AGL Energy Limited

Barker Inlet Power Station

Environmental and Social Assessment Report

Section 49 Development Application supporting report

October 2017

coffey

A TETRA TECH COMPANY

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Barker Inlet Power Station

Prepared for
AGL Energy Limited

Prepared by
Coffey Services Australia
Level 2, 12 Creek Street
Brisbane, QLD, 4000
t: 07 3239 9300
ABN: 55 139 460 521

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1 Introduction

AGL Energy Limited (AGL) is proposing to develop the Barker Inlet Power Station (BIPS) to replace units of the aging Torrens Island Power Station (TIPS). Replacing the old A Station units with the new power station will ensure energy supplies continue to be available for South Australia. The BIPS will be located on Torrens Island which adjoins Port Adelaide and is approximately 15 km northwest from Adelaide, SA.

Various options of power stations were reviewed by AGL and it was considered that the most efficient, cost effective approach to meet the market demand was to use reciprocating engines in the new power station. Multiple, large scale, low speed reciprocating engine generators will ensure fast start-up and flexible operations, which are well placed to react to the variability observed in the South Australian electricity market.

The BIPS project will provide a generating capacity of approximately 420MW, with Stage 1 providing 12 engines capable of 210MW and Stage 2 providing another 12 engines also capable of 210MW. The new configuration would also have the option of diesel firing.

The power station will be built on land owned by AGL adjacent to the existing TIPS and it will play a critical role in securing South Australia's energy supplies for the future.

Subject to development approval, AGL propose to begin construction in 2018 with commercial operation of Stage 1 commencing in mid-2019.

1.1 Previous development approval

A development application for a preceding project, termed the Torrens Island Energy Park Project (comprising of an expansion of the existing power station and a gas storage facility) was submitted by AGL and approved with conditions under the *Development Act 1993* (Development Act) in November 2010 (010/V008/10). The development approval permitted the development of heavy-duty gas turbines, with a capacity of up to approximately 600-800MW and a gas storage facility comprising a liquefied natural gas (LNG) processing plant, storage tank and re-gasification units.

The development application and approval acknowledged that the proposed options were likely to change in the future and the final selection of the generating plant units would be determined by market demand and a tender process. The timing of construction would also be dependent upon the market conditions.

AGL's assessment of the current and future state of the National Electricity Market (NEM) indicates that market conditions now warrant the development of new thermal generating capacity in SA and wish to proceed with the construction of a new power station at Torrens Island.

AGL consulted with the Department of Planning, Transport and Infrastructure (DPTI) regarding the most appropriate approvals pathway, and DPTI advised that the BIPS project requires a new development application rather than a variation to the existing approval.

1.2 Project proponent

AGL has been operating in Australia for over 180 years, commencing in Sydney in 1837. AGL now provides gas, electricity, solar PV and related products and services to more than 3.7 million customers across South Australia, Queensland, New South Wales, and Victoria.

AGL is focused on delivering new, innovative and integrated offerings to meet the changing needs of customers in an ever-changing energy environment.

Listed on the Australian Securities Exchange, AGL is an S&P/ASX 50 company and maintains a Baa2 credit rating from Moody's. AGL is one of Australia's leading integrated energy companies and largest ASX listed owner, operator and developer of power generation. The diverse power generation portfolio includes base, peaking and intermediate generation plants, spread across traditional generation fuel sources as well as renewable sources including hydro, wind, solar, landfill gas and biomass.

AGL's current portfolio of operations includes significant investment in South Australia, including the 1280MW Torrens Island Power Station (TIPS), operation of 438MW of wind generation across 5 wind farms and is also a major retailer of energy to South Australians.

1.3 Project location and tenure

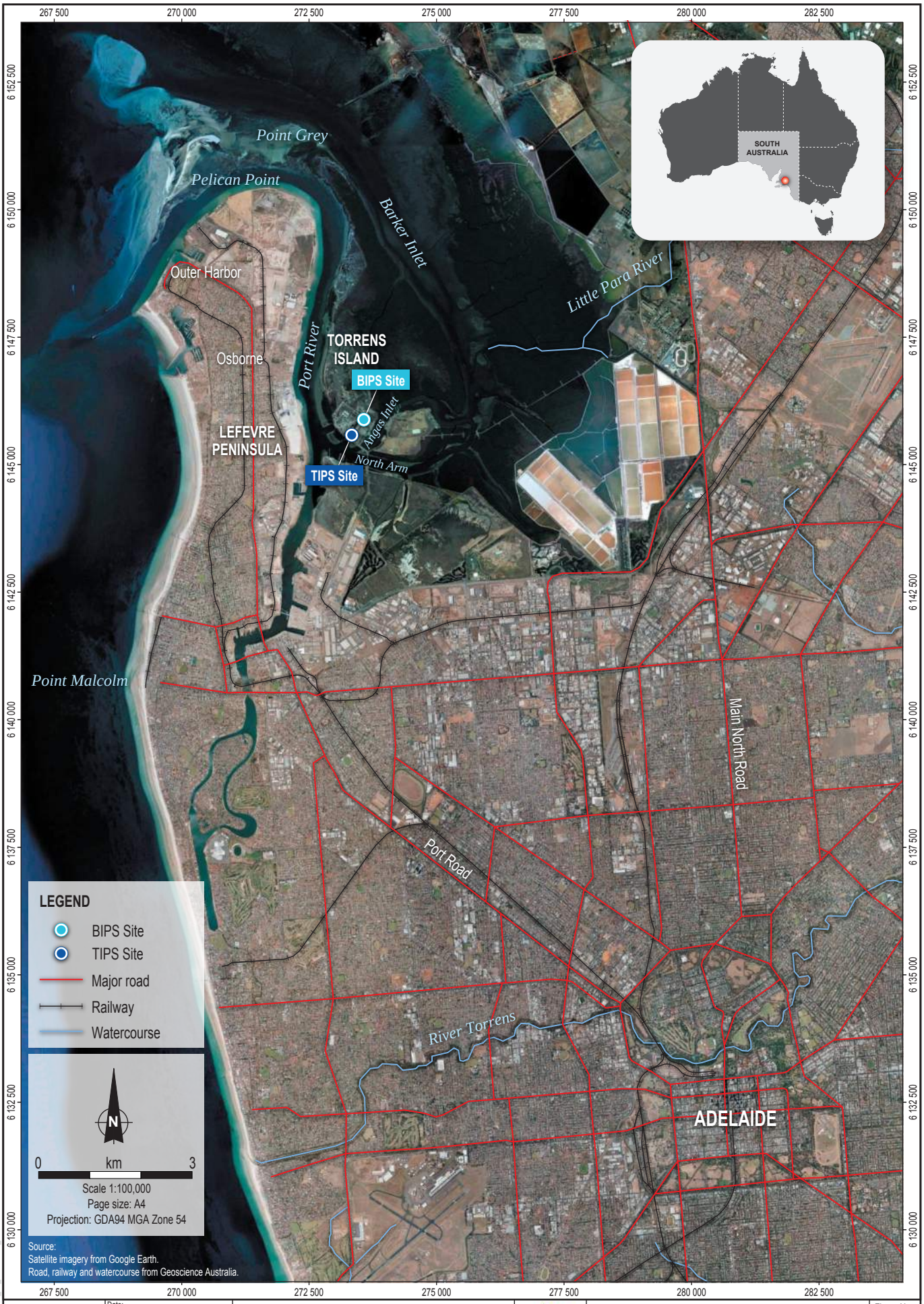
BIPS will be located on Torrens Island which is adjacent to Port Adelaide and is approximately 15 km northwest from Adelaide (see Figure 1.1). Torrens Island is in the Port River estuary between the Port River and Barker Inlet. It sits outside a council area, but is most proximate to the municipality of Port Adelaide Enfield. The power station will be located in an industrial area and is approximately 1.5 km from the nearest residential area across the Port River at Taperoo.

Torrens Island is serviced by existing roads and other infrastructure and access is controlled by a security checkpoint. Surrounding land is a mix of industrial land and vacant land. The Torrens Island Conservation Park is located to the north and east of the site, and is listed on the Commonwealth Government's Register of the National Estate. The site comprises freehold allotments as described in Table 1.1 and shown on Figure 1.2. BIPS will be fully contained within Certificate of Title Volume 6168 Folio 491 (D55734 Q302 (Lot 302)).

Table 1.1 Allotments within the general area

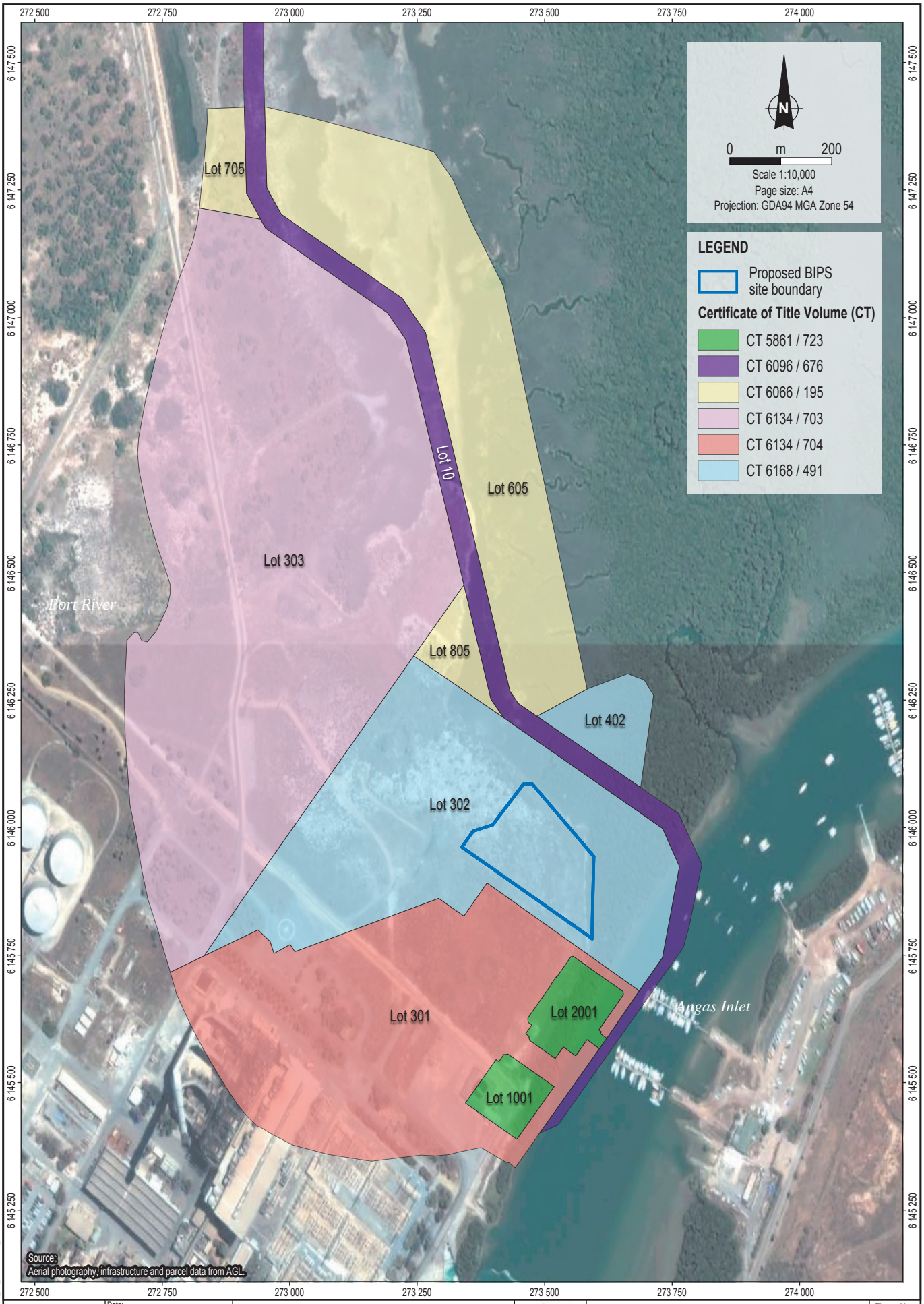
Title Description	Plan and Parcel Description
Certificate of Title Volume 6066 Folio 195	D55734 Q705 (Lot 705) D55764 Q605 (Lot 605) D55734 Q805 (Lot 805)
Certificate of Title Volume 6134 Folio 703	D55734 A303 (Lot 303)
Certificate of Title Volume 6168 Folio 491	D55734 Q402 (Lot 402) D55734 Q302 (Lot 302)*
Certificate of Title Volume 6134 Folio 704	D55734 Q301 (Lot 301)
Certificate of Title Volume 6096 Folio 676	D55734 A10 (Lot 10)
Certificate of Title Volume 5861 Folio 723	D55734 Q1001 (Lot 1001) D55734 Q2001 (Lot 2001)

* The BIPS project is located on this land parcel



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F01.01_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Location of the BIPS and TIPS site	Figure No: 1.1

AI Reference: 202225_02_GRA001.ai_4



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F01.02_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Land tenure of the Barker Inlet Power Station area	Figure No: 1.2

AI Reference: 202225_02_GRA002.ai_7

1.4 Purpose and structure of this report

This Environmental and Social Assessment Report (ESAR) has been prepared as part of the assessment process for crown development and public infrastructure under Section 49 (2)(c) of the South Australian *Development Act 1993*. The ESAR provides the assessment of the environmental and social impacts of the project and provides management strategies for the identified impacts.

