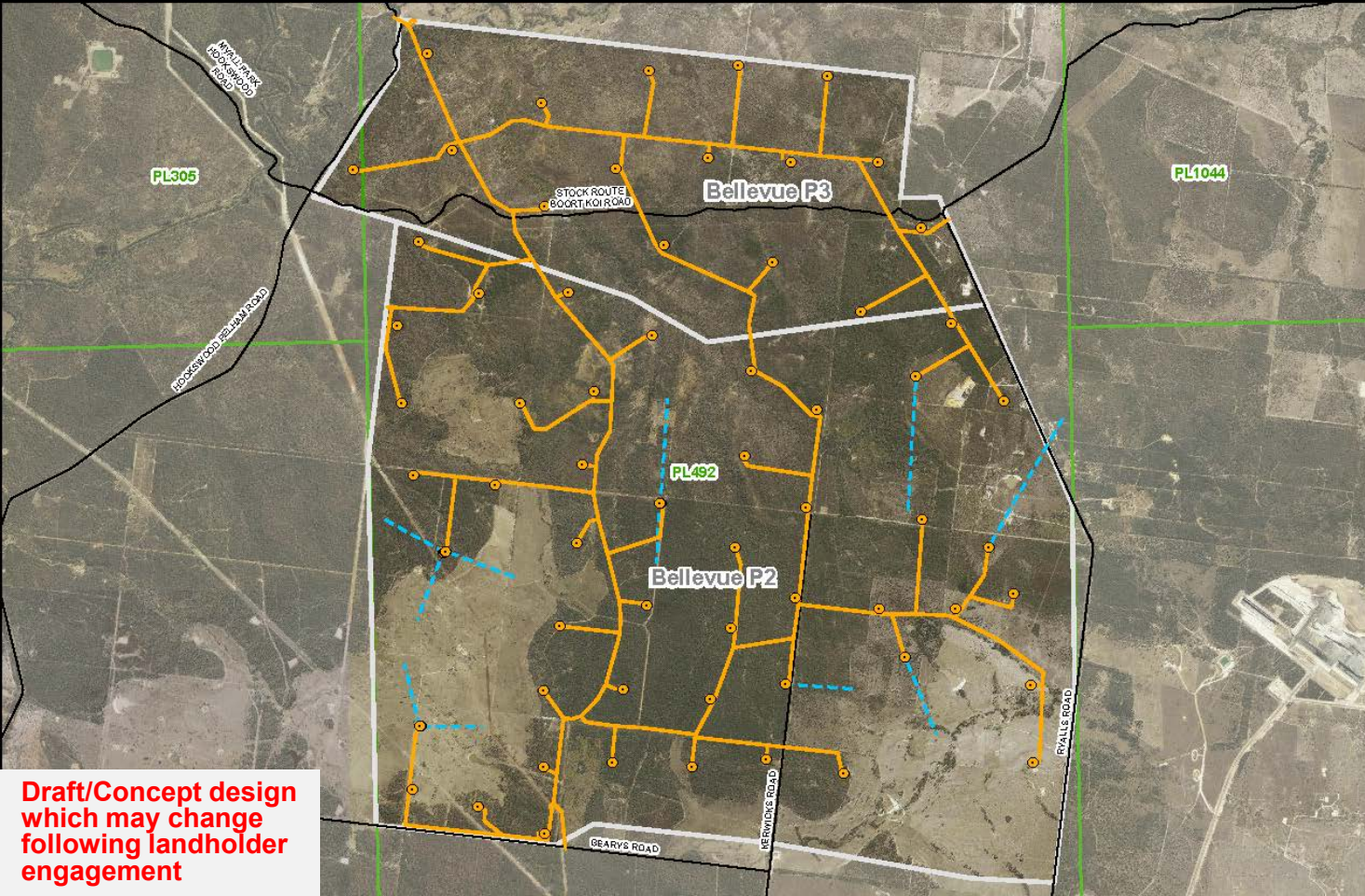


## Wells & Gathering

- Approximately 107 wells in total:
  - Bellevue Part 1 (approx. 40 wells)
  - Bellevue Part 2 (approx. 51 wells)
  - Bellevue Part 3 (approx. 16 wells)
- Approximately 120km of water and gas gathering pipelines in total

