South West Power Project, Collie

Griffin Energy Pty Limited

Report and advice
of the Environmental Protection Authority
under section 16(j) of the Environmental Protection Act

Environmental Protection Authority
Perth, Western Australia
Bulletin 1090
February 2003

ISBN. 0 7307 6728 0
ISSN. 1030 - 0120

Summary and conclusions

Griffin Energy Pty Limited ("Griffin Energy") has requested early strategic advice from the EPA on any constraints which may be "fatal flaws" from an environmental impact perspective, which may apply to the construction and operation of an 800MW advanced supercritical coal-fired power facility in the Collie Region of Western Australia.

The EPA has been advised that the power station is one element of an overall integrated sustainable energy project (referred to as the South West Power Project (SWPP) being evaluated by Griffin Energy, which could also include:

- a renewable energy project using a wind farm to produce up to 80 MW.

  This would include the installation of a substantial wind farm on land near Cataby, 170 km north of Perth. The wind farm has the potential to produce 80MW of electricity. By combining the wind component into the overall strategy there is the potential to partially offset the greenhouse impact from the power station;
- use of wood wastes for up to 10% co-firing with coal.

  The design of the fuel feed for the power station will include the use of forestry products derived from plantation timbers. Up to 10% of the fuel for the station could be from this renewable source;
- carbon sequestration on pastoral land and via tree planting; and
- implementation of a water management strategy involving diversion and desalination of high salinity flows from the East Collie River for use in the Power Station cooling and subsequent supply of mine dewatering water to Wellington Dam to improve water quality in the dam for potable purposes.

This report provides the Environmental Protection Authority's (EPA's) early advice to Griffin Energy on the strategic environmental factors relevant to the construction and operation of an 800MW advanced supercritical coal-fired power facility in the Collie Region of Western Australia.

Section 16(j) of the *Environmental Protection Act 1986* enables the EPA to advise the proponent on the environmental protection aspects of any proposal or scheme, and on the evaluation of information relating thereto.

Relevant strategic environmental factors

The EPA considered that the following strategic environmental factors relevant to the proposed SWPP required detailed evaluation in the section 16(j) report:

(a) greenhouse gas emissions;

(b) gaseous and particulate emissions;

(c) terrestrial flora;

(d) terrestrial fauna;

(e) groundwater quantity;

(f) groundwater quality;

(g) marine water quality;

(h) waste management;

(i) noise and vibration; and

(j) buffer zones.

The EPA expects that a detailed analysis of these factors (and others) would need to be undertaken by the proponent prior to referral to the EPA of a specific proposal under Section 38 of the *Environmental Protection Act 1986*.

Summary of advice

The EPA's advice on the strategic environmental factors responds to Griffin Energy's request for early advice on any environmental constraints which may apply to the installation of up to 800MW of coal-fired power generation facilities at Collie. The EPA expects that a proposal with more specific details of the power generation facility, together with an appropriate mitigation programme, particularly addressing greenhouse gas emissions, will be provided by the proponent in the future for assessment under the Section 38 process, if the company decides to proceed with the project.

The following issues are highlighted:

Greenhouse gases – The EPA notes that, if implemented, the proposed power station would be a significant contributor of greenhouse gases in the State, emitting about 4.5Mt of CO_2 per year.

The EPA has previously advised (EPA, 1990) that its preference in relation to meeting electricity demand is, in declining order of rank:

- conservation and efficiency improvements;
- renewable energy sources such as wind and solar energy;
- gas, including combined cycle, turbines;
- new technology coal plants;
- old technology coal plants; and
- petroleum fuel plants.

The EPA is aware that the demand for electricity in Western Australia will continue to grow and, ideally, additional demand should be satisfied through energy conservation and renewable energy sources, and if not practicable, through efficient electricity generating facilities which minimise the production of greenhouse gases. If power stations are proposed which do not result in the least greenhouse gas intensity, the EPA expects that mitigation actions would be proposed, investigated during the Section 38 process and adopted as appropriate.

The EPA notes the broad package of sustainable development measures which have been identified and considered by Griffin Energy as part of its strategic evaluation of the SWPP to date. Specific measures relevant to the reduction and mitigation of greenhouse gas emissions include:

- renewable energy generation (wind and biomass);
- advanced high efficiency coal-fired generation technology;
- sequestration via forestry;
- desalination as part of a regional water management strategy; and

The EPA considers such a package of mitigating measures presents a responsible way of addressing the environmental impacts associated with higher greenhouse gas

emissions from coal-fired power stations. The EPA would expect Griffin Energy to commit to a package of mitigating measures at least as effective as those outlined earlier in this section in support of any proposal for a 800 MW coal-fired power station.

The EPA understands that part of the justification for the proposal is based on the environmental benefits gained from the replacement of the nearby aging Muja A and B power stations which currently generate some 250 MW of power. The proposed coal-fired, super critical steam cycle plant offers advantages over the old coal-fired power stations in terms of higher thermal efficiencies and lower carbon dioxide emissions per GJ of energy produced. Replacement of old coal-fired power stations with new technology coal plants is a progressive step in relation to meeting electricity demands and contributing to a reduction in greenhouse gas emissions.

The EPA notes that currently there is debate on the time-frame for calculating greenhouse intensity to facilitate a comparison between coal and natural gas generated emissions, i.e. 100 years (which is the more accepted time frame) or 20 years. The issue is relevant when considering the impact of short-lived greenhouse gases such as methane that has an atmospheric lifetime of 10-15 years. The impact of methane is significantly underestimated when a 100-year timeframe is adopted instead of the 20-year timeframe (IPCC 2001).

The proponent estimates that, based on a 20-year timeframe analysis on full production, whole life cycle emissions, the coal-fired power plant greenhouse emissions are approximately 10% above (or 375,000 tonnes/annum more than) that from a combined cycle gas turbine power plant of similar load use. Over a 100-year timeframe, the coal-fired power plant greenhouse emissions are approximately 42% above that from a combined cycle gas turbine power plant. The EPA has been advised by the Office of Sustainable Energy that a 100 year time frame should be used. The EPA considers that greenhouse emissions could be partially ameliorated by the implementation of appropriate mitigating measures.

On the basis of greenhouse gas emissions, the EPA would prefer combined cycle gas plants to coal-fired plants as a source of electricity generation. However, the EPA concludes that if the proposed power plant was effectively implemented with a very strong package of mitigation measures, it could meet the EPA's objectives for greenhouse gas emissions provided that:

- the greenhouse gas estimation (and comparisons with natural gas) are further refined to provide accurate data for a s38 assessment;
- specific design parameters of any proposed power generating facility are subject to section 38 assessment;
- the proposed or a similar package of measures as outlined in the SER are used to mitigate greenhouse gas emissions.

Gaseous and particulate emissions

The proposed power station would emit significant quantities of nitrogen oxides (NO_X) and sulphur dioxide (SO_2) and, to a lesser extent, particulates and unburnt hydrocarbons. The Strategic Environmental Review (SER) predicts fugitive dust emissions and emissions of PM_{10} (50 mg/m^3), SO_2 (1090 mg/m^3), NO_2 (500 mg/m^3) and ozone (O_3). No specific monitoring for $PM_{2.5}$ has been undertaken in the Collie region.

SO_2 and NO_2 Ground Level Concentrations (GLC) from the proposal alone and combined with other sources would need to be compared with the National Environment Protection Measure (NEPM) Standard.

There is potential for emissions of poly aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), dioxin and furan, but the proponent expects these to be at low levels. The EPA believes that hazardous pollutants such as dioxins should be controlled to the maximum extent achievable, irrespective of location, and notes that the latest international standards specify $0.1ng/m^3$ which is the same as required in the EPA's Guidance No. 13 *Management of Air Emission from Biomedical Waste Incinerators* (EPA, 2000).

The EPA's approach to the management of gaseous emissions is that they should be avoided if practicable, and if not they should be minimised by the use of best practicable technology and measures. In addition, proposals should not cause an exceedance of any recognised environmental protection standards (for instance National Environmental Protection Measures, hazard and risk guidelines, standards in Environmental Protection Policies etc). For new sources or significant extensions to existing sources that come to the EPA for assessment, issues of cost will not be considered where pollution reduction or other environmental management measures are needed in order to comply with recognised environmental standards.

With regard to discharges, the EPA makes a distinction between common pollutants such as sulphur dioxide and nitrogen dioxide (sometimes called criteria pollutants) and hazardous pollutants such as asbestos, dioxins, PCBs and cadmium for example. With respect to the hazardous pollutants, the EPA requires that these pollutants be controlled to the Maximum Extent Achievable, irrespective of location. The Maximum Extent Achievable incorporates technology and environmental management procedures which are the most stringent measures available and achievable, at a scale relevant to the proposal, to control the level of risk imposed by the hazardous pollutants being considered. These pollutants may pose a risk to human health at low concentrations due to their toxicity. The EPA would retain the option of recommending against the approval of such emissions if in its judgement there was a significant risk to human health or the environment. The proponent should undertake an assessment of health risk where appropriate, in support of their proposed approach.

The EPA considers that Griffin Energy's proposal to use high efficiency fabric filters will significantly reduce the emission of particulates in comparison to existing facilities.

The EPA's advice on gaseous emissions has focused on the potential impact from SO_2 emissions, given the quantity of coal needed to generate 800MW of electricity, the presence of significant levels of sulphur in the coal and the outcome of SO_2 modelling.

Under the proposed scenario of 800 MW of power generation, modelling of SO_2 emissions showed that the airshed is reaching capacity and there may be short-term exceedances of the NEPM Standard under certain worst-case scenarios. However, if the second stage of the Collie Power Station is not built, the area within which an exceedance of the NEPM Standard is predicted to occur is generally small and either close to the power stations or in locations where residences do not occur (and the NEPM Standard would not apply).

The EPA considers that proposals with significant atmospheric emissions should not be designed to just come within the NEPM Goal, which allows an exceedance of the NEPM Standard on one day per year. In addition, there may be an opportunity cost to the State if the affected air shed in the Collie region is fully utilised by this power station project. Options to address these issues which should be examined and addressed in the s38 process include the use of pollution control technology (eg desulphurisation), reducing the power generation capacity, increasing the stack height and moving the location of the power plant. There is certainly potential for pollution control and the EPA notes the European Council Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants, specifies more stringent emission limits than suggested by the proponent.

In relation to atmospheric emissions, the EPA would clearly prefer combined cycle gas plants to coal fired power plants for electricity generation, However, it is the EPA's opinion that a power generating facility of the type and capacity proposed could meet the EPA's strategic environmental objective for gaseous and particulate emission provided that:

(i) the proponent undertakes further work in consultation with the DEP and in collaboration with other industries in the region, to demonstrate that the model being used to predict air quality impacts from SO_2 is reliable and being used correctly with reliable data;

(ii) the proponent demonstrates via modelling that atmospheric emissions from the proposal, when combined with the emissions from other sources in the region, are comfortably within ambient ground level criteria so as not to preclude future opportunities, nor cause unacceptable impacts on vegetation;

(iii) specific design parameters of any proposed power generating facility are subject to section 38 assessment;

(iv) through the s38 assessment, full characterisation of all stack emissions is produced;

(v) undertakes an assessment of health risk where appropriate, in support of their proposed approach; and

(vi) the proponent demonstrates through the s38 assessment that best practicable technology is used to minimise all discharges, particularly SO_2 and other air emissions.

Terrestrial flora

The EPA notes that Griffin Energy proposes, as far as practicable, to locate the plant and infrastructure on cleared or degraded land. The EPA notes that 27ha of degraded vegetation on the power station site and 1.5ha of state forest at the conveyor site could be directly impacted. The EPA notes the commitments by the proponent to minimise the impacts of the proposal on the local flora, including the preparation of Construction and Operational Phase Environmental Management Plans, conducting a DRF and Priority Flora Survey of the power station site and conveyor corridor, and a dieback survey of the conveyor corridor should State Forest require clearing.

The EPA considers that Griffin Energy's proposal to fence, destock and rehabilitate the areas of remnant vegetation that remain on its property after construction, to allow regrowth of understorey species, is environmentally beneficial. The EPA encourages the proponent to investigate what role the potentially affected area has

as an ecological linkage between other regionally significant areas. The EPA also considers that further mitigation measures may be appropriate, depending on the amount of vegetation impacted upon. With regard to any DRF which may be found in the footprint area, the EPA advises that approval to take would be a separate matter for the Minister for the Environment and Heritage to consider pursuant to the Wildlife Conservation Act.

Terrestrial fauna

The EPA notes that there is potential for loss of habitat, particularly avifauna breeding sites if clearing of up to 27ha of degraded *E. marginata - C. calophylla - A. fraseriana* on the power station site and 1.5ha of state forest for the conveyor is to occur. The EPA notes that there is potential for six threatened species of avifauna to occur on the power station site. In addition, five more terrestrial species could occur along the conveyor corridor.

The EPA notes the commitments by the proponent to minimise the impacts of the proposal on terrestrial fauna to conduct a survey of areas likely to be disturbed for the occurrence of Baudin's and the Red-tailed Black Cockatoo and to determine the need to conduct an additional threatened fauna survey of the conveyor corridor. The EPA also notes that the proponent will consult with CALM prior to undertaking any clearing and conduct a targeted survey to identify nesting hollows and breeding pairs in consultation with the WA Museum. Depending on the outcome of future surveys, it is unlikely that terrestrial fauna would represent a fatal flaw for this project.

Groundwater quantity

The supply of water to the power station will initially be from mine dewatering sourced from the Ewington I pit. It is estimated that the total station annual water consumption will be 15 GLpa, although this could be reduced by approximately 3GLpa with the application of recycling technology. The EPA acknowledges that power stations in the Collie region currently operate under the principle that the primary use of groundwater resources (e.g. mine dewatering) is for power generation.

The EPA notes that the site area is underlain by an unconfined near surface aquifer and below this is the Collie Basin where transmissive sandstone beds occurring in the interburdens between the coal seams form the major aquifer zones. There appears to be limited hydraulic interconnection between surficial aquifers and wetlands in some areas.

The EPA notes the issues raised in submissions, particularly concerns that groundwater abstraction from the Collie Basin should be minimised and that there is a need to assess and overcome existing impacts of groundwater abstraction, particularly on surrounding wetlands and property owners.

The EPA notes that, as part of the mitigation measures proposed by Griffin Energy, the proposed water management strategy to capture saline river water in mine voids and reuse it in the power stations has the potential to be a significant environmental benefit. The EPA supports and encourages that this water supply strategy be formalised and documented in consultation with DEWCP, the Water Corporation, the Collie Water Advisory Group and other relevant regulatory authorities and stakeholders.

The EPA considers that Griffin Energy's strategy to pursue alternative water supply options could improve water management within the entire Collie Basin and could possibly result in a significant contribution to the South West of Western Australia's fresh water supplies.

Groundwater quality

The quality of the groundwater is generally fresh (TDS <500mg/L), although higher salinities occur at the margins of the basin and salinities at the nearby Collie Power Station site are highly variable. Fly ash disposal at the South West Power Project has the potential to affect the quality of groundwater. Fly ash will initially be held on-site in silos prior to being trucked to Ewington 1 for disposal, above the water table within the returned overburden.

The EPA considers that further investigation may be required to demonstrate the effectiveness of disposing of overburden above the water table in preventing groundwater pollution. The EPA encourages Griffin Energy to pursue its research efforts towards finding a beneficial use for the fly ash that does not have any significant impact on the environment, such as in cement manufacture or similar uses.

The EPA considers that a commitment by the proponent to prepare and implement an Operations Phase Environmental Management Plan to monitor groundwater quality to ensure that potential impacts from the power station on groundwater quality are managed would be capable of adequately dealing with this issue.

The EPA has previously noted that Griffin Energy is investigating alternative water supply options within the Collie Basin, including capturing saline river water into mine voids and reusing the water in the power stations. Full details of this proposal are not yet available and it is not the intention of the EPA to assess the associated impacts at this stage. While the replacement of potable water for cooling with saline water has the potential to have environmental benefits, the EPA notes that there is the potential for the saline water to contaminate the groundwater in the area, if such measures were implemented and this aspect would need careful attention.

The EPA considers that Griffin Energy's strategy to pursue alternative supply options could improve water management within the entire Collie Basin and result in a significant contribution (over 130Glpa) to the South West of Western Australia's fresh water supplies.

The EPA considers it appropriate that the water supply strategy be finalised and documented in consultation with DEWCP, the Water Corporation and other relevant regulatory authorities and stakeholders.

Marine water quality

Griffin Energy proposes to discharge the saline cooling water from the power station via the existing Collie Power Station pipeline to the ocean. Although monitoring results associated with the marine outfall disposal suggests that there has been negligible impact on the marine environment to date, the EPA advises that in any subsequent proposal, the proponent may need to provide for assessment, a detailed characterisation of the waste stream and justify that sufficient observations had been made to properly map and characterise the benthic habitat. The EPA suggests that the proponent extend its management objective to avoid or minimise

waste discharge to the marine environment, and take every opportunity for reuse and recycling.

The EPA advises Griffin Energy to become familiar with the water quality requirements for Cockburn Sound and test the quality of the ocean outfall water against this criteria (EPA Revised Draft Environmental Protection-Cockburn Sound-Policy 2002, November 2002)

Waste management

The EPA notes that Griffin Energy proposes to use best practicable measures to avoid/minimise emissions to air, water and land consistent with waste minimisation principles. A commitment by the proponent to investigate zero off-site discharge is encouraged and, if implemented, would be a highly desirable environmental and natural resource outcome; it would also set a new benchmark for the power generation industry in the State.

The EPA considers that disposal of saline cooling water to the marine environment and fly ash to mine voids are important issues to be addressed in the section 38 environmental assessment. The proponent is encouraged to continue developing environmental beneficial uses and markets for the ash, such as incorporation in cement products. Any proposal to dispose of ash into coal mining voids will need to demonstrate that groundwater quality will not be significantly affected. Similarly, options for saline water disposal such as evaporation and on-site reuse for cooling water should be pursued.

Noise

The EPA notes that the plant will result in noise levels less than 25 dB(A) at the nearest residences in Collie, and therefore should neither exceed the assigned level nor significantly contribute to an exceedance.

However, the proponent's documentation does not indicate whether the predicted noise levels meet the L_{A10} assigned noise level for neighbouring premises (i.e. 65 dB(A)) for industrial and utility premises. In the event that the noise emissions were tonal, and the tonality could not practicably be removed without reducing the overall level of the noise emission, the proponent should ensure that the units are set back at least 400m, or at a sufficient distance based on modelling data, to achieve the boundary assigned level.

The EPA encourages Griffin Energy to consult with the Shire of Collie and nearby landowners and residents that may be affected by construction and operational noise impacts.

Buffer Zone

The EPA notes that a buffer zone of about 4 km in radius around the existing Collie Power Station is to be established through the draft Town Planning Scheme No.4. However the EPA advises that a larger buffer zone to exclude residential development is likely to be required should this proposal be implemented. The EPA considers that appropriate limits and standards for noise and air quality protection would apply via DEP licence conditions. The EPA encourages Griffin Energy to consult with the Shire of Collie, the Ministry of Planning and Infrastructure, Western Power, the local community and other stakeholders to put in place an adequate buffer zone that will protect industry from the encroachment

of residential development close to the development and which could constrain its operations.

Conclusions

The EPA would clearly prefer combined cycle gas plants to coal fired power plants for electricity generation. However, in providing this advice the EPA considers that the construction and operation of a supercritical coal-fired power generating facility of the type proposed could be managed such that it is likely that the EPA's objectives would be met, provided that there is a commitment by Griffin Energy, at the time of any section 38 referral, to implement a substantial package of mitigation measures to adequately address greenhouse gas emissions, which could include alternative water supply and renewable energy options, that will demonstrably result in significant environmental benefit.

The EPA advises Griffin Energy that, in putting forward a specific proposal for a power generating facility in the future, it should take into account:

- the issues raised in the Strategic Environmental Review document;
- the public submissions and Griffin Energy's response to them;
- the advice in this report on the relevant strategic environmental factors as set out in Section 3;
- commitments to address greenhouse gas emissions by best practice and a substantial mitigation programme which could include the following:

  a renewable energy project using a wind farm to produce about 80 MW.

  It has been proposed that this would include the installation of a substantial wind farm on land near Cataby, 170 km north of Perth. The wind farm has the potential to produce 80MW of electricity. By combining the wind component into the overall strategy the greenhouse impact from power station could be partially offset;

  use of wood wastes for about10% co-firing with coal.

  The design of the fuel feed for the power station will include the use of forestry products derived from plantation timbers. About 10% of the fuel for the station could be from this renewable source;

  substantial carbon sequestration on pastoral land and via tree planting; and

  implementation of a water management strategy involving diversion and desalination of high salinity flows from the East Collie River for use in the Power Station cooling and subsequent supply of mine dewatering water to Wellington Dam to improve water quality in the dam for potable purposes.

- that such a proposal will need to undergo section 38 assessment.

Contents

Tables

Figures

Appendices

1. Introduction and background

Griffin Energy Pty Limited ("Griffin Energy") has requested early strategic advice from the Environmental Protection Authority (EPA) on any constraints which may be "fatal flaws" from an environmental impact perspective, which may apply to the construction and operation of a 800MW advanced super critical coal-fired power facility in the Collie Region of Western Australia (Griffin Energy, 2002). The power station proposal, referred to as the South West Power Project (SWPP), is one element of an overall integrated sustainable energy project.

The intent is for Griffin Energy to bid to sell electricity as an "owner and operator" of a power station through the power procurement process under the *Electricity Corporation Act 1994*. In addition, should the Government implement the recommendations of the Electricity Review Task Force, Griffin Energy could also sell electricity into a wholesale electricity pool.

The EPA has assessed the proposal and provides strategic advice to the proponent under Section 16(j) of the *Environmental Protection Act 1986*. The advice is provided to guide the proponent on a more specific power generation proposal in the future, through identification of 'fatal flaws' and the type and extent of further work that will be required for environmental approval, in order to address environmental issues of concern to the EPA.

Griffin Energy prepared the Strategic Environmental Review (SER) document for the proposal which was made available for a four week public review period which commenced on 2 September 2002 and closed on 1 October 2002.

The EPA has considered the relevant strategic environmental factors associated with the proposal, issues raised in public submissions, the proponent's response to submissions and advice of the Department of Environmental Protection (DEP) and other government agencies.

Further details of the proposal are presented in Section 2 of this report while Section 3 discusses strategic environmental factors relevant to the proposal. Section 4 outlines the EPA's conclusions on the strategic assessment.

A list of people and organisations that made submissions is included in Appendix 1 and references are listed in Appendix 2. Appendix 3 contains a summary of the proposal characteristics and the environment for each of the preliminary environmental factors, a summary of public and government agency submissions and the identification of the more important, relevant strategic environmental factors. The EPA has considered issues raised in public submissions and the response from Griffin Energy to those issues when identifying relevant strategic environmental factors. Appendix 4 contains the proponent's response to submissions and is included as a matter of information only – it does not form part of the EPA's report.

2. The proposal

The proposal is for the construction and operation of an 800MW advanced super critical coal-fired power facility (referred to as the South West Power Project (SWPP) in the Collie Region of Western Australia.

The proposed SWPP will be located on Griffin Coal freehold land approximately 4.5km north east of Collie, WA. Collie is approximately 200km south of Perth and approximately 55km east of the City of Bunbury (Figure 1).

The power station is one element of an overall integrated sustainable energy project (referred to as the South West Power Project (SWPP) being evaluated by Griffin Energy, which could also include:

- a renewable energy project using a wind farm to produce up to 80 MW.

  This would include the installation of a substantial wind farm on land near Cataby, 170 km north of Perth. The wind farm has the potential to produce 80MW of electricity. By combining the wind component into the overall strategy there is the potential to partially offset the greenhouse impact from power station;
- use of wood wastes for up to 10% co-firing with coal.

  The design of the fuel feed for the power station will include the use of forestry products derived from plantation timbers. Up to 10% of the fuel for the station could be from this renewable source;
- carbon sequestration on pastoral land and via tree planting; and
- implementation of a water management strategy involving diversion and desalination of high salinity flows from the East Collie River for use in the Power Station cooling and subsequent supply of mine dewatering water to Wellington Dam to improve water quality in the dam for potable purposes.

A summary of key project characteristics of the SWPP is provided in Table 1. A detailed description is provided in Section 4 of the Strategic Environmental Review document (Griffin Energy 2002).

Table 1: Key Proposal Characteristics

Element	Characteristic
Plant Design	
Project Purpose	To produce electricity to supply to the SWIS grid and local industry
Construction Period	36 months to first unit commercial operation
Project Life	30 years
Power Plant Type	High efficiency, advanced super critical coal fired power station
Power Generating Capacity	2 units x 420MW (gross)
Plant Operation	Base load operation 24 hrs/day, 365 days/yr
Shutdown Time	Plant shutdowns for maintenance may be scheduled annually. Units will be capable of operating separately.
Facility Footprint	60 hectares excluding buffer zones
Plant Facilities	
Number of Stacks	1
Height of Stacks	~170m
Number of Cooling Towers	2 x 25m high
Number of Liquid Fuel Storage Tanks	2
Renewables (wood)	about 10% of fuel source
Utilities	
Water Supply	~ 15,000 ML (7,500 ML each)
Coal Supply	3 Mtpa via conveyor
Fuel Oil Storage	To be determined
Tranmission line length	Less than a few hundred metres
Emissions	
Noise	Less than 60 dBA at 150 metres from the plant
Flue Dust (PM_{10})	50 mg/m^3
Nitrogen Oxides	500 mg/m^3
Sulphur Oxides	1090 mg/m^3
Greenhouse Gases	4.5 Mtpa

Element	Characteristic
Waste	
Ash	440 ktpa disposed to the adjacent Ewington I mine
Septage	Packaged treatment plant
Saline Water	Disposal via existing pipeline
Workforce	
Construction	Approximately 1,000 personnel at peak of construction
Operations	40 - 50 full time personnel, with maintenance support equivalent to additional 80 - 100 personnel

– source Griffin Energy (2002)

In overview the SWPP will consist of the following components:

- 2 x 420MW (gross) power units;
- 2 x 25m high cooling towers;
- a common 170m high stack;
- switchyard;
- water treatment plant;
- coal conveyor from the Ewington II coal processing plant;
- fly ash disposal to the Ewington I pit;
- saline water disposal via the existing pipeline; and
- various building and storage facilities.

