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# 4.0 Site and Context

*This Chapter provides details on the Project Site and its context in accordance with the Director General's Environmental Assessment Requirements which include specific requirements for the description of the proposal. The majority of information regarding the proposal can be found in Chapter 5 (Project Description). The EARs also require:*

*Identification of likely worst case development footprint;*

*Details of the extent to which existing infrastructure and facilities (including water sourcing and ash disposal) would be used for the project;*

*Supporting maps/plans clearly identifying existing environmental features (e.g. watercourses, vegetation), infrastructure and landuse (including nearby residences and any approved sensitive landuse) and the siting of the project in the context of the existing environment.*

## 4.1 Regional Overview

The Project is situated within the Hunter Region, which is located approximately 200 km to the north-north east of Sydney. The Hunter is one of Australia's largest regional populations being home to approximately 589,000 people (ABS, 2006). It contains one of Australia's oldest wine growing area, the world's largest coal export port (Newcastle Port), and contributes significantly to NSW energy supply. Tourism, aluminium and horse breeding are also important regional industries.

The Hunter Region comprises 11 LGAs, which are broken up into three subdivisions; the Lower Hunter, Upper Hunter, and Other Hunter. The Bayswater B project is located in the Upper Hunter region and traverses two LGAs, Singleton and Muswellbrook.

Much of the Hunter Region has been cleared for agricultural production since European settlement. The majority of cleared land in the region is managed by private landholders comprising family owned and operated farms, corporate farms and small lifestyle farms. Land uses in the northern and western areas of the Hunter Region include pasture for sheep, beef and dairy cattle, cultivation for grain and vegetable crops, viticulture, horse breeding, coal mining and power stations. Towards Newcastle in the southern area of the region, residential, commercial and industrial land uses (including significant underground coal mining and power stations) are more dominant (refer to **Chapter 18 Socio-economic Assessment)**.

Large areas of land in the region, mostly in steep rugged terrain, have been set aside as National Parks (NP) and State Forests for conservation, preservation, recreation, wilderness and forestry purposes. The two largest National Parks in the region (some 20 km south of the Project Site) are the Yengo NP and Wollemi NP, which form part of the Greater Blue Mountains World Heritage Area. Other National Parks in the region include Mount Royal NP and Barrington Tops NP which are north east of the project site, and the Goulburn River NP approximately 40km west of the site.

### 4.1.1 Singleton LGA

The Singleton LGA is located approximately 80 km north west of Newcastle (200 km north of Sydney) and contains the Project Site. Singleton maintains a thriving industrial sector and is supported by a well-established agricultural community. Coal mining, power generation, engineering support, Defence, beef cattle, dairy farming, tourism and viticulture are all major economic contributors to the area. Singleton has considerable coal mining with 20 coal mines operating within the LGA, providing direct employment to approximately 6000 people (approximately 25% of the LGA population), and producing around 85 million tonnes of raw coal per year.

### 4.1.2 Muswellbrook LGA

The Muswellbrook LGA is located approximately 130 km northwest of Newcastle, sharing a border with the Singleton LGA to the south east. Almost half of the LGA is within National Parks. The LGA contains two main towns, Muswellbrook and Denman, as well as a number of large rural communities. Major industries in Muswellbrook LGA include coal mining activities and power generation. The existing Bayswater and Liddell Power Stations are located within Muswellbrook LGA. The area is also supported by agriculture, viticulture and an equine industry.

## 4.2 Existing Environment

### 4.2.1 Project Site Overview

The proposed site for Bayswater B Power Station is located within the Singleton LGA, although it borders on the Muswellbrook LGA to the north and west. Part of the infrastructure for the site such as the gas pipeline or coal conveyer, roads and transmission lines would be within the Muswellbrook LGA. The terrain is slightly undulating and is cleared of woodland. The land is rural in nature and surrounded by operating coal mines and the existing MacGen power stations (Bayswater to the east and Liddell to the north east). The site is located north of Plashett Dam and is within the Hunter River catchment.

Residents to the west and south are approximately 8-10 km distance. The nearest township is Jerrys Plains with a population of less than 1,000 people and lies some10 km to the south. Muswellbrook is the nearest town which lies approximately 15 km to the north.

The project area spans approximately 2km$^2$ and is leased for low intensity cattle grazing.

### 4.2.2 Land Use

The Project Site and surrounding land are zoned as ‘Rural’, except for land zoned as ‘Infrastructure’ to the north east of the site, on which the existing Bayswater and Liddell Power Stations are situated. The land within the vicinity of the site is largely cleared. Surrounding land uses include open cut mines, power stations and man-made lakes.

MacGen owns most of the land within the buffer zone surrounding the Site, with a minority of land being owned by other users. Landowners are detailed in **Section 4.4**.

### 4.2.3 Infrastructure

Transport of coal fuel (if coal fired technology was the preferred option), storage and construction materials would be via road and rail routes (**Chapter 21 Traffic**). Gas fuel (if gas fired technology were the preferred option) would be supplied via a pipeline connected to the approved Queensland to Newcastle gas pipeline. The main road networks servicing the Hunter region and Project Site are outlined below.

**Road**

The Hunter has a highly developed network of highways and arterial roads. The major road access routes into the Hunter Region and proposed Bayswater B Project Site are:

- Sydney to Newcastle Freeway (F3)
- Pacific Highway
- New England Highway
- Golden Highway

Access to the existing Bayswater facility is via the New England Highway. This would also act as the primary entrance for the Project Site, with a secondary and dedicated access road constructed off this access specifically to access the proposed power station as discussed in detail in **Chapter 5 Project Description**.

**Rail**

The Antiene Rail Loop would be utilised if the coal fired option were to proceed. The current rail loop is approved under DA 50-3-2005, allowing MacGen to receive up to 15 million tonnes of coal per year. Should the Bayswater B project be coal fired, the increase in coal deliveries to the rail loop would require a modification to the Antiene approval, taking the required capacity of the rail loop up to 21 million tonnes per year and the number of trains unloading from 5 to 7 per day.

Should coal fired technology become the preferred approach and a Project Approval Application submitted to DoP, the required modification would be assessed and submitted at that point.

For the purposes of this EA, the increase in use of the existing infrastructure has been assessed on the assumption that the existing rail loop approval could and would be modified at that later date. This is discussed in more detail in **Chapter 14 Noise**.

**Water**

No new water supply would be required for this project. A raw water supply pipeline is proposed to connect the Project Site to the existing water infrastructure (e.g. dams) at the existing Bayswater site. Appropriate commercial arrangements would have to be put in place.

**Transmission**

The proposed 500 kV switchyard which is an integral part of transmission for the project would connect to the existing dual (double circuit) 500 kV transmission lines 73 and 74 which pass the proposed Bayswater B site.

The project would require minor re-alignment of this transmission line in order to connect to the proposed switchyard which is to be located to the northeast of the proposed power station site.

**Ash Disposal**

Ash disposal would be required if the project uses coal fired technology. Ash from the Bayswater and Liddell plants is currently disposed of at the mine void at Ravensworth via progressive in-filling and rehabilitation and the Liddell Ash Dam respectively. Ash disposal options are discussed in further detail in **Chapters 5 Project Description**, **13 Groundwater** and **22 Waste**, which shows that the preferred disposal option is to place the conditioned ash within a redundant mine void within the vicinity of the Project Site. This form of disposal would require detailed design input and discussion and agreement with specific land (mine) owners. As such, a defined disposal point has not been identified for the purposes of this Concept Approval EA.

The final disposal point would be assessed in detail by the Proponent of a Project Approval application, based on detailed design and landowner discussions. To minimise transport effects, preference would be given to a suitable mine void adjacent to Macgen's land holdings.

For the purposes of this Concept Approval application, a notional ash haulage route (for bottom ash) and a semi-enclosed conveyor (for fly ash) has been included going north from the Project Site and the assumption of invoid ash disposal has been used as the basis for the groundwater assessment.

The detailed design and Project Application would also include a confirmation or re-assessment of changes to the locations and associated infrastructure assessed in this report.

### 4.2.4 Natural Environment

The area in the vicinity of the site has been previously disturbed as a result of mining, industrial and agricultural land uses. Natural features include some remnant areas of Narrabeen Footslopes Slaty Box Woodland located to the west of the site and Hunter Floodplain Red Gum Woodland Complex located to the east south east of the site. In the immediate vicinity of the site, the majority of the areas not disturbed by mining or industrial uses, support pasture. The proposed project site itself is vegetated by pasture.

The man-made Plashett Dam is the closest substantial water body to the south of the proposed power station site. The much larger Lake Liddell (also man-made) is located approximately 6 km to the north east of the Site, while the Hunter River is approximately 6 km to the south west. An ephemeral stream (Saltwater Creek) is immediately to the east of the site.

## 4.3 Project Site

The site is located west of the New England Highway, Muswellbrook, NSW, to the north of Plashett Dam. The project site comprises approximately $2km^2$ as shown in **Figure 1-2.** An associated switchyard would be constructed to the north east.

The specific requirements in relation to both the coal and gas fired options for the proposed Bayswater B project are discussed individually below.

### 4.3.1 Coal Fired Power Generation

The coal fired option would include the main power station footprint (as discussed above) and development of infrastructure including:

- Use of the existing Antiene Rail Loop for the delivery of coal
- Construction of a new conveyor to transport coal from the Antiene Rail Loop to the Bayswater B site
- Construction of an access road from the existing Bayswater access road
- Raw water supply pipeline connecting the Bayswater B site to the freshwater supply dam
- Construction of an ash haulage route
- Ash disposal point within an existing mine void (within a 10 km radius of the Bayswater B site if possible)
- Re-alignment of the existing transmission line to connect the Bayswater B switchyard
- Live coal stock pile (short term coal storage area) within a dry storage enclosure
- Long term coal storage yard.

The power station footprint and associated infrastructure for a coal fired plant is provided in **Figure 4-1.**

### 4.3.2 Gas Fired Power Generation

The gas fired option would include the main power station footprint (as discussed above) and development of infrastructure including:

- Gas supply pipeline
- Construction of an access road from the existing Bayswater access road
- Raw water supply pipeline connecting the Bayswater B site to the freshwater supply dam
- Re-alignment of the existing transmission line to connect the Bayswater B switchyard
- Gas spur line to connect Bayswater B to the approved QHGP which will be constructed approximately 20 km to the north east of the site.

The power station footprint and associated infrastructure for a gas fired plant is provided in **Figure 4-2.**

**Pipeline Corridor**

For the gas fired option, the proposed gas pipeline corridor from the Bayswater B site would extend to the north east towards the Antiene Rail Loop, and then continue north north east. The proposed pipeline would traverse approximately 18 km of land before connecting with the approved QHGP near Beggary Creek Road. The pipeline corridor is shown in **Figure 4-2** and **Figure 5-5.** Two-thirds of the proposed pipeline route is on MacGen owned land; the pipeline corridor predominantly crosses grazing land.

The detailed design and future Project Application would also include a confirmation or re-assessment of any changes to the locations and associated infrastructure assessed in this report.

## 4.4 Land Ownership and Legal Description

Lot and DP details for land required for both the construction of the coal and gas fired plant options and their associated infrastructure were provided by Macgen and are shown in the following table. Lot and DP details for land associated with the gas pipeline were also provided by Macgen are presented in **Figure 4.3**. It should be noted that the Lot and DP details overlap between the table and **Figure 4.3** although those provided in the table are more extensive.

**Table 4-1: Bayswater B Property Description – Coal Fired Option**

| Bayswater B Component | Property Description | LGA |
|---|---|---|
| Power station | Lot 322 DP 625513, Lot 25 DP 225426 | Singleton |
| Antiene Rail Loop | Lots 21,22,24,25,45,46 DP 241179, Lots 3,23,24,25 DP 752468, Lot 1 DP 532672 | Muswellbrook |
| Coal conveyor | Lot 23 DP 225426, Lots 1,8,11 DP 247944, Lot 1 DP 369326, Lot 322 DP 625513, Lots 25,163,162,313 DP 752486, Lot 3 DP 774681, Lot 2 DP 1095515, | Singleton/Muswellbrook |
| Access road | Lot 25 DP 225426, Lot 1 DP 369326, Lot 322 DP 625513, Lot 103 DP 752486 Lot 2 DP 1095515 | Singleton/Muswellbrook |

| Bayswater B Component | Property Description | LGA |
|---|---|---|
| Raw water supply pipeline | Lot 25 DP 225426, Lot 1 DP 369326, Lot 322 DP 625513, Lot 103 DP 752486 Lot 2 DP 1095515, Lot 2 DP 327372 | Singleton/Muswellbrook |
| Ash haulage route | Lot 23 DP 225426, Lot 322 DP 625513, Lot 2 DP 1095515 – this is notional at this stage until the final ash disposal point has been confirmed | Singleton/Muswellbrook |
| Ash disposal point | To be confirmed subsequent to detailed design and discussion with specific landowners | To be confirmed subsequent to detailed design and discussion with specific landowners |
| Transmission line re-alignment | Lot 322 DP 625513, Lot 23 DP 225426, Lot 25 DP 225426, Lot 1 DP369326 | Singleton |
| Live coal stock pile | Lot 322 DP 625513 | Singleton |
| Long term coal storage | Lot 322 DP 625513, Lot 25 DP 225426 | Singleton |

The project area includes land listed in Table 4-2 below with respect to the gas fired technology and infrastructure requirements.

