Section 16

CUMULATIVE IMPACTS

16. Cumulative Impacts

16.1 Methodology

16.1.1 Assessing Cumulative Impacts

The Surat Energy Resources Province (shown in Map 1 – Locality in the Map Folio), located in southern Queensland, contains substantial thermal coal and coal seam gas which have only been subject to feasibility studies and minimal exploitation of mining opportunities. The region is recognised as having significant potential to be developed into an energy and industrial province.

Throughout Central Queensland, between the Surat Basin and the port facilities near Gladstone, there will be a host of potential projects supporting or as a result of the development of the Surat Energy Resources Province.

Rail, water and gas pipeline infrastructure have been identified as critical requirements for the feasible export of coal and gas from the Surat Basin. Port facilities are also critical to enable the export of coal and proximity to existing facilities makes Gladstone the most suitable export location. These projects will all result in construction and operational impacts, located within the same general region and potentially at the same time.

This Section considers the interaction of the various environmental impacts outlined in the previous issue-specific EIS sections, and the interaction of the Project with other projects within the Surat Energy Resources Province and Central Queensland.

Considering cumulative impacts recognises that various impacts can combine and interact to cause an aggregate effect that may be different in nature or extent to the individual impact. For the purpose of this cumulative impact assessment the assumed impacts of the projects considered are the residual impacts that are likely to exist after appropriate mitigation measures have been taken.

Cumulative impacts are difficult to quantitatively determine because they are based on the interaction of different impacts of the Project itself as well as those impacts in combination with other projects. These inherent difficulties in cumulative impact assessment are exacerbated due to the lack of information about proposed major developments in the region as a result of the preliminary nature of many projects and impacts yet to be assessed. These difficulties associated with cumulative impact assessment necessitate a conservative approach, and an overall consideration of the interaction of projects in a regional context to ensure that projects are not considered in isolation of the broader impact they may have on the region.

16.1.2 Classification of Impacts

Potential cumulative impacts have been considered in terms of the specific ecosystem, resource and community factors being affected.

Cumulative impact can occur as a consequence of either time, space, environmental resources, or environmental processes, or a combination of these classes of change.

Cumulative impacts can be direct (simple stimulus and response relationship), indirect (secondary or higher order relationships that act through intermediate sets of stimuli and responses) or multivariate (multivariate responses are multiple stimuli with interrelationships that act in concert to produce a response), with indirect and multivariate impacts being particularly difficult to quantify (Irving *et al*. 1986).

The discussion of the potential cumulative impacts of the Project has been structured as follows:

- The aggregate effect of individual impacts of the Surat Basin Rail (SBR) Project on the receiving environment resulting in a greater impact than the individual impacts in isolation (e.g. a noise and dust impact combined may result in a more significant community amenity impact than those impacts being assessed in isolation) (Section 16.2); and
- Cumulative environmental impacts that are caused by the Project in combination with other known and proposed developments in the area. These impacts are addressed under the following headings:
  - Wandoan Coal Project: anticipated to be the first coal mine to utilise the Project and may be the largest user of the railway (Section 16.3);
  - Moura Railway System upgrade: required for this critical rail link between the Project and the Gladstone port facilities catering for the increased rail traffic as a result of the operation of the Project (Section 16.4); and
  - Other projects that are existing or proposed within the Central Queensland region and Surat Energy Resources Province that are sufficiently linked in time, location, purpose or impacts to the Project to justify their consideration in terms of cumulative impacts (Section 16.5).

16.2 Surat Basin Rail Project

16.2.1 Cumulative Impacts Considered

This section considers the interaction of individual impacts of the Project and their cumulative impact upon the receiving ecosystem, resource or community.

16.2.2 Potential Cumulative Impacts: Construction Phase

Ecosystem and Resource Factors

The construction phase impacts of the Project are likely to have a number of cumulative impacts on the ecosystems and resources of the area as a result of their interaction in terms of time, space, environmental resources or environmental processes, or a combination of these factors.

Most construction phase impacts on ecosystems and resources are likely to be concentrated geographically at the construction front and construction camp locations. Throughout the anticipated 24 month bulk construction work phase, as the construction front moves across the landscape, the intensity of the impacts will move along the alignment accordingly.

The most extreme cumulative changes to the ecosystem and resources occurring at the construction front are temporary by nature, however, the remaining physical structure of the railway and associated clearing will remain as a permanent change to the landscape.

