6. Project development and alternatives

6.1 Selection of proposed supply option

There are numerous ways to service periods of peak electricity demand, including demand management, renewable energy (including hydro-electric and wind power generation), and coal-fired and gas-fired generation options. A brief discussion of each option is provided in the following sections.

6.1.1 The 'do nothing' option

The NSW Government has demonstrated a need for additional electricity generation capacity to meet peak demand requirements in NSW in the short to medium term (NSW Government 2004). The Statement of Opportunities produced by the National Electricity Market Management Company (NEMMCO) in 2007 provides further evidence that additional peak load generation capacity will be required by the year 2013-14, based on current and potential future energy demand trends.

As the largest builder of power stations and gas pipelines in Australia over the past 3 years, ERM Power is ideally placed to develop a facility to assist the NSW Government in meeting the peak demand needs (described in Chapter 5). Without additional peak power generation facilities, electricity shortages are likely to result when peak electricity demand exceeds available supply reserves as a result of the estimated supply-demand projections expected over the next 3–5 years. For these reasons, the 'do nothing' option was not considered feasible.

6.1.2 Demand management

An alternative to increasing peak electricity supply is reducing the demand for energy during peak periods, known as 'electricity demand management'. Electricity demand management includes a wide range of options, including:

- actions taken on the consumer side of the electricity meter (the 'demand side'), such as energy efficiency measures and power factor correction (making individual/household power use more efficient through the installation of a power factor correction unit)
- arrangements for reducing loads on request, such as interruptibility and direct load control
- fuel switching, such as a change from electricity to gas for water heating
- distributed generation, such as the use of stand-by generators in office buildings or solar panels on rooftops.

The NSW Government acknowledged in its Green Paper (2004) that 'even if the full estimates of cost-effective demand management potential in the immediate future are achieved, its effect will be to defer the need for new supply by a year or two, rather than eliminate it'.

The NSW Government has acknowledged that the long-term potential for curbing the rate of demand growth is significant, and it is important that government policies and strategies continue to pursue this potential. However, as the demand for energy increases with an increase in the NSW population, the implementation of demand management strategies can only defer the need for new supply infrastructure; these strategies are not sufficient to address the state's medium- to long-term energy demands.

6.1.3 Hydro-electric power stations

A number of hydro-electric power stations currently operate in NSW, providing peak-load supply to the National Electricity Market. These plants include a 240 megawatt (MW) facility at Shoalhaven, which is owned and operated by Eraring Energy. Mini hydro-electric plants exist at Mount Piper (350 kilowatt (kW)), Hunter Water's Chichester Dam (130 kW) and at the Dungog wastewater treatment plant (130 kW). There is also a 3,756 MW hydro-electric power generation project in the Southern Alps: the Snowy Mountains Scheme. The scheme includes cooling water micro-hydro generators at Tumut3, and a 1.1 MW mini hydro-electric power station at Jindabyne Dam. Snowy Hydro Ltd is currently constructing a small hydro-electric power station at Jounama Dam, to be completed by 2008.

Based on the currently installed capacity, substantial new hydro-electric capacity would be required to meet NSW's projected peak demand. At present, there are no viable hydro-electric generation sites within NSW or other parts of Australia that could provide sufficient capacity to meet the projected peak demand requirements. The long lead-time required, and potential environmental implications associated with such a proposal, also make this technology difficult to implement. For these reasons, hydro-electric generation is not considered a viable option to meet NSW's short- to medium-term peak energy demand requirements.

6.1.4 Wind turbines

NSW has an estimated 1,000 MW of potential wind energy. Currently, four wind farms have been installed with a total generation capacity of 17 MW: Blayney wind farm has 15 turbines; Crookwell wind farm has eight turbines; Hampton wind farm has two turbines; and Kooragang Island has one turbine. Each turbine has a capacity of 660 kW (Department of Energy, Utilities and Sustainability 2006).

While wind energy provides an effective renewable energy supply with zero emissions, the inherent limitations in finding suitable wind generation sites, and the intermittent nature of wind-generated electricity, make it unsuitable for on-demand peak supply. The absence of viable technologies to store excess generation capacity produced by the wind turbines also makes this type of technology unsuitable for meeting the rapid increase in supply needed during peak-demand periods.

