6. Existing environment and risk analysis

This chapter provides a description of the existing environment and relevant background information for the impact assessment provided in Chapters 7 and 8.

6.1 Existing environment

6.1.1 Land use and tenure

The proposed power station is located within the Tallawarra Lands site, on the south western shore of Lake Illawarra, approximately 13 kilometres southwest of Wollongong. The land uses within the wider study area include open space, industrial, commercial, rural and residential. Industrial development is located at Albion Park and Yallah, whilst commercial centres are at Dapto, Albion Park, Oak Flats, Berkeley and Kemblawarra, with smaller areas at Windang and Blackbutt. The industrial areas at Albion Park and Yallah are of higher density than those currently at Tallawarra Lands. The development that surrounds most of Lake Illawarra is mixed industrial and residential development, with existing and newly developing residential areas to the north and south of the proposed power station. Koonawarra (and Kanahooka) are the closest existing residential suburbs to the proposed power station site, located to the north (refer to **Figure 6-1a**).

The proposed 'West Dapto Release Area' is located approximately 1 kilometre from the western boundary of the Tallawarra Lands site, and some 3 kilometres from the power station site, extending in a northern and western direction. The new residential area of Haywards Bay is located along the southern boundary of the Tallawarra Lands site. Mount Brown Reserve and a number of other smaller public reserves are located to the north and northwest of the proposed power station site. The Southern Freeway and Princes Highway run along the western boundary.

The Tallawarra site and surrounding Tallawarra Lands (a total area of 565 hectares) were purchased by TRUenergy in April 2003. The site was previously used for a coal-fired power station, which was decommissioned in 1989. As a result of its previous uses, the majority of the Tallawarra Lands site is vacant and has been cleared of vegetation. Currently, cattle grazing and other rural activities constitute the primary land use, occupying nearly half of the site. Three ash settling ponds, which were used by the former coal-fired power station, are located to the south of the proposed power station site. According to the Wollongong Local Environmental Plan 1990, the Tallawarra Lands site is predominantly zoned 5(a) Special Uses, although areas of 7(a) Special Environmental Protection, 7(b) Environmental Protection Conservation and 6(b) Private Recreation exist to the north and south of the proposed power station site. **Figure 6-1a** shows the existing land use zoning of the Tallawarra Lands site and surrounds.

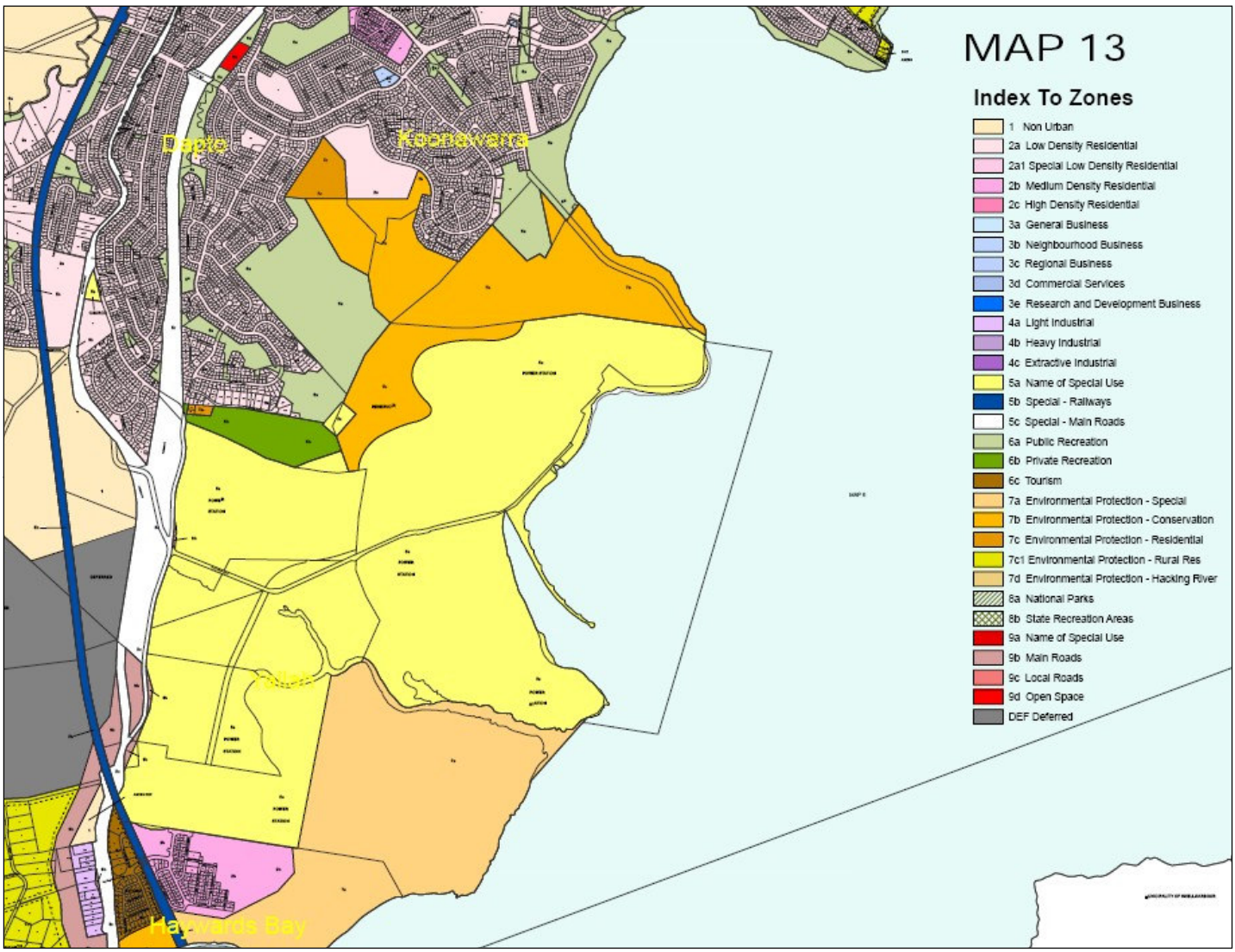

Figure 6-1a - Land Zoning

Source: Wollongong LEP 1990 Map (extract from Map 13)

EN02239 - Tallawarra Stage B Power Station

February 17, 2009
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TRUenergy has applied for rezoning of the Tallawarra Lands site to enable the 550 hectares of surplus land to be redeveloped to provide a mix of industrial, commercial, residential and community/conservation uses.

As part of the rezoning of the Tallawarra Lands site, a buffer zone has been established between the proposed power station and the surrounding land uses in order to minimise potential land use conflicts. The draft LEP is shown in **Figure 6-1b**. The buffer zones around the power station site extend well beyond the fenced area such that no industrial, residential or commercial developments can be established within a specific distance of the power station site. The buffer zone allows for a distance of approximately 145 metres from the power station site to the proposed residential zoning to the west and approximately 185 metres to the proposed residential zoning to the north.

The foreshore area adjacent to the former coal-fired power station and extending to the northern Tallawarra Lands boundary has been dedicated to the Lake Illawarra Authority, is accessible by the general public and has provided residents in the area with direct access to Lake Illawarra. Access to Yallah Bay is now provided via Yallah Bay Road.

Lake Illawarra provides important recreational uses for the local community, as well as supporting recreational and commercial fishing industries. Recreational uses within Lake Illawarra include swimming and other aquatic activities, such as wind surfing, sailing, rowing and water skiing.

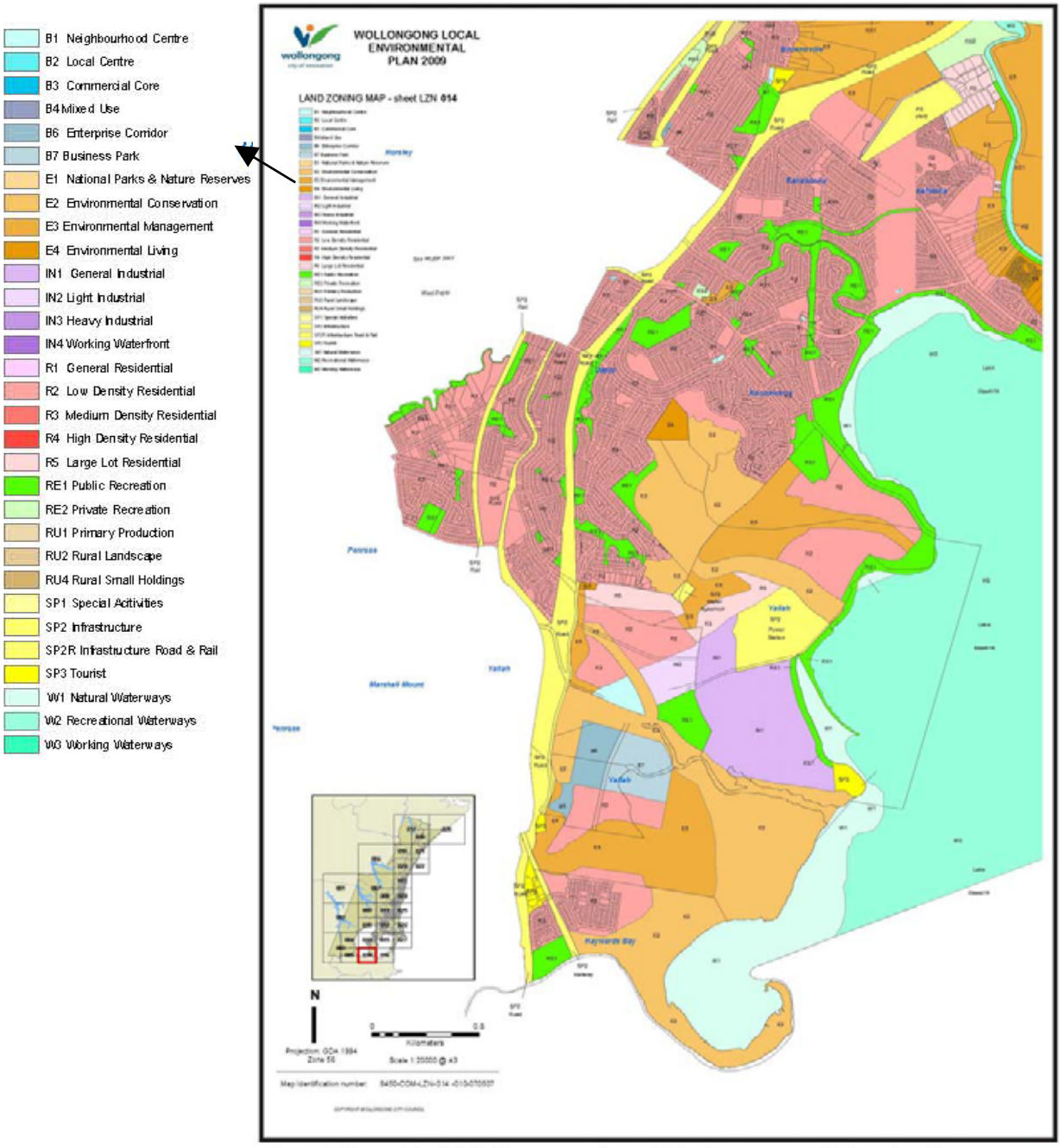
In addition, the Tallawarra Lands site is used by a local bird watching group. The Tallawarra Stage B project will not result in any reduction or alteration of the existing foreshore access arrangements in the vicinity of the site. Increased public use is anticipated with the development of the Tallawarra Lands project.