Potential cumulative impacts are likely to be most significant when the construction front directly interacts with waterways, steep countryside and protected habitat and vegetation, because of the vulnerability of the ecological landscape values of these areas to disturbance.

The cumulative impacts that occur at each of these vulnerable locations have been considered in terms of their impacts on ecosystem and resource factors, namely, flora, fauna, ecological values, hydrology, water quality and soil quality.

Flora, fauna and ecological values of the area may be subject to cumulative impacts as a result of the interaction with one or more of the following:

- Direct impact resulting from direct removal, disturbance and fragmentation of habitat; and
- Indirect impact resulting from changes to hydrology including overland flow and drainage, changes to water and soil quality, erosion, noise, vibration and light levels.

Hydrology and water quality (surface and ground) of the area may be subject to cumulative impacts as a result of the interaction with one or more of the following:

- Direct impact from contamination of water sources as a result of dust and accidental spills;
- Direct impact from changes to water flows as a result of construction structures and works;
- Indirect impact from the depletion of water sources due to extraction for construction;
- Indirect impact from contamination of water sources as a result of overland runoff and stormwater discharge, and distribution of weeds, seeds and pathogens; and
- Indirect impact from the clearing of vegetation (causing a change to water flows and an increase in sedimentation and supply of nutrients to watercourses).

Many of the impacts on ecosystems and resources are interrelated with potential changes to hydrology and water quality indirectly altering soil quality which could consequently impact on the flora, fauna and ecological values of the area.

Community Factors

The construction phase impacts of the Project are likely to have a number of beneficial and adverse cumulative impacts on the communities of the area as a result of their interaction in terms of time, space, environmental resources or environmental processes, or a combination of these factors.

Construction phase impacts on communities (economic and social factors) are likely to be experienced most acutely by the residents of nearby population centres and directly affected land owners.

The region is likely to experience a combination of cumulative economic and social impacts throughout the construction phase, primarily as a consequence of the large construction workforce that will be required.

Economic and social impacts are often linked and dependent upon each other. Changes are likely to occur to the nearby communities (as detailed in Section 13) as the region experiences direct and indirect economic benefit as a result of the Project and the social changes that accompany it, such as local employment and supply of goods and services.

Indirect economic and social impacts may include increased rent, increased prices for goods and services and lack of available labour in the towns. The extent of impact will vary depending on the sourcing of natural resources, construction materials and location of construction camps.

A small percentage of the population of the region may also experience further direct and indirect cumulative impacts during the construction phase of the Project due to their physical location. The amenity and quality of life of the rural areas may be affected by noise and visual impacts of the Project.

The extent of cumulative impacts on residents of land directly affected by the Project primarily depends on the proximity of properties and households to the rail line. Some residents may be subject to the aggregate impacts of increased noise, decreased safety, being subject to land acquisition processes (participation in negotiation and loss of land), changes to individual access, potential decrease in viability of businesses and livelihood, and decreased visual amenity. Concurrently, directly affected landholders may also benefit economically through compensation packages which will be negotiated proportionate to the extend of the impact.

16.2.3 Potential Cumulative Impacts: Operation Phase

Ecosystem and Resource Factors

The impacts to ecosystems and resources during the operation phase will be significantly less intensive and more stabilised than during the construction phase although permanently changed due to the physical structure and habitat barrier created by the rail line.

The cumulative impacts that occur along the alignment have been considered in terms of their impacts on ecosystem and resource factors, namely, flora, fauna, ecological values, water quality and soil quality. Most operation phase impacts on ecosystems and resources are a result of the rail line being a permanent change to the landscape. The impacts are likely to be located relatively evenly in location and intensity along the alignment throughout the lifespan of operation of the rail line.

Although there will be no significant clearing of vegetation during operation, flora, fauna and ecological values of the area may continue to be affected indirectly as a result of habitat fragmentation and changes to hydrology, potential erosion, noise, vibration and light.

Water quality may be subject to slight cumulative impact as a result of direct impact from potential localised contamination of surface water as a result of accidental spills and indirect impact from contamination of water sources as a result of overland runoff and stormwater discharge.

As with construction phase impacts, many of the impacts are interrelated with changes to hydrology and water quality having the potential to alter soil quality which can have a consequent impact on the flora, fauna and ecological values of the area.

Community Factors

The operation phase impacts of the Project are likely to have a number of cumulative impacts on the communities of the area as a result of their interaction in terms of time, space, environmental resources or environmental processes, or a combination of these factors.