While an environmental impact statement is not formally required for projects assessed under Section 49, AGL has chosen to prepare the ESAR for the proposed BIPS project to ensure that the potential environmental and social impacts are fully understood and appropriate mitigation and management measures are designed and implemented.

The ESAR has been prepared to support the development application for consideration by the State Commission Assessment Panel (formally called the Development Assessment Commission (DAC)). The State Commission Assessment Panel (SCAP) will consider the application and matters raised in the ESAR and, following referral of the application for comment by relevant agencies and public consultation, will independently assess and report to the Minister for Planning. The Minister has the final decision making authority on the proposed development and will decide whether to approve the BIPS project. Further details on the governing legislation, policies and standards that apply to the project are outlined in Chapter 2.

In undertaking its critique and assessment of the development proposal, SCAP will refer the proposal and the ESAR to regulatory authorities including the Environment Protection Authority (EPA), Department of Environment, Water and Natural Resources (DEWNR), Department of Planning Transport and Infrastructure (DPTI), Department of Premier and Cabinet (DPC) and the City of Port Adelaide Enfield Council.

The objectives of this ESAR are to:

- Provide details of the project to SCAP, regulatory authorities, the general public and other stakeholders.
- Identify, quantify and assess the potential environmental and social impacts associated with the development of the project.
- Present proposed mitigation and management measures to ensure that the project minimises its impact on the environment and complies with environmental guidelines.
- Provide an assessment of the future effectiveness of the mitigation measures and the residual impacts following their implementation.

The main report is intended to be understood without reference to the specialist reports in the appendices. The structure of the report is provided in Table 1.2.

Table 1.2 Structure of the report

Chapter	Main report	Author
1	Introduction	Coffey
2	Legislation	
3	Rationale	
4	Project description	
5	Stakeholder engagement	
6	Environmental and social impact assessment	
7	Health, Safety and Environmental Management Framework	
8	Conclusion	
9	References	
Appendix	**Appendices**	
A	Section 49 Public infrastructure endorsement	SA Government
B	Office of the Technical Regulator Certificate	DPC - OTR
C	EPBC Act referral decision	Department of the Environment, Water, Heritage and the Arts
D	Flora and fauna addendum & Flora and fauna main report	Donato Environmental Services
E	Water management plan and sea level rise assessment	Tonkin Consulting
F	Contamination assessment	Coffey
G	Air quality assessment	Pacific Environment
H	CASA plume assessment	CASA
I	Greenhouse gas assessment	Pacific Environment
J	Environmental noise assessment	Sonus
K	Surface water and groundwater assessment	Coffey
L	Cultural heritage survey preliminary advice	Australian Cultural Heritage Management
M	Non-Indigenous historical and cultural heritage study	Austral Archaeology

1.5 Report conventions

BIPS is a development proposal and its implementation is conditional on a number of factors such as project approvals and final investment decision. For reasons of style the project and related proposed activities have been described in the active ‘will’ rather than ‘would’.

Information contained herein that describes existing conditions, avoidance, management and mitigation measures, and residual impacts is taken from both literature sources and the specialist studies listed in Table 1.2. To avoid excessive repetition, the number of references in the text to these sources, particularly when summarising information from the specialist studies reports in Chapter 6, has been minimised.

2 Legislation

This section describes the relevant South Australian and Australian government legislation for the project.

2.1 South Australian legislation

South Australia has numerous pieces of environmental legislation which regulate development in the State. The following sections provide a summary of environmental legislation which will be triggered by the project.

2.1.1 Development Act and regulations

The *Development Act 1993* (Development Act) and associated Development Regulations 2008 provide for the planning and regulation of development in South Australia. Among other things, this framework regulates the use and management of land and the design and construction of buildings.

The Development Act establishes a number of assessment and approval pathways for new development. The BIPS project involves the construction of new electricity generating infrastructure that will provide a public benefit to South Australia. Accordingly, the Department of Premier and Cabinet (DPC) has agreed that the project is 'public infrastructure' that will be assessed under the public infrastructure provisions of Section 49 of the Development Act.

In order for a project to be assessed as public infrastructure a development must be supported by a state agency for the purposes of the provision of public infrastructure and specifically endorsed by the State agency. In a letter to AGL Energy Limited (AGL) dated 13 September 2017, DPC confirmed that it would "support and specifically endorse the Development Application" under Section 49(2)(c) of the Development Act, confirming that the BIPS project can be assessed under that legislative provision (Appendix A).

The BIPS development application is the principal document used to apply for development approval. The development application and supporting documentation (this ESAR), will be submitted by the sponsoring agency DPC to SCAP on behalf of AGL in accordance with Section 49(2).

While an environmental impact statement is not legally required for projects assessed under Section 49, AGL wants to ensure that the potential environmental and social impacts associated with the project have been fully understood and appropriate mitigation and management measures are implemented. This report provides the findings of the environmental and social impact assessment to support the development application.

The development application and all supporting documentation will undergo a period of internal government consultation with regulatory authorities and relevant local governments. As the BIPS development occurs outside of a local government area the nearby council will be consulted (City of Port Adelaide Enfield Council).

For projects with a total capital value (i.e., when all stages are complete) of more than $4 million, Section 49A(7)(d) provides that SCAP are required, by public advertisement, to invite interested

persons to make written submissions to the proposal within a period of up to 15 business days. Given the capital value of BIPS, this project satisfies that criteria.

SCAP is required to consider all submissions and is also required to meet with any interested persons regarding their concerns about the project. SCAP will then prepare a report based on the information provided in the development application and public submissions, and provide that report to the Minister for Planning. SCAP has three months to prepare the report to the Minister (which includes the internal consultation period and 15 business day period of public consultation). The Minister will then make the final decision based on the SCAP report and other relevant documentation. The Minister's decision on the development application is binding and is not subject to appeal. Figure 2.1 shows the development assessment process under the Development Act.

In May 2017, the new Development (Electricity Generators) Variation Regulations 2017 came into force under the Development Act. Section 49(2) of the Development Act requires that a development application contains 'prescribed particulars' which are outlined within the Development Regulations 2008. These 'prescribed particulars' are defined section 70(1) which was amended as part of the new Development (Electricity Generators) Variation Regulations.

As the BIPS development is for the purposes of the provision of an electricity generating plant with a generating capacity of more than 5MW and connected to SA's power system, a certificate from the Technical Regulator certifying that the proposed development complies with the requirements of the Technical Regulator in relation to the security and stability of the State's power system is required. The Technical Regulator issued a certificate on 1 September 2017 (Appendix B) conditional on further discussions proceeding between the Technical Regulator and AGL to assess other parameters of these generators relating to system security in the context of their shortfall of specific inertia.

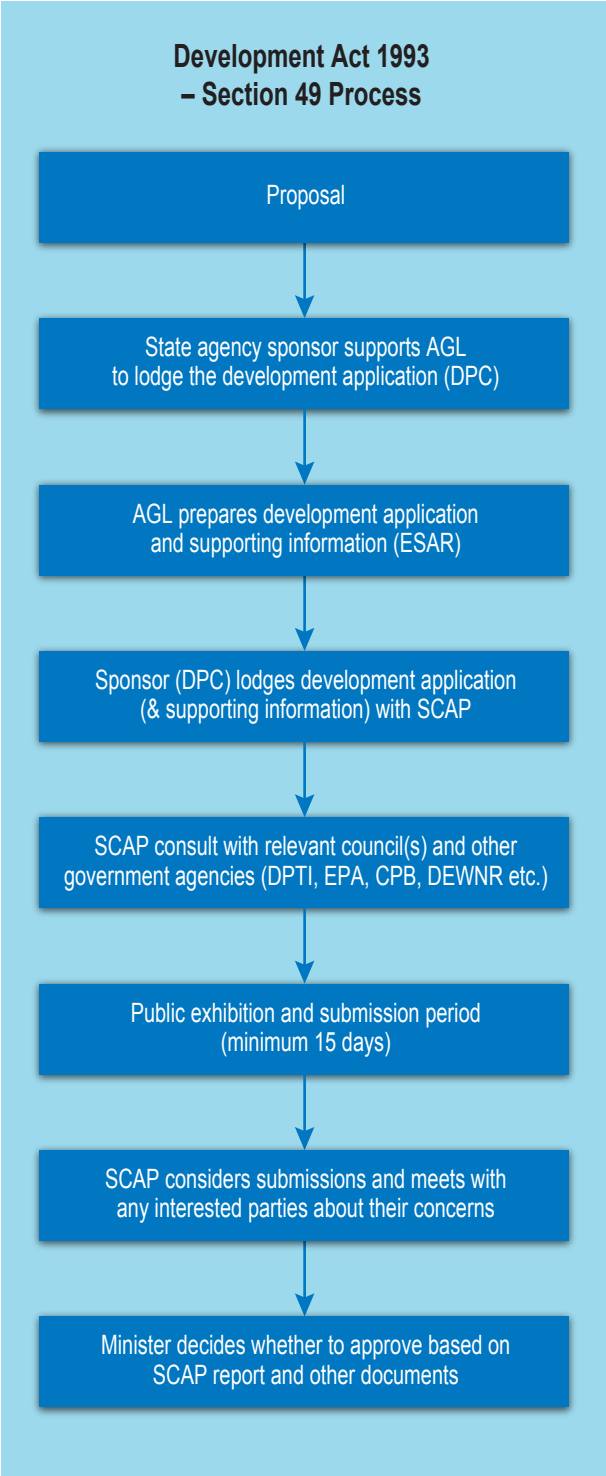
Existing development approval

AGL has a current approval for developing a gas power station at the site. The primary change from the previously approved development is that the BIPS project will use reciprocating engines and the addition of diesel as an alternative fuel rather than heavy duty turbines fired on gas only. The project footprint, supporting infrastructure, site access and proposed workforce of the BIPS project has not changed significantly from the previously approved project. The other components of the previously approved project (such as the development of a gas storage facility comprising a LNG processing plant, storage tank and re-gasification units) are no longer required.

AGL has been advised by DPTI that the BIPS project should proceed as a new development application, rather than a variation to the existing approval.

2.1.2 Environment Protection Act and regulations

The *Environment Protection Act 1993* (EP Act) and associated regulations provide for the protection of the environment and is administered by the South Australian Environment Protection Authority (EPA). The EP Act also provides for the establishment of environment protection policies and guidelines.



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F02.01_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Process for development application	Figure No: 2.1

AI Reference: 202225_02_GRA004.ai_7

While developments assessed under the Development Act are exempt from having to apply for works approvals under the EP Act, the EPA is provided the opportunity to assess the project in its capacity as a referral authority for the development application. In addition, an environmental licence will be required to undertake prescribed activities of environmental significance.

The design and layout of the reciprocating engines proposed for the BIPS project will not result in any discharge of process waste water or cooling water into the marine environment around Torrens Island. The existing power station at Torrens Island does discharge water into the marine environment and thus legislative provisions regarding EPA conditions are relevant to the existing site, which is currently operating under EPA specified conditions (EPA Exemption (30002) and EPA Licence (12849)). Given the design and layout of the proposed development it is not expected that further conditions will be required to manage these activities.

Dredging and dewatering are activities that require a licence under the EP Act. There are no proposed plans to undertake dredging for the construction of the power station. If required, a licence will be sought in accordance with the EP Act for the groundwater dewatering for the excavation work.