6.1.2 Air quality and climate

Climate

The climate of the Illawarra region is described as temperate, with warm summers and cool winters. The region is located on a narrow coastal strip with a steep escarpment to the west, the width of the coastal strip increases from north to south until it terminates in a ridge of hills running from the escarpment to the sea. The region's climate is strongly influenced by its latitude, coastal location including Lake Illawarra and the escarpment to the west (DECC, 2007).As the significant topographic feature, the escarpment is a major influence on local meteorology and hence on air quality in the region. The escarpment can direct winds longitudinally along the coast, as well as create a decoupling effect on the winds above and below the escarpment. As a result, an inversion can form at the top of the escarpment, limiting the dispersion of pollutants in the Illawarra region (Hyde *et al.*, 1997).

- **Figure 6-1b Extract from Wollongong Draft LEP**

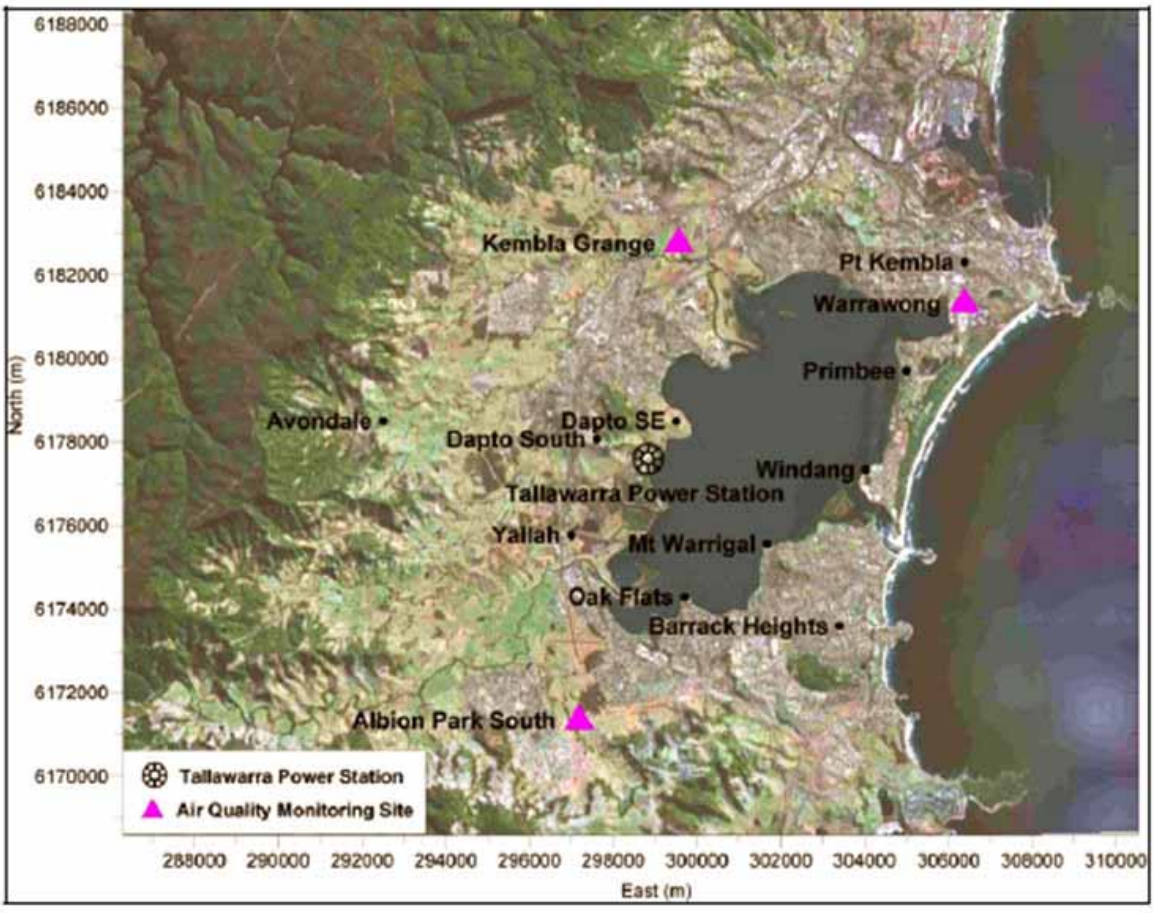


Extract from draft Wollongong Local Environmental Plan land zoning maps

Meteorological data have been obtained from the Bureau of Meteorology (BoM) for the Port Kembla, Wollongong and Kiama automatic weather stations (AWS). The closest AWS is located at Port Kembla, approximately 6km north-east of the Tallawarra Stage B power station site (**Figure 6-2**) and these data are the most relevant to the site. Readings at each AWS are automatically taken daily at 9am and 3pm. Mean 9am temperatures at Port Kembla weather station range between 12.4°C in July to 21.6°C in February. The 3pm mean temperature range is between 15.6°C in July to 22.9°C in February. Kiama and Wollongong experience very similar temperatures to Port Kembla. Rainfall data from the Port Kembla AWS shows that March is the wettest month of the year, receiving a mean monthly rainfall of 183.7mm, while the driest month of the year is September, recording a mean monthly rainfall of 55mm. The 9am and 3pm relative humidity recorded in the Illawarra region remains moderate throughout the year, although humidity is higher in the summer season. The 3pm relative humidity readings are generally slightly lower than the 9am readings throughout the year.

The Illawarra region is strongly influenced by sea breezes and the alignment of the western escarpment. On an annual basis, wind predominates from the west and north-west, although wind speed and direction is subject to seasonal variability. Wind direction is consistently from the west and north-west throughout autumn, winter and spring, although wind speed has notable variance. Autumn experiences lower intensity wind on average than winter and spring. Summer by contrast is a season with large variability in wind direction, experiencing more frequent wind from the north-east and south-east as well as westerly winds.

Meteorological data for the year 2002 from four DECC sites (Kembla Grange, Warrawong, Wollongong and Albion Park) were observed and compared with the wind data predicted by The Air Pollution Model (TAPM) at those sites. The 2002 meteorological data also provided input for modelling of local area annual average air pollution impacts. The year 2002 provides a conservative assessment due to the higher background air pollution concentrations recorded in the Illawarra region during that year.



Note: Wollongong air quality monitoring site is approximately 9km north-east of Kembla Grange.
Kiama weather station is approximately 12km south-south-east of Albion Park.

Figure 6-2 Air Quality Monitoring Sites

EN02239 - Tallawarra Stage B Power Station

July 22, 2008
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Wind data for the Tallawarra site have been predicted using TAPM. In terms of annual wind data at Tallawarra, TAPM predicted the following:

- an annual average wind speed of 2.5 m/s, with higher wind speeds reaching a maximum of 8.8 m/s from all directions;
- approximately 47 percent of winds between 2.1 m/s and 5.7 m/s;
- approximately 45 percent of winds less than 2.1 m/s;
- a dominant westerly flow with a frequency of about 52 percent, maybe due to the more open location of the site relative to the western escarpment; and
- other components, at approximately, 16 percent north-easterly, and south-easterly components at 13 percent.

In terms of seasonal variability, TAPM predicted:

- seasonal influence of easterly winds in spring and summer, with an effective dispersion of air pollution towards the southwest of the Tallawarra site in spring and summer; and
- seasonal influence of westerly winds in autumn and winter, with an effective dispersion of air pollution towards the east of the Tallawarra site in autumn and winter.

Air quality

The Illawarra has two dominant types of air pollution - photochemical smog and particulates. Ozone in the Illawarra region can occur as a result of photochemical smog produced from local emissions or from smog or precursors transported down the coast from the Sydney region (DECC, 2007). The major sources of air pollution in the Illawarra airshed include motor vehicles, iron and steel production and primary metallurgical works (NSW EPA, 2002). The sea breeze, generally north-easterly in direction, is the dominant meteorological influence on elevated concentrations of ozone in the region. This suggests that transport of pollutants from the Sydney region is the major contributor to elevated ozone concentrations in the Illawarra region, although it appears that most ozone events in the Illawarra occur as a result of the combined effect of these two factors (DECC, 2007).

The DECC conducts air quality monitoring at numerous sites in the Illawarra Region. Kembla Grange, located approximately 5.5 km north of the proposed Tallawarra Stage B power station, provides a representative indicator of background air quality in the vicinity of the proposed Stage B power station. The northerly location of Kembla Grange from the proposed Stage B development also provides a conservative treatment for background air quality transported from the Sydney airshed.

