KEY FINDINGS

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SUPPLEMENTARY REPORT TO THE EIS

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Key Findings of the SREIS

This section summarises the main findings of the Bowen Gas Project (the Project) Supplementary Report to the Environmental Impact Statement (SREIS). The SREIS has been prepared to respond to the request by the Chief Executive of the Department of Environment and Heritage Protection (EHP) to provide additional information, to address issues raised in submissions on the Bowen Gas Project Environmental Impact Statement (EIS), and to reflect refinements and updates to the project description.

SREIS Process

Details of submissions received on the EIS, the consultation carried out by Arrow Energy Pty Ltd (Arrow), changes to the project description, and the additional technical studies completed to inform the SREIS are summarised below.

Submissions

The EIS was placed on public exhibition from 11 March 2013 to 23 April 2013 to provide the public and government agencies with the opportunity to view and comment on the EIS in the form of submissions. A total of 53 submissions were received by the Chief Executive during this time.

A comprehensive review was undertaken of the 53 received submissions to classify specific issues raised. Submissions were reviewed to define individual issues, which were then recorded and assigned an issue number. In total, 1,327 issues were identified from the 53 submissions received. Arrow has considered the issues which were raised in the submissions and provided detailed responses which are contained in Part B of the SREIS.

Consultation Activities

The EIS consultation process was designed to inform stakeholders of Project activities, provide an overview of potential environmental and socioeconomic impacts and provide the community with an opportunity to present their concerns.

A range of activities were undertaken during the public exhibition period of the EIS to provide information to the community about the findings of the EIS. These activities included community wide consultation activities, promotional activities, distribution of information materials (electronic and printed), drop-in sessions and community information sessions.

Beyond the EIS process and throughout the life of the Project, Arrow will continue to ensure stakeholders receive regular communication about the Project and are able to provide feedback or raise issues.

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

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

Project Updates

Since publication of the EIS for public comment, Arrow's field development plan and conceptual design for the Project has advanced. This progression is the result of ongoing exploration activities that have improved Arrow's understanding of the gas resource, and the evolution of Arrow's conceptual design, planning and operational processes. Further refinements to the basis of design, including revised typical arrangements, configurations, construction methods and coal seam gas (CSG) infrastructure design are being undertaken by Arrow to prepare for the front-end engineering design (FEED) phase and incorporate new design elements to improve efficiencies and reduce the Project's disturbance footprint.

The main changes to the project description since the EIS was submitted include the following:

- An increase to the number of development (or drainage areas) to 33 due to expected low gas pressures and as a result of the preliminary engineering undertaken in the concept select phase. Each of these drainage areas now represent an approximate 6 km radius area rather than the previous 17 drainage areas with a 12 km radius;
- The term "integrated processing facility (IPF)" is no longer being used for the SREIS case. Water treatment facilities (WTFs) will now be co-located with the central gas processing facilities (CGPFs) rather than at the previously named IPFs;
- A reduced number of production wells (from up to 6,625 to approximately 4,000) will be drilled throughout the Project area over the life of the Project;
- Multi-branch lateral wells (MBL's) are now the preferred well type. This involves the drilling of lateral wells (in addition to vertical wells) allowing for up to 12 wells (6 lateral + 6 vertical production wells) at a specific surface location (multi-well pad);
- The power supply concept has been revised to network supply from the grid, rather than in-field power generation. However an integrated power generation scenario is being considered as a temporary alternative supply if connection to the grid is not available on time. Under this scenario, it is proposed to develop temporary power generation facilities, utilising CSG as a fuel source, at selected CGPFs and FCFs as required for approximately the first 2 years of operation;
- An estimated total water production of 153 GL over the Project life for the SREIS compared to approximately 264 GL presented in the EIS;
- The peak of the construction workforce is expected to be approximately 2,450 personnel in 2018 compared to a peak of approximately 1,540 personnel in 2016 assessed in the EIS; and
- A refined strategy for water management.

These Project changes were reviewed by the relevant study team technical specialists to determine whether the impacts assessed in the EIS captured the full range of potential impacts of the Project and whether the proposed mitigation and management measures were adequate.