Operation phase impacts of the Project itself on the communities (economic and social factors) of nearby population centres will be minimal because the significant workforce required during the construction phase will no longer be required.

The amenity and quality of life of the rural areas may diminish due to the interaction of fragmentation, access, noise, air and visual impacts caused by the rail line being a permanent change to the landscape and train operation.

Areas in close proximity to the Project may be indirectly affected due to a combination of direct loss of agricultural land, fragmentation of agricultural land by the rail line and changed hydrology.

Land owners and residents of land directly affected by the Project may be subject to cumulative impacts from a combination of direct and indirect effects including changes to access, potentially impacting operation of businesses and livelihood, increased noise and decreased visual amenity.

16.3 Wandoan Coal Project

16.3.1 Cumulative Impacts Considered

This Section considers the cumulative environmental impacts potentially caused by the Project in combination with the Wandoan Coal Project.

It is anticipated that the proposed Wandoan Coal Project will be the first coal mine to utilise the Project and may be the largest single user of the railway. The SBR Project is critical infrastructure to enable the transport of coal from the Wandoan Coal Project to port and coal load-out facilities in Gladstone. The Wandoan Coal Project is critical to generating rail traffic volume on the SBR Project.

The two projects are also linked spatially where they converge near Wandoan, will be constructed at approximately the same time and will require some similar resources during construction.

The mine life is estimated to be in excess of 30 years with an anticipated initial rate of extraction of approximately 7 Mtpa ramping up to around approximately 30 Mtpa Run of Mine (ROM) (expected to be roughly equivalent to 20 Mtpa on rail). The Wandoan Coal Project will also include water and energy supply arrangements for the mines and coal wash plant. It is possible that a raw water supply pipeline for the mine may run parallel to the preferred alignment of the SBR Project.

At the time of assessing the cumulative impacts of the two projects, the Wandoan Coal Project was still in the process of developing the EIS and subsequently data analysis and reporting had not been finalised. As such the information in this Section is deemed indicative and the reader is encouraged to review this Section in combination with the Wandoan EIS document that was released on 6 December 2008 for public consultation.

16.3.2 Potential Cumulative Impacts

The interaction of the Wandoan Coal Project and the Project are likely to have a number of cumulative impacts on the ecosystems, resources and communities of the area as a result of their interaction in terms of time, space, environmental resources or environmental processes, or a combination of these factors.

The majority of cumulative impacts of the two projects are likely to be concentrated where the projects meet geographically near Wandoan, in particular during the construction phase of the projects. These cumulative impacts will commence when construction works are underway at both sites. The Proponent and the Xstrata group undertaking the Wandoan Mine EIS have agreed that where possible, negotiations with State and local government agencies for issues such as road impacts and water supply will be made under a tripartite approach.

During the operation of the projects, the overall impacts of the SBR Project are likely to be negligible when combined with the overall impact of the Wandoan Coal Project, causing the cumulative impacts of the projects to be significantly reduced as compared to construction.

The following environmental values are considered to be impacted by both projects:

- Flora and fauna;
- Water;
- Air;
- Noise;
- Transport; and

- Social and Economic.

Flora and Fauna

The Wandoan Coal Project and SBR Project may require direct clearing of similar regional ecosystems and endangered ecological communities, with cumulative impacts on Brigalow (*Acacia harpophylla*) dominant and co-dominant and Semi-evergreen vine thicket of the Brigalow Belt (North and South) and Nandewar Bioregions, being of particular concern. These impacts will occur during the construction period of the SBR Project and construction and operation of the mine. There may also be impacts on native flora as detailed in the respective EIS documents.

Water

The cumulative water impacts as a result of the Wandoan Coal Project and the SBR Project are restricted mainly to the construction phase when both projects will require water for construction activities. The construction water demand for the Wandoan Coal Project is approximately 350 ML, whilst the construction water demand for the SBR ranges from 6,000 to 9,000 ML spread over the construction period.

Potable water for both the Wandoan Coal Project and the SBR Project is proposed to be sourced from the Dalby Regional Council, using existing Wandoan Town Bores.

The cumulative impacts of the combined developments on the water resources in the Project area will be further considered during the approvals process for water licences and permits.

Air

The cumulative air impacts as a result of the Wandoan Coal Project and the SBR Project are essentially construction dust from respective construction sites and construction traffic and coal dust as a result of the operation of both projects. These impacts will be experienced most acutely around Wandoan where the projects converge.