**Table 4-2: Bayswater B Property Description – Gas Fired Option**

| Bayswater B Component | Property Description | LGA |
|---|---|---|
| Power station | Lot 322 DP 625513, Lot 25 DP 225426 | Singleton |
| Access road | Lot 25 DP 225426, Lot 1 DP 369326, Lot 322 DP 625513, Lot 103 DP 752486 Lot 2 DP 1095515 | Singleton/Muswellbrook |
| Raw water supply pipeline | Lot 25 DP 225426, Lot 1 DP 369326, Lot 322 DP 625513, Lot 103 DP 752486 Lot 2 DP 1095515, Lot 2 DP 327372 | Singleton/Muswellbrook |
| Transmission line re-alignment | Lot 322 DP 625513, Lot 23 DP 225426, Lot 25 DP 225426, Lot 1 DP369326 | Singleton |

| Bayswater B Component | Property Description | LGA |
|---|---|---|
| Gas pipeline | Lot 23 DP 225426, Lots 16,46 DP 241179, Lots 1,8,11 DP 247944, Lot 6 DP 258548, Lot 1 DP 369326, Lot 322 DP 622513, Lots 23,24,162,163,313 DP 752486 Lot 2 DP 1095515, Enclosure Permit 51329<br>Lot 9 Sec C DP 6841, Lots 21,151,152 DP752486, Lot 4 DP 929149, Lot 4 DP 1115243, Lot 51 DP 1124127<br><br>Railway Line easement, various crown and council roads | Singleton/Muswellbrook |

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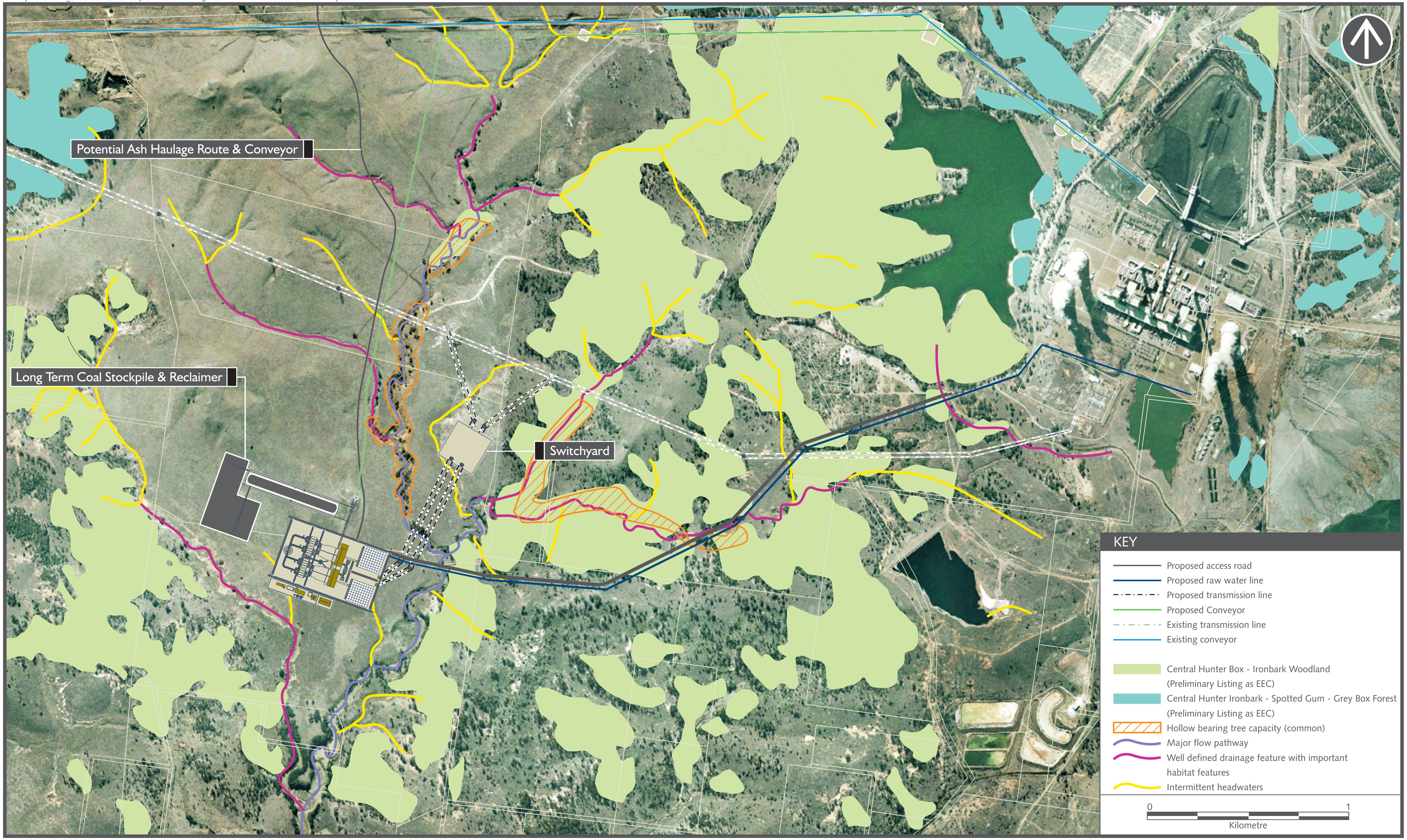


AECOM

PROJECT FOOTPRINT - COAL

Environmental Assessment

Bayswater B Power Station

Figure 4.1

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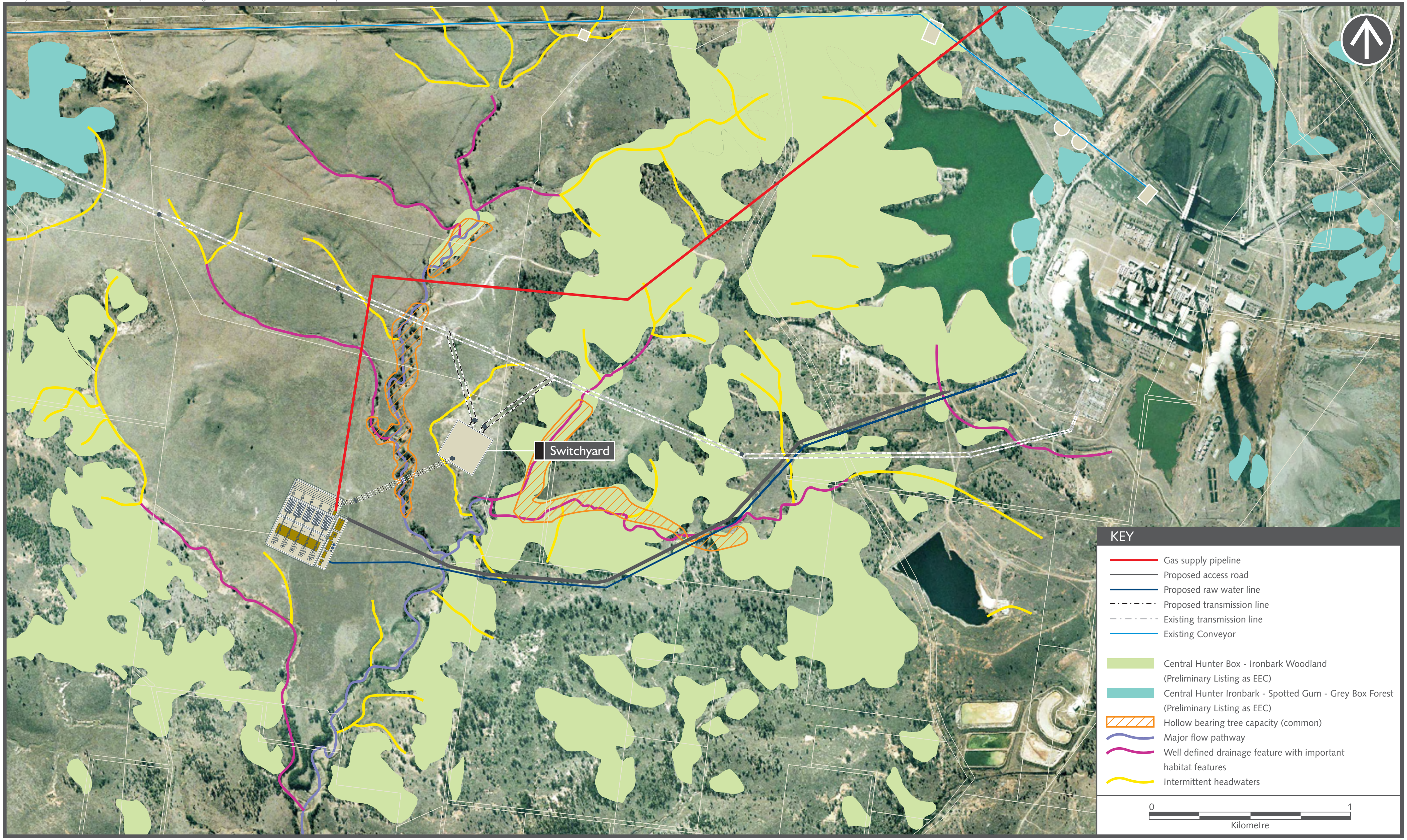


AECOM

PROJECT FOOTPRINT - GAS

Environmental Assessment

Bayswater B Power Station

Figure 4.2

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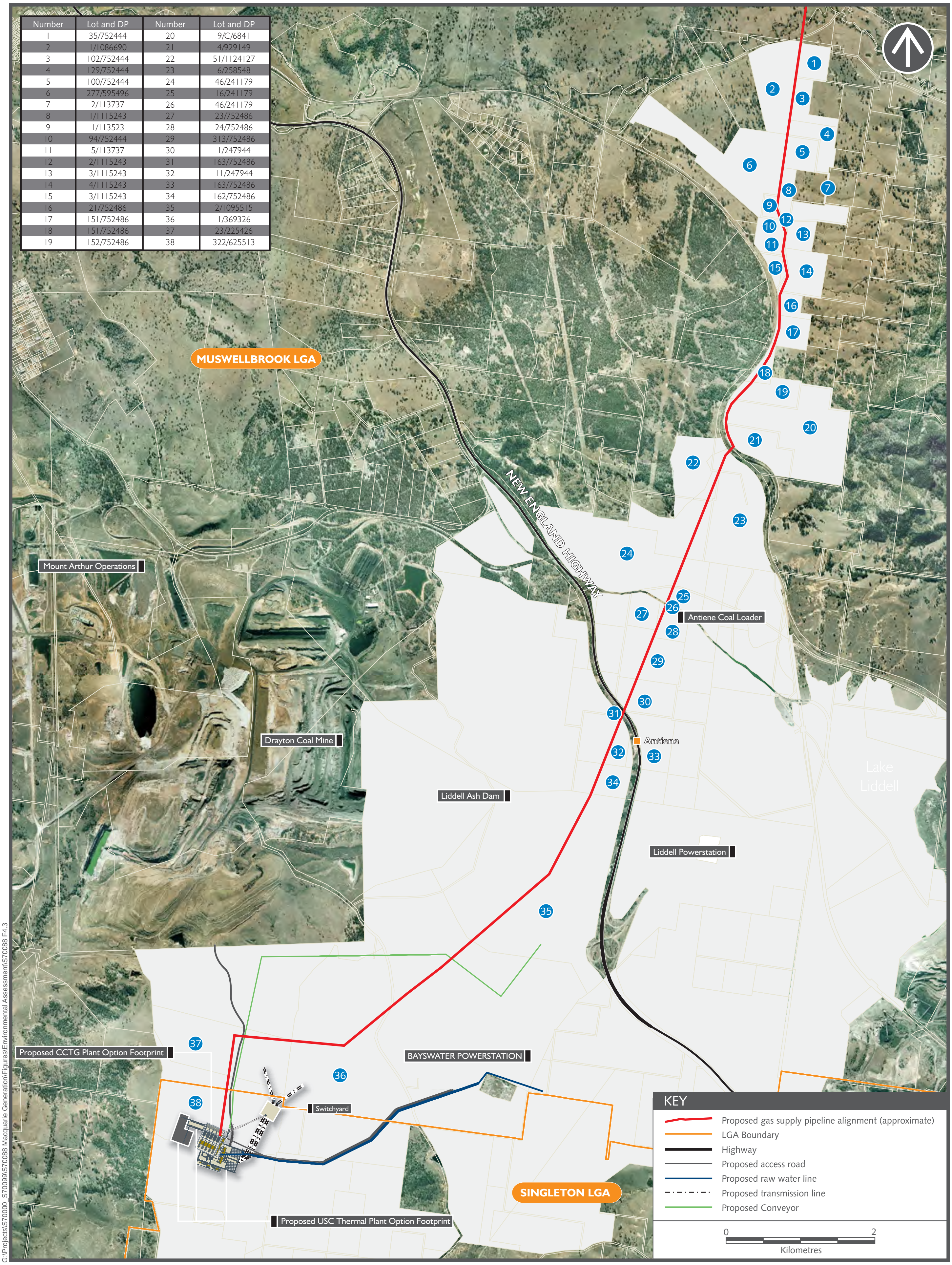
| Number | Lot and DP | Number | Lot and DP |
|---|---|---|---|
| 1 | 35/752444 | 20 | 9/C/6841 |
| 2 | 1/1086690 | 21 | 4/929149 |
| 3 | 102/752444 | 22 | 51/1124127 |
| 4 | 129/752444 | 23 | 6/258548 |
| 5 | 100/752444 | 24 | 46/241179 |
| 6 | 277/595496 | 25 | 16/241179 |
| 7 | 2/113737 | 26 | 46/241179 |
| 8 | 1/1115243 | 27 | 23/752486 |
| 9 | 1/113523 | 28 | 24/752486 |
| 10 | 94/752444 | 29 | 313/752486 |
| 11 | 5/113737 | 30 | 1/247944 |
| 12 | 2/1115243 | 31 | 163/752486 |
| 13 | 3/1115243 | 32 | 11/247944 |
| 14 | 4/1115243 | 33 | 163/752486 |
| 15 | 3/1115243 | 34 | 162/752486 |
| 16 | 21/752486 | 35 | 2/1095515 |
| 17 | 151/752486 | 36 | 1/369326 |
| 18 | 151/752486 | 37 | 23/225426 |
| 19 | 152/752486 | 38 | 322/625513 |