Annual average and maximum 1-hour NO_2 concentrations recorded at Kembla Grange were within the respective NSW DECC criteria of 62 µg/m^3 and 246 µg/m^3 during the period 2001 to 2005. Kembla Grange recorded a similar long-term pattern of air quality NO_2 concentrations, compared with the ambient air monitoring sites of Warrawong and Albion Park. Concentrations at Kembla Grange generally ranged between levels recorded at Warrawong and Albion Park.

On numerous occasions during the summer months of 2000 to 2005, O_3 concentrations in the Illawarra region have exceeded the NSW DECC criteria for the 1-hour average (214 µg/m^3) and the 4-hour average (171 µg/m^3). **Table 6-1** presents the peak concentrations and exceedances of the 1-hour and 4-hour average standards (DECC, 2007).

Table 6-1 Number of Exceedance Days of O_3 Criteria at Illawarra Sites (1994-2004)

Site	Number of Exceedance Days 1-Hour Criteria (10 pphm)	Maximum 1-Hour O_3 Concentration (pphm)	Number of Exceedance Days 4-Hour Criteria (8 pphm)	Maximum 4-Hour O_3 Concentration (pphm)
Wollongong	12	12	17	11
Kembla Grange	18	14	26	12
Warrawong	6	13	12	12
Albion Park	14	14	22	12
No. of Station Days	50		77	
No. of Distinct Days	30		40	

Source: DECC 2007

The National Environment Protection Measures (NEPM) goal for ozone is to maintain ozone concentrations below the standards (10 pphm for the one-hour and 8 pphm for the four-hour), with a goal that the maximum concentration is exceeded on no more than one day a year by 2008 for each standard (NEPC, 1998). During the period 1994 to 2005, the maximum number of exceedance-days in one year at one site was 5 days at Albion Park in 1997 for the one-hour standard and 6 days at Kembla Range in 1998 for the four-hour standard. Recent data for 2004 show exceedances of up to 3 days a year for both standards (DECC, 2007). Therefore, data indicates that the Illawarra region fails to comply with the NEPM goal of no more than one exceedance day a year at a specific site.

The potential air quality impacts and associated mitigation measures for an OCGT power station and CCGT power station are outlined in **Sections 7.1** and **8.1** respectively. The full air quality assessment is provided in **Appendix B.**

6.1.3 Noise environment

The existing noise environment in the vicinity of the proposed Tallawarra Stage B power station site is largely influenced by its proximity to Lake Illawarra, which is the main water body in the

Illawarra catchment area. The power station site is located within a relatively undeveloped area, on the western side of Lake Illawarra. The surrounding area has a large residential population, the majority of which would be classified as urban or suburban, with some rural residential properties located further from the coast. Across Lake Illawarra are the residential areas of Oak Flats, Mount Warrigal, Lake Illawarra and Windang. South and south-west of the site are the residential areas of Albion Park, Haywards Bay and Yallah. To the north of the site is the residential area of Koonawarra which continues to the west of the site and would be separated from the proposed Stage B power station by Mount Brown.

Local industry closely follows the Southern Freeway that runs west of the proposed Stage B power station site along the south coast and connects into the Princes Highway, providing the road connection between Wollongong and the south. The proximity of this important traffic route means that traffic noise is also a feature of the area for locations that are adjacent to or have a line of sight to the road network. Other noise sources include the BHP steel mill, which operates in Port Kembla, approximately 8.5 km to the north of the proposed plant. Due to the size of the steel mill and the fact that it operates 24 hours a day, it is audible as a low humming noise from some locations around Lake Illawarra during the quietest part of the night.

Noise monitoring

In accordance with NSW government requirements, it is necessary to conduct noise monitoring for the proposed project to enable appropriate criteria to be set with respect to the existing environment. In order to quantify the noise environment at residential locations near the Tallawarra Stage B power station, noise levels were measured using both attended and unattended monitoring methods. The measurements were undertaken in general accordance with the DECC Industrial Noise Policy (INP) (January 2000). The identification of noise sensitive receivers is taken from Table 2.1 of the INP, which list various types of receivers that may be considered to be sensitive to noise emissions from industrial sources.

A list of common descriptors used in the noise assessment (refer to **Sections 7.4** and **8.4**) includes:

- L_{A10} – the noise level exceeded for 10 percent of the 15 minute interval; this is commonly referred to as the average-maximum level;
- L_{A90} – the noise level exceeded for 90 percent of the 15 minute interval; this is commonly referred to as the background noise level and represents the quietest 90 seconds in a 15 minute period;
- L_{Aeq} – the noise level having the same energy as the time varying noise level over the 15 minute interval; and
- L_{Amax} maximum noise level measured at a given location over the 15 minute interval.

The locations for noise monitoring were selected based on their proximity to the proposed Tallawarra Stage B power station site, freedom from extraneous noise sources and the availability and willingness of the owners to have the noise monitors located on their property.

Table 6-2 lists the locations of the noise surveys while **Figure 6-3** shows the noise monitoring locations in relation to the Tallawarra site and the local area. In **Figure 6-3** the blue dots represent the unattended monitoring locations and the red circles indicate the location of the attended noise surveys.

Table 6-2 Unattended noise monitoring locations

ID	Address	Description
T1	Tallawarra Site South	Located in the south of the development site, near the wetlands area.
T2	Carlyle Street, Koonawarra	The properties on Carlyle Street are adjacent to the Tallawarra site to the east of the power station
T3	Tallawarra Site North	The monitoring site was located on the ridgeline to the north of the power station, within the Tallawarra Lands site.
T4	Wyndarra Way, Koonawarra	The monitoring site was located in the backyard of a property in the existing residential area to north of the Tallawarra site.

Attended monitoring was undertaken during a day and a night time period at three locations around the Tallawarra site. These locations were at or near the locations where unattended noise monitors were positioned. The monitoring locations inside the Tallawarra site did not have attended monitoring undertaken due to access restrictions during the night time. At the southern Talawarra monitoring site, however, attended monitoring was undertaken at the boundary of the Tallawarra site and Hayward's Bay residential development, which is considered to be representative of noise levels at the T1 location. Attended monitoring was undertaken over 15-minute intervals using a Bruel & Kjaer 2260 Type 1 Sound Level Meter. Weather conditions during the attended measurements were calm to light winds with clear skies and moderate temperatures. Results of attended monitoring and a description of the audible noise sources at the time of the survey are presented in **Table 6-3**.

During the night time measurements, background (L_{A90}) and minimum (L_{Amin}) noise levels were consistent between locations. The L_{Aeq} levels were also closely matched at Wyndarra Way and Carlyle Street, both having similar noise environments during the survey period. The background and minimum noise level at Haywards Bay were comparable, whilst the L_{Aeq} noise level was affected by road traffic noise and loud events such as the movement of freight trains.

Legend

- Tallawarra Land Border
- A1-A3 - Attended Monitoring
- T1-T4 - Un-attended Monitoring

Source: Aerial supplied by TRUenergy, Topographic data by Streetworks

0 250 500
Metres

1:18,000 @ A4

SKM

Figure 6-3 - Noise Monitoring Locations

Projection: GDA94 MGA Zone 56

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February 24, 2009
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The Carlyle Street location may also be affected by train noise, although no train movements were observed during the monitoring at this location. At both Carlyle Street and Haywards Bay locations, the background noise levels show a significant increase between night and day measurements, due to road traffic noise from the Southern Freeway and the Princes Highway. At Wyndarra Way, the minor variation between the daytime and night time background noise levels indicates that the noise levels are not greatly affected by traffic noise and other influences during the daytime.

- **Table 6-3 Attended monitoring results**

Location	Time (24hr)	Sound pressure levels (dB(A))					Comments
		L_{Aeq}	L_{A10}	L_{A90}	L_{Amax}	L_{Amin}	
Wyndarra Way (A3)	23:15	42	43	40	63	37	The night time noise levels in this area are generally dominated by the steady background level from BHP. Other influences include road traffic noise and animals such as dogs and birds.
Carlyle Street (A2)	23:50	43	44	40	60	35	Road traffic noise was variable at this location depending on the direction of the wind. Traffic noise was dominant during some of the monitoring period. Port Kembla (BHP) was possibly audible but not dominant. Wildlife (crickets) was a noted contribution to noise level.
Haywards Bay (A1)	00:18	51	54	40	66	36	Road traffic noise was the dominant noise source. Wildlife in the wetland area was also a major contributor to the measured noise levels. A freight train movement provided significant transient noise source at this location. BHP was not clearly audible, even during quiet periods.
Wyndarra Way (A3)	09:00	48	50	39	66	36	Local wildlife, birds and dogs. Traffic noise, planes, BHP. General noise sources such as children playing and some construction (distant) activity on the nearby hillside to the south.
Carlyle Street (A2)	09:30	48	50	46	57	42	Road traffic was the dominant noise source. Some animal noise (birds, dogs). Breeze was gusty and moderate from the north east during this measurement.
Haywards Bay (A1)	10:05	56	58	51	72	48	Some earth moving equipment was active on the eastern part of the development. The dominant noise source was traffic on the Southern Freeway/Princes Highway. Occasional light plane activity. Wind was gusty from the NNE during the measurement.

Unattended noise monitoring was undertaken for a total of seven days between 2 March and 15 March 2007, using automatic noise loggers. The loggers were set to record a range of noise indices at 15 minute intervals. These data were used to determine the median values for the L_{Aeq}, L_{A90}, L_{A10} and L_{A1} descriptors for the day, evening and night time period.