AGL has a general environmental duty, as required by Section 25 of the Environment Protection Act, to take all reasonable and practical measures to ensure that the activities on the whole site, including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

During discussions with the EPA the key areas of interest were air quality, existing areas of contamination on Torrens Island, water quality, noise and waste management. Assessments of these aspects are provided in Chapter 6.

2.1.3 Aboriginal Heritage Act and regulations

The *Aboriginal Heritage Act 1988* provides protection for Aboriginal objects, remains and sites of spiritual, archaeological, anthropological and historical significance. This Act contains provisions for Traditional Owners to determine the significance of land or objects to Aboriginal people.

Discovery of any Aboriginal objects or sites are to be reported to the Minister for Aboriginal Affairs and Reconciliation as soon as practicable. If destruction, disturbance or interference with a registered site is required, an application must be submitted to the Minister.

Searches of the Aboriginal Affairs and Reconciliation Division (AARD) Central Archive (which includes the Register of Aboriginal Sites and Objects) were conducted for the project area in 2009 to determine whether the details of any Aboriginal sites, objects or remains have been entered. These searches were requested in relation to the allotment subject to the BIPS project, the surrounding allotments and all watercourses around Torrens Island. The search of the Central Archive identified a number of Aboriginal sites within the project area however, all of these sites are outside the disturbance footprint (refer to Section 6.11). Site surveys were also conducted within the project area in December 2009 by the Traditional Owners (the Kaurna People) with the assistance of their technical advisers (archaeological and anthropological) provided by Australian Cultural Heritage Management (ACHM). No sites were identified within the BIPS project area. The BIPS site is a secure parcel of land located on AGL land. No Aboriginal activities have occurred on the site since the previous survey.

If any Aboriginal sites or objects are discovered within the disturbance footprint, an authorisation to damage, disturb or interfere with Aboriginal sites would be required from the Minister for Aboriginal Affairs and Reconciliation prior to construction of the BIPS commencing.

AGL has chosen to directly engage with the registered native title claimants, the Kaurna People in considering indigenous heritage matters. The most recent engagement activities have been in August 2017. The details are outlined in Chapter 5.

2.1.4 Native Vegetation Act and regulations

The *Native Vegetation Act 1991* and Native Vegetation Regulations 2017 are administered by the Native Vegetation Council (NVC), Department of Environment, Water and Natural Resources (DEWNR). This legislation regulates the clearance of native vegetation and provides incentives and assistance to landowners in relation to the preservation and enhancement of native vegetation.

The allotment relevant to the BIPS project is outside the Native Vegetation Act jurisdictional boundary, hence approval for clearance under the Native Vegetation Act is not required. However, clearance of vegetation will be assessed as part of the assessment process under the Development Act.

2.1.5 Other approvals that may be required from the State

There are a number of other state approvals, permits, licenses and agreements that, subject to certain conditions and circumstances, may be required prior to the commencement of the project.

Natural Resources Management Act and regulations

The *Natural Resources Management Act 2004* and associated regulations promote sustainable and integrated management of the State's natural resources (particularly land and water resources) and provides for their protection. The Natural Resources Management Act requires permits for the construction of water harvesting/extracting facilities such as wells, watercourse diversions and dams, and water licences are required along with any endorsed water allocation for water use from any prescribed water resource. As there are no natural drainage lines across the project area and activities will be managed to minimise any potential erosion or land degradation, no permits will be required under this Act.

Heritage Places Act and regulations

The *Heritage Places Act 1993* and associated regulations make provision for the identification, recording and conservation of places and objects of non-Aboriginal heritage significance. If destruction, disturbance or interference to a registered site is required, an application must be submitted to the Minister for Environment and Conservation. There are no local, state, national or world heritage places within the project area. Therefore, no application is required to be submitted or approval required under this Act.

2.2 Australian government legislation

Relevant Australian government legislation is provided below.

2.2.1 Environment Protection and Biodiversity Conservation Act

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that are likely to have a significant impact on a matter of national environmental significance are assessed. The Australian Government Department of the Environment and Energy is responsible for administering the Act. Matters considered to be of national environmental significance include:

- World Heritage properties.
- National Heritage places.
- Threatened species and ecological communities.
- Migratory species.
- Nuclear actions.
- Commonwealth marine areas.

AGL submitted an EPBC Act referral for the previously proposed Energy Park project, and the Minister declared the project to be 'not a controlled action' on 14 April 2010 (Appendix C) and it did not require formal assessment under the EPBC Act.

Using the EPBC self-assessment process within the 'Significant impact guidelines 1.1' (DoE, 2013) and the advice of flora and fauna specialist, Donato Environmental Services (Section 6.7), it was determined that the proposed BIPS will not affect any matters of national environmental significance. Therefore an EPBC Act referral has not been submitted.

The assessment of potential impacts to EPBC Act species and communities is provided in Section 6.7 and Appendix D.

2.2.2 Native Title Act

The *Native Title Act 1993* provides legal recognition of the rights and interests of the Aboriginal people over land and water possessed under their traditional laws and customs. The Act sets out basic principles regarding native title in Australia and establishes a regulating and governing body, the National Native Title Tribunal.

The statutory regime imposes certain procedural processes that must be complied with in the event something is proposed to be done that may affect or impact native title. As such, consideration must be given as to whether any aspect of the BIPS development will impact or affect native title.

A native title assessment has been carried out for the allotment subject to the project and concluded that native title is wholly extinguished. Therefore, no native title agreement is required (Blake Dawson, 2009). As no native title exists in the area, no aspect of the proposed BIPS development necessitates any statutory compliance process.

2.3 Local government

South Australia is divided into 68 local government or council areas. However, there are areas of the state that are not within a council area and Torrens Island is one of these areas. Torrens Island is therefore controlled by the South Australian Government through the Development Plan

for Land not within a Council Area (Metropolitan) Consolidated 5 May 2016. Under this plan, the project area is zoned as Public Purpose (Power Station). The Public Purpose (Power Station) Zone is an area of strategic importance for the South Australian power generation industry.

The Development Plan sets out the objectives and principles of development control for the zone. These include:

- A zone for the continued operation, maintenance and essential development of the Torrens Island Power Station consistent with sound management and protection of the natural environment.
- A zone for associated development relating to the production and utilization of energy, the utilization of waste products and education and research activities.
- Development in the Public Purpose (Power Station) Zone should be for the generation and transmission of power, maintenance and storage activities and associated activities involved in the production and utilization of energy, the utilization of waste products (namely cooling water), education and research.
- Development involving the production of energy should be consolidated around the existing power station in the southern portion of the zone.

The development of the BIPS project is consistent with the current zoning and the objectives and principles of development control in the Public Purpose (Power Station) Zone, and is not otherwise in conflict with the Development Plan.

2.4 South Australia Strategic Plans and priorities

The project will align, where possible with the South Australian State Government priorities. Important plans for South Australia include:

- South Australian Strategic Plan.
- South Australia's Seven Strategic Priorities.
- South Australia's Ten Economic Priorities.
- Integrated Transport and Land Use Plan.
- SA Energy Plan.

2.4.1 Strategic Plan

The Strategic Plan contains visions, goals and targets. The Plan outlines three foundations of a sustainable society: Our Community, Our Prosperity and Our Environment, which are organising priorities for the Strategic Plan.

There are 100 targets within the Strategic Plan, with topics including tourism, housing, open spaces, childhood literacy, reducing crime and violence, road safety, aboriginal culture, economic growth, mineral exploration, defence projects, employment, renewable energy, recycled water, salinity, healthy weight and sport.

The project will contribute towards objectives within each of the State's Strategic Plan, Economic Priorities and the South Australian Energy Plan. The key elements which support the Government's objectives include:

- Target #35 - Economic growth

- The project will contribute a $295m investment in modern new generation energy infrastructure to support South Australia's successful energy transition to a low carbon economy.

- BIPS replaces ageing energy infrastructure in a timely fashion ahead of the scheduled mothballing of the ageing TIPS A Station.

- Target #36 - Labour productivity and Target #47 – Jobs

- More than 250 jobs are forecast during construction phase.

- Target #56 - Strategic infrastructure

- The new capacity will provide firm, flexible and dispatchable synchronous generating capacity, complementary to existing renewable generation, to allow electricity to be contracted and delivered to consumers reliably and securely.

- Importantly, the new plant will enhance contract volume and liquidity, putting downward pressure on wholesale prices and thereby supporting the State Economic Priorities.

- Target #59 - Greenhouse gas emission reduction

- BIPS will be more fuel efficient than the existing TIPS and the greenhouse gas emissions of the existing operations will reduce once the new plant is commissioned.

- Upon commissioning of the new plant, the existing fuel oil firing capability of the existing B Station will be decommissioned, thereby reducing emissions.

- The new plant will be air cooled and therefore does not rely on river water nor impart thermal load into the local river system.

2.4.2 SA Energy Plan

The BIPS project supports the intent of the SA Energy Plan with regards to increasing local generating capacity, improving reliability and creating jobs. BIPS also addresses the key objectives of the Energy Security Target with additional investment in cleaner energy production plant, as outlined above. The project supports the Government's aim of becoming a successful low carbon economy, built on reliable, affordable and clean energy generation.

The BIPS project has been developed and planned to ensure new generating capacity is brought into service prior to old capacity in the TIPS A Station being taken out of service and mothballed in September 2019. The timely transfer of generating capacity from A Station to BIPS will provide predictable and stable electricity market signals that should avoid the market disruptions associated with closure of power stations in the last few years. More information on the project rationale is provided in Chapter 3.

3 Rationale

Federal and State government policies promote the use of gas for electricity generation and the forecast demand for electricity indicates a shortfall in generating capacity in the near future. This chapter describes the rationale for the project based on opportunities in the gas and electricity markets and the forecast conditions.

The proposed BIPS project provides an opportunity to:

- Contribute to long-term planning for South Australia's future electricity generation requirements.
- Replace the shortfall in electricity that will occur with the mothballing of the TIPS A.
- Provide electricity generation facilities on an existing power station site and within an existing industrial envelope.

Sections 3.1 to 3.3 provide context to the current market conditions and Chapter 4 describes the proposed project.

3.1 National Electricity Market

The National Electricity Market (NEM) was established in 1996 and brings together the generation, distribution and supply of electricity into a single market that includes Victoria, New South Wales, Australian Capital Territory, Queensland, South Australia and Tasmania. The participating jurisdictions are linked by interconnectors (high voltage overhead transmission lines and underground and subsea cables) that enable the transfer of electricity throughout the NEM. The NEM is managed by the Australian Energy Market Operator (AEMO).

An underlying commercial principle of the NEM is that generation plant owners will build new plant in response to market demand for new capacity. In recent years', growth in electricity demand across the NEM flattened out creating less incentive for energy companies to develop and build new thermal generating plant reducing the 'pipeline' of new power projects. With the closure of coal fired generators in South Australia and Victoria there is now concern that there may be a shortage of dispatchable synchronous generation creating the market signal to build new plant to provide reliability and security in the NEM.

3.2 Security and stability of the SA power system

AGL has a long-standing commitment to South Australian customers and contributing to creating a secure energy system as the market transitions.

The installation of significant wind generation together with the expectation of large scale solar generation has changed the characteristics of South Australia's power system. Typically, firm generating capacity is provided in Australia mainly by steam or gas turbines. Steam turbines, such as those at Torrens Island were designed for base loaded operation and so have very slow starting characteristics, moderate thermal efficiency but can follow variations in demand or renewable generation output. Gas turbines, either open cycle or combined cycle, have small economic turn down capability and so tend to operate close to their maximum output, providing limited capability to respond to changes in power system loads.

The A Station at Torrens Island Power Station was built during the 1960s with the first unit being commissioned in 1967. By the time the first stage of BIPS enters commercial operation the A Station generating units will be more than 50 years old and well past their original life expectancy. To ensure reliable operation of the A Station units until BIPS is built, AGL is undertaking additional maintenance and overhaul work to allow the life of these units to be safely extended for a limited time.

BIPS will deliver tangible benefits to South Australia through the ongoing production of electricity at Torrens Island. BIPS will replace capacity that will come out of service when two units of the A Station at Torrens Island Power Station are mothballed in September 2019. The remaining A Station units will be progressively mothballed in 2020 and 2021.The B Station at TIPS will continue in service for the foreseeable future, except that once the BIPS is operational, the current fuel oil firing capacity at the B Station will be taken out of service, and liquid fuel capability transferred to BIPS.