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AECOM

# LOT AND DP DETAIL ALONG GAS PIPELINE ALIGNMENT

Environmental Assessment

Bayswater B Power Station

Figure 4.3

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# 5.0 Project Description

This Chapter describes the preferred project. It provides discussion on both coal and gas fired technologies and additional detail in accordance with the EARs as follows:

*The EA must include a description of the proposal including:*

- *Details of project construction, operation, decommissioning, staging and key ancillary infrastructure (e.g. transmission line connection, ash disposal, haulage roads, fuel delivery and storage) under both coal fired and gas generation scenarios including identification of likely worst case development footprint*
- *Identification of fuel source options for the project and feasibility of those options*

## 5.1 Overview

The Proponent is seeking Concept Plan Approval for the proposed Bayswater B project. Development of the concept design for the project has been undertaken by Worley Parsons, and has considered a number of key drivers impacting on the feasibility of the proposal. This chapter provides an overview of the activities proposed, the likely timeframe and staging of construction and details of operation processes.

Electricity can be generated in a power station by converting energy from the combustion of fuel into mechanical energy and then into electrical energy. Approval for Bayswater B is being sought for two fuel alternatives:

- Pulverised Coal Fired USC Thermal Plant
- Gas Fired CCGT Plant

Approval is sought for the construction and operation of a 2000MW power station that is either coal or gas fired. Approval is also sought for associated infrastructure and utilities for each option. It should be noted that the gas pipeline (if gas fired) or ash haulage route, ash conveyor and coal conveyor (if coal fired) have been assessed as part of this EA. However, the identified routes are notional at this stage, and so further survey and assessment may be required during the detailed design and further approvals stages to confirm any potential impacts.

There would be temporary construction facilities required, including construction worker camp and laydown area. The location and characteristics of these temporary items are not yet known, and therefore at this stage, approval is not sought for either of those items.

The key components of the proposed Bayswater B project would depend upon the fuel option chosen and are described in further detail in the following sections. Refer also to **Section 10.3.3** for a discussion of thermal efficiency and best achievable technology.

## 5.2 Pulverised Coal Fired Ultra Supercritical Thermal Power Station

### 5.2.1 Overview

For coal fired generation, a Pulverised Coal Fired Ultra Supercritical (USC) Thermal Plant is the preferred option, together with Post Combustion Carbon Capture (PCCC) ready design. Pulverised coal fired USC technology is commercially viable and offers higher thermal efficiency and lower greenhouse emissions than current coal fired plant in NSW.

The coal fired power station would operate continuously 365 days a year. Infrastructure and systems involved in the production and transmission of electricity from coal at Bayswater B would be as follows:

- Raw products supply:
  - Transport of fuel coal to site via rail and conveyor with delivery to the coal bunkers and coal storage area
  - Fuel oil for ignition of boiler furnaces would be transported to site via truck, with delivery to storage tanks.
- Main plant (refer to **Figures 5.1** and **Figure 5-3**):
  - Coal pulverising mills which grind supplied coal into fine powder
  - Boilers (boiler furnaces), to which pulverised coal is directed. Combustion of fuel occurs with the addition of air, heating water that flows through the boiler tubes, converting the water into steam and then (with further heating) into superheated steam.
  - Turbine house (containing steam turbine generators), where the superheated steam expands on passing through turbine blades at successively lower pressures, rotating the turbine shaft which in turn powers a generator, creating electricity.
  - Steam exhausts from the turbine and enters an air cooled condenser (ACC), where it is cooled and condensed back into water. The water is re-used as feedwater for the boiler furnaces.
  - Ash handling and disposal plant, which collects and disposes of dense mineral matter rejected by the pulverising mills, course ash from the furnaces, and fine flue ash (fly ash) that is collected by fabric filters. Ash would then be conditioned and disposed of in open-cut mine voids in the vicinity of the site.
  - Stack, from which exhaust flue gases would be discharged after filtration.
  - Other plant, including a chemical dosing plant, condensate polishing and regeneration plant, fire protection systems, hydrogen plant, carbon dioxide plant, compressed air plant, station electrical plant and auxiliary cooling systems would be required as part of the operation of Bayswater B.
- Emissions control and sustainability technology:
  - USC technology to maximise plant thermal efficiency and minimise greenhouse emissions
  - Use of dry cooling (ACC) reducing the water usage of the site
  - Use of low-sulphur domestic grade coal, along with application of table mills for the coal pulverising plant, both minimising sulphur emissions
  - Low-$NO_x$ burners in the furnaces to control combustion temperatures to minimise the formation of nitrous oxide

- Use of fabric filter plant to minimise particulate emissions
- Use of a 300 m high stack to increase the dispersion of atmospheric emissions and achieve appropriate ground level concentrations
- Appropriate and comprehensive ash handling and disposal methods
- Carbon capture readiness employing PCCC (provision made for future deployment)
- Solar augmentation readiness by the introduction of solar heat into feedwater systems (provision made for future deployment)

- Transmission infrastructure:
  - Generator circuit breaker and transformers, which step up the voltage to 500 kV and connect each of the two 1000 MW generators to the transmission switchyard
  - Transmission switchyard, which connects the two 1000 MW generators to the 500 kV TransGrid transmission lines
  - Existing TransGrid 500 kV transmission lines, which transmit the electricity generated by the power station to the distribution networks.
- Utilities and general infrastructure:
  - Water management, which includes raw water supply, drainage systems for water and other fluids, sewage treatment and water sprays for the ACC
  - Electrical plant, including transformers and switch gear, to supply electricity on site at suitable voltages for use in motors and lighting on the site.
  - Access to site and within the site
  - Other items as described in **Section 5.3.3**

The stages of the proposed project are as follows:

- Construction stage, with sub stages and considerations including:
  - Site establishment, which includes preparation of site, formation of lay down areas, storage and paving to facilitate construction
  - Site activities, from bulk earthworks and foundation preparation, to construction of all power generation and transmission infrastructure, completion and rehabilitation disturbed areas of the site
  - Construction staging including ordering of works and timing to allow efficient construction and timely rehabilitation of each stage or area
  - Construction employees including numbers and types of employees
  - Access, traffic and transport considerations including to site and within the site
  - Environmental management considerations and measures that are specific to the construction stage
- Commissioning, following completion of construction, involving the quality assurance inspection and testing of all systems and components of the power station to ensure that they meet operational requirements, followed by commencement of operations.
- Operation, as described in **Sections 5.3.2** to **5.3.7**
- Decommissioning, which would occur at the end of the life of the power station.

### 5.2.2 Raw Products Supply and Handling

**Coal**

The proposed Bayswater B project would require up to approximately 6.3 million tonnes of coal per year, dependent on the specific energy value of the coal, which could vary the final volume required. This coal would be supplied by rail. Coal trains delivering approximately 9,000 tonnes each would deliver the coal for Bayswater B via MacGen's existing Antiene Rail Coal Unloader (ARCU). The ARCU currently delivers coal for the existing Bayswater and Liddell Power Stations. Coal would be transferred from ARCU to the Bayswater B plant via a new conveyor from the head of the ARCU conveyor. Coal delivery would occur 365 days per year.

Conveyors would deliver coal directly from the ARCU and its conveyor system into coal bunkers at Bayswater B. This Bayswater B conveyor system would be rated at 4,000 tonnes per hour to match the rating of the rail unloader. To cater for maintenance, plant failures or interruptions in supply of coal by rail, it is proposed to provide a fully covered dry storage stockpile of coal at Bayswater B sufficient for up to 10 days coal supply (approximately 188,000 tonnes). This stockpile, with an area of approximately 2.5 ha, would include fully mechanised formation and reclamation by means of a long-travelling stacker and a long-travelling reclaimer. Additionally, provision would be made for an uncovered long term coal storage yard for a further 10 days of coal supply. Due to the lower stacking height of this stockpile, an area of approximately 4.0 ha would be allocated.

**Fuel Oil**

Fuel oil would be used on site for ignition of boiler furnaces. The fuel oil would be transported to site via truck, diesel stored in tanks on site and pumped to igniters in the boilers. Depending upon operating requirements, typically 3,000 kL of fuel oil would be consumed per annum.

### 5.2.3 Main Plant Operation

The main plant associated with the proposed power units comprises a series of plant areas, including the boiler plant and the turbine plant. Within each plant area, there are several different components which function together to operate the plant, as outlined below. Refer also to **Figure 5.2** (Coal Fired Plant Process).

**Coal Pulverising Mills**

Coal would be used by Bayswater B at a rate of up 800 tonnes per hour. Coal feeders would transfer coal at a controlled rate from the coal bunkers into the pulverising mills, where it is heated and dried while rollers grind the coal into a fine powder. This pulverised coal is blown through pipes into the boiler furnace. The pulverising mill classifiers return larger particles to the mill to ensure fine pulverised coal is delivered to the boiler furnace to facilitate complete and efficient combustion.

The grinding elements for the pulverising mill reject dense mineral matter within the coal (such as pyrite / iron sulphide), which is collected and transported to the ash plant as discussed below.

**Boilers**

The once-through ultra supercritical boilers would be designed to supply main steam at 28.5 MPa and 600°C with reheat steam at 620°C.

Two boilers, each of approximately 64 metres wide, 80 metres long and 95 metres in height, would be started by a fuel oil firing system. Pulverised coal would be directed into furnace chambers along with air heated by the flue gases (in the air heaters at the boiler outlet). Use of low-NOx burners in the furnaces would control combustion temperatures to minimise the formation of nitrogen oxides (NOx). Combustion of the coal within each furnace results in thermal radiation and convective heat release which heats water flowing through tubes which form the furnace walls. As the boiler operates at a pressure above the critical point for water (i.e. 22 MPa, 374°C), the water undergoes the phase change from liquid to vapour (steam) without boiling. The steam is further heated and the resulting superheated steam is piped to steam turbines.

Coarse furnace ash and fine fly ash generated during coal combustion would each be collected by different components of the ash handling and disposal plant, as discussed below.

**Turbine House**

The turbine house would be approximately 40 metres wide, 200 metres long and 40 metres in height. It would contain two steam turbine generators, each made up of a series of interconnected turbine cylinders at successively lower pressures, attached to a generator on a common shaft.

The superheated steam (28.5 MPa, 600°C) first enters the high pressure (HP) steam turbine and progressively expands as it passes through the cylinder. From the HP turbine, steam is then reheated in the boiler (to 620°C) before passing through the double flow intermediate pressure (IP) turbine and then two or three double flow low pressure (LP) turbines. As the steam expands through each turbine it imparts a force on the rotor blades thereby rotating the turbine shaft, which is coupled to the generator rotor in which electrical energy is generated at typically 23,000 volts.

After passing through the LP turbines the steam is exhausted to the air cooled condenser (ACC), discussed below. The generated electricity is transferred to the transmission infrastructure, discussed in **Section 5.3.5**.

**Air Cooled Condensers**

Low energy steam exhausted from the LP turbines is directed to the ACC, where it is condensed back into water. Each ACC unit would comprise of some 81 cells with overall dimensions of 110 m x 110 m x 38 m high.

A dry ACC uses direct heat transfer to the atmosphere to cool and condense the steam. Steam at approximately 50°C is ducted directly to the large heat exchanger elements which are cooled by ambient air pushed past the finned tubes by large fans. As the heat transfer mechanism is by convection, the performance of the ACC depends on ambient dry bulb temperatures. During hot periods the effectiveness of the ACC decreases and performance of the plant declines. To help counter this effect, water sprays cool the incoming air and provide some evaporative cooling on the external surfaces of the heat exchanger elements. This provides plant performance improvements on hot days by allowing more heat to be dissipated.