**Draft/Concept design  
which may change  
following landholder  
engagement**





## Workforce

- Construction crews to stay in existing accommodation facilities in Miles
- Proposed short-term (mobile) drilling camp

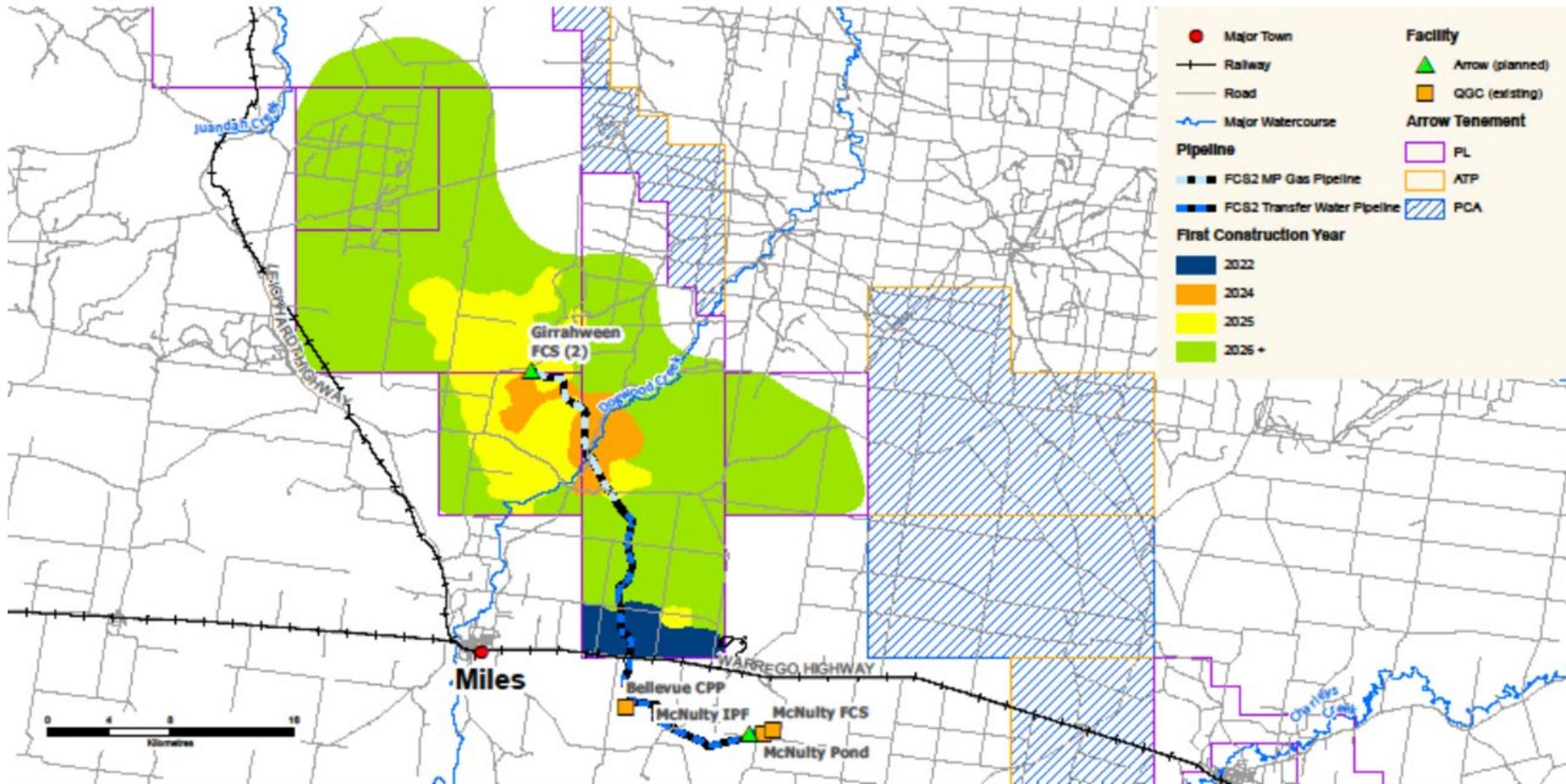
## Water

- Construction water sourced from existing pilot dams and other water sources in the area