The Rating Background Level (RBL) is the overall, single-figure, background level representing each of the day, evening or night assessment periods over the whole monitoring period. This is the level used for assessment purposes. It is defined as the median value of all the day, evening or night assessment background levels over the monitoring period. A summary of the noise data is shown in **Table 6-4.**

- **Table 6-4 Results of Unattended Noise Monitoring**

Location	Rating Background Level (RBL)			L_{Aeq} over the assessment period		
	Day 07:00 to 18:00	Evening 18:00 to 22:00	Night 22:00 to 07:00	Day 07:00 to 18:00	Evening 18:00 to 22:00	Night 22:00 to 07:00
Tallawarra Site South (T1)	36 dB(A)	36 dB(A)	39 dB(A)	49 dB(A)	48 dB(A)	47 dB(A)
Carlyle Street, Koonawarra (T2)	41 dB(A)	43 dB(A)	38 dB(A)	45 dB(A)	48 dB(A)	44 dB(A)
Tallawarra Site North (T3)	34 dB(A)	33 dB(A)	31 dB(A)	46 dB(A)	40 dB(A)	37 dB(A)
Wyndarra Way, Koonawarra (T4)	34 dB(A)	36 dB(A)	33 dB(A)	49 dB(A)	47 dB(A)	38 dB(A)

Monitoring locations at Tallawarra Site South and Carlyle Street are exposed to road and rail traffic and therefore have a greater noise influence from these sources than the other two monitoring locations. This is shown in the higher overall background noise levels. Tallawarra Site North provides a good measure of general noise in the area and is less affected by temporal variations in the noise environment, such as increased local traffic movements and other activity during the evening period.

The noise data at Tallawarra Site South, Carlyle Street and Wyndarra Way in **Table 6-4** were used for the setting of criteria at existing receiver locations. The Tallawarra Site North is representative of a greenfield site within the Tallawarra Lands and, although there are no existing dwellings within the Tallawarra Lands, the setting of noise criteria at this location should aim to meet the INP guidelines for future development. It should be recognised that the criteria at Tallawarra Site North is nominal and while the project should aim to meet these criteria within the Lands boundary, residential buildings may also require design considerations in some areas.

6.1.4 Waterways and water quality

Drainage

The Tallawarra site is located along the eastern edge of Lake Illawarra and is intersected by three watercourses: Duck Creek, Wollingurry Creek and Yallah Creek (**Figure 6-4**). Duck Creek drains a total area of 20 km^2, passing to the north of the former Ash dam 3 and to the south of the former Ash dams 1 and 2, to discharge into Nijong Bay, Lake Illawarra. Wollingurry Creek is a tributary draining the south of the site, which joins Duck Creek 1.5 km upstream of Lake Illawarra. Yallah Creek is an ephemeral stream which flows in a west-east direction from Mount Brown to the northern section of the inlet canal. Yallah Creek is piped under the north-west section of the Stage B power station site before discharging into Lake Illawarra. Yallah Creek catchment is small (0.35 km^2), compared with the neighbouring tributaries, and has a total stream length of approximately 600 m. The upper catchment is steep and funnels flow to the lower catchment, to the north of the power station site, where the creek is of a lesser grade. Another ephemeral stream is located within Yallah Gully to the south of Yallah Creek. It also flows in a west-east direction and is currently piped under the southern portion of the Tallawarra Stage A power station site before discharging to Lake Illawarra.

A bunded artificial wetland is located in the upper Yallah Creek catchment (**Figure 6-4**). The wetland is fed by first flush and small intermittent flows. During periods of high and sustained flow, water from Yallah Creek bypasses the wetland down its original course. Some flow then enters the northern drain which is an open channel to the site road where it passes underneath the development through a 1.8 m diameter pipe. The remaining flow enters a pipe which runs adjacent to the site, with some water being diverted to the sewage treatment plant. Water from the treatment plant is used to irrigate the surrounding catchments and does not re-enter the creek. The northern drain rejoins Yallah Creek 140 m upstream of the outlet.

Legend

- Study area
- Lot
- Artificial Wetland and Bund
- Dams
- Proposed Tallawara B
- Tallawara A
- Power Station Site Boundary

Source: Aerial supplied by TRUenergy, Topographic data by Streetworks

0 250 500
Metres

1:20,000 @ A4

Figure 6-4 - Location of Watercourses

GDA 1994 MGA Zone 56

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Water quality

Lake Illawarra is a broad, shallow, saline lagoon that is 9.5 km in length and 5.5 km wide. The Lake Illawarra catchment area covers approximately 270 km^2, of which the lake itself comprises 35 km^2. The maximum depth of Lake Illawarra is 3.7 m, although one quarter of the lake area is less than 1.2 m deep. Due to the narrow connection from the lake to the Pacific Ocean at Windang Island, Lake Illawarra is subject to limited flushing, which has effects on water quality. The daily exchange of ocean and lake equates to about 1 percent of the lake volume (Public Works Department of NSW, 1982).

Lake Illawarra experiences significant fluctuations in salinity, creating a harsh aquatic environment. In addition, the disturbances associated with the urban, industrial and agricultural development that has occurred around Lake Illawarra has resulted in the accumulation of sediment within the lake, with silt and nutrients tending to be retained (Pacific Power, 1998). Lake Illawarra experienced excessive algal growth during the 1970s and 1980s, although recent catchment management measures have drastically reduced the nutrient content within the lake. Since the establishment of the Lake Illawarra Authority (LIA) in 1988, approximately 40 percent of the major drains discharging into the lake have been fitted with some form of water quality treatment device (Wollongong City Council, 2007). It should be noted that two wetlands and stormwater sedimentation basins are included in the Stage A development at Tallawarra.

According to the 2006/2007 Wollongong City Council State of the Environment Report, Lake Illawarra generally did not meet the ANZECC guidelines for several water quality parameters, including total nitrogen, total phosphorus and ammonia. Chlorophyll-a levels were generally within the ANZECC guidelines. The water quality within Lake Illawarra is significantly influenced by rainfall, wind, temperature and the conditions of the lake's connection to the ocean. The lake has sufficient levels of dissolved oxygen as a result of frequent wind stirring (Pacific Power, 1998).

Recent works have been undertaken to upgrade the entrance of Lake Illawarra to provide a permanent opening. Despite these works the lake entrance remains narrow thus continuing to limit its flushing capacity and consequent water quality

Flooding

An Environmental Impact Statement (EIS) was prepared by Pacific Power for the Tallawarra Stage A CCGT power station in 1998, and the development was approved by Wollongong Council in 1999. The EIS considers the impact of the proposed development on the water cycle, focussing on the assessment of water quality. There is no reference to flood risk imposed by the lake/watercourses or management thereof in the EIS.

The Tallawarra site has been the subject of flood studies associated with the construction of the Tallawarra Stage A CCGT power station. Two studies relevant to the development site are:

- Lake Illawarra Study (July 2001); and
- Lake Illawarra Floodplain Risk Management Study and Plan, version 6 (May 2005), referred to hereafter as FRM Study.

The Lake Illawarra Study investigates flooding from the lake itself and the FRM Study provides more detailed assessment of flooding from the lake and foreshores. Flooding directly from watercourses traversing the site is not investigated in either of the above, and specifically there is no publicly available flood study for Yallah Creek.

Cardno Forbes Rigby (CFR) carried out a flood study of Duck Creek (April 2007) as part of the Local Environmental Study (LES) for the preparation of the Local Environmental Plan (LEP) for the Tallawarra Lands site. The report focused on flood risks to the site imposed by Duck Creek. The 1% AEP flood inundation map provided in this report shows that flooding from Duck Creek would not affect the proposed power station site, as it is limited to the south of the site. CFR repeated the flood study in May 2009 with updated survey from around the proposed power station and concluded that the power station site remains above the 1% AEP flood level plus 500mm.

CFR were also required by Wollongong Council to consider flood risk from the smaller tributaries within the development site; this included Wollingurry Creek, Barrons Gully and Pithungar Gully and hydraulic calculations of flood extents for Pithungar Gully and Barrons Gully were undertaken. The CFR report noted that the top widths of flooding are considerably less than the riparian corridor widths for the watercourses examined and concluded that the flooding from these tributaries was minimal.

The Tallawarra Lands LES was prepared by Willana Associates in December 2006. It draws upon work undertaken by Northrop Engineers and identifies a risk of flooding from two sources, Lake Illawarra and Duck Creek. Localised flooding was shown to affect the site in the vicinity of Yallah and Wollingurry Creek. Northrop carried out preliminary calculations and estimated a 1% AEP flood width of approximately 20 m for Yallah Creek. This flood extent is shown in **Figure 6-5** with respect to the site. The boundary of the flood extent is approximately 35 m away from the proposed Tallawarra Stage B power station. Although the calculation of 'top width' is based on assumptions such as uniform channel shape and steady-state flow, it provides an indication of the flood envelope in the absence of detailed data.

Legend

- Yallah Creek
- 1% AEP flood width estimated by Northrop Engineers
- Dams
- Proposed Tallawara B
- Tallawara A
- Power Station Site Boundary

Source: Aerial supplied by TRUenergy, Topographic data by Streetworks

0 75 150

Metres

1:5,500 @ A4

Figure 6-5 - Yallah Creek - 1% AEP flood extent

Projection: GDA94 MGA Zone 56

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February 24, 2009
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6.1.5 Terrestrial ecology

Flora

The Tallawarra Lands site is predominantly cleared and is affected by weed invasion and grazing. The site drains into Lake Illawarra via Yallah Creek, Duck Creek and Wollingurry Creek. Two areas of SEPP 14 wetlands are located to the south of former Ash Dam 1 and Ash Dam 2 (**Figure 6-6**).