The water output from the ACC (condensate) has impurities removed by the polishing plant before being heated by the regenerative feedwater heaters, which utilise bled steam from the turbines to improve plant thermal efficiency. The heated water then returns to the boiler. This completes the Steam/Water Cycle which begins with water being converted to steam in the boiler, followed by steam passing through the turbines before being exhausted to the ACC where it is converted back to water, which is then treated in the polishing plant and heated by the feedwater heaters, before returning to the boiler.

**Ash Handling and Disposal Plant**

The ash plant involves a number of different components, including the Pulveriser Rejects Handling Plant, Furnace Ash Collection and Handling Plant, Flue Gas Cleaning Plant, Fly Ash Handling Plant, Ash Conditioning Plant, and Ash Disposal Plant. Each of these is addressed below.

*Pulveriser Rejects Handling Plant*

The coal pulverising mills generate rejects (including dense mineral matter) which are collected and transported via a wet jet pump system and disposed of with the furnace ash.

*Furnace Ash Collection and Handling Plant*

Coarse furnace ash (bottom ash) makes up approximately 10-20% of the ash generated by the furnace. After combustion of coal, the coarser furnace ash collects in the furnace hopper and is removed by a wet submerged scraper conveyor system. The furnace ash along with the pulveriser rejects are then dewatered and conditioned if required prior to being transported to the ash disposal site by truck.

*Flue Gas Cleaning Plant*

The remaining 80-90% of ash generated by the furnace is in the form of fine fly ash (dust), which is transported with flue gases through the boiler. The fly ash is removed from the flue gases prior to emitting the gases to the atmosphere. The flue gas dust collecting plant would involve fabric filter baghouses which are highly efficient particulate removal devices.

Fabric filter baghouses (four per boiler furnace, eight in total) would be approximately 50m wide, 42m long and 30m in height. Fly ash collected on the fabric filter bags is dislodged by pulse jet into hoppers and then transferred to the fly ash handling plant as discussed below.

*Fly Ash Handling Plant*

A fly ash handling plant is required to remove and transport fly ash from the fabric filter hoppers to the Ash Conditioning Plant prior to disposal.

*Ash Conditioning Plant*

Ash conditioning would be required to improve handling and control dust from ash, however the type and extent of conditioning required is dependant on the condition of the ash and other products received together with the system selected for disposal. Ash would be conditioned with recycled wastewater from the site before being transferred to the Ash Disposal Plant.

*Ash Disposal Plant*

Ash disposal is proposed to occur in existing void/s created as a result of past open cut coal mining operations located within a 10 km radius of the site. The conditioned fly ash would be transported by enclosed conveyor, while furnace ash and pulveriser rejects would be transported by truck via a purpose-built private ash haulage road to the ash disposal site. The ash conveyor and ash haulage road are proposed to be built side-by-side.

**Stack**

The flue exhaust gases from burning of fuel in the furnace would be discharged via the chimney stack after filtration. A single twin flue stack would be provided at Bayswater B, having a height of 300m and a diameter of 10 – 11.6m depending on capacity.

**Other Plant**

Other plant forming part of the project includes:

*Chemical Dosing Plant*

A number of chemicals are required for dosing and treatment processes. Most would be delivered by road tanker to a central unloading and storage facility incorporating safety and spill containment measures. Chemicals to be stored in this facility include sulphuric acid, caustic soda and ferric chloride for water treatment and ammonia for feedwater dosing. Chemicals would be stored in cylinders or above ground tanks with surrounding bunds and connections to the chemical drains system. Dosing and transfer pumps would also be located within bunded areas.

Feedwater for the boiler furnace would be deoxygenated to control corrosion of the ferrous materials in the boiler and pipe work. This involves injection of oxygen gas into the feedwater upstream of the boiler. Oxygen would be supplied in high pressure cylinders and stored in a designated area near the dosing point.

Chlorine gas for dosing the domestic water and the auxiliary cooling water system (cooling tower) would be supplied in high pressure cylinders/drums and stored in separately.

*Condensate Polishing and Regeneration Plant*

The once-through design of the boiler requires very high feedwater quality to prevent corrosion and fouling within the boiler. The condensate polishing plant removes impurities from the condensate and is located upstream of the feedwater heaters. The targeted feedwater chemical characteristics are sodium ≤ 0.5ppb and cation/acid conductivity ≤ 8 µS/m. Ammonia dosing would be used to maintain a pH of around 9 – 9.5.

The polishing plant for each unit comprises polisher service vessels containing ion exchange resin and an associated resin trap to capture resin slippage and fines, preventing resin from entering the boiler. A booster pump raises the pressure of the polished condensate for its reintroduction to the feedwater system. At the end of the service period, the exhausted resins are transferred to the resin regeneration plant for chemical regeneration.

The resin regeneration plant would include resin and water transfer line/s from the polishing plants to the regeneration plant. The regeneration plant is likely to consist of regeneration water tank/s (supplied by the demineralised water tank and from expended condensate from "oxygen rinsing" of polishing vessels), cation regeneration/resin separator vessel/s, anion regeneration/mixing vessel/s, resin balance vessel/s, chemical batching and injection equipment.

The regeneration process would involve regeneration of the cation ion exchange resin with a dilute acid (most likely sulphuric acid); whilst the anion resin is regenerated with dilute caustic soda (sodium hydroxide).

The condensate polishing regeneration plant and the demineralised water treatment plant would have common bulk chemical storage facilities.

*Fire Protection Systems*

A comprehensive fire protection system would be provided including automatic smoke and thermal detection and alarms, automatic sprinkler and spray deluge fire fighting systems and various manual fire fighting systems.

The central fire fighting plant would include a dedicated fire water tank and various pumps, which would supply water to the dedicated fire mains serving the automatic and manual fire fighting systems throughout the plant.

*Hydrogen Plant*

Hydrogen is used for cooling generators during operation (the generators rotate within a hydrogen gas environment). Minor amounts are required for replenishment while sufficient storage capacity is required for complete fills of the generators (following maintenance). Hydrogen gas would be sourced in cylinders and stored in the Hydrogen Plant.

*Carbon Dioxide*

$CO_2$ gas is used to periodically purge the hydrogen used in generators as part of maintenance (approximately every two years). $CO_2$ gas would be stored in high pressure cylinders near the injection point.

*Compressed Air Plant*

Compressed air is used in many systems including pneumatic instruments and tools, and would be supplied throughout the plant from three compressors and dryers with storage vessels.

*Station Electrical Plant*

Station Electrical Plant is discussed in **Section 5.3.6 – Utilities and General Infrastructure**.

*Auxiliary Cooling System*

A small auxiliary wet cooling tower is required to provide cooling for the various items of plant such as the generators, numerous oil coolers, air compressors, and other auxiliary plant. The auxiliary cooling water from the cooling tower is pumped through water-water heat exchangers, which in turn cool the treated demineralised water recirculated through heat exchangers throughout the plant.

### 5.2.4 Emissions Control and Sustainability

**USC technology**

The use of USC technology would maximise plant thermal efficiency and minimise greenhouse emissions.

**Dry Cooling**

The use of dry cooling would require up to 2.4GL pa of water (under waste conditions) compared to around 24 GL p.a. for wet cooling. This has significant benefits to the local region in terms of both landowner and environmental uses of water.

**Low $NO_x$ Burners**

Low NOx burners optimise fuel and air mixing at each burner in order to create large flames with less available air in order to reduce peak flame temperature and thermal NOx formation. Low NOx burners typically have three stages: combustion, reduction and burnout. In the first stage, combustion occurs in a fuel rich, oxygen deficient zone where the majority of thermal NOx is formed. The reducing atmosphere follows, where hydrocarbons are formed which react with the already formed NOx. In the third stage, additional air staging completes the combustion process although some additional NOx formation may occur.

**Fabric Filter Technology**

Bayswater B would use fabric filter plant to minimise particulate emissions. Fabric filter bags can achieve overall collection efficiencies of 99.9 % of primary particulates.

The fabric filter plant uses woven or felted cotton, synthetic, or glass-fibre material bags to filter the fly ash from the flue gas. All the flue gas enters from the bottom of the fabric filer plant casing and flows from the outside to inside of the bags. A metal cage prevents collapse of the bag, as the fly ash forms a cake on the surfaces of the bags. The fabric bag primarily provides a surface on which fly ash collects, with the build up of fly ash enhancing the collection efficiency.

The build up of fly ash cake on the filter bags eventually increases the resistance to flue gas flow and necessitates periodic cleaning. The pulse jet cleaning system cleans the bags by injecting a short burst of compressed air through a common manifold over a row of bags. The jet pulse causes the bag surfaces to flex, dislodging the fly ash which falls into a storage hopper below.

**Stack Height**

Stack height was determined based on modelling of atmospheric emissions to achieve satisfactory emissions dispersion and appropriate ground level concentrations in areas surrounding the project site. On the basis of this, modelling has identified a stack height of 300 m as appropriate for Bayswater B.

**Ash Handling and Disposal**

A number of sustainability options were considered as part of the feasibility work for the project in regard to ash handling and disposal, including:

- Removal and handling of ash from the furnace and other locations in the boiler to ensure efficient operation and reduce the amount of ash contained in boiler gases
- Dry ash disposal to minimise environmental effects of wastewater and leachate.

**Carbon Capture Readiness**

Carbon capture readiness employing PCCC ready design would be incorporated at Bayswater B. An area of 4 ha would be allocated on the site to allow for PCCC if and when it becomes available.

PCCC implementation is likely to require connection to flue gas ducts, additional cooling, additional auxiliary power usage and potentially use of steam as part of the PCCC process. Depending upon the technology adopted, other components of the plant may be required. PCCC is likely to involve compressed captured carbon which is subsequently piped to a suitable storage site.

Advances in the development of PCCC technology are being made and it is possible that the technology may become feasible within the operational life of Bayswater B. Manufacturers are able to make generators PCCC ready in their designs to enable retrofitting of the technology when it becomes proven and commercially viable.

It is unknown at this stage which PCCC option/s may become available or suitable as technology develops. The proponent would continue to monitor and investigate developing PCCC technologies.

**Solar Augmentation Readiness**

Solar augmentation by the introduction of solar heat into feedwater systems is currently being adopted at Liddell Power Station. However, it is not viable at Bayswater B.

The proponent would continue to monitor developing technologies in this field and would make provisions in the design of the proposed project for its future deployment.

### 5.2.5 Transmission Infrastructure

The transmission plant would include a 500 kV transmission switchyard, generator circuit breaker and transformer yards, as outlined below. Each of the two generators would be connected to a generator circuit breaker, which in turn is connected to step-up voltage transformers and then to the 500 kV transmission switchyard.

**Generator Circuit Breaker and Transformer Yards**

For the coal fired option, the generators would generate electricity at typically 23,000 volts (23 kV). Generator circuit breakers allow the passage of continuous high electrical currents, but interrupt the current by separating two contacts in order to protect the generator.

After passing through the generator circuit breakers, electricity would enter the transformers. The transformers increase the voltage of generated electricity from 23 kV to 500 kV before it enters the electricity transmission system for distribution to consumers. Transmission wires have resistance and consequently dissipate electrical energy. By transforming electrical power to a high-voltage (and therefore low-current) form for transmission and back again afterward, transformers enable efficient transmission of power over long distances.

**Transmission Switchyard**

The proposed Bayswater B project would be connected to the network via the 500 kV transmission system. Connection to 500 kV transmission lines would be via a new green field 500 kV transmission switchyard developed as part of the proposed Bayswater B project.

**Transmission Lines**

The 500 kV switchyard would connect to the existing dual (double circuit) 500 kV transmission lines 73 and 74 which pass the proposed Bayswater B site.

### 5.2.6 Utilities and General Infrastructure

**Water Management**

Bayswater B would incorporate several water systems related to handling and treating water and wastewater streams, including raw water and domestic water supply, stormwater, contaminated water and chemical drains, sewage and water recycling systems.

Sufficient water resource exist within MacGen's existing entitlements and future water purchases to supply water demand for the proposed Bayswater B project if it is dry cooled. Refer to **Section 10.5** for more detail.

*Raw Water Supply*

Raw water would be supplied to Bayswater B by new pumps and a new pipeline from the existing Bayswater Freshwater Dam, which contains water that has been conditioned by lime softening. Additional pre-treatment may be required prior to use as service water (for fire/hydrant supply, plant wash down, irrigation, equipment cooling, process water and make-up to the auxiliary cooling water wet mechanical draft cooling tower).

*Filtered Water System*

Some of the raw water would be clarified and filtered to supply the domestic water and demineralised water plants. This filtered water would also be used for spraying the air cooled condenser during hot weather. These new filtered water facilities would consist of a clarifier, open gravity sand filters and facilities for dosing of ferric chloride.

*Domestic Water Supply*

Domestic (potable) water would be used for drinking, showers, amenities, etc on site and would be supplied from a new domestic water treatment plant, which would incorporate chlorination (of filtered water) and storage facilities.

