Kwinana Gas-Fired Power Station (Water Cooled Condenser)

NewGen Power Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
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Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
12/05/05	**Referral received**	
07/07/05	**Proponent's Final EPS document received by EPA**	**8**
18/07/05	**Intention to set EPS Level of Assessment advertised (no appeals)**	**1.5**
08/08/05	**EPA report to the Minister for the Environment; Science**	**3**

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1. Introduction

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to a proposal by NewGen Power Pty Ltd (NewGen) to construct and operate a nominal 320 megawatt (MW) base-load combined cycle gas turbine (CCGT) power station situated in Kwinana.

NewGen's proposal for the Kwinana Gas-Fired Power Station (KGPS) is a part of Western Power Corporation's (WPC's) South West Interconnected System (SWIS) Stage 2 Power Procurement Process (PPP). This process is part of a WPC and WA Government strategy to provide extra generating capacity to meet growing demand in the region and to replace aging power plants. Stage 2 of the PPP involves the acquisition of 300-330MW of additional generation capacity to be in service by 2007-2008 (EPA, 2002). NewGen is one of three proponents bidding to provide the extra capacity.

EPA Bulletin 1174 *Kwinana Gas-Fired Power Station* (EPA, 2005) outlined a proposal for an air-cooled CCGT power station situated on the same site as the proposed NewGen power station. NewGen propose to amend the condenser cooling system of the power station by replacing the currently proposed array of 20 air cooled condenser units with a seawater cooled condenser.

Wambo Power Ventures Pty Ltd, the proponent for the air-cooled proposal, has undergone a name change to become NewGen Power Pty Ltd. There has been no change to the parties involved in the joint venture.

The EPA was advised of the proposal in May 2005. Based on the information provided, the EPA considered that while the proposal had the potential to have an effect on the environment, the proposal could be readily managed to meet the EPA's environmental objectives. Consequently it was notified in *The West Australian* newspaper on 18th July 2005 that, subject to preparation of a suitable Environmental Protection Statement (EPS) document, the EPA intended to set the level of assessment at EPS.

The proponent has prepared the EPS which accompanies this report (ELP, 2005). The EPA considers that the proposal described can be managed in an acceptable manner subject to the commitments to the proposal being legally binding.

The EPA therefore has determined under Section 40 (1) that the level of assessment for the proposal is EPS, and this report provides the EPA's advice and recommendations in accordance with Section 44 (1).

2. The proposal

NewGen Power Pty Ltd (NewGen) proposes to construct and operate a natural gas-fired, combined cycle gas turbine (CCGT) power plant with a nominal generation capacity of 320 megawatts (MW) on a site located off Leath and Barter Roads on the western edge of the Kwinana Industrial Area (KIA) (Figure 1 and Figure 2). The plant could provide

approximately 2,800 gigawatt hours (GWhr) of electricity annually into the SWIS electricity market.

The main components of the power plant will be (Figure 3):

- one natural gas-fired turbine of 160MW nominal generating capacity;
- one 160MW steam turbine;
- one heat recovery steam generator (HRSG);
- water-cooled condenser;
- sub-sea diffuser (80m) and associated pipeline (300m);
- demineralised water production plant (156kL/day capacity);
- one 60m HRSG stack; and
- administration, laboratory and control buildings.

The CCGT power station would be operated in two modes:

- as a base load CCGT providing 240MW of power (65-85% of operating time); and
- with auxiliary duct firing to provide an additional 80MW of power during times of peak demand (10-15% of operating time).

Cooling will be provided by a water-cooled condenser. Seawater from Cockburn Sound would be drawn into Western Power Corporation's existing inlet at a rate of $5m^3/s$. The project would involve construction of an 80m sub-sea diffuser and associated 300m pipeline.

Many of the environmental impacts and associated environmental management strategies considered in the previous proposal (EPA Bulletin 1174) remain unchanged for this proposal. Environmental factors that will be affected by the change include:

- Marine - major area of change from previous proposal. The use of seawater from Cockburn Sound for cooling purposes is the major area of environmental consideration for the proposal;
- Air Quality - air emissions will reduce slightly (2% less annual load of pollutants than for an air cooled station) (Table 1);
- Noise - noise emissions will reduce slightly (Table 1);
- Greenhouse Gas - emissions will reduce slightly (Table 1); and
- Flora and Fauna - small increase in area disturbed.

A detailed description of the proposal can be found in the proponent's referral document (ELP, 2005). The main characteristics of the proposal are summarised in the table below.

Table 1: Summary of key proposal characteristics

Element	Description
Project Purpose	To construct, operate and maintain a nominal 320 megawatt base-load power station for the South West Interconnected System Grid
Life of the Project	30 years
Power Generating Capacity	320MW (nominal)
Facility footprint	Approximately 4 hectares
Fuel Type Gas Transportation Liquid Fuel	 Natural Gas Dampier to Bunbury Natural Gas Pipeline Approximately 200 litres diesel for emergency shutdown. Diesel will not be used as a generating fuel
Plant Facilities Gas turbine specifications Steam turbine specifications Heat recovery steam generator (HRSG) Number of stacks Height of HRSG stack	 1 x gas turbine of 160MW nominal generating capacity fitted with dry low NO_x burners 1 x single shaft, axial exhaust steam turbine of 160MW nominal steam generating capacity. 100% steam turbine bypass 1 x dual pressure HRSG with horizontal gas path and supplementary firing One 60m
Cooling System Cooling water intake Sub-sea diffuser and associated pipeline Cooling water intake rate Average temperature increase Benthic area disturbed during construction of pipeline and diffuser	Water cooled condenser Existing Western Power Cockburn 1 intake 300m pipeline with 80m diffuser $5m^3$/sec (~158GL/year) ~7 degrees Celsius 4m wide x 300m = 0.1 hectares disturbed
Thermal Efficiency Thermal Efficiency based on net higher heating value	 48% during base load (without duct firing) 46% during peak load (with duct firing)
Plant operation	Base load (65-85% of operation time) plus peaking capacity (10-15% of operation time)
Operation Hours Operation without duct firing Operation with duct firing	Available 24 hours, 365 days/year Approximately 5600-7500 hours/year (65-85% ACF) Approximately 1000-1300 hours/year (10-15% ACF)
Chemical Storage	All chemical/storage areas will be bunded and all chemical use areas will be paved
Inputs Natural Gas Process water	 ~55 TJ per day (14.5 PJ/year) 150ML/year, supplied by Water Corporation
Outputs Waste water Waste water fate Waste water composition	 Approximately 5.5ML/year Contained in Evaporation Pond or removed from site Salty water (max TDS 15000mg/L). Some inorganic salts and residual acids/alkalis may be present in the waste water
Air Emissions Oxides of Nitrogen (NO_X) Sulphur dioxide (SO_2) Carbon Dioxide (CO_2) Carbon Monoxide (CO) VOCs PAHs Dioxins and furans	 25- >31ppmv; 640 tonnes/year 4 tonnes/year 0.42 tonnes CO_{2e}/MWh; 0.75Mt/year 750 tonnes/year 2 tonnes/year 3 kilograms/year Will meet best practice of $0.1ng/Nm^3$ (I-TEQ)
Predicted Noise Emissions	36.3dB(A) at nearest residential premise 46.3dB(A) at nearest industrial premise
Other Additional infrastructure	 Control building, laboratory, electrical switchrooms, stores and workshops

Abbreviations

ACF	annual capacity factor
CO_{2e}	carbon dioxide equivalent
dB(A)	decibels (A weighted)
GL	gigalitres (10^9 litres)
HRSG	heat recovery steam generator
I-TEQ	international toxic equivalent
L	litres
m	metres
mg	milligrams (10^{-3} grams)
ML	megalitres
Mt	megatonnes (10^6 tonnes)
MW	megawatts (10^6 watts)
MWh	megawatt hours
ng/Nm^3	nanograms (10^{-9} grams) per normal cubic metre at 1 atmosphere, O deg C
PAHs	polycyclic aromatic hydrocarbons
PJ	petajoules (10^{15} joules)
ppm	parts per million
ppmv	parts per million by volume
TDS	total dissolved solids
TJ	terajoules (10^{12} joules)
VOCs	volatile organic compounds

Figure 1: Regional location (Source: Figure 4.1 from ELP 2005)

Figure 2: Location in Kwinana Industrial Area (Source: Figure 4.2 from ELP 2005)