6.1.5 Coal-fired power stations

Coal-fired power stations are widely used to provide base-load generation capacity. Generally, however, they are not suitable for peak-load generation, particularly as they require around 2 days to start up. Coal-fired power stations also require substantially more capital expenditure, infrastructure and environmental controls.

Although existing coal-fired power stations could possibly be used to service peak-demand periods, the use of this type of technology in this way would result in significantly higher greenhouse gas emissions per unit of output when compared to other forms of power generation. This is not desirable and would be inconsistent with the objectives of the project as stated in Section 5.1.

6.1.6 Open-cycle gas turbine power stations (the project)

Open-cycle gas turbine power stations comprise one or more gas turbine units and generally represent the best-practice technology option for peak load operations due to their relatively small footprint, quick start-up times (around 6 minutes) and improved environmental performance over coal-fired power stations (e.g. reduced water requirements and lower greenhouse gas emissions). These types of stations generally use natural gas as the primary fuel and, in some cases, liquid fuel (such as distillate) as a back-up fuel in the event of an interruption to the natural gas supply.

A further benefit of an open-cycle gas turbine power station is that, in the event that intermediate or base-load operations become commercially viable in the future, the station can be easily converted to a combined-cycle gas turbine power station to increase the generating capacity, thermal efficiency and environmental performance of the station.

6.1.7 Combined-cycle gas turbine power stations

Combined-cycle gas turbine power stations comprise one or more gas turbine units coupled with a heat-recovery steam generator and steam turbine system. They provide the added benefits of increased capacity for intermediate or base-load production, and improved thermal efficiency and environmental performance over an equivalent open-cycle gas turbine power station.

Combined-cycle gas turbine facilities are better suited to intermediate and base-load generation, since they require longer start-up and shut-down periods (about 2 hours) than open-cycle gas turbine facilities. The longer start-up and shut-down periods mean combined-cycle gas turbine power stations are unable to provide the quick response necessary to generate electricity during peak demand periods.

6.1.8 Selected option

The proposed open-cycle gas-fired power station has been selected as the preferred supply option because it represents the most appropriate and economic solution to meet the projected short- to medium-term peak load demands described in Section 5.3. Furthermore, this type of electricity generator has the flexibility to be converted to a combined-cycle gas turbine facility in the future if intermediate or base-load generation becomes commercially viable at this site.

6.2 Selection of power station site

This project comprises two main components: the power station and the gas pipeline. This section explains the process undertaken to select the power station site in the regional and local context, and how the orientation/layout of the plant within the selected site was optimised. Section 6.3 explains the process undertaken to select the gas pipeline route.

6.2.1 Overview

ERM Power has undertaken a comprehensive review of possible sites for the proposed gas-fired peaking power station. Primary criteria applied to the selection process included:

- availability of a sizeable block of land with sufficient distance from neighbouring residences to minimise environmental impacts during construction and operation
- proximity to the NSW power grid and, in particular, a strong electrical connection to the National Electricity Market
- good access for heavy plant and machinery, especially during construction
- proximity to a skilled labour resource, and ready availability of goods and services
- proximity to a gas supply adequate to provide sufficient capacity of natural gas to the proposed power station.

ERM Power identified that it would be advantageous to establish the proposed gas-fired power station adjacent to an existing TransGrid substation, as it would provide the optimum efficiency of transfer into the national electricity supply network. Furthermore, proximity to an existing substation would minimise the requirement to establish transmission lines and easements within which to construct them. Transmission line easements are generally wider than those required for gas pipelines, and the construction and operation of the transmission lines often has a greater impact on the natural and social environment, and the ongoing use of the land through which they pass.

The substation at Wellington is the major hub for electricity supply in Central Western NSW. Construction of the proposed Wollar to Wellington 330 kV transmission line will ensure strong connection to the NSW power grid, including the National Electricity Market.

ERM Power identified a gas source near Alectown that would provide sufficient capacity for its proposed power station. Near Alectown the gas pipeline changes from a 200-millimetre diameter pipe to a 150-millimetre diameter pipe and is the closest adequate supply. Furthermore, the distance between Alectown and Wellington is sufficient to provide ERM Power’s line pack requirements.