The replacement of A Station capacity with BIPS will enable AGL to use that firm generating capacity to contract the supply of electricity to customers in South Australia. Once the BIPS project has reached certainty in terms of construction contracts, connection agreements and government approvals, AGL will be in a position to write electricity contracts against this firm replacement generating capacity.

Changes in the gas supply market across Australia has led to increased gas prices and potentially constrained physical supply. To ensure operational flexibility, particularly at times of high demand, dual fuel reciprocating engines capable of firing both natural gas and distillate are proposed for the BIPS. Natural gas will be the predominant fuel. The diesel fuel used in the reciprocating engines will be standard low sulphur automotive distillate.

The new power station will provide firm, flexible and dispatchable synchronous generating capacity, complementary to existing renewable generation, to allow electricity to be contracted and delivered to consumers reliably and securely. Importantly, the new highly efficient and flexible power plant will be available to meet summer loads and sudden disturbances in the power system that arise from time to time. The highly flexible engines will have very fast load response times and fast start time and be capable of delivering the full 210MW per stage from stopped in 5 minutes.

After evaluating a range of power generation technologies AGL determined that large scale reciprocating engines would provide the best technical and economic technology to meet the unique requirements of South Australia’s electricity system. It is expected that the new power station will play a critical role is securing reliable power supply for South Australia.

3.3 Summary of rationale

The rationale for the BIPS project relates to the high degree of peak demand in the South Australian energy market, forecast shortfalls in electricity supply due to increased demand, and the planned mothballing of the TIPS A station.

Specifically, the BIPS, will:

- Provide flexible engines with a fast start time, capable of meeting the required loads during peak times or when there are sudden disturbances or fluctuations to the State power system.

- Provide operational flexibility with dual fuel reciprocating engines capable of firing both natural gas and distillate.
- Combined inertia from partly loaded generators equivalent to single gas turbine units operating at full load.
- Black start capability independently available from all units.
- Improve reliability and security of supply in South Australia using modern, responsive technology that is more fuel efficient and less carbon intensive than the existing plant.
- Address the expected shortfall in conventional generation in South Australia and be consistent with the Government's call for new generating capacity to be built to address that shortfall.

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4 Project description

AGL propose to develop the Barker Inlet Power Station (BIPS) on Torrens Island, located in the southwestern portion of the island and about 15 km northwest of Adelaide (see Chapter 1, Figure 1.1). It will be located adjacent to AGL's existing Torrens Island Power Station (TIPS).

The proposed site is in the area zoned public purpose (power station) as per the *Land Not Within a Council Area (Metropolitan) Development Plan*. This plan includes objectives and principles of development control for the public purpose (power station) zone which seek, among other things, development for the purpose of the production of energy to be consolidated around the existing power station in the southern portion of the zone.

The public purpose (power station) zone is an area of strategic importance for the South Australian power generation industry. The existing use, location, size and nature of the zone allows for future opportunities for the expansion of AGL's existing infrastructure, such as the BIPS project.

The proposed development of BIPS will support growth in peak demand, providing a more reliable supply of energy to SA customers in light of the mothballing of TIPS A. To do this, AGL proposes to develop up to 420MW of additional peaking generation over a two stage development.

The power station configuration will initially have 12 engines capable of 210MW with a Stage 2 expansion of another 12 engines (210MW). The new configuration will also be capable of diesel firing, which will be implemented as market conditions require or if emergency conditions arise.

The project facilities will be constructed within a 4 ha area located immediately northwest of the existing power station facilities.

4.1 Existing power station

The Torrens Island Power Station comprises two sections known as TIPS A and TIPS B. Each section uses a steam cycle to generate electricity. This involves the combustion of fuel in a boiler to produce steam that is used to rotate a turbine coupled to a generator. TIPS currently has a total generating capacity of 1,280MW. TIPS A consists of four 120MW units commissioned between 1967 and 1971 and TIPS B has four 200 MW units commissioned between 1975 and 1980. TIPS A and B can operate continuously using natural gas as a fuel source. Two units at TIPS B can also operate for limited run times using fuel oil. TIPS features two 160 m high chimneys.

The principal fuel for both sections is natural gas supplied by two pipelines, one from Moomba in northern South Australia (the EPIC pipeline) and the other from Iona near Port Campbell in Victoria (SEAGas pipeline). Fuel oil, stored on site, is used as a back-up in the event of gas restrictions or constraints.

All eight units within the two sections can operate independently of each other. However, there are some common station utilities and systems such as fuel oil storage, water treatment and storage, and compressed air systems, as well as operations and maintenance support systems. Plate 4.1 shows the existing TIPS site.

4.2 Barker Inlet Power Station

The staged development of BIPS will ultimately lead to 420MW of new generation capacity being installed, with Stage 1 providing 12 engines capable of 210MW and Stage 2 providing another 12 engines also capable of 210MW. The timing of the Stage 2 is dependent on the future forecasts of supply and demand in the National Electricity Market. At this time the schedule for building Stage 2 has not been determined. Table 4.1 provides a summary of the key features of the proposed expansion.

There are two conceptual options for the BIPS Stage 1 layout (Figure 4.1) being proposed by the two contractors currently tendering for the project. Stage 2 will essentially be the mirror image of Stage 1 and the general area is indicated on the figure. The layouts provided are conceptual and will be refined during the detailed design phase. The development will however remain within the proposed project area. Plate 4.2 show the general BIPS project area and Plate 4.3 an aerial photograph of BIPS site.

Table 4.1 Summary of key features of proposed project

Item	Proposed project
Project location	Located in the southwestern portion of the Torrens Island about 15 km northwest of Adelaide.
Project footprint	Approximately 4 ha
Power station	Stage 1: 12 reciprocating engines capable of 210MW Stage 2: 12 reciprocating engines capable of 210MW
Dimensions of engine house	Approximately 100 m x 70 m for each stage.
Stacks	There will be six exhaust pipes per structure (i.e., there will be two stack groups for Stage 1 and another two for Stage 2) at 30 m in height.
Project lifespan	The design life is 25 years.
Access	Access to the site will be via the existing road and via the Grand Trunkway. A relocation of an internal road to the north east of the BIPS site will be required.
Operating hours	Available for operation 24 hours a day, 7 days a week
Employment	Construction workforce on average 200-300 staff over an 18 month period. Operational and maintenance workforce will not increase as the existing TIPS personnel will transition to BIPS.

4.2.1 Reciprocating engines

The proposed reciprocating engines were originally developed for marine applications, primarily LNG ships using boil-off gas as fuel. They are currently used for power generation projects across the world. Their typical power generation application is in relatively weak grids, including large mines, and in support of variable dispatch generation such as wind farms.

Photo credit: AGL

Plate 4.1
The existing TIPS site

Photo credit: AGL

Plate 4.2
The proposed BIPS site

Photo credit: Google Earth

Plate 4.3
Aerial photo of the proposed BIPS site

The power station will consist of multiple smaller units (18MW) operating as a single dispatchable power station. The highly flexible engines will have very fast load response times and fast start time, capable of delivering the full output from stopped in 5 minutes. The typical layout of a set of 12 reciprocating engines (as is proposed for Stage 1) is provided in Figure 4.2.

The power station control system will be configured to operate all the units as a virtual large single generating unit. It will be capable of coordinating the start and loading of individual generator sets to follow a single load signal while achieving best thermal efficiency while maintaining very fast dynamic response and optimising synchronous inertia connected to the network.

The dual fuel reciprocating engines have superior generating efficiency (20-30% better) compared to gas turbine and steam plants of comparable size. The gas consumption per unit of electricity generated approaches the best thermally practical as represented by the sea water cooled Pelican Point and Osborne power stations, but without the need for sea water cooling and with much faster start times and dynamic response. The air cooled BIPS plant will not put any additional heat loading into the Port River system. As the TIPS A Station is taken out of service and mothballed, the heat from the A Station currently dissipated into the river will reduce to zero. The B Station will continue its existing operation (other than the fuel oil firing, once decommissioned) using river water for cooling.

Changes in the gas supply market across Australia has led to increased gas prices and potentially constrained physical supply. To ensure operational flexibility, particularly at time of high demand, reciprocating engines capable of firing both natural gas and distillate are proposed. Natural gas will be the predominant fuel. Dual fuel engines have the ability to use a backup liquid fuel when gas supply is interrupted. The diesel fuel used in the reciprocating engines will be standard low sulfur automotive distillate.

The combustion products will be discharged via 30 m stacks which will be grouped as six exhaust pipes per structure (i.e., there will be two stack groups for Stage 1 and another two stack groups for Stage 2). When operating on either gas or diesel emissions will be controlled to be within the limits set out in the Environment Protection (Air Quality) Policy 2016 by the installation of selective catalytic reduction (SCR) units to reduce NO_x emissions in the exhaust gases to acceptable levels. SCR on the BIPS plant will always be in operation for both gas and diesel firing operation to control the NO_x to the levels that have been modelled.

The use of cleaner diesel together with catalytic emission reduction will result in lower emissions than the current TIPS B on the rare occasions when liquid fuel is used.

4.2.2 Timing of development

BIPS will be developed in two stages, each of nominally 210MW capacity. The first 210MW stage, consisting of 12 x 18MW reciprocating engine generator sets is planned to commence construction in early 2018 with commercial operation in mid-2019 (Figure 4.1).

BIPS will replace capacity that will come out of service when two units of the A Station at Torrens Island Power Station are mothballed in September 2019. The remaining two units of the TIPS A Station will be progressively mothballed in September 2020 and September 2021.

When Stage 1 is in commercial operation the fuel oil firing capacity at the TIPS B station will be de-commissioned. Liquid fuel operation capacity will be transferred from TIPS B to BIPS. The

TIPS heavy fuel oil firing will be replaced with those from the reciprocating engines operating with SCR during the rare times that liquid fuels are used. The use of SCR is expected to result in lower emissions than the current TIPS.

The timing of the second stage of the BIPS project will be dependent on market conditions and therefore no definite timing has been determined at this stage. Table 4.2 summarises the timeframe for development.

Table 4.2 Timeframe for development

Timeframe	Development activities
Early 2018	Construction of BIPS (Stage 1) commences
Mid 2019	Commercial operation of BIPS (Stage 1) Mothballing of two units of the TIPS A Station Fuel oil firing capacity at TIPS B Station will be taken out of service and liquid fuel generating capability will be transferred from TIPS B to BIPS
2020 - 2021	Progressive mothballing of remaining two units of the TIPS A Station
No definite timing	Construction of BIPS (Stage 2) commences (dependant on market conditions and mothballing plans for the TIPS A Station) Commercial operation of BIPS (Stage 2)