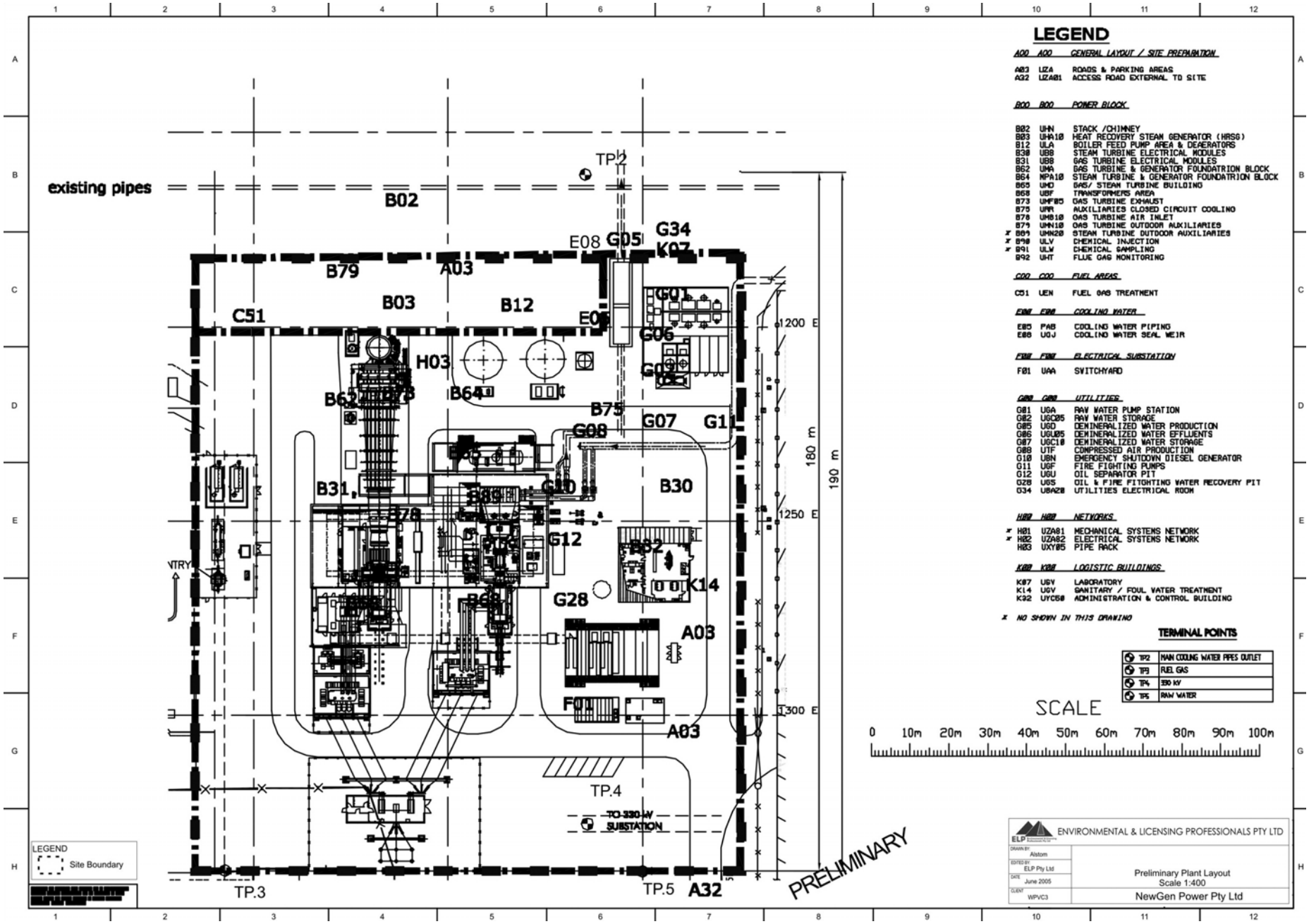

Figure 3: Proposed Kwinana Gas-Fired Power Station site layout (Source: Figure 4.7 from ELP 2005)

3. Consultation

During the preparation of the EPS, the proponent has undertaken consultation with government agencies and companies with a direct interest in the project and other key stakeholders. Consultation was also undertaken with the local community via a press release made to the local paper inviting comment. The organisations consulted, the comments received and the proponent's response are included in Section 17 and Appendix O of the EPS (ELP, 2005).

The community consultation for this proposal follows on from the consultation undertaken for the air-cooled proposal (EPA, 2005). The proponent undertook three stages of community consultation with stakeholders to discuss the air-cooled proposal. Community groups whose interests would be affected by the change of condenser were included in the consultation for the water cooled proposal, as well as some additional stakeholders that would be affected by the marine issues arising as a result of the water cooled condenser.

The community involvement process was designed in accordance with the Community Involvement Framework (DoE, 2003a) and Interim Industry Guide to Community Involvement (DoE, 2003b). The process was designed to have three stages. In Stage 1 stakeholders were identified and initial meetings were conducted to introduce the project and explain the involvement process. Stakeholders were also asked for their initial comments describing what their key issues might be and if they knew of additional stakeholders who should be involved. In Stage 2 stakeholders were provided with more detailed information on the proposal and their feedback was sought. Stage 3 consisted of the proponent reporting back to the stakeholders with responses to their comments.

The following groups provided comment during the consultation process:

- Cockburn Sound Management Council;
- Fremantle Port Authority;
- UWA Centre for Water Research Professor Chari Pattiaratchi;
- Aquaculture Council of WA;
- Western Australian Fishing Industries Council;
- Water Corporation;
- WA Mussel Growers Association;
- Recfishwest;
- Chamber of Commerce and Industry Training;
- Kwinana Industries Council;
- Kwinana Industries Coordinating Committee;
- Conservation Council of WA Inc;
- City of Cockburn;
- City of Rockingham;
- Town of Kwinana; and

- Kwinana, Cockburn and Rockingham based community action groups.

A number of environmental issues were raised by the stakeholders during the consultation. Table 2 below summarises the main issues raised and details the actions taken by NewGen to address the issues raised by the stakeholders.

Table 2: Issues raised during consultation and NewGen responses

Issue	Action Taken By NewGen
NewGen should consider the effect of combining the discharges with the adjacent proposed Water Corporation desalination plant that has lower volumes of denser, more saline water.	Co-disposal with the desalination plant was modelled and discussion is continuing with the Water Corporation.
Is it possible to combine with other new industries and existing businesses to pipe discharges outside the Sepia Depression?	NewGen will participate in investigations into shared disposal facility to the Sepia Depression.
What is the possibility of toxins or contaminants leaching/leaking into the Sound from the equipment/heat exchangers via the cooling water?	No toxic chemicals are to be used near the cooling water system. Residual chlorine chemicals will be kept very low. Environmental emergency response procedures will be developed.
The cumulative impacts of all activities are impacting the sound. Impacts include increased turbidity, loss of seagrass, disturbance of contaminated sediments, fish stocks and fisheries.	NewGen will become an active member of Kwinana and Cockburn groups involved in monitoring the Sound.
NewGen should continue access for boat and shore anglers, and should consider providing moorings for anchoring a safe distance from discharge outlet.	NewGen will consider these issues in the detailed design.
Fremantle Port development will impact on the discharge from the power station.	Fremantle Port Authority has been made aware of the NewGen proposal.
The proposal should comply with the policy and guidelines for Cockburn Sound.	Modelling shows that policy requirements will be met.
The plant should minimise its use of scheme water to meet freshwater requirements.	Water re-use is a major part of plant design.
The proponent needs to ensure that noise emissions from the project comply with the regulations.	Noise emissions will meet regulations.
Some participants did not support the use of seawater cooling despite modelling results.	NewGen noted concerns.
Have other synergies and cleaner production opportunities been investigated? For example, can waste heat be utilised in other aspects of the process?	It would be difficult to utilise any more heat from the NewGen plant as the heat recovery steam generator uses the excess heat from the turbine to generate 80MW of additional power.
What strategies will be in place to prevent intake of sea life with cooling water?	NewGen will use the existing Western Power intake. Screens are used to prevent the intake of marine life that would damage both the marine life and the generation capacity of the power station.
What are the indirect greenhouse gas emissions associated with the project, for example taking account of the energy required for the reverse osmosis treatment of tertiary treated wastewater from Water Corp?	Auxiliary power is estimated at 5.5MW and this is accounted for in the estimate of annual greenhouse gas produced.
Modelling was not undertaken for operation during spring.	Environmental quality criteria for spring are identical to autumn.
NewGen should commit to a dredging environmental management plan.	NewGen will prepare a dredging environmental management plan for the Works Approval.
Cumulative atmospheric emissions are a major concern in the Kwinana Airshed. NewGen should commit to on-line NO_X monitoring.	NewGen will work with KIC and the DoE on airshed issues.
What happens when sediments with high levels of TBT or arsenic are disturbed?	Sediments near wharves or shipping channels will not be disturbed.
NewGen should provide offsets for 100% of the greenhouse gas emissions from the power station.	This is not proposed. NewGen will report greenhouse gas emissions annually.

The proponent has advised that if the bid to construct and operate the power station is successful, all of the issues raised by the stakeholders that can be addressed by the proponent

would be addressed by the agreed strategy and action. The results of actions taken would be communicated to the stakeholders.

The EPA considers that the consultation process has been appropriate and that reasonable steps have been taken to inform the community and stakeholders on the proposed development.

4. Relevant environmental factors

Section 44 of the *Environmental Protection Act, 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

In the EPA's opinion the following environmental factors are relevant to the proposal:

(a) Marine environment;

(b) Nitrogen oxides;

(c) Greenhouse gas emissions; and

(d) Noise.

Details on the relevant environmental factors and their assessment are contained in Sections 4.1 - 4.4. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

4.1 Marine environment

Description

The Kwinana Gas-Fired Power Station requires approximately 158 gigalitres of seawater per year (flow rate of 5m^3/sec) to be pumped from Cockburn Sound to cool and condense the superheated steam that drives the steam turbine. Seawater is to be taken in at the existing Western Power Corporation intake and released back into the Sound through an 80m sub-sea diffuser, beginning 100m offshore.

The seawater used to cool the condenser has no direct contact with process fluids or wastes as it is pumped through the system. However the seawater increases in temperature as it exchanges heat with the steam in the pipes of the power station. Given the large quantity of seawater involved, the increased temperature of the seawater leaving the condenser has the potential to increase the ambient temperature of Cockburn Sound.

A cumulative model of the major existing and approved thermal loads entering Cockburn Sound was used to determine the expected impact of the thermal plume from the NewGen KGPS. The thermal outflows included in the scenarios were:

- Western Power Corporation: Kwinana Power Station Stage A/B and Stage C, Cockburn 1 and Cockburn 2 (approved but not constructed);

- BP Refinery;
- TiWest;
- CSBP; and
- Proposed NewGen KGPS.

The modelling also considered the effects of the Water Corporation's proposed Perth Desalination Plant, and the approved James Point Stage 1 wharves and breakwater.