6.2.2 Site selection process

Having established the desirability of locating in proximity to the existing electricity hub at Wellington, the review of alternate sites was necessarily limited to sites within a few kilometre radius of the preferred site.

ERM Power conducted a comparative assessment of three potential sites to identify the most appropriate location for the project. The assessment considered the criteria described in Section 6.2.1, particularly the physical space constraints, potential interruptibility to existing operations, existing network connection constraints and benefits, and environmental sensitivity.

The locations of the alternative sites discussed below are shown on Figure 6-1.

Site 1

Site 1 is located on the north-eastern floodplains of the Macquarie River, 1–2 kilometres off the Mitchell Highway and approximately 6 kilometres north-west of Wellington.

Site 1 is on the floodplain of the Macquarie River, and is generally low-lying and subject to flooding, which poses significant constructability issues for a gas-fired power station, not the least of which is the management of stormwater from the site.

Development of the proposed gas-fired power station at this location would require the construction of two new 330 kV transmission circuits between the proposed power station and TransGrid's Wellington substation, a distance of approximately 5 kilometres. From an operational perspective, these lines would preferably be constructed as single circuit lattice steel towers similar to the existing towers around the Wellington substation. As single circuit lines, the structures would be less visible (with a lower profile), but the lines would have a larger footprint, requiring an easement approximately 100 metres wide between the proposed power station and Wellington substation.

Consideration was also given to the possibility of reconstructing some of the existing 132 kV circuits that bypass the site, in particular the two Country Energy 132 kV lines that run from TransGrid's Wellington substation to Dubbo. However, a 132 kV connection has significantly less capacity than a 330 kV connection and would impose limitations on the proposed power station's operation in the event that one of the lines was out of service. The reconstruction activity would place the security of the Dubbo and Central NSW electricity supplies at risk, and would require the implementation of special construction arrangements. Finally, a 132 kV connection would likely require upgrading of the transformer capacity at TransGrid's Wellington substation, which would impose significant additional cost on the project. Accordingly, connection at a 132 kV transmission line is not considered a viable option.

Given that the proposed power station would be remote from the Wellington substation if located at Site 1, a small switching station would be required to marshal the transmission lines at the proposed power station. Consequently, the footprint of the proposed power station would be considerably larger than that proposed for the selected site (see below and Chapter 7).

When comparing the visual and social impacts of Site 1 with those of the selected site, an equal number of residences are located in proximity to each. Hence, visual and noise impacts associated with the proposed power station would be similar to those of the preferred site.

The length of the gas pipeline associated with this alternative site would not be significantly shorter than that of the selected site.