*Demineralised Water Supply*

Demineralised water would be used in the power plant steam cycle and auxiliary cooling systems. It is produced by passing the filtered water through ion exchange resins to remove dissolved salts and produce high purity water. A new demineralised water treatment plant would be provided including filtered water pumps, degassed water pumps, degassers and degassed water storage tanks, cation and anion vessels, mixed bed vessels, a demineralised water storage tank and regeneration and resin cleaning systems.

*Condensate Polishing and Regeneration Plant*

Each unit would have a condensate polishing plant to remove impurities from the condensate and maintain the purity of feedwater. The resins used to remove the impurities are chemically regenerated in the regeneration plant. With regard to water management, the regeneration plant includes a regeneration water tank suppled by the demineralised water tank and from the condensate expended during “oxygen rinsing” polishing vessels prior to their return to service. (See also **Section 5.3.3** - Other Plant).

*Stormwater and ‘Dirty Drains’*

Stormwater from roads and other hard surfaces which may contain dust or other contaminants would be directed via ‘dirty drains’ to a First Flush Pond where a plate separator would remove contaminants. The water may then be discharged via the detention pond to Plashett Dam. Alternatively it may be reused on site if required as part of plant processes.

For the coal fired option, the long-term coal stockpile would be outside and uncovered. As such, wastewater runoff from this area is likely to be contaminated with coal dust. Similarly any runoff from the ash plant is likely to be contaminated with ash dust. Both of these areas would have their own ‘dirty drain’ systems and settling ponds, with water from the settling ponds reused as required for dust control, or alternatively transferred to the First Flush Pond for further filtration.

*Contaminated Water Drains*

Contaminated water drains would be installed to collect water from sources which may contain oil or other contaminants.  Fluid drained from transformer bunds, oily water from equipment drain collection points and washdown water would be drained initially to an underground Oil Catch Tank to remove oil by the use of oil traps.  This wastewater would then drain to the First Flush Pond and be released via plate separators (to remove other contaminants) to the detention pond or to the ash plant for re-use.

*Chemical Drains*

Drains would be installed for facilities producing wastewater which may contain hazardous chemicals such as the demineralised water treatment plant and polisher regeneration plant, as well as wash down water and stormwater from bunded chemical storage areas.  Chemical wastewater would be neutralised and discharged via closed chemical drains for use in ash conditioning.

*Sewage Treatment*

Sewage would be treated at a new dedicated sewage treatment plant installed as part of the proposed Bayswater B project.  The treated effluent would be discharged via the closed chemical drains system.

*Auxiliary Cooling Tower Blowdown*

The blowdown from the wet cooling tower installed for the auxiliary cooling system would have an increased concentration of salts and contaminants.  Due to the small quantities of wastewater involved, this wastewater would be discharged via the chemical drains system to the ash plant (for ash conditioning and make-up to the furnace ash submerged chain conveyor).

**Electrical Plant**

Electrical plant / auxiliary power supplies would be required on site to power motors and lighting, using electricity generated on site.  Unit and station electrical plant would consist of 500 kV/11 kV station transformers, 23 kV/11 kV unit transformers, 11 kV/3.3 kV and 3.3 kV/415 V auxiliary transformers, medium voltage (11 kV and 3.3 kV) switchgear, low voltage (415 V) switchgear, all related control, protection and metering and direct current systems.

The primary Station Transformer would be connected to the 500 kV grid at the step-up substation.  The secondary Station Transformer would be rated at 11 kV and would supply the Station 11 kV switchboards.  3.3 kV Station switchboards would be supplied from the 11 kV Station switchboards via 11/3.3 kV transformers.  110 V direct current and battery systems would also be provided to protect the plant in the event of interruptions to the main power systems and emergency situations.

The intermediate capacity motors (e.g. coal conveyors, boiler fans, ash plant, air compressors) would be supplied from the medium voltage (3.3 kV) system.  The 3.3 kV system would also supply the 415 V system via 3.3 kV/415 V transformers.

The low voltage (415 V) system would supply the smaller capacity motors, as well as the Station DC and Essential AC systems. The 415 V motors would typically include station common services load such as HVAC, lighting, water treatment, hydrogen generation and fire pumps.

**Access**

The majority of construction supplies are likely to be delivered to the site via road. Ongoing access to and around the site would be required during operational stages.

A road would be required to be constructed to access the proposed Bayswater B site from Bayswater River Road. Sealed roads would be provided for the main access road to the site as well as in and around the power station. Other roads would include a haulage road from the ash plant to mine void/s for ash disposal, as well as a road beside the coal conveyors. A short road and bridge would be required between the main power station site and the switchyard. Wherever possible, road construction for Bayswater B would utilise bottom ash (coarse furnace ash, similar to fine gravel) from Bayswater as a road base. Refer to **Chapter 21 Traffic and Transport** for more detail.

### 5.2.7 Use of Existing Infrastructure

Where possible, existing infrastructure is to be used for the project unless there is a strategic benefit in supplying new infrastructure. Existing infrastructure proposed to be used is summarised in **Table 5.1** below. All other infrastructure is likely to be specific to the new project.

**Table 5-1: Use of Existing Infrastructure – Coal Fired Option**

| Requirement | Commentary |
|---|---|
| Coal delivery | Use of the existing ARCU and associated conveyor would result in an increase in train movements. An amendment would be required to the ARCU development consent to increase the annual coal receival tonnage. However no new construction is required. |
| Access road | Existing access from New England Highway to Bayswater to be used (a new access road would be required from Bayswater site to Bayswater B). Refer to **Chapter 21 Traffic and Transport** for more detail. |
| Water supply and treatment | Water for dry cooling is available within existing Bayswater/Liddell entitlements. Existing Bayswater water infrastructure (i.e. dams) can also be utilised. Refer to **Chapter 11 Water** for more detail. |
| Transmission lines | Existing transmission lines to be used with minor re-alignment. |

### 5.2.8 Coal Fired Plant Operating Parameters

The technical assessments in this EA have been based on the following operating parameters:

- Plant operating duty: 92% annual capacity factor
- Electrical energy production: 14,806 GWh per annum sent out
- Thermal efficiency: 39.2% High Heating Value (HHV) sent out
- Fuel (coal) consumption: 6.3 Mt per annum
- Calorific value: 21.76 MJ/kg
- Fuel proximate analysis:
  - Moisture: 9.4%
  - Ash: 26.15%
  - Volatile matter: 22.9%
  - Fixed carbon: 41.55%
  - Carbon in ash: up to 3%

- Ash produced:
  - Furnace (bottom) ash: 0.34 Mt per annum
  - Fly ash: 1.35 Mt per annum

### 5.2.9 Construction

**Site Establishment**

Before other works commence, construction of the access road would be required to provide vehicular access to the proposed Bayswater B site from the sealed road at Bayswater Power Station

Site preparation involves clearing and leveling the main power station site and surrounding areas as applicable (for coal storage areas, lay-down areas, etc), fencing, establishing drainage systems and installation of facilities for underground services (e.g. reticulated water, electrical conduits) ready for erection of the equipment. The establishment of a concrete batching plant and facilities for processing fill materials would also occur ready for first concrete foundations.

Based on preliminary assessments, the main power station would be on a single level bench (elevation 144 m), while the coal storage area would be on an elevated bench (elevation 164 m). The volumes of cut and fill would be minimised where possible.

The construction lay-down area would be approximately three times the size of the eventual power station footprint, due to the large components of plant requiring assembly in addition to areas for cranes and other large construction equipment to operate from.

**Site Activities**

*Excavation and construction of foundations and underground services*

Depending on the final foundation design, excavation for foundations would be undertaken. Excavations up to some 5 m for concrete foundations and piling to a depth of up to approximately 30 m may be necessary for major plant foundations. Formwork would be assembled, concrete poured and completed foundations back-filled. Once the major plant foundations are complete, foundations for other structures, plant and equipment can commence. Where specific underground services are required, these services are installed in conjunction with the foundation works to avoid subsequent excavation and disturbance of the foundations.

Where possible, fly ash from Bayswater would be used as a component of concrete in the construction of Bayswater B. This would serve to maximise reuse of this product from the nearby site, as well as reducing truck movements.

*Plant buildings and structures*

Once the foundations are complete, erection of plant buildings and structures would commence. The basic “shell” of the building would be completed, followed by installation of equipment into the building. The construction of the building would then be completed.

Major structures such as the boiler, turbine building and stack would also be constructed early in the programme, followed by other service buildings such as the water treatment plant and air cooled condensers.

*On-site pre-assembly of component parts and installation*

Equipment and components would be progressively delivered to site. The size of most deliveries would be dictated by the method of transport and any associated limitations. Larger equipment would be delivered in modules or components for pre-assembly at site prior to installation.

*Equipment installation (mechanical, electrical, controls)*

As access to buildings and structures becomes available, installation of plant and equipment would progressively occur. Mechanical, electrical and control equipment would be installed and systems connected by pipework and cabling. Extensive inspection and testing of the equipment would be carried out throughout installation to ensure plant is set for operation.

**Construction Staging**

The following indicative program of works is anticipated for each stage construction of the proposed coal fired option:

- Detailed design – 24 months
- Procurement, manufacture and delivery of components – 35 months
- Site preparation – 3 months
- Civil works and foundations – 28 months
- Equipment assembly and erection – 31 months
- Commissioning and functional testing – 12 months (6 months per unit)

With the overlapping of various stages, the total construction period is in the order of 54 months. Construction would progressively 'ramp up' during construction of the first unit, which comprises the first 38 months approximately. The construction timeline is indicatively proposed as follows: from zero staff at commencement, staff numbers would increase lineally up to a maximum of between 900 and 1000 staff by month 25, staying at that level to month 36, then ramping down to approximately 45% staff at month 42, continuing down to zero staff at completion in month 54. Refer to **Figure 5-6**.

**Construction Employees**

Accommodation for construction employees would be required during the construction period. This would be in the form of construction camp/s incorporating hostel type accommodation for approximately 80% of the construction work force. Two camps are anticipated to be built at off-site location/s, however exact locations and details would depend on suitable sites with necessary services (power, water, sewerage, etc) as well as local council approval. A shuttle bus service would be used to transport personnel to and from the project site each day. Impacts of construction camps on nearby towns have been considered as part of the social impacts investigation. Refer to **Chapter 18 Socio-Economic** for more detail.

**Construction Access, Traffic and Transport**

During construction, various truck transport would be required for site establishment, delivering construction materials and plant components and transporting construction machinery to and from site. There would also be considerable car and/or bus transport required for construction workers. Traffic volumes during construction are likely to be greater than those during the operational phase. Access to site would be via the existing road to Bayswater Power Station and a new road constructed to the proposed project site. Refer to **Chapter 21 Traffic and Transport** for more detail.

**Construction Environmental Management**

The initial selection of a site to locate the proposed project took into account various environmental issues. The site was selected within MacGen's landholdings based on being relatively level and clear of native vegetation, having been used for grazing over recent years, and not likely to have significant archaeology or heritage constraints. The location of the proposed project, having regard to the site selected, would therefore minimise the extent of impacts.

The construction phase of the project would impact upon a larger footprint at the site than would the final operating power station, due to the construction laydown areas required. This has been considered as part of the EA. **Chapter 24 Environmental Management** of this EA deals with management of specific construction-related environmental impacts in more detail.

### 5.2.10 Commissioning

Once the plant and equipment has been installed and construction completed, the following commissioning stages are carried out:

- Preliminary Pre-Commissioning Tests include installation checks, preliminary mechanical and electrical checks, pressure testing, flushing and cleaning of equipment and pipework, and proving the integrity of all mechanical and electrical connections (including the site safety system, hydrostatic pressure test of pressure parts and air flow tests).
- System Commissioning Tests include tests on individual items or sub-units for correct operation including setting of limits, operating points, sequence operation and load sharing tests, tests of all fire and safety systems and controls, air flow tests and combustion tuning, etc.
- Functional Tests demonstrate that the plant as a whole can safely and correctly operate and meets all of its functional capabilities.
- Performance Tests and Environmental Emission Tests include maximum capacity and efficiency tests, flue gas emissions tests, noise tests and reliability run.

### 5.2.11 Decommissioning

The proposed project would have an expected life of not less than 30 years, but it may be possible to extend the life of the project if deemed appropriate due to new technology. At the end of its service life, Bayswater B Power Station may be closed. Closure works would typically include the following activities:

- Plant and equipment would be de-commissioned and removed
- Above ground structures would be demolished while below ground facilities and structures would be sealed
- Ponds and dams would be drained and filled, or maintained as wetland nature reserves
- The overall site would be landscaped, drained and/or rehabilitated.

The methodology for the decommissioning each component of the power station would be plant specific, however the typical techniques include:

- Dismantling
- Conventional demolition
- Mechanical shearing
- Controlled collapse
- Explosion/implosion
- Manual handling

It is anticipated that concrete crushing and steel shredding plants would be located on site with concrete used offsite for fill or road base, whilst steel and metals would be sold as scrap for recycling. Hazardous materials would be separated from general materials and either disposed of in an approved facility off-site or sealed in below-ground structures such as cable tunnels, pits and large conduits and foundation areas using crushed concrete.