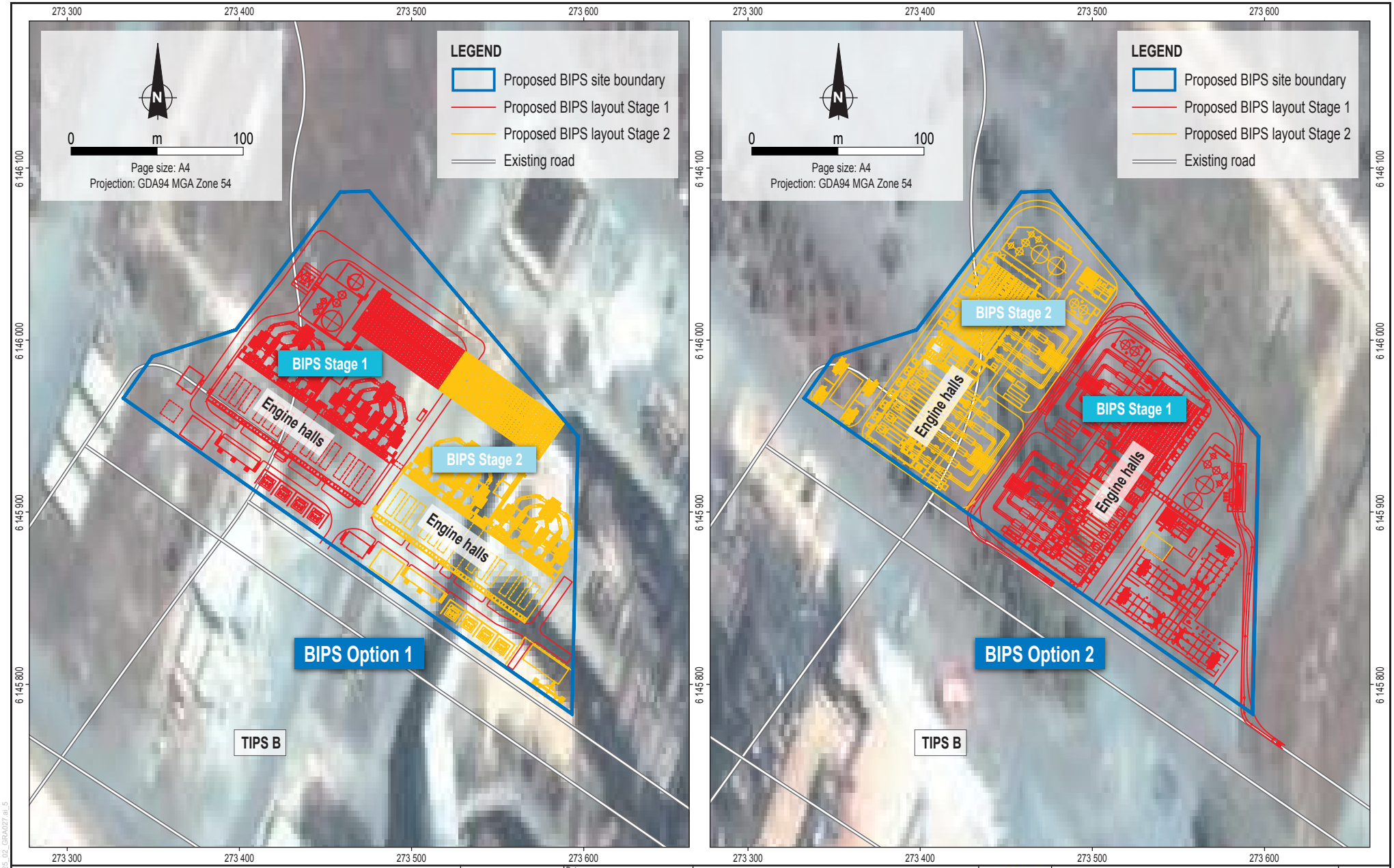
4.2.3 Construction

Construction will be conducted and managed to avoid impacts on the environmental aspects of the site and its surrounds. As groundwater is only 2 m below the ground surface in the area of the site, care will be taken in construction to ensure the groundwater in the area is not affected. Section 6.9.3 provides details on groundwater management during construction.

Prior to commencement of construction works, the contractor will prepare detailed construction programs and methods including a Construction and Environmental Management Plan (CEMP). Details of the content of the CEMP are provided in Chapter 7.

These plans and programs will demonstrate compliance with the conditions of consent for development and other statutory requirements. Construction activities will include:

- Mobilisation – establishing the site with equipment and facilities necessary to execute the construction phase.
- Clearing – minimal vegetation clearing will be required for the arrangement of the new infrastructure. All cleared vegetation will be forwarded to a green waste facility for recycling or used as part of the site landscaping works.
- Laydown of construction materials – materials used for construction will be placed within the laydown area.
- Bulk earthworks – a nominal fall will be applied to the platform to provide adequate site surface drainage. Dust suppression, water containment and water extraction will be employed during the bulk earthworks program. Sand excavated during bulk earthworks will be used as fill or will be disposed of in an appropriate manner.



Source:
Aerial photography and infrastructure data from AGL.

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Date: 31.10.2017
Project: 754-BNEEN202225
File Name: 202225_02_F04.01_GRA

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Conceptual site layout options

Figure No: 4.1

AI Reference: 202225_02_GRA027.ai_5

ENGINE HALL						
Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
1	12	SQA	Engine generator set W18V50DF		371780	+0.000
5	12	MOD	Engine auxiliary module 3.0		9696	+0.000
7	12	PCC	Engine fuel booster (LFO only)		6258	+0.000
124	12	ZAC	Compact gas ramp		1350	+0.000
157	12	QBF	Oil mist separator unit		250	+1.335
203	6	TSB	Starting air bottle	4,8	2023	+0.000
250	2	VBA	Maintenance water tank	10	11500	+0.000
300	24	NGA	Intake air filter		2510	+1.336
350	12	NHA	Exhaust gas module		10240	+4.490
355	12	NHA	Exhaust gas ventilation unit		200	+3.450
653	12	BAN	Neutral point cubicle			+0.000
659	3	BFB	Station transformer			–
668	12	CFE	Local control panel			+0.000
701	12	EAA	Ventilation unit, aux. area 18 m³/s		2100	+1.336
702	25	EAA	Ventilation unit, engine hall 18 m³/s		2600	−0.200

LV / MV / CONTROL BUILDING						
Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
650	4	AEE	Substation control panel			+2.000
652	3	BAC	MV Switchgear			+2.000
655	1	BEY	DC–system			+2.000
656	2	BFA	LV Switchgear			+2.000
661	1	BLI	Lighting panel			+2.000
664	1	BLN	Fire detection panel			+2.000
666	1	CFA	Control panel, common			+2.000
667	12	CFC	Control panel, engine wise			+2.000
678	1	BLN	Gas detecting panel			+2.000
679	1		Office IT equipment			+2.000
684	1		CCTV			+2.000

COMPRESSOR, FEEDER AND TRANSFER PUMP BUILDING						
Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
113	3	PCA	LFO feeder unit			
154	1	QAE	LO transfer pump unit		470	
200	2	TCA	Instrument and working air unit			+0.000
201	1	TCB	Instrument air bottle			+0.000
202	2	TSA	Starting air unit			+0.000
553	1	VBD	Water booster unit			
713	2		Ventilation unit			

SITE AREA						
Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
251	48	VCA	Radiator (low noise)		6200	+6.000
252	12	VEA	Expansion vessel	1,2	1450	+7.500
351	12	NHA	Exhaust gas silencer		7200	+4.590
356	36	–	Rupture disc		365	
403	12	YBA	SCR			
500	4	DAD	Oily water collecting pit	2,5		
551	1	VBB	Water treatment container		5000	
552	1	VCB	Treated water tank	10	11470	
602	1	VFC	Fire pump station		5000	
651	4	AET	Step-up transformer			
663	1	BLM	Black starting unit		5500	

Plan

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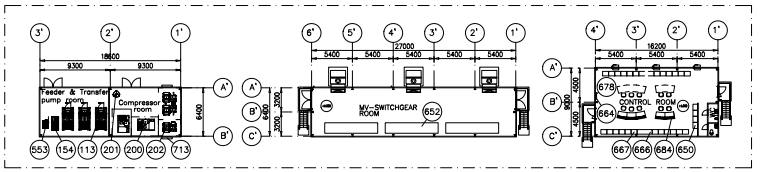

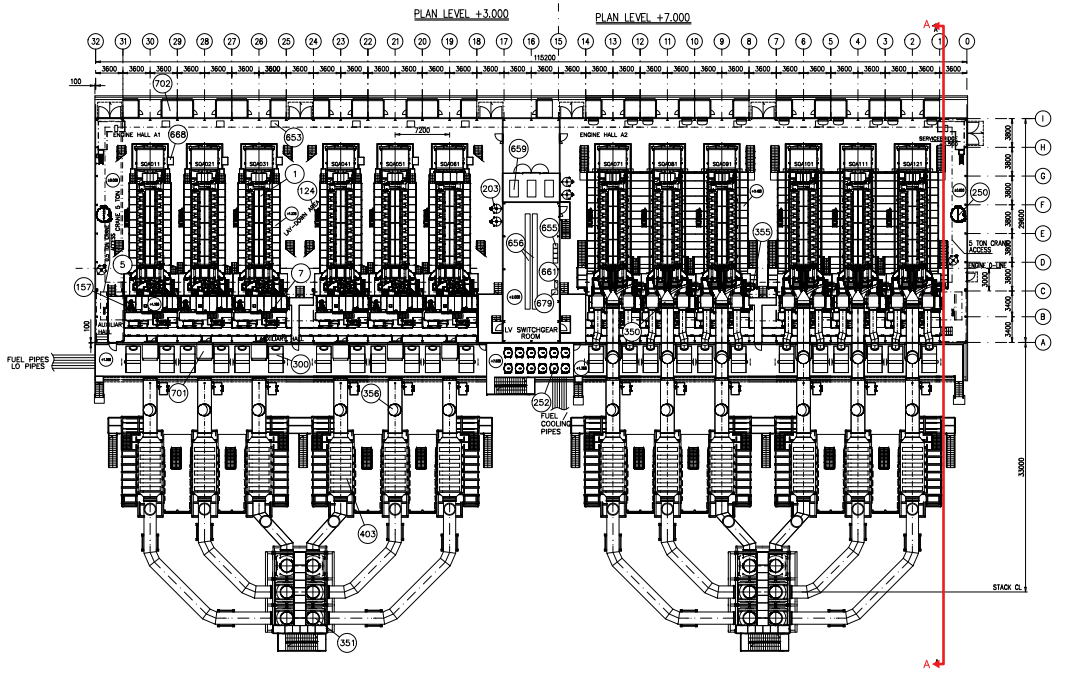

Section A–A

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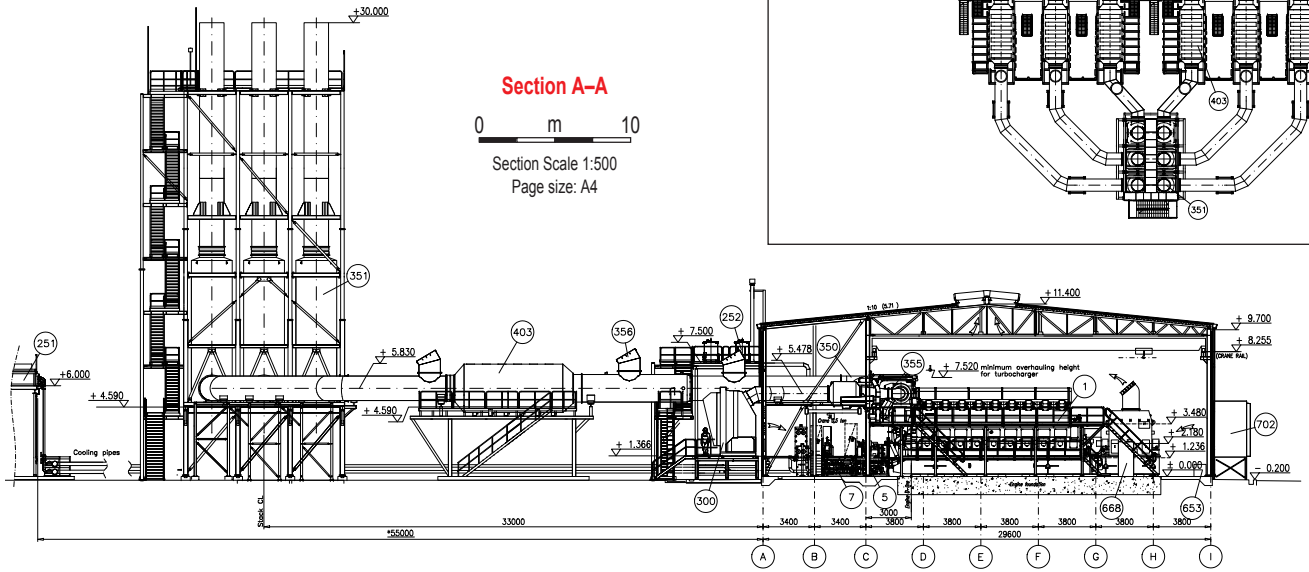

Source:
Infrastructure data from AGL (Wärtsilä).