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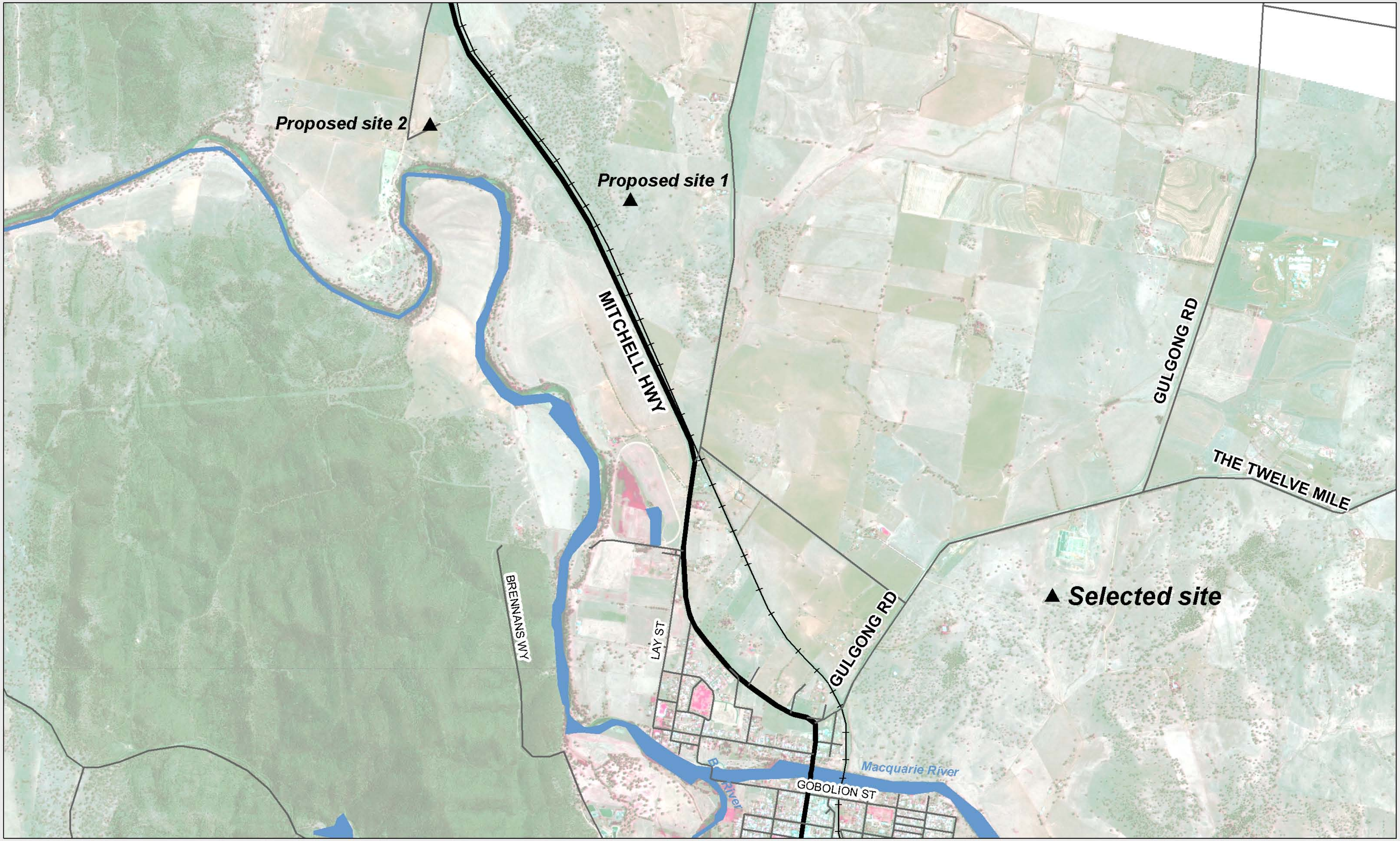

Figure 6-1 Sites considered for the proposed power station

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Site 2

Site 2 is located on the northern floodplains of the Macquarie River, just west of the Mitchell Highway and approximately 7 kilometres north-north-west of Wellington. The area is already being used for light industry purposes, with a quarry and a fish farm in the vicinity of this site. The constraints associated with developing a gas-fired power station at Site 2 are similar to those discussed for Site 1, as follows:

- Construction of a power station on the floodplains of the Macquarie River would be difficult, as would management of stormwater run-off during operation.
- Construction of two new single circuit 330 kV transmission lines on steel lattice towers would be required between the proposed power station and Wellington substation, a distance of approximately 6.5 kilometres.
- Construction of a switching station would be required, increasing the footprint of the proposed power station.
- The length of the gas pipeline associated with this alternative site would not be significantly shorter than that of the selected site.

When comparing the visual and social impacts of Site 2 with those of the selected site, Site 2 has fewer residences in proximity to it. However, the new 330 kV transmission lines would have a significant visual and social impact and, as such, this site is not considered suitable.

Selected site

The selected site is located adjacent to the 330/132 kV Wellington substation on Gulgong Road, approximately 2 kilometres north-north-east of the outskirts of Wellington. This site is considered the most appropriate for development of a gas-fired power station for the following reasons:

- The proposed power station would be located on land that has already been heavily disturbed, having been cleared and utilised for agricultural practices for many decades.
- The proposed power station would be located adjacent to (directly south of) the Wellington 330/132 kV substation (owned and operated by TransGrid), thus:
  - providing the optimum efficiency of transfer into the national electricity supply network
  - removing the requirement to develop new 330 kV transmission lines, thus minimising environmental and social impacts
  - reducing the footprint of the power station because a switching station would not be required.
- Access to the proposed site would be straightforward and would require minimal modification to the main carriageway of Gulgong Road.