## 5.3 Gas Fired Option

### 5.3.1 Overview

For gas fired generation, a gas fired Combined Cycle Gas Turbine (CCGT) plant is the preferred option. CCGT technology is commercially viable and is suited to providing for base load requirements, with high efficiency due to the combination of a gas turbine and a steam turbine in each unit.

The gas fired power station would operate continuously 365 days a year. Infrastructure and systems involved in the production and transmission of electricity from gas at Bayswater B would be as follows:

- Gas supply involving transport of natural gas via pipeline directly to the site.
- Each of the five proposed CCGT units would include (refer to **Figures 5.2 and 5.4**):
  - Gas turbine, which firstly compresses air, which is used for combustion of gas, with the resultant hot gases rotating the shaft of the power turbine, producing mechanical energy to drive the electrical generator (and the air compressor).
  - The Heat Recovery Steam Generator (HRSG) then takes in the hot gases exhausted from the gas turbine, using this to heat water flowing through tubes, converting the water into superheated steam.
  - Steam turbine, where the superheated steam rotates a turbine, which in turn adds to the mechanical energy provided to the generator, creating additional electricity.
  - Generator, driven by both the gas turbine and the steam turbine.
  - Air cooled condensers (ACC), where steam exhaust from the turbine is condensed back into water, which is re-used as feedwater for the HRSG.
  - Stacks, from which exhaust gases from the HRSG would be discharged.
  - Other plant, including a chemical dosing plant, condensate polishing and regeneration plant, fire protection systems, hydrogen plant, carbon dioxide plant, compressed air plant, station electrical plant and auxiliary cooling systems would be required as part of the operation of Bayswater B.

- Emissions control and sustainability technology:
  - CCGT technology maximising the efficiency of fuel use, along with F Class Gas Turbine technology to maximise plant thermal efficiency and minimise greenhouse emissions
  - Use of dry cooling (ACC) for steam turbine exhaust, reducing the required water usage of the site
  - Inclusion of low-NOx burners in the gas turbine combustion chambers to control combustion temperatures to minimise the formation of nitrogen oxides
  - Carbon capture readiness employing Post Combustion Carbon Capture (PCCC) (provision made for future deployment)
- Transmission infrastructure:
  - Generator circuit breaker and transformers, which step up the voltage to 500 kV and connect each of the five 400 MW generators to the transmission switchyard
  - Transmission switchyard, which connects the five 400 MW generators to the 500 kV TransGrid transmission lines
  - Existing TransGrid 500kV transmission lines, which transmit the electricity generated by the power station to the distribution networks.
- Utilities and general infrastructure:
  - Water management, which includes raw water supply, systems to filter and demineralise water, drainage systems for water and other fluids, sewage treatment and a condensate polishing plant to purify condensate for re-use as HRSG feedwater
  - Electrical plant, including transformers and switch gear to supply electricity generated on site at suitable voltages for use in motors and lighting on the site
  - Access to site and within the site.
  - Other items as described in **Section 5.4.6**.

The stages of the proposed project are as follows:

- Construction stage, with sub stages and considerations as for the coal fired project option.
- Commissioning, following completion of construction, involving the quality assurance inspection and testing of all systems and components of the power station to ensure that they meet operational requirements, followed by commencement of operations.
- Operation, as described in **Sections 5.4.2** to **5.4.7**
- Decommissioning, which would occur at the end of the life of the power station.

### 5.3.2 Gas Supply and Handling

Gas would be supplied to Bayswater B via a spur pipeline (approximately 18 km long) from the approved QHGP which would be situated to the north east of the Bayswater B site (**Figure 5-5**). The spur pipeline is proposed to run from the power station site to the north east towards the ARCU, and then continue north-northeast before connecting with the QHGP near Beggary Creek Road. Gas would need to be able to be delivered to proposed project site 365 days per year. A gas fired power station at Bayswater B would require approximately 340 TJ per day or 112 PJ per year of natural gas. (Refer to **Chapter 3 Alternatives - Section 3.5** for a full discussion of fuel source options, selection criteria and rationale for the selected gas fuel option.)

Gas would be piped to a gas receival station incorporating metering, regulation of gas pressure and conditioning of gas (warming). The gas would then enter the compressor station (depending on pipeline supply pressure and gas turbine requirements) before being supplied to each gas turbine. As gas would be delivered directly into the process units, no storage of gas would be required on site.

### 5.3.3 Main Plant Operation

Each of the five CCGT units would include a gas turbine – steam turbine – generator enclosure with air inlet filters (approximately 40 m x 8 m x 18 m high), heat recovery steam generator and air cooled condenser. Stacks and various other items of plant are also required for operation of a CCGT power station. These components are discussed below. Refer also to **Figure 5.4** (Gas Fired Process).

**Gas Turbine**

The gas turbine comprises compressor, combustion and power turbine stages. Ambient air is drawn into the gas turbine through the inlet filters by the compressor stage, which supplies high pressure air to the combustion stage. The gas fuel and high pressure air are then supplied to the gas turbine's low-$NO_x$ burners in the combustion chambers. Combustion of fuel gas occurs, resulting in hot gases that pass through the power turbine stage, rotating the shaft, producing mechanical energy to drive the electrical generator as well as the compressor stage.

Gas turbine performance relies on the mass flow of air, however during hot periods, lower air density reduces output and performance. In order to offset performance degradation of gas turbines during hot periods, spray systems for cooling the intake air cooling system may also be installed.

The primary pollutants from gas turbine engines are nitrogen oxides ($NO_x$), carbon monoxide (CO), and to a lesser extent, volatile organic compounds (VOC's). As an emissions control measure to control the formation of $NO_x$, low- $NO_x$ combustion burners would be employed while carbon monoxide and volatile organic compound emissions from incomplete fuel combustion are minimised by normal maintenance management.

**Heat Recovery Steam Generator**

The exhaust from the gas turbines has significant heat energy which is recovered by the HRSG to produce superheated steam.

Each HRSG would be some 45 m x 14 m x 22 m high and would consist three sets of three major components – the economiser, evaporator and superheater. The economiser is a heat exchange device which initially heats the feedwater using exhaust heat. The steam drum and evaporator then convert the heated water into steam. This steam passes through the superheater to raise the temperature past the saturation point, converting saturated steam into dry superheated steam for use in the steam turbines.

A triple pressure reheat HRSG is planned for Bayswater B, which would consist of three sections: a LP (low pressure) section, a reheat/IP (intermediate pressure) section, and an HP (high pressure) section. Each section would have an economiser, evaporator and superheater.

After passing through the HRSG, the cooled gases would be discharged to the atmosphere via the stack, while the steam is used to drive the condensing steam turbine, which drives the electrical generator.

**Steam Turbine**

The steam turbine extracts thermal energy from the steam and converts it into rotary motion. The HP superheated steam is passed through the HP stage of the steam turbine, with the exhaust returned to the HRSG. The reheated steam is combined with the IP steam and supplied to the IP stage of the turbine, which in turn supplies the LP turbine. LP steam from the HRSG is also supplied to LP turbine.

The steam turbine drives the generator via direct coupling (i.e. a direct drive system) which adds to the mechanical energy already provided to the generator by the gas turbines, creating additional electricity.

After passing through the LP steam turbines, the steam exits to the air cooled condensers, discussed below. The generated electricity is transferred to the transmission infrastructure, discussed in **Section 5.3.5**.

**Generator**

It is proposed that the generators would be driven by the gas turbine and steam turbine in a single shaft arrangement. Generators would have a voltage of about 19.5kV depending on the manufacturer and would link into transmission infrastructure as discussed in **Section 5.4.5**. Separate generators for the gas turbine and steam turbine may also be used.

**Air Cooled Condensers**

Low energy steam exhausting from the steam turbine is directed to ACC, where it is cooled and condensed back into water. Each of the five ACC units would comprise of some 15 cells with overall dimensions of around 40 m x 66 m x 38 m high. The condensed water would be pumped back to be re-used in the HRSG.

As for the coal fired option, a dry ACC with spray cooling is the preferred option. Refer to **Section 5.3.3** – Air Cooled Condensers.

**Stacks**

The cooled exhaust gases from the HRSG would be discharged via five wake-free stacks.

Each combined cycle unit would have a stack some 55 metres high each with a diameter of approximately 7 metres. The stacks would be the highest part of the power station infrastructure.

**Other Plant**

*Chemical Dosing Plant*

The chemical dosing plant for the gas fired power station would be largely the same as for the coal fired option, with the exception that for the gas fired option, phosphate dosing of feedwater may be required for water chemistry control depending on the manufacturer of the HRSG. Refer to **Section 5.3.3**.

*Condensate Polishing and Regeneration Plant*

The condensate polishing plant would remove impurities from the condensate as for the coal power station option. The resin regeneration plant would also operate as for the coal fired option. Refer to **Section 5.3.3**.

*Fire Protection Systems*

Fire protection and fire fighting systems would be as for the coal fired option. Refer to **Section 5.3.3**.

*Hydrogen Plant*

The hydrogen plant would operate as for the coal fired option. Refer to **Section 5.3.3**.

*Carbon Dioxide*

Carbon dioxide use and storage would be as for the coal fired option. Refer to **Section 5.3.3**.

*Compressed Air Plant*

Compressed air use and storage would be as for the coal fired option. Refer to **Section 5.3.3**.

*Station Electrical Plant*

Station Electrical Plant is discussed in **Section 5.4.6 – Utilities and General Infrastructure**.

*Auxiliary Cooling System*

The auxiliary cooling system would be as for the coal fired option. Refer to **Section 5.3.3**.

### 5.3.4 Emissions Control and Sustainability

**CCGT technology**

It is proposed to use CCGT technology, utilising F Class Gas Turbines and unfired triple-pressure reheat HRSG to maximise plant thermal efficiency and minimise greenhouse emissions per unit of energy produced. The benefit of CCGT is that the maximum energy is derived from the gas fuel source due to the amalgamation of a gas turbine and a heat recovery steam generator combined with a steam turbine in each unit.

**Low $NO_x$ Burners**

As an emissions control measure to control the formation of $NO_x$, low-$NO_x$ combustion burners would be employed. Refer to **Section 5.3.4** for further details.

**Dry Cooling**

The use of dry cooling requires some 2 GL p.a. of water compared to around 11 GL p.a. for wet cooling. This has significant benefits to the local region in terms of both landowner and environmental uses of water.

**Carbon Capture Readiness**

Carbon capture readiness employing PCCC ready design would be incorporated at Bayswater B. An area of 4 ha would be allocated on the site to allow for PCCC if and when it becomes available. The process for the gas fired project is currently anticipated to be similar to that for the coal power station option. Refer to **Section 5.3.4** for further details.

### 5.3.5 Transmission Infrastructure

The transmission plant would include a 500 kV transmission switchyard, generator circuit breaker and transformer yards, as outlined below. Each of the five generators would be connected to a generator circuit breaker, which in turn is connected to step-up voltage transformers and then to the 500 kV transmission switchyard.

**Generator Circuit Breaker and Transformer Yards**

For the gas fired option, the generators would generate electricity at typically 19,500 volts (19.5 kV). High-voltage generator circuit breakers allow the passage of continuous high electrical currents, but interrupt the current by separating two contacts in order to protect the generator.

After passing through the generator circuit breakers, electricity would enter the transformers. The transformers increase the voltage of generated electricity from 19.5 kV to 500 kV before it enters the electricity transmission system for distribution to consumers.

**Transmission Switchyard**

The proposed Bayswater B project would be connected to the network via the 500 kV transmission system. Connection to 500 kV transmission lines would be via a new 500 kV transmission switchyard developed as part of the proposed Bayswater B project.

**Transmission Lines**

The 500 kV switchyard would connect to the existing dual (double circuit) 500 kV transmission lines 73 and 74 which pass the proposed Bayswater B site.

### 5.3.6 Utilities and General Infrastructure

**Water Management**

Bayswater B would incorporate several water systems related to handling and treating water and wastewater streams, including raw water and domestic water supply, stormwater, contaminated water and chemical drains, sewage and water recycling systems.

Sufficient water resource exist within MacGen's existing entitlements and future water purchases to supply water demand for the proposed Bayswater B gas fired option if it is dry cooled. Refer to **Chapter 11** for more detail.

*Raw Water Supply*

Raw water supply for the gas power station would be as for the coal fired option. Refer to **Section 5.3.6**.

*Filtered Water System*

The filtered water system would be as for the coal fired option. Refer to **Section 5.3.6**.

*Domestic Water Supply*

The domestic water system would be as for the coal fired option. Refer to **Section 5.3.6**.

*Demineralised Water Supply*

The demineralised water supply would be as for the coal fired t option. Refer to **Section 5.3.6**.

*Condensate Polishing and Regeneration Plant*

The condensate polishing and regeneration plant would be as for the coal fired option. Refer to **Section 5.3.3 and 5.3.6**.