The predicted cooling water outflows and the annual average temperature increase were modelled for each season of the year. Summer has the highest predicted temperature increase (maximum 8.8ºC), due to the additional duct firing required to meet the increased demand of the SWIS in summer. Duct firing refers to a process where additional gas is burnt directly (without going through the gas turbine) to increase the capacity of the HRSG. The proponent has advised that duct firing is expected to be used approximately 11% of the time. The average annual increase in temperature is predicted to be 7.2ºC at the outlet. By way of comparison, the temperature increase at the outlet of the Cockburn 1 CCGT station is 9ºC (ELP, 2005).

Modelling was also undertaken to determine whether the KGPS outflows would comply with the requirements of the *State Environmental (Cockburn Sound) Policy, 2005* (SEP) (EPA, 2005a). The spatial distribution of the predicted thermal plume from the power station was modelled to determine the effect of the plume on bottom and surface temperatures in the Sound. The model results showed that, with all sources present, the temperature requirements of the SEP would be met throughout the year in each environmental protection zone.

Assessment

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

- ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and marine uses by meeting statutory requirements and acceptable standards; and
- maintain the environmental values of the seabed and marine waters.

The EPA expects that the KGPS outflow would comply with the requirements of the *State Environmental (Cockburn Sound) Policy, 2005* (SEP). The policy contains quantitative environmental quality criteria (EQCs) that have been specifically developed for Cockburn Sound to ensure that the environmental quality objectives of the SEP are being met.

The SEP details environmental protection zones within Cockburn Sound that provide three levels of protection that apply spatially within the Sound (EPA, 2005a):

- Low Ecological Protection Areas (LEPAs) allow for large changes in the quality of water, sediment and biota, but the changes should not result in bioaccumulation/biomagnification in nearby high ecological protection areas. A LEPA is located adjacent to the proposed KGPS and the proposed diffuser will be contained within this area.
- Moderate Ecological Protection Areas (MEPAs) allow for moderate changes in the quality of water, sediment and biota, but these changes should not result in detectable changes from the natural diversity of species and biological communities. The MEPA

that would be most affected by the construction of the KGPS is located in a long strip, approximately 1.5km wide, along the eastern shore of Cockburn Sound (adjacent to the KGPS site).

- High Ecological Protection Areas (HEPAs) allow for small changes in the quality of water, sediment and biota. The HEPA forms the majority of the Sound and is located west of the 1.5km boundary of the MEPA on the eastern edge of Cockburn Sound.

The SEP requires that the unimpacted median ambient water temperature at any individual site is not exceeded by more than the reference values in Table 3 below during the relevant seasons.

Table 3: Allowable variation (ºC) in median temperature Environmental Quality Guidelines (EQGs) in HEPAs and MEPAs

Season	High Protection EQG	Moderate Protection EQG
Summer	0.8 ºC	1.6 ºC
Autumn	1.9 ºC	3.1 ºC
Winter	0.5 ºC	1.5 ºC
Spring	1.2 ºC	3.0 ºC

Source: EPA, 2005b. Extracted from Table 1a(E), page 21.

Relevant proposal characteristics

The EPA notes that the proponent's modelling shows that the temperature environmental quality guidelines (EQGs) required by the SEP will be met during all seasons. This includes consideration of all major existing and approved sources.

Although modelling demonstrates that the thermal discharges entering the Sound would comply with the EQGs required by the SEP, the EPA notes that there are projects that will contribute significant plumes into the Sound that have been approved but have not yet reached a detailed design stage to be constructed. Two of these projects (the Water Corporation's Perth Desalination Plant and Western Power's Cockburn 2 Combined Cycle Gas Turbine Power Station) have approval to be located very close to the proposed KGPS. The exact details of the outfalls associated with these two projects are not yet finalised. Although the projects were included in the modelling, the close proximity of the plumes meant that the CORMIX model applied by the proponent's consultant was unable to accurately resolve the interaction between the buoyant power station plumes and the dense desalination plant plume. The proponent advises that any uncertainty arising from this situation only applied to the scenario containing the desalination plant, and that the other scenarios should be interpreted with greater confidence.

The proponent's consultant argued that the uncertainty is not likely to influence the outcomes of the modelling as there will be no significant interaction between the buoyant thermal plumes from the proposed Western Power Corporation and NewGen power stations and the dense saline plume from the desalination plant.

The EPA recognises that the dense saline and buoyant thermal plumes are unlikely to interact. However, the EPA considers that further modelling should be completed to reduce this uncertainty once the exact location and design of the desalination plant diffuser is finalised.

Consequently, the EPA has recommended a condition requiring the proponent to submit further detailed modelling prior to the commencement of construction, as it is expected that the final details of the desalination plant diffuser will be known by this time. This modelling would be required to verify the assumption that there will be no interaction between the two plumes prior to construction commencing.

As an additional safeguard, the EPA has recommended a condition requiring that the proponent ensure that the two plumes will not mix in the near field (the area of initial mixing that can be controlled using the design parameters of the diffuser). The EPA has recommended that the proponent be required to ensure that the median temperature increase of the ambient water will not exceed the temperature increase required by the SEP at a radial distance of 50m from the diffuser. Such a condition would ensure that the thermal discharge from the KGPS diffuser would be largely contained within the 50m boundary around the KGPS. Combined with the condition requiring that the final design should demonstrate that there is adequate separation between the plumes such that they do not interact in the near field, the EPA is satisfied that the risk of the plumes mixing and causing an exceedance of the EQC is sufficiently low to allow the project to proceed.

The EPA has also recommended a condition that the proponent be required to monitor the thermal discharge from the KGPS diffuser and the temperature elevation field in Cockburn Sound, and prepare contingency plans to address any exceedances of the guidelines.

Summary

Having particular regard to the:

- proponent's modelling, which suggests that the cumulative thermal load from existing and approved sources will not exceed the requirements of the EQC detailed in the *State Environmental (Cockburn Sound) Policy, 2005*;
- assurance from the proponent's consultant that it is very unlikely that the dense desalination plant plume and the KGPS and Cockburn II Power Station thermal plumes will mix;
- recommended condition requiring the proponent to provide further detailed modelling of the plumes after the exact location of the diffusers is verified; and
- recommended condition requiring the proponent to achieve compliance with the requirements of the temperature EQCs within a radial distance of 50m of the KGPS diffuser;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.2 Nitrogen oxides (NO_X)

Description

The KGPS is expected to have a NO_X emission rate of:

- 30.8 parts per million by volume (ppmv) when operating at the nominal capacity of 320MW (10-15% of operation time); or

- 25.7ppmv when the plant is operating at 240MW (without duct firing) (15% oxygen reference level, dry, at STP).

The total mass of NO_X emitted from the KGPS is predicted to be 636 tonnes per year. An equivalent air-cooled facility is predicted to emit 705 tonnes of NO_X per year.

The cumulative impact of the proposed plant was evaluated by modelling NO_2 at seven nearby ambient air quality monitoring stations by combining its emissions with those from existing and approved (but not operational) industries. Under worst case conditions, the highest predicted ground-level concentration of NO_2 was 216.8µg/m^3, which is 88% of the National Environment Protection Measure (NEPM) standard (246µg/m^3). Under more realistic model conditions, the highest predicted ground-level concentration of NO_2 was 155µg/m^3, which is 63% of the NEPM (ELP, 2005).

Assessment

The EPA's environmental objective for this factor is to ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

EPA Guidance Statement No. 15 - *Guidance Statement for Emissions of Oxides of Nitrogen from Gas Turbines* provides assessment guidance and criteria for the management of NO_X emissions. For this proposal the relevant maximum emission level is 0.07g/m^3 or 34ppmv NO_X at 15% dry oxygen and STP reference level (EPA, 2000a). This is an upper limit and the EPA considers that proponents should use best practicable technology to better these limits.

Consistent with the EPA's strategic advice to bidders in the power procurement process, the EPA expects the best practice of dry low-NO_X burners to be installed in all gas turbines (EPA, 2002a).

The EPA notes that the relevant criterion for ambient air quality is the NEPM standard of 0.12ppmv NO_2 (246µg/m^3, 1 hour average) and 0.03ppmv NO_2 (61 µg/m^3, 1 year average). The cumulative effect of NO_2 emissions from the KGPS and surrounding industries should not exceed this standard.

Relevant proposal characteristics

The proponent advises that the KGPS would not exceed the EPA's guideline level of 34ppmv during normal operations. Model results show that emissions will be less than 31ppmv under all operating loads with the exception of start-up. During periods of low operating loads (65-85% of operations), emissions of NO_X will be less than 26ppmv (ELP, 2005).

The KGPS will utilise dry low-NO_X burners. Whilst the EPA is aware that technologies are emerging in other parts of the world that may be able to reduce NO_X levels further than the levels proposed by the proponent, the EPA has been informed that these technologies are not yet available as original equipment manufacture and have not been proven to work under Australian conditions. At the current time, the EPA considers that the use of dry low-NO_X burners demonstrates the implementation of best practicable technology.

Air dispersion modelling results provided in the referral document show that the proposed KGPS will contribute a minor amount to existing ambient NO_2 levels in the Kwinana

Industrial Area, and that the NEPM standard for cumulative NO_2 is not likely to be exceeded (maximum 88% of the 1-hr averaged standard and 39% of the 1-year averaged standard).

The EPA recommends that the proponent be required to design and implement a stack emissions monitoring strategy in accordance with recommended Condition 8 attached in Appendix 2 of this bulletin.

The EPA notes that the proposal will only use natural gas as a fuel. Liquid fuel will not be used for generation (ELP, 2005).