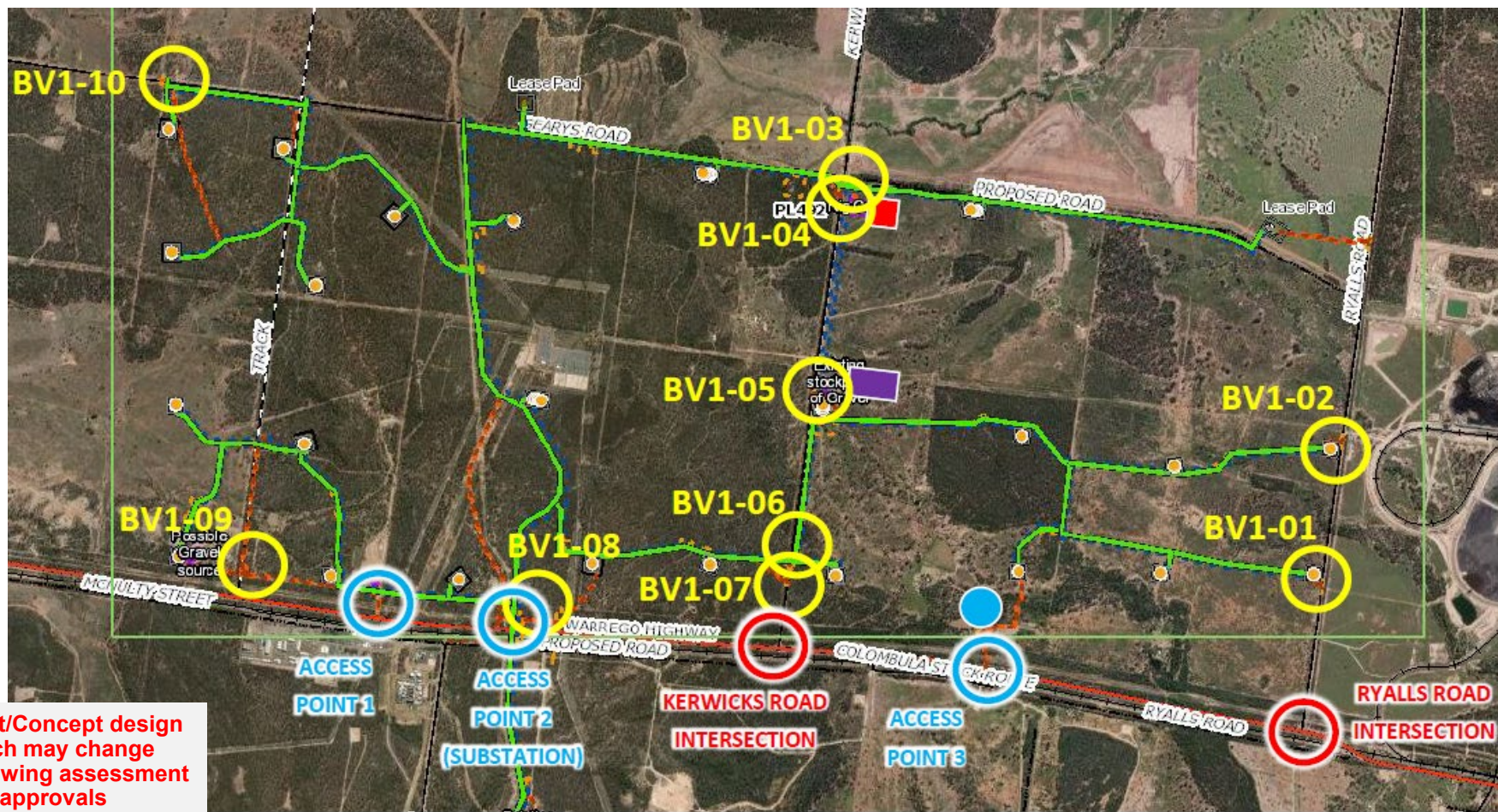
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# Miles development area – proposed development