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Additional Studies

Arrow commissioned a number of supplementary technical studies to address aspects of the changes made to the project description and to provide additional information to inform the review of impacts as assessed in the EIS. These supplementary technical studies are presented in full as appendices in Part C of the SREIS, and summarised as chapters in Part A of the SREIS.

In some cases, the studies also responded to specific issues raised in stakeholder submissions including comments received from EHP and the Department of Sustainability Environment Water Population and Communities (formerly SEWPaC now the Department of the Environment).

Supplementary technical studies were carried out as follows:

- Air quality: A reassessment of potential regional and localised impacts was undertaken following revision of the project description, including the temporary gas fired power generation scenario, revised flaring scenarios, and assessment of diesel power generation units for drilling;
- Greenhouse gas: The greenhouse gas assessment was updated following revision of the project description, with the inclusion of updated and new datasets, and supplementary information requested by stakeholders;
- Groundwater: Issues identified in the EIS as requiring further attention were the capacity of faults to act as conduits for groundwater flow, the potential for hydraulic stimulation to trigger seismic events affecting faults, subsidence arising from depressurisation of coal seam groundwater systems, and the occurrence of groundwater dependent ecosystems. Investigations progressed as part of the SREIS include an uncertainty analysis of the groundwater modelling results, horizontal flow barrier modelling to determine the behaviour of groundwater at faults, an analysis of faulting in the Bowen Basin and its susceptibility to seismic events from hydraulic stimulation activities, assessments of historic and potential subsidence, and a review of the potential for groundwater dependent ecosystems to exist in the Project area;
- Surface water: The surface water environment was assessed against the revised project description which included potential discharge of CSG water to watercourses. Characterisation of the receiving environment along reaches of the Isaac River in the areas of potential WTF localities was undertaken;
- Hydrology and geomorphology: A supplementary study was undertaken to address the potential impacts caused by the construction and operation of two co-located WTFs and CGPFs at two preferred localities, as well as any potential impacts that might be caused to the receiving environment from discharges of CSG water;
- Aquatic ecology: A revised assessment of aquatic ecology values associated with the potential discharge of CSG water to watercourses was undertaken. An updated assessment of wetlands within the Project area was also undertaken to address stakeholder submissions;
- Terrestrial ecology: A supplementary study was undertaken to address changes to state and commonwealth legislation since the release of the EIS, the updated project description and submissions received. The Project's potential impacts on newly identified ecological values were assessed and mitigation measures revised or identified where appropriate;
- Matters of National Environmental Significance (MNES): An update to the MNES report is presented as an appendix to the SREIS to detail a number of revisions, and additional information

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received as part of the assessment process, as well as recognising water resources as a new MNES in relation to CSG;

- Roads and transport: The Project's potential impacts on roads were assessed in a supplementary road impact assessment (RIA), following advancement of Arrow's field development plan and conceptual design. The RIA established that there is unlikely to be any residual road impacts that cannot be managed and that there will be no significant residual impacts;
- Landuse and tenure: Identifies landuse impacts that may result from the revised project description, and provide additional mitigation and management measures that may be required to ameliorate the revised potential impacts;
- Noise and vibration: Remodelling of noise and vibration was undertaken following updates to the project description including updated well designs, changes to flaring scenarios, and changes to the design and capacity of FCFs and CGPFs;
- Social: A supplementary study was undertaken to validate potential impacts identified in the EIS as well as identify any changes to potential impacts on local communities due to project description changes, and update social baseline statistical information; and
- Waste management: An assessment was undertaken to investigate if changes to the project description necessitated any amendments to the waste management strategies proposed in the EIS.

Validation of Environmental Impacts

Many of the environmental aspects assessed in the EIS did not require review or reassessment as the Project changes did not materially alter the conclusion of the EIS. These include the following:

- Climatic adaptation;
- Contaminated land;
- Soils and land suitability;
- Geology;
- Landscape and visual amenity;
- Economics.
- Indigenous and non-Indigenous cultural heritage;
- Preliminary hazard and risk;
- Decommissioning and rehabilitation;
- Health and safety; and
- Cumulative impacts.

Further information and clarifications on these aspects have been provided in Part B of the SREIS through the responses to submissions. However, the impacts and management measures for these aspects remain as presented in the EIS.