6.2.3 Optimisation of plant location

Once the preferred site was identified, a comparative investigation was undertaken to determine the preferred location and orientation of the proposed power station within the selected site. Given the potential for noise impacts on surrounding properties as a primary concern for the overall assessment, selection of the preferred location focused on the consideration of potential noise impacts on surrounding properties. In this context, it became apparent that, if the proposed power station could be partly positioned on the TransGrid land surrounding its Wellington substation, the low-lying area south of the substation could be used to attenuate noise and minimise visual impacts. At this location, the proposed power station would also be as close as practicable to the substation and blend with its electrical infrastructure. Three locations and orientations considered within the selected site are shown in Figure 6-2.

Three receptors and one group of receptors are located close to the selected site: the Keston Rose Garden Café, Nanima House, Mount Nanima and the Cadonia subdivision (see Figure 6-2). To minimise potential noise impacts of the proposed power station on these receptors, preliminary noise modelling was undertaken to assist in selection of the preferred location and orientation. The modelling assessed three locations/orientations of the proposed power station within the selected site; Table 6-1 summarises the modelled noise results for each scenario (noise is further discussed in Section 9.3).

Table 6-1 Comparison of modelled noise levels at four receptors around the site

Receptor	Received noise levels (dB(A))[1]		
	Site A	Site B	Site C
Mount Nanima	36	35	35
Cadonia subdivision	26.5	26.5	26
Keston Rose Garden Café	34.5	36	36
Nanima House	43	44.5	45.5

Notes: 1. dB(A) = decibels, A-weighted; Measured to the nearest 0.5 dB(A) during neutral meteorological conditions.

Based on the results of the noise modelling, and careful consideration of numerous other engineering, environmental and social constraints and benefits, Site A was selected as the preferred location and orientation of the gas-fired power station. The following key factors contributed to this selection:

- The potential noise impact on sensitive receptors would be minimised.
- The proposed power station’s ancillary infrastructure would, as far as possible, follow natural ground contours (e.g. stormwater would naturally flow downhill toward the stormwater pond(s)/water treatment area). This would minimise the amount of cut and fill required, and would further reduce the visual impact of the facility.
- The orientation of the gas turbines would maximise the close proximity of TransGrid’s substation and subsequently minimise the amount of infrastructure required to connect the two.

6.3 Selection of the gas pipeline route

Development of a gas-fired peaking power station at Wellington would require construction of an underground gas pipeline connecting the existing Central West Pipeline to the proposed power station. The proposed pipeline route was developed during the concept development phase, and considered engineering, environmental and social benefits and constraints.

Some of the key factors considered in the route selection process were the need to:

- minimise the length of the pipeline
- maximise the distance between the pipeline and residential or other sensitive receptors
- minimise the amount of vegetation clearance and avoid sensitive habitats
- minimise the number of road, rail and watercourse crossings
- avoid sites of cultural heritage significance
- minimise potential land use impacts.

Having identified a preliminary route for the pipeline, a one-day workshop was held, including representatives of ERM Power, geographic information systems (GIS) specialists, and senior specialists in ecology, cultural heritage, environmental planning, and land use and property issues. Through the workshop, the alignment was refined using high-resolution aerial imagery and other GIS data. This enabled the above-mentioned key factors to be addressed (e.g. residences and vegetation avoided, and bends minimised) along the entire 100 kilometres of the pipeline.

At the completion of the workshop a modified alignment was generated that minimised impacts on the above-listed factors. On-site consultation was then undertaken with the affected land owners to discuss the proposed pipeline route and to identify any associated potential engineering, environmental or social problems (refer Chapter 4). The result of this consultation was the further refinement of the proposed pipeline route to that shown in Figures 7-6, 7-7, 7-8 and 7-9. The alternative routes, which were subsequently dismissed, are shown in Figure 6-3. Consultation with land owners also provided an opportunity to progress in principle agreements on future easement arrangements.

This refined alignment was used as a basis for detailed biodiversity assessment and cultural heritage assessment (including Aboriginal heritage consultation) by specialist fieldwork teams. These assessments are discussed in detail in Chapter 9.