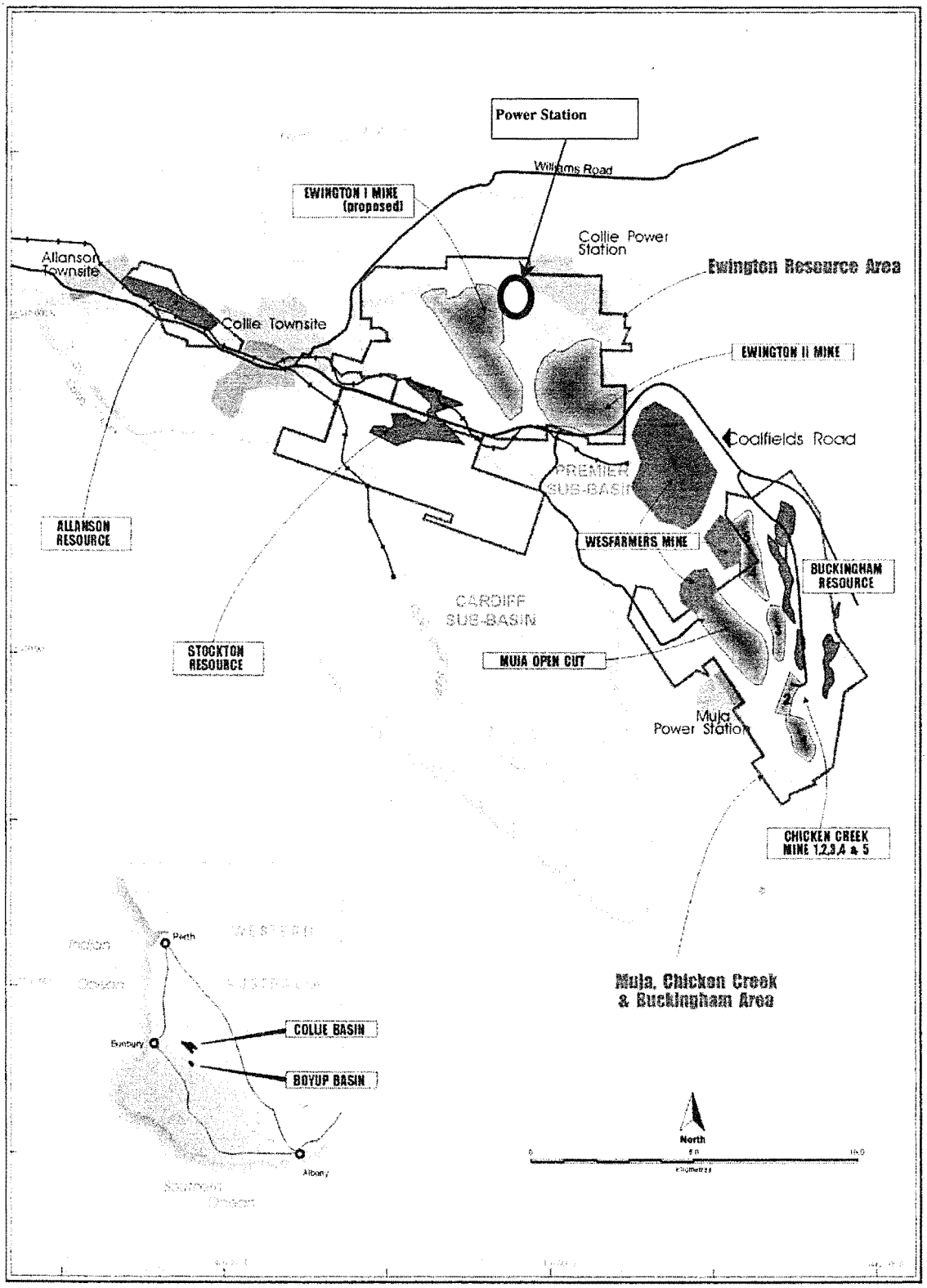

Figure 1: Location of proposed power generation facility near Collie

3. Relevant strategic environmental factors

The EPA has identified the relevant strategic environmental factors, firstly by referring to the preliminary list of factors identified in the EPA's guidelines and secondly from the proponent's SER and public submissions.

Appendix A of the SER contains a copy of the EPA's guidelines for the strategic assessment and identifies the issues to be addressed by Griffin Energy in the SER.

Accordingly, it is the EPA's opinion that the following strategic environmental factors relevant to the proposed SWPP require detailed evaluation in this report:

(a) greenhouse gas emissions;
(b) gaseous and particulate emissions;
(c) terrestrial flora;
(d) terrestrial fauna;
(e) groundwater quantity;
(f) groundwater quality
(g) marine water quality
(h) waste management;
(i) noise and vibration; and
(j) buffer zones.

The identification of relevant factors selected for detailed evaluation in this report is summarised in Appendix 3. The description of each factor shows why it is important and how the development of power generation facilities at the site may impact upon the environment.

Objectives for each factor have been included in this section to provide guidance for a specific proposal which may be referred to the EPA for assessment in the future. Objectives for any or all factors may change for any subsequent proposal based on this strategic assessment and any subsequent information that becomes available.

Greenhouse gas emissions

Description

The proposed power station would be a significant contributor of greenhouse gases in the State and will emit approximately 4.5Mt of CO_2 per year. During the public review period it was discovered that there were minor errors in Table 10.8 of the SER showing predicted annual CO_2 emission from the project. These are reproduced in the correct form in this report.

The proposed supercritical coal-fired plant will produce 796 $kgCO_{2e}$/MWh and will be considerably more efficient than the recently built Collie A power station (950 $kgCO_{2e}$/MWh) and Muja power stations (1030 – 1205 $kgCO_{2e}$/MWh).

Table 2: Predicted CO_{2e} Emissions Per Project Year for SWPP

Source	Project Year (emissions in kilotonnes)		
	1 - 3	4 - 10	11 - 20
Coal Production			
Mining/Extraction	0	70	70
Blasting	0	0.050	0.050
Spontaneous Combustion	0	2.8	2.8
Coal Transport / Delivery			
Conveyor	0	1.6	1.6
Power Station Construction			
Vegetation Clearing	0.230	0.230	0
Mobile equipment use	?	0	0
Power Station Operation			
Coal Combustion	0	4,392	4,392
Fly ash Disposal - Landfilling	0.320	0.320	0.320
Domestic Wastewater Decomposition	0.060	0.003	0.003
Total (rounded)	**1**	**4,467**	**4,467**

– source Griffin Energy (2002)

A broad package of sustainable development measures have been identified and considered by Griffin Energy as part of its strategic evaluation of the SWPP to date. Specific measures relevant to the reduction and mitigation of greenhouse gas emissions include:

- renewable energy generation (wind and biomass);
- advanced high efficiency coal-fired generation technology;
- sequestration via forestry; and
- desalination as part of a regional water management strategy.

The effect of these mitigating measures in reducing greenhouse gas emissions from coal-fired power generation facilities compared to gas-fired power facilities station are summarized in Table 3 (Reference: Appendix 4 of this report- Response to submissions).

The proponent estimates that, based on a 20 year timeframe analysis on full production, whole life cycle emissions, the coal-fired power plant greenhouse emissions are approximately 10% above (or 375,000 tonnes/annum more than) that from a combined cycle gas turbine power plant of similar load use. Over a 100 year timeframe, the coal-fired power plant greenhouse emissions are approximately 42% above that from a combined cycle gas turbine power plant. The EPA considers that greenhouse emissions could be partially ameliorated by the implementation of appropriate mitigating measures.

Table 3: Comparison between Coal and Natural Gas Greenhouse Emissions

	Greenhouse Emissions per Year			
	20-Year Timeframe		100-Year Timeframe	
	Coal	Gas	Coal	Gas
Process:				
• Mining and Extraction of fuel (kg CO_{2e} / MWh_e)	12.60	96.96	12.60	95.22
• Transport and Distribution (kg CO_{2e} / MWh_e)	0.29	214.13	0.29	50.30
• Fuel Combustion (kg CO_{2e} / MWh_e)	795.88	425.60	795.88	425.60
Total (kg CO_{2e} / MWh_e)	**808.77**	**736.69**	**808.77**	**571.12**
Total per year (kilotonnes CO_{2e} pa)* (800 MW @ 75% Capacity Factor)	**4,251**	**3,873**	**4,251**	**3,002**
Amelioration Initiatives:				
• Renewable Fuel	180		180	
• Wind Generation	150		150	
• Desalination energy Savings	129		129	
• Carbon Sequestration	110		110	
Total per year (kilotonnes CO_{2e} pa)	**569**		**569**	
Ameliorated Total Emissions (kilotonnes CO_{2e} pa)	**3,682**	**3,873**	**3,682**	**3,002**

Note * : this excludes other SWPP project greenhouse emissions (refer SER, Table 10.8).
– source Appendix 4 of this report

Submissions

A number of submissions focused on the following:

- the use of a 20-year timeframe versus a 100-year timeframe for calculation of global warming potential's, which can significantly favour coal over gas;
- the assumptions made by the proponent and used in the lifecycle assessment about fugitive gas emissions from upstream gas infrastructure, which favour coal-fired generation over gas-fired generation; and
- the thermal efficiency of gas-fired versus coal-fired plants for electricity generation.

Other submissions commented on:

- the use of emissions trading to offset greenhouse impacts of fossil fuel use;
- the legal requirement for Western Australia to develop some 250 MW of renewable energy by the year 2010;
- the need for the State to not only maintain coal for fuel diversity reasons, but also to develop renewable energy power projects, especially in light of Kyoto and the MRET legislation.
- the true cost of renewable electricity, suggesting that renewable energy is now cheaper than coal or gas fired generation when the costs associated with externalities are properly considered; and
- the inappropriateness of burning more coal for power generation when the world requires a reduction in greenhouse gas emissions.

Strategic advice

The EPA's strategic environmental objective for this factor is that:

- greenhouse gas emissions are minimised for the project;
- emissions per unit product are reduced to as low as reasonably practicable; and
- greenhouse gas emissions are mitigated in accordance with the Framework Convention on Climate Change 1992, and with established Commonwealth and State policies.

The EPA notes that, if implemented, the proposed power station would be a significant contributor of greenhouse gases in the State, emitting some 4.5Mt of CO_2 per year.

The EPA has previously advised (EPA, 1990, 2002) that its preference in relation to meeting electricity demand is, in declining order of rank:

- conservation and efficiency improvements;
- renewable energy sources such as wind and solar energy;
- gas, including combined cycle, turbines;
- new technology coal plants;
- old technology coal plants; and
- petroleum fuel plants.

The EPA is aware that the demand for electricity in Western Australia will continue to grow and, ideally, additional demand should be satisfied through electricity generating facilities which minimise the production of greenhouse gases. If power stations are proposed which do not result in the least greenhouse gas intensity, the EPA expects that mitigation actions would be investigated during the Section 38 process and adopted as appropriate.

Renewables will be an important means of achieving this. The EPA, however, recognises that in assessing electricity generating proposals, supply agencies will need to give consideration to the size of the supply required, technical issues (eg the need for rapid response to peak demands) and strategic requirements (eg. maintaining a balance of sources and types of fuel).

The EPA notes the broad package of sustainable development measures which have been identified and considered by Griffin Energy as part of its strategic evaluation of the SWPP to date. Specific measures relevant to the reduction and mitigation of greenhouse gas emissions include:

- renewable energy generation (wind and biomass);
- advanced high efficiency coal-fired generation technology;
- sequestration via forestry; and
- desalination as part of a regional water management strategy.

The EPA considers such a package of mitigating measures presents a responsible way of addressing the environmental impacts associated with higher greenhouse gas emissions from coal-fired power stations. The EPA would expect Griffin Energy to commit to a package of mitigating measures at least as effective as those outlined earlier in this section in support of any proposal for a 800 MW coal-fired power station.

The EPA understands that part of the justification for the proposal is based on the environmental benefits gained from the replacement of the nearby aging Muja A and B power stations which currently generate some 250 MW of power. The proposed coal-fired, super critical steam cycle plant offers advantages over the old coal-fired power stations in terms of higher thermal efficiencies and lower carbon dioxide emissions per GJ of energy produced. Replacement of old coal-fired power stations with new technology coal plants is a progressive step in relation to meeting electricity demands and contributing to a reduction in greenhouse gas emissions.

The EPA notes that currently there is debate on the time-frame for calculating greenhouse intensity to facilitate a comparison between coal and natural gas generated emissions i.e. 100 years (which is the more accepted time frame) or 20 years. The issue is relevant when considering the impact of short-lived greenhouse gases such as methane that has an atmospheric lifetime of 10-15 years. The impact of methane is significantly underestimated when a 100-year timeframe is adopted instead of the 20-year timeframe (IPCC 2001).

The proponent estimates that, based on a 20-year timeframe analysis on full production, whole life cycle emissions, the coal-fired power plant greenhouse emissions are approximately 10% above (or 375,000 tonnes/annum more than) that from combined cycle gas turbine power plant of similar load use. Over a 100-year timeframe, the coal-fired power plant greenhouse emissions are approximately 42% above that from a combined cycle gas turbine power plant. The EPA considers that greenhouse emissions could be partially ameliorated by the implementation of appropriate mitigating measures.

It is the EPA's opinion that the proposed SWPP, if implemented with the proposed or a similar package of mitigating measures as outlined, could meet the EPA's objective for greenhouse gas emissions provided that:

- the greenhouse gas estimation (and comparisons with natural gas) are further refined to provide accurate data for a section 38 assessment;
- specific design parameters of any proposed power generating facilities are subject to section 38 assessment; and
- the proposed or a similar package of measures as outlined in the SER are used to mitigate greenhouse gas emissions.

Gaseous and particulate emissions

Description

The proposed power station would emit significant quantities of NO_X and SO_2 and, to a lesser extent, particulates and unburnt hydrocarbons. The SER predicts fugitive dust emissions and emissions of PM_{10} (50 mg/m^3), SO_2 (1090 mg/m^3), NO_2 (500 mg/m^3) and O_3. No specific monitoring for $PM_{2.5}$ has been undertaken in the Collie region. There is potential for emissions of Poly Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), dioxin and furan, but the proponent expects for these to be at low levels.

Griffin Energy proposes to use high efficiency fabric filters to significantly reduce particulate emissions. Griffin Energy considers that fabric filters have a higher collection efficiency than electrostatic precipitators (ESP's) for trace elements, such as mercury and other toxics.

SO_2 and NO_x emissions depend on combustion conditions and the coal batch being burned. The NO_x burners are designed to meet a design maximum emission limit of 500 mg/m^3 although the annual average emission level would be much lower than this. The SO_2 emission rate quoted is based on an average sulphur content in the coals of 0.42% sulphur (as-fired basis). The Run of Mine daily sulphur content ranges from 0.2 to 0.9% although further blending and homogenisation in the coal stockyard and facilities should ensure that sulphur is within desired specifications before becoming power station feed.

Revised modelling of ground level SO_2 concentrations by the proponent (refer to Appendix 3) during the assessment process for Scenario 2 (i.e. Collie A, Griffin Energy operating at 800MW, Muja C & D, Worsley) shows that the highest 1 hour maximum concentrations exceed the National Environmental Protection Measure (NEPM) standard set by the National Environment Protection Council (NEPC, 1998) in an area 3 km north of Collie townsite, as well as the areas around the Muja and Collie A power plants where residences do not occur (and the NEPM standard would not apply). However the modelling shows that, in the area north of Collie, the second-highest 1 hour maximum concentration did not exceed the NEPM standard.

SO_2 and NO_X emissions have the potential to impact on vegetation. Vegetation monitoring performed by Western Power between 1997 and 2000 has indicated that, based on statistical analyses, no impact of ambient SO_2 on vegetation could be determined. In 1990 a review was conducted on the likelihood of acid deposition in the Collie region. This indicated that some changes in the pH of rainfall could occur, however measurable adverse (or beneficial) effects would be unlikely.

Submissions

Most of the submissions related to SO_2 issues, namely:

- the quality of the modelling work used by the proponent to predict ground level SO_2 concentrations;
- the use of the NEPM Goal to limit the project design;
- SO_2 modelling showing that the airshed is becoming quite full and there may be exceedances under certain worst case scenarios;
- need for the proponent to undertake further work to show that the data and modelling are correct;
- need for collaborative work with Western Power to test TAPM and other models as required;
- consideration of options such as desulphurisation, increased stack height and changing the site location, if subsequent modelling shows that SO_2 could still be a potential constraint to the project operation;
- definition of the boundary beyond which the NEPM standard and DEP licence conditions should apply;
- possible expansion of the buffer zone;
- the use of the most up-to-date environmental techniques and best practice for pollution control; and
- the value and range of coal sulphur content chosen for air quality modelling.

The Air Quality Management Branch (AQMB) of the DEP commented on the quality of the modelling work undertaken for ground level SO_2 concentrations as presented in the SER and an ancillary report, in particular errors in the input emissions data, the overly large meteorological grid size for the TAPM model and errors in data presentation. Subsequent further modelling undertaken by the proponent was considered of sufficiently high standard for the purposes of this strategic assessment, and check modelling by the AQMB generally gave similar results to the latest modelling work by the proponent.

Strategic advice

The EPA's strategic environmental objective for this factor is that:

- during construction, the surrounding land users are protected such that dust and particulate emissions will not adversely impact upon their welfare and amenity or cause health problems, in accordance with EPA *Guidance Statement No. 18: Prevention of Air Quality Impacts from Land Development Sites*; and
- during operations, particulate and gaseous emissions, both individually and cumulatively, meet acceptable criteria for ambient ground level concentrations, and that all reasonable and practicable measures are taken to minimise emissions.

The area considered for this assessment is the SWPP site, surrounding properties and the Collie air-shed generally.

Air quality is an issue that continues to be one of the key environmental concerns for the community. Research has clearly shown that air pollution can adversely affect human health and the environment, depending on the nature and concentration of the pollutants of concern. The EPA is currently preparing a draft Environmental Protection Policy for Ambient Air Quality (EPA, 2001) in accordance with prior commitments to implement the Ambient Air Quality National Environmental Protection Measure (NEPM).

The EPA considers that Griffin Energy's proposal to use high efficiency fabric filters will significantly reduce the emission of particulates in comparison to existing facilities.

The EPA's assessment on gaseous emissions has focused on the potential impact from SO_2 emissions, given the quantity of coal needed to generate 800MW of electricity, the presence of significant levels of sulphur in the coal and the outcome of SO_2 modelling.

Under the proposed scenario of 800 MW of power generation, modelling of SO_2 emissions by both the proponent and the DEP shows that the airshed is reaching capacity and there may be short-term exceedances of the NEPM Standard under certain worst-case scenarios. However, provided the second stage of the Collie Power Station is not built, the area within which an exceedance of the NEPM Standard is predicted to occur is generally small and either close to the power stations or in locations where residences do not occur (and where the NEPM Standard would not apply).

The EPA considers that proposals with significant atmospheric emissions should not be designed to just come within the NEPM Goal, which allows an exceedance of the NEPM Standard on one day per year. In addition, there may be an opportunity cost to

the State if the affected air shed in the Collie region is fully utilised by power station project. Options to address these issues include reducing the power generation capacity, increasing the stack height, moving the location of the power plant, and using desulphurisation or other technology.

It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor, provided that:

- the proponent undertakes further work in consultation with the DEP and in collaboration with other industries in the region, to demonstrate that the model being used to predict air quality impacts from SO_2 is reliable and being used correctly with reliable data;
- the proponent demonstrates via modelling that atmospheric emissions from the proposal, when combined with the emissions from other sources in the region, do not exceed ambient ground level criteria, nor cause unacceptable impacts on vegetation;
- specific design parameters of any proposed power generating facilities are subject to section 38 assessment;
- through the s38 assessment, full characterisation of all stack emissions is produced;
- the proponent undertakes an assessment of health risk, where appropriate, in support of its proposal approach; and
- through the s38 assessment, the proponent demonstrates that best practicable technology is employed to minimise all discharges, particularly SO_2 and any toxic air emissions.

Terrestrial flora

Description

The total area of disturbance for the power station site is 60ha, although the exact location of the power station and associated infrastructure within proponent's private property is yet to be determined. The property comprises 64ha of cleared land, 6ha of seasonal sedge swamp and 27ha of degraded *E. marginata - C. calophylla - A. fraseriana* (i.e. the proposed power station construction could impact on up to 27ha of native vegetation.)

A mine conveyor and services corridor of about 1.5km may be located within the existing 330kV transmission corridor or in adjacent State Forest, in which case up to 1.5ha of native vegetation would need to be cleared.

The proposal has no significant impact on known populations of rare flora, however a rare flora survey over the site is yet to be conducted.

There is the potential for the introduction and spread of dieback, Jarrah Leaf Miner and weeds through the spread of soil and/or cleared vegetation during construction.

Vegetation loss due to modification to surface hydrology is unlikely as no major drainage lines exist on-site.

Submissions

The main issues raised in submissions on terrestrial flora included:

- clarification on whether there would be a requirement for additional clearing for powerlines over the full life of project;
- failure to address additional impacts on biodiversity and other values from any expansion of environmental footprint from coal mining over the life of project;
- no details are provided for additional dams or roads;
- no guarantee or commitment that mitigation measures will be implemented;
- mitigation measures, including the identification of opportunities for enhancement of surrounding biodiversity values, need to be addressed in some detail prior to subsequent formal assessment;
- degradation of the existing site has substantially reduced the vegetation's conservation potential and protection values;
- remnant vegetation to be retained within the site should be fenced to allow regeneration and revegetated where necessary;
- the conveyor route from Ewington II coal mine should utilise one or more of the existing cleared corridors;
- the SER does not include a vegetation condition map;
- the role of the area as an ecological linkage between other regionally significant areas has not been determined; and
- a survey for the presence of *Phytopthora cinnamom*i has not been undertaken for the proposed site.

Strategic advice

The EPA's strategic environmental objectives for this factor are to:

- maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities;
- protect Declared Rare and Priority Flora consistent with the provisions of the Wildlife Conservation Act 1950; and
- protect other flora species of conservation significance.

The area considered for this assessment is the SWPP site and the mine conveyor and services corridor.

The EPA notes the commitments by the proponent to minimise the impacts of the proposal on the local flora, namely:

- Commitment 2 - Prepare a Construction Phase Environmental Management Plan for the project.
- Commitment 3 - Prepare an Operations Phase Environmental Management Plan for the project.
- Commitment 4 - Conduct a DRF and Priority Flora Survey of the power station site and conveyor corridor.
- Commitment 5 - Conduct a dieback survey of the conveyor corridor should State Forest require clearing.

The EPA notes that Griffin Energy proposes, as far as practicable, to locate the plant and infrastructure on cleared or degraded habitat. However the proponent should investigate what role the potentially affected area has as an ecological linkage

between other regionally significant areas. Mitigation measures may be appropriate, depending on the amount of vegetation impacted upon.

The EPA supports Griffin Energy's proposal to fence, destock and rehabilitate the areas of remnant vegetation that remain on its property after construction, to allow regrowth of understorey species.

Given the commitments by Griffin Energy in the SER and in response to submissions, it is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's environmental objective for this factor provided that:

- specific design parameters of the proposal are subject to section 38 assessment;
- the removal of any native vegetation is minimised and appropriate mitigating measures applied; and
- declared rare and priority flora are managed in accordance with CALM's requirements.

Terrestrial fauna

Description

The majority of the proposed power station site is cleared with some isolated groves of native vegetation and is currently being used for grazing. Native vegetation occurs to the south of the site. Fauna surveys of the general area have been conducted to support approvals for the nearby Ewington I and II mines. These surveys identified the presence of one Schedule One species and several Priority species.

Potential loss of habitat, particularly avifauna breeding sites, will result from clearing of up to 27ha of degraded *E. marginata - C. calophylla - A. fraseriana* on the power station site and 1.5ha of state forest for the conveyor. There is the potential for 6 Threatened species of avifauna to occur on the power station site. In addition to these a further 5 terrestrial species could occur along the conveyor corridor.

Submissions

The Ecological Systems Branch, Terrestrial Section raised a number of concerns in its submission, including:

- the accuracy and consistency of information in the tables, text and appendices regarding the presence of avifauna and hepetofauna;
- mobility of fauna between sites may not be as great as indicated in SER;
- justification that the habitat is significantly degraded and therefore of little conservation significance (given that a number of Schedule 1 and Priority species have been identified on the site);
- clearing outside the breeding season will still impact on the habitat of Baudin's Cockatoo and that the site should be assessed for current tree hollow usage; and
- clearing will be undertaken between January and June to avoid the breeding season of species such as Chuditch, Southern Brown Bandicoot, Brush-tailed Phascogale, Brush Wallaby and Yellow-footed Antechinus despite the fact that, with the exception of the Antechinus, all of these species are likely to breed between January and June.