Summary

Having particular regard to the:

- results of the dispersion modelling, which indicates that it is unlikely that the NEPM ambient air quality standard would be exceeded by the proposed power plant;
- proposed design and construction of the KGPS, particularly in relation to the installation of dry low-NO_X burners; and
- recommended Condition number 8, which requires the proponent to prepare and implement a monitoring strategy to gauge in-stack air emissions;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.3 Greenhouse gas emissions

Description

The proposed KGPS CCGT plant would emit approximately 744,000 tonnes of carbon dioxide (CO_2) per year. The plant would also emit small amounts of methane and nitrous oxide. The total carbon dioxide equivalent (CO_{2e}) is approximately 746,000 tonnes per year. Based on emissions data from the year 2000, this represents approximately 0.14% of the national CO_2 emissions. Western Australia's greenhouse emissions were last compiled in 1995 and based on these data, the CO_2 equivalent emitted from the KGPS would represent approximately 1.5% of Western Australia's emissions (AGO, 1998). Using 1995 data, the implementation of the KGPS would increase Western Australia's total CO_{2e} from 49.3 million tonnes to 50 million tonnes.

The total greenhouse gas emissions figure is based on a full fuel cycle analysis, and includes the losses incurred due to production, processing, transport and combustion of the gas, as well as the auxiliary power required to generate electricity at the KGPS. Incorporating these losses in the greenhouse gas emissions for the project results in an 8% increase in the total greenhouse gases emitted (ELP, 2005).

The proposed plant has a net total energy efficiency of 48.1% (based on net higher heating value, modelled at 15ºC). World's best practice total efficiency for a combined cycle gas turbine plant adjusted for Australian conditions is (AGO, 2001):

- 52.0%, for a plant of capacity greater than 250MW; or
- 46.7% for a plant of capacity less than 250MW.

The predicted average carbon intensity of the KGPS operating at full load is 0.4 tonnes of carbon dioxide per megawatt hour (CO_{2e}/MWh). The average carbon intensity of Western Power Corporation's SWIS during the year 2002 was 0.9 tonnes of CO_{2e}/MWh. Table 6.6 in the proponent's referral document (ELP, 2005) quotes best practice carbon intensity for a new combined cycle gas turbine plant as approximately 0.4 tonnes of CO_{2e}/MWh (NSW Government, 2004).

Assessment

The EPA's objective for greenhouse gases is to ensure that:

- best practicable measures are applied to maximise energy efficiency and minimise emissions;
- comprehensive analysis is undertaken, where residual impacts occur, to identify and implement appropriate offsets; and
- proponents undertake an on-going programme to monitor and report emissions and periodically assess opportunities to further reduce greenhouse gas emissions over time.

EPA Guidance Statement No. 12 - *Guidance Statement for Minimising Greenhouse Gas Emissions* outlines the EPA's expectations for the minimisation of greenhouse gas emissions from new proposals. The EPA expects the proponent to use best practicable measures to maximise energy efficiency and minimise greenhouse emissions to the lowest practicable level (EPA, 2002b).

Western Power Corporation will impose conditions on the preferred bidder in the PPP as stated in the SER (Western Power Corporation, 2002). Western Power Corporation advise that the following conditions are relevant to a gas bidder in the PPP:

- become a signatory to the Greenhouse Challenge; and
- implement best practicable thermal efficiency design and operating goals.

Relevant proposal characteristics

Western Power Corporation requires 300-330MW of new capacity to meet the demand of the SWIS. This presents a problem for a bidder proposing a CCGT power station since gas turbines are manufactured in standard sizes such that it is difficult to generate at high thermal efficiency at capacities other than those favoured by the standard gas turbine sizes.

The KGPS will utilise a standard 160MW gas turbine. In CCGT configuration, this turbine is typically arranged to generate 240MW using the 160MW gas turbine in combination with an 80MW HRSG and steam turbine. To meet the required 300-330 MW, NewGen proposes to use the 160MW gas turbine with a 160MW steam generator and steam turbine, resulting in a total capacity of 320MW.

The larger steam generator and turbine results in a lower overall thermal efficiency as additional gas is required to heat the water and create the steam needed to drive the steam turbine (duct firing). The proponent advises that this is the reason that the KGPS is less efficient than world's best practice (WBP) for a CCGT of capacity greater than 250MW (i.e. 48.1% compared to WBP 52.0% sent-out thermal efficiency).

The proponent advises that the demand for power fluctuates throughout the day, and that the base demand for electricity can be met by a 240MW capacity plant for the 65-85% of the time that the plant is operating in CCGT mode. Duct firing will only be required during peak load periods, which corresponds to 10-15% of the time (note that these estimates incorporate a worst-case scenario during which the plant is anticipated to be off line, and hence the numbers do not always add to 100%). The KGPS is intended to operate as a 240MW capacity plant for 65-85% of the time, and would exceed world's best practice thermal efficiency for a plant of that size (WBP is 46.7% sent-out thermal efficiency) during that time.

The EPA notes that the proposed CCGT combination results in a loss of thermal efficiency but also notes that such a combination is significantly more efficient than an equivalently sized coal-fired power station. The EPA understands that the proposed combination represents best practice given the constraints imposed by the new capacity requirements of the SWIS.

The EPA notes that the proposed KGPS has a greenhouse gas intensity that is 41% of the average greenhouse gas intensity of Western Power Corporation's operations which will result in a small net average reduction in the greenhouse gas intensity of the SWIS if it is constructed (EPA, 2002b).

The EPA notes that the proponent has made a commitment to become a signatory to the Greenhouse Challenge which requires the proponent to undertake annual emissions reporting to the Greenhouse Office and operational performance monitoring of combustion to ensure that power generation meets the design criteria (Commitment 2 in Appendix 2 of this report).

The EPA notes that the proponent has not committed to offsetting any of its carbon emissions. The EPA understands that the proposed CCGT combination represents the best practicable means of meeting the additional base-load power demand required by the SWIS. While the efficiency of the combination is less than a wholly CCGT plant, the EPA is satisfied that it represents best practice for base-load power generation in consideration of the new capacity requirements of the SWIS. CCGT plants are more thermally efficient than coal-fired plants and the EPA does not require offsets to approve this proposal. However, the EPA would encourage the proponent to consider carbon sink projects during the life of the project.

The EPA recommends that the standard ministerial condition (i.e. Condition 7 in Appendix 2 of this report) which is applied to all proposals with large greenhouse gas inventories, be imposed on this proposal. This condition requires a greenhouse gas emissions management plan to be prepared and implemented.

Summary

Having particular regard to the:

- constraints on thermal efficiency imposed by the new capacity requirements of the SWIS (i.e. the required 300-330MW capacity);
- proponent's optimised configuration and plan to minimise duct firing, allowing the proponent to meet world's best practice thermal efficiency for a CCGT unit with a capacity of less than 250MW for 65-85% of the time;
- proponent's commitment to participate in the Greenhouse Challenge; and
- recommended condition requiring the development and implementation of a greenhouse gas management plan;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.4 Noise

Description

Noise modelling was undertaken to predict noise levels at the nearest residential premises (Hope Valley; approximately 1km east of the site) and the nearest commercial premises (Naval Base Hotel; approximately 200m from the site boundary).

Results from the modelling are compared with the relevant noise regulations (*Environmental Protection (Noise) Regulations, 1997)* in Table 4 below:

Table 4: Predicted noise levels and compliance with regulations

Location	Predicted Noise in dB(A)	Max allowable in dB(A)
Hope Valley	36.1	41
Naval Base Hotel (accommodation in use)	46.2	50
Naval Base Hotel (accommodation not in use)	46.2	55

Source: ELP, 2005. Table 7.2 page 81.

The modelling results predict that the noise regulations would be met.

The proposed plant design includes housing the gas turbine in an enclosure which features 0.75mm thick aluminium cladding and locating the turbine within a turbine hall. The ventilation air louvers, fans and ducting would have silencers installed to restrict noise breakout from the building. The noise controls assumed in the modelling are outlined in the noise report in Appendix G of the EPS document (ELP, 2005).

Assessment

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

- noise levels from construction activities comply with the requirements of Australian Standard 2346-1981 - *Guide to Noise Control on Construction, Maintenance and Demolition Sites*; and
- noise levels from the proposed power station comply with the *Environmental Protection (Noise) Regulations, 1997.*

Relevant proposal characteristics

The EPA notes that the proposed power station will comply with the requirements of the *Environmental Protection (Noise) Regulations, 1997* at the nearest sensitive premises.

The EPA notes that the proponent advises that construction work will be carried out in accordance with the requirements of the *Environmental Protection (Noise) Regulations, 1997,*

and hence, noise will comply with Australian Standard 2346-1981 - *Guide to Noise Control on Construction, Maintenance and Demolition Sites*. The proponent further advises that a Construction Noise Management Plan will be prepared and implemented.

The proponent has agreed to participate in the cumulative noise model being developed by the Kwinana Industries Council (KIC) by providing results of noise modelling and noise monitoring conducted (ELP, 2005).

Summary

Having particular regard to the results of noise modelling which indicate that the proposed plant will comply with the requirements of the *Environmental Protection (Noise) Regulations, 1997,* it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

5. Other advice

5.1 Site contamination

The two existing ash disposal dams on the proposed site are a potential source of soil and groundwater contamination. The volume of ash in the ponds is estimated to be between 11,000 and 15,000m^3. Ash is known to contain concentrations of metals and polycyclic aromatic hydrocarbon compounds (PAHs).

A preliminary inspection of the site found that there may be contamination issues to consider. Staining on the walls of the pond suggests that leachable concentrations of metals, other chemicals and possibly acid may be present in the ash (ELP, 2005).

NewGen will lease the site from Western Power Corporation. Western Power Corporation will ensure that the site is of a suitable standard for industrial use as part of the lease arrangement with NewGen.