The following vegetation communities are present on the Tallawarra Lands site, including seven communities that are, or form part of, endangered ecological communities (EECs) (Eco Logical, 2006) (refer to **Figure 6-7**):

- Alluvial Swamp Mahogany Forest (part of the EEC – Swamp Sclerophyll Forest on Coastal Floodplains);
- Coastal Grassy Red Gum Forest (part of the EEC – Illawarra Lowlands Grassy Woodland);
- Coastal Swamp Oak Forest (part of the EEC – Swamp Oak Floodplain Forest);
- Floodplain Wetland (part of the EEC - Freshwater wetlands on Coastal Floodplains);
- Lowland Dry-subtropical Rainforest (part of the EEC – Illawarra Subtropical Rainforest);
- Lowland Woollybutt-Melaleuca Forest (part of the EEC – Illawarra Lowlands Grassy Woodland);
- Saltmarsh (part of the EEC – Coastal Saltmarsh);
- Estuarine Alluvial Wetland;
- Moist Box-Red Gum Foothills Forest;
- Weeds and Exotics;
- Artificial wetlands; and
- Acacia Scrub.

Legend

- Tallawarra Land Border
- Proposed Tallawara B
- Tallawara A
- SEPP 14 wetlands
- Dams

Source: Aerial supplied by TRUenergy, Topographic data by Streetworks

0 250 500
Metres

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Figure 6-6 - SEPP 14 Wetlands

Projection: GDA94 MGA Zone 56

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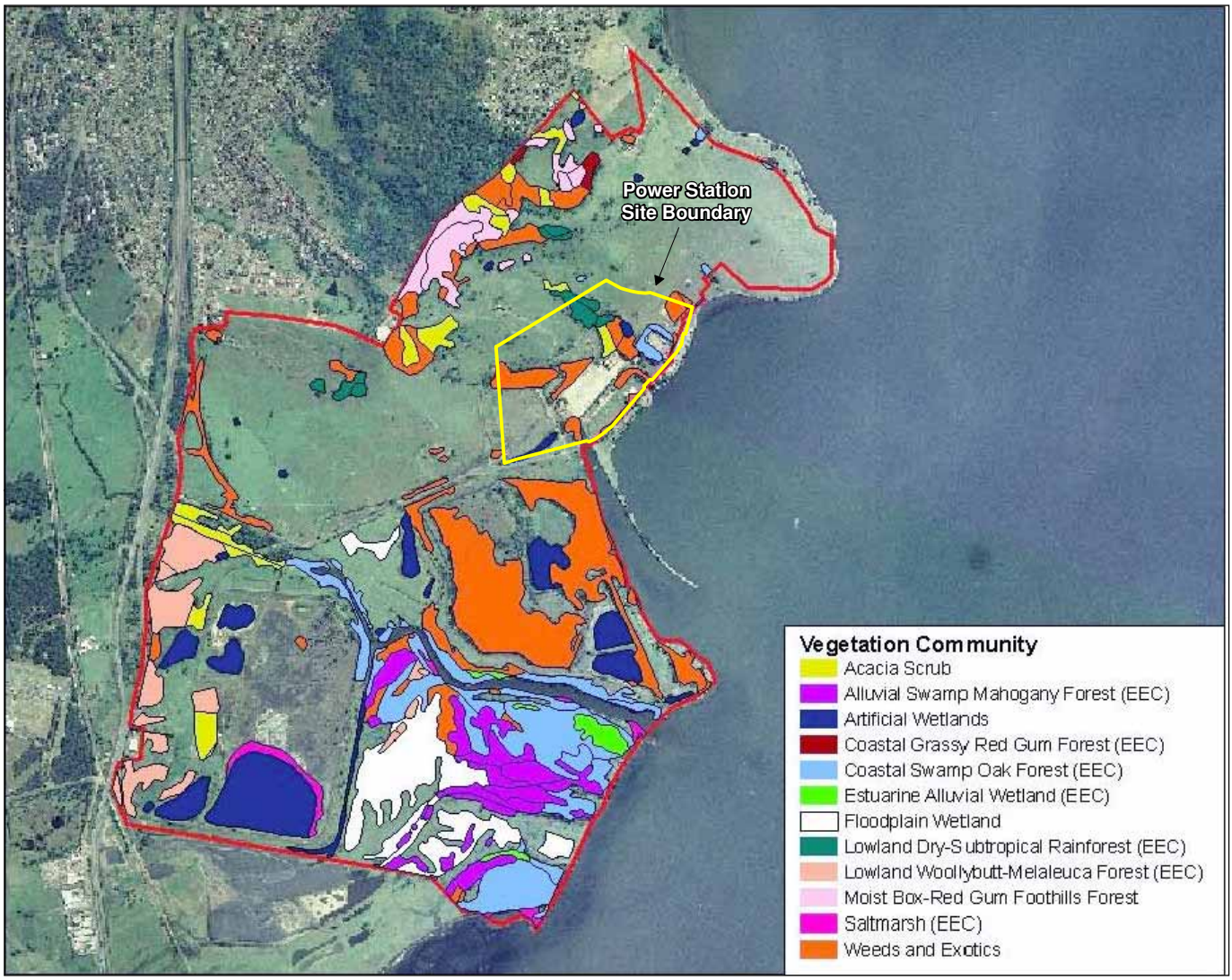

Fig 6-7 Vegetation communities

Source: Eco Logical, (2006), Tallawarra Lands Ecological Assessment, Local Environment Study. Report prepared for Willana Associates, NSW.

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Despite the occurrence of native vegetation on the site, the understorey is predominantly lantana (Eco Logical, 2006). Whilst there is considerable weed invasion and grazing occurring throughout the Tallawarra Lands site, the Swamp Oak Woodland to the east of Ash Dam 3 and immediately south of Duck Creek is in moderate to good condition.

A search of the DECC Atlas of NSW Wildlife was carried out and indicated that a small number of threatened flora species have been recorded in the area (refer to **Table 6-5**). The four threatened flora species in **Table 6-5** are listed as endangered species under the NSW *Threatened Species Conservation Act 1997* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Table 6-5 Threatened flora species in the vicinity of the proposed site

Scientific Name	Common Name	Habitat	Likelihood of occurrence on project site and impact zone
Pterosylis gibbosa	Illawarra Greenwood Orchid	Occurs in Illawarra Lowlands Grassy Woodlands community.	Low likelihood of occurrence. Species not recorded during previous studies and no suitable habitat recorded.
Cynanchum elegans	White-flowered Wax Plant	Typically occurs in remnant stands of dry rainforest and often recorded in dry lowland grassy woodlands.	Low likelihood of occurrence. Species not recorded during previous studies and no suitable habitat recorded.
Zieria granulate	Illawarra Zieria	Often seen in a variety of plant communities, including subtropical rainforest, lowland grassy woodland and melaleuca scrub.	Low likelihood of occurrence. Species not recorded during previous studies and no suitable habitat recorded.
Pimelea spicata	Spiked Rice-flower	Occurs in grassland and open woodland.	Low likelihood of occurrence. Species not recorded during previous studies and no suitable habitat recorded.

Terrestrial Fauna

Important fauna habitat is not found on or adjoining the proposed Stage B power station site. Although, a small number of terrestrial fauna species listed under the TSC Act and EPBC Act have been recorded on the Tallawarra Stage B site (refer to **Table 6-6**).

■ **Table 6-6 Threatened fauna species in the vicinity of the proposed site**

Scientific name	Common name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence on project site and impacts zone
Mammals					
Pteropus poliocephalus	Grey-headed Flying Fox	V	V	Forages on nectar and pollen in sclerophyll forest and rainforest.	May occasionally forage over northern gully line and in grassy woodland and rainforest along northern ridgeline and slopes of Mount Brown.
Scoteanax ruepellii	Greater Broad-nosed Bat	V	-	Forages along well vegetated gullies and open flyways through forest.	Recorded by Richards (1997) in *Casuarina* forest south of the main access road. Species is more likely to forage in extensive areas of escarpment forest to the west of the site.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Forages high above tree canopy for insects and roosts in tree hollows.	Recorded by Richards (1997) in wet sclerophyll forest on the site.
Myotus macropus	Southern Myotis	V	-	Roosts in caves and forages over water bodies for insects and small fish.	Richards (1997) captured 12 individuals during surveys conducted on the site in 1997 but failed to detect any site roosts.
Miniopterus schreibersii	Common Bent-wing Bat	V	-	Dry sclerophyll forest and woodland in valleys.	Much more likely to forage in wet sclerophyll forest in Macquarie Pass National Park rather than in the very patchy vegetation on the subject site. One call of this species was recorded by Turton (1996).
Birds					
Calyptorhynchus lathami	Glossy Black-cockatoo	V	E	Inhabits open forest and woodlands of the coast.	Likely to forage in the *Casuarina glauca* stands in the riparian zone. Due to the general lack of hollow-bearing trees within and around the project site, roosting habitat is not available.
Stictonetta naevosa	Freckled Duck	V	-	Densley vegetated freshwater wetlands. A rare coastal visitor.	Low likelihood of occurrence. Species is much more likely to utilise the large ash dams to the south of Duck Creek, where it was regularly recorded in the 1980s.
Botaurus poiciloptilus	Australasian Bittern	V	-	Permanent freshwater wetlands dominated by sedges, reeds and rushes.	Low likelihood of occurrence. Suitable habitat not recorded.

Scientific name	Common name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence on project site and impacts zone
Ixobrychus flavicollis	Black Bittern	V	-	Edges of permanent wetlands, rivers and creeks with dense fringing vegetation, often in tidal zones of watercourses and estuaries.	Low likelihood of occurrence. Suitable habitat not recorded. No records of the species existing on the site since the 1980s. Recorded occasionally in estuaries in the Lake Illawarra basin.
Haematopus longirostris	Pied Oystercatcher	V	-	Intertidal, mudflats and ocean beaches.	Low likelihood of occurrence. No suitable habitat recorded.
Frogs					
Littoria aurea	Green and Golden Bell Frog	E	V	Ephemeral and permanent freshwater wetlands, ponds and dams.	Low likelihood of occurrence. Potentially suitable habitat recorded in Yallah Creek by Australian Museum, although a dedicated search for this species did not detect it.