Strategic and advice

The EPA's strategic environmental objectives for this factor are to:

- Maintain the abundance, diversity and geographic distribution of terrestrial fauna; and
- protect Specially Protected (Threatened) Fauna consistent with the provisions of the *Wildlife Conservation Act 1950*.

The area considered for this assessment is the SWPP site and the mine conveyor and services corridor.

The EPA notes the commitments by the proponent to minimise the impacts of the proposal on the local fauna, namely:

- Commitment 2 - Prepare a Construction Phase Environmental Management Plan for the project.
- Commitment 3 - Prepare an Operations Phase Environmental Management Plan for the project.
- Commitment 6 - Conduct a survey of areas to be disturbed for the occurrence of Baudin's and the Red-tailed Black Cockatoo.
- Commitment 7 - Determine the need to conduct an additional Threatened Fauna Survey of the conveyor corridor.

The EPA notes the response by the proponent to issues raised in submissions, in particular that CALM will be consulted prior to any clearing and that the proponent will conduct a targeted survey to identify nesting hollows and breeding pairs in consultation with the WA Museum.

Given the commitments by Griffin Energy in the SER and in response to submissions, it is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's environmental objective for this factor provided that:

- specific design parameters of any proposed power generating facility are subject to section 38 assessment;
- the impact of removal of native vegetation containing fauna habitat is minimised and appropriate mitigating measures applied; and
- declared rare and priority fauna are managed in accordance with the requirements of CALM and the WA Museum.

Groundwater quantity

Description

The supply of water to the power station will initially be from mine dewatering sourced from the Ewington I pit. It is estimated that the total station annual water consumption will be 15 GLpa; this could be reduced by approximately 3GLpa with the application of recycling technology.

The site area is underlain by an unconfined near surface aquifer within the superficial lateritic soils. Below this is the Collie Basin which consists of a multiple layered aquifer system where groundwater flow is controlled by lithology, subcrop zones and fault structures. Transmissive sandstone beds occurring in the interburdens between

the coal seams form the major aquifer zones. There appears to be limited hydraulic interconnection between superficial aquifers and wetlands in some areas (EPA 1990). Disused mine voids from open cut and below ground operations further complicate the situation. The total storage volume of the Basin is estimated to be about 7300GL, with 2100GL being practically recoverable. Of this 33% is within the Premier Sub-Basin.

There has been a general lowering of the water table in near surface aquifers within the Collie Basin. The draw down of groundwater has impacted on surface water, particularly the pools within the Collie River. Within the basin, the trend has been that extraction rates are in excess of recharge rates. Below average rainfall and increased mining and power generation activity have resulted in a net loss of groundwater from the system which was estimated at 7Glpa in 1996.

Griffin Energy is actively pursuing alternative supply options that will improve water management within the entire Collie Basin. Once the SWPP is operational, Griffin Energy proposes to capture saline river water in its mine voids and reuse the water in the power station. The water supply strategy would be finalised and documented in consultation with DEWCP, the Water Corporation and other relevant regulatory authorities and stakeholders. Part of the water supply strategy will address minimising the mine dewatering volumes in order to maximise the groundwater resources of the basin.

Submissions

Issues raised in submissions on groundwater quantity included the need to:

- minimise groundwater abstraction from the Collie Basin;
- assess and overcome existing impacts of groundwater abstraction, particularly on surrounding wetlands and property owners;
- address the long-term recovery periods for groundwater levels after mining;
- investigate alternatives that may reduce the volume of water abstracted;
- involve the Water and Rivers Commission and Water Corporation in the detailed planning and environmental studies aimed at understanding the water resources of the basin and how they would be impacted by the proposed project; and
- undertake specific hydrology and hydrogeology investigation work together with more detailed explanations and plans of proposed water management infrastructure and regime.

Strategic advice

The EPA's strategic environmental objectives for this factor is to maintain sufficient quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

The area considered for this assessment is the SWPP site and areas that may be affected by associated groundwater abstraction.

The EPA understands that power stations in the Collie region currently operate under the principle that the primary use of groundwater resources (e.g. mine dewatering) is for power generation (CWAG 1999). The EPA notes that the total annual water consumption for the proposed power station will be 15GL (to be supplied from

Ewington I dewatering activities) and that this could be reduced by approximately 3GLpa with the application of recycling technology.

The EPA notes the issues raised in submissions, particularly concerns that groundwater abstraction from the Collie Basin should be minimised and that there is a need to assess and overcome existing impacts of groundwater abstraction, particularly on surrounding wetlands and property owners.

The EPA notes, as part of the broad package of sustainable development measures proposed by Griffin Energy, an initiative in water management to capture saline river water in its mine voids and reuse the water in the power stations. Although the initiative is not part of this assessment, the EPA considers it appropriate that, given the potential of this strategy to reduce the current impacts on the groundwater resource, the water supply strategy be finalised and documented in consultation with DEWCP, the Water Corporation, the Collie Water Advisory Group and other relevant regulatory authorities and stakeholders.

The EPA considers that Griffin Energy's strategy to pursue alternative supply options will improve water management within the entire Collie Basin and could possibly result in a significant contribution to the Perth metropolitan area's fresh water supplies.

It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor provided that:

- specific design parameters of any proposed power generating facility are subject to section 38 assessment;
- the water supply strategy, when finalised and prior to implementation, is referred to the EPA for assessment.

Groundwater quality

Description

The SER reports that groundwater at the site is likely to be similar in quality to that in the nearby coal measures. The water is generally fresh (TDS <500mg/L), but it is known that higher salinities occur at the margins of the basin, and salinities at the nearby Collie Power Station site are highly variable. Groundwater in coal measures is typically acidic (particularly near existing or abandoned mines), and has high concentrations of dissolved iron, sulphate, hydrogen sulphide and carbon dioxide. High numbers of iron and sulphate bacteria can be present. Background concentrations of some elements, including heavy metals, in groundwater can be high in some areas.

Groundwater monitoring of the existing Collie Power Station site shows that groundwater quality outside the coal basin boundary is variable eg pH varies from 5.9 to 7.8, total dissolved solids from 165 to 7,709 mg/L and iron from 0.022 to 6.19 mg/L (Pacific Power International 2000). Groundwater monitoring will be needed, prior to the construction of the SWPP, to obtain baseline water quality data.

The operation of the power station has the potential to affect the quality of groundwater in the following ways:

- run-off from coal handling and storage areas;
- fly ash disposal;
- saline water leakage from storage ponds; and
- hydrocarbons and other chemicals used on site.

In section 6.3 of the SER Griffin Energy outlines measures to be taken at the site to ensure that contaminants are not released into the groundwater. These include:

- Fly ash will be initially held on-site in silos prior to being trucked to Ewington I for disposal above the water table within the returned overburden. The option exists for the use of fly ash in the cement and other industries and this will be pursued in preference to in-pit disposal.
- Saline water will be held on-site within sealed ponds (either compacted clay or plastic lined) prior to discharge via the existing saline water disposal pipeline to the ocean (refer to section 3.7 on marine water quality).
- Wash down water and water used in dust suppression will be collected and passed through sediment traps and oil separation systems prior to transfer to settling ponds.
- All potentially hazardous material will be stored in accordance with relevant legislation and regulations. Any areas containing hazardous material such as hydrocarbons will be designed to prevent run-off into general areas. Oils and cleaning wastes will be disposed offsite to a licensed off-site facility.

The SER indicates that monitoring bores will be installed once the layout of the site has been finalised. Groundwater monitoring will allow the collection of water quality data to quantify background temporal and spatial variability within the site, and will concentrate on areas which are likely to be downstream (in relation to groundwater flow) of bunded areas. This will allow the early identification of movement of water from the site (and associated contaminants) into the groundwater. Monitoring results will be compared to ANZECC and ARMCANZ (2000) trigger values for protection of freshwater ecosystems. Exceedance of these values in monitoring bores would trigger management actions to prevent the release of fly ash contaminants into groundwater.

Submissions

Issues raised in submissions on groundwater quality focused:

- possible diversion of saline or brackish Collie River water into mine voids; and
- disposal of flyash with overburden during rehabilitation of mine voids.

Strategic advice

The EPA's strategic environmental objective for this factor is to maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the Australian and New Zealand Water Quality Guidelines (ANZECC 2000 and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy.

The area considered for this assessment is the groundwater under the SWPP site and that under any mine voids that may be filled with saline water diverted from the Collie East River as part of the water supply strategy being developed.

The EPA notes that there is the potential for leachate from fly ash to contaminate the groundwater. The proposal by Griffin Energy to dispose of the material with

overburden above the water table may have merit, however the EPA considers that further investigative work may be required to demonstrate the effectiveness of this approach. The EPA encourages Griffin Energy to pursue its research efforts towards finding a beneficial use for the flyash that does not have any significant impact on the environment, such as in cement manufacture and other uses.

The EPA notes a commitment by the proponent to prepare an Operations Phase Environmental Management Plan to ensure protection of groundwater. This plan will incorporate monitoring and reporting requirements.

The EPA considers that, from a strategic perspective, that the measures proposed by Griffin Energy to monitor and manage potential impacts from the power station proposal on groundwater quality are appropriate.

The EPA considers that Griffin Energy's strategy to pursue alternative supply options could improve water management within the entire Collie Basin and result in a significant contribution (over 130Gl pa) to the South West of Western Australia's fresh water supplies.

Full details of this proposal are not yet available and it is not the intention of the EPA to assess the associated impacts at this stage. However it is evident that there is the potential for the saline water to contaminate the groundwater in the area if such measures were implemented.

The EPA considers it appropriate that the water supply strategy be finalised and documented in consultation with DEWCP, the Water Corporation and other relevant regulatory authorities and stakeholders.
It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor provided that:

- specific design parameters of the proposal are subject to section 38 assessment;
- further study is undertaken to demonstrate that the proposed disposal of flyash does not create unacceptable environmental impacts on groundwater;
- the water supply strategy, when finalised and prior to implementation, is referred to the EPA for assessment.

Marine quality

Description

Griffin Energy proposes to discharge the saline cooling water from the power station via the existing Collie Power Station pipeline to the ocean. The existing pipeline is approved for about twice the current discharge.

Cooling water from the Collie Power Station has been disposed offsite via a 68km long pipeline to the coast north of Leschenault Inlet, near Buffalo Road since January 1999. The outlet is 500m to the south of an outfall operated by Millenium Inorganic Chemicals.

The nearshore habitat is dominated by bare sand overlying limestone pavement. Further offshore predominantly sand and pavement habitat occurs with patches of low

relief reef and sparse seagrass. Seagrass meadows are generally confined to offshore areas (>600m).

The SER reports that the existing outfall for the Collie Power Station appears to have had little affect on the adjacent seagrasses. Water and sediment quality have not been impacted by the current discharge.

Additional brine disposal has the potential for cumulative impacts. The current mixing zone is predicted to increase to 15m x 92m (based on a 100-fold dilution) although concentrations of contaminants in the brine are expected to be similar to current levels.

Submissions

Issues raised in submissions on marine water quality focused on:

- the need for a detailed characterization of the waste stream and background seawater concentrations when any subsequent proposal is submitted for detailed assessment;
- the size of an authorized "mixing zone" which needs to be more accurately defined ;
- the most suitable time for undertaking environmental water quality assessments (being in the summer/autumn ie non riverine flow period);
- an increased focus in the future on analytical and sampling methods required by EPASU to achieve satisfactory LOR's;
- a possible review of the DEP licence conditions, monitoring requirements and management strategy;
- a requirement for some governance model to ensure that, cumulatively, the conditions of the licence are being met if there is more than one user of the pipe;
- the application of environmental values to the marine environment, unless there is some specified requirements to exempt small zones about the outfall;
- monitoring results associated with the marine outfall disposal, which suggest that there has been negligible impact on the marine environment;
- low levels of polluting heavy metals in Collie coal, which suggest that the risk of exceeding the assimilative capacity of the receiving environment at the pipeline diffuser may be low; and
- the possibility of no spare capacity in the saline water pipeline if Collie B is in operation.

Strategic advice

The EPA's strategic environmental objective for this factor is to maintain or improve marine water and sediment quality to protect Environmental Values (EV's) and Environmental Quality Objectives (EQO's) defined in Perth Coastal Waters Environmental Values and Objectives (EPA 2000) and sediment and water quality guidelines documented in Australian and New Zealand Water Quality Guidelines (ANZECC 2000).

The area considered for this assessment is the marine environment in the vicinity of the existing ocean outfall for the Collie Power Station, located on the coast north of Leschenault Inlet, near Buffalo Road.

The EPA notes the advice of DEWCP, Bunbury Regional Office, that monitoring results associated with the existing marine outfall disposal suggests that there has been negligible impact on the marine environment to date. The EPA also notes the advice of the Marine Branch of the EPASU that, prior to any subsequent proposal being submitted to the EPA for detailed assessment, the proponent may need to provide:

- a detailed characterization of the waste stream and background seawater concentrations; and
- a justification that sufficient observations had been made to properly map and characterize the benthic habitat.

The EPA considers that it would be preferable for Griffin Energy to negotiate access to the existing pipeline (if spare capacity is available), rather than build a separate pipeline adjacent to the existing structure. In the event that this occurs, it would be appropriate for some governance model for joint monitoring and to ensure that, cumulatively, the conditions of the licence are met and that responsibility is accepted for any mitigation measures required.

Although monitoring results associated with the marine outfall disposal suggests that there has been negligible impact on the marine environment to date, the EPA advises that in any subsequent proposal, the proponent may need to provide for assessment, a detailed characterisation of the waste stream and justify that sufficient observations had been made to properly map and characterise the benthic habitat.

The EPA notes that Griffin Energy is investigating options to reduce the volume of saline water discharged (for example via evaporation or on-site reuse). The EPA encourages the proponent to extend its management objective to avoid or minimise waste discharge to the marine environment, and take every opportunity for reuse and recycling.

The EPA advises Griffin Energy to become familiar with the water quality requirements for Cockburn Sound and test the quality of the ocean outfall water against this criteria (EPA Revised Draft Environmental Protection-Cockburn Sound-Policy, November 2002).

It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor provided that:

- specific design parameters of the proposal are subject to section 38 assessment;
- further information is provided that demonstrates that the proposed disposal of saline water via marine discharge would not cause unacceptable impacts on the marine environment; and
- further information is provided on the evaluation of alternatives aimed at avoiding marine discharge altogether.

Waste management

Description

The Griffin Energy proposal will generate a variety of non-hazardous waste materials including scrap metal, wood, paper and domestic solid and liquid waste. In addition

the project will require the handling of a variety of substances which will need to be managed to prevent an unacceptable impact to the environment. These include:

Fly ash
The project will require the disposal of around 440,000 tonnes of fly ash per annum. Griffin Energy is still considering the options for fly ash disposal. The priority will be for reuse of the ash (for example in the cement industry), however it is expected that there would be a limit to the volume that industry could absorb.

In the absence of a market for fly ash, the preferred option for disposal is for ash from the electrostatic precipitators to be collected in silos prior to off-site disposal to the Ewington 1 overburden dumps. Fly ash will be mixed with claystone, incorporated into the dumps and stored above the water table.

As part of the in-pit disposal option, Griffin Energy will initiate a groundwater monitoring programme to determine whether the disposal of fly ash to the Ewington 1 overburden dumps above the water table will affect groundwater quality. Prior to disposal occurring a management plan will be prepared that will identify trigger levels and a course of action to be followed in the event that unacceptable impacts occur.

Should further investigation demonstrate that this method is not environmentally acceptable, the default will be disposal of the ash to lined ponds as is currently practised at Collie Power Station.

The main environmental issue of concern is the potential for leachate from the fly ash to contaminate groundwater - refer to section 3.6 for assessment of this factor.

Saline water;
Saline cooling water will be treated on-site to remove heavy metals and then discharged to the ocean via the existing saline water disposal pipeline. Griffin Energy is also investigating options to reduce the volume of saline water discharged (for example via evaporation or on-site reuse), however this is the subject of ongoing engineering investigations.

Refer to section 3.7 above for assessment of this factor on marine water quality.

Domestic Liquid Waste
A treatment facility will be constructed on-site to treat wastewater during the construction and operations phases of the project. Treated wastewater will be used for on-site irrigation with sludge periodically removed from site by a licensed contractor.

Hydrocarbons
The SER states that the storage, handling and disposal of materials will comply with all local and State regulations. All drums of hydrocarbon products will be stored upright in appropriately bunded and designed areas. Where practicable, these will be covered to prevent water collecting on the tops of drums and causing corrosion. Storage areas will have impermeable floors and bunding.

Drums will be checked regularly for corrosion and leaks. All drums and fuel storage areas will be appropriately labelled, as required by the relevant legislation. Waste

hydrocarbon drums will be properly labelled and an inventory maintained to track the waste material. Fuel oil tanks will also be contained within appropriately bunded areas.

Potential spills will be contained and appropriately managed by techniques including the placement of absorbent material and the excavation and removal of contaminated soil to a remediation site. All soil contaminated by hydrocarbons will be removed from site by a licensed contractor for disposal at an approved facility.

Submissions

Issues raised in submissions on waste management focused on:

- maximising the recycling and reuse of water and solid waste (including considering alternative uses for flyash);
- methods to avoid contamination of groundwater if mine void disposal is chosen;
- the need to minimise the impact of oil and chemical spillage;
- differences between NSW fly ash and Collie fly ash make up;
- consideration of bioremediation on site of hydrocarbon contaminated soil;
- benchmarking of proposals for ash disposal against world's best practice; and
- need for the proponent to consider pro-actively researching and developing alternative uses for ash rather than relying on existing markets.

Strategic advice

The EPA's strategic environmental objective for this factor is to ensure that waste products are disposed of in an acceptable manner.

The area considered for this assessment is SWWPP site and any disposal areas such the Ewington1 pit and the local land fill facility.

As noted in section 3.6, there is the potential for leachate from fly ash to contaminate the groundwater. The EPA considers that further investigative work may be required to demonstrate the effectiveness and environmental acceptability of disposing the fly ash with the overburden above the water table.

The EPA notes that Griffin Energy proposes to use best practicable measures to avoid/minimise emissions to air, water and land consistent with waste minimisation principles. A commitment by the proponent to investigate zero off-site discharge is encouraged and, if implemented, would be a highly desirable environmental and natural resource outcome; it would also set a new benchmark for the power generation industry in the State.

The EPA considers that disposal of saline cooling water to the marine environment and fly ash to mine voids are important issues to be addressed in the section 38 environmental assessment. The proponent is encouraged to continue developing beneficial uses and markets for the ash, such as incorporation in cement products. Any proposal to dispose of ash into coal mining voids will need to demonstrate that groundwater quality will not be significantly affected. Similarly options for saline water disposal such as evaporation and on-site reuse for cooling water should be pursued.

It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor provided that:

- specific design parameters of the proposal are subject to section 38 assessment;

- development of a Waste Management Plan to ensure waste minimisation and recycling practices are implemented; and
- further information is provided on the evaluation of alternatives aimed at minimising the disposal of fly ash (refer to section 3.6) and the marine discharge of saline water (refer to section 3.7).

Noise and vibration

Description

Noise in the project area originates from coal mining and handling activities and from the neighbouring Collie Power Station. The closest residence to the project site is on the eastern edge of the Collie townsite, around 4.5km to the south-west. The plant site is located within an existing noise buffer established for the Collie Power Station.

Noise will be generated during the construction and operation of the plant and will arise from:

- earth moving equipment and power plant assembly during construction;
- construction vehicles;
- coal pulverising mill;
- air plant;
- steam generators and turbines; and
- coal conveyor.

Modelling has been undertaken to predict noise level contours for the Collie area from the power station operations, with the exclusion of the coal conveyor, the alignment of which has yet to be determined.

Vibration is likely to be generated during the construction phase through the use of compaction equipment. However, given the distance between the site and the closest residence (~4.5km) it is unlikely that the impacts from vibration will be significant. Griffin Energy is not aware of any specific complaints relating to vibration during construction of the Collie Power Station.

Noise Criteria

Griffin Energy is aware that noise emissions from the operations of the power station will need to comply with the *Environmental Protection (Noise) Regulations 1997* for the protection of noise sensitive premises. To determine environmental noise impacts from the operations, noise emissions need to be compared to the assigned noise levels specified in the *Environmental Protection (Noise) Regulations* at noise sensitive premises for various times of the day (refer to table below). As the noise is likely to be present for more than 10% of the time in any four hour period, the L_{A10} criteria are the most relevant.

Assigned Noise Levels at Residence

Time of Day	Type of Assigned Noise Level		
	L_{A10}	L_{A1}	L_{max}
0700 - 1900 hours - Monday to Saturday	45	55	65
0900 - 1900 hours - Sunday & Public Holidays	40	50	65
1900 - 2200 hours - All Days	40	50	55
2200 - 0700 hours - Monday to Saturday	35	45	55
2200 - 0900 hours - Sunday & Public Holidays	35	45	55

Under Regulation 7, noise emissions are not considered to "significantly contribute" to an exceedance of the Assigned Level at any noise sensitive premises if the noise received at the premises is 5 dB(A) below the assigned noise level. Therefore, achieving a noise level of 30 dB(A) or less at any noise sensitive premise would ensure that the power station complies with the Regulations.

The assigned noise levels are also conditional on there being no annoying characteristics present, such as tonality, modulation or impulse. If any of these characteristics do exist then the measured levels must be adjusted and the adjusted level must comply with the assigned level.

Noise from construction works is covered by Regulation 13 of the *Environmental Protection (Noise) Regulations 1997.*

Modelling of impacts

Modelling of noise emission propagation from the power station was carried out using an environmental noise modelling computer program, SoundPLAN. The objective was to predict the noise levels at all noise sensitive premises located around the site under worst case propagation conditions.

Modelling results demonstrated that noise levels at the closest residence within the town of Collie will be less than 25 dB(A) at all times. Based on the calculated levels the resultant noise at the residences within the town of Collie would not be tonal or contain any other annoying characteristics.

Griffin Energy has concluded from the modeling results that noise emissions from the power station would not be considered to "significantly contribute" to any exceedance at a residence and would be deemed to comply with the *Environmental Protection (Noise) Regulations 1997* at all times. No specific management is required.

Noise modelling undertaken for the proposed Collie Power Station expansion (which is similar to the SWPP) by Herring Storer Acoustics (Western Power 2002) indicates that construction noise would be below the assigned noise levels as determined by Regulation 7 of the *Environmental Protection (Noise) Regulations 1997* (ie 30dB(A) at 1900m from the site and 35dB(A) at 1500m).

Monitoring and management

The SER states that, given the remoteness of the site to the nearest noise sensitive premise, routine noise monitoring is not expected to be required. In the event that complaints are lodged these will be recorded and investigated.

Traffic volumes will increase on local roads due to workforce movements and the movements of plant and equipment. Discussions will be held with the local council to identify any specific management measures.

Griffin Energy will prepare a Noise Management Plan as part of the Construction Phase Environmental Management Plan to address noise management for the site.

Submissions

The noise modelling and predicted impacts have been assessed by the DEWCP, Environmental Regulations Division, whose submission focused on the following issues:

- the acceptability of the noise modeling and conclusions regarding construction and operational noise impacts on nearest residences in Collie;
- the possible need for further modelling to demonstrate that the predicted noise levels meet the L_{A10} assigned noise level for neighbouring premises, that is, 65 dB(A) for Industrial and Utility premises;
- the possible need to set back power units at least 400m, or such distance as detailed modeling shows is required to achieve the boundary assigned level;
- the need to ensure that sound power levels for the power units, as modelled in the SER report, are not exceeded in the procurement stage, and that tonal components are not present in the noise emissions; and

Other submissions pointed out that:

- the residence at Blue Waters is recognised under the Environmental Protection (Noise) Regulations 1997;
- the operation will require an Environmental Protection Act 1986 licence; and
- any effect upon adjoining landowners is unknown and close consultation is encouraged.

Strategic advice

The EPA's strategic environmental objectives for this factor are to:

- ensure that noise impacts emanating from construction and operational activities comply with statutory requirements and acceptable (and appropriate) standards (eg. *Environmental Protection (Noise) Regulations* 1997); and
- ensure that vibration impacts emanating from the proposed plant are acceptable

The area considered for this assessment is the SWPP site, associated infrastucture such as the mine conveyor, and any nearby residences and operations, as defined by the *Environmental Protection (Noise) Regulations* 1997.

The EPA notes the outcome of the assessment by the Environmental Regulations Division of DEWCP that the predicted operational plant noise levels should comply with the requirements of the *Environmental Protection (Noise) Regulations* 1997.

The EPA notes that the plant will result in noise levels less than 25dB(A) at the nearest residences in Collie, and therefore should not exceed the assigned level nor significantly contribute to an exceedance.

However, the EPA notes that the proponent's documentation does not indicate whether the predicted noise levels meet the L_{A10} assigned noise level for neighbouring premises (i.e. 65 dB(A)) for industrial and utility premises. In the event that the noise emissions were tonal and the tonality could not practicably be removed without reducing the overall level of the noise emission, the proponent should ensure that the units are set back at least 400m, or at a sufficient distance based on modelling data, to achieve the boundary assigned level.

The EPA encourages Griffin Energy to consult with the Shire of Collie and nearby landowners and residents that may be affected by construction and operational noise impacts.

It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor provided that:

- specific design parameters of the proposal are subject to section 38 assessment;
- sound power levels for the power units, as modelled in the SER report, are not exceeded in the procurement stage, and that tonal components are not present in the noise emissions.

Buffer zone

Strategic advice

The EPA's strategic environmental objective for this factor is to ensure that an adequate buffer zone is established around major industrial projects to ensure that inappropriate residential development does not occur which could constrain that industry's activities.