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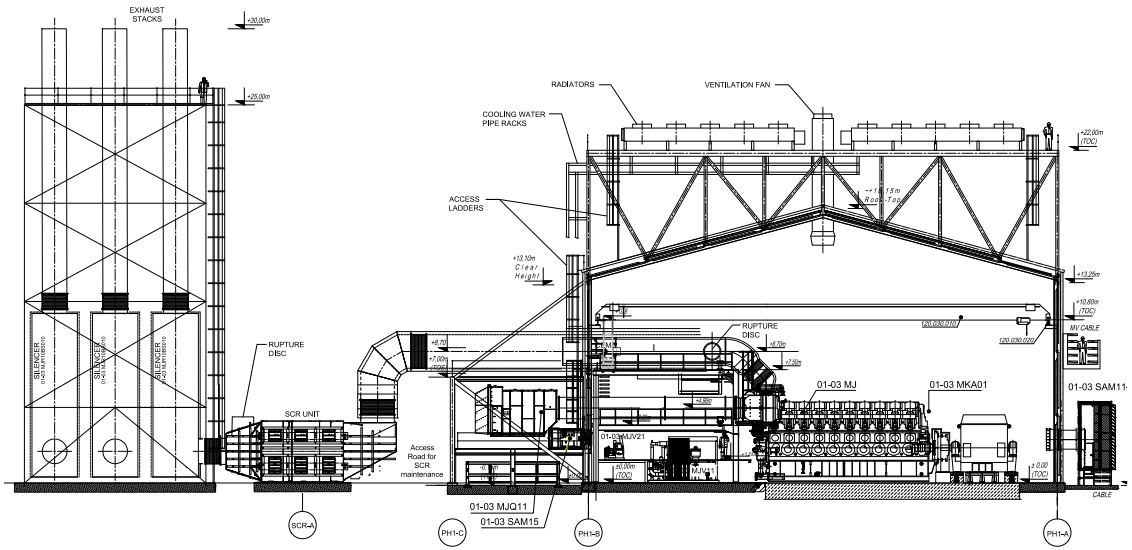
Layout of a typical reciprocating engine house Option 1

Figure No: 4.2a

AI Reference: 202225_02_GRA006.ai_7



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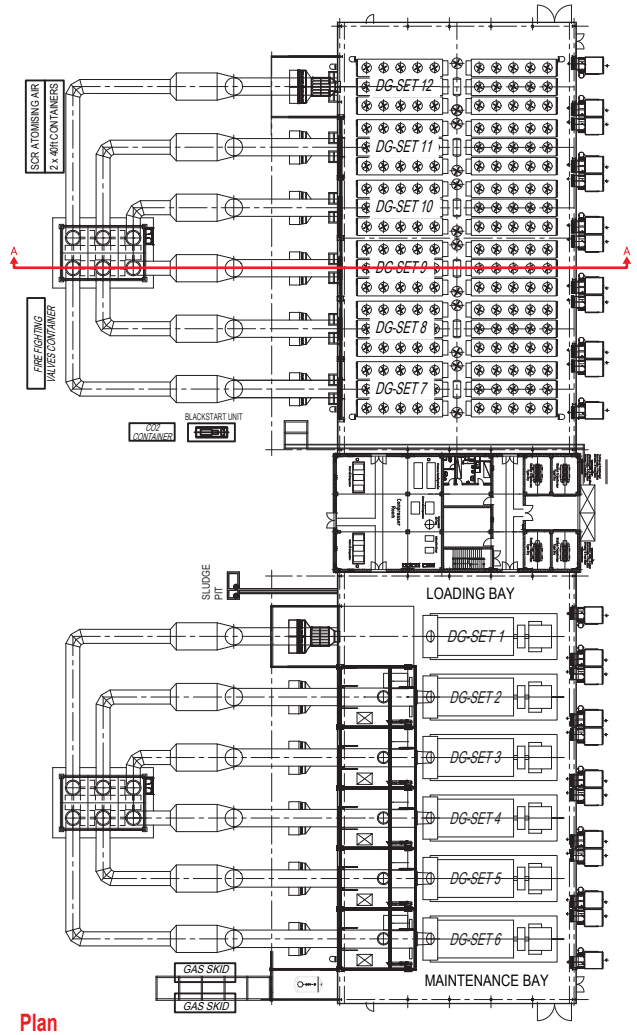

Plan

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Source:
Infrastructure data from AGL (UGL)

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Project: 754-BNEEN202225
File Name: 202225_02_F04.02b_GRA

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Layout of a typical reciprocating engine house Option 2

Figure No:
4.2b

AI Reference: 202225_02_GRA006.ai_6

- Establishing and preparing foundations – footings for major plant items and buildings will be established on appropriately designed piles where necessary. The detailed design and construction of the foundations will take into account future subsidence and include a means of monitoring ground movement.
- Construction of buildings and plant – where possible, to minimise the construction time, prefabricated components will be imported to the site and erected during construction. Mobile cranes will be used to erect and complete the construction of heavy plant items.
- Demobilisation by removing all construction equipment and facilities and rehabilitation of areas impacted by construction activities.

All plant, equipment, buildings and services will be supplied, erected, operated and maintained in accordance with the relevant Australian Standards and the Building Code of Australia. Where an appropriate Australian Standard may not exist, the most suitable International Organisation for Standardisation (ISO), British, American or approved alternative standard will be used.

Construction will require heavy loads of plant and equipment to be delivered to the site. The main components of the power station will be assembled overseas and delivered to the site using special haulage vehicles. The remaining plant and equipment will be erected on the site. The proposed site is adjacent to a sufficiently large and cleared parcel of land to permit laydown and parking within the area. A traffic assessment is provided in Section 6.13.

4.2.4 Gas receiving and metering station

The reciprocating engines of BIPS will be provided with gas from the existing natural gas supply transported to the site via the SEAGas pipeline from Victoria's Otway Basin and the EPIC pipeline from Moomba. AGL has contracts with both pipeline operators that allows gas to be sourced through either pipeline. This provides a high level of security of supply as well as commercial competitive tension.

New underground gas pipelines from the existing TIPS gas distribution system will be constructed to the BIPS infrastructure. New fuel gas pipelines and any associated gas conditioning equipment will be designed, constructed and installed in accordance with the relevant legislation and Australian Standards.

4.2.5 Bulk liquids receiving and storage

Diesel will be transported to site via trucks using heavy truck routes. A diesel receiving area is proposed as part of the BIPS with up to two truck unloading bays.

It is estimated that approximately 1-2 diesel fuel trucks will be delivered each week. The diesel will then be loaded into a tank onsite which will have a capacity of approximately 1,500 m^3. Diesel will then be supplied to the BIPS as required.

There will be a reduction in the liquid fuel storage volumes on Torrens Island from the current capacity of 16,000 m^3 to approximately 1,500 m^3.

The diesel tank will be managed in accordance with the requirements of the relevant legislation (*Workplace Health and Safety Act 2012*). Diesel is a class C1 combustible liquid and not listed in the Australian Dangerous Goods Code. The diesel tank will be installed in accordance with

relevant regulatory guidelines, Australian Standard AS1940:2004 Storage and Handling of Flammable and Combustible Liquids and other relevant standards.

Lubricating oil will be received by road tanker within the diesel unloading bay and stored in bulk storage tanks of nominally 100 m^3 contained within a bunded area. Lubricating oil is not classified under as a dangerous good under the Australian Dangerous Goods Code.

Both the diesel and lubricating oil storage areas will be fitted with fire detection and protection systems.

Urea used for controlling air emissions in the Selective Catalytic Reduction units will be transported and stored on site as 40% solution. Urea tankers will be unloaded in a dedicated bunded unloading bay and stored in a bunded storage tank of nominally 500 m^3 capacity. Urea is not classified under as dangerous good under the Australian Dangerous Goods Code.

Other smaller tanks will be provided to store and then recover lubricating oil and radiator water during maintenance activities to minimise wastage and potential loss of containment. These storage tanks will be situated within bunded areas.

4.2.6 Transmission connection

The new power station will be connected to ElectraNet's 275kV network by extending the western bus of the B Yard of their Torrens Island switch yard using gas insulated switchgear equipment. The connection between ElectraNet and BIPS will be by buried cable. The formal process for preparing a transmission connection agreement with ElectraNet and AEMO connection approval is in progress. The ElectraNet connection point location is provided in Figure 4.3.

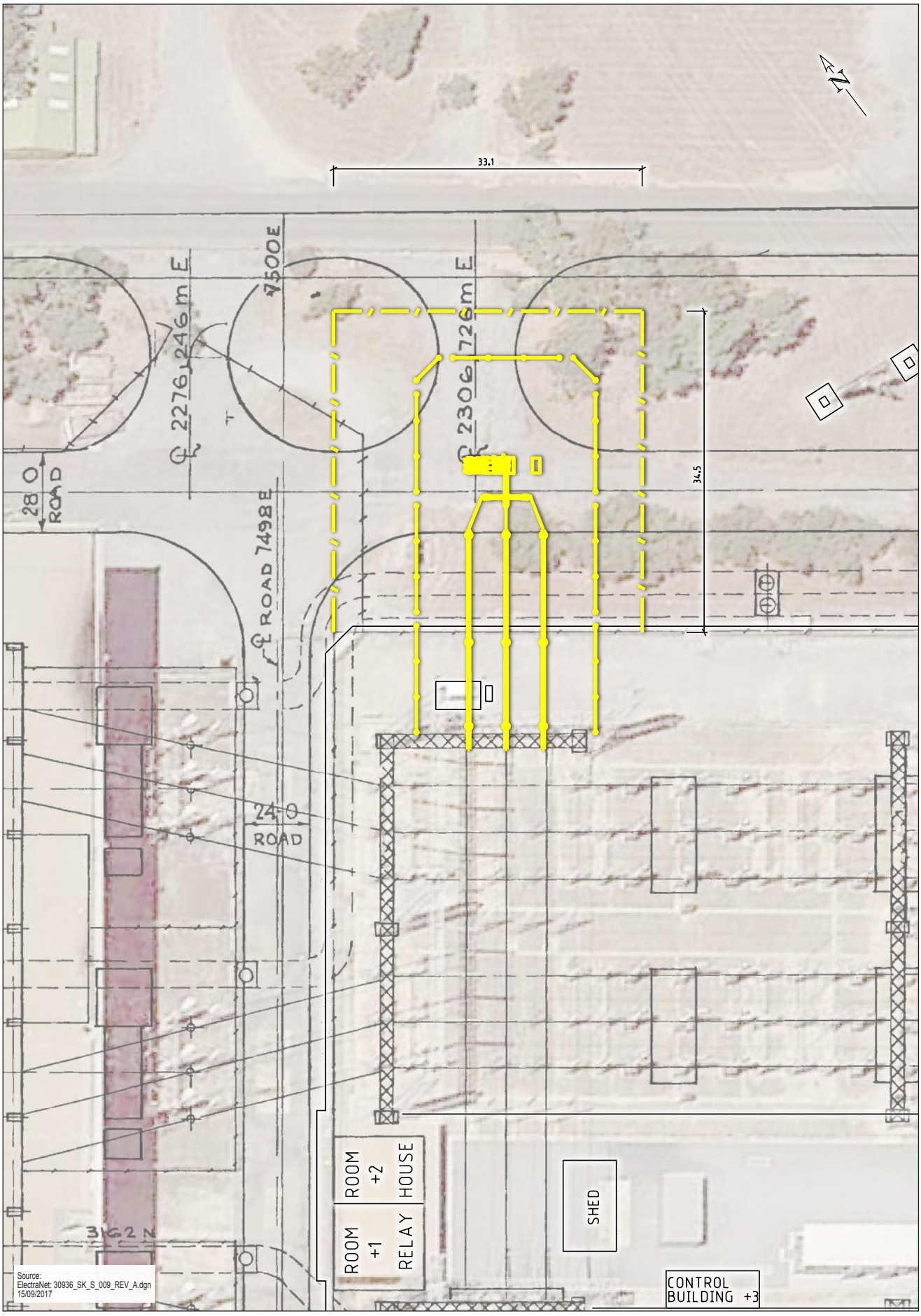
4.2.7 Water supply

Water is required for the use of amenities on site and fire protection of the entire power plant. There are several water storage facilities at the existing power station. Water for fire services and domestic use will be sourced from the two existing main town water storage tanks, each having a capacity of 2,250 kL. The town water storage tanks are supplied from the SA Water mains system.

Demineralised water from the existing power station may be used for filling the radiators, if required.