The supplementary technical studies undertaken for the SREIS validated the assessments presented in the EIS with the findings used to review and update management measures and commitments where required. This section summarises the findings of the supplementary technical studies and any additional mitigation commitments proposed to address potential Project impacts.

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The key findings of the supplementary technical studies and the revised or new management measures are summarised below.

Air Quality

The same atmospheric dispersion modelling methodology for regional scale air quality impacts applied in the EIS was used in the SREIS.

The SREIS air quality assessment was based on two power supply scenarios. The 'base case' scenario represented grid power supply based on connection to existing electricity transmission infrastructure. This is the preferred scenario. An alternative temporary power supply scenario was also considered in the event that grid connection is delayed. In this temporary scenario, CSG would be used for power generation at the Project facilities (CGPFs and FCFs) for approximately the first two years of Project life, with connection to the existing electricity network from around the third year onwards.

Air emissions from power generation at wellheads were significantly lower in the 'base case' than the alternative scenario, and the EPP (Air) objective for human health and wellbeing will be achieved at wellheads for both scenarios. In both scenarios, annual average NO_2 background concentrations are likely to be higher than the EPP (Air) objective for health and biodiversity of ecosystems for the same areas surrounding coal mines as a result of background sources. The impact of Project emissions on ground level concentrations in these areas is very small or negligible.

In the local air quality assessment, the same methodology was adopted with the exception of the atmospheric dispersion modelling package. This was changed to reflect an update to modelling best practice in Australia since publication of the EIS. In the local air quality assessment, the preliminary indicative separation distance between the largest power generation source, located at the largest CGPF, and sensitive receptors was determined for the alternative power generation scenario. The distance for the SREIS alternative scenario power source configuration was estimated to be lower than that for the EIS configuration.

No relevant air quality objectives for NO_2, CO and particulate matter are predicted to be exceeded for flaring from well completions and workovers, if and where that occurrs. While the forecast gas flaring rates associated with planned and unplanned maintenance at facilities increased in the SREIS, predicted 1-hour NO_2 concentrations are estimated to be well below the EPP (Air) objective.

In the EIS, mitigation measures were established to ensure the Project is acceptable. With the updates to separation distances between power sources and proximate sensitive receptors estimated in the SREIS, the recommended EIS mitigation measures remain valid.

Greenhouse Gas Emissions

The updates to the project description and the resulting greenhouse gas (GHG) inventory show that total Project GHG emissions are likely to be lower than those quoted in the EIS. However for the alternative worst impact scenario, direct Project emissions (Scope 1) in the ramp-up phase will be higher than the indirect Project (Scope 2) emissions for the first two years of the Project due to the combustion of gas for power generation.

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GHG intensity, a measure of the GHG emitted per unit of energy produced, averaged over the Project is higher in the SREIS than the EIS. This is not unexpected as the reduction in forecast gas production is greater than the predicted reduction in GHG emissions. Despite the expected increase in intensity of GHG emissions during the life of the Project after the project description refinements, the inventory update shows that overall Project emissions are likely to reduce by 4.3% compare to the EIS.

In the ramp up period (around 2019), other indirect emissions (Scope 3) are projected to be initially significantly higher for the updated project description described in the SREIS than that for the EIS, where increased production rates result in an increase of downstream processing requirements and subsequently the end use of the gas. It should be noted however that power demand and hence calculated emissions for the possible alternative temporary power generation scenario during ramp-up were based on a full capacity power demand for each facility, and hence are deemed to be highly conservative. In the operational period, other indirect emissions are higher in the EIS than the SREIS which corresponds to the overall reduction in gas production due to the reduced life of the Project compared to the EIS, and the subsequent reduction in emissions from downstream processing and end use. Similarly, in the ramp-down period SREIS Scope 3 emissions are approximately a quarter of those estimated in the EIS as a result of lower overall gas production over the Project life.

Arrow remains committed to the mitigation measures described in the GHG Technical Report (Appendix I) of the EIS and new climate change adaptation commitments described in the Supplementary Greenhouse Gas Technical Report (Appendix C) of the SREIS. It is considered that the mitigation measures applied for the EIS are still appropriate to address the identified potential impacts.