During operation, the air impacts from the mine would be substantially different from those arising from rail operations. The operation of freight and coal trains would result in emissions of coal dust and soot from the combustion of diesel fuel. It is understood that air quality impacts from the mine are mostly associated with dust generated from mining activities and disturbed surfaces within the mine lease application area boundaries.

As the majority of the dust sources associated with the mine are some distance from the rail line, the effect of the mine would be to marginally increase the existing regional dust levels experienced at the rail line.

The impacts on air quality arising from the dust sources associated with the projects would be assessed by the EPP(Air) goals.

As impacts from rail operations fall rapidly with increasing distance from the rail line, the rail operations are unlikely to affect the compliance of the mine to air quality goals at the location of sensitive receptors.

Overall, the air quality impacts of the projects are different in nature and although they will combine to have a cumulative impact at locations in close proximity to the projects, these cumulative impacts should not affect the air quality compliance of either project or the combined impact of both projects.

Noise

Cumulative noise impacts of the Wandoan Coal Project and the SBR Project will occur during the operation phase of the rail line and at locations in close proximity to both projects where both mining noise and rail noise would be audible. In addition, there would also be short term cumulative noise impacts during the construction phase of the Project.

During operation, it is understood that the main noise sources from the mine will be from mining operations, mobile equipment and the rail load-out loop. Although the noise level criteria for mining noise and for rail operations are substantially different, in the regions where both noise sources are audible, the cumulative noise impacts would primarily be due to the different character of the noise. Noise from the mine and associated infrastructure would be relatively constant, generally adding to the background noise of the area, with relatively infrequent and minor fluctuations in the noise emissions. In comparison, noise from the rail line would be intermittent, with short-term noise events at relatively regular time intervals.

Overall, the cumulative impacts of these two different types of noise sources are difficult to quantify, however the substantial difference in noise level criteria leads to the following expectations at receivers where both noise sources are audible:

- The presence of mining noise will not affect the compliance of rail noise; and
- The presence of rail noise will not affect the compliance of mine noise, because the rail noise will need to be excluded from the measurement assessment.

Transport

Traffic impacts during construction of the Wandoan Coal Project and the SBR Project are likely to have a short term cumulative impacts due to the physical and temporal connection between their respective construction and the use of shared construction haulage roads.

Cumulative impact is likely to be concentrated at the southern end of the rail project near Wandoan where construction traffic from the two projects will mix. Whilst interaction occurs mainly at the southern end of the alignment, some cumulative impacts are likely to occur at other sections of the Project throughout the construction phase.

Construction traffic will mix on the Leichardt Highway and Jackson Wandoan Road at the southern end of the Project alignment near Wandoan. The impacts may affect operations, safety and pavement maintenance which are discussed below.

In relation to traffic flow, it is understood that the Wandoan Coal Project is expected to add up to 33 daily trips of construction traffic to Leichhardt Highway during the peak construction period (not including construction workforce shift days). The SBR Project will add approximately 60 daily truck trips on the Leichhardt Highway at the peak of its construction period. Local worker commuter trips will add to the traffic flows but these trips will mainly be in smaller vehicles and occur at specific times during the day that will generally not overlap with construction traffic delivery times.

The cumulative effect of the SBR Project traffic will only occur until about 2012 when construction of the railway is completed. Therefore the cumulative impact will be short term and involve a small number of truck trips, albeit mostly with large and heavy loads.

In relation to traffic operations, the extra construction volumes will require traffic management measures to control access to and from the mine where the rail alignment crosses the access to the mine via Jackson Wandoan Road or an alternative dedicated access road to Leichardt Highway. Close liaison with the mine management will be maintained on any aspects likely to affect mine access.

It is understood that the Wandoan Coal Project will enter into an agreement with DMR and possibly the Dalby Regional Council in relation to repair and maintenance of the road network pavement. Construction traffic for the SBR Project could reasonably be expected to enter into a similar agreement with DMR, however the impact is much smaller (possibly 125,000 ESA for the duration of the rail project along -Leichhardt Highway south of Wandoan). The final details will depend on the construction program and construction methodology adopted for the rail project.

Overall, the volumes from both the mine and SBR Projects are relatively small so the cumulative impact of the two projects will be manageable. SBR will continue to liaise with government stakeholders regarding potential pavement loading (ESAs) arrangements.

Social and Economic

The SBR Project in conjunction with the proposed Wandoan mine will result in significant cumulative socio-economic impacts throughout the region.