The EPA's objectives for site contamination are to ensure that:

- the nature and extent of soil contamination is fully determined so that appropriate remedial and management measures can be implemented for the rehabilitation of the site;
- the rehabilitation of the site is to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria; and
- the remediation strategy is consistent with the objectives of the EPA's hierarchical approach for site remediation (EPA Guidance Statement No. 17).

EPA Guidance Statement No. 17 - *Guidance Statement for Remediation Hierarchy for Contaminated Land* states that the EPA's preferred hierarchy for site remediation is for contaminated material to:

- be treated on-site and the contaminants reduced to acceptable levels; or
- be treated off-site and returned for re-use after the contaminants have been reduced to acceptable levels.

The Department of Environment's (DoE's) *Contaminated Sites Management Series* provides assistance in the identification and remediation of contaminated sites. The EPA expects that these guidelines would be applied to potentially contaminated sites such as the KGPS site.

The EPA expects that the site will be cleaned to a standard that is suitable for industrial use prior to construction commencing. The proponent has advised the EPA that Western Power Corporation owns the site and will ensure that the site has been investigated, and that the necessary remediation is undertaken to allow development as part of the lease arrangements with NewGen. The EPA expects that the remediation strategy should give consideration to the DoE's *Contaminated Sites Management Series* and the EPA's hierarchy for contaminated land (EPA, 2000b), by considering a range of treatment options before a decision is made to remove the material from the site.

The EPA expects that NewGen will undertake groundwater monitoring to ensure that issues arising from contamination either entering the site's groundwater from outside influences or from the failure of processes on the site are picked up quickly. The EPA expects that the proponent will work with the DoE to identify a suitable monitoring and reporting program for the site.

5. Conclusions

Section 44 of the *Environmental Protection Act, 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA has considered the proposal by NewGen Power Pty Ltd to construct and operate a nominal 320MW base-load CCGT power station in Kwinana.

Marine environment

The proponent's cumulative water temperature elevation modelling of existing and approved sources indicates that the NewGen KGPS will not lead to an exceedance of the Environmental Quality Criteria for temperature detailed in the *State Environmental (Cockburn Sound) Policy, 2005*. Although the location of the Water Corporation's Perth Desalination Plant diffuser lends some uncertainty into the scenario including the desalination plant, the likelihood of the dense desalination plume interacting with the buoyant warm plumes from the power stations is considered to be very low.

The EPA has recommended that the proponent should undertake a further round of detailed discharge modelling once the exact location of the desalination plant diffuser is finalised. This modelling shall demonstrate to the satisfaction of the EPA that the separation between the dense and buoyant plumes is sufficient to ensure that the plumes do not interact. In addition, the EPA has recommended a condition requiring the proponent to achieve compliance with the Environmental Quality Guideline (Moderate Ecological Protection) specified in the *Environmental Quality Criteria Reference Document for Cockburn Sound (2003-2004)* at a radial distance of 50m from the diffuser. This localises the heating effects of the diffuser discharge and will ensure that the thermal plume is well separated from, and unlikely to mix with the desalination plume.

The EPA has further recommended that the proponent should undertake monitoring of temperature in Cockburn Sound and prepare a contingency plan to address exceedances in the Environmental Quality Guidelines and Environmental Quality Criteria for water temperature, as set out in the Environmental Quality Reference Document for Cockburn Sound.

Provided that these conditions are imposed, the EPA concludes that the proposal can be managed to meet the EPA's environmental objective for this factor.

Nitrogen oxides (NO_X)

Predicted ground level NO_X concentrations obtained from cumulative air modelling for the KGPS are below the relevant National Environmental Protection Measure (NEPM) standards. Dry low-NO_X burners will be used in the proposed plant. The EPA concludes that the proposal can be managed to meet the EPA's environmental objective for this factor.

Greenhouse gas emissions

The EPA is aware that demand for electricity in Western Australia will continue to grow, and considers that the greenhouse intensity of power suppliers should continue to be reduced. The EPA notes that the KGPS will reduce the greenhouse intensity of the SWIS if constructed.

The EPA notes that the predicted thermal efficiency of the KGPS (48.1%) is less than the world's best practice (WBP) efficiency for a plant of capacity ≥250MW (52.0%) (AGO, 2001). However, the EPA also notes that the KGPS will operate as a 240MW power station for 65-85% of the time. WBP for a plant of capacity of <250MW is 46.7%, so the KGPS will exceed WBP thermal efficiency during the majority of its lifetime. Duct firing will only be used to accommodate peak loads (10-15% of the time). During this time the plant will operate at less than WBP thermal efficiency for a CCGT power station.

The EPA considers that the measures taken by the proponent to achieve maximum efficiency are satisfactory given the constraints imposed on the proponent by the new capacity demands of the SWIS.

The EPA concludes that the proposal can be managed to meet the EPA's environmental objective for this factor provided that recommended Condition 7 is imposed upon the proponent.

Noise

The EPA notes that noise modelling suggests that the *Environmental Protection (Noise) Regulations, 1997* will not be exceeded at the closest noise sensitive premises to the KGPS. The EPA concludes that the proposal can be managed to meet the EPA's environmental objective for this factor.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation of the recommended conditions and proponent's commitments set out in Appendix 2.

6. Recommendations

The EPA considers that the proponent has demonstrated, in the EPS document, that the proposal can be managed in an environmentally acceptable manner and provides the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is for the construction and operation of a seawater-cooled, nominal 320MW combined cycle gas turbine plant in Kwinana, Western Australia.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 4.
3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions and proponent commitments as set out in Appendix 2.
4. That the Minister imposes the conditions and procedures recommended in Appendix 2 of this report.

Appendix 1

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Appendix 2

Recommended environmental conditions and proponent's commitments

RECOMMENDED CONDITIONS AND PROCEDURES

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986)

KWINANA GAS-FIRED POWER STATION (WATER COOLED CONDENSER)
LEATH & BARTER ROADS
TOWN OF KWINANA

Proposal: The construction, operation, and maintenance of a nominal 320MW combined cycle base-load power station at Kwinana, as documented in schedule 1 of this statement.

Proponent: NewGen Power Pty Ltd

Proponent Address: PO Box 98
Kenmore Qld 4069

Assessment Number: 1583

Report of the Environmental Protection Authority: Bulletin 1190

The proposal referred to above may be implemented by the proponent subject to the following conditions:

1 Implementation

1-1 The proponent shall implement the proposal as documented in schedule 1 of this statement subject to the conditions of this statement.

2 Proponent Commitments

2-1 The proponent shall implement the environmental management commitments documented in schedule 2 of this statement.

3 Proponent Nomination and Contact Details

3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the *Environmental Protection Act, 1986* is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.

3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.

3-3 The nominated proponent shall notify the Department of Environment of any change of contact name and address within 60 days of such change.

4 Commencement and Time Limit of Approval

4-1 The proponent shall substantially commence the proposal within five years of the date of this statement or the approval granted in this statement shall lapse and be void.

Note: The Minister for the Environment will determine any dispute as to whether the proposal has been substantially commenced.

4-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement to the Minister for the Environment, prior to the expiration of the five-year period referred to in condition 4-1.

The application shall demonstrate that:

1. the environmental factors of the proposal have not changed significantly;

2. new, significant, environmental issues have not arisen; and

3. all relevant government authorities have been consulted.

Note: The Minister for the Environment may consider the grant of an extension of the time limit of approval not exceeding five years for the substantial commencement of the proposal.

5 Compliance Audit and Performance Review

5-1 The proponent shall prepare an audit program and submit compliance reports to the Department of Environment which address:

1. the status of implementation of the proposal as defined in schedule 1 of this statement;

2. evidence of compliance with the conditions and commitments; and

3. the performance of the environmental management plans and programs.

Note: Under sections 48(1) and 47(2) of the *Environmental Protection Act, 1986*, the Chief Executive Officer of the Department of Environment is empowered to monitor the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement.

5-2 The proponent shall submit a performance review report every five years after the start of operations, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority, which addresses:

1. the major environmental issues associated with implementing the project; the targets for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those targets;

2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;

3. significant improvements gained in environmental management, including the use of external peer reviews;

4. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and

5. the proposed environmental targets over the next five years, including improvements in technology and management processes.

6 Marine Environment (Temperature Elevation)

6-1 Prior to submitting a Works Approval application, the proponent shall submit to the Environmental Protection Authority a final diffuser design and the results of detailed discharge plume modelling which demonstrates that the proposed separation between the diffuser and other existing or approved discharges will be sufficient to ensure that there are no plume interactions in the near field at the time of commencement of construction. The design and modelling shall be to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

Note: The "near field" is defined as the zone of initial mixing where the design and hydraulics of the discharge controls the dilution. The size of the near field can be engineered by manipulating parameters such as discharge velocity, density of the effluent, and the position and orientation of the diffuser ports. This is opposed to the "far field", where background physical oceanographic processes (such as currents, waves and the density stratification of the ambient water) control mixing and dilution.

6-2 The proponent shall design, construct and operate the diffuser:

1. in accordance with the requirements of condition 1-1; and

2. such that the median monthly water temperature at a distance of 50 metres from the diffuser does not exceed the unimpacted background temperature by more than the relevant seasonal Environmental Quality Guideline (Moderate Ecological Protection) specified in the *Environmental Quality Criteria Reference Document for Cockburn Sound (2003-2004)* and its updates.

Note: The "unimpacted background temperature" shall be determined by monitoring of a thermally unimpacted 'reference site' measured over the same period as the potentially impacted 'monitoring site' for subsequent comparison of monitoring data against the requirements of condition 6-2-2. The 'reference site' location(s) shall be decided in consultation with the Department of Environment.

6-3 The proponent shall measure temperature having regard for the *Revised Manual of Standard Operating Procedures, 2004* which supports the *State Environmental (Cockburn Sound) Policy, 2005* and its updates.