Groundwater

The assessment of potential impacts on groundwater resources in the Project area was presented in the EIS. Peer review of the numerical groundwater model and uncertainty analysis confirmed the adequacy of the model to predict drawdown within directly and indirectly affected aquifers. The drawdowns presented in the EIS were found to be conservative and close to worst case. The estimate of average water production was revised down from 7 GL/a to 4.25 GL/a, which will reduce predicted drawdown.

The capacity of faults to act as conduits for groundwater flow, the potential for hydraulic stimulation to trigger seismic events affecting faults, subsidence arising from depressurisation of coal seam groundwater systems, and the existence of groundwater dependent ecosystems were investigated in the SREIS in response to issues raised by the Independent Expert Scientific Committee in its review of the EIS.

As stresses in geological strata in the Bowen Basin are predominantly compressive, faults were found to be typically low permeability discontinuities that result in compartmentalisation of hydro-stratigraphic units within the groundwater systems. The results of numerical groundwater modelling presented in the EIS showed there was little difference between a scenario without faults and a scenario with faults acting as horizontal flow barriers. In the SREIS, a Telescopic Mesh Refinement (TMR) model (built for a discrete area) further tested the potential for faults to act as conduits for groundwater flow. The TMR

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modelling confirmed that faults would only play a minor role in propagation of drawdown impacts across the formations.

Although naturally occurring seismic events have been recorded in the Bowen Basin, the Bowen Basin is considered relatively aseismic. Hydraulic stimulation causes microseismic events which are localised to the area around the injection bore hole. These events are imperceptible at the surface as they typically have magnitudes less than 1 on the Richter scale. The risk of hydraulic stimulation causing a seismic event was assessed as low, a view shared by Geoscience Australia which noted that the risks of induced seismicity from hydraulic stimulation were low compared to natural earthquakes.

Satellite interferometry carried out across the Moranbah Gas Project area over the period from December 2006 to January 2011 observed ground movement (both uplift and subsidence) as a consequence of natural processes of swelling and shrinking soils, settling of manmade structures (e.g. earthen embankments) and coal mining. Potentially, some settlement (up to 20 mm) also occurred during this period as a result of coal seam gas extraction. The magnitude of this potentially observed settlement is at the lower end of the aggregate subsidence of 15 to 75 mm calculated for the Moranbah Gas Project by taking into consideration the depressurisation of groundwater formations and the shrinkage in the coal measures that could be caused by gas extraction.

It is concluded that these outcomes will also apply to the Bowen Gas Project because the Moranbah Gas Project area and the activities undertaken are considered to be a reasonable analogue of the Project area and the Bowen Gas Project activities. In addition, it is noted that any subsidence resulting from coal seam gas development would be broadly distributed and that differential subsidence would not occur, further reducing the risks of surface impacts arising.

Spring vents, watercourse springs and groundwater dependent ecosystems (GDEs) were identified in the Project area and a 50-km buffer to the Project area. No springs are predicted to be impacted. Two Indigenous wells whose source aquifers have not been confirmed may be affected, as might Lake Elphinstone which, although supplied by surface water, could receive groundwater baseflow. Other nationally important wetlands will not be affected by predicted drawdown. Non-spring GDEs are potentially present throughout the study area and are unlikely to be affected because the water table is typically greater than 10 m below ground level, beyond the typical root zone for vegetation. In some areas however groundwater may be sufficiently shallow along watercourses and drainage lines to support GDEs. Where this occurs and coincides with the extent of predicted groundwater drawdown in the aquifer that supports the ecosystems, there is the potential for impact to GDEs.

The Queensland Government has established a comprehensive framework for monitoring and management of groundwater resources. The Water Act 2000 and Environmental Protection Act 1994 set out the monitoring and management requirements, and conditions for hydraulic stimulation respectively. Arrow will prepare, or update, Underground Water Impact Reports (UWIRs) incorporating a Water Monitoring Strategy (WMS) and a Spring Impact Management Strategy (SIMS) for tenures within the Project area not covered by existing UWIRs (including the Surat CMA UWIR). Should springs be identified in the future, the SIMS will detail the investigations and mitigation measures required to manage potential impacts on spring complexes, spring vents, and watercourse springs. An environmental authority under the Environmental Protection Act 1994 will be required for hydraulic

stimulation activities. The application will incorporate a risk assessment and require the provision of evidence that restricted chemicals will not be used in hydraulic stimulation fluids. An environmental authority for CSG activities requires a groundwater monitoring plan and management on non-spring based GDEs, cultural and spiritual sites.