Draft/Concept design  
which may change  
following assessment  
and approvals



- Arrow undertake Traffic Impact Assessments to identify potential road safety issues caused by our increased traffic
- Any road upgrades or maintenance require approval from the road owner
- Transport routes are subject to approval by Department of Transport and Main Roads (TMR) and Councils
- Road Use Management Plans are developed directly prior to construction and tailored to specific areas and conditions







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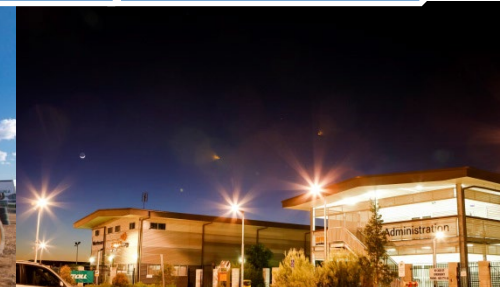
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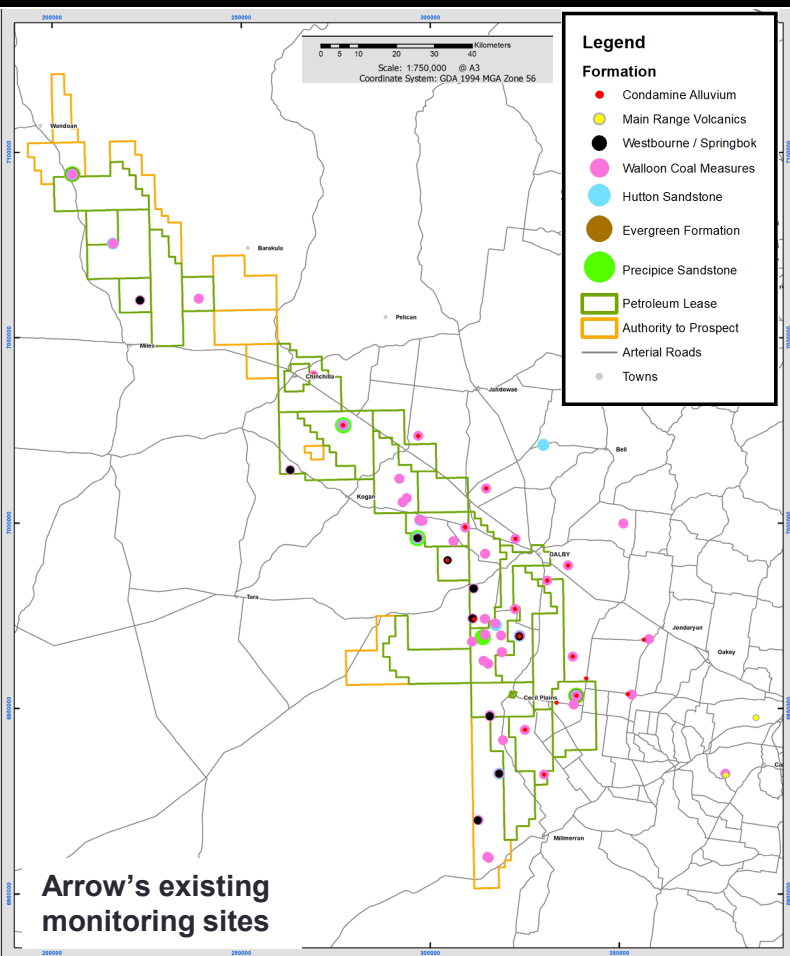
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- The Queensland Office of Groundwater Impact Assessment (OGIA) prepares the UWIR which includes modelling of industry-wide CSG impacts to groundwater resources.
- The groundwater model is informed by groundwater monitoring across the area.
- The third Surat Cumulative Area UWIR was released in July 2019 (following 2012 and 2016 versions) and found:
  - less impacts are predicted to the Hutton Sandstone and Condamine Alluvium.
  - greater impacts are predicted to the Walloon Coal Measures and Springbok Sandstone.