6-4 The proponent shall not allow thermal discharges from the diffuser other than in accordance with a Marine Environment Temperature Elevation Management Plan, prepared to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The objective of this Plan is to ensure that the thermal discharge from the diffuser meets the objectives of the *State Environmental (Cockburn Sound) Policy, 2005* and its updates.

This Plan shall address:

1. specific measures to monitor thermal discharge from the diffuser and the temperature elevation field in Cockburn Sound. The monitoring plan shall have regard for the *Revised Manual of Standard Operating Procedures, 2004* which supports the *State Environmental (Cockburn Sound) Policy, 2005* and its updates; and

2. Contingency plans to address exceedances of the Environmental Quality Guidelines specified in the *Environmental Quality Criteria Reference Document for Cockburn Sound (2003-2004)* and its updates. The contingency plans shall outline specific management actions to be taken in the event of an exceedance of the Environmental Quality Guidelines, including an investigation against the temperature Environmental Quality Standards included in the *Environmental Quality Criteria Reference Document for Cockburn Sound (2003-2004)* and its updates. The contingency plans shall outline management actions to be taken in the event of an exceedance of the Environmental Quality Standard in either near surface or near bottom waters.

6-5 The proponent shall implement the Marine Environment Temperature Elevation Management Plan required by condition 6-4.

6-6 The proponent shall make the Marine Environment Temperature Elevation Management Plan required by condition 6-4 publicly available.

7 Greenhouse Gas Emissions

7-1 Prior to commencement of construction of the power station, the proponent shall prepare a Greenhouse Gas Emissions Management Plan to:

- ensure that through the use of best practice, the total net "greenhouse gas" emissions and/or "greenhouse gas" emissions per unit of product from the project are minimised; and

- manage "greenhouse gas" emissions in accordance with the *Framework Convention on Climate Change, 1992*, and consistent with the National Greenhouse Strategy;

to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This Plan shall include:

1. calculation of the "greenhouse gas" emissions associated with the proposal, as advised by the Environmental Protection Authority;

Note: The current requirements of the Environmental Protection Authority are set out in: *Minimising Greenhouse Gas Emissions, Guidance for the Assessment of Environmental Factors, No. 12* published by the Environmental Protection Authority (October 2002). This document may be updated or replaced from time to time.

2. specific measures to minimise the total net "greenhouse gas" emissions and/or the "greenhouse gas" emissions per unit of product associated with the proposal using a combination of "no regrets" and "beyond no regrets" measures;

3. estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product, both within Australia and overseas;

4. actions for the monitoring and annual reporting of "greenhouse gas" emissions and emission reduction strategies;

5. a target set by the proponent for the reduction of total net "greenhouse gas" emissions and/or "greenhouse gas" emissions per unit of product and as a percentage of total emissions over time, and annual reporting of progress made in achieving this target. Consideration should be given to the use of renewable energy sources such as solar, wind or hydro power;

6. consideration by the proponent of entry (whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate) into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement program. Components of the agreement program include:

    - an inventory of emissions;
    - opportunities for abating "greenhouse gas" emissions in the organisation;
    - a "greenhouse gas" mitigation action plan;
    - regular monitoring and reporting of performance; and
    - independent performance verification.

    Note: In (2) above, the following definitions apply:

1. “no regrets” measures are those which can be implemented by a proponent and which are effectively cost-neutral.

2. “beyond no regrets” measures are those which can be implemented by a proponent and which involve additional costs that are not expected to be recovered.

7-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 7-1.

7-3 Prior to the commencement of construction, the proponent shall make the Greenhouse Gas Emissions Management Plan required by condition 7-1 publicly available.

8 Stack Emissions

8-1 Prior to commencement of construction, the proponent shall prepare a Stack Emissions Management Plan, to ensure that best available practicable and efficient technologies are used to minimise total air emissions from the power station, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This Plan shall address:

1. specific measures to minimise total air emissions from the power station to meet emission limits consistent with best practicable technology and current industry standards;

2. monitoring of air emissions, including nitrogen oxides (NO_X) and volatile organic compounds (VOCs); and

3. public reporting of air emissions and any complaints about air emissions.

8-2 The proponent shall implement the Stack Emissions Management Plan required by condition 8-1.

8-3 The proponent shall make the Stack Emissions Management Plan required by condition 8-1 publicly available.

Procedures

1 Where a condition states “to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority”, the Environmental Protection Authority will provide that advice to the Department of Environmental Protection for the preparation of written advice to the proponent.

2 The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment.

3 Where a condition lists advisory bodies, it is expected that the proponent will obtain the advice of those listed as part of its compliance reporting to the Department of Environment.

Notes

1 The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment over the fulfilment of the requirements of the conditions.

2 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act, 1986*.

3 Within this statement, to "have in place" means to "prepare, document, implement and maintain for the duration of the proposal".

Schedule 1

The Proposal (Assessment No. 1583)

The proposal is to construct and operate a natural gas-fired combined-cycle gas turbine power plant with a nominal generation capacity of 320 megawatts on a site located off Leath and Barter Roads on the western edge of the Kwinana Industrial Area, being portion of Crown Reserve No. 30611 and part of Kwinana Lots 161, 218 and 1772 (vesting order number 90 for *Use and Requirements of State Energy Commission*) and part of Lot 22. (The location is shown in Figures 1 and 2 attached).

The main components of the power plant will be (Figure 3 attached):

- one natural gas-fired turbine of 160MW nominal generating capacity;
- one 160MW steam turbine;
- one heat recovery steam generator (HRSG);
- water-cooled condenser;
- sub-sea diffuser (80m) and associated pipeline (300m);
- demineralised water production plant (156kL/day capacity);
- one 60m HRSG stack; and
- administration, laboratory and control buildings.

The CCGT power station would be operated in two modes:

- as a base load CCGT providing 240MW of power (65-85% of operating time); and
- with auxiliary duct firing to provide an additional 80MW of power during times of peak demand (10-15% of operating time).

Cooling will be provided by a water-cooled condenser. Seawater from Cockburn Sound would be drawn into Western Power Corporation's existing inlet at a rate of $5m^3/s$. The project would involve construction of an 80m sub-sea diffuser and associated 300m pipeline.

The main characteristics of the proposal are summarised in the table below.

Figure 3 (attached) shows the site layout of the proposed Kwinana Gas-Fired Power Station.

Table 1: Summary of key proposal characteristics

Element	Description
Project Purpose	To construct, operate and maintain a nominal 320 megawatt base-load power station for the South West Interconnected System Grid
Life of the Project	30 years
Power Generating Capacity	320MW (nominal)
Facility footprint	Approximately 4 hectares
Fuel Type Gas Transportation Liquid Fuel	 Natural Gas Dampier to Bunbury Natural Gas Pipeline Approximately 200 litres diesel for emergency shutdown. Diesel will not be used as a generating fuel
Plant Facilities Gas turbine specifications Steam turbine specifications Heat recovery steam generator (HRSG) Number of stacks Height of HRSG stack	 1 x gas turbine of 160MW nominal generating capacity fitted with dry low NO_x burners 1 x single shaft, axial exhaust steam turbine of 160MW nominal steam generating capacity. 100% steam turbine bypass 1 x dual pressure HRSG with horizontal gas path and supplementary firing One 60m
Cooling System Cooling water intake Sub-sea diffuser and associated pipeline Cooling water intake rate Average temperature increase Benthic area disturbed during construction of pipeline and diffuser	Water cooled condenser Existing Western Power Cockburn 1 intake 300m pipeline with 80m diffuser $5m^3$/sec (~158GL/year) ~7 degrees Celsius 4m wide x 300m = 0.1 hectares disturbed
Thermal Efficiency Thermal Efficiency based on net higher heating value	 48% during base load (without duct firing) 46% during peak load (with duct firing)
Plant operation	Base load (65-85% of operation time) plus peaking capacity (10-15% of operation time)
Operation Hours Operation without duct firing Operation with duct firing	Available 24 hours, 365 days/year Approximately 5600-7500 hours/year (65-85% ACF) Approximately 1000-1300 hours/year (10-15% ACF)
Chemical Storage	All chemical/storage areas will be bunded and all chemical use areas will be paved
Inputs Natural Gas Process water	 ~55 TJ per day (14.5 PJ/year) 150ML/year, supplied by Water Corporation
Outputs Waste water Waste water fate Waste water composition	 Approximately 5.5ML/year Contained in Evaporation Pond or removed from site Salty water (max TDS 15000mg/L). Some inorganic salts and residual acids/alkalis may be present in the waste water
Air Emissions Oxides of Nitrogen (NO_X) Sulphur dioxide (SO_2) Carbon Dioxide (CO_2) Carbon Monoxide (CO) VOCs PAHs Dioxins and furans	 25- >31ppmv; 640 tonnes/year 4 tonnes/year 0.42 tonnes CO_{2e}/MWh; 0.75Mt/year 750 tonnes/year 2 tonnes/year 3 kilograms/year Will meet best practice of $0.1ng/Nm^3$ (I-TEQ)
Predicted Noise Emissions	36.3dB(A) at nearest residential premise 46.3dB(A) at nearest industrial premise
Other Additional infrastructure	 Control building, laboratory, electrical switchrooms, stores and workshops

Abbreviations

ACF	annual capacity factor
CO_{2e}	carbon dioxide equivalent
dB(A)	decibels (A weighted)
GL	gigalitres (10^9 litres)
HRSG	heat recovery steam generator
I-TEQ	international toxic equivalent
L	litres
m	metres
mg	milligrams (10^{-3} grams)
ML	megalitres
Mt	megatonnes (10^6 tonnes)
MW	megawatts (10^6 watts)
MWh	megawatt hours
ng/Nm^3	nanograms (10^{-9} grams) per normal cubic metre at 1 atmosphere, O deg C
PAHs	polycyclic aromatic hydrocarbons
PJ	petajoules (10^{15} joules)
ppm	parts per million
ppmv	parts per million by volume
TDS	total dissolved solids
TJ	terajoules (10^{12} joules)
VOCs	volatile organic compounds