The largest initial impact is the likely change to the regional population as construction and then operational employees associated with the respective projects move either temporarily or permanently to the area. Adding to population growth will be the 'service' population which is comprised of those people who move to the region to take advantage of the expanding economic opportunities created by the wealth injected into the regional economy as a result of the projects. The influx of this population will result in significant changes to existing regional demographic characteristics including gender, age, employment, occupations, education level and industry of employment.

Such changes may impact on the social amenity of the communities within the region. Social amenity refers to the attributes that the community sees as adding comfort, attractiveness, enjoyment or value to their everyday lives. Social amenity aspects identified in the region such as enjoyment of a quiet, rural lifestyle and living in a close-knit community-minded area may be impacted by the influx of population. There may be concerns that existing community spirit and identity will be diluted as more people move into the area who may not share those values. The process of change can be assisted through community workshops and meetings which focus on community visioning so as to enable the articulation of the kind of community they hope to live in and empower participants to work together to develop and implement plans for the future.

There will be a significant beneficial socio-economic impact resulting from increased economic activity and employment opportunities created by respective projects. The influx of wealth and the creation of employment opportunities in the region will lead to beneficial regional impacts such as regional employment opportunities and the establishment of new businesses and services. Social amenity may potentially be significantly improved as a result of improvements to local facilities, greater participation in local activities and creation of a socially and economically sustainable regional community.

16.4 Moura Railway System Upgrade

16.4.1 Cumulative Impacts Considered

This Section considers the cumulative environmental impacts that are caused by the Project in combination with the Moura Railway System Upgrade.

The Moura Railway System currently transports coal from the southern tip of the Bowen Basin coal province and the Callide Basin to several coal export terminals located at Gladstone and will provide a critical link for coal transportation from the Project rail line to coal load-out and other facilities at Gladstone.

The operation of the Project will have a direct impact on the capacity of the Moura Railway System. The current capacity of the line is approximately 15-17 Mtpa. The SBR Project will provide a connection between the Western Railway System (see Section 1.3.2) and the Moura Railway System which will result in a significant increase in rail traffic volume on the Moura Railway System, primarily because of the increase in the need for transportation of coal from the region to coal load-out facilities at Gladstone. The Moura Railway System will require upgrades to accommodate the anticipated increase in rail traffic volumes.

At a strategic level, the Exclusive Mandate signed between the Proponent and the State requires the Proponent to undertake certain actions with regard to the Moura Railway System, including that the JV enter into a commercial agreement with QR with regard to the potential upgrade of the Moura Railway System to handle the proposed future rail volumes. It is likely that this agreement would involve project management from QR in relation to the planning work, development of the concept plans, any state approvals required and ultimately construction. Negotiations between QR and the JV in relation to this agreement are underway as evidenced by the letter provided in Appendix D5.

Strategic meetings between senior management of QR, the SBR Project and the Central Queensland Ports Authority currently occur on a regular basis to ensure 'whole of coal chain' issues are considered in a coordinated manner throughout the upgrade process.

On an operational level, Maunsell AECOM on behalf of QR Network Access (QRNA) have developed a simulation model of the Moura and Blackwater coal rail networks to assist in assessing the capacity of the network. In consultation with the Proponent and QRNA, the rail simulation model was also extended to include the Surat Basin Rail link. The geographical scope of the rail network includes:

- The Blackwater and Moura Coal Systems including SBR link;
- The Callemondah Yard, Powerhouse Loop and Golding Loops;
- The network between South Gladstone and Auckland Point;
- Rail infrastructure for the support of Wiggins Island Coal Terminal and Fisherman's Landing; and
- Interfaces with the North Coast line at Rocklands and Parana, the Central West system at the Springsure - Emerald junction and the Goonyella System in the north.

The model enables QR to assess the capacity of the wide-area network under a variety of operational and infrastructure scenarios. In particular it can be used as a tool to refine the *Coal Rail Infrastructure Master Plan* (Queensland Rail 2008) scenarios (which outlines infrastructure works to upgrade and maintain the Moura Railway System) and provides QR with the capability to assess the operational performance of the network with the proposed SBR volumes.

Work has also been undertaken to ensure the communication system and signal system adopted by the SBR Project will be able to be integrated into both the current and future system planned for the Moura Railway System.

For the purposes of considering the cumulative impacts between the SBR Project and the Moura Railway System Upgrade, the potential impacts of the Moura Railway System Upgrade were assumed based on the typical impacts likely to occur for this type of project given the works planned and the potential sensitive receivers. For this reason the potential impacts are only considered to be indicative.