*Stormwater and 'Dirty Drains'*

Stormwater from roads and other hard surfaces which may contain dust or other contaminants would be directed via 'dirty drains' to a First Flush Pond where a plate separator would remove contaminants. The water may then be discharged via the detention pond to Plashett Dam.  Alternatively it may be reused on site if required as part of plant processes.

*Contaminated Water Drains*

Contaminated water drains would be as for the coal fired option. Refer to **Section 5.3.6**.

*Chemical Drains*

Drains would be installed for facilities producing wastewater which may contain hazardous chemicals such as the polisher regeneration plant, as well as washdown water and stormwater from bunded chemical storage areas.  Chemical wastewater would be neutralised and then collected in closed chemical drains prior to being transported via truck or pipe to Bayswater for further treatment and reuse as applicable.

*Sewage Treatment*

Sewage would be treated at a new dedicated sewage treatment plant installed as part of the proposed Bayswater B project.  The treated effluent would be discharged via the closed chemical drains system.

*Auxiliary Cooling Tower Blowdown*

The blowdown from the wet cooling tower installed for the auxiliary cooling system would have increased concentration of salts and contaminants.  Due to the small quantities of wastewater involved, this wastewater would be treated and discharged via the chemical drains system as above.

**Electrical Plant**

Electrical plant / auxiliary power supplies would be required on site to power motors and lighting, using electricity generated on site.  Unit and station electrical plant would consist of 500kV/11kV station transformers, 19.5 kV/11 kV unit transformers,  11 kV/3.3 kV and 3.3 kV/415 V auxiliary transformers, medium voltage (11 kV and 3.3 kV) switchgear, low voltage (415 V) switchgear, all related control, protection and metering and direct current systems.

Electrical plant for the gas power station would generally be the same as for the coal fired option (see **Section 5.3.6**), except that there would be fewer high capacity motors to be powered in a gas power station (i.e. only air compressors).

**Access**

The majority of construction supplies are likely to be delivered to the site via road. Ongoing access to and around the site would be required during operational stages.

Roads would be required to be constructed to access the proposed Bayswater B project site from the Bayswater River Road. Sealed roads would be provided for the main access road to the site as well as in and around the power station. A short road and bridge would also be required between the main power station site and the switchyard. The gas spur pipeline is unlikely to require a permanent access route along its length. Refer to **Chapter 21 Traffic and Transport** for further detail.

Wherever possible, road construction for Bayswater B would utilise bottom ash (coarse furnace ash) from Bayswater as a road base. Bottom ash is a very consistent by-product, similar to fine gravel.

### 5.3.7 Use of Existing Infrastructure

Where possible, existing infrastructure is to be used for the project unless there is a strategic benefit in supplying new infrastructure. Existing infrastructure to be used is summarised in **Table 5.2** below. All other infrastructure is likely to be specific to the new project.

**Table 5-2: Use of Existing Infrastructure – Gas Fired Option**

| Requirement | Commentary |
|---|---|
| Access road | Existing access from New England Highway to Bayswater to be used (a new access road would be required from Bayswater site to Bayswater B). Refer to **Chapter 21 Traffic and Transport** for more detail. |
| Water supply | Water for dry cooling is available within existing Bayswater/Liddell entitlements. Existing Bayswater water infrastructure (i.e. dams) can also be utilised. Refer to **Chapter 11 Water** for more detail. |
| Transmission lines | Existing transmission lines to be used with minor re-alignment |

### 5.3.8 Gas Fired Plant Operating Parameters

The technical assessments in this EA have been based on the following operating parameters:

- Plant operating duty: 92% annual capacity factor
- Electrical energy: 15,602 GWh per annum sent out
- Thermal efficiency: 50% (HHV) sent out
- Fuel consumption: 112.5 PJ per annum
- Natural gas calorific energy: 51.24 MJ/kg

### 5.3.9 Construction

**Site Establishment**

Before other works commence, construction of the access road would be required to provide vehicular access to the proposed Bayswater B site from the sealed road at Bayswater Power Station

Site preparation involves clearing and levelling the main power plant site and surrounding areas as applicable (for lay-down areas, etc), fencing, establishing drainage systems and installation of facilities for underground services ready for erection of the equipment. The establishment of a concrete batching plant and facilities for processing fill materials would also occur ready for first concrete foundations.

Based on preliminary assessments, summed the power plant would be on a single level bench (elevation 144 m). This level reflects balancing of cut and fill quantities in the proposed plant location away from Saltwater Creek. The volumes of cut and fill would be minimised where possible.

The construction lay-down area would be approximately three times the size of the eventual power station footprint, due to the large components of plant requiring assembly in addition to areas for cranes and other large construction equipment to operate from.

**Site Activities**

*Excavation and construction of foundations and underground services*

Excavation and construction of foundations and underground services would be as for the coal fired option. Refer to **Section 5.3.8**.

*Plant buildings and structures*

Once the foundations are complete, erection of plant buildings and structures would commence. The basic "shell" of the building would be completed, followed by installation of equipment into the building. The construction of the building would then be completed.

Major structures would also be constructed early in the programme, followed by other service buildings such as the water treatment plant and air cooled condensers.

*On-site pre-assembly of component parts and installation*

Delivery and pre-assembly of equipment and components would be as for the coal fired option. Refer to **Section 5.3.8**.

*Equipment installation (mechanical, electrical, controls)*

Equipment installation would be as for the coal fired option. Refer to **Section 5.3.8**.

**Construction Staging**

The following indicative program of works is anticipated for construction of the proposed gas fired project:

- Detailed design – 18 months
- Procurement, manufacture and delivery of components – 21 months
- Site preparation – 3 months
- Civil works and foundations – 20 months
- Equipment assembly and erection – 22 months
- Commissioning and functional testing – 14 months

With the overlapping of various stages, the total construction period is therefore in the order of 36 to 38 months (approximately three years). The construction timeline is indicatively proposed as follows: from zero staff at commencement, staff numbers would progressively 'ramp up', increasing lineally to a maximum of approximately 800 staff by month 14, staying at that level to month 24, then ramping down again to zero staff at completion in month 38. Refer to **Figure 5.6**.

**Construction Employees**

As for the coal fired option, accommodation for construction employees would be required during the construction period of the gas fired project. Refer to **Section 5.3.6** and **Chapter 18 Socio-Economic**.

**Construction Access, Traffic and Transport**

As for the coal fired option, the construction phase of the gas fired project would generate various truck, car and/or bus traffic. Access to site would be via the existing road to Bayswater Power Station and a new road constructed to the proposed project site. Refer to **Section 5.3.6** and **Chapter 21 Traffic and Transport** for more detail.

**Construction Environmental Management**

The initial selection of a site to locate the proposed project took into account various environmental issues. The site was selected within MacGen's landholdings based on being relatively level and clear of native vegetation, having been used for grazing over recent years, and not likely to have significant archaeology or heritage constraints. The location of the proposed project, having regard to the site selected, would therefore minimise the extent of impacts.

The construction phase of the project would impact upon a larger footprint at the site than would the final operating power station, due to the construction laydown areas required. This has been considered as part of the EA. **Chapter 24 Environmental Management** of this EA deals with management of specific construction-related environmental impacts in more detail.

### 5.3.10 Commissioning

The commissioning process for the gas fired option would be similar to that for the coal fired option. Refer to **Section 5.3.9**.

### 5.3.11 Decommissioning

The proposed project would have an expected life of not less than 30 years, but it may be possible to extend the life of the project if deemed appropriate due to new technology. At the end of its service life, Bayswater B Power Station may be closed. Closure and decommissioning works for a gas fired power station would be similar to those for the coal fired option. Refer to **Section 5.3.10**.

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AECOM

SITE LAYOUT (COAL)

Environmental Assessment

Bayswater B Power Station

Figure 5.1

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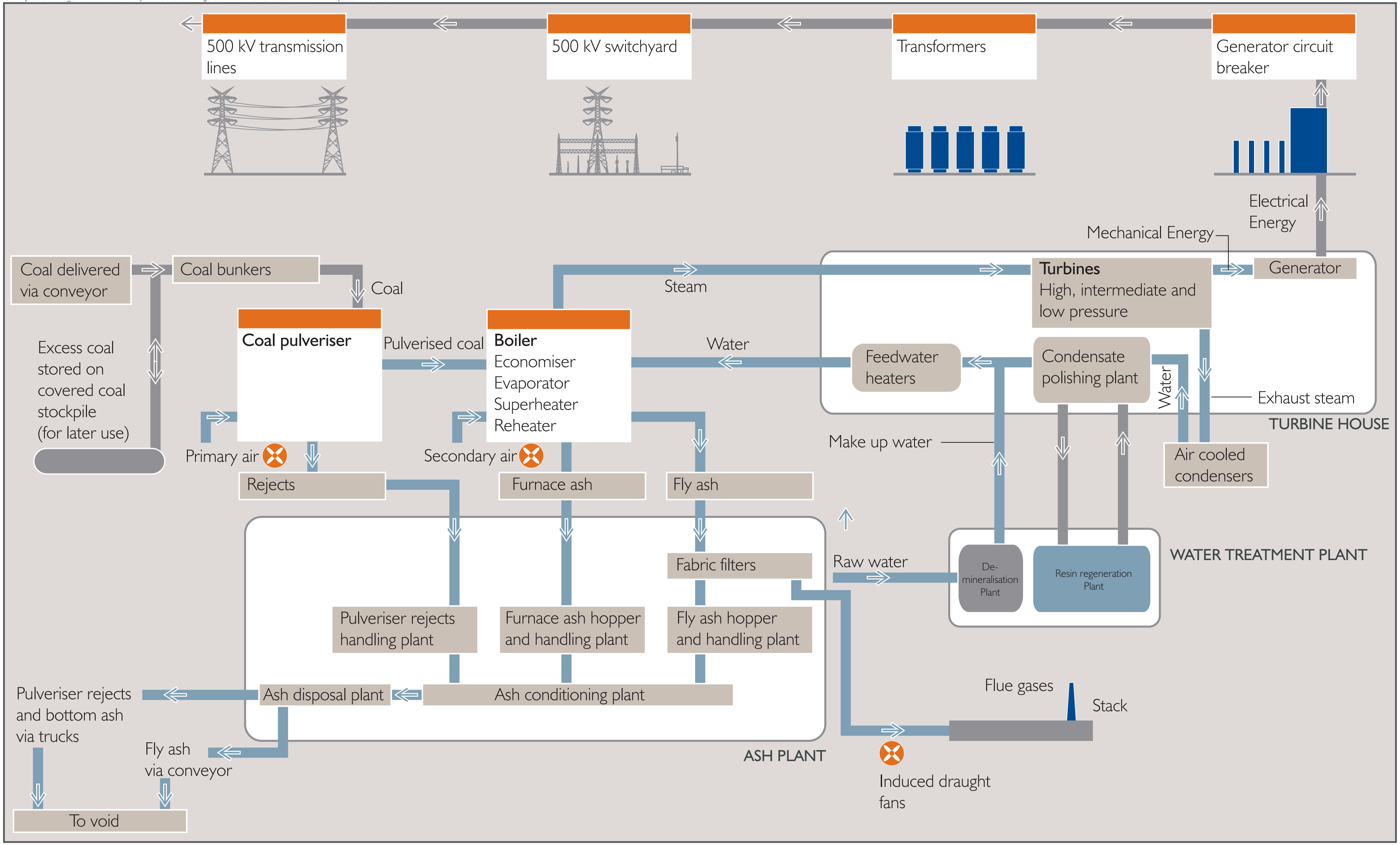




PROCESS DESCRIPTION (COAL)