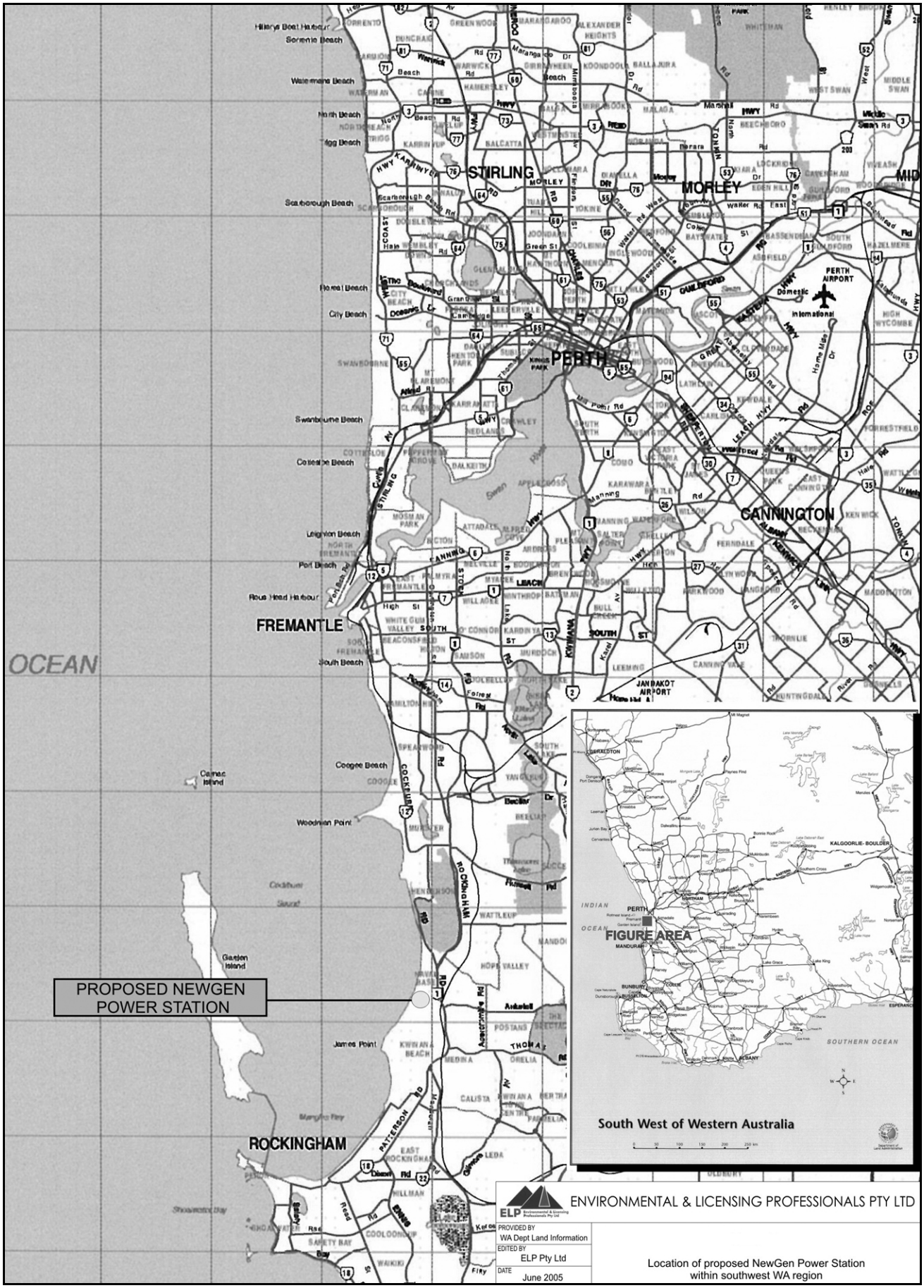

Figure 1: Regional location (Source: Figure 4.1 from ELP 2005)

Figure 2: Location in Kwinana Industrial Area (Source: Figure 4.2 from ELP 2005)

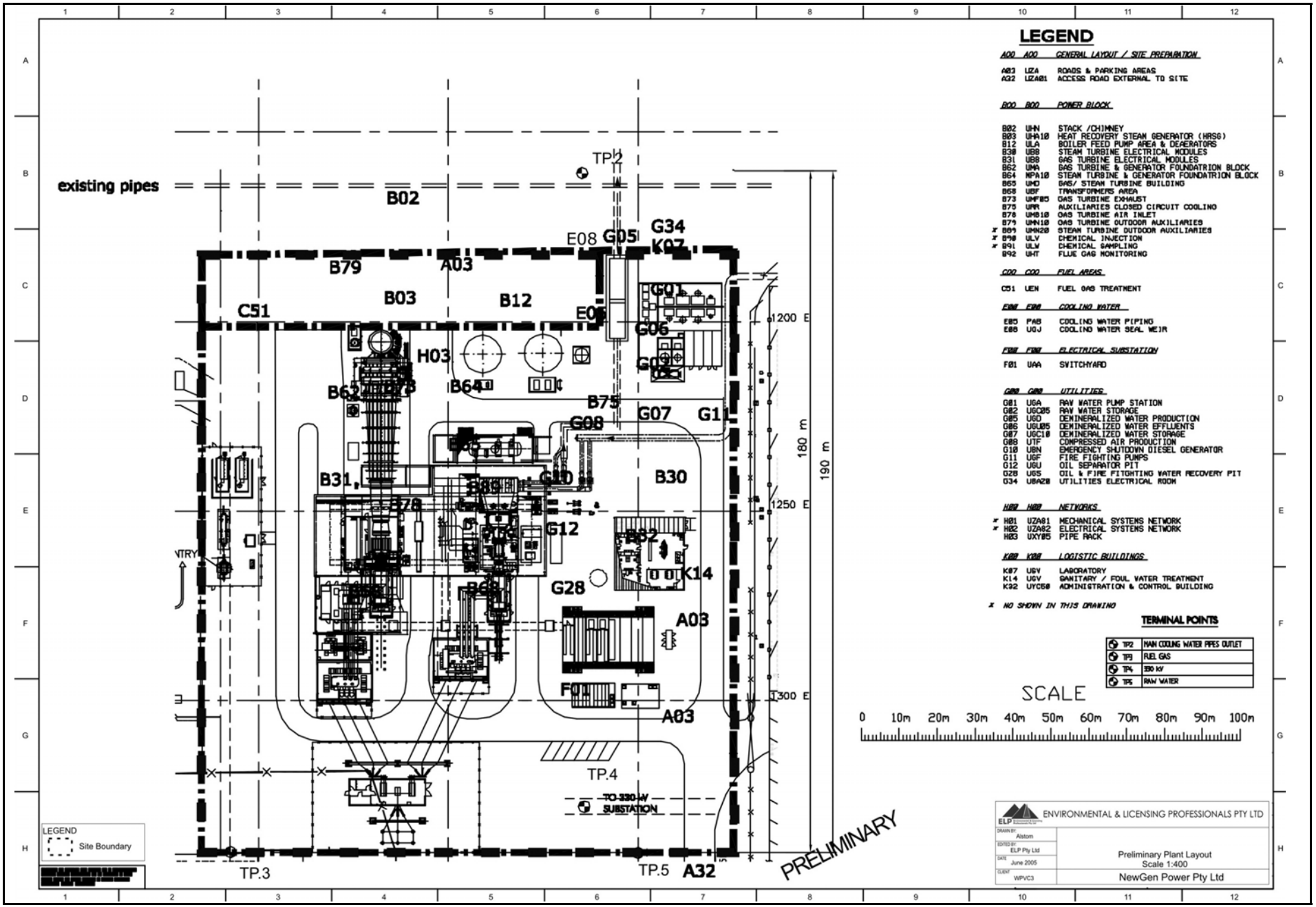

Figure 3: Proposed Kwinana Gas-Fired Power Station site layout (Source: Figure 4.7 from ELP 2005)

PROPONENT'S CONSOLIDATED ENVIRONMENTAL MANAGEMENT COMMITMENTS

KWINANA GAS-FIRED POWER STATION

(Assessment No. 1583)

Note: The term "commitment" as used in this schedule includes the entire row of the table and its six separate parts as follows:

- a commitment number;
- a commitment topic;
- the objective of the commitment;
- the 'action' to be undertaken by the proponent;
- the timing requirements of the commitment; and
- the body/agency to provide technical advice to the Department of Environment.