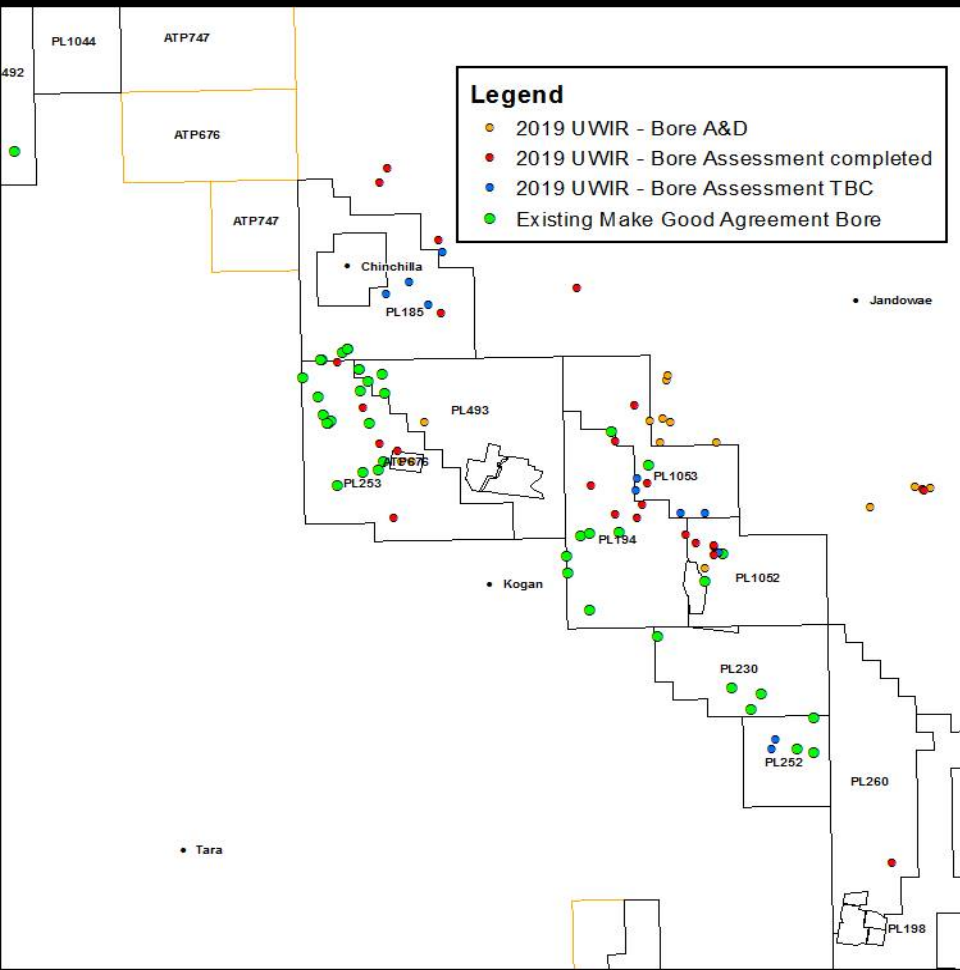


- Across the CSG industry at late 2020, the UWIR monitoring network comprised ~780 monitoring points in the Surat Basin.
- Arrow's own monitoring network includes:
  - 197 groundwater bores in the Surat Basin (additional bores in the Bowen Basin)
  - UWIR monitoring obligations:
    - 137 points for water level and pressure
    - 29 points for water quality
  - telemetry for 'real time view' of data collected every hour
  - data contributes to the understanding of groundwater impacts in the Surat Basin and OGIA's Annual Review.
- Data is available to download via Queensland Globe on Google Earth™: <https://qldglobe.information.qld.gov.au>





- Arrow's current points:
  - 137 points for water level and pressure
  - 29 points for water quality
  - 6 points for ground movement monitoring
- Arrow's future additional points:
  - 19 points for water level and pressure
  - 2 points for water quality
  - 5 points for ground movement monitoring