Surface Water

The supplementary surface water assessment undertaken for the SREIS has confirmed the original findings presented in the surface water assessment of the EIS. These findings have been refined and the potential impacts assessed against the revised project description. One of the key updates to the project description since the EIS is the identification of areas of interest for potential WTF locations in the Project area. The supplementary surface water report characterises the receiving environment along reaches of the Isaac River main channel in the areas of interest to assess potential impacts of different CSG water discharge scenarios.

A large surface water quality dataset for all the sub-catchments of the Project area was obtained from local operational coal mines and from the database maintained by the Department of Natural Resources and Mines (NRM) This data confirmed the surface water quality findings reported in the EIS, and identified that the surface water quality for the Isaac River main channel complies with the published water quality objectives (WQOs) with the exception of turbidity and dissolved aluminium for which local WQOs have been derived in this study.

The SREIS surface water report describes a set of principles that allow Arrow to assess the volume, frequency, duration and quality of CSG water that can be safely discharged. It was determined that by incorporating knowledge of the quality of the CSG water and that of the receiving environment, CSG water can be discharged without significantly impacting the receiving environment (surface water quality, environmental flow objectives, geomorphological environmental values).

By applying the principles outlined in the surface water report, controlled releases of either treated or untreated CSG water are not expected to have any significant impact on the environmental values of the Isaac River main channel. The impacts arising from uncontrolled releases will vary depending on a number of variables, including: flows and water quality in the receiving environment; and the volume, discharge rate and quality of the CSG water released.

Hydrology and Geomorphology

The supplementary hydrology and geomorphology assessment undertaken for the SREIS has provided information on likely potential impacts of activities included in the updated project description.

The environmental flows assessment in the supplementary assessment describes the Isaac River at the reaches proximate to the areas being considered for the proposed WTFs as highly ephemeral, with flows occurring only for short durations between December and April. For the remainder of the year the river is dry or is limited to a series of isolated pools. Recommendations are tailored to provide a framework for the management of CSG water releases at rates which will avoid a significant impact to the receiving environment (including surface water quality, hydrological regime, and geomorphic environmental values). The findings of the supplementary hydrology and geomorphology assessment, as well as those presented in the supplementary Surface Water Quality Technical Report (Appendix F)

of this SREIS, enable Arrow to develop a discharge strategy according to the variable water quality and stream flow conditions within the Project area.

Aquatic Ecology

The supplementary assessment of aquatic ecological values was undertaken following revision of the project description and review of submissions received on the EIS. One of the key project description changes relevant to aquatic ecology is the identification of potential receiving environments along the Isaac River main channel in the localities of the two proposed WTFs. Also, public submissions requested further clarification of wetlands within the Project area, which has been presented in the updated acquatic ecology assessment.

A literature review was undertaken of previous aquatic ecology and surface water studies carried out within reaches of the Isaac River. This review identified that the river is typically characterised as homogeneous throughout the Moranbah region with little natural variation, supporting instream habitat generally comprising intermittent pools and runs, with edgewaters providing habitat during flows.

The review identified aquatic flora and fauna species including macrophyte, fish, macroinvertebrate and turtle species. No conservation significant aquatic values were identified. Field survey results from existing studies were analysed to provide an indicative assessment of aquatic habitat within the study areas.

The potential impacts resulting from discharge of CSG water was also assessed against a range of scenarios, including the release of treated or untreated CSG water during controlled or uncontrolled conditions. Whilst an unlikely occurrence, the impact assessment identified that the uncontrolled release of untreated CSG water poses the greatest risk to aquatic values, with potential for loss and degradation of habitat. However, the application of mitigation measures, including the principles outlined in the surface water study, determined that CSG Water is not expected to have any significant impact on the environmental values of the Isaac River main channel.

The assessment to identify potential wetlands within the Project area identified numerous wetlands that support various ecological values. The reduced Project footprint proposed in the updated project description results in a reduction in potential impact intensity on a regional scale. However, an increase in localised potential impacts may occur. It is considered that the mitigation measures applied in the EIS are still appropriate to address identified potential impacts.