4.2.8 Surface water management

The site drainage systems for the BIPS will be segregated so that potentially contaminated surface water runoff will be kept separate from clean rainwater runoff. Design of the power station will ensure that only clean water flows into the stormwater system.



coffey A TETRA TECH COMPANY	Date: 29.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F04.03_GRA	AGL Energy Limited Barker Inlet Power Station	agl	ElectraNet connection point	Figure No: 4.3

AI Reference: 202225_02_GRA039.ai_1

Clean water

As outlined in the Tonkin Consulting water management plan (Appendix E), clean stormwater will be captured from the following areas and diverted to the stormwater treatment train as shown in Figure 4.4:

- **Roads and hardstand.** Stormwater from roadways and hardstand areas will be directed, using kerb and gutter or concrete spoon drains to the underground drain via inlet pits. The drain will have a flat grade to reduce the invert of the downstream treatment system. The runoff could contain silt, suspended solids and attached pollutants, hydrocarbons and heavy metals which would mainly be sourced from vehicles and machinery traversing the site. Potentially contaminated water will first be directed to an oil/water separator before discharge to the stormwater system.
- **Gravel.** Limited runoff will be generated from the gravel areas as they will act in a similar manner to the existing site conditions. In the areas nominated to be gravel, it is proposed that a single sized gravel layer be used and underlain with a sandy sub-grade material. Rainfall falling on the gravel surface will retain water onsite to infiltrate rather than quickly running off. This will reduce erosion and the generation of suspended solids when runoff does occur. Runoff that does occur will be collected by the stormwater drainage system and directed to the stormwater treatment train.
- **Roofs.** Runoff from roofed buildings is considered ‘clean’ and will be directed to the bio-retention basin (see Figure 4.4). As the site is typically unmanned, and other operational water uses identified are small, it is unlikely that there would be sufficient demand for roof water reuse to warrant installation of rainwater tanks. The use of rainwater tanks to capture water from the roof will be considered if there is sufficient demand for its use in the future.
- **Bunded Areas.** Rainfall on bunded areas will be contained by the bund and will evaporate over short time frames. When an undesirable build-up of stormwater occurs the water will be directed to the onsite Class 1 separator to achieve a concentration of less than 5mg/L of oil under standard test conditions. This will have an emergency shutoff and alarm system.

The stormwater treatment train is likely to consist of the following:

- Gross pollutant trap (GPT) to capture trash, course and fine sediments.
- Spill control system to capture hydrocarbon-based pollutants from accidental spills.
- A bio-retention basin to allow settlement and nutrient uptake of total phosphorus, total nitrogen and any remaining total suspended solids.

The bio-retention basin will be designed to reduce direct stormwater discharges to the Angas Inlet. The water from the basin will dissipate through evaporation and infiltration thereby efficiently removing suspended solids and attached pollutants and minimising the volume of stormwater that is discharged directly to the waterway by up to 50 to 98 percent (depending on the infiltration rate). Any outflows from the basin will be controlled by a valve and will be connected to an existing drain located close to the site of the basin (see Figure 4.4). The contamination assessment (Appendix F) identified that the underlying soil profile in the vicinity of the proposed bio-retention basin is suitable for stormwater infiltration (the soil generally consists of a fine to medium grained sand with no evidence of contamination).

Source:
From Tonkin Consulting 'Stormwater Management Plan', Appendix A

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Project: 754-BNEEN202225
File Name: 202225_02_F04.04_GRA

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Barker Inlet Power Station

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Proposed stormwater management plan
(Stage 1 - Option 1)

Figure No:
4.4

AI Reference: 202225_02_GRA015.ai_4

If necessary, excess water may be discharged to the marine environment via the existing TIPS storm water system in accordance with the Environment Protection (Water Quality) Policy 2015 requirements.

Potentially contaminated water

The site will have liquid storage tank yards and unloading zones where there is potential for spills or leakages to occur. These areas will be bunded in accordance with the Bunding and Spill Management Guidelines (EPA, 2016).

Surface water from the facility that may potentially be contaminated includes:

- Wash water from washing and cleaning of various components.
- Rainfall runoff from bunded plant areas of the site.
- Spills within a bunded area.
- Accumulated water within bunds.

Water from these areas will be directed through an interceptor system designed to remove any oil and grease, and minimise suspended solids to an acceptable level prior to discharge to the sedimentation pond or bio-retention pond. The engine hall will also be bunded to contain any contaminated water that might be created from wash down activities. Wash down of the plant equipment inside the engine hall or small workshop would be infrequent and would be limited to specific maintenance activities. Water will only be discharged if the water quality meets the EPA requirements for discharge to the marine environment.

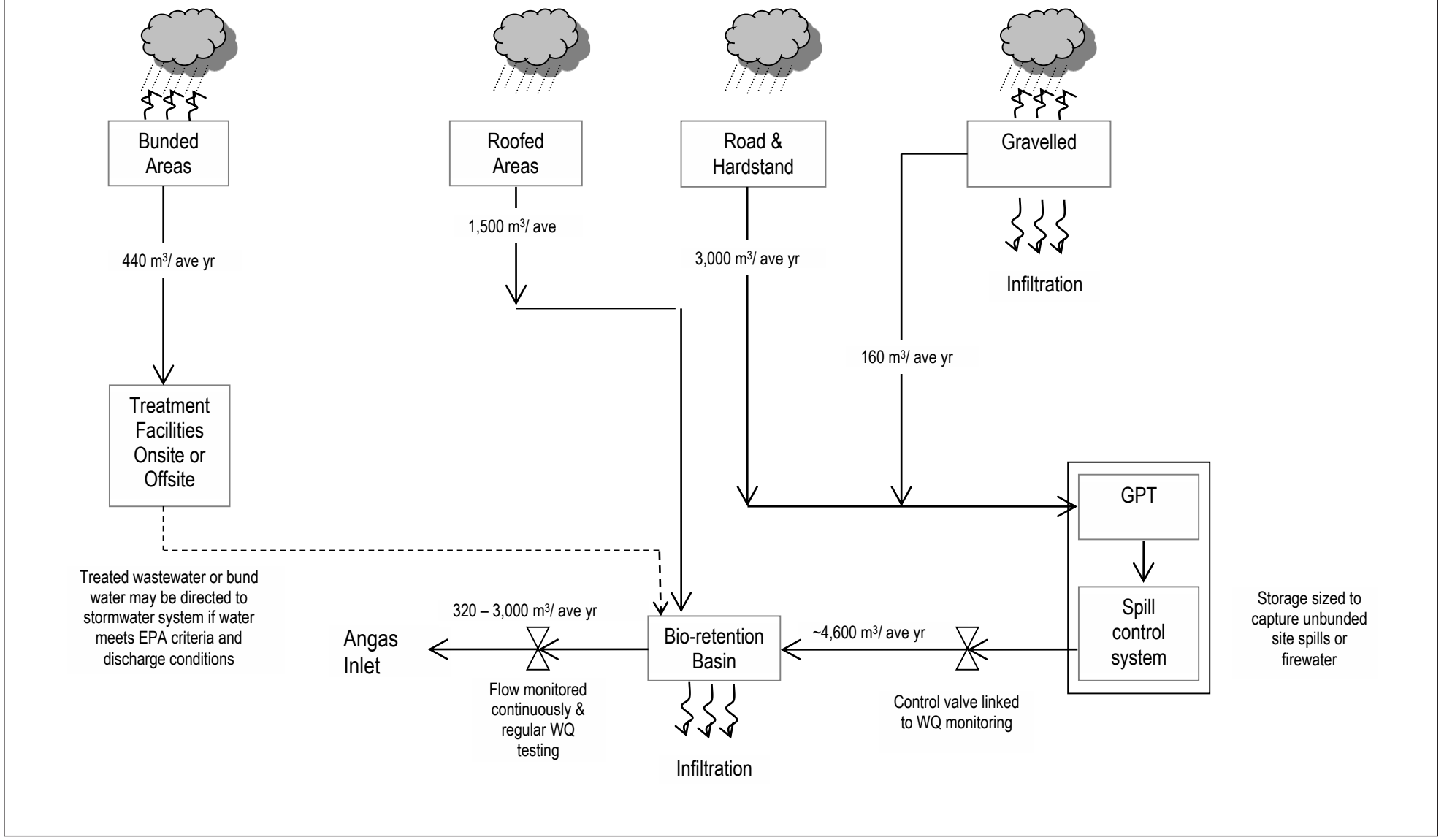
The outlet from the bio-retention basin will operate automatically, but can also be closed manually. In the event of highly contaminated water residues forming, these will be contained within the interceptor system or bunds and be disposed off-site by a licensed contractor in accordance with EPA requirements. The stormwater management flow diagram is shown in Figure 4.5.

4.2.9 Sea level rise management

The Intergovernmental Panel on Climate Change (IPCC) was established to provide independent advice on climate change. It was recognised that human activities were a major catalyst to the increasing amount of greenhouse gas in the atmosphere. The first of the IPCC Assessment Reports served as the basis for negotiating the United Nations Framework Convention on Climate Change (UNFCCC).

Climate change and related sea level rise are based on IPCC predictions for a number of different scenarios with the most recent IPCC report being the Fifth Assessment Report (IPCC, 2014).

The top (high emission scenario termed RCP 8.5) of the IPCC scenarios indicate that the global average sea level could rise by nearly 1 m by 2100 (0.45 to 0.82 m from a 1986 to 2005 baseline). The lowest emissions scenario (termed RCP 2.6) indicates, then global average sea level could rise by between 0.26 to 0.55 m by 2100 (compared to a 1986 to 2005 baseline).



Source: From Tonkin Consulting Stormwater management flow diagram' Appendix B	coffey A TETRA TECH COMPANY	Date: 29.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F04.05_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Stormwater management flow diagram	Figure No: 4.5

AI Reference: 202225_02_GRA040.ai_1

The predicted range of sea level rise for the period 2046 to 2065 is 0.17 to 0.32 m (average 0.24 m) for the low emission scenario and 0.22 to 0.38 m (average 0.30 m) for the high emission scenario (IPCC, 2014). These predicted ranges vary with geographic location, although the values can give an indication of future sea level rise to design the project to allow for future sea level rise where possible.

The Climate Change Adaptation Framework for South Australia (DEWNR, 2012) aims to guide action by government agencies, local government, businesses and the community to be better prepared for climate change impacts. The report modelled the sea level rise predictions from the 2002 IPCC projections, which indicated that a 0.5 m sea level rise would flood the centre of Port Adelaide (DEWNR, 2012).

In South Australia, the sea level rise protection requirements are set out in the Coast Protection Board Policy Document (Coast Protection Board, 2016) and subsequently within the Land Not Within a Council Area (Metropolitan) Development Plan.

The Development Plan stipulates that:

> *All new developments must allow for sea level rise due to natural subsidence and predicted climate change during the first 100 years of the development.*
>
> *The storm tide, stormwater and erosion protection requirements need to be based on an anticipated rate of sea level rise due to global warming of 0.3 metres between 1991 and 2050. Development should also be capable of being protected against a further sea level rise, and associated erosion, of 0.7 metres between 2050 and 2100.*
>
> *The standard sea-flood risk level for a development site is defined as the 100-year average return interval extreme sea level (tide, stormwater and associated wave effects combined), plus an allowance for land subsidence for 50 years at that site.*

The requirements set out in the Development Plan are consistent with those contained in the current Coast Protection Board Policy (Coast Protection Board, 2016), which sets out requirements for protection of coastal development from the effects of high tide and sea level rise.

Tonkin Consulting prepared an assessment of the impacts of flooding due to extreme tide and sea level rise was carried out for the City of Port Adelaide Enfield in 2005, as part of the Port Adelaide Seawater and Stormwater Flooding Study (Tonkin Consulting, 2005). While the project area is outside of the area, the findings for Inner Harbour are relevant to Torrens Island, which lies immediately adjacent to the project area. Tonkin Consulting (Appendix E) propose that the design level elements should cater for the 100 year storm tide, land subsidence, wave set up, wave run up and amplification. These are provided in Table 4.3.

Tonkin Consulting propose that the BIPS project should cater for the levels predicted for the Inner Harbour area which are 3.4 m AHD for the predicted sea level rise (including waves, tides and land subsidence) to 2050 and 0.7 m AHD to 2100.

During stakeholder engagement activities, the Department of Environment, Water and Natural Resources (DEWNR) Coast Protection Board have indicated an interest in ensuring the project is constructed to allow for predicted future sea level rise.