The area considered for this assessment is the SWPP site and associated infrastructure such as the mine conveyor.

The EPA notes that a buffer zone of about 4 km in radius around the existing Collie Power Station is to be established through the draft Town Planning Scheme No.4. However the EPA advises that a larger buffer zone to exclude residential development is likely to be required should this proposal be implemented.

The EPA encourages Griffin Energy to consult with the Shire of Collie, the Ministry of Planning and Infrastructure, Western Power, the local community and other stakeholders to put in place an adequate buffer zone that will protect industry from the encroachment of residential development close to the development and which could constrain its operations.

It is the EPA's opinion that the proposed SWPP could be managed to meet the EPA's strategic environmental objective for this factor provided that an adequate buffer zone is put in place.

4. Conclusions

The EPA would clearly prefer combined cycle gas plants to coal fired power plants for electricity generation. However, in providing this advice the EPA considers that the construction and operation of a supercritical coal-fired power generating facility of the type proposed could be managed such that it is likely that the EPA's objectives would be met, provided that there is a commitment by Griffin Energy, at the time of any section 38 referral, to implement a substantial package of mitigation measures to adequately address greenhouse gas emissions, which could include alternative water supply and renewable energy options, that will demonstrably result in significant environmental benefit.

The EPA advises Griffin Energy that, in putting forward a specific proposal for a power generating facility in the future, it should take into account:

- the issues raised in the Strategic Environmental Review document;
- the public submissions and Griffin Energy's response to them;
- the advice in this report on the relevant strategic environmental factors as set out in Section 3;
- commitments to address greenhouse gas emissions by best practice and a substantial mitigation programme which could include the following:
  - a renewable energy project using a wind farm to produce about 80 MW.

    It has been proposed that this would include the installation of a substantial wind farm on land near Cataby, 170 km north of Perth. The wind farm has the potential to produce 80MW of electricity. By combining the wind component into the overall strategy the greenhouse impact from power station could be partially offset;
  - use of wood wastes for about10% co-firing with coal.

    The design of the fuel feed for the power station will include the use of forestry products derived from plantation timbers. About 10% of the fuel for the station could be from this renewable source;
  - substantial carbon sequestration on pastoral land and via tree planting; and
  - implementation of a water management strategy involving diversion and desalination of high salinity flows from the East Collie River for use in the Power Station cooling and subsequent supply of mine dewatering water to Wellington Dam to improve water quality in the dam for potable purposes.

- that such a proposal will need to undergo section 38 assessment.

Appendix 1

List of submitters

Bunbury Port Authority;
Bunbury Wellington Economic Alliance;
Shire of Collie;
Conservation Council of Western Australia;
Western Power Corporation;
Department of Conservation and Land Management (CALM);
Department of Environment, Water and Catchment Protection (DEWCP) - Bunbury Regional Office;
Department of Environment, Water and Catchment Protection (DEWCP) - Environmental Regulations Division;
Department of Environment, Water and Catchment Protection (DEWCP) - Marine Branch;
Department of Environment, Water and Catchment Protection (DEWCP) - Ecological Systems Branch;
Department of Planning and Infrastructure (DPI);
Department of Minerals and Petroleum Resources (DMPR) - Office of Major Projects (OMP);
EcoCarbon Incorporated;
Office of Energy; and
Water Corporation.

Appendix 2

References

ANZECC/ARMCANZ (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy No. 4*, October 2000.

Collie Water Advisory Group (CWAG) 1999, *Collie Basin Water Resource Management – Reconsideration of Long and Short Term Strategies*, Report prepared for the Government of Western Australia, July 1999, CWAG report ISBN 0-646-38509-7.

Environmental Protection Authority (EPA) 1990, *Proposed Collie Power Station*, Environmental Protection Authority, Western Australia, Bulletin 472, November 1990.

Environmental Protection Authority (EPA) 2001, *Towards an Environmental Protection Policy (EPP) for Ambient Air Quality in Western Australia,* A Discussion Paper to Facilitate Stakeholder Consultation, Environmental Protection Authority, Western Australia, March 2001.

Griffin Energy Pty Limited 2002, *South West Power Project Strategic Environmental Review*, Report prepared by Halpern Glick Maunsell Pty Ltd for Griffin Energy Pty Limited, September 2002.

National Environment Protection Council (NEPC) 1998, *National Environment Protection Measure for Ambient Air Quality*, National Environment Protection Council, 26 June 1998.

State Energy Commission of Western Australia (SECWA) 1990, *Proposed Collie Power Station Environmental Review and Management Programme*, State Energy Commission of Western Australia, April 1990.

Western Power Corporation 2002e, *Collie Power Station Expansion Strategic Environmental Review*, Report prepared by Sinclair Knight Merz for Western Power Corporation, June 2002.

Appendix 3

Summary of identification of relevant strategic environmental factors

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Terrestrial flora - ▪ vegetation communities; ▪ Declared Rare Flora and Priority Flora; ▪ flora of Conservation Significance.	Total area of disturbance for power station site is 60ha. Exact location of power station yet to be determined but will be within proponent's private property which comprises: 64ha of cleared land; 6ha of seasonal sedge swamp; and 27ha of degraded *E. marginata - C. calophylla - A. fraseriana.* ie proposal could impact on **up to 27ha** of native vegetation. Conveyor and services corridor about 1.5km long may be located within existing 330kV transmission corridor or in adjacent State Forest which would require up to 1.5ha of clearing of native vegetation. No impact on **known** populations of rare flora but rare flora survey on site yet to be conducted. Potential for introduction and spread of dieback, Jarrah Leaf Miner and weeds through the spread of soil and/or cleared vegetation. Vegetation loss due to modification to surface hydrology is unlikely as no major drainage lines exist on-site	**CALM:** • It is unclear if proposal will result in requirement for additional clearing for powerlines over full life of project. • Proposal has failed to address additional impacts on biodiversity and other values from any expansion of environmental footprint from coal mining over life of project. • No details for additional dams or roads are provided. • Proponent be required to clarify full extent of potential off-site impacts prior to EPA determining its recommendations under this SER. • There is no guarantee or commitment that mitigation measures will be implemented. • Better understanding of efficacy of mitigation proposals is required. • Mitigation measures, including the identification of opportunities for enhancement of surrounding biodiversity values, need to be addressed in some detail prior to subsequent formal assessment. **DEWCP (South West Region):** • Acknowledged that proposed site has been severely impacted by grazing with a substantial part of the area cleared. Degradation of the site has substantially reduced the vegetation's conservation potential and protection values. • Remnant vegetation to be retained within the site should be fenced to allow regeneration and revegetated where necessary to recoup the cost benefits to the local environment where possible. • Conveyor route from Ewington II should utilise one or more of the existing cleared corridors. **DEWCP (Ecological Systems Branch, Terrestial Section):** • A survey and map of any vegetation proposed to be cleared does not appear to have been done. • The SER does not include a vegetation condition map. • The proposed conveyor or service road is yet to be confirmed so the impacts on vegetation and fauna of the whole area (looking at vegetation communities, structure, and condition) cannot be determined. • The role of the area as an ecological linkage between other regionally significant areas has not been determined. • A survey for the presence of *Phytopthora cinnamomi* has not been undertaken for the proposed site. • There needs to be a vegetation survey of the whole area (looking at vegetation communities, structure, and condition) rather than just that likely to be affected by the conveyor. Without undertaking a vegetation survey the most appropriate area for the location of the conveyor can't be determined.	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Terrestrial Fauna - ▪ all fauna ▪ Specially Protected (Threatened) fauna	The majority of the proposed power station site is cleared with some isolated groves of native vegetation and is currently being used for grazing. Native vegetation occurs to the south of the site. Fauna surveys of the general area have been conducted to support approvals for nearby Ewington I and II mines. These surveys identified the presence of one Schedule One species and several Priority species Potential loss of habitat, particularly avifauna breeding sites, will result from clearing of up to 27ha of degraded *E. marginata - C. calophylla - A. fraseriana* on the power station site and 1.5ha of state forest for the conveyor. Potential for 6 Threatened species of avifauna to occur on the power station site. In addition to these a further 5 terrestrial species could occur along the conveyor corridor.	**DEWCP (Ecological Systems Branch, Terrestrial Section):** • The information in Tables 8.3, 8.4 and 8.5 is different to the information in the text and Appendix 3 and is full of inaccuracies. The fauna information needs to be consistent. For example the text doesn't refer to the presence of Western Grey Kangaroo or Western Brush Wallaby which are likely to be on site but Table 8.3 highlights both as likely to be on site. • Mobility of fauna not as great as indicated in SER. Small bird species tend to have a median breeding range of 2.4ha so it is very unlikely that they will move between all of the sites. Similarly reptiles and amphibians are unlikely to be highly mobile between sites. • Accuracy of information in is queried and needs to be consistent. Table 8.4 includes a number of species likely to be found within the project area and which are totally outside their known range, eg Little Button Quail (desert species), Variegated Fairy Wren (desert species), and Fairy Martin (northern species). A number of species that are highly likely to be found on the site eg Goshawk, Sparrowhawk, Little Wattlebird and Spotted Pardalote are not in the table. • Table 8.5 similarly is missing a number of species that are found in Appendix 3 and would definitely be found on the site e.g. *Litoria moorei, Litoria adelaidensis, Crinia pseudinsignifera*, and *Geocrinea leai. Glaphyromorphus gracilipes* is also included in the Table. As this species is known to occur in the Collie area together with the similar looking Priority listed Bunbury Skink, *Glaphyromorphus "koontoolasi"* this should be further investigated. • On what basis is the statement *'this habitat is significantly degraded and therefore of little conservation significance'* justified given that a number of Schedule 1 and Priority species have been identified on the site? • There is currently no evidence to suggest that Baudin's Cockatoo moves to new trees if it's current hollows are destroyed so clearing outside the breeding season will not minimise the impact on the species. The site should be assessed for current tree hollow usage. • What is the justification for the population not being important given that it is a Schedule 1 species and listed under the EPBC Act? • The SER states that *'clearing will be undertaken between January and June to avoid the breeding season of species such as Chuditch, Southern Brown Bandicoot, Brush-tailed Phascogale, Brush Wallaby and Yellow-footed Antechinus'*. Within the exception of the Antechinus, all of these species are likely to breed between January and June. • Appendix 2 and 3 - What is the data source for these appendices? A number of the species outlined within Appendix 3 do not occur in this area eg Black-breasted Buzzard (desert species), Spotted Bowerbird (not found south of Mullewa), Sandhill Dragon (a coastal sand dune species).	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Marine Biota and Associated Habitat.	The nearshore habitat is dominated by bare sand overlying limestone pavement. Further offshore predominantly sand and pavement habitat occurs with patches of low relief reef and sparse seagrass. Seagrass meadows are generally confined to offshore areas (>600m).	**DEWCP, Marine Branch:** • In any subsequent proposal, the proponent would need to document and map benthic marine habitats in the vicinity of the proposed outfall with considerably greater detail, and justify that sufficient observations had been made to properly map and characterize the benthic habitat.	Considered to be a relevant strategic environmental factor
Marine Water and Sediment Quality	There are two outfalls that dispose of wastewater to the ocean - these are operated/managed by Millennium Inorganic Chemical and Western Power (from the Collie Power Station). The existing outfall appears to have had little affect on the adjacent seagrasses. Water and sediment quality have not been impacted by the current discharge. Additional brine disposal with the potential for cumulative impacts. Existing pipeline is approved for around twice the current discharge. Current mixing zone predicted to increase to 15m x 92m (100-fold dilution). Concentrations of contaminants are expected to be similar to current levels.	**DEWCP, Marine Branch:** • In any subsequent proposal, the proponent would need to provide for assessment, a detailed characterization of the waste stream. This effluent characterization would need to be verified post commissioning, and would be used to develop a routine effluent monitoring program. • It is very important for there to be a robust characterization of background seawater concentrations. We question some of the values given in Table 9.1 (eg Cu, Zn). This information must be credible and in hand at the time of a detailed project assessment. • As part of any subsequent proposal assessment, the proponent will need to provide up front a detailed characterization and assessment of natural levels of trace elements/heavy metals in background seawater (ie away from the influence of other outfalls, and in the summer/autumn period, when the influence of the Leschenault Estuary outflows were lowest). This information needs to be based on actual data from a carefully designed measurement and analysis program, and is required to more accurately define the size of an authorized "mixing zone" and will provide greater surety both for the operator and the regulator. • The crucial importance of this information is perfectly illustrated in Table 9.1, where column 4 shows metal concentrations for 100-fold dilution of the effluent with seawater assuming zero trace metal content, while column 6 indicates that in 'typical' seawater trace metals are present at significant. The natural background metal concentrations need to be resolved to properly define a "mixing zone". • The most suitable time for undertaking environmental water quality assessments of the influence of the Effluent Discharges will be in the summer/autumn (ie non riverine flow period). • In relation to analytical procedures and required LOR's, a set of Standard Operating Procedures for environmental monitoring is being developed by the EPASU. It is likely that in the future there will be increased focus on the analytical and sampling methods required by EPASU to achieve satisfactory LOR's. • From the values provided in Table 9.1, more work would be required for the purposes of a detailed project assessment to resolve the cadmium and mercury concentrations for the saline water storage pond. • The DEP licence conditions, monitoring requirement and management strategy may be reviewed. If more than one user of the pipe, then some governance model may be required to ensure that, cumulatively, the conditions of the licence are being met.	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		• The EPA (consistent with AWQMS) has recognised environmental values of the marine environment. These environmental values are of two types – ecological and social. As a default setting, all environmental values apply everywhere in the marine environment. Only through specific application to exempt some specified requirements in small zones about the outfall can this situation be relaxed. While the above documents have been developed for Perth marine waters and Cockburn Sound, it is expected that the same philosophy would apply. **DEWCP, Bunbury Regional Office:** • The monitoring results associated with the marine outfall disposal suggests that due to the high energy receiving environment, there has been negligible impact on the marine environment. Furthermore, Collie coal generically has low levels of polluting heavy metals, hence the risk of exceeding the assimilative capacity of the receiving environment at the pipeline diffuser is considered low. **Western Power:** • If Collie B is in operation, there may be no spare capacity in the saline water pipeline.	

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Surface Water Flows	The dominant drainage system within the area is the East Collie River (located to the north of the plant site), which feeds into the Collie River and flows into Wellington Dam. There are no defined drainage lines on-site. Sheet flow discharges south-east to a Wetland within the Collie A site. Studies have commenced to investigate options to better manage water resources within the Collie Basin	**Water Corporation:** The Water Corporation has been working with the Commission and the community over an extended period to reduce salinity levels in the Collie River and Wellington Dam. The Corporation is intending to make greater future use of Wellington Dam water for public and industrial water supply. Lower salinity levels are also beneficial for the irrigation industry. There were no other significant issues raised in respect of waste management.	Comments by Water Corporation relate to possible redirection of the Collie East River into mine voids at the beginning of winter, as part of a package of sustainable development measures that could be proposed by Griffin Energy at a later date. This is not a specific element of the power station proposal and is therefore not considered to be a relevant strategic environmental factor
Surface Water Quality	The East Collie River contributes around 25% of the flow and 60% of the salt to Wellington Dam. The TDS concentration of water within the East Collie River varies widely. Average salinity at Coolangata Farm is 1737 mg/L and flow into Wellington Dam averages 880 mg/L. Potential for surface drainage to become contaminated with coal sediments, fly ash, on-site chemicals, hydrocarbons and saline water.	There were no significant issues raised in respect of waste management.	Note comments above for Surface Water Flows. Not considered to be a relevant strategic environmental factor
Groundwater Quantity	The site area is underlain by an unconfined near surface aquifer within the superficial lateritic soils. No impact on groundwater quantity is predicted by the proponent.	**DEWCP, Bunbury Regional Office:** • The principles and objectives of CWAG are of strategic importance to the successful integration of the project into an already complex and in parts stressed basin-wide water supply strategy. • The proponent will need to undertake investigations to demonstrate how the project will operate in accordance with the principles and objectives of CWAG with particular attention given to: 1. the need to minimising groundwater abstraction from the Collie Basin to overcome existing substantial drawdown and address the long-term recovery periods for groundwater levels after mining. In this regard the proponent should demonstrate that: • 15 GL/year of groundwater would actually need to be dewatered from the mines over the long term, and investigate alternatives that may reduce this volume; and • assess potential impacts of dewatering at this scale on the social and ecological values of the local environment, including such features as river pools, wetlands and riparian vegetation.	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		Water Corporation: • The impact of Griffin's proposal on surface water and groundwater resources of the Collie River basin cannot be determined from the document provided. Specific hydrology and hydrogeology investigation work is needed together with more detailed explanations and plans of proposed water management infrastructure and regime. Of particular concern is the proposal to divert brackish Collie River water into mine voids with potential for contamination of the groundwater resource. • Responsibility for decision making in these matters lies with the water and rivers Commission. The Commission and Water Corporation need to be involved in the detailed planning and environmental studies aimed at understanding the water resources of the basin and how they would be impacted by the proposed project. **Shire of Collie:** • Recognising that the main water supply for the proposed power station will be from groundwater sources, the Collie Shire Council will have concerns about future extraction rates. • The current decline in annual rainfall rates gives no assurance that groundwater supplies will be replenished to levels adequate to satisfy the quantities of water required for a new power station. This issue must be addressed in great detail to ensure no adverse drawdown impacts upon surrounding wetlands or other property owners. Evidence of such impacts already exist, e.g. in the Collie Cardiff area, and the battles to rectify these experiences have, at times, been long and intense	

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Groundwater Quality	Twenty bores sampled in 1984 ranged in salinity from 125 - 832 mg/L TDS. Typically the groundwater in coal measures is <500mg/L TDS and slightly acidic. Potential for groundwater to become contaminated via coal sediments, fly ash disposal, on-site chemicals, hydrocarbons and saline water.	**DEWCP, Regional Office:** • The proponent will need to undertake investigations to demonstrate how the project will operate in accordance with the principles and objectives of CWAG with particular attention given to the ability of disused open-cut voids to contain saline water with minimal impact on background groundwater quality, taking into account the hydrogeology, stratigraphy and geological structure of the area of the voids and nearby dewatering and groundwater abstraction activity. **Water Corporation:** • Of particular concern is the proposal to divert brackish Collie River water into mine voids with potential for contamination of the groundwater resource.	Considered to be a relevant strategic environmental factor
Water Supply	A number of water supply options have been investigated for the site. These include mine dewater and Wellington Dam water.	**Western Power:** • Annual water consumption is said to possibly be reduced by about 3 GL per year by application of recycling technology. What technology would be applied and why is it not already adopted as part of the sustainability aspects of the CFPS? • Has air-cooling, such as is used in the Millmerran power station in Queensland, been considered as an option to reduce the water requirements of the project? The Millmerrin project uses only 10% of the normal water requirements of a conventional power station. **CALM:** • The option of sourcing water for power production purposes by actively draining agricultural farmland should be evaluated.	Site specific impacts are considered under groundwater quantity. Not considered to be a separate relevant strategic environmental factor for this assessment
POLLUTION			
Gaseous and Particulate Emissions	The proposed power station would emit NO_X, SO_2 and, to a lesser extent, particulates and unburnt hydrocarbons. SER predicts fugitive dust emissions and emissions of PM_{10} (50 mg/m^3), SO_2 (1090 mg/m^3), NO_2 (500 mg/m^3) and O_3. No specific monitoring for $PM_{2.5}$ has been undertaken in the Collie region. Low levels of PAH's due to incomplete combustion of coal. VOC, dioxin and furan emissions will be <1 µg/m^3 Revised ground level SO_2 modeling output by the proponent during the assessment process for Scenario 2 (Collie A, Griffin operating at 800MW, Muja C & D, Worsley) shows highest 1	**DEP Air Quality Management Branch:** • The AQMB initially had concerns about the quality of the modeling work for ground level SO_2 concentrations as presented in the SER and an ancillary report, in particular errors in the input emissions data, the overly large meteorological grid size for the TAPM model and errors in data presentation. Subsequent further modeling undertaken by the proponent was considered of sufficiently high standard for the purposes of this strategic assessment. • Check modeling by the DEP's AQMB generally gave similar results to the latest modeling work by the proponent. Furthermore the use of the 9th highest 1 hour maximum concentrations to compare against the Kwinana EPP standard showed that the area within which an exceedance is predicted to occur is small and close to the power stations and therefore likely to be acceptable (if the model is correct). • The DEP is of the opinion that projects should not be designed to just come within the NEPM Goal, which allows an exceedance of the NEPM Standard on one day per year; this view is the same as that of the SA and NSW EPAs. • Modeling shows that the airshed is becoming quite full and there may be exceedances under certain worst case scenarios. The DEP considers it prudent to	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	hour maximum concentrations exceeding the NEPM standard in an area 3 km north of Collie townsite, as well as areas around the Muja and Collie A power plants (which would not affect residences). However the modelling shows that, in the area north of Collie, the **second-highest** 1 hour maximum concentration did not exceed the NEPM standard. Sulphur dioxide and NO_X have the potential to impact on vegetation. Vegetation monitoring performed by Western Power between 1997 and 2000 has indicated that no statistical impact of ambient SO_2 on vegetation could be determined. In the 1990 assessment a review was conducted on the likelihood of acid deposition in the Collie region. This indicated that some changes in the pH of rainfall could occur, however measurable adverse (or beneficial) effects would be unlikely.	flag the issue at this stage and believes that any recommendation by the EPA regarding the acceptability of air quality impacts be conditional on the proponent undertaking further work, at a far higher level of competence than that demonstrated on this occasion, to show that the data and modeling are correct. • Further expert work is required to prove the TAPM model (or alternatives) at Collie. Model testing requires good quality records of meteorology and sulfur dioxide, which are costly and time-consuming to obtain. Given Western Power's significant investment in monitoring over a number of years, there is clearly merit in the proponent exploring the possibility of collaborative work with Western Power to test TAPM and other models as required. • If the subsequent modelling shows that SO2 could still be a potential constraint to the project operation, the proponent could consider options such as changing the site location further to the north to minimise the cumulative effect of plumes under easterly winds on Collie and the area to the north of the townsite. Desulphurisation and other plant modifications such as increased stack height have the capacity to reduce potential SO2 impacts. • The boundary beyond which the NEPM standard and possibly DEP licence conditions should apply needs to be more clearly defined. The buffer zone should also probably be expanded to cover the existing Coal Mining Leases in the area, as it is unlikely that the relevant government departments would allow residences to be built on them. **Shire of Collie:** • Emission control will perhaps be the most essential environmental consideration and whilst the Council can offer no technical response whatsoever in this regard, it is vital that the most up-to-date environmental techniques be employed. The Council is confident that Griffin will, by regulation and its own willingness, adhere to best practice in this regard. **Western Power:** • In discussing SO_2 emissions, several different coal sulfur content prognostications were offered, expressed variously on "as fired", "22.5% moisture" and "standard moisture" bases. How does the 0.42% S value relate to other ranges of sulfur values quoted? • With S content of coal varying between 0.2% and 0.9% (or 0.2% and 0.7%?) it is likely that there could be periods of time where coal with a S content above the average could be burned. Consequently, the value chosen for air quality modeling should be conservatively above the average so as to more closely represent potential excursions of SO_2 emissions and resultant extremes of ambient SO_x concentrations. Long experience with Collie coal is that "as fired" S content averages more closely to 0.6% than 0.4%. Is 0.42% the maximum S content that will be burned on a daily or hourly basis?	