Terrestrial Ecology

This supplementary assessment of terrestrial ecology investigated potential impacts on terrestrial ecological values from Project activities arising from changes to the project description and updates to relevant State and Commonwealth legislation subsequent to the EIS. Additionally, the report addressed particular submissions made following the public consultation stage of the EIS.

The status of three flora species listed under the NC Act was downgraded from near threatened to least concern. Four flora and two fauna species listed under the EPBC Act were delisted and the Australian painted snipe (*Rostratula australis*) was upgraded from vulnerable to endangered. These changes resulted in no material impact to the findings of the EIS.

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The likelihood of occurrence assessment for two listed flora species and six listed fauna species was reviewed in the EIS and presented as Unlikely. This review also resulted in the inclusion of one flora species (*Omphalea celata*) and six species of fauna (red goshawk; yakka skink; black-chinned honeyeater; glossy-black cockatoo, grey goshawk and square-tailed kite). Where relevant, for each of the species included, additional potential habitat mapping and species profiles were created within the MNES Report (Appendix Q) of the SREIS. Potentially impacted habitat associated with these updates was considered as part of the Environmental Offsets Strategic Management Plan (Appendix P) of the SREIS.

Current Project development planning has enabled a refined understanding of the key Project components such as CGPFs, FCFs, wells and gathering systems. Overall, the physical impacts from infrastructure have been reduced as a result of refined development planning. While actual well locations and the specific disturbance footprint have not been finalised, however potential areas of disturbance for REs, TECs and species of conservation significance have been estimated as part of the Environmental Offsets Strategic Management Plan (Appendix P) of the SREIS.

Mitigation measures and commitments were developed in the EIS to minimise impacts to terrestrial ecology values. The EIS found that Project design and site selection for specific infrastructure that seeks to avoid these high value sites is the primary means by which protection for terrestrial values will be achieved. Revised commitments have been presented in this SREIS. This update has resulted from changes made to the project description since the EIS was finalised.

Matters of National Environmental Significance

The MNES Report (Appendix J) of the SREIS provides an update to, and supersedes, the previous standalone MNES Report (Appendix CC) of the EIS.

The updated MNES Report includes a revision of the MNES likelihood of occurrence analysis, and an update of the listed EPBC species in line with the most recent listings. The updated report also includes a revision and update of potential species habitat mapping to include processing of light detection and ranging (LiDAR) imagery, which refines and improves habitat identification and mapping. This refined potential habitat mapping was used to update the protected species profiles and impact criteria assessment to provide an updated assessment of potential species distribution within the Project area and any associated potential impacts and mitigation measures and commitments.

Roads and Transport

The Roads Impact Assessment (RIA) (Appendix K) of the SREIS has sought to establish if there are likely to be any road impacts that cannot be effectively managed through the application of typical EIS approval requirements and the implementation of the planned management strategies. The assessment has identified the following:

- Existing traffic conditions including traffic volumes, levels of traffic growth, the presence of school bus and stock routes remain broadly consistent with that previously considered in the RIA (Appendix R) of the EIS;

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- In line with the updated project description and recent logistics planning, the traffic generation estimates have been refined from those presented in the EIS RIA to ensure that a 'worst-case' scenario has been considered within the SREIS RIA;
- Traffic modelling identifies that as a result of the revised traffic generation assumptions and the updated Project planning, the Project's peak transport period is anticipated to occur earlier than previously forecast within the EIS RIA;
- An environmental values significance assessment has confirmed the effectiveness of the planned management strategies to avoid, minimise and mitigate all significant road impacts;
- The traffic engineering assessment has identified that Project traffic demands have the potential to increase baseline traffic demands, however this increase is unlikely to significantly affect the level of service afforded by the road network; and
- The pavement assessment has established that Project traffic demands have the potential to increase the required maintenance works and potentially reduce the pavement service life of various road sections. Post-EIS RIAs and revised traffic modelling will be undertaken as the Project matures in order to identify impacts and what, if any, compensation arrangements are required.

The SREIS RIA has established that there is unlikely to be any residual road impacts that cannot be managed via infrastructure agreements with road authorities, post-implementation of the planned management strategies, and that there will be no significant residual impacts.