Environmental Assessment

Bayswater B Power Station

Figure 5.2

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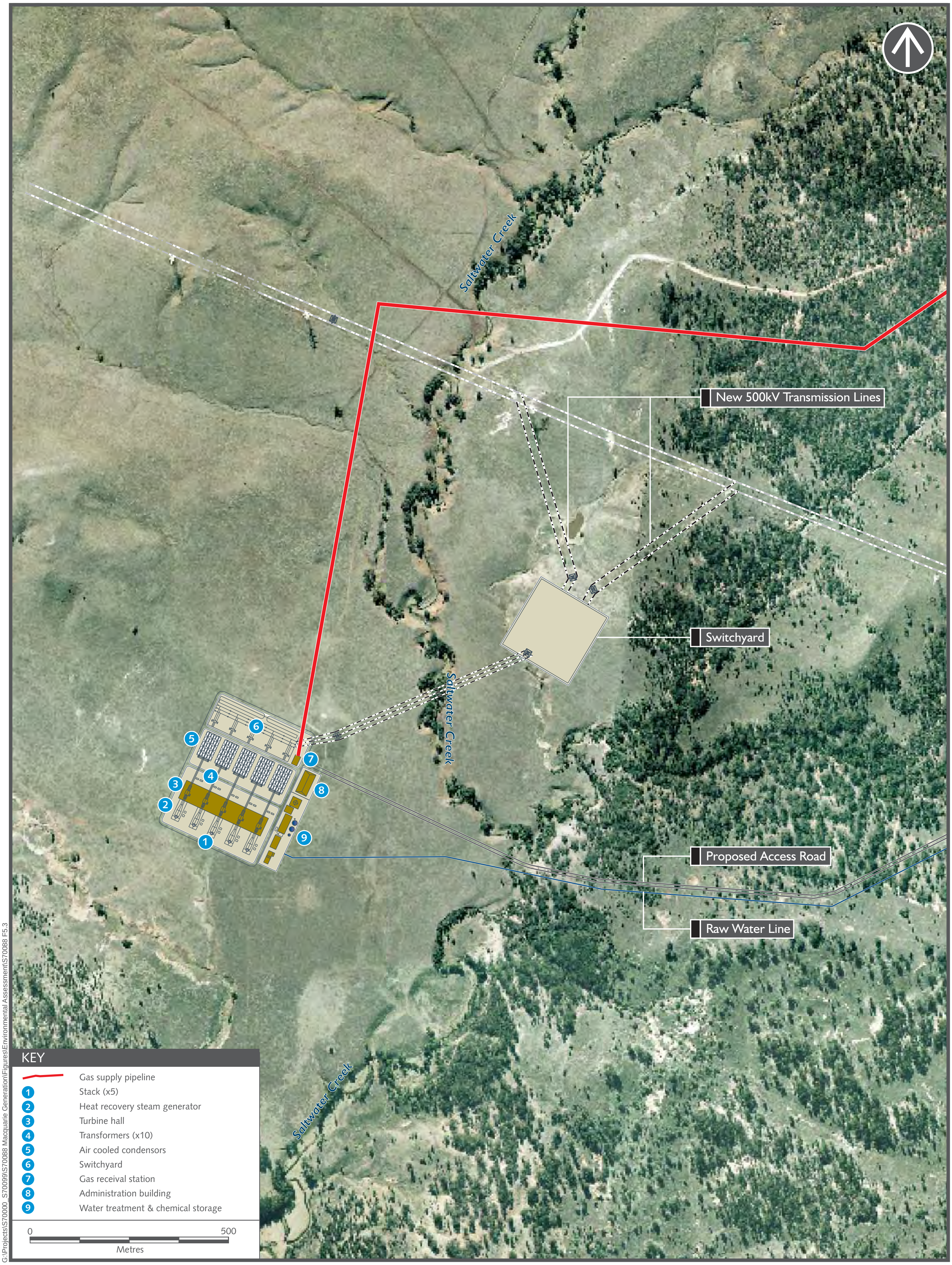


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AECOM

SITE LAYOUT (GAS)

Environmental Assessment

Bayswater B Power Station

Figure 5.3

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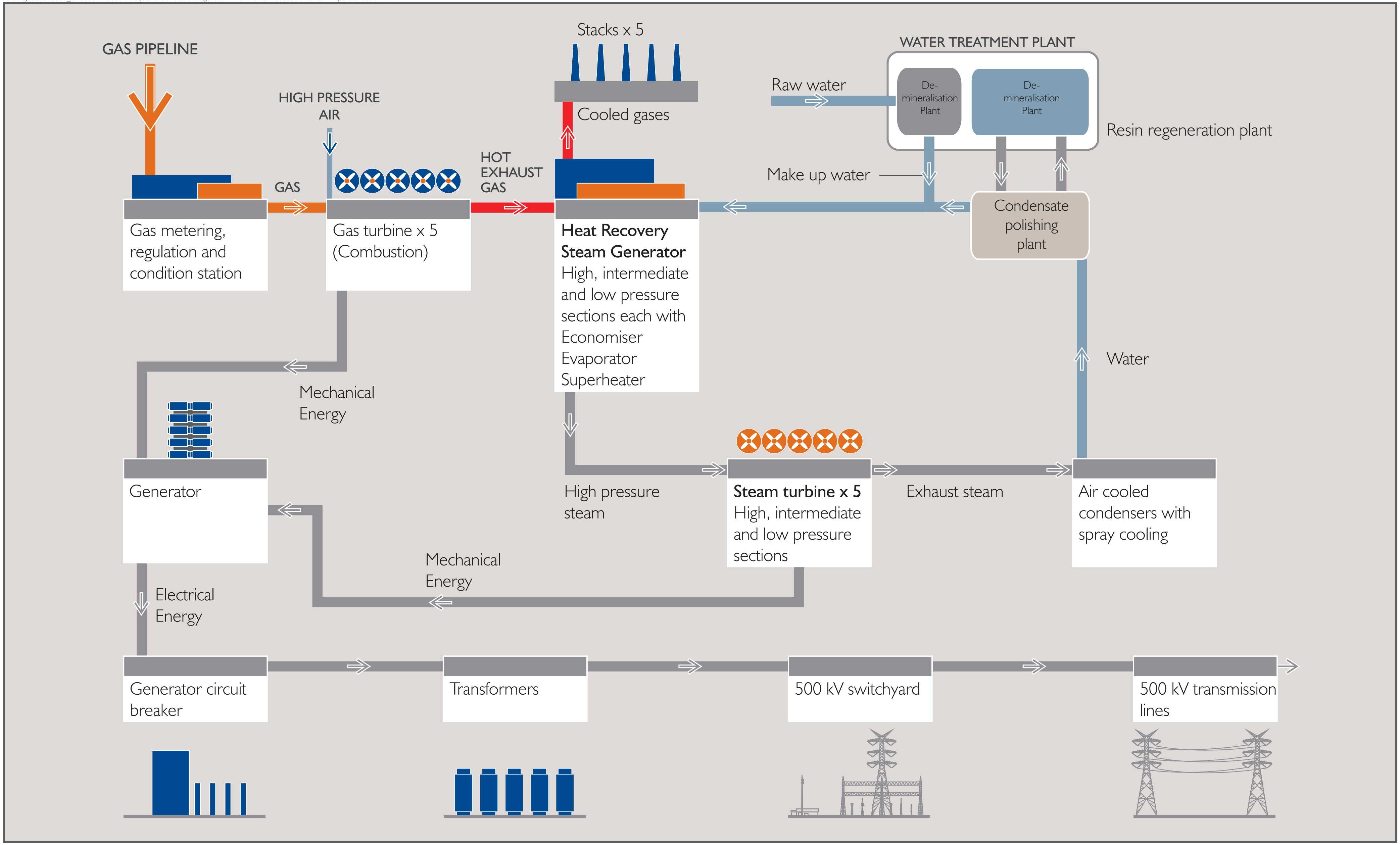


AECOM

PROCESS DESCRIPTION (GAS)
Environmental Assessment
Bayswater B Power Station

Figure 5.4

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AECOM

PROPOSED GAS PIPELINE ALIGNMENT

Environmental Assessment

Bayswater B Power Station

Figure 5.5

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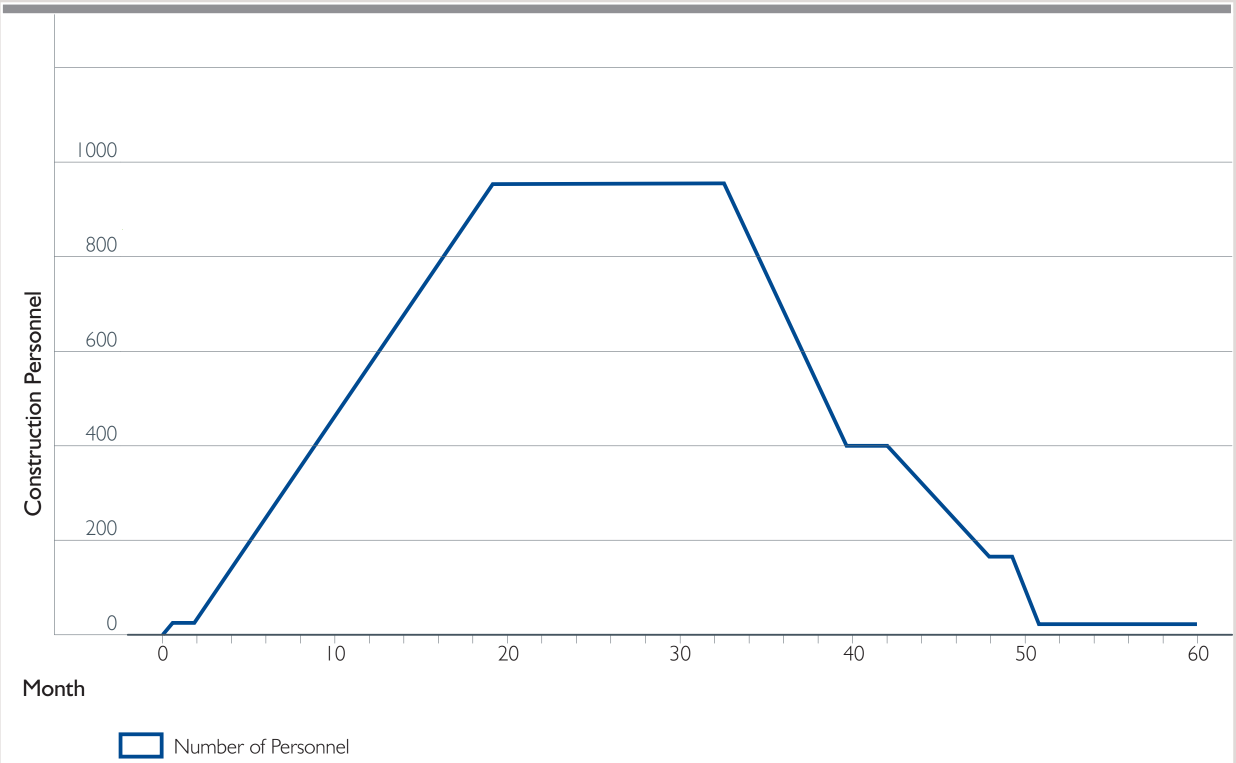


**Figure 5.6**
Indicative Construction Staging for Coal Fired Power Station
(Data Source: AECOM, 2009)

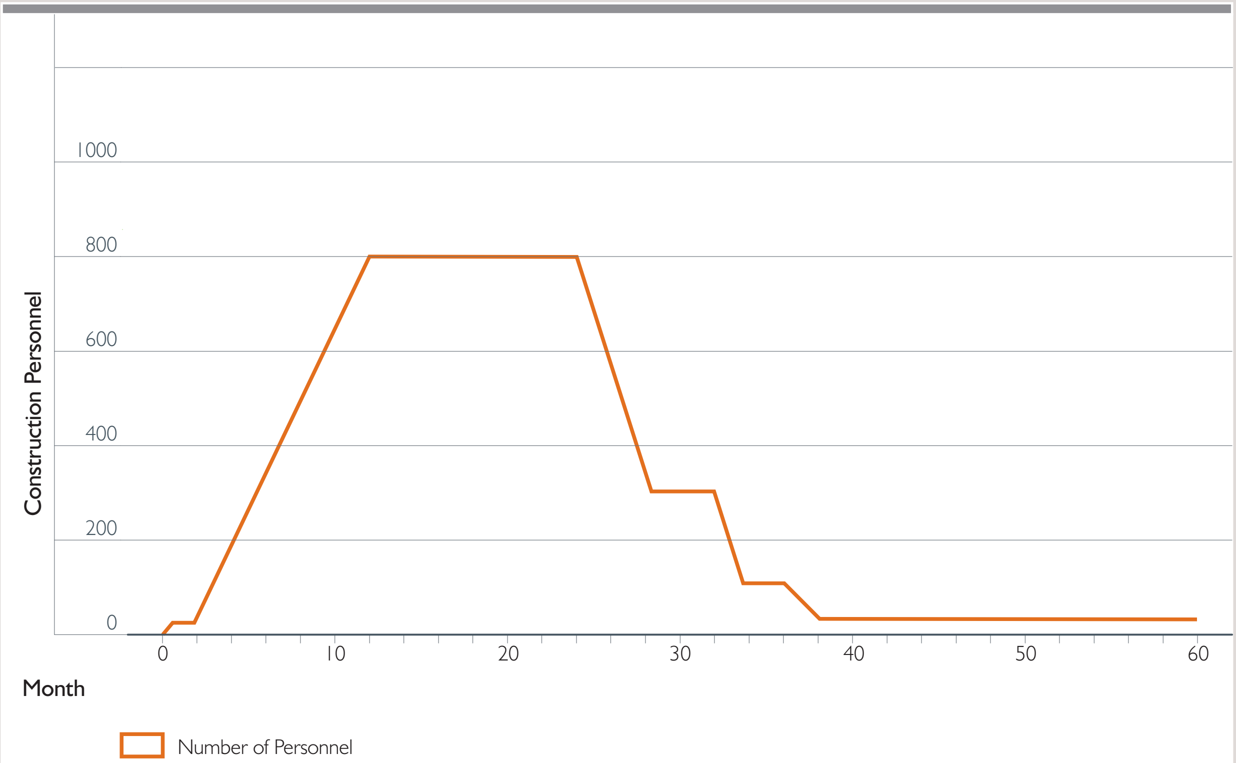


**Figure 5.7**
Indicative Construction Staging for Gas Fired Power Station
(Data Source: AECOM, 2009)

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