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		• Figures 10.3 and 10.4 of the SER suggest that ambient levels of SO_x for the CFPS - alone case (Scenario 2) are similar to those of existing emissions (Scenario 1) over a broad area. This does not support the claim in paragraph 2 of Section 10.1.6.1, that the CFPS contribution is not significant. • In discussing model results under Scenario 3 (future scenario with CFPS, Collie A&B, Muja C&D and Worsley) the claim is made, and reflected in Table 10.4, that "the highest predicted ground level concentration of 200ppb (100% NEPM) occurs close to the power plants, whilst the maximum predicted ground level concentrations in the regional areas beyond 3km of the power plants range from 100ppb to 175ppb (near the old Shotts town site)." Reference to Figure 10.5 indicates ground level concentrations over 800 ppb near the power stations and large areas outside a 3km boundary where the concentrations exceed 200ppb. • Table 1.3 is lacking in the "Air Emissions" row. Under the "Future Environment" column, proposed management seems only to discuss particulates (dust) and does not address, for example, operational NO_x, SO_x issues. Therefore it seems the statement of "No exceedance of Standards and Regulations" in the "Predicted Outcome" column is not well founded – particularly as subsequent detail (see Sulfur Dioxide, below) may suggest otherwise. **CALM:** • Various options are discussed for reducing pollutant levels, for example NO_x and SO_x pollutants and ash. The proponent should make a commitment to using best practice technologies to minimise environmental (air, soil and water) pollution.	
Dust from Construction	Dust generation from vegetation clearing, earthworks, materials handling and vehicle movements..	**Shire of Collie:** • Efforts should be undertaken to ensure that no adjoining landowners are effected by dust emissions during the construction phase. It is highly unlikely that there would be any dust effects during construction over the townsite of Collie.	Not considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Greenhouse Gas Emissions	Up to 4.5 Mtpa of CO_{2e} released (approximately 9% more than comparable gas fired power station). The proposed supercritical plant has less greenhouse gas emissions in comparison to plant constructed in 1990. 796 $kgCO_{2e}$/MWh emitted from the proposed power station compared to 950 $kgCO_{2e}$/MWh from Collie A and 1030 – 1205 $kgCO_{2e}$/MWh from Muja. A number of measures and technologies for minimisation and mitigation of greenhouse gas emissions are proposed, including: • advanced high efficiency coal-fired generation technology; • renewable energy generation (wind and biomass); • sequestration via forestry; • sequestration by re-mineralisation. These and other aspects such as a regional water management plan form part of an integrated sustainable energy Project designed to off-set the effects of greenhouse gas emissions associated with the energy intensive nature of the coal fired power station proposal.	**DEWCP, Bunbury Regional Office:** • Greenhouse gas emissions need to be considered in a total lifecycle scenario. Bearing this in mind, pollution control and burning technology will only improve as time goes on, requiring Griffin Energy to capitalize on this where possible throughout the project development. **Office of Energy:** • The use of lifecycle assessment, incorporating economic, social and environmental impacts, is supported when considering matters such as fuel selection for power stations. • The use of a 20-year timeframe results in significantly lowering the lifecycle greenhouse emissions of coal relative to gas. However, the use of this timeframe for calculation of global warming potential's (GWP) is not the internationally recognised standard. It is suggested that all GWP's used to calculate carbon dioxide equivalents be based on a 100-year timeframe as this is the accepted World Meteorological Organisation (WMO) and Australian Greenhouse Office (AGO) policy. • The assumptions made about gas fugitive emissions from upstream gas infrastructure may overstate the actual value significantly, which tends to favour coal-fired generation over gas-fired generation. . • The discussion within the SER in relation to thermal efficiency of electricity generation is confusing and provides inappropriate examples for the comparison of gas and coal which again tends to favour coal over gas fired generation. A competitive gas fired plant for comparison with the suggested coal fired units would be combined cycle gas turbines which would have approximately a 5% efficiency advantage over coal fired electricity generation **Western Power:** • There is an overstatement of the full fuel cycle emissions from natural gas and an understatement of the difference between gas fired plant and the coal fired plant being proposed. • Comparison of CFPS "full fuel cycle" emissions with those from natural gas alternatives is misleading because a Greenhouse Global Warming Potential (GWP) of 60 was used for methane, rather than the GWP of 21 adopted by the National Greenhouse Gas Inventory Committee. • Comparison of CFPS "full fuel cycle" emissions with those from natural gas alternatives is misleading because fugitive gas losses of 2% were assumed. • Comparison of the greenhouse intensity of emissions from the proposed power station with existing generation in WA is also misleading and overstates the greenhouse benefit of the CFPS.	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		EcoCarbon: • The issue of greenhouse gas emissions is discussed comprehensively in the SER. • The situation specific and life-cycle approach to comparing greenhouse emissions between different fuels such as coal and gas given in the SER is appropriate. • Selection of the appropriate timeframe (20 years or 100 years) over which to conduct an analysis of emissions can have significant effects on the results. • Emissions trading is often cited as allowing the most efficient greenhouse gas abatement. Emissions trading mechanisms to offset the greenhouse impacts of fossil fuel use are currently available eg the Greenhouse Friendly Program, administered by the Australian Greenhouse Office. • the proponent may strengthen their proposal by committing to establishing and maintaining a greenhouse gas emissions registry and method of reporting according to accepted standards. • Cost effectiveness of coal fired generation is likely to depend on strategy for GHG mitigation in the medium to long-term. • A comprehensive plan for GHG management may seek to reduce the greenhouse intensity of coal fired generation to some amount below the intensity or absolute amounts stated in the SER. An overview of such a quantitatively defined strategy would improve both the environmental and economic arguments used to support the proposal. • Minimising the carbon intensity of generation and minimising the costs involved in complying with expected future carbon constraints will provide a more stable and competitive future electricity supply. • The state and national benefits cited in the SER do not incorporate the potential contribution that Griffin Energy's activities may make to the commercialisation of new technologies associated with reducing the greenhouse footprint of the project **Conservation Council:** • The SER document does not deal with the fact that under Federal Government legislation, there is a legal requirement for Western Australia to develop some 250 MW of renewable energy by the year 2010. If WA does not construct this capacity it will be built on the eastern seaboard, leaving WA taxpayers to foot the bill (to the tune of some $600M). All the jobs associated with the development of this renewable electricity will be lost to the eastern seaboard. • There must be an explanation of the attributes of the power station that will best match the new renewable energy generation that is to be built. Furthermore, there must be a discussion on what will be the best technology in 2010. This issue needs to be clearly spelt out in the document and requires a detailed analysis that shows how the new generation will impact on renewable plants that are required through legislation. • The proponents must explain if WA will require additional fossil fuel generation once the required 250 to 500 MW of renewable capacity, required by 2010, is built.	

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		• The statement is made that WA should maintain coal for fuel diversity reasons. Surely the same statement is even more applicable to the development of renewable energy power projects and this should be addressed, especially in light of Kyoto and the MRET legislation. • There must be discussion on the true cost of renewable electricity. It is the view of the Conservation Council that renewable energy is now cheaper than coal or gas fired generation – when the costs associated with externalities are properly considered. The Table below shows the relative cost, per kilowatt for electricity generated from various energy generation technologies. **Private submission (no name provided):** • It is inappropriate to burn more coal for power generation (even with the wind farm and salinity scheme) when the world requires a reduction in greenhouse gas emissions. Muja's replacement power station must produce less greenhouse gas.	
Noise and Vibration - ▪ Construction Phase ▪ Operations Phase	Noise in the area is currently dominated by the Collie Power Station and nearby mining operations. The closest noise sensitive residence is 4.5km to the south west. Noise during construction will originate from earth moving equipment and power plant assembly. Operations noise will originate from the coal pulverising mill, air plant, steam generators and turbines and conveyor. Modelling indicates that noise emissions from the power station will comply with the Noise Regulations at all times. There will be no vibration impacts due to the distance between the site and the closest residence.	**DEWCP, Environmental Regulations Division:** • The predicted plant noise levels show that the plant should result in noise levels less than 25 dB(A) at the nearest residences in Collie, and therefore should neither exceed the assigned level nor significantly contribute to an exceedance. This finding is accepted. • In the report, the noise emission is not considered to contain tonal characteristics. While no direct evidence is presented to support this view, it is accepted on the basis that the predicted levels are so low that any tonal components should be effectively masked by the ambient noise. • The report does not indicate whether the predicted noise levels meet the L_{A10} assigned noise level for neighbouring premises, that is, 65 dB(A) for Industrial and Utility premises. The proponent should ensure that the power units are set back at least 400m, or such distance as detailed modeling shows is required to achieve the boundary assigned level. • The proponent needs to ensure that the sound power levels for the power units, as modelled in the SER report, are not exceeded in the procurement stage, and that tonal components are not present in the noise emission. • Construction noise should be able to be adequately managed under noise regulation 13. **DEWCP, Bunbury Regional Office:** • Due to the distance to the nearest residence, noise and vibration are unlikely to be a problem. However, it is important to note that regardless of the fact that the residence at Blue Waters is a Griffin owned property, it is still recognised under the Environmental Protection (Noise) Regulations 1997. The operation will require an Environmental Protection Act 1986 licence.	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		Shire of Collie: • It is not expected that construction noise or vibration will have an effect upon the Collie townsite although any effect upon adjoining landowners in unknown. Close consultation with adjoining land owners (as outlined in the SER under Clause 11) is encouraged and, in fact, is emphasised as being vital. Noise is not expected to be an issue during operational phase of the power station.	
Waste	Wastes include fly ash, saline water, domestic liquid waste and solid waste. Fly ash will be collected, combined with claystone and disposed above the water table at the Ewington I mine. Alternative uses for fly ash being investigated. Saline water disposed to the ocean. Treatment facility installed for domestic liquid waste. Solid waste disposed to a licensed landfill facility.	**DEWCP, Bunbury Regional Office:** • Recycling and reuse of water and solid waste (including flyash) should be maximised. • With respect to flyash disposal, preference should be given to opportunities for alternative uses. However, if flyash is disposed of to a mine void, it is imperative that it be deposited above the highest known groundwater level and may need to be combined with some form of stabilisation additive. **DEWCP, Environmental Regulations Division:** • The objective to minimise the impact of oil and chemical spillage- are spills inevitable? • Why is the preferred method of disposal of fly ash landfilling at Ewington 1 pit, what about reuse? • How will potential leachate from fly ash be contained before ground water contamination? • Have other opportunities been explored above and beyond off-site disposal to landfill? • Reference to reuse priority contradicts claimed preferred disposal to pit in 12.1. NSW fly ash different make up to Collie fly ash r e reference to comparison of techniques used in NSW. • What about bioremediation on site of hydrocarbon contaminated soil? **CALM:** • It is not clear as to whether the ash will be disposed of into backfilled pits or 'out of pit' overburden dumps. • In order to reduce the impact of footprint of ash disposal in overburden, fly ash and bottom ash should be considered for disposal above the water table in backfilled pits. The proponent should consider this measure subject to appropriate investigations of all alternatives. • Proposals for ash disposal should be benchmarked against world's best practice and best practice adopted if applicable. • The proponent should consider pro-actively researching and developing alternative uses for ash rather than relying on existing markets.	Considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Contamination – oil and chemical spills	The operation of the power station would require the transportation, storage and handling of hydrocarbon products including liquid fuel, lubricating oils and greases and degreasers. Hazardous materials such as herbicides, acids, solvents and explosives (if blasting required) may also be used and stored on-site. The potential impacts associated with these activities include: - Discharge of hydrocarbons to the environment contaminating surface and ground waters, the atmosphere and soil; - Creation of acute and/or chronic toxic hazards; and - Creation of flammable or explosive hazards.	Refer to submissions under Waste above. There were no other significant issues raised in respect of hydrocarbon and hazardous materials.	See waste, groundwater and surface water. Not considered to be a separate relevant strategic environmental factor for this assessment
SOCIAL SURROUNDINGS			
Visual Amenity	The proposed power station site is on cleared land. Forest exists immediately to the south - southwest, and approximately 5 km northwest of the site. The general area is dominated by industrial (power stations) and mining operations. Power station will be built in an area that already contains significant mining and industrial developments. The station will not be visible from Collie.	There were no significant issues raised in respect of visual impacts.	Not considered to be a relevant strategic environmental factor

Preliminary Environmental Factors	Proposal Characteristics / Existing Environment	Government Agency and Public Comments	Identification of Relevant Environmental Factors
Transport	Public roads currently used for the transport of construction materials and machinery to support the mining industry. Use of public roads to transport materials and machinery. Level of use is expected to be similar to that experienced for Collie A.	**DEWCP, Environmental Regulations Division:** • The SER report dismisses noise from construction traffic as a public health and safety issue, without discussion of likely traffic routes and associated impacts. Given the numbers of average daily, the issue warrants more detailed consideration. • The proponent should, prior to EPA assessment, carry out a study to identify the most appropriate construction traffic routes and assess noise levels at noise-sensitive premises along these routes in accordance with preliminary draft Guidance No.14 – Road and Rail Transportation Noise. **Shire of Collie:** • The SER indicates the clear expectation of increased traffic movements to cater for the influx of workers and the delivery of construction materials, including normal trucks, buses, light vehicles and very heavy multi-axle vehicles. The Collie Shire Council will expect to be consulted on the proposed routes for these vehicles and work with Griffin to achieve satisfactory outcomes where potential may exist to impact upon residential areas.	Not considered to be a relevant strategic environmental factor
Public Risk	Low level of risk from the adjacent Collie Power Station. Qualitative assessment indicates low potential levels of public risk. Public will be excluded from the area immediately surrounding the Power Station.	There were no significant issues raised in respect of Public Risk.	Not considered to be a relevant strategic environmental factor
Aboriginal Heritage	The site has previously been extensively cleared for grazing and it is unlikely that any sites of significance occur. Desktop investigations indicate a low likelihood of heritage sites being discovered.	**Shire of Collie:** • The Collie Shire Council strongly supports liaison with local Aboriginal people to ensure that any concerns are adequately and sympathetically dealt with.	Not considered to be a relevant strategic environmental factor
European Heritage	No known European heritage sites occur. No impact on known sites.	There were no significant issues raised in respect of European Heritage.	Not considered to be a relevant strategic environmental factor

Appendix 4

Summary of Submissions and
Proponent's Response to Submissions

Griffin Energy

South West Power Project Strategic Environmental Review Response to Submissions

EP026818A1

AN AECOM COMPANY

February 2003

HGM Maunsell

AN AECOM COMPANY

February 2003

Griffin Energy

South West Power Project Strategic Environmental Review Response to Submissions

EP026818A1

Consulting
Engineers &
Environmental
Scientists

629 Newcastle St
Leederville WA 6007
Australia

Telephone:
(08) 9281 6100
Facsimile:
(08) 9281 6295
email: hgm@hgm.com.au

Report by: Filipe Dos Santos

Signed:

Reviewed & Approved: I. McCardle

Signed:

Date: 2 December 2002

Distribution: Griffin Energy
Filipe Dos Santos
HGM Library
HGM File

Contents

1 Introduction

1.1 Background

Griffin Energy Pty Limited (Griffin Energy) proposes an integrated sustainable energy project including a coal fired power station at Collie, a scheme to significantly reduce salinity in the Collie Basin, plans to potentially provide up to 60 gigalitres (GL) of additional potable water to the State (15% of the current needs of the South West) and a 40 - 80MW wind-power project north of Perth.

This document addresses one element of the project, namely the construction and operation of an 800MW advanced super critical coal fired power installation comprising 2 x 420MW units (400MW net) in the Collie Region of Western Australia, referred to as the South West Power Project (SWPP).

Griffin Energy is part of the Griffin Group that, through The Griffin Coal Mining Company Pty Limited (Griffin Coal) is the major coal supplier to customers in the south west of Western Australia. Griffin Coal has mined coal in the region for over 75 years, and owns and operates the Muja and Ewington II open cut mines and is finalising environmental approval for the Ewington I and Chicken Creek III mines. The company is privately owned.

The intent is for Griffin Energy to bid to sell electricity as an "owner and operator" of a power station through the power procurement process under the *Electricity Corporation Act 1994.* In addition, should the Government implement the recommendations of the Electricity Review Task Force, Griffin Energy could also sell electricity into a wholesale electricity pool.

The proponent seeks strategic advice under Section 16(e) of the *Environmental Protection Act 1986* to establish a coal fired power station on Griffin freehold land (situated within CML 12/846 and 12/847).

The environmental assessment process involved the preparation of a Strategic Environmental Review (SER) document covering the proposed Griffin Energy South West Power Project. The purpose was to obtain advice on its suitability from an environmental perspective under Section 16(e) of the *Environmental Protection Act 1986*

The Section 16(e) document is a public document and was subject to a four week public review period, during which the public and other groups were invited to make submissions to the EPA. The EPA will then provide advice to the Minister for the Environment and Heritage on whether a project on this site can likely be implemented in an environmentally acceptable manner.

The EPA's advice is not considered as a "formal" assessment under Part IV of the Environmental Protection Act and no legally binding Ministerial Conditions are set. The objective of the Section 16(e) is, in this instance, to seek advice and "approval" (in principle) for the site to accommodate a power generating facility

This document provides the proponent's formal response to issues raised during the public review period.

1.2 The Integrated SWPP Project

The Project takes a holistic approach that provides a sustainable basis for development. With the central intent of providing a sustainable response to the announced Western Power Corporation's Power Procurement Process (PPP), the Project combines the development of a coal fired power station to meet the need for new base load power generating capacity with the development of a renewable energy project (wind) and an initiative in water management that could see over 130 GL of new potable water resource realised while providing the time necessary to allow longer term salinity solutions to be implemented in the Collie Catchment.

The coal station is to be located on Griffin owned land immediately adjacent to the Western Power Collie A site and adjacent to the Griffin Ewington 1 coal deposit. The plant will be designed as a latest technology "supercritical" facility capable of efficiencies as high as 43%. As well, the plant will be designed to accept up to 10% biofuel in the form of wood waste as an alternative fuel.

The Project assumes the combined coal and wind capacity will be capable of delivering up to 400 MW in the first phase but at any point the coal plant (being dispatchable) can have output reduced in order to allow the renewable energy to be maximised. This is a critical feature of the initiative as at present under the WA system all generators must load follow their customers and this is simply not possible from an intermittent, non-dispatchable source such as wind. Combining the two generating sources allows the Project to create its own Renewable Energy Certificates (REC's) and provide these to energy retailers as part of its product offering.

The Project includes a proposal to work closely with State and local governments to take a new approach to the management of both water and salinity in the Collie Catchment. Recently the Collie Catchment Recovery Team identified this initiative as its preferred option for dealing with the salinity issues of the catchment. The initiative suggests diverting early salt laden flows from the East Collie River into existing and soon to be enlarged mine voids and then using this water for cooling and desalination. The proposal creates some 60 GL of additional water resource including that produced from new mining operations at Ewington 1 and allows the Wellington Reservoir (70 GL) to be quickly returned to potable levels. Further, the initiative negates the requirement for construction and intermittent operation of a large and expensive desalination facility at Kwinana that uses upwards of 25 MW of electricity for the desalination of seawater. By comparison, the desalination of brackish stream water at Collie can be accomplished at far lower capital and operating costs and would utilise only 5 MW of energy on average, reducing CO_2 emissions well below those expected from a seawater desalination plant.

Griffin is undertaking a number of staged studies with CSIRO and CALM to research and determine the carbon sequestration potential of improved pastoral land management and also to quantifying the sequestration of carbon in tree planting initiatives in the Collie Catchment. These research and development initiatives are expected to have wider ranging benefits to WA and Australia. The project will also convey conservation benefits through the revegetation of cleared land, the re-establishment of vegetation corridors and the recovery of understorey vegetation that has been degraded through grazing.

Based on a 20-year timeframe analysis on full production, whole of life cycle emissions (wellhead to burner tip versus mine to burner tip) it has been calculated

that should gas suffer 0.925% fugitive (transmission and distribution) losses of methane gas, the difference in greenhouse gas contribution to the atmosphere is approximately 375,000 tonnes/annum. That is, the coal-fired power plant greenhouse emissions are approximately 10% above that from a combined cycle gas turbine power plant of similar load use (Table 1). However, when considering the project holistically, taking into account a number of ameliorative actions, total emissions from the project are less than those for a gas-fired combined cycle power station in isolation.

Although the "standard" method for calculating greenhouse intensity uses a 100-year timeframe, there is currently debate on the applicability of this time frame when considering the impact of short lived greenhouse gases. For example, the global warming potential (GWP) of methane (CH_4), with an atmospheric lifetime of 10-15 years, is significantly underestimated when a 100-year timeframe is adopted instead of the 20-year timeframe (IPCC 2001). The IPCC states that the "choice of time horizon depends in part on whether the user wishes to emphasise shorter-term processes or longer term phenomena that are linked to sustained alterations of the thermal budget". In addition, "if the speed of potential climate change is of greatest interest (rather than the eventual magnitude), then a focus on shorter time horizons can be useful" (IPCC 2001). Further, studies have examined the relationship between GWP and climatic response using simple energy balance models. These noted that for the 100-year GWP the calculated temperature responses (both instantaneous and integrated over time) and the calculated sea level rise was of good accuracy for N_2O (a long-lived gas). However, for CH_4 (a short-lived gas), although the sea level rise was of good accuracy the instantaneous temperature change was less well represented over the 100-year time horizon (IPCC 2001).

Table 1: Comparison between Coal and Natural Gas Greenhouse Emissions

	Greenhouse Emissions per Year			
	20-Year Timeframe		100-Year Timeframe	
	Coal	Gas	Coal	Gas
Process:				
• Mining and Extraction of fuel (kg CO_{2e} / MWh_e)	12.60	96.96	12.60	95.22
• Transport and Distribution (kg CO_{2e} / MWh_e)	0.29	214.13	0.29	50.30
• Fuel Combustion (kg CO_{2e} / MWh_e)	795.88	425.60	795.88	425.60
Total (kg CO_{2e} / MWh_e)	**808.77**	**736.69**	**808.77**	**571.12**
Total per year (kilotonnes CO_{2e} pa)* (800 MW @ 75% Capacity Factor)	**4,251**	**3,873**	**4,251**	**3,002**
Amelioration Initiatives:				
• Renewable Fuel	180		180	
• Wind Generation	150		150	
• Desalination energy Savings	129		129	
• Carbon Sequestration	110		110	
Total per year (kilotonnes CO_{2e} pa)	**569**		**569**	
Ameliorated Total Emissions (kilotonnes CO_{2e} pa)	**3,682**	**3,873**	**3,682**	**3,002**

Note * : this excludes other SWPP project greenhouse emissions (refer SER, Table 10.8).

Calculations were based on the following input data:

- Combined Cycle Gas Turbine (CCGT) Annual Average Efficiency of 43.52% HHV basis assuming reasonable loading profile;
- Supercritical Coal-fired plant Annual Average Efficiency of 41.34% HHV basis assuming reasonable loading profile;
- 4.2% by weight of gas consumed in pumping (EPIC Pipeline Report);
- CO_2 emission at Well of 0.35 kg $CO_{2\,e}$ per kg of product (based on Australian Petroleum Production and Exploration Greenhouse Challenge Report);
- Electric Power generation of 6.14 kWh per kg of natural gas producing CO_2 direct emissions of 118.22 kg CO_{2e} / GJ or 425.60 kg CO_{2e} / MWh; and
- Fugitive losses of 0.925% (based on mid-point between AGA and New Coal claims suggested by SEDO), which would result in greenhouse emissions of 8.79 kg CO_{2e} / GJ or 31.64 kg CO_{2e} / MWh.

Conclusions

20-Year Timeframe:

- CCGT life cycle greenhouse emissions of 736.69 kg CO_{2e} / MWh or 3,873 kilotonnes CO_{2e} per year; and
- Collie CFPS greenhouse emissions of 808.77 kg CO_{2e} / MWh or 4,251 kilotonnes CO_{2e} per year.

Thus natural gas CCGT is approximately 91% of Collie Coal CFPS greenhouse emissions. Total greenhouse emissions are completely ameliorated by the initiatives forming part of the Project and the differential swings in favour of coal generation.

100-Year Timeframe:

- CCGT life cycle greenhouse emissions of 571.12 kg CO_{2e} / MWh or 3,002 kilotonnes CO_{2e} per year; and
- Collie CFPS greenhouse emissions of 808.77 kg CO_{2e} / MWh or 4,251 kilotonnes CO_{2e} per year.

Thus natural gas CCGT is approximately 71% of Collie Coal CFPS greenhouse emissions. Total greenhouse emissions are partially ameliorated by the initiatives forming part of the Project and the differential is reduced to where natural gas emissions are approximately 82% of the Project emissions.

Concluding Remark

The Projects sets as its target to produce a sustainable (social, environmental and economic) response to the Western Power base load PPP and, by combining initiatives in renewable generation, water management and carbon sequestration with the economics of base load coal fired generation, accomplishes this goal.

1.3 Social, Economic and Strategic (SES) Study

Griffin Energy commissioned independent consultants to undertake a preliminary assessment of the social, economic and strategic (SES) issues associated with its proposed integrated energy development near Collie. The SES study was designed to complement the strategic environmental assessment prepared in accordance with s16 (e) of the *Environmental Protection Act.*

The SES study will ultimately identify, and where possible, quantify the likely social, economic, and strategic implications of the development. The study also considered management options to enhance positive effects and eliminate or mitigate any undesirable implications.

The first stage of the SES study identified the likely social, economic, and strategic implications of the proposed Griffin Energy power station and associated developments. The SES Study examined:

- the core element of the SWPP project - the construction and operation of the first phase (350 - 400 MW) of the coal fired power station, plus development and operation of Ewington I coal mine, that has already received environmental approval, to supply fuel for the power station; and
- the associated proposals, including land and water management initiatives and development of energy intensive industry near Collie.

Research commenced in mid July 2002 and the document report of the first stage of the SES Study was completed at the end of August 2002. The following methodology was adopted:

- an economic and social review of the study area and the surrounding region;
- personal and phone interviews were held with representatives of local government, business associations, State members of Parliament, State Government departments, major industries in the region and other interested parties;
- receipt of submission responses from the community; and
- strategic level assessment of the issues identified through the research and consultation process.

Findings

Consultations revealed that:

- there is a general concern in Collie about the future well being of the town. Of particular concern is the town's ability to retain young people and young families, and about breakdown of traditional social structures;
- despite substantial reductions in numbers of people employed in coal mining and electricity generation, there remains strong support for the industry and its companies;
- the community recognised that construction of the Collie A power station was fundamental to ensuring that the coal and electricity industries continue to be major contributors to the Collie economy;
- the community and its leaders appear united in their support for development in the region that would help sustain the community;
- a strong desire for business in the region to participate directly in supplying the project in both construction and operational phases. Small businesses in the Collie area felt that they had missed out on opportunities from past construction projects because of the nature and scale of supply contracts, and procurement policies; and
- people in Collie were generally enthusiastic about the proposed power station and the economic and social benefits it could bring. There were some concerns expressed about the impact the power station and any associated industrial cluster might have on the local environment - in particular in relation to noise and drawdown of the water table.

Conclusions

The study concluded that:

- the proposed power station will provide significant economic benefits to Collie and the rest of the South West through direct and indirect employment, business opportunities and the likely development of an industrial cluster that will take advantage of lower cost and reliable electricity;
- these impacts will in turn have flow-on effects that will affect the social fabric of Collie and the rest of the South West. In particular, the proposed power plant will attract large numbers of workers to the area during the construction phase, which is expected to take three years for the first stage of the project. The operational phase will attract highly skilled people seeking long term employment to the area;
- associated with these influxes of workers will be additional demand for local business and services that will add to the longer term sustainability of Collie and the rest of the South West. However, it must be recognised that there may be some undesirable implications that will need to be mitigated or eliminated;
- the social and economic effects will be felt greatest during the construction phase of the project because of the sheer size of the expected workforce; and
- the extent to which Collie will benefit will be dependent on the Town's ability to attract workers to live in the town and the capacity of local businesses to respond to the increase in demand caused by the larger population. It will also depend on the capacity of local business to respond to the demand for services from the proposed power station. Finally, the level of benefit for Collie will depend on Griffin's commitment to 'buy local' and 'employ local'.