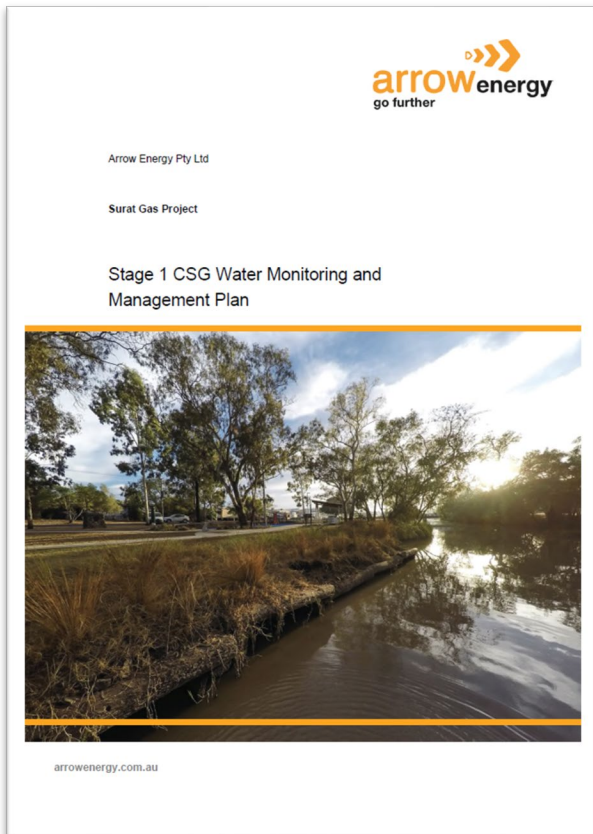


- The Queensland Water Act requires CSG companies to 'make good' impacts to water bores due to CSG.
- When released OGIA'S 2019 UWIR identified 57 immediately affected area (IAA) bores where Arrow is the responsible tenure holder.
- In 2020/2021, OGIA updated the status of 8 additional bores where Arrow is the responsible tenure holder and is now required to do a bore assessment.
- Arrow has completed 80 bore assessments in the Surat Basin to date.



- If your bore is identified in the UWIR:
  - Arrow will contact you to conduct a bore assessment
  - If the bore assessment finds that your bore will be impacted, Arrow will provide make good measures including payment of compensation or monitoring (depending on how imminent and likely the impact is).
- To date, Arrow has entered into 41 make good agreements for bores in the Surat Basin.
- Please contact Arrow through your Land Liaison Officer, if you think bore is experiencing impacts
- Arrow will not make good bores which cannot make water.





- Subsidence and ground movement due to groundwater use and soil wetting/drying cycles predates CSG activity
- Arrow has strict EPBC Act compliance obligations in it's WMMP\* which was approved by Federal Dept of Agriculture Water & Environment (DAWE) after assessment by it and an independent water expert
- Must report results to DAWE by January 2022, annually thereafter
- We use the most accurate techniques available i.e. relative change in elevation and change in gradient, noting:
  - Subsidence impacts due to CSG are less than natural variation
  - Arrow is not aware of any technique which has absolute accuracy high enough to identify CSG impacts. Instead we use techniques which measure relative change





## Summary

- Analysis of historical observations indicates CSG-induced subsidence is unlikely to be perceptible at property scale and small compared to natural variability (such as from soil wetting/drying)
- Consistent with previously presented modelling indicating a minor impact compared to existing slopes
- We have installed 6 out of 11 ground-truthing monitoring points, ahead of any possible SGP subsidence
- We are obliged, by the Commonwealth, to address impacts regardless of whether a CCA is in place
- Arrow convened its committees to obtain feedback on the WMMP on 25 August; all feedback was recorded and we will work through each item of feedback and prepare a response





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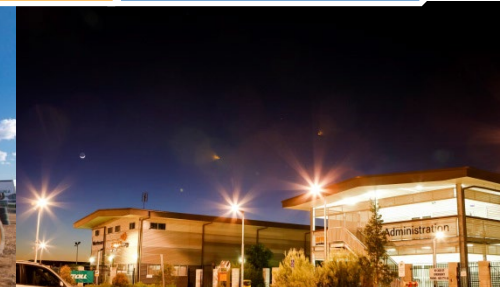
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FEATURE VIDEO

## Deviated drilling

Deviated drilling from multi-well pads reduces our...