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Figure 6-2 Locations and orientations considered for the proposed gas-fired power station within the selected site

——— Alternative operational layouts

0 125 250 500 Metres

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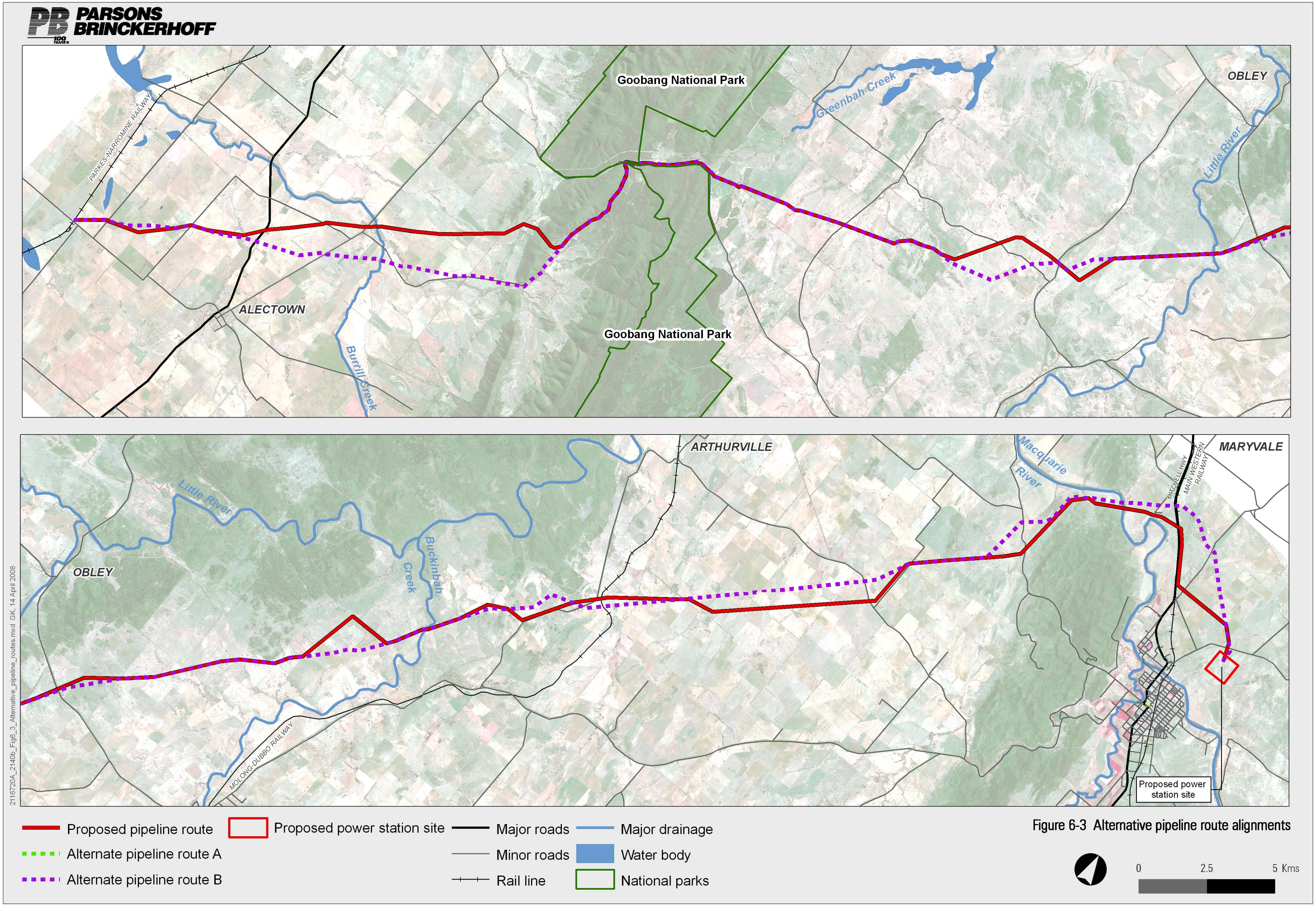

Figure 6-3 Alternative pipeline route alignments