Note: E – Endangered; V – Vulnerable

6.1.6 Aquatic ecology

Lake Illawarra is a shallow saline lake with an area of 35km^2. The maximum depth reaches 3.7m, however, over one quarter of the lake is less than 1.2m deep. The lake has a narrow connection to the Pacific Ocean at Windang Island which allows for limited flushing. Even when the channel connection is open, Lake Illawarra is only slightly tidal with a maximum tidal range of 50mm. The daily exchange of ocean and lake is estimated to be approximately 1 percent of the total lake volume (Public Works Department of NSW 1982). This limited exchange with the ocean results in significant fluctuations in salinity exacerbated by evaporation rates and the input of freshwater from rainfall.

Aquatic flora

A variety of aquatic flora exists in Lake Illawarra including seagrasses, macroalgae and phytoplankton.

Seagrassess are submerged flowering plants (angiosperms) which form underwater meadows in the shallow waters of sheltered estuaries and bays. Seagrass meadows provide an important habitat for juvenile fish, prawns and benthic populations such as snails, shellfish and worms.

Zostera capricorni is the dominant seagrass found in Lake Illawarra, growing in silt sandy sediments around the perimeter of the lake. Other seagrasses recorded within Lake Illawarra include *Ruppia maritime,* and *Halophila ovalis.* The abundance and densities of *Zostera* has increased in recent years due to improved water quality (King *et al.* 1997). Reduced sewage overflow and nutrient input from the catchment has reduced the occurrence and abundance of macroalgae blooms which in conjunction with reduced turbidity from sediment inputs has improved access to light.

A small bed of seagrass comprising *Zostera capricorni* and patchy *Halophila ovalis* has been mapped in the vicinity of the old Tallawarra Power Station outlet canal and Wollingurry Point (WBM, 2003). It is anticipated that the seagrass beds located in the outlet canal may be affected by the operation of Tallawarra Stage A. Monitoring is being undertaken by TRUenergy as part of the Stage A approvals.

Macroalgae are multicelled algal species which are generally referred to as ‘seaweed’. Macroalgae has a variety of growth forms such as long filamentous growth to clusters of lettuce shaped species. Macroalgaes grow on rocks, benthic substrate and on or behind seagrass beds.

Nuisance macroalgae species within Lake Illawarra include Chaetomorpha, Cladophora and Enteromorpha. Spyidia also occurs within the Lake however it is not considered a nuisance species. Various catchment management measures have been found to greatly reduce the quantities of nuisance macroalgaes within Lake Illawarra, with the non nuisance species Spyridia now the

dominant macroalgae (King et al 1997). **Table 6-7** shows the dominant green, red and brown macoalgaes to be recorded within Lake Illawarra.

- **Table 6-7 Dominant Macroalgae within Lake Illawarra (King et al. 1997 and WBM, 2003).**

Green Algae (Charophyta)	*Ulva sp.*
	Chaetomorpha linum
	Enteromorpha intestinalis
	Codium fragile
	Cladophora sp.
	Oscukkatoria sp.
	Anabaena sp.
	Lyngbya
	Lamprothamnium populosum
Red Algae (Phaeophyta)	*Gracilaria verrucosa*
	Polysiphonia sp.
	Ceramium sp.
	Hypnea valentiae
	Pterocladia sp.
	Spyridia filamentosa
Brown Algae (Rhodophyta)	*Colpomenia peregrina*
	Ectocarpus silicolosus
	Dictyota sp.
	Ecklonia radiata
	Hincksia sp.
	Sargassum sp.

Phytoplankton are microscopic plants which float within the water column of the lake. They are thought to be the dominant primary producer in deeper sections of the lake, because limited light penetration to the lake sediments, prevents seagrasses and macroalgaes from taking hold (WBM 2006).

Phytoplankton concentrations are assessed through chlorophyll-a concentrations present in the Lake. Elevated chlorophyll-a concentrations are found during late summer within Lake Illawarra, coinciding with higher nutrient levels, high light intensity and high water temperatures. Studies undertaken by UNSW found that low plankton levels during sampling undertaken in spring 1996 and autumn 1997 were attributed to lower nutrient concentrations and high turbidity (King *et al.* 1997).

In the past, toxic dinoflagellate phytoplankton blooms would occur after heavy rainfall events, however current catchment management strategies appear to be minimising the overall occurrence of phytoplankton blooms in response to rainfall events. However, in December 2000, a toxic dinoflagellate, *Gymnodinium* spp. is thought to be responsible for a fish kill in Koonawarra Bay within Lake Illawarra, through the production of a chemical toxic to fish.

Aquatic fauna

The aquatic fauna of Lake Illawarra includes zooplankton (including microscopic animals and shellfish larvae); benthos (animals that live on the bottom of the lake); fish and prawns.

Zooplanktons are generally microscopic animals which feed upon the phytoplankton within the water column. Zooplankton can include both permanent organisms (haloplankton such as copepods, amphipods and isopods) and temporary zooplankton (meroplankton such as mollusc, fish and prawn larvae).

A wide number of zooplankton species have been recorded within Lake Illawarra with the dominant zooplankton, *Noctiluca scintillans* appearing to be associated with moderate nutrient conditions. This is because *Noctiluca scintillans* is a large dinoflagellate which can photosynthesise and consume detrital matter. The average density of species aside from *Noctiluca scintillans* such as copepods were found to be low, this was attributed to the low phytoplankton densities of which zooplankton feed upon (King *et al.* 1997).

Commercially important fish larvae within Lake Illawarra are reported as the Silver Biddy (*Gerres subfasciatus*), the River Garfish (*Hyporhamphus regularis*) and Luderick (*Girella tricuspidata*). The larvae of other commercially important fish are also likely to occur within Lake Illawarra, however it is likely that most species will spawn at sea, with the larvae entering during flood tides (WBM, 2003).

Jellyfish such as *Catostylus mosiacus* are highly abundant within Lake Illawarra, particularly along the western shoreline, due to the prevailing wind driven currents. *Catostylus mosiacus* is a large jellyfish which occurs in dense aggregations in surface waters and is often commercially harvested.

Benthos are bottom dwelling organisms which live on or within the substrate at the bottom of a water body such as oysters, clams and burrowing worms. Lake Illawarra has great diversity and spatial variability of benthic macroinvertebrate communities with three main habitat types identified; sublittorial fringes, the entrance channel and the central basin (Gibbs 1986). Commercial catches of molluscs are low within Lake Illawarra and not important to the lakes commercial fishery (Gray, 2004).

Previous sampling undertaken has identified Lake Illawarra as an important fish nursery for commercial, recreational and non-commercial species with a great diversity of fish communities present. In addition to providing distinct habitats for benthic macroinvertebrates, seagrass beds such as of *Zostera capricorni* within Lake Illawarra provides important fish nursery areas. Other species of fish such as bar biddy's and anchovies spawn at sea and will instead use the seagrass beds to avoid predators once they enter Lake Illawarra.

Recent surveys of fish biodiversity within Lake Illawarra between 1997 and 2000 found 70 species of fish, none of which were defined as threatened under the *Fisheries Management Act 1994* (Williams *et al.* 2004). Thirty-four of the species found have economic significance. Only 37 species were permanent residents within Lake Illawarra, 24 spent juvenile stages within the lake then moving off to spawn, 6 moving in to spawn and 3 as tropical transients.

The commercial fishery of Lake Illawarra is an important input into the total estuarine commercial catch within NSW, with an average 120 tonnes of finish, 17 tonnes of prawns and 12t of blue swimmer crab caught between 1997 and 2002 (Gray, 2004). The commercial finfish catch of Lake Illawarra is dominated by sea mullet (47%), and luderick (10%). Dusky flathead, silver biddy, bream and river garfish are also commercially fished, each contributing more than 5 tonnes yearly.

The commercial prawn catch of Greasyback Prawns has rapidly declined since the 1970's from the dominant prawn species, to representing only approximately 0.5 percent of the total catch. Other Prawn species such as King Prawns (71% of total catch) and School Prawns (28.5% of total catch) are now the dominant commercially fished species (Pacific Power 1998). It is thought that increased sedimentation within Lake Illawarra is responsible for the sharp decline in Greasyback Prawns, due to the corresponding reduction in phytoplankton abundance, upon which the Greasyback Prawn larvae feeds. King and School Prawns enter spawn at sea, thus their larvae are not dependant upon phytoplankton abundance, rather they can feed upon benthic diatoms or seagrass beds.

6.1.7 Aboriginal heritage

The Tallawarra Lands area (incorporating the project site) has been subject to a number of Aboriginal archaeology investigations, the most recent of which included Salmon (1998), Kelleher Nightingale Consulting (2006) and the Environmental Impact Statement for the Tallawarra Stage A CCGT power station (Pacific Power, 1998).

The project area falls within the boundaries of the Illawarra Local Aboriginal Land Council (ILALC). Several other Aboriginal community groups have a registered or known interest in the Illawarra region, several of which expressed an interest in and were involved in the Kelleher Nightingale Consulting (2006) study. These groups included:

- Illawarra Local Aboriginal Land Council;
- Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation;
- Wodi Wodi Elders Corporation;
- Wadi Wadi Coomaditchie Aboriginal Corporation; and
- Northern Illawarra Aboriginal Collective.

Database searches

A National Native Title Tribunal search was undertaken for the Wollongong City Council area in March 2007. The native title search results showed that only one site is present under the Register of Native Title Claims within the Wollongong local government area. The proposed site would not be located on or in close proximity to the land subject to the Native Title land.

A search of the NSW Department of Environment and Climate Change's (DECC) Aboriginal Heritage Information Management System (AHIMS) database was undertaken (March 2007) as part of the assessment to identify any known Aboriginal items that could be affected. The search identified 117 Aboriginal objects and places in the Wollongong local government area.

Four AHIMS Aboriginal items are located in close proximity to the study area and are summarised in **Table 6-8** (refer to **Figure 6-8**).