16.4.2 Potential Cumulative Impacts: Construction Phase

The extent of cumulative impacts on ecosystems, resources and community (social and economic factors) will depend on the alignment or alignments required to accommodate increased demand, the extent of greenfield required and the timing of construction.

Ecosystem and Resource Factors

The aggregate effect of these projects may cause direct and indirect cumulative regional ecosystem impacts through direct removal of vegetation, disturbance and fragmentation, changes to hydrology including overland flow and drainage, minor changes to water and soil quality, noise, vibration and light, however, based on current available information, the cumulative impact of the Moura Railway System and the Project on ecosystems are not likely to be concentrated on particular species or communities.

The aggregate effect of the Moura Railway System upgrade and the Project may cause minor cumulative resource impacts such as impact on the quality of water, air and soil, however, this is unlikely to be significant due to the spatial separation of the projects.

Both projects are located within the Dawson Fitzroy catchment and the water sourcing for the projects, especially during construction, may have a cumulative impact although it is likely that the Moura Line will be able to utilise water from sources that may not be practical for the SBR Project.

Community Factors

Economic and social cumulative impacts are likely to be the most significant during the construction period of these projects due to the sudden increase in demand for workforces with similar skills within the region. The potential aggregate social and economic impacts of the projects will depend on when construction commences and the size and skill of the construction workforce required.

16.4.3 Potential Cumulative Impacts: Operation Phase

The Moura Railway System is already in operation so the operation phase of the upgrade is likely to result in incremental increases only in existing impacts and some new impacts if the upgrade design requires the development of greenfield sites.

Ecosystem and Resource Factors

Cumulative impacts of these projects on ecosystems and resources during operation are unlikely due to the spatial separation of the projects.

Community Factors

Increased connectivity and access throughout the region that these projects create, will allow for significant economic benefit for the region and associated social implications such as an incremental

increase in employment, supply of goods and services, and flow on effects through the local and regional economy.

Those residents of land directly affected by the existing Moura Railway System may experience an increased frequency and intensity of noise and nuisance impacts as a result of increased rail traffic. The level of impact is likely to be directly related to the distance of residential dwellings to the rail line.

16.5 Central Queensland and Surat Energy Resources Province Projects

16.5.1 Possible Projects

In addition to the Wandoan Coal Project and the Moura Railway System upgrade there are a number of other projects that may be constructed within the region and which may result in measurable cumulative impacts.

A workshop organised by the Department of Infrastructure and Planning (DIP) in early 2008 identified a possible 22 projects with an interest in the Surat Energy Resources Province and Central Queensland. A complete list of these projects is not available but included a number of coal mines, liquefied natural gas related projects including pipelines, water pipelines, a power station and an electricity distribution network.

Some of these potential infrastructure proposals are identified in DIP's *Invitation to Offer: Surat Basin to Gladstone Multi-User Linear Infrastructure and Services Corridor Investigation* (DIP 2008). This Invitation to Offer provides the following preliminary list of known infrastructure proposals:

- Sunwater: Glebe Weir and Nathan Dam water pipelines.
- Santos Gladstone LNG: Gladstone Liquefied Natural Gas Project – Santos' future operation is focussed on increasing the size and productivity its coal seam gas fields in the Surat Basin. The 425 km gas transmission pipeline planned from Comet Ridge to the Gladstone LNG plant is anticipated to be of nominal diameter 650-800 mm.
- Queensland Gas Company: Queensland Curtis LNG Project – The Interconnection Pipeline Network linking QGC's production areas will generally extend from an area east of Tara to west of Wandoan. There is potential for further laterals to feed into the Interconnection Network from the south and north.
- Powerlink: currently undertaking studies which are considering alternative options of extending to Wandoan from different points in the network:
  - At 132 kV from Coolumboola (East of Miles) to Wandoan; or
  - At 275 kV from Auburn River (north of Mundubbera) to Wandoan; or
  - At 275 kV from Western Downs (new site in the vicinity of Braemar or Kogan) to Wandoan; or
  - At 275 kV from Halys (near Tarong) to Wandoan.
- Origin Energy: pipeline corridor from Wallumbilla to the Darling Downs Power Station.
- Impel: Southern Cross LNG proposes to construct an open access LNG terminal on Curtis Island, including an LNG plant, two storage tanks and loading facilities. Impel also proposes to build a 400 km open access pipeline.