Landuse and Tenure

The principal change resulting from the updated project description will be noticed by those land uses subject to the direct impacts of construction activity. While some areas will see a lessening of impacts to that outlined in the EIS, others will likely experience a negligible increase. The lessening of impacts will be noticed most where there is a reduction in the total number of wells and the associated linear infrastructure to access those wells.

This will have a twofold effect including:

- The reduction in overall disturbance and displacement area; and
- The associated reduction in activity during construction and, to a lesser extent, operation.

It is anticipated that the potential agricultural impacts can be mitigated appropriately through the mitigation measures presented in the EIS and any new management measures identified in the Land Use and Tenure chapter (Section 13) of the SREIS.

Noise and Vibration

The SREIS noise assessment has demonstrated that the Project criteria can be achieved using a combination of noise attenuation by distance, and engineering noise control treatments to plant and equipment. In some of the cases modelled, significant noise control treatments may be required. In all cases the amount of noise reduction required will depend on the proximity of sensitive receptors to the noise sources.

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As the locations of the Project facilities are not yet known, the proximity to sensitive receptors cannot be gauged; however, the noise level predictions presented in this SREIS provide guidance for the selection of suitable locations based on acceptable distances to receptors.

Additionally, the noise level predictions in this SREIS and in the EIS will also be used to inform the siting of Project facilities by taking into consideration the contribution of individual plant toward cumulative noise impacts and the site environmental setting.

Social

The SREIS has assessed that the changes in potential social impacts from the updated project description are minimal. The only area where the Project's potential impacts will change is in relation to a less significant level of impact in the deterioration of roads and effects on agricultural activity, land use and property. The updated project description has resulted in a significant reduction of the Project's footprint and reduced land access requirements during operations. These changes have decreased the Project's expected impacts on land use and property.

While housing affordability in the Project area has improved considerably since the EIS was prepared, Arrow has maintained its commitment to monitor housing affordability based on the inherent volatility of housing markets across the Project area.

Similarly, the impacts to community values and lifestyles and community infrastructure and services are considered to remain the same as those assessed during the EIS. The updated project description has maintained the separation of non-resident workforce accommodation from towns, largely mitigating impacts to community values. While the revised workforce profile has increased the size of the non-resident and resident workforce, these populations are generally in line with confidence limits of organic growth expected and established planning parameters. However, Arrow recognises the sensitivity of impacts on health services in the Project area and maintains its commitment to a number of initiatives, including the provision for on-site health services for Project employees.

The impacts surrounding health, safety and the environment have remained unchanged since the EIS was prepared, despite considerable reductions in the Project's footprint. The assessed risk rating for the Project remains at minor, recognising that the updated project description is not likely to alter the perceptions of stakeholders in the local community in the short-term.

Updates to the draft Social Impact Management Plan (Appendix N) in the SREIS have consolidated Arrow's social impact management commitments into five action plans that are aligned with the impact areas addressed in the SREIS. Arrow has strengthened existing actions for managing social impacts and included additional actions to reflect changes to impacts where warranted. Arrow's social investment initiatives that are implemented through the Brighter Futures Program are also reflected in the updated SIMP.

Waste Management

The updated project description has not resulted in any significant change to the overall volume of waste generated. The type, quantity and management of wastes are indicative estimates, as the

detailed design and execution plans are to be completed prior to construction. It is intended that the majority of waste materials generated from the Project will be managed as described in the EIS.

General and regulated waste generated over the life of the Project will be managed in accordance with the preferred waste management hierarchy discussed in the EIS, which remains valid for this SREIS, as presented below:

- Source reduction: avoid or reduce practices that result in the generation of wastes;
- Reuse: where practical, reuse waste materials that are in their original form;
- Recycling: where practical, send waste to appropriate facilities to convert waste into other usable materials;
- Treatment: where waste can no longer be reused or recycled, make safe for disposal; and
- Disposal: to appropriately licensed facilities operated by third parties.

There are a number of licensed waste disposal facilities that currently exist across the Central Highlands, Isaac, Whitsundays and surrounding local government areas. Commercial waste processing facilities are also licensed to operate in the region. The SREIS provides an updated list of existing licensed waste management facilities near the Project area.

Arrow will continue to monitor existing landfill facilities to determine if they have capacity to take the Project's waste. An alternative option for disposal of waste generated by the Project is third party development and operation of a new engineered landfill (on tenure or nearby) to accept residual waste, potentially including regulated waste streams from the Project.