- **Table 6-8 AHIMS record of Aboriginal sites or items within or close to study area.**

NPWS Site ID	Site Name	Site Type
52-5-0122	Yallah Site 2	Open Camp Site
52-5-0246	Yallah Gully 3	Midden and Open Camp Site
52-5-0247	Yallah Gully 2	Open Camp Site
52-5-0248	Yallah Gully 1	Open Camp Site

Previous studies

Previous archaeological assessments of the Tallawarra Lands area were conducted in 1997 (Pacific Power), 1998 (Salmon) and in 2006 (Kelleher Nightingale Consulting). The studies were undertaken to determine if known Aboriginal and historical sites were located within the area under investigation and to place the area within an archaeological and heritage management context. The investigations revealed that Yallah Creek contained a number of Aboriginal heritage sites and several other areas had the potential to contain further Aboriginal heritage sites.

The EIS for the Tallawarra A CCGT power station stated that no Aboriginal archaeological sites were listed on the Register of the National Estate or the Wollongong Local Environment Plan (Pacific Power, 1997).

Legend

- AHIMS Heritage Site
- Proposed Tallawara B
- Tallawara A
- Power Station Site Boundary
- Tallawarra Land Border

Source: Aerial supplied by TRUenergy
Topographic data by Streetworks

0 250 500
Metres

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SKM

Figure 6-8 - Aboriginal Heritage Sites

Projection: GDA94 MGA Zone 56

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The review of the NPWS Register of Aboriginal Sites undertaken for the EIS identified various sites within, or in the immediate vicinity of, the proposed Tallawarra B project. These are shown in **Table 6-9.**

- **Table 6-9 Records from the Register of Aboriginal Sites**

Site Type					
Artefact	**Artefacts/ Scatter**	**Isolated Shell Scatter**	**Midden Find**	**Scarred Tree**	**Scarred Tree/ Artefacts**
Duck Creek 2	Yallah Gully 3	Yallah Site 1	Tallawarra Midden	Yallah	Duck Creek 3
Yallah Site 2	Elizabeth Point	Bomberry Point 1	Wollingurry Point		
Yallah Gully 2		Wollingurry Creek 2	Haywards Bay 2		
Yallah Gully 1			Bomberry Point 2		
Ash Pond 1					
Duck Creek 1					

No previously unidentified Aboriginal archaeology sites were identified during field surveys undertaken for Salmon (1998). Existing sites which were identified included:

- Yallah Gully Sites (Nos. 52-5-248, 52-5-247 and 52-5-246) containing artefact scatters were found to retain relatively high scientific significance and research potential;
- Yallah Gully 1 contains an open scatter of artefacts in the vicinity of Yallah Gully. It is closely associated with Yallah Gully 2 and 3. The site occurs on two exposures, the first containing 14 artefacts from the top terraces to nearly the creek bed, and the second containing 6 artefacts on a track leading to Yallah Creek. These artefacts suggest an area of primary flaking;
- Yallah Gully 2 contains a group of 21 fine retouched artefact pieces on a drainage channel. These pieces represent stone technology and suggests the area may have been used for re-shaping or re-working of tools;
- Yallah Gully 3 contains a low density scatter of artefacts and shell over a large area. The site has been heavily disturbed and there is an absence of formal tools, small non-utilised flakes and dispersed shell. Considerable amounts of artefact material have been collected from the site including ground edge axes, large pebble choppers and other easily identifiable formal tools. The majority of this material is stored at a local museum; and
- Yallah Site 2 has been extensively disturbed and artefacts have been scattered over a 40 m^2 (2 m x 20 m) area.

The report suggested that consideration should be given to retaining and conserving areas surrounding Yallah Gully.

A walkover survey of the Tallawarra Lands area was conducted in 2006 (Kelleher Nightingale Consulting) at the site by a representative from Korewal Elouera Jerrungarugh Tribal Elders Aboriginal Corporation (KEJ). A number of Aboriginal sites have been recorded along the Lake Illawarra foreshore and Yallah Creek and these have been identified as being important. These sites are evidence of past use of the area by Aboriginal people and of the use of these sites for specific activities. There are also areas surrounding Yallah Creek that have the potential to contain sites or items of Aboriginal heritage significance. Based on the findings, the KEJ Tribal Elders Aboriginal Committee identified the significance of the area for Aboriginal people and identified that the Yalla Creek area should be conserved. This report also reviewed the Salmon (1998) report and found the results to be consistent with the previous archaeological assessment of the study area.

No sites have previously been identified within the Tallawarra Stage B site. The Tallawarra Stage B site has been subject to previous disturbance, including excavation, as it is proposed to be situated on the former infrastructure area of the decommissioned coal fired power station. As such, the site area has little or no potential for the discovery of significant surface or sub-surface Aboriginal heritage.

The potential impact of the project on Aboriginal heritage and associated mitigation measures is discussed in **Sections 7.8** and **8.8,** for an OCGT power station and CCGT power station respectively.

6.1.8 Visual amenity

The proposed Tallawarra Stage B power station would be sited on approximately two hectares of land previously occupied by the former Tallawarra coal fired power station, immediately adjacent to the approved Tallawarra Stage A CCGT power station which has recently been commissioned. The surrounding landscape comprises a mix of steep ridge tops, undulating to flat cleared lands and low lying flood affected wetland areas.

The site of the proposed power station is located at the base of Mount Brown, within the footprint of a previous coal fired power station. Mount Brown (120m ASL) lies to the north-west of the site and is a prominent feature in the landscape, providing substantial regional views. Yallah Creek, an intermittent creek that flows from Mount Brown, flows underneath the northwest section of the power station site. Another prominent feature, Lake Illawarra, is located immediately to the east of the site.

The nearest residential areas are Dapto and Koonawarra located approximately one kilometre to the north-east and north of the site respectively. Haywards Bay, a new residential subdivision, is located approximately two kilometres to the south.

The main roads including the Princes Highway and the Southern Freeway pass in a north-south direction approximately two kilometres to the west of the site. Views of the site from the major transport routes are shielded by a ridge associated with Mount Brown.

The land surrounding the existing power station is owned by TRUenergy and forms a part of the Tallawarra Lands area. It is in a fairly closed environment due to the undulating topography and intervening vegetation which generally screens the area from existing development. Higher topographic areas of the Illawarra escarpment and ridges to the west have some views of the site, although these would be at a distance of approximately 4 km.

The Tallawarra Lands area is largely cleared of vegetation with the exception of small pockets of remnant native vegetation and regrowth. Pockets of denser vegetation and woodland are generally limited to the ridge tops and low lying wetland areas, as well as some natural regrowth around the former Ash Dams of the decommissioned coal fired power station.

Current land uses within the Tallawarra Lands area include power station construction, grazing livestock (currently the predominant use over much of the area), and recreational facilities such as sports oval and horse agistment.

The Tallawarra Lands area is earmarked for future development under the Tallawarra Lands scheme, which would include a mixture of residential, commercial and industrial land uses and approximately 200 hectares of conservation and recreation areas. The immediate surrounding area would comprise industrial land, with residential housing further north, along a spur extending west-east from Mount Brown.

6.1.9 Traffic and transport

The proposed Stage B power station site is situated within close proximity to local and regional road networks. The Princes Highway and Southern Freeway are located to the west of the Tallawarra Lands site, both of which provide direct access to major centres including Wollongong and Sydney. Access to the site is provided via a private road which intersects with the Princes Highway, providing both northbound and southbound access.

Existing Construction traffic

The Traffic Impact Assessment for the Tallawarra Stage A CCGT power station estimated that 150 workers would be required during peak construction times (Pacific Power, 1998). Based on a rate of 1.25 people per vehicle, it was estimated that approximately 240 vehicle trips per day would be

generated (including 120 inbound and 120 outbound trips), with an additional 20-30 truck movements per day for materials deliveries. However, it has been noted that up to 600 workers are involved in the construction of Tallawarra Stage A at any given time, resulting in up to 800 vehicle trips to the site per day (400 inbound and 400 outbound).

The hardware and materials for the construction of the Tallawarra Stage A CCGT power station was hauled to the site by truck. RTA approval was obtained to haul all oversized hardware. The main hardware for the Stage A plant (two 300 tonnes containers) was trucked from Port Kembla using existing roads.

Construction vehicles utilise the temporary car park off the service road, which intersects Yallah Bay Road to the south of the water channel, at the southern access to the site. The car park and service road are shown in **Figure 6-9**. Sight distances appear to be adequate in this area, based on an assessment of the aerial imagery.

- **Figure 6-9 Southern access into the site, showing the temporary car park and service road**

Existing Operational traffic

The operational workforce of the Tallawarra Stage A CCGT plant is expected to consist of approximately 35 full time staff, with an additional 50 workers required during maintenance shutdowns, totalling a maximum of 85 staff members (Pacific Power, 1998). Using a rate of 1.25 persons per vehicle, the traffic generation of the power station was estimated at 136 light vehicle movements per day. The Visitors Centre, to be constructed in the complex, was estimated to attract approximately 50 vehicles per day, based on estimates from similar developments. In total, this equates to approximately 186 light vehicle movements per day. In addition to this, delivery personnel and contractors will also visit the site on an irregular basis, generating an additional 11 heavy vehicle movements per day. During normal operation with only the core 35 staff on site, 56 employee vehicle movements and 11 heavy vehicle movements would be expected each day.

Employees would utilise the northern access to the site and would park in the designated parking area immediately inside the main entrance.

Site access

The only access to the site is via the Southern Freeway / Princes Highway and Yallah Bay Road. Construction vehicles currently access the site from the southern entrance on Yallah Bay Road, with minimal activity occurring at the northern access. During the operational phase, the majority of vehicles will utilise the main (northern) access to the site, with a small proportion of vehicles utilising the southern access and service road.

There have been no reports of traffic incidents along the route or at access points, nor any other indications of safety hazards at present. Similarly, no reports of significant road degradation have been brought to the attention of the authorities.