In addition, the following projects, in varying stages of planning, are considered sufficiently linked in time, purpose or impacts to the Project to potentially contribute to cumulative impacts in the region:

- The proposed Wiggins Island Coal Terminal Project: a brief description of this project and anticipated timeframe is provided in Section 1.4.
- The proposed Moura Link-Aldoga Rail Project: a brief description of this project and anticipated timeframe is provided in Section 1.4.
- The proposed upgrade of the Wandoan to Toowoomba rail line: collaboration with QR is required in relation to the required upgrades to the existing rail line between Wandoan and Toowoomba.

16.5.2 Possible Cumulative Impacts

Early works for the Project are scheduled to begin once government approvals are granted and landowner agreements and acquisitions are in place. It is currently anticipated that the operational phase of the Project will commence in mid 2012. All of the above projects within the Surat Energy Resources Province and the Central Queensland region (shown in Map 1 – Locality in the Map Folio) are planned or expected to occur within the same approximate time period.

The extent of cumulative impacts is dependent on when projects commence construction and operation and the locations chosen for infrastructure, with impacts usually being least intense when projects occur at different times and within corridors or areas that are already disturbed. Most of the above projects are either port facilities or require linear infrastructure through the region to link to major infrastructure at Gladstone or the port facilities. Cumulative impacts of projects that require linear infrastructure may be reduced by shared corridor usage if this is feasible.

The Project will be one of the catalysts for further development in the area and associated positive and negative impacts because of the connection and increased access it provides.

Ecosystem, resource and community factors are likely to experience cumulative impacts to varying degrees by future projects in the region. Cumulative impacts are likely to be greatest from those projects that will require the most natural or human resources within the area and/or cause degradation of environmental values.

Ecosystem and Resource Factors

Generally there will be region wide impacts where ecosystem and resource factors are impacted through the development of land in the Surat Energy Resources Province and the Central Queensland region. These impacts may be direct and indirect or multivariate on a number of ecosystem and/or resource factors.

The preferred alignment for the Project has been located to avoid, where possible, areas with high environmental value. Future projects may further reduce areas and connectivity of areas of high environmental value.

Site selection and selection of offset locations for projects will be important factors that will influence the extent of cumulative impacts on ecosystems in the area. Vegetation clearing for the projects may require legally binding offsets, however, if site selections and offset locations are not appropriate, there may be a loss of habitat connectivity and an increase in edge effects of ecosystems. The more a habitat is fragmented the greater the impact on the ecosystem, regardless of whether the total area preserved remains the same.

The projects may also have a cumulative effect on resource impacts such as hydrology, water quality and soil quality in the area, however, the extent of these impacts will depend on design features and the extent of on-site environmental management measures.

Water security and quality could be one of the most critical cumulative impact considerations for the region, especially in light of predicted climate change and existing climate pressures in the area. Interference and overuse of waterways may have a cumulative impact on the health of the aquatic and riparian ecosystems as well as on surface and groundwater hydrology and surface water quality in the area potentially causing implications for human and natural use.

The noise and air quality impacts in the region will increase from current levels with increased activity, including rail and road traffic, as part of the expected development of the Surat Energy Resources Province. These impacts will be localised to development specific locations as well as their conduit transport connections.

Landform features and visual amenity of the area could also be expected to change with the further development of the Surat Energy Resources Province and the Central Queensland region.

Any projects in the area that contribute to greenhouse gas emissions will, based on current science, contribute to climate change.

Community Factors

The potential social and economic changes as a result of future regional projects are likely to be widespread and may have both beneficial and adverse cumulative impacts. It is difficult to predict the likely cumulative impacts of the various projects interacting due to the preliminary nature of many projects and impacts yet to be assessed.

The increase in economic development resulting from the development of the Surat Energy Resources Province is likely to have a significant beneficial economic impact on the regional economy. It may also reduce the reliance of the region on agriculture and diversify and result in stabilising the regional economy. The influx of wealth and the creation of employment opportunities in the region could lead to beneficial regional impacts such as regional employment opportunities, establishment of new businesses and services and up-skilling of the local labour force. Social amenity could also significantly improved as a result of improvements to local facilities, greater participation in local activities and creation of a socially and economically sustainable regional community.

Sudden increases in local population due to the development of new job opportunities as a result of economic development may also have adverse impacts local community and place additional demand on existing infrastructure.