Proponent's Consolidated Environmental Management Commitments (Assessment No. 1583)

	Topic	Objective	Action	Timing	Advice
1	Flora and Fauna	To ensure no disturbance of dune/native vegetation along the western boundary of the site	1.1 The remnant vegetation within one metre of the western boundary of the site will not be disturbed by construction activities.	1.1 Construction	
2	Greenhouse Gases	To ensure that emissions are within the greenhouse gas guidelines	2.1 Become a signatory to the Greenhouse Challenge programme	2.1 Project Design	Australian Greenhouse Office

Appendix 3

Summary of identification of relevant environmental factors

Preliminary Environmental Factors	Proposal Characteristics	Government agency and Public Comments	Identification of relevant environmental factors
BIOPHYSICAL			
Flora	The site is predominantly cleared with a narrow strip of coastal dune vegetation along the western boundary of the site. Five native species were identified on site, none of which are listed as declared rare or priority flora. Potential for significant species occurring on site is low due to highly degraded nature of site. Vegetation on site has no local or regional significance.	**NewGen consultation process:** Greening of the sites ought to be considered with a planting strategy developed and implemented.	NewGen will develop a greening strategy for the site in partnership with Naragebup Rockingham Environment Centre. NewGen advises that the vegetation on the western edge of the site will not be disturbed. The EPA considers that the concern raised has been adequately addressed. Due to the highly degraded nature of the site, the EPA considers that this factor does not require further evaluation.
Fauna	No declared rare or priority species were observed on site, and the potential for species of conservation significance to utilise the site is low given the high level of disturbance and lack of suitable habitat. Dune vegetation adjacent to the western edge of the site is likely to be of value to fauna, and may contain the priority 3 species Black-striped Snake and the Perth lined Lerista.	No specific concerns were raised in the submissions received.	NewGen advises that the vegetation on the western edge of the site will not be disturbed. The EPA considers that this factor does not require further evaluation.
POLLUTION			
Greenhouse gas emissions	The Kwinana Gas-Fired Power Station will generate up to 744,000 tonnes of CO_2 per year. This is approximately 0.14% of national CO_2 emissions (based on 2000 emissions). Other greenhouse gas levels provided are: CH_4 - 2,439 CO_2 equivalent and N_2O - 450 CO_2 equivalent.	**ACF/Conservation Council WA** The proponent should be required to offset 100% of their greenhouse emissions associated with this project. **Rockingham Naregebup Environment Centre** Consideration should be given to potential for co-generation and molten carbonate fuel cell technology. **City of Rockingham** The proposal should consider some sort of carbon offset program.	In view of the significant quantity of greenhouse gas that would be emitted by the proposed power station, the EPA considers that greenhouse gas emissions is a relevant environmental factor.

Atmospheric Emissions	Dispersion modelling has been undertaken for NO_2, SO_2, PM_{10}, and odour. Maximum 1-hr average concentrations are as follows: NO_2: 217µg/m^3 (86% of NEPM standard) SO_2: 0.8% of Kwinana EPP standard PM_{10}: 2% of Kwinana EPP standard (24hr average) $PM_{2.5}$ estimated to be approx 4% of the NEPM $PM_{2.5}$ advisory standard Odour modelling shows that a maximum odour concentration of around 0.9 odour units (3min average) could occur as a result of the power station. The EPA's odour guideline requires a maximum odour concentration of 2OU (3min average, 99.5th percentile) and 4OU (3 min average, 99.9th percentile). Predicted levels of other pollutants are as follows: CO: 50ppmv VOCs: 2.4 tonnes/year PAHs: 2.5 kg/year These levels are low due to the high combustion efficiency of gas turbines. Levels of other organics (eg. benzene, toluene, xylene) are expected to be negligible as long-chain hydrocarbons are removed from the gas by the Wesfarmers LPG plant upstream of the proposed power station uptake.	**NewGen consultation process** Emissions need to be considered in terms of potential health impacts. Odour may be an issue. Measurement of particulates should be provided in greater detail. Will emissions be worse at the new site than at the Donaldson Road site? **Kwinana Progress Association/ Conservation of Rockingham's Environment.** Requests for a commitment for continuous on-line NO_x, SO_2 and $PM_{2.5}$ monitoring. **ACF/Conservation Council WA** Note that the levels of NO_x and SO_2 are low for this proposal.	The EPA is satisfied that the levels of PM_{10} and SO_2 have been adequately modelled and shown to comply with the relevant standards. Similarly odour has been modelled according to EPA Guidance Statement No. 47 and the shown to comply with the requirements of this document. These emissions do not require further evaluation by the EPA. Due to the significant quantity of NO_x that will be emitted from the proposed power station, the EPA considers that nitrogen oxides are a relevant environmental factor.
Marine Environment	KGPS will require 157GL of seawater per year for condenser cooling, to be pumped from Cockburn Sound. Average predicted temperature increase is 7.2 degrees Celsius at the diffuser outlet. Cumulative thermal modelling demonstrates that the KGPS will be unlikely to lead to exceedances of the *State Environmental (Cockburn Sound) Policy, 2005*.	A wide range of comments were made through NewGen's consultation process. Issues raised included marine management, nutrients, impacts on fish and dolphins, dredging, antifoulant chemicals to be added to the cooling water, sediment contamination, thermal discharge into the Sound, and access to the project area.	NewGen has provided a response to the submissions in the EPS document. The EPA considers that the major marine issue is the thermal load from the power station's cooling water outfall plume. Due to the large quantity of heated water that is proposed to be discharged, the EPA considers that temperature elevation of the ambient water is a relevant environmental factor.

Liquid and Solid Waste Disposal	The major sources of wastewater are HRSG boiler blowdown water, sampling drain streams and demineralisation plant water. Total waste water generated is expected to be 3ML/year. Wastewater is to be contained in the existing Western Power evaporation pond. Effluent is expected to have a maximum TDS of 15,000mg/L.	No specific concerns were raised in the submissions received.	NewGen Power expects to be able to contain all wastewater in the evaporation pond. If disposal is required, the preferred option is disposal via the Water Corporation's Sepia Depression line. This factor does not require further evaluation by the EPA.
Surface water and Groundwater	The Kwinana gas-fired power station will require about 150ML/yr of fresh water to be sourced from the Water Corporation. Groundwater at the site is unlikely to be pristine due to other contaminating sources in the vicinity. However no further contamination should result from the power station. The proponent advises in their EMP that any potentially contaminated surface water runoff will be retained on site and treated before release to the environment.	No specific concerns were raised in the submissions received.	The proponent advises that water use is low due to the operation of a blow-down water recovery system. NewGen has had discussions with the Water Corporation regarding the use of recycled water sourced from the Kwinana Wastewater Recycling Plant. The proponent advises that all areas that can potentially be contaminated with hydrocarbons or chemicals will be contained with bunding and/or drainage systems. The proponent will comply with the relevant Australian Standard for hydrocarbon storage and handling (AS1940). The proponent has developed preliminary environmental management plans (EMPs) for the storage and handling of chemicals (Section 6.10, Appendix N of EPS document), waste and saline water (Section 6.8, Appendix N), and sediment control, hydrocarbon and water quality management (Section 6.3, Appendix N). Monitoring is included in these EMPs. This environmental factor does not require further evaluation by the EPA.
Noise	Construction and operation of the Kwinana Gas-Fired Power Station has the potential to affect existing noise levels in the KIA.	**NewGen consultation process** Concerns about the cumulative effects of noise in the KIA and the noise from air cooling. **ACF/ Conservation Council WA** Consider that the EPA must be satisfied that the applicable noise restrictions will be met prior to approving this proposal. **City of Rockingham**	Noise modelling predicts that the proposed Kwinana Gas-Fired Power Station will not exceed the *Environmental Protection (Noise) Regulations, 1997* at any location except the Naval Base Hotel when accommodation is in use. As the noise regulations are predicted to be exceeded, the EPA considers that noise is a relevant environmental factor.

		Various questions relating to noise (see referral document page 110). Can works be offered to the Naval Base Hotel to improve soundproofing of the rooms? Will vibrations be a concern?	
Site contamination	Two ash ponds on site are used by Western Power to dispose of ash from the Kwinana Power Station. NewGen has accepted responsibility for the remediation of the ponds prior to construction commencing. Visual inspection of the ponds led the consultant to suspect that the ponds were contaminated with metals, other chemicals and possibly acids. PAHs are also known to occur in ash dams.	**Department of Environment** Further investigations of the ponds are required to determine if the ponds are contaminated. Further inspections should be carried out in accordance with the DoE's *Contaminated Sites Management Series*.	The proponent has proposed to remediate the site by dewatering the ash and evaporating the liquid after removing as many suspended sediments as practicable. It is proposed to dispose of the remaining ash in a licensed facility. The nature and extent of the contamination is not known and the EPA considers that site contamination is a relevant environmental factor.
SOCIAL SURROUNDINGS			
Aboriginal Culture and Heritage	A desktop survey did not identify any Aboriginal heritage (archaeological or ethnographic) sites on the proposed site. Four archaeological and six ethnographic sites were located within 5km of the site, however, the proposed power station is highly unlikely to impact any of these sites.	No specific concerns were raised in the submissions received.	The proponent has developed a heritage environmental management plan to ensure that heritage objects or artefacts that may be found on site are appropriately managed (Section 6.11, Appendix N of referral document). This environmental factor does not require further evaluation by the EPA.
Non-indigenous Heritage	A search of the Register of the National Estate did not identify any registered sites of interest on the proposed site. The Heritage Council of WA identified one site of interest 2km from the proposed power station site, however, this will not be impacted by the proposed power station.	No specific concerns were raised in the submissions received.	The proponent has developed a heritage environmental management plan to ensure that heritage objects or artefacts that may be found on site are appropriately managed (Section 6.11, Appendix N of referral document). This environmental factor does not require further evaluation by the EPA.
Visual Amenity	The most significant visual impact of the Kwinana Gas-Fired Power Station will be the 60m tall stack. Surrounding land is zoned industrial and two similar power stations (one existing, one proposed) are adjacent to the site.	No specific concerns were raised in the submissions received.	The proponent has made a commitment to minimise the visual impacts of the power station and has developed an environmental management plan to achieve this (Section 6.6.2 Appendix N of the referral document). Stack is similar height or lower than surrounding industries. Stack will not be visible at closest residential area (Hope Valley). This environmental factor does not require further evaluation by the EPA.
Recreational Activities	The Kwinana Gas-Fired Power Station is unlikely to have an impact on recreational activities in the general area.	No specific concerns were raised in the submissions received.	This environmental factor does not require further evaluation by the EPA.