6.2 Preliminary Environmental Risk Analysis

A preliminary environmental risk analysis has been conducted to assist in the identification of key environmental matters that would require detailed assessment. The preliminary environmental risk analysis has been prepared in accordance to the general principles outlined in Australian Standard *AS/NZS 4360:2004 Risk Management* (Standards Australia, 2004) and *HB 203:2006 Environmental Risk Management – principles and process* (Standards Australia, 2006). Risks have been analysed in relation to their possible consequence and likelihood of occurrence, as follows:

		Consequence	5	4	3	2	1
			Limited impact to minimal area	Reversible, short to medium term impact to local area	Reversible medium term local impact	Medium to long term widespread impact	Long-term, widespread impacts
Likelihood	A	Common or frequent	**High**	**High**	**Extreme**	**Extreme**	**Extreme**
	B	Will probably occur in most circumstances	**Moderate**	**High**	**High**	**Extreme**	**Extreme**
	C	Might occur at some time	**Low**	**Moderate**	**High**	**Extreme**	**Extreme**
	D	Not likely to occur	**Low**	**Low**	**Moderate**	**High**	**Extreme**
	E	May only occur in exceptional circumstances	**Low**	**Low**	**Moderate**	**High**	**High**

For the purposes determining key environmental matters of the project, such matters have been defined as those with a risk rating greater than moderate.

Table 6-10 Preliminary Environmental Risk Analysis

Aspect	Status and Proposed Control	Risk Assessment			Further Assessment Requirements	Key Issue
		C	L	R		
Air quality	The existing air quality around the project area is influenced by surrounding land uses and transport movements. In addition, the Illawarra region is subject to existing concerns regarding air pollution, specifically photochemical smog which is associated with emissions of NOx. Operation of the power station will result in the emission of nitrogen oxides (NOx). Construction activities will include the excavation, levelling and clearing of approximately 2 hectares and other demolition activities. Appropriate dust management measures will be implemented throughout the duration of construction activities.	3	B	H	Refer to Section 7.1, Section 8.1 and Appendix B for the air quality assessment.	Yes
Greenhouse gases	Operation of the Tallawarra Stage B power station will result in the emission of greenhouse gases through exhaust stacks. The combustion of fuels by construction equipment and vehicular movements will also contribute to greenhouse emissions within the local environment. However, provided equipment and vehicles are properly maintained emissions will not cause a significant impact.	3	B	H	Refer to Section 7.3, Section 8.3 and Appendix D for the greenhouse gas assessment.	Yes
Noise	Background noise levels at the project site are currently low. However the area will be impacted by the Tallawarra A power station which was recently commissioned. It is expected that noise emissions associated with the operation of the project will mainly be limited to the gas turbines and generators. During construction, noise will be generated though building and assembly works, major earthworks and excavations, crane operations and material deliveries. Construction and operational noise impacts will generally be mitigated through appropriate management and design measures, such as limiting construction to DECC normal working hours and maintaining ongoing consultation with nearby residential receivers.	3	B	H	Refer to Section 7.4, Section 8.4 and Appendix E for the noise assessment.	Yes
Hazard	*State Environmental Planning Policy No. 33 (SEPP 33) – Hazardous and Offensive Development* applies to all industries that are considered to be potentially hazardous industry or potentially offensive industry. The policy is designed to ensure new developments only proceed if they are suitably located and able to demonstrate that they can be built and operated with an adequate level of safety. The assessment process detailed in the guidelines accompanying SEPP33 will be applied to the project to ensure that risks to surrounding land uses are clearly identified and mitigation measures developed, if required.	2	E	H	Refer to Section 7.5, Section 8.6 and Appendix F for the preliminary hazard analysis.	Yes

Water	The proposed power station is located within the Lake Illawarra Catchment. Potable water for drinking, general power station use and steam plant make-up will be supplied to the site from the existing supply along the Sydney Water main. Water for domestic and construction supply will be piped directly to usage points. The remaining water, for use in the steam circuit, plant washdown, station services and fire services, will be supplied via the two existing 1ML storage tanks. Demineralised water for NOx control (when operating on diesel fuel (OCGT only)) will also be stored on-site. The CCGT option will also draw water from Lake Illawarra for condenser cooling.	3	C	H	Refer to Section 7.6 and Section 8.5 for the assessment of impacts on waterways and water quality.	Yes
Aviation	Due to the proximity of the proposed power station to the Illawarra Regional Airport, the Civil Aviation Safety Authority (CASA) has identified the need to assess the potential hazards to aviation due to the vertical velocity from gas efflux that may cause airframe damage and/or affect the handling characteristics of an aircraft in flight. Aviation authorities have established that an exhaust plume with a vertical velocity in excess of 4.3 metres/second at the aerodrome Obstacle Limitation Surface (OLS) or at 110 metres above ground level anywhere else, may cause damage to an aircraft frame or upset an aircraft when flying at low levels. The OLS for Illawarra Regional Airport is 52 metres. The risk posed by an exhaust plume to an aircraft during low level flight can be managed or reduced if information is available to pilots so that areas of likely air disturbance can be avoided.	3	B	H	Refer to Section 7.2, Section 8.2 and Appendix C for the plume rise assessment.	Yes
Land use	The proposed Stage B power station is situated on the former coal fired power station site. TRUenergy recently commissioned the Tallawarra Stage A CCGT power station adjacent the proposed Tallawarra B power station. Site remediation works have been undertaken as part of the Tallawarra Stage A project however a small amount of additional site remediation works may be required for Stage B. These works would be conducted in the same manner and subject to the same controls as those undertaken for Stage A. The surrounding Tallawarra Lands site is currently owned by TRUenergy and is leased for grazing purposes. However, a pre zoning submission was made to Wollongong City Council in July 2005 to seek Council's in principle support to proceed with the preparation of a formal rezoning submission and draft Local Environment Plan for Tallawarra lands. A draft LEP has been prepared for the site and Council has endorsed the Tallawarra component of the draft LEP. The LEP was placed on exhibition in 2008 until May 2009. Dapto and Koonawarra residential areas are located approximately 1.2 kilometre north-east and north of the project site, respectively. A new residential subdivision, Haywards Bay, is located approximately 2 kilometres south of the project site. It is considered unlikely that the construction and operation activities associated with the project will cause any significant risk to land use within the project area. A buffer area has been designated around the approved Stage A power station and the proposed Stage B power station will be sited inside this designated buffer area.	4	D	L	Refer to Section 6.1 for a description of existing and proposed land use.	No

Ecology	The land on which the proposed power station will be located has been previously disturbed by former power station infrastructure. Much of the surrounding Tallawarra Lands have been previously cleared of vegetation as a result of past land use. Remnant vegetation is found in localised parts of the site. Remnant vegetation associated with Yallah Creek to the north of the project site is listed as a threatened ecological community under the *Threatened Species Conservation Act* 1995. Tallawarra Lands also provide habitat for several threatened species, including the green and golden bell frog, large bent-wing bat, large-footed myotis bat and four other bat species. The majority of infrastructure associated with the proposed power station will be located on disturbed land within the former power station site and will not cause any significant vegetation disturbance or clearing.	4	D	L	Refer to Section 7.7 and Section 8.7 for an assessment of potential impacts on ecology.	No
Traffic	The development site is situated within close proximity to local and regional road networks. The Princes Highway and Southern Freeway are situated to the west of the Tallawarra Lands site. Access to the site is provided via a private road which intersects with the Princes Highway, providing both northbound and southbound access. During construction, new traffic movements will be generated by construction workers and material deliveries to and from the project construction sites. Access to the site will be via Yallah Bay Road, off the Princes Highway. The existing road network is considered sufficient to accommodate the increased traffic movements from the proposed development.	5	C	L	Refer to Section 7.10 and Section 8.10 for an assessment of traffic impacts.	No
Visual amenity	The proposed Stage B plant will be located on the edge of Lake Illawarra adjacent to the approved Stage A power station. Views of the area from existing residential areas on the western shoreline of Lake Illawarra are generally limited due to intervening topography and screening vegetation. Views from residential areas on the eastern shoreline of Lake Illawarra will be limited, intermittently screened by intervening vegetation and against the backdrop of Mount Brown. Views of the Stage B plant will not dominate the horizon. The proposed Stage B power station will be in keeping with the nature of the site, as it is to be situated adjacent to the approved Stage A power station.	4	C	M	Refer to Section 7.9 and Section 8.9 for an assessment of potential impacts on visual amenity.	No
Aboriginal heritage	A search of the DECC Aboriginal Heritage Information System (AHIMS) database identified seven previously recorded Aboriginal sites located within 200m of the project area. Two types of sites were recorded; middens and artefact scatters. All infrastructure associated with the proposed power station will be located within the former power station site and will not result in the disturbance of land outside previously disturbed areas.	4	C	M	Refer to Section 7.8 and Section 8.8 for the Aboriginal heritage assessment.	No

Climate change	Climate change, and the associated sea level rise and increase in rainfall intensity, has the potential to increase flooding risk on-site. The proposed power station will be constructed at 3.1m AHD, in line with the Tallawarra A plant. The flood studies undertaken for the Tallawarra Lands site (refer to Section 6.1.4) have taken climate change into account in the hydrological modelling. Based on these reports, it is unlikely that climate change impacts will lead to increased flooding risk on-site. In addition, the Lake Illawarra Floodplain Risk Management Study is currently being updated to include impacts of climate change on flood levels in the catchment. The results of this revised study will inform the detailed design, where necessary.	4	D	L	Refer to Section 7.6.2 for an assessment of flooding.	No
Waste	Waste management systems and facilities (including an on-site package sewage treatment plant) have been established at the project site as part of the Stage A CCGT power station project. During construction, general building waste such as timber, masonry, scrap metal, packaging materials and plastics will be generated. In addition, a small quantity of waste (sewage and domestic rubbish) will be generated from the construction compound. The Stage B project will not generate significant quantities of waste during operation.	4	D	L	Refer to Section 7.11 and Section 8.11 for an outline of potential waste generation.	No