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# > Phases of pipeline construction

- ~80 gathering construction workers on site at any one time
- Construction timeframes vary, however typically daytime hours (6am - 6pm)
- Construction workforce housed in Dalby in existing accommodation

Right of way cleared and levelled, topsoil stockpiled



Pipeline is laid out and welded in a continuous string



The trench is excavated to at least 750mm to top of pipe, the pipe is lowered into the trench



Above ground infrastructure (high-point vents, low point drains) are constructed



The pipeline is pressure tested (road closures may be necessary)



The right of way is rehabilitated



During operations, maintenance will be required from time to time












## Typical construction workforce numbers per site:

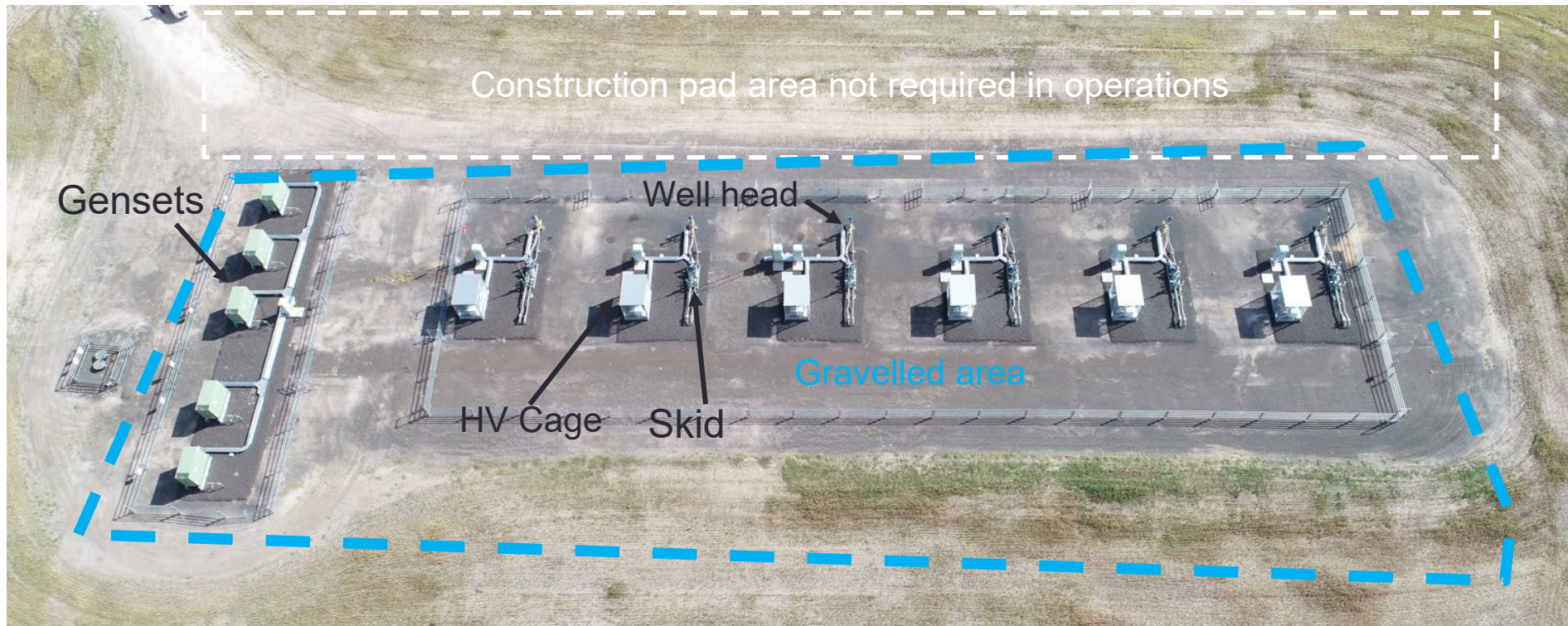
- Site prep: ~8 workers
- Drilling: ~ 15 workers
- Surface facility construction: ~10 workers
- Completions: ~12 workers

Site Prep: Well pad cleared and levelled	4-8 days	
Drilling	4-7 days	
Installation of well surface facilities	30-90 days	
Completions: Installation of water pump	5 days per well	
Well maintenance (workovers)	3-6 days per well	