1.4 Response to Public Submissions

This document responds to comments on environmental issues raised by various government agencies, local authorities, private companies, regional and local interest groups and individuals received during the 4-week public review period. From these submissions, issues were summarised into questions and a response to each question is provided. This is done to avoid duplication of questions posed by multiple submissions so that a concise response to the issues raised can be provided without repetition. Submissions were received from the following groups:

- Bunbury Port Authority;
- Bunbury Wellington Economic Alliance;
- Shire of Collie;
- Conservation Council of Western Australia;
- Western Power Corporation;
- Department of Conservation and Land Management (CALM);
- Department of Environment, Water and Catchment Protection (DEWCP) - Bunbury Regional Office;
- Department of Environment, Water and Catchment Protection (DEWCP) - Environmental Regulations Division;
- Department of Environment, Water and Catchment Protection (DEWCP) - Marine Branch;

- Department of Environment, Water and Catchment Protection (DEWCP) - Ecological Systems Branch;
- Department of Planning and Infrastructure (DPI);
- Department of Minerals and Petroleum Resources (DMPR) - Office of Major Projects (OMP);
- EcoCarbon Incorporated;
- Office of Energy; and
- Water Corporation.

One submission was also received from an unidentified individual on a Response sheet supplied by the proponent at one of the public display centres.

The issues raised fall generally under the following environmental factors:

- greenhouse gas emissions;
- atmospheric (pollutant) emissions;
- flora, fauna and ecology;
- water (groundwater, river and marine) systems;
- waste disposal;
- social aspects; and
- planning and infrastructure development.

Key issues raised in these submissions relate to greenhouse gas management, wastewater discharge, flyash disposal, water supply and the use of natural resources.

Griffin Energy's response to all issues raised in the submissions are provided in Sections 2 through to 9.

2 General Issues

2.1 Project Justification and Economic Benefit

Issue: State Government Power Demand Forecasts.

Q: **The predicted growth rate of between 3% and 4% per annum (80 to 120MW) demands that action be taken sooner rather than later for new generation capacity to be brought on line. Collie Shire Council and Bunbury Wellington Economic Alliance (BWEA) are not convinced that the State Government's current programme (which appears to have been fraught with delays for whatever reasons) is going to meet demand requirements.**

R: Griffin is also concerned about any further delays in the base load power procurement process. Griffin is relying on assurance from the Minister for Energy that the process will commence in late 2002. Given that timing, Griffin is offering a time line that can effectively cater for both growth in demand and plant retirement without prejudicing the continuity of future power supplies.

Issue: Fuel Type.

Q: **The Collie Shire Council/BWEA agrees totally with statements relating to the relative values of fuels proposed for power generation. In short, natural gas has an extremely high value-adding potential and should not be used for perceived short-term gains (environmental debate) in the production of electricity. Coal is a well-defined resource, has permanency and reliability of supply and, subject to price competitiveness, should be the preferred fuel supply. This position needs to be clearly enunciated from all levels of Government and its agencies.**

R: Griffin agrees. This provides a compelling argument for using coal to ensure a sustainable, productive economy through use of a low cost and secure fuel source.

Q: **It is inappropriate to burn more coal for power generation (even with the wind farm and salinity scheme) when the world requires a reduction in greenhouse gas emissions. Muja's replacement power station must produce less greenhouse gas.**

R: Griffin believe that over a 20 year project life timeframe, the resultant lifecycle greenhouse gas emissions from a Supercritical coal-fired power station are similar to those emissions from a combined cycle gas turbine power plant of the same capacity. The proposed new coal plant will emit less greenhouse gas emissions per unit of electricity than Muja A&B, which are in part to be replaced by this facility.

Issue: Efficiency and Technology

Q: **In discussions of the relative merits of the proposed CFPS and gas turbine technology, several references are made to the more distinct fall-**

off in performance of gas turbine technology at low loads. Given that this mode of operation is often a system requirement and that the coal fired plant could be subject to the same regime, how responsive is the proposed plant to low and fluctuating demand and does this sort of operation affect its life expectation or long term durability?

R: Griffin Coal note that Western Power has raised this issue. As Western Power would be aware through their operation of the Collie A facility most coal fired plants are capable of operating at a minimum load of 40% of Maximum Capacity Rating. Combined cycle gas generation has much the same minimum requirement while cogeneration is far less flexible as it must also meet the thermal demands of its industrial host.

In most cases coal fired facilities can be ramped up to full production on a reasonably short schedule at least sufficient to meet normal daily load fluctuations. Provided the increase in output is progressed on the basis suggested by the boiler manufacturer no loss of life expectancy or long-term durability is expected.

2.2 Integrated Project - 4 Aces

Issue: Integrated Project Development.

Q: The proposed coal fired power station is presented as an integrated sustainable energy project, with renewable energy and regional water management components integrated with the power station operation. However little detail is provided of the renewable energy and water management infrastructure development and timing in relation to the power station. Further, while offering the integrated package as project justification, the coal fired power station is submitted for strategic environmental assessment separate from the other components. What commitments are made to the sustainability components of the project?

R: The renewable energy and regional water management components of the integrated project are being developed in parallel with the power procurement process. Griffin is committed to developing those components of the integrated project, provided they can each be accomplished within a sustainable framework with government department and corporatised bodies support, and within regulatory constraints.

Q: The project will, based on the report provided, reduce the salinity of the Collie River and Wellington Catchment area. The increasing importance of ensuring that our waterways remain healthy for future generations is noted. The intended use of cooling water and diversion of highly saline water from the upper parts of the Collie River are critical to achieving this objective.

R: Griffin agrees. The use of water in the proposed power stations will be optimised in final design to assist in Collie Basin water management. At all times at least the minimum environment flow will be maintained in the East Collie River.

Issue: Water Supply.

Q: The provision of water for the proposed Griffin owned power station is an interesting concept and one that attempts to address a whole range of issues within the Collie coal basin and the wider Collie Water Catchment (reference also to SER Part Three – Potential Environmental Impacts & Their Management). The lateral thinking being shown by Griffin may well prove to have community, and indeed state, benefits beyond their own interests of coal mining and power generation. The Council, and the Collie community, would be concerned however to receive assurances that the proposed new power station would not result in an overall deleterious affect on existing groundwater supplies and access to those supplies by other private land owners.

R: Griffin addressed groundwater management in its separate application for mining Ewington I, which was previously approved subject to an acceptable Environmental Management Plan. Griffin is committed to involving other users to ensure they are not adversely affected by its operations.

Q: The proponents propose an "in principle" water management scheme for the region. There is clearly a need for an integrated Collie Basin wide approach to management of water resources in the region, taking into account the rights of existing water users. To what extent is the proponent willing to support a multi interest regional approach to management of water and water quality in the Collie Basin?

R: Griffin is very supportive of a multi-interest regional Collie Basin catchment approach to management of water quality. Griffin is conducting studies that are supportive of this approach and is in discussion with the remaining stakeholders on how best to achieve the most productive sustainable outcomes. Griffin's recognition of the need for a regional approach, the availability of fresh groundwater and the availability of mine voids from its operations inspired the proposed water management scheme.

Q: While the intent of reducing the amount of salt flowing into the Wellington Dam is supported, there needs to be consideration of maintaining some level of water in the river system during the diverting period.

R: Griffin is committed to maintaining a minimum environmental flow in the East Collie River. The diversion of water will occur at the beginning of the wet season and will reduce in volume as the rivers salinity reduces.

Q: The proponent discusses mitigation measures such as improved water management systems and the 4 Aces Project in general terms (section 3.1.2.4, p 3-4) and whilst the objectives are appropriate, there is no guarantee or commitment as to what extent the mitigation measures will be implemented.

R: Griffin is committed to implementing measures relating to reducing salinity identified in the State Salinity Strategy providing they are sustainable and within the constraints of government requirements.

Q: The impact of Griffin's proposal on surface and groundwater resources of the Collie River Basin cannot be determined from the document provided. Specific hydrology and hydrogeology investigation work is needed together with more detailed explanations and plans of the proposed water management infrastructure and regime. Of particular concern is the proposal to divert brackish Collie River water into mine voids with potential for contamination of the groundwater resource.

Responsibility for decision-making in these matters resides with the Water and Rivers Commission whose interests in water quality and quantity management is closely aligned with those of the Water Corporation. Both agencies need to be involved in the detailed planning and the environmental studies aimed at understanding the water resources of the basin and how they would be impacted by the proposed project.

R: Griffin has commissioned a hydrogeological consultant to investigate Griffin's sustainable development package. The conceptual scheme involves the following elements:

- diversion of water from the Collie River East Branch to an existing mine void;
- desalination of water in the void to potable quality; and
- disposal of the high salinity wastewater from the desalination process to the sea, via the existing saline water pipeline.

The consultant's report concludes that:

- no fatal flaws were identified in the proposed diversion and desalination scheme;
- refinements of various aspects of the proposed scheme are required by Griffin Energy, including:

    - the desalination scheme should be adopted in conjunction with a phased introduction of salinity management works at catchment scale (ie., a combination of short and long-term reafforestation, groundwater pumping and drainage schemes). Desalination without an associated implementation of catchment works is not the best approach: (i) because of the relatively short-lived nature of the desalination scheme (30 years) compared to improved catchment management; and (ii) because the control of the desalination plant would rest with Griffin;
    - the desalination plant will need to cope with seasonal variations in streamflow and salt load due to changing catchment conditions, which is achievable;
    - additional consideration of the relative cost and time-line benefits of desalination compared with implementation of salinity management works throughout the catchment. It is likely that while the implementation of salinity management works will be cheaper, it may also be technically more challenging and slower to achieve results;
    - consideration of the social impacts of the scheme. Griffin Energy is aware of the potential political and social impediments to the development of a desalination scheme and is currently addressing these issues;

- the scale of the desalination plant is significant in an Australian context, and given the planned throughput will almost double the aggregate production of all the Reverse Osmosis Desalination Plants in Australia. However, it is smaller than the desalination plant currently being considered by the Water Corporation at Kwinana; and
- the concept of using the Chicken Creek or Muja mine voids to store saline stream flow appears to be environmentally sound as regards the protection of the fresh groundwater in the Collie Basin. While the possibility of the contamination of aquifer zones from such storage appears remote, this aspect needs to be carefully considered during the more detailed design phases of the project. It is noted that groundwater salinity in the area of the proposed Chicken Creek Area 3 mine is up to 5,000 mg/L TDS.

2.3 Renewable Energy

Issue: Future Development of Renewable Energy.

Q: The SER document does not deal with the fact that under Federal Government legislation, there is a legal requirement for Western Australia to develop some 250 MW of renewable energy by the year 2010. This requirement is legislated through the Renewable Energy (Electricity) (Charge) Act 2000, supported by the Renewable Energy (Electricity) Regulations. If WA does not construct this capacity it will be built on the eastern seaboard, leaving WA taxpayers to foot the bill (to the tune of some $600M). All the jobs associated with the development of this renewable electricity will be lost to the eastern seaboard.

R: Griffin Energy supports and is actively working towards an era of sustainable energy that will see increased renewable energy generation. The responses below show the positive impact of the various Griffin Energy initiatives on the currently mandated renewable energy targets as Griffin understand them. The Griffin Energy initiatives will exceed the incremental requirements of the federal legislation, for the Griffin CFPS itself, and will contribute to the achievement of the overall targets. There is some anticipation in the community of an increased requirement for renewable energy. This is consistent with the transition to a sustainable energy era. As an energy company Griffin continues to seek out further opportunities to participate in the provision of sustainable energy to the WA community.

Based on the Western Power Electricity Outlook 2003 -2013 released June 2002 the Central Forecast anticipates a Sent-out Energy load of 18.6 TWh in 2010. The 2% federal government requirement would therefore equate to 372 GWh at that date. Assuming a 35% load factor on average for renewable sources this would require 120 MW of installed renewable capacity. Griffin's initiative includes an initial 40 MW wind farm expandable to 80 MW. This represents, at the first stage, better than 30% of the 2010 capacity requirement.

Using the same load factor assumption and anticipating a 70% load factor for the CFPS the expanded 80 MW wind farm will produce energy equivalent to 5% of the overall energy production. Well ahead of the mandated 2% requirement.

Q: There must be an explanation of the attributes of the power station that will best match the new renewable energy generation that is to be built. Furthermore, there must be a discussion on what will be the best technology in 2010. This issue needs to be clearly spelt out in the document and requires a detailed analysis that shows how the new generation will impact on renewable plants that are required through legislation.

R: Responding to this issue would require speculation given that the nature (diurnal energy profile) of the likely renewable energy generation is not known. However the removal of Kwinana and Muja A/B power plants from the SWIS system allows a component of base load to be installed. Griffin's wind farm energy actually peaks in the afternoon and is complimentary to the SWIS power demand peak. Further the CFPS will be designed to accept up to 10% renewable fuel most likely in the form of wood waste from tree cropping and processing operations. This fuel switching to a renewable fuel supply also qualifies for the Renewable Certificate program helping WA meet its commitments under this federal program.

Q: The proponents must explain if WA will require additional fossil fuel generation once the required 250 to 500 MW of renewable capacity, required by 2010, is built.

R: As shown in figure 3.1 of the SER around 1500MW of additional generation is required by 2010. This will necessitate far in excess (700MW) of the 800MW of power contemplated by Griffin. Furthermore, it is likely the SWPP will be built in two stages, one in 2004 – 2007, the other in 2007 – 2011 provided a market is available for second stage outgoings from the plant. There is ample remaining room for the renewable energy required to meet mandatory requirements.

Q: The statement is made that WA should maintain coal for fuel diversity reasons. Surely the same statement is even more applicable to the development of renewable energy power projects and this should be addressed, especially in light of Kyoto and the MRET legislation.

R: Griffin's initiative has addressed the renewable power project requirements of the community and in fact goes further than Kyoto Protocol or MRET legislation. Griffin is proposing at least a 10% renewable energy component.

Q: There must be discussion on the true cost of renewable electricity. It is the view of the Conservation Council that renewable energy is now cheaper than coal or gas fired generation – when the costs associated with externalities are properly considered. The Table below shows the relative cost, per kilowatt for electricity generated from various energy generation technologies.

Technology	Capital cost ($/kw)	Total Cost (c/kw)
Wind	1,800	7 - 9
Solar PV	6,500	30 - 50
Biomass	2,500	8 - 12
Coal-fired Steam Turbine	1,500	4 - 7
Combined Cycle Gas Turbine	1,000	4 - 7
Open Cycle Gas Turbine	500	7 - 12

Source: Western Power - Strategic Planning for Future Power Generation, Response to Submissions, August 2002.

R: The costs provided appear to contradict the statement that precedes it. Alternatively these numbers do not incorporate costs associated with externalities. Renewable and fossil fuel both have externality costs. Without having a basis for calculating these costs Griffin is unable to comment further.

The material in the table above provides only a portion of the information contained in the source document (Western Power - Strategic Planning for Future Power Generation, Response to Submissions, August 2002). The original table also indicated the availability of the technology, the area required to operate the technology and the typical installed capacity in Australia. The availability of windpower is 33% compared to 95% offered by coal-fired power generation. The area required for windpower generation is 12 ha/MW compared with 0.3 ha/MW for coal-fired power plants. Most importantly, however, is that typically windpower plants provide up to 20 MW of capacity, which is significantly less than current demand. Coal-fired power generation easily meets demand typically providing between 120 - 2000 MW.

Furthermore, the Western Power (2002) report concluded (from the table) that "wind energy technologies came closest to providing a cost competitive renewable energy source, however there (were) technical and commercial constraints upon the use of windpower", for example, wind generators operate intermittently and "are not able to reliably produce their rated output when required to meet demand" (Western Power 2002, pp4).

2.4 Offsite Impacts

Issue: Minimising Pollutants

Q: Various options are discussed for reducing pollutant levels, for example NO_x and SO_x pollutants and ash. The proponent should make a commitment to using best practice technologies to minimise environmental (air, soil and water) pollution.

R: Griffin does make the commitment to use best practice technology for coal fired electricity generation. This is demonstrated through the use of:

- low NO_x burner technology; and
- ultra high efficiency fabric filter technology.

This correlates to lower air emissions per GJ of energy produced.

Ultra high efficiency fabric filter technology is successfully used in power plants operating in the Hunter Valley, alongside sensitive industries such as dairy farms, horse studs and vineyards (viticulture).

The potential for soil and water pollution will be minimised by implementing best practice management, including:

(Commitments 2 and 3)

- Hazardous Material Management Plan for Construction and Operation phases;
- Solid and Liquid Waste Management; and
- Sediment and Erosion Control Management.

Griffin, in conjunction with a number of agencies is currently considering an alternative management strategy for Collie Basin Water. Griffin is also continuing investigations towards zero discharge.

3 Greenhouse Gas Emission

3.1 Comparison of Coal and Natural Gas Greenhouse Emissions

Issue: 20-year Time Horizon and GWP for Methane

Q: Comparison of CFPS "full fuel cycle" emissions with those from natural gas alternatives is misleading because a Greenhouse Global Warming Potential (GWP) of 60 was used for methane, rather than the GWP of 21 adopted by the National Greenhouse Gas Inventory Committee.

The SER uses a 20-year timeframe for greenhouse gas emissions analysis throughout. The use of a 20-year timeframe results in significantly lowering the lifecycle greenhouse emissions of coal relative to gas. However, the use of this timeframe for calculation of global warming potential's (GWP) is not the internationally recognised standard. It is suggested that all GWP's used to calculate carbon dioxide equivalents be based on a 100-year timeframe as this is the accepted World Meteorological Organisation (WMO) and Australian Greenhouse Office (AGO) policy.

These assumptions result in Table 3.1 of the SER providing an overstatement of the full fuel cycle emissions from natural gas and an understatement of the difference between gas fired plant and the coal fired plant being proposed.

R: Historically, the 100-year time frame was chosen because it could incorporate all residency times of the six main greenhouse gases (CO_2, CH_4, N_2O, HFC's, PFC's and S_6F_6). In the absence of the latter four gases, a consideration of a 20-year time horizon for CO_2 and CH_4 is more appropriate for comparison.

As stated, in the SER, the next 20 years is shaping up as a critical period in relation to greenhouse emissions and consideration of impacts over this time period is more relevant. Furthermore, the issue of applying the correct time horizon has continued to be the subject of considerable debate and changes to the Kyoto rules may be considered (refer Section 1.2 and IPCC 2001 and IPCC 1994).

It should also be noted that the IPCC (1995) publication "The Science Of Climate Change" "gives a GWP for methane as 53 and the IPCC (1994) publication "Climate Change 1994" gives GWP for methane as 62 for a 20-year time horizon. Both of these include allowance for ozone and atmospheric water as secondary products of the methane but not the carbon dioxide. They also assume constant base levels of carbon dioxide in the atmosphere. These publications demonstrate that consideration of the 20-year time frame is an appropriate time horizon for greenhouse emission estimates.

Issue: Natural Gas Fugitive Emissions

Q: Comparison of CFPS "full fuel cycle" emissions with those from natural gas alternatives is misleading because fugitive gas losses of 2% were assumed. This is an extreme value based on reports for transmission and distribution systems. In the context of full fuel cycle power station

emissions it is more appropriate to consider only gas transmission losses and the value of 0.14% quoted for high pressure gas transportation in the Dampier to Bunbury (not Burrup) Natural Gas Pipeline would be more relevant.

What are the comparative greenhouse gas emission intensities of the coal and gas fired generating plants if calculated using the more widely accepted methane GWP of 21 and a high-pressure gas pipeline fugitive loss of 0.14%?

R: As stated in the SER, there were varying reports on the percentage of "unaccounted for gas" losses due to transmission and distribution in Australia. Choosing the most "favourable to the gas industry" value of 0.14% supplied by Epic Energy could also be viewed as "misleading" or "extreme". None-the-less such a value for methane with a GWP of 21 would lead to greenhouse fugitive emissions (assuming no distribution losses) of 4.79 kg CO_{2e} per MWh of electricity generation or 1.33 kg CO_{2e} per GJ raw gas. Overall this would result in 543.03 kg CO_{2e} / MWh, which is approximately 67% of Collie Coal emissions.

These figures are based on losses associated with transmission and distribution only. Given that WA gas reserves are produced a considerable distance offshore, are processed in conjunction with a facility producing LNG and finally transported some 1500 km, using only the fugitive losses associated with transmission very likely understates the losses considerably.

Interestingly, the AGA (2000) report used a value of 0.02% transmission losses, which is well below the Epic Energy quoted value and demonstrates the levels of uncertainty inherent in quantifying the losses.

Q: The assumptions made about gas fugitive emissions from upstream gas infrastructure may overstate the actual value significantly. Overstating the assumptions in relation to gas fugitive emissions also tends to favour coal-fired generation over gas-fired generation. Uncorroborated gas industry analyses (Australian Gas Association Research Paper No. 12) use a value of 0.1% for gas fugitives in exploration, production and transmission; this is 5% of the assumption used within the SER. In the absence of independent data that could be used to validate these assumptions, it is considered reasonable to assume a mid point between the competing claims.

SEDO has made preliminary estimates of greenhouse emissions from baseload coal and gas powered stations based on the following approach and assumptions:

- **100 year timeframe yielding GWPs of 1 for carbon dioxide and 21 for methane;**
- **Fugitive emissions of 0.925% (mid point between competing gas and coal industry claims);**
- **Indicative sent-out higher heating value (HHV) efficiencies of 40% for coal fired plant and 45% for gas fired plant.**

Analysis using these assumptions leads to comparative lifecycle emissions for electricity generation from gas being 55 – 60% those of coal. This

contrasts strongly with the results of the analysis presented within the SER in which Griffin Energy P/L claims "there is sufficient information to demonstrate that Collie coal has similar full-cycle greenhouse gas emissions to natural gas for electricity generation" (page 3-7).

R: The AGA (2000) report presented the following modelling results for the Woodside Energy Limited WA Gas Supply (Scenario 3, refer pp.44, Table 7.1):

- Production greenhouse emissions of 5.46 kg CO_{2e} / GJ;
- Transmission greenhouse emissions of 0.02 kg CO_{2e} / GJ;
- No Distribution greenhouse emissions; and
- Combustion greenhouse emissions of 52.6 kg CO_{2e} / GJ.

The AGA report does not fully indicate how these results have been determined (ie the model inputs used) as most of the details are not available (see pp.67, Appendix B), however the following can be generalised:

- Production losses:
  - Flaring -3.0% raw gas flared;
  - Fugitive emissions - general venting of 5.3%:
  - Fugitive emissions - CO_2 extraction of 3.0%;
- Transmission losses of 0.02%; and
- No Distribution losses.

Our calculations were based on the following input data:

- Combined Cycle Gas Turbine (CCGT) Annual Average Efficiency of 43.52% HHV basis assuming reasonable loading profile;
- 4.2% by weight of gas consumed in pumping (EPIC Pipeline Report);
- CO_2 emission at Well of 0.35 kg $CO_{2\,e}$ per kg of product (based on Australian Petroleum Production and Exploration Greenhouse Challenge Report); and
- Electric Power generation of 6.14 kWh per kg of natural gas producing CO_2 direct emissions of 118.22 kg CO_{2e} / GJ or 425.60 kg CO_{2e} / MWh.

As stated above, a transmission loss of 0.14% would have led to greenhouse emissions of 1.33 kg CO_{2e} / GJ raw gas or 4.79 kg CO_{2e} / MWh electricity generation. Overall this would result in 543.03 kg CO_{2e} / MWh, which is approximately 67% of Collie Coal emissions.

For transmission losses of 0.925% this would result in greenhouse emissions of 8.79 kg CO_{2e} / GJ or 31.64 kg CO_{2e} / MWh. Overall this would result in 571.12 kg CO_{2e} / MWh, which is approximately 71% of Collie Coal emissions.

It is reiterated that these calculations are all based on assumptions with a high degree of uncertainty.

3.2 Efficiency and Technology

Issue: Thermal Efficiency

Q: The discussion within the SER in relation to thermal efficiency of electricity generation is confusing and provides inappropriate examples for the comparison of gas and coal which again tends to favour coal over gas fired generation. A competitive gas fired plant for comparison with the suggested coal fired units would be combined cycle gas turbines which would have approximately a 5% efficiency advantage over coal fired electricity generation

R: Section 3.2.2.2 refers to thermal efficiency comparisons between coal-fired and combined cycle-gas turbines. Further, Figure 3.4 makes comparison (graphically) between plant efficiency and load factors, indicating that a Supercritical coal-fired power plant has similar efficiency to equivalent combined-cycle gas turbines.

This section also notes that efficiency in power generation varies with the conditions under which the plants are operated, the two largest factors being ambient temperatures and load factor.

At 100% load factor combined cycle gas turbines do display an efficiency advantage over coal generation of as high as 5%. However, the nature of electricity demand in WA means plants seldom operate at 100% load factor throughout the day.

The most recent Western Power Corporation Electricity Outlook released in June 2002 shows that on an average summer weekday in 2000 demand varied between approximately 1000MW over night to as high as 1900MW during the day. This "natural" profile of demand means all generating capacity must operate at load factors well below their 100% capacity.