A concern associated with previous resource booms, such as in the Bowen Basin, was that local communities were bearing many of the costs of accommodating new developments whilst economic benefits seemed to flow on to regional centres and the remainder of the State (Rolfe *et al,* 2007). Whilst it is recognised that the mining boom has been generally positive for the Bowen Basin and the Central Queensland Region, a number of adverse impacts have been identified including:

- Competition for employees and resources leading to negative spill-over effects on other industries and resources;
- Higher rents unavailability of housing in smaller communities making it difficult for people on lower incomes to continue living in towns and making it harder for industries to attract new workers; and

- Concerns over planning where planning documents had been drafted at a time of declining mining workforce numbers and therefore provided little guidance about appropriate development strategies in times of mining booms.

The extent of social impacts will depend on the demand for human and natural resources and construction materials and the location of temporary or permanent work camps and associated requirements on infrastructure and housing. These cumulative impacts will need to be assessed in detail during each projects respective EIS.

16.5.3 Possible Mitigation Measures

For cumulative impacts to be adequately evaluated throughout the region they must be considered and addressed by each individual project as well as managed on a regional scale by the relevant government authorities responsible for approving, monitoring and overseeing impacts on the region. The management of cumulative impacts requires a cooperative approach between community, industry and government stakeholders.

Throughout the EIS process the Proponent has consulted with land owners, local community groups, members of the public, local councils and elected representatives to understand their concerns and needs and develop relationships which will assist in cumulative impacts to be identified and managed through continued communication.

Potential cumulative impacts as a result of the interaction of individual impacts of the Project have been considered in the preparation of the EIS and have assisted ongoing design and the development of the EMP.

Ongoing monitoring of impacts and consultation will ensure that any unforeseen cumulative impacts within the control of the Proponent can be addressed accordingly.

The Proponent can only directly address the impacts that occur as a result of the construction and operation of the Project and has limited control over the cumulative impacts on the region. For effective management of cumulative impacts throughout the region it is necessary to have active management by government authorities external to the individual projects. In the subject region this responsibility of managing overall cumulative impacts of projects falls primarily to State and local governments.

Steps have already been taken by the government to:

- Identify potential co-location opportunities; and
- Investigate potential cumulative impacts and formulate policies to proactively address expected impacts.

Potential Co-location Opportunities

Co-location of infrastructure, where possible, has the potential to decrease cumulative impacts. The feasibility of co-location depends on a number of design and safety considerations and it may be difficult to achieve compatibility with major infrastructure.

Where achievable, co-location can decrease cumulative impacts to the natural environment by reducing the amount of land and disturbance required overall and minimising the fragmentation of habitat. For directly affected land owners co-location can avoid overlap of consultation, avoid the necessity for staged acquisition of land and piecemeal fragmentation of land.

Communication and actions have already occurred to investigate the possibilities of co-location of other utilities within the proposed rail corridor. The DIP has released an Invitation to Offer for the Surat Basin to Gladstone Multi-User Linear Infrastructure and Services Corridor Investigation to assess the suitability of a Multi-User Linear Infrastructure and Services Corridor from the Surat Basin to Gladstone.

Proactively Addressing Potential Cumulative Impacts

There have been a number of government initiatives aimed at anticipating and addressing cumulative impacts in the region.

The Department of State Development (2007) commissioned an investigation into the impacts and opportunities of resource production, economic activity, employment, population and community infrastructure associated with expected and likely resource development in what is referred to as the Surat Energy Resources Province. The report identifies a strategy for the region so that the community, business and local government may take advantage of these opportunities.

Also, in September 2008 the Queensland Government released the Sustainable Resource Communities Policy. This Policy follows on from the Sustainable Futures Framework for Queensland Mining Towns released in 2007 and builds on the key principles of leadership, collaboration, corporate responsibility, sustainability, communication and community engagement. While the Policy has been developed in response to continuing rapid growth in the Bowen Basin, it will also apply to the expected growth in the Surat Basin and the North West Minerals Province and is a step towards minimising cumulative impacts.

Overall, the effective management of cumulative impacts requires a cooperative approach between different industries and different levels of government. The Project has a responsibility to cooperate with different levels of government, relevant authorities and other proponents to assist in the management of cumulative impacts including:

- Communicating unforeseen or potential region-wide problems when they arise; and
- Providing information requested by authorities to assist in managing cumulative impacts, such as revised projections or increased labour force.

Proactive management of cumulative impacts to minimise the impact on the environment and towns will benefit the long term sustainability of the Project.