# Multi-well pad layout







# Single vertical well pad





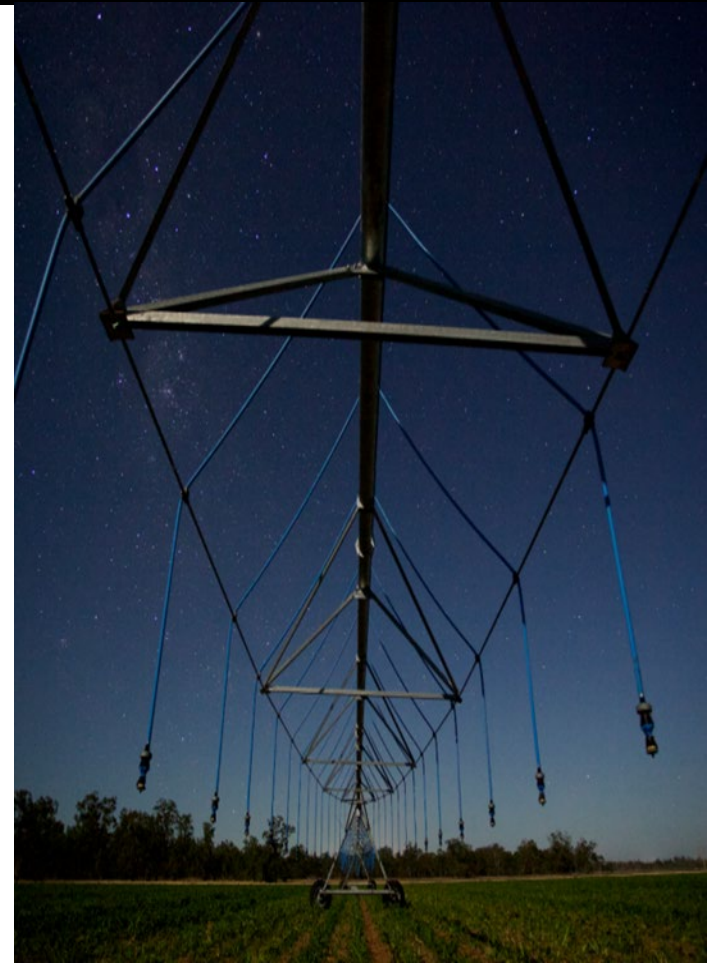


# Wellsite rehabilitation





- Arrow Energy is mandated, under section 297 of the Australian *Environmental Protection Act 1994A*, to provide **financial assurance** as part of its tenure and environmental approval (EA) process.
- The Act stipulates that prior to EA approval Arrow must make an upfront payment. These funds are held in a Queensland Government escrow account to cover the cost of site rehabilitation.
- The cost of financial assurance is site specific and is equal to the expense that would be incurred if the Queensland Government were required to rehabilitate the area.
- EA rehabilitation requirements state; financial assurance funds may not be released until the site has been rehabilitated and landholders are satisfied.



- Rehabilitation is highly regulated through the Environmental Authority (EA) granted by the State Government
- Arrow's rehabilitation requirements are underpinned by a Financial Provisioning Scheme, proportional to the construction and operational footprint

## **Operational rehabilitation**

- Construction work is undertaken and completed. The site is reduced to its operating size, with the area required during construction, able to be reused by the landholder

## **Final rehabilitation**

- At the end of life of the above-ground infrastructure, it is cleared from the site, the landform reinstated and, in un-farmed areas, seeded
- The rehabilitated area is monitored until it meets its EA
- To demonstrate the conditions have been met:
  - the landholder is consulted during the rehab process
  - Arrow must lodge a final rehabilitation report with the Department of Environment and Science (DES), who must agree that final rehabilitation is complete

**Only once these steps have been achieved, the EA is surrendered and the tenure is relinquished**



## > Recap: why are we here today



- Our objectives are to:
  - present information on how Arrow works
  - share information on our proposed development
  - explain next steps, and how we would like to involve you in the process
  - seek your feedback on our plans ([info@arrowenergy.com.au](mailto:info@arrowenergy.com.au))
  - encourage you to consider where infrastructure could be located on your property
- Next steps:
  - Spend some time viewing the Bellevue area maps and speaking with the Arrow Staff
  - Land Liaison Officers will be in contact to seek your feedback on development plans



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