As discussed under Section 3.2.2.2 of the SER and shown in Figure 3.4, a modern coal fired plant is less susceptible to reductions in efficiency as a result of reduced load factor than a modern combined cycle plant. As a result coal fired generation compares favourably with gas particularly in the Western Australian supply context where the (demand) load profile varies considerably across the operating day.

Issue: Technology

Q: A number of items that have the potential to reduce environmental impacts of the power station have been identified within the SER, including:

- **Co-firing with forestry process 'residues';**
- **Commissioning of a wind farm;**
- **Future development of Integrated Combined Cycle Gasification coal plant; and**
- **Future development of zero emissions coal technology.**

None of these aspects of the proposal have been developed or described in detail within the SER. It is clear that the proposed wind farm does not fit

within the context of the proposal as it stands. Other aspects relate to technology, which is not yet commercialised, and/or may not be able to be retrofitted to the technology proposed in the SER. It is likely that all will carry significant environmental implications requiring extensive review in their own right prior to adoption. There appears to be little to be gained from considering these matters as part of the current proposal.

R: Only co-firing with forestry process residues was considered as a means of reducing greenhouse gas emissions. This option requires further work and will be detailed in any subsequent approvals. The proposed wind farm was discussed to demonstrate that Griffin's interest is broader than coal mining and coal fired generation. The last two technologies are not commercially viable at this stage and were documented to identify that the technology adopted by Griffin for the power station (super critical steam) is the best currently available.

Q: **Comparison of the greenhouse intensity of emissions from the proposed power station with existing generation in WA is also misleading and overstates the greenhouse benefit of the CFPS. Emissions performance for the CFPS is stated on an "as generated" basis (i.e. it takes no account of the electricity consumed in works) whereas the values quoted for Muja and Collie power stations are on a "sent out" basis. What percentage of electricity produced will be used in the power station and what is the expected "sent out" greenhouse intensity performance of the proposed CFPS?**

R: The SER is based on 800 MW of sent-out capacity generated from two 420 MW nominally rated units. At full capability 40MW or 4.8% of capability is used within the power station.

The greenhouse gas intensity based on "sent-out" energy is expected to be 0.90 tonnes CO_{2e} / MWh.

4 Atmospheric Emissions

4.1 Dust and Particulates

Issue: Construction Dust Emissions.

Q: The SER recognises that there may well be some dust emissions during construction but the Council is relatively satisfied that there will be no long term impacts. Efforts should be undertaken to ensure that no adjoining landowners are effected by dust emissions during the construction phase. It is highly unlikely that there would be any dust effects during construction over the townsite of Collie.

R: Dust management during the construction phase will be detailed in the Construction Phase Environmental Management Plan and will include:

- minimising clearing with rehabilitation undertaken as soon as practicable; and
- regular watering of unsealed roads, exposed surfaces and stockpiles.

Griffin agrees that dust is manageable and will not be a significant issue.

Issue: Emission Control.

Q: The Council notes the proponent's objectives to:

- ***'protect the surrounding land users such that dust and particulate emissions will not adversely impact upon their welfare and amenity or cause health problems; and***
- ***'Minimise greenhouse gas emissions for the project. Reduce emissions per unit product to as low as reasonable practicable.'***

Emission control will perhaps be the most essential environmental consideration and whilst the Council can offer no technical response whatsoever in this regard, it is vital that the most up-to-date environmental techniques be employed. The Council is confident that Griffin will, by regulation and its own willingness, adhere to best practice in this regard.

R: Best practice design has already been implemented in the Griffin CFPS. The plant will be the first power station in WA to use ultra-high efficiency fabric filter technology to eliminate visible plumes and significantly reduce particulate emissions. The power station will also employ low NO_X burner technology. Management practices will also be directed to reducing emissions by blending and homogenising of run of mine (ROM) coal in the coal stockyard so that coal feed meets desired sulphur content specifications. Griffin will prepare a Greenhouse Gas Emissions Management Plan. The management plan will be a detailed assessment of project greenhouse gas emissions, focusing on minimising greenhouse gas emissions using the EPA's "Guidance for the Assessment of Environmental Factors", No. 12, "Guidance Statement for Minimising Greenhouse Gas Emissions", October 2002.

4.2 Sulphur Dioxide Emissions

Issue: Coal Sulphur Content

Q: In discussing SO_2 emissions, several different coal sulfur content prognostications were offered, expressed variously on "as fired", "22.5% moisture" and "standard moisture" bases. It is unclear how the sulfur values quoted relate to each other and how the final value of 0.42% was arrived at. As this value is critical to ambient air quality modelling results it deserves better definition. How does the 0.42% S value relate to other ranges of sulfur values quoted?

R: The run of mine (RoM) coal will on average have a sulphur content of 0.35%. This average will be maintained by blending and homogenising the coal prior to it becoming power station feed. To be conservative, a value of 0.42% sulphur content has been used in the air emissions modelling. This allows for a 20% increase above the average.

Q: With S content of coal varying between 0.2% and 0.9% (or 0.2% and 0.7%?) it is likely that there could be periods of time where coal with a S content above the average could be burned. Consequently, the value chosen for air quality modelling should be conservatively above the average so as to more closely represent potential excursions of SO_2 emissions and resultant extremes of ambient SO_x concentrations. Long experience with Collie coal is that "as fired" S content averages more closely to 0.6% than 0.4%. This is the basis on which emission rates for existing emitters were established and used in the modelling for CFPS. Coal S values should be comparative for modelling to be truly representative of cumulative effect. Is 0.42% the maximum S content that will be burned on a daily or hourly basis?

R: See response above. Western Power is referring to their experience with other Collie coal deposits as they are not familiar and do not receive Ewington I coal. The Griffin power station will utilise only Ewington I coal that will be blended and homogenised so as to achieve the desired sulphur content specifications stated in the SER.

Q: Figures 10.3 and 10.4 of the SER suggest that ambient levels of SO_x for the CFPS - alone case (Scenario 2) are similar to those of existing emissions (Scenario 1) over a broad area. This does not support the claim in paragraph 2 of Section 10.1.6.1, that the CFPS contribution is not significant.

R: The comment refers only to the contribution of PM_{10} by CFPS alone, namely 2.3$\mu g/m^3$ PM_{10}, which is not significant in light of the contributions by Muja A/B/C/D and Collie A whose combined contribution is 38$\mu g/m^3$ at Collie townsite.

Q: In discussing model results under Scenario 3 (future scenario with CFPS, Collie A&B, Muja C&D and Worsley) the claim is made, and reflected in Table 10.4, that "the highest predicted ground level concentration of 200ppb (100% NEPM) occurs close to the power plants, whilst the

maximum predicted ground level concentrations in the regional areas beyond 3km of the power plants range from 100ppb to 175ppb (near the old Shotts town site)." Reference to Figure 10.5 indicates ground level concentrations over 800 ppb near the power stations and large areas outside a 3km boundary where the concentrations exceed 200ppb.

R: There were no ground level concentration contours presented in Figure 10.5 that are greater than the 350ppb SO_2 contour surrounding Collie A & B. The "800ppb near the power stations" referred to is not presented in Figure 10.5.

It should be noted that SO_2 modelling has been revised to exclude Collie B as an additional emission source. As stated in the SER (refer 10.1.6.3, pp 10-9), future impacts allowed for 1100MW of additional base load capacity (300MW for Collie B and 800MW for Griffin CFPS). However, in light of recent discussions with DEWCP (following the SER release) relating to SO_2 concentrations approaching the NEPM standard near the Griffin freehold boundary, modelling was revised to exclude Collie B. This recognised that an additional 1100MW of capacity is a highly unrealistic scenario.

The results of revised SO_2 modelling are presented in the Appendix. The results clearly show that with the exclusion of Collie B, second highest maximum 1-hour SO_2 concentrations in Collie regional areas outside of the Griffin leasehold boundary and Collie Power Station Buffer boundary are below the NEPM standard. Maximum 24-hour concentrations and annual average concentrations were also below the respective NEPM standard.

Issue: Management of Gaseous Emissions

Q: **Table 1.3 is lacking in the "Air Emissions" row. Under the "Future Environment" column, proposed management seems only to discuss particulates (dust) and does not address, for example, operational NO_x, SO_x issues. Therefore it seems the statement of "No exceedance of Standards and Regulations" in the "Predicted Outcome" column is not well founded – particularly as subsequent detail (see Sulfur Dioxide, below) may suggest otherwise.**

R: There is a comment in this table that the NEPM standards will be met when cumulative stack emissions are considered. Further, best practice designs including low NO_X burners and best practice management to ensure that sulphur content in feed coal meets specifications will be implemented.

5 Water Management

5.1 Water Supply and Quality

Issue: Reduction in Water Use.

Q: Annual water consumption is said to possibly be reduced by about 3 GL per year by application of recycling technology. What technology would be applied and why is it not already adopted as part of the sustainability aspects of the CFPS?

R: The use of recycling can be engineered into the plant. This essentially involves settlement/treatment of the site wastewater by collection pond / sedimentation weir and then cycling to the service water reservoir for reuse.

Water plant wastes – salty water / sludges and other wastes are collected in a Wastewater Pond for use in ash conditioning and coal plant dust suppression.

Finally as described in the SER Griffin expects that through the use of new water conditioning and materials design that some of the high saline water diverted from the Collie Basin could be used as cooling water for plant operations as opposed to the fresh mine dewatering water used by the existing facilities.

Q: Has air-cooling, such as is used in the Millmerran power station in Queensland, been considered as an option to reduce the water requirements of the project? The Millmerrin project uses only 10% of the normal water requirements of a conventional power station.

R: In dry-type cooling systems the heat is transferred by convection and radiation instead of by evaporation as with wet towers as proposed. The major drawbacks of these systems are higher turbine back pressure, decreased turbine efficiency and higher fuel and power consumption rates when compared to a typical wet cooling tower system. Also, the capital costs of a dry type system are significantly higher than those for an evaporative system. This factor and excessive unit fuel and energy costs have made these towers practical only where extreme environmental conditions have necessitated their use.

At Collie, sufficient water is available and the project has the ability to use high-saline water.

Q: The option of sourcing water for power production purposes by actively draining agricultural farmland should be evaluated.

R: As part of the 4 Aces project it may be possible to introduce salty water from agricultural land into a revised water management system for the Collie Basin. However due to the high salinity of this water, desalination will be required prior to its use. This option is outside of the scope of the SER.

Q: Recognising that the main water supply for the proposed power station will be from groundwater sources, the Collie Shire Council will have concerns about future extraction rates. The current decline in annual rainfall rates gives no assurance that groundwater supplies will be replenished to levels adequate to satisfy the quantities of water required for a new power station. This issue must be addressed in great detail to ensure no adverse drawdown impacts upon surrounding wetlands or other property owners. Evidence of such impacts already exist, e.g. in the Collie Cardiff area, and the battles to rectify these experiences have, at times, been long and intense.

R: Groundwater will be sourced from dewatering operations associated with existing and future (approved) mining operations. The power station will not source its own independent groundwater supply. This strategy widens use of mine flow required to create safe mining conditions.

Q: The principles and objectives of CWAG are of strategic importance to the successful integration of the project into an already complex and in parts stressed basin-wide water supply strategy. The proponent will need to undertake investigations to demonstrate how the project will operate in accordance with these principles and objectives with particular attention given to:

1. **The need to minimising groundwater abstraction from the Collie Basin to overcome existing substantial drawdown and address the long-term recovery periods for groundwater levels after mining. In this regard the proponent should demonstrate that:**

   - **15 GL/year of groundwater would actually need to be dewatered from the mines over the long term, and investigate alternatives that may reduce this volume; and**

   - **assess potential impacts of dewatering at this scale on the social and ecological values of the local environment, including such features as river pools, wetlands and riparian vegetation.**

2. **The ability of disused open-cut voids to contain saline water with minimal impact on background groundwater quality, taking into account the hydrogeology, stratigraphy and geological structure of the area of the voids and nearby dewatering and groundwater abstraction activity.**

R: 1. Groundwater for the power station will be sourced from existing and proposed (approved) mining operations. Groundwater will only be extracted at a rate that allows safe mining. No additional groundwater extraction is required.

2. As discussed in the SER, further work is required to "prove up" the water management strategy proposed by Griffin for the Collie Basin. There are a number of groups evaluating the concept and ultimately, if the proposal progresses it may not be driven by Griffin. The water management strategy is not being put forward for environmental approval at this stage but was included in the SER to demonstrate that Griffin is active in

considering alternatives to the current water management regime and takes a wider view of the long term community benefits that could be realised.

5.2 Marine

Issue: Benthic Habitats

Q: **EPA should advise that, in any subsequent proposal, the proponent would need to document and map benthic marine habitats in the vicinity of the proposed outfall with considerably greater detail, and justify that sufficient observations had been made to properly map and characterise the benthic habitat.**

R: The benthic habitats have been mapped as part of the Collie Power Station environmental approvals and as part of the Western Power SER. No further mapping is warranted.

Issue: Marine Water Quality

Q: **It is very important for there to be a robust characterisation of background seawater concentrations. We question some of the values given in Table 9.1 (eg Cu, Zn). This information must be credible and in hand at the time of a detailed project assessment**

EPA should advise that, as part of any subsequent proposal assessment, the proponent will need to provide up front a detailed characterisation and assessment of natural levels of trace elements/heavy metals in background seawater (ie away from the influence of other outfalls, and in the summer/autumn period, when the influence of the Leschenault Estuary outflows were lowest). This information needs to be based on actual data from a carefully designed measurement and analysis program, and is required to more accurately define the size of an authorised "mixing zone" and will provide greater surety both for the operator and the regulator.

The crucial importance of this information is perfectly illustrated in Table 9.1, where column 4 shows metal concentrations for 100-fold dilution of the effluent with seawater assuming zero trace metal content, while column 6 indicates that in 'typical' seawater trace metals are present at significant levels. The natural background metal concentrations need to be resolved to properly define a "mixing zone".

R: The 100-fold dilution column in Table 9.1 is not strictly correct since it does not take the background concentrations of the receiving environment into account. The values only reflect the dilution of the metals originating from the discharge.

Typical seawater concentrations given in Table 9.1 were originally sourced from the EPA (1995). Since preparation of the SER, further results have been obtained for the existing Collie Power Station marine outfall. These indicate that the reference sites in the vicinity of the outfall have higher values for Cadmium, Chromium and Lead than typical seawater, and exceeded licence conditions (URS 2002). The licence conditions were subsequently modified such that a greater emphasis is placed on regular monitoring of the discharge

from site, and that exceedences measured during the outfall monitoring are to be reported to the DEP for information purposes only.

Prior to formal approval of the discharge, the background concentrations will be more thoroughly investigated and dilution will be modelled using these values. This will allow a more accurate prediction of the mixing zone. It is likely, however, that the zone will be of a similar magnitude to that already described in the SER.

6 Waste Management

6.1 Ash Disposal

Issue: Suitability of In Pit Filling

Q: With respect to flyash disposal, preference should be given to opportunities for alternative uses. However, if flyash is disposed of to a mine void, it is imperative that it be deposited above the highest known groundwater level and may need to be combined with some form of stabilisation additive

R: This is precisely the approach that will be adopted as described in the SER.

Q: The proposal states ash will be disposed of in overburden (section 6.3, pp. 6-4, para 2) or by supplying ash to existing markets. Section 12-1, paragraph 5, states that it will be disposed of in the Ewington I pit. Section 12.2.2 states that this strategy remains subject to further detailed investigation. It is not clear as to whether the ash will be disposed of into backfilled pits or 'out of pit' overburden dumps.

In order to reduce the impact of footprint of ash disposal in overburden, fly ash and bottom ash should be considered for disposal above the water table in backfilled pits. The proponent should consider this measure subject to appropriate investigations of all alternatives.

R: The process of coal mining entails the initial disposal of overburden to out-of-pit dumps until sufficient space is created within the pit to allow in-pit disposal to occur. From an economic perspective, in-pit disposal of overburden and interburden is the cheapest option. Griffin has committed to maximise in-pit dumping at the earliest opportunity as a component of the Ewington I environmental approvals. The preferred option for flyash disposal is reuse, however, any ash that cannot be reused will be co-disposed with overburden and interburden within the pit and above the water table.

Q: Proposals for ash disposal should be benchmarked against world's best practice and best practice adopted if applicable.

R: This will be done.

Q: The proponent should consider pro-actively researching and developing alternative uses for ash rather than relying on existing markets.

R: Griffin will consider all options for flyash reuse.

Q: Management of flyash to prevent groundwater contamination is a critical issue. Reuse of flyash (incorporating it into an inert form), rather than land dumping would be a better option and EPA should very strongly encourage the company in this direction.

R: Griffin will consider all options for flyash reuse. Flyash that cannot be reused will not be "land dumped". Rather, it will be incorporated into overburden and interburden within mining voids. This is a preferrable method of disposal to the current method that relies on the use of ash storage dams.

Q: Some detail of the composition of the flyash has been provided. However further information is required, particularly for toxicants such as As, Cd, Cr, Cu, Hg, Zn, Ni, Pb, Se, and the like. If the flyash were to contain only 0.07% on dry weight of any of these substances (Hg for argument's sake), this represents 300, 000 kg per year of that toxicant being dumped to the Ewington 1 Overburden Site, in a very much more concentrated (and therefore toxic) form than it occurred in the coal, and in a form that is far more vulnerable to release into the environment (eg groundwater). For this reason, the company needs to conduct a much more detailed characterisation of the flyash composition with particular reference to the amount of toxicants. Input from the Contaminated Sites Branch of DEWCP to this issue would be advisable.

R: The burning of coal and the return of flyash to the mine pit will not introduce any new toxicants into the environment. Returned flyash will be mixed and stabilised with clay stone and incorporated with over burden and interburden within the pit and above the water table.

By mixing the flyash with the overburden, toxicants will be diluted rather than concentrated. The clay content of the overburden will fix the heavy metals in a form that is stable in the long term. By placing this mixed material above the water table the potential to subsequently leach out these toxicants will be eliminated.

Issue: Alternatives to Ash Disposal

Q: If the landfill option were to be used, this would need very detailed justification prior to approval, based on complete data from current operations, and would require a long term monitoring program, with monitoring outcomes tied to pre-defined trigger levels, with feedback to preventative /remedial action if these levels were exceeded.

R: It is recognised that further work will need to be done to detail the placement of flyash over the period of the project. However, this method of disposal has been successfully implemented elsewhere and there is no reason to believe that it wouldn't be acceptable in this situation. Monitoring will be an ongoing requirement.

Q: Given that the company will make reuse of flyash a priority, it should commit to setting targets and ongoing reporting of its performance against these targets in achieving acceptable reuse levels.

R: Although flyash reuse is a priority there is no indication at this stage as to the volume of material that could be taken. Griffin, with other parties, is funding research into ash stabilisation and will take advantage of the most up to date technology available to it. Given that flyash reuse will depend on plants or industries operated by others, it is not appropriate to set targets given that volumes of flyash reuse are outside of Griffin's control.

6.2 Wastewater / Effluent Disposal

Issue: Waste Minimisation

Q: The stated management objectives at the top of Section 12 are inadequate. There is no management objective to minimise waste discharge through minimising waste generation, reuse and recycling. This objective should be explicitly identified as one of the objectives, and the management plans should provide evidence of the company's commitments to this objective. Such an objective is mentioned under 12.1.1, but it should be elevated to be a more generic objective for the project.

R: Griffin agrees with this objective and has specifically stated that reuse of flyash is an objective as is minimisation of off-site discharge.

Q: A key statement in the draft document is as follows: 'Griffin is also investigating the option of having no off-site discharge' (Section 12.2.2). This would be a highly desirable environmental and natural resources management outcome, setting a new benchmark for the power generating industry in WA. Yet, to my knowledge, there has been no elaboration on this option. The EPA should encourage the proponent in the direction of this option. The hierarchy of recycle, reuse, waste minimisation for discharges should be applied in design. In view of the above, it is unsatisfactory that the rest of the draft report simply assumes waste discharge to the ocean.

R: The option of no off-site discharge will be further investigated during the detailed design phase of the project. Waste discharge to the ocean is an acceptable means of disposal, as is currently practised at the existing Collie Power Station. At this stage Griffin is only looking to increase the discharge in the current pipe to its approved design capacity. In relation to determining the impact of the proposal it is appropriate to assess this "worst" case scenario.

Issue: Pipeline Options

Q: The SER assume that the capacity in the existing saline water disposal pipeline to the ocean is available to the CFPS. However, for strategic environmental assessment, other options should be explored in more detail so that an informed judgement of the options is possible. What are the "options to remove the need to dispose of saline water to the ocean" being investigated?

R: Options being considered include evaporation and on-site reuse following on-site collection.

Q: Arrangements for any use of a pipeline jointly with Western Power seem to be vague possibilities only. There is no existing formal arrangement with Western Power.

R: Joint use of the pipeline would be subject to commercial negotiation between Griffin and Western Power. If Griffin is successful with its bid to provide

base load power there is unlikely to be any significant reason why the pipeline would not be shared.

Q: There is a concern that WP, Griffin, Millennium and possible future projects associated either with Collie or Kemerton Industrial area could lead to a 'spaghetti' of discharge pipes to this area, which is close to a part of the coast used for recreational and commercial fishing. The EPA/DEWCP needs to consider and agree its position on how best to manage these multiple waste sources.

R: The Griffin proposal is for a sharing of the existing pipeline or, at worst, duplication. Other projects will need to be assessed on their merits.

Q: The proposal discusses the option of an additional saline pipeline to the coast (section 12.2.3, p 12.2) but the likelihood for its requirement is unclear. This is a potentially significant issue. Ideally a zero discharge of brine products should be adopted.

R: Griffin does not believe that an additional pipeline is a significant issue. Monitoring of the existing outfall has demonstrated that there are no significant impacts on the marine environment.

Q: The proposal suggests but does not provide details of where additional dams for water storage or roads are to be placed.

R: These will be located on-site following detailed geotechnical and engineering design.

Issue: Effluent Assessment

Q: EPA should advise that, in any subsequent proposal, the proponent would need to provide for assessment a detailed characterisation of the waste stream. This effluent characterisation would need to be verified post commissioning, and would be used to develop a routine effluent monitoring program.

R: Griffin agrees with this statement.

Q: The monitoring results associated with the marine outfall disposal suggests that due to the high energy receiving environment there has been negligible impact on the marine environment. Furthermore, Collie coal generically has low levels of potentially polluting heavy metals, hence the risk of exceeding the assimilative capacity of the receiving environment at the pipeline diffuser is considered low.

R: Griffin agrees with this statement.

Q: EPA should advise that the most suitable time for undertaking environmental water quality assessments of the influence of the effluent discharges will be in the summer/autumn (ie non riverine flow period).

R: The specifics of the marine monitoring programme will be developed in conjunction with DEWCP.

Q: **From the values provided in Table 9.1, more work would be required for the purposes of a detailed project assessment to resolve the cadmium and mercury concentrations for the saline water storage pond.**

R: No further assessment of water quality in the saline water pond is required. This pond will be sealed (clay or synthetic liner). Following initial dilution metal contaminations would be below the 95% trigger level.

Issue: Monitoring and Management

Q: **The DEP licence conditions, monitoring requirement and management strategy may be reviewed. If more than one user of the pipe, then some governance model may be required to ensure that, cumulatively, the conditions of the licence are being met.**

R: The final conditions of operation will be the subject of further discussion once environmental approval has been obtained.

Q: **The EPA (consistent with AWQMS) has recognised environmental values of the marine environment. These environmental values are of two types – ecological and social. As a default setting, all environmental values apply everywhere in the marine environment. Only through specific application to exempt some specified requirements in small zones about the outfall can this situation be relaxed. While the above documents have been developed for Perth marine waters and Cockburn Sound, it is expected that the same philosophy would apply.**

R: This is already recognised in the SER.

7 Terrestrial Biology

7.1 Fauna and their Habitat

Issue: Species Lists

Q: The information in Tables 8.3, 8.4 and 8.5 is different to the information in the text and Appendix 3 and is full of inaccuracies. The fauna information needs to be consistent. For example the text doesn't refer to the presence of Western Grey Kangaroo or Western Brush Wallaby which are likely to be on site but Table 8.3 highlights both as likely to be on site.

R: In order to produce a concise SER only key information central to impact assessment has been included in the text. As such, species lists of fauna (as determined by previous studies) were tabulated or presented in appendices. For example only the three most common native mammals previously recorded in the vicinity of the project area were mentioned in the text.

Q: Paragraph 2 states that 'fauna at all 3 sites will be similar. The close proximity of these areas (within 5km radius) and the mobility of fauna (especially mammals and birds) means that overlap of fauna between these areas may even extend to individual fauna using all three the sites'. Small bird species tend to have a median breeding range of 2.4ha so it is very unlikely that they will move between all of the sites. Similarly reptiles and amphibians are unlikely to be highly mobile between sites.

R: Agree, however it should be recognised that macropods and larger birds are highly mobile and are likely to move between these sites.

Q: Table 8.4 includes a number of species likely to be found within the project area and which are totally outside their known range, eg Little Button Quail (desert species), Variegated Fairy Wren (desert species), and Fairy Martin (northern species). A number of species that are highly likely to be found on the site eg Goshawk, Sparrowhawk, Little Wattlebird and Spotted Pardalote are not in the table.

R: Species lists (including the Variegated Wren and Little Button Quail) were obtained from previous fauna studies (HGM 1994, 2000a; Ecologia 1991) and presented to place the project in a regional context. The source of such lists is assumed to be from CALM database searches, literature and/or records from the WA museum. The reference to the Fairy Martin is a text error and should be substituted with the Tree Martin (*Hirundo nigricans*). Upon recommendation from CALM Griffin has made a commitment to undertake a project specific fauna survey that will identify species likely to be impacted. At this stage the likely impact on fauna is considered to be minimal given the small area of vegetation that could be disturbed.