It should be noted that disposal of the waste salt concentrate to landfill is not expected to commence until approximately 30 years after water production commences. Arrow expects a third party landfill operator will take advantage of the commercial opportunity to develop and operate a suitable regulated waste facility (RWF) local to Arrow WTFs to receive the waste salt concentrate.

Coal Seam Gas Water and Salt Management

Arrow has undertaken further works and amendments to the CSG Water and Salt Management Strategy since publication of the EIS to align with current government policy. Arrow's CSG Water and Salt Management Strategy (Appendix D) of this SREIS aims to maximise beneficial use of CSG water and salt and to reduce environmental impacts associated with their use or disposal.

Management of CSG water will include a combination of management options which address Arrow's statutory obligations and commitments. The field development plan, which is refined over time to incorporate learnings and improvements as the Project develops, and the development sequence for the Project, will determine the timing, combination and implementation of the management options.

Arrow will seek to beneficially use or dispose of CSG water in the most cost effective manner that limits its exposure to residual liability. This necessitates that the supply and use or discharge of water is managed in proximity to the point of treatment.

Untreated water may be suitable for some of the identified beneficial use options, depending upon the water quality requirements of the end user. Management options for treated (and in certain instances untreated) CSG water are outlined below:

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- Distribution to new and existing users via pipeline as an additional supply;
- Distribution via watercourses to existing and new users in managed schemes; and
- Discharge to watercourses under defined conditions when CSG water cannot be beneficially used due to operational, technical, environmental or economic constraints.

Arrow has considered several brine management options including selective salt recovery, injection into a suitable formation and discharge to the ocean. The preferred management option is disposal of salt to a Regulated Waste Facility.

The management options for CSG water and salt will be reviewed as opportunities for additional beneficial uses present themselves.

Environmental Offsets

Arrow developed an Environmental Offset Strategy for the EIS that sets out its approach to the delivery of offsets across all of its projects. Offsets will meet the requirements of Australian and Queensland government policy and will only be used once the hierarchy of avoiding, minimising, and mitigating significant impacts has been implemented. Any offsets will contribute to managing and protecting biodiversity.

A Bowen Environmental Offsets Strategic Management Plan has been developed for the SREIS. The strategy describes measures taken to avoid and minimise impacts, identifies Arrow's likely disturbance of vegetation and habitat for relevant environmental values, presents evidence of opportunities to offset the potential impacts, and sets out Arrow's preferred approach to the provision of environmental offsets.

Management Measures

Arrow has reviewed the management measures and strategies presented in the EIS following the updates to the project description, the review of findings of the supplementary technical assessments, and comments made in stakeholder submissions.

The commitments made in the EIS have been specifically reviewed against the updated project description and the results of the supplementary technical assessments so that they remain appropriate for managing Project activities and addressing the identified potential impacts for the updated project description.

A complete list of existing, new and revised commitments are presented in the Commitments Update (Appendix O) of this SREIS. New and revised commitments are presented as a result of changes to the project description since the EIS was finalised, and to further clarify the intent of the commitment in regard of the objective to mitigate potential impacts.

Conclusion

The SREIS presents the updated project description which includes revised development planning and sequencing, configurations, well type and layout, construction methods and Project infrastructure

Key Findings

design. These changes have allowed Arrow to incorporate new design elements into the Project that will reduce the Project's footprint and potential environmental and social impacts.

The assessments undertaken for the Project, as detailed in the EIS and reviewed and validated in the SREIS, re-affirm that the potential impacts of the Project are manageable through the implementation of the proposed mitigation and management measures which have been committed to by Arrow.

Arrow has made additional mitigation commitments to those set out in the EIS based on results of supplementary technical studies completed for this SREIS. Information has also been provided in this SREIS on the management and monitoring plans to be developed for the Project, as well as on environmental offset requirements.

No new projects which meet the criteria for assessment of cumulative impacts have been announced within or surrounding the Project area since the release of the EIS. Hence it is considered unlikely that cumulative impacts will differ from those outlined and assessed in the EIS

The SREIS confirms the conclusions of the EIS, addresses comments made in submissions on the EIS, and completes Arrow's response to the Chief Executive of EHP's request to provide additional information.