Q: Table 8.5 similarly is missing a number of species that are found in Appendix 3 and would definitely be found on the site e.g. *Litoria moorei, Litoria adelaidensis, Crinia pseudinsignifera*, and *Geocrinea leai. Glaphyromorphus gracilipes* is also included in the Table. As this species is known to occur in the Collie area together with the similar looking Priority listed Bunbury Skink, *Glaphyromorphus "koontoolasi"* this should be further investigated.

R: The fauna information in the SER is based on published reports in the vicinity of the project area (HGM 1994, 2000a; Ecologia 1991). Upon recommendation from CALM Griffin has made a commitment to undertake a project specific fauna survey of areas impacted.

Q: What is the data source for Appendix 2 and 3? A number of the species outlined within Appendix 3 do not occur in this area eg Black-breasted Buzzard (desert species), Spotted Bowerbird (not found south of Mullewa), Sandhill Dragon (a coasthill sand dune species).

R: The data source for the fauna appendices are as follows:

- Ecologia (1991). Consultative Environmental Review: Fauna Survey. Prepared for Halpern Glick Maunsell on behalf of the Griffin Coal Mining Company Pty Ltd.
- Halpern Glick Maunsell (1994). Notice of Intent for Ewington II Open-Cut Mine. Prepared for the Griffin Coal Mining Company Pty Ltd.
- Halpern Glick Maunsell (2002a). Ewington I Open Cut Mine. Environmental Management Plan. Prepared for the Griffin Coal Mining Company Pty Ltd.

Issue: Baudin's Cockatoo

Q: Paragraph 5 states that 'to minimise impact on the Baudin's Cockatoo clearing will be restricted to the non-breeding season'. There is currently no evidence to suggest that Baudin's Cockatoo moves to new trees if it's current hollows are destroyed so clearing outside the breeding season will not minimise the impact on the species. The site should be assessed for current tree hollow usage.

R: Griffin has committed in the SER to conduct a targeted survey to identify nesting hollows and breeding pairs in consultation with the WA Museum.

Q: Paragraph 6 states 'As the general area has only recently been identified as being a potential breeding site and any individuals are not part of an "important population" the impact to Baudin's Cockatoo is considered minimal.' What is the justification for the population not being important given that it is a Schedule 1 species and listed under the EPBC Act?

R: This statement was not suggesting that Baudin's Cockatoo is not an important *species*. The statement relates to the 'Degraded' to 'Completely Degraded' (after Keighery 1994) areas of vegetation being unlikely to be capable of

sustaining a sizeable population of this Schedule 1 fauna. Regardless of this statement Griffin has committed to investigating this issue further in consultation with the WA Museum.

Issue: Breeding Habitats

Q: Paragraph 3 states 'this habitat is significantly degraded and therefore of little conservation significance'. On what basis is this statement justified given that a number of Schedule 1 and Priority species have been identified on the site?

R: This statement was made in reference to the "principal habitat' lost from clearing, vegetation association EmCcAf (refer to table 8.1 of the SER). This vegetation was significantly disturbed with sparse understorey and considered unlikely to support a diversity of flora or fauna. The Schedule One and Priority fauna that were identified as potentially occurring on this site (Baudin's Cockatoo, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo, Barking Owl, Masked Owl, and the Western False Pipistrelle) are highly mobile with a wide foraging range. Use of the large trees in this area by significant avifauna (such as Baudin's Cockatoo) for breeding purposes is of concern and Griffin has committed to investigating the conservation significance of such areas. This will involve the WA Museum conducting a targeted survey to identify nesting hollows and breeding pairs.

Q: Paragraph 7 dot point 4 states that 'clearing will be undertaken between January and June to avoid the breeding season of species such as Chuditch, Southern Brown Bandicoot, Brush-tailed Phascogale, Brush Wallaby and Yellow-footed Antechinus'. Within the exception of the Antechinus, all of these species are likely to breed between January and June.

R: CALM will be consulted prior to any clearing.

7.2 Flora and Vegetation

Issue: Clearing and Degradation

Q: It is acknowledged that the proposed site has been severely impacted by grazing with a substantial part of the area cleared. Degradation of the remnant vegetation has substantially reduced the vegetation's conservation potential and protection values. Nevertheless, remnant vegetation to be retained within the site should be fenced to allow regeneration and revegetated where necessary to recoup the cost benefits to the local environment, where possible. In this regard, the conveyor route from Ewington II should utilise one or more of the existing cleared corridors.

R: Griffin has already agreed to improve the conservation value of vegetation remaining on site through fencing and destocking and to utilise existing cleared corridors wherever possible.

Q: The proposal includes the clearing of up to 27ha of bushland. Reference has now been made to the new clearing legislation stating there is a requirement for no net loss of bushland however, no management recommendations regarding this have been proposed.

R: It is unlikely that 27ha of vegetation will be cleared. The condition of the remaining remnant vegetation will be improved as an offset to any loss of vegetation. These areas will be fenced, destocked and rehabilitated to allow regrowth of understorey species. The "no net loss" statement has been misused and does not imply a moratorium in all clearing.

Q: The document identifies existing power lines in the vicinity that will be connected to the power station, however it is unclear if the proposal will result in a requirement for additional clearing for powerlines over the full life of the project.

R: The site is bordered by 330 KV transmission line to the north and 132 KV transmission line to the south. Limited clearing, if any, will be necessary to interconnect to these systems. Ultimate interconnection requirements will be dictated by the Transmission Division of Western Power.

Issue: Survey Mapping

Q: The EPA highlighted in its scope for the project the need for a survey and map to be prepared of any vegetation proposed to be cleared. This does not appear to have been done. The survey work used for the SER is based on that from adjacent land (Halpern Glick Maunsell 1994, 2002a and Mattiske and Associates 1991). The SER does not include a vegetation condition map

R: The vegetation associations of the power station site were mapped on aerial photographs, groundtruthed in May of 2002 and presented in Figure 8.1 of the SER. These vegetation associations are based on previous mapping in the area (HGM 1994, 1995, 2002a; Mattiske and Associates 1991). The vegetation condition of these associations is discussed in Section 8.1.1 "Vegetation Conservation Significance".

Q: The proposed conveyor or service road is yet to be confirmed so the impacts on vegetation and fauna cannot be determined. Survey work needs to be undertaken in order to determine whether the conveyor or service road is vegetated and if so the condition of the vegetation.

R: The location of the conveyor corridor will be determined during the detailed design phase. If any vegetation is to be impacted then a vegetation survey will be undertaken.

Q: There needs to be a vegetation survey of the whole area (looking at vegetation communities, structure, and condition) rather than just that likely to be affected by the conveyor. Without undertaking a vegetation survey the most appropriate area for the location of the conveyor can't be determined. A survey of DRF and Priority Flora alone is not enough.

R: It has not yet been determined whether the conveyor corridor will impact on any vegetation at all. Any area to be impacted will be surveyed. The vegetation survey will include determination of vegetation composition, vegetation condition and a search for DRF and Priority Flora.

Q: A survey for the presence of *Phytopthora cinnamomi* has not been undertaken for the proposed site. Only the surrounding areas have been survey as part of previous work undertaken.

R: A survey for the presence of *Phytopthera cinnamomi* has not yet been undertaken because of advice from CALM that a dieback survey should be conducted prior to, and within one year of construction commencing, to verify the current status of a vegetated project area. A dieback survey will be conducted according to this protocol by a suitably qualified consultant. In addition hygiene measures will be established to manage potentially contaminated material.

Issue: Regional Significance

Q: The role of the area as an ecological linkage between other regionally significant areas has not been determined. A significant role of linkages is in facilitating the seasonal migration of small Passerine birds. A number of species move northwards at the beginning of winter and move southwards in spring. These species require native vegetation for food, shelter and roosting sites while in transit. Remnant bushlands also have long-term value in helping maintain the genetic movement between different areas and thus they have a significant role in the conservation of biological diversity.

R: As stated in the SER the vegetation to be impacted is at the northern edge of State Forest. Despite the fact that these areas of remnant vegetation potentially form an ecological linkage the 'Degraded' to 'Completely Degraded' (after Keighery 1994) condition of these remnant areas suggest that they are not of significant ecological value. As such, it is unlikely that these areas are ideal for the foraging, roosting and shelter for small passerine birds. Upon recommendation from CALM Griffin has made a commitment to undertake a project specific fauna survey. During the course of this fauna survey the importance of these areas as fauna habitat linkages will be investigated further.

Q: The proposal has failed to address or discuss to what extent this proposal would result in additional impacts on biodiversity and other values from any expansion in the environmental footprint from coal mining over the life of the project.

R: Coal mines that will be developed, in part to support the power station have already gained environmental approval. The footprints associated with these mines have been previously assessed. This current assessment covers a power station only.

8 Social Issues

8.1 Aboriginal Heritage

Issue : Aboriginal Liaison and Consultation

Q: The Council notes the SER comment that 'Aboriginal groups of the southwest that have an association with the Collie area will be consulted with prior to the construction to determine any sites of ethnographic significance'. The Council also notes that the power station site is on freehold land and not subject to native title issues. The Collie Shire Council strongly supports liaison with local Aboriginal people to ensure that any concerns are adequately and sympathetically dealt with.

R: This will certainly be the case. Also, archaeological and ethnographic field surveys of the project area will be conducted once the footprint of the project is finalised.

8.2 Noise

Issue: Operational Noise

Q: It is not expected that construction noise or vibration will have an effect upon the Collie townsite although any effect upon adjoining landowners in unknown. Close consultation with adjoining land owners (as outlined in the SER under Clause 11) is encouraged and, in fact, is emphasised as being vital. Noise is not expected to be an issue during operational phase of the power station.

R: Noise during construction will be managed in accordance with Australian Standard 2436 - 1981 and construction activities will be carried out during hours covered by the *Environmental Protection (Noise) Regulations 1997*. A Noise Management Plan will be prepared as part of the Construction Phase EMP to address noise management for the site. Given the remoteness of the site to the nearest noise sensitive premises it is not expected that noise during operations will be an issue.

Q: Due to the distance to the nearest residence, noise and vibration are unlikely to be a problem. However, it is important to note that regardless of the fact that the residence at Blue Waters is a Griffin owned property, it is still recognised under the Environmental Protection (Noise) Regulations 1997. The operation will require an Environmental Protection Act 1986 licence.

R: The *Environmental Protection (Noise) Regulations 1997* will be adhered to during construction. An EPA licence will be obtained prior to operations and conditions relating to noise nuisance will be complied with.

Q: While the plant layout given in the SER report does not clearly show the relationship between the power units and the boundaries of the proposed site, the proponent should ensure that the units are set back at least 400m,

or such distance as detailed modelling shows is required to achieve the boundary assigned level.

R: The power plant will be set back an appropriate distance from the Griffin freehold boundary.

Q: The proponent needs to ensure that the sound power levels for the power units, as modelled in the SER report, are not exceeded in the procurement stage, and that tonal components are not present in the noise emission.

R: As stated in the SER, the resultant noise at Collie townsite will not be tonal or contain any other annoying characteristics. Noise levels at Collie townsite is expected to be less than 25dB(A) at all times, which is significantly less than the 30dB(A) noise level requirement under Regulation 7 of the *Environmental Protection (Noise) Regulations 1997*.

8.3 Traffic

Issue: Traffic Volumes

Q: The SER indicates the clear expectation of increased traffic movements to cater for the influx of workers and the delivery of construction materials, including normal trucks, buses, light vehicles and very heavy multi-axle vehicles. The Collie Shire Council will expect to be consulted on the proposed routes for these vehicles and work with Griffin to achieve satisfactory outcomes where potential may exist to impact upon residential areas.

R: Griffin certainly intend to hold discussions with the local council to identify any specific management measures in order to alleviate traffic congestion and minimise risk to the community.

Q: The SER report (section 4.6) mentions traffic volumes of 3,000 return truck trips, 13,200 return bus trips and 462,000 light vehicle return trips per year. Based on 200 working days per year, these trips would number 15 trucks, 66 buses and 2310 light vehicle movements per day. Section 13.3 of the report dismisses noise from construction traffic as a public health and safety issue, without discussion of likely traffic routes and associated impacts. Given the numbers of average daily movements indicated above, I consider the issue warrants more detailed consideration.

R: The traffic volumes quoted in the SER report were an indication only. At this stage it is not fully known what the traffic volumes will be and how these could change if rail delivery of plant and equipment is used. Certainly traffic volumes will increase on local roads due to workforce movements and the movement of plant and equipment but this is not expected to be significantly different than that which occurred for Collie A construction. Discussions will be held with local council to identify any specific management measures. A Noise Management Plan will be prepared as part of the Construction Phase EMP to address noise management for the site and associated vehicle movements including offsite road use.

8.4 Economic and Social Benefits

Issue: Economic Benefit, Workforce and Local Supplies

Q: The economic benefit to the community from the project will ensure the continued viability of the Collie townsite and surrounding areas.

The Council has noted the anticipated workforce numbers: peak of construction 1,000 personnel with an expectation of 30% of works being sourced locally, and an operational workforce of between 40 and 50 personnel plus an additional 80 to 100 personnel for maintenance support. The Shire of Collie is well placed to accommodate the social infrastructure needs of such a workforce and would be encouraging maximum use of local residents throughout the expected 36 month construction period and on-going operational phases.

Collie also has an excellent TAFE Centre and it would be appropriate for Griffin to consider, as part of the lead-in to the construction phase, the workforce training needs and liaise with TAFE to ensure that appropriate skills training programs are established locally. It may even be beneficial to source out and utilise local trainers who have first hand knowledge of the district and complementary industries.

The SER makes no comment on the supply of materials either during construction or during the on-going operational phases. It will be the expectation of the Council and local industry groups (e.g. Collie Chamber of Commerce & Industry Inc) that Griffin maintains close contact with the local community on supply opportunities and indeed liaise publicly with local suppliers to instruct them on how they can gain access to supply contracts.

R: Griffin is well established in the Collie community and as such understand the value of sourcing local employment and supplies where possible.

9 Planning and Infrastructure Development

9.1 Zoning

Issue: Establishment of a Buffer Zone

Q: Whilst the SER makes no comment on a future 'buffer zone' surrounding the proposed power station (as exists for the Collie Power Station) it will no doubt be an environmental requirement for one to be developed. The Collie Shire Council will be requiring information on whether such a buffer zone will be invoked and what the extent of its influence will be. Any impacts upon the existing Collie townsite and other surrounding land owners' properties will be of vital concern to both the Council and Collie residents.

R: Further environmental assessment will be required to adequately define a buffer around the power station. This work will be conducted as a component of any subsequent environmental approval with the extent of the buffer being related to the ultimate project make up. The Collie Shire Council will be involved in this progress.

Q: In several instances relating to air emissions and noise emissions compliance, reference is made to a 3 kilometre buffer round the power station. What are the proponent's plans to establish the buffer and preserve it from sensitive activities in the future?

R: Noise and atmospheric modelling conducted to date suggest that the impacts of the power station will be restricted to Griffin's freehold land. This will need to be confirmed during any subsequent approvals. Ultimately it would be desirable to incorporate the buffer in the Town Planning Scheme.

Q: The site is located adjacent the Collie Power Station, Ewington minesite and in an area proposed for an industrial estate. Albeit it is beneficial to have key industry and their potential impacts concentrated in one area rather than throughout the basin, it is also important to acknowledge the potential for cumulative impacts.

R: The SER, as occurs with other environmental approvals, is required to address cumulative impacts. For example the SER recognises the atmospheric emissions originating from Collie and Muja Power Stations. Any future developments in the area will also need to address cumulative impacts.

Q: Land use planning issues associated with the proposal have not been addressed. The proponent should ensure that the South West Power Project is consistent with the State Planning Strategy (WAPC, 1997), the Bunbury-Wellington Region Plan (WAPC, 1995), Collie Basin Structure Plan (WAPC, 1995) and Western Australian Planning Commission's policies such as SPP No. 4 State Industrial Buffer Policy.

R: Development of a power station on this site is not inconsistent with previously conducted studies, which identified the site as being suitable for an industrial estate. The Bunbury - Wellington Region Scheme recommends the adoption

of the Coolangatta Industrial Estate in this location. The State Buffer Policy will need to be applied to the ultimate development, however, this process can only commence once the ultimate project has been defined ie: following any subsequent environmental approvals.

Q: A rezoning of the proposed site will be required under the Town Planning Scheme to facilitate the development. A revision of the Collie Power Station Controlled Development Area Buffer will also be required. The existing buffer is mentioned in the document, but is not reflected on any of the figures nor is there any discussion about the need for the buffer to the revised.

R: Revision of the buffer will be conducted once further assessment is undertaken as part of finalising the environmental approvals.

Q: It is suggested that the proponent provide additional information outlining the reasons for the existing controlled development area buffer, identifying impacts of this proposal that may affect the extent of the buffer and, if these impacts cannot be mitigated, suggesting a revision of the buffer. In particular, air emissions (Section 10) and noise and vibration (Section 11) on near-by areas zoned (or proposed as) 'Rural Residential' should be considered. Mechanisms to establish and maintain buffers to the proposed plant should also be addressed.

R: It is premature at this stage to provide additional information on definition of the buffer. Ultimately the buffer is likely to be established on the basis of atmospheric and noise emissions. However, other considerations such as the need to accommodate future industrial development may also need to be allowed for. At this stage, modelling suggests that the buffer can be accommodated within Griffin freehold land. Ultimately, any buffer established would be incorporated into the Town Planning Scheme.

10 References

Australian Gas Association (2000). Assessment of Greenhouse Gas Emissions from Natural Gas. AGA Research Paper No. 12, May 2000.

Environmental Protection Authority (1995). Collie Power Station Wastewater Management and Disposal System. Western Power Corporation. Report and recommendations of the Environmental Protection Authority. Bulletin 777, May 1995.

IPCC (1994). Climate Change 1994: Radiative Forcing of Climate Change and an Evaluation of the IPCC IS92 Emission Scenarios. Cambridge University Press, Cambridge, UK and New York, USA.

IPCC (1995). : Climate Change 1995—The Science of Climate Change – Contribution of Working Group I to the Second Assessment Report, 1996. Cambridge University Press, Cambridge, UK and New York, USA.

IPCC (2001). Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. (www.grida.no/climate/ipcc_tar/wg1/247, received 28 November 2002).

URS (2002). Environmental Study of Collie Power Station Ocean Outfall. August 2002. Prepared for Pacific Western Pty Ltd.

Western Power Corporation (2002). Strategic Planning for Future Power Generation. Response to Submissions. August 2002. Prepared by Sinclair Knight Merz.

Appendix

Revised Regional Air Quality Contours

Introduction

Assessment of sulphur dioxide emission impacts has been revised to exclude Collie B since it is highly unrealistic that an additional 1100MW will be developed in the Collie region. Griffin's proposal for 800MW provides sufficient additional capacity for industry and will be progressively developed dependent on industry demand. Revised modelling also recognised changes to neighbouring source emission characteristics and stack design (multi-flue).

Modelling Methodology

Consequently, modelling has been undertaken only for additional 800MW Capacity (ie. excludes Collie B):

- Griffin CFPS (CFPS);
- Collie A Power Station (Collie A);
- Muja Power Stations C and D (Muja C & D); and
- Worsley Alumina Refinery (Worsley).

CFPS

The source emission characteristics for the proposed CFPS were based on design criteria provided by Pacific Power International (2002) (see Appendix). The sulphur dioxide emission rate has been determined using calculations based on required stack volumetric flow rates and coal-feed sulphur content.

Collie A

Collie A emissions were obtained from "Collie Power Station Expansion, Strategic Environmental Review" (Western Power Corporation 2002), which was based on Collie A main stack emissions testing results (refer Appendix).

Muja C & D

Total Muja power station (A, B, C & D) emissions were reported in Western Power Corporation (2002). Muja C & D emissions were determined via calculations based on individual plant capacity factors and energy generated during 2000/2001 (refer Appendix).

Worsley

Worsley emissions were obtained from "Collie Power Station Expansion, Strategic Environmental Review" (Western Power Corporation 2002), which was based on the National Pollutant Inventory 2000/2001 Report (www.npi.gov.au) (refer Appendix).

NEPM Standards and Goals

The relevant ambient air quality criterion for sulphur dioxide, which follows the NEPM standard (NEPC 1998), is provided in Table 1 below. The standard specifies a maximum concentration and the goal that is to be achieved within 10 years. "To comply with the NEPM State Governments need to use the NEPM standards as the means for assessing air quality against the goal of the NEPM"

(NEPC 1998, pp10). The EPA proposes to "adopt the current NEPM standards in the Statewide Air Quality EPP for general application to air quality management programs and the assessment of development proposals in Western Australia. However the Statewide Air Quality EPP would not apply the NEPM standards within industrial areas and residence free buffer areas around industrial estates" (EPA 1999, pp3).

For the purpose of this assessment, these NEPM standards will apply outside of the Griffin freehold boundary and Collie power station buffer boundary at any residential premises. This is a more conservative application of the standards, which were designed to protect populations rather than individuals.

Table 1: National Environmental Protection Measures – Standards and Goals

Pollutant	Averaging Period	Maximum Concentration	Goals within 10 years - Maximum allowable exceedances
Sulphur dioxide	1-hour 24-hour 1-year	570 µg/m^3 228 µg/m^3 57 µg/m^3	1 day a year 1 day a year none

Source: NEPC (1998).

The standard for the 1-hour averaging period allows for a maximum allowable exceedance of one day a year. To reflect this allowance, the predicted second-highest maximum 1-hour concentrations have been presented in this assessment.

Modelling Results

Figures 1, 2 and 3 presents (graphically) the predicted second-highest maximum 1-hour, maximum 24-hour and 1-year average SO_2 concentrations in the Collie region, respectively.

The highest second-highest maximum concentration of 667 µg/m^3 occurs near Muja power station over adjacent mining pits, where the NEPM standard does not apply. Second-highest maximum concentrations outside of the Griffin freehold boundary range from 100 µg/m^3 to 427.5 µg/m^3. At Collie and Collie-East town sites the highest predicted maximum ground level concentrations are approximately 316 and 370 µg/m^3, respectively. The second-highest maximum ground level concentrations at Collie and Collie-East town sites are 277 and 284 µg/m^3, respectively. All these results are below the NEPM standard of 570 µg/m^3.

The highest maximum 24-hour average concentration of 129 µg/m^3 m^3 occurs within the Collie power station buffer boundary. Outside the Griffin freehold boundary, the highest maximum 24-hour average concentration of approximately 87 µg/m^3 occurs north of Collie-East town site, which is well below the NEPM standard of 228 µg/m^3.

A maximum annual average concentration of 9 µg/m^3 occurs within the Collie power station buffer boundary. Maximum annual average concentrations outside the Griffin freehold boundary are below 7 µg/m^3, which is well below the NEPM standard of 57 µg/m^3.

Comparison with the NEPM Standard

A comparison of the predicted second-highest maximum ground level concentrations for scenarios 1 and 2 at Collie and Collie-East town sites and within the Collie region outside of the Griffin freehold boundary with the NEPM standard is summarised in Tables 2 and 3 below. Tables 4 and 5 compare the predicted maximum 24-hour average concentrations and annual average concentrations for both scenarios.

Table 2: Predicted Maximum Concentrations for both Scenarios

Location	2nd Highest Maximum 1-hour		Maximum 24-hour		1-Year Average	
	Predicted ($\mu g/m^3$)	% NEPM Standard	Predicted ($\mu g/m^3$)	% NEPM Standard	Predicted ($\mu g/m^3$)	% NEPM Standard
Collie town site	277	48.6	49	21.5	3.2	5.6
Collie-East town site	284	49.8	74	32.5	4.6	8.1
Collie regional area	427.5	75.0	87	38.2	7.0	12.3

Conclusions

Assessment has been undertaken that excludes Collie B since it is highly unrealistic that an additional 1100MW will be developed in the Collie region. Revised modelling for this scenario show that emissions will not cause an exceedance of air quality criteria in the Collie region. Second-highest maximum 1-hour concentrations outside of the Griffin freehold boundary and Collie Power Station Buffer boundary are below the NEPM standard. Maximum 24-hour average and annual average concentrations are well below their respective NEPM standard.

Concluding Remarks

Modelling for the Griffin CFPS has been conducted using conservative design maximum emissions. Actual emissions will be significantly less, as is the case with Collie A Power Station (refer SECWA 1990, Appendix A, pp. 6). Modelling did not allow for the removal of sulphur dioxide through wet deposition and chemical reactions.

Although ground level concentrations of SO_2 are acceptable when compared with the NEPM standard and its goal, there is a need to incorporate a buffer in the Town Planning Scheme to adequately protect the site from unacceptable encroachment.

References

EPA (1999). Developing a Statewide air quality Environmental Protection Policy. Concept Discussion paper for public comment. Environmental Protection Authority, Perth Western Australia, June 1999.

NEPC (1998). National Environment Protection Measure for Ambient Air Quality. National Environment Protection Council, 26 June 1998.

Pacific Power International (2002). Personal and email communication with Allen Lowe, Manager Strategic Projects, Pacific Power International on 27/5/02.

State Energy Commission of Western Australia (1990). Proposed Collie Power Station Environmental Review and Management Programme, State Energy Commission of Western Australia (SECWA), Report No. BD 90/12, March/April 1990.

Western Power Corporation (2002). Collie Power Station Expansion. Strategic Environmental Review. June 2002. Prepared by Sinclair Knight Merz.