Table 4.3 Design level elements

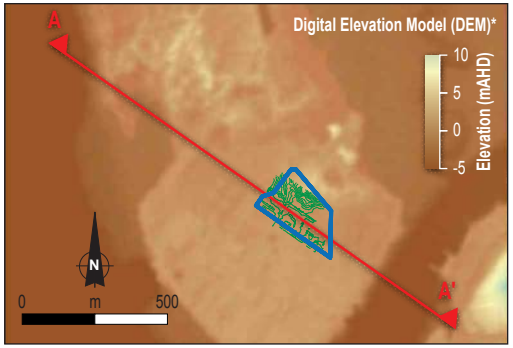
	Inner Harbor (m AHD)	Outer Harbor (m AHD)	Gillman (m AHD)
100 year ARI storm tide	2.5	2.5	2.5
Sea level rise (to 2050)	0.3	0.3	0.3
Land subsidence	0.1	0.1	0.5
Wave setup	0.2	0.2	0.2
Wave runup	0.2	0.2	0.2
Amplification	0.1	-	-
Total (to 2050)	**3.4**	**3.3**	**3.7**
Additional sea level rise (to 2100)	0.7	0.7	0.7
Total (to 2100)	**4.1**	**4.0**	**4.4**

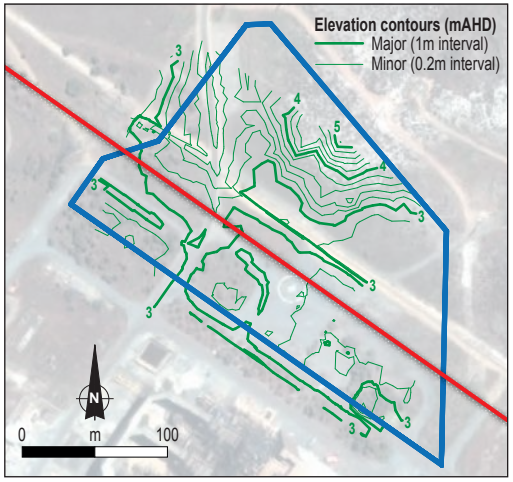
Flood protection strategy

Tonkin Consulting (Appendix E) provides an assessment of the sea level rise and a proposed flood protection strategy which is summarised below.

The project infrastructure will be designed and constructed to be above the predicted future sea levels. A flood protection strategy will also implemented, which will be refined after the project design is finalised. The proposed site and finished floor level levels will be approximately 3.4 m AHD, which will allow for 0.3 m of potential future sea level rise, plus the consideration of tides, waves and land subsidence predicted for the duration of the project (until 2050). The existing elevation at the site is approximately 2.8 m AHD to 3.0 m AHD, and a cross section of the initially proposed design levels are provided in Figure 4.6.

As the BIPS project design life is 25 years and the project would be mothballed or decommissioned at the end of its life (around 2045 to 2050), the proposed finished floor levels of 3.4 m AHD would provide protection from a 100 year ARI tide event with 0.3 m sea level rise and land subsidence within this period. If the project requires protection for the period 2050 to 2100, then protection measures against a further sea level rise of 0.7 metres of sea level rise and land subsidence will be implemented. This would be in the form of a sea flood protection levee or wall to a level of 4.1 m AHD around the development. If an embankment is constructed, further investigations would be undertaken to allow for the most appropriate design (e.g., a non-return valve may be required be installed on the outlet to the Angas Inlet so that tide levels do not back up through the storm water system thereby flooding the development).

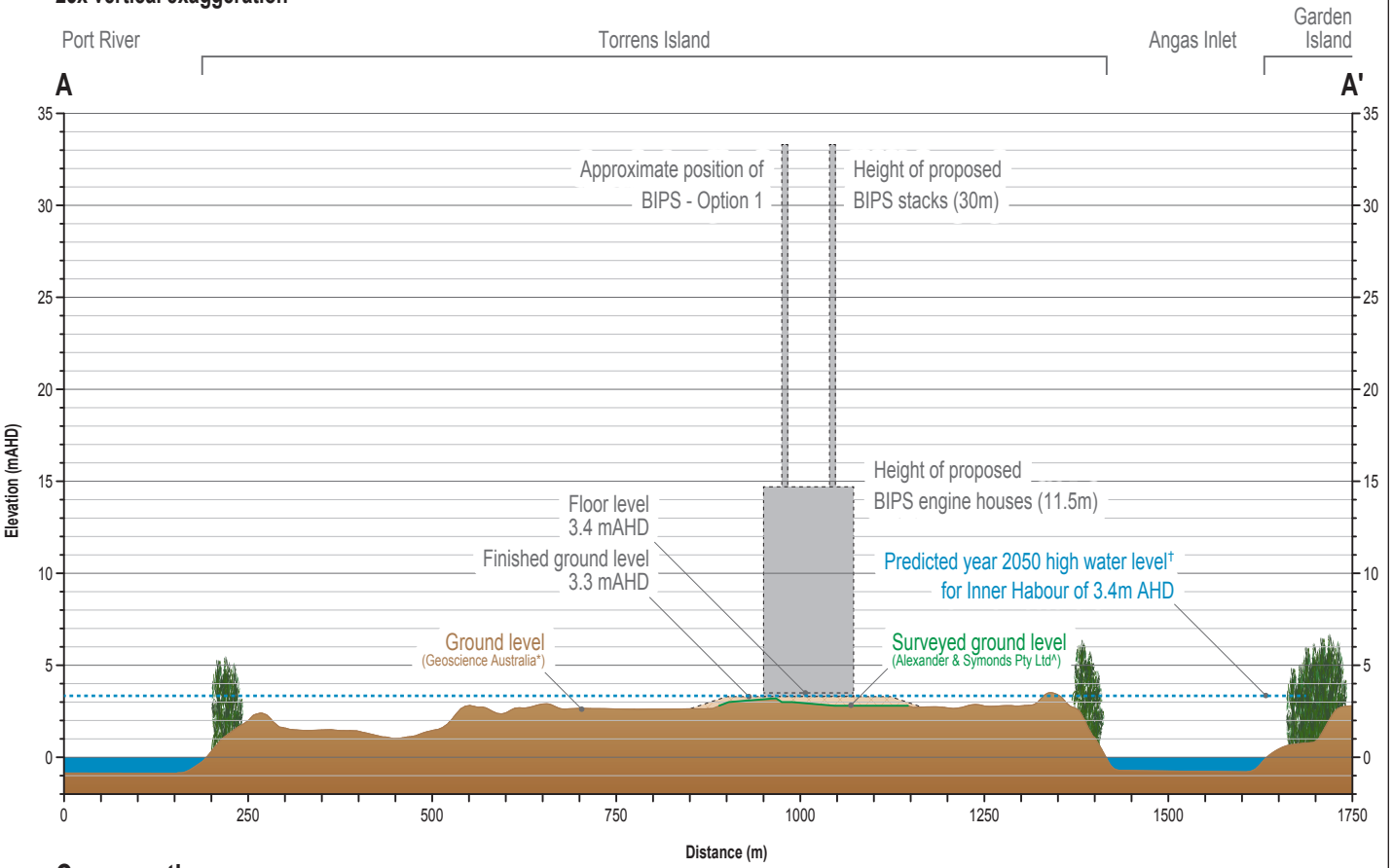




Cross section

Horizontal : Vertical = 25 : 1

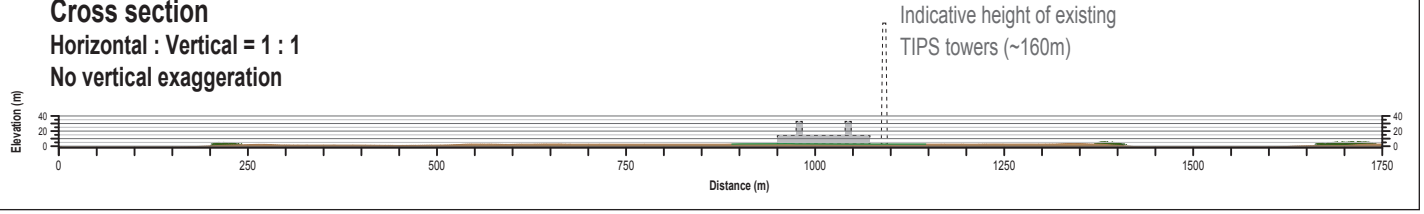
25x vertical exaggeration



Cross section

Horizontal : Vertical = 1 : 1

No vertical exaggeration



Source:
Aerial photography and infrastructure data from AGL.
^ Surveyed ground level from Alexander & Symonds Pty Ltd: Drawing A049017 DET (B1A).
* Digital Elevation Model (DEM) 5 Metre Grid of Australia derived from LiDAR from Geoscience Australia: Extract date: 2017-09-05T06:39:07
† Predicted year 2050 high water level from Tonkin Consulting takes into consideration 100 year storm tide, land subsidence, wave set up, wave run up and amplification.

coffey
A TETRA TECH COMPANY

Date: 29.09.2017
Project: 754-BNEEN202225
File Name: 202225_02_F04.06_GRA

AGL Energy Limited

Barker Inlet Power Station

agl

BIPS (Stage 1) topography and conceptual cross section of potential sea level rise

Figure No: 4.6

AI Reference: 202225_02_GRA022.ai_6

4.2.10 Waste management

Solid waste

The normal operation of the facility is not expected to generate significant quantities of solid waste. Most solid waste will be classified as 'inert waste' and will be generated from spent filters such as air, fuel and oil filters, as well as:

- Scrap metal from packaging waste and plastic cabling.
- General maintenance e.g., wood and cloth.

Solid waste will be segregated where possible into recyclable and non-recyclable waste products and disposed of appropriately by licensed contractors. Sediment and sludge from the bio-retention basin will be periodically removed and disposed of according to the EPA requirements.

Liquid waste and sewage

Liquid waste generated at the site includes waste oil and solvents.

All liquid wastes will be contained on site and where possible separated into recyclable and non-recyclable materials. They will then be disposed of by a licensed contractor in accordance with EPA requirements.

A small amount of wastewater will be generated by staff using the site. The additional wastewater from the BIPS is estimated to be less than 60 kL/year. Sewage from new amenities could be directed to an on-site proprietary wastewater treatment system (such as Advanced Wastewater Treatment System or Ecomax system) to ensure that there will be zero discharge from the site. Alternatively, it may be beneficial to connect the new facilities to the existing power station sewage treatment system. The final method of sewage management will be determined following more detailed assessments during the design phase.

The system will comply with the requirements of the SA Department of Health.

Chemicals and hazardous materials management

Due to the nature of the facility, only small quantities of chemicals and/or dangerous goods will be stored on site. The majority of bulk chemical requirements will be stored within the existing power station storage area.

Any chemicals required to be stored in the vicinity of the new power station will be stored in designated chemicals storage facilities that will comply with relevant Australian Standards, including but not limited to:

- Australian Standard AS 1940 (2004) The Storage and Handling of Flammable and Combustible Liquids (Standards Australia, 2004b).
- Australian Standard AS 4452 (1997) The Storage and Handling of Toxic Substances (Standards Australia, 1997).
- Australian Standard AS 3780 (2008) The Storage and Handling of Corrosive Substances (Standards Australia, 2008).

- *Workplace Health and Safety Act 2012* and Workplace Health and Safety Regulations 2012.

Suitable spill control will be provided around the site where required. A Hazard and Operability (HAZOP) study during the design phase will identify any required changes to the design, management, handling and storage activities to ensure appropriate management of chemicals and hazardous material.

4.2.11 Access road

The existing access road, which provides a thoroughfare to the northern areas of Torrens Island, will be redirected around the boundary of the TIPS site.

A short section of a new road will be constructed to allow for access around the east of the BIPS site. It will join the existing road providing access to the central and northern sections of Torrens Island.

The access to Torrens Island is via the Grand Trunkway bridge. The bridge has the appropriate loading limits for heavy machinery (400 t), which will be required during the construction phase. The additional traffic caused by the project is well within the theoretical roadway capacities, and the existing declared road network and local road network are generally in good condition and meet the relevant standards. The potential impacts to traffic are provided in Section 6.13.

4.2.12 Workforce and working hours

It is expected approximately 200 to 300 construction workers will be engaged on site for approximately 18 months during the construction of the project. While the specialised generation equipment will be sourced overseas, to the extent practicable, South Australian contractors and workers will be engaged to fabricate auxiliary systems, erect the plant and supply various services associated with a project of this magnitude.

The new power plant will be operated and maintained by personnel from the existing TIPS operations whose employment will be continued by transitioning from the mothballed TIPS A Station to the new BIPS plant.

The new power station will be available for operation 24 hours a day, 7 days a week.

4.2.13 Security system

A controlled security system currently applies across the existing power station and this will be extended to include the new power station.

The existing power station’s security system includes a chain mesh fence surrounding the entire site, topped with barbed wire. There is also an infra-red beam and microwave detection system with security closed circuit television (CCTV) cameras in several locations (including in the administration office), transferring images and alarms to the security office and control room. A similar security system will be adopted for BIPS.

Vehicle entrance to the power station site is currently only via a continuously manned security gatehouse with boom gate and electronically driven gates, which are normally closed outside of normal working hours.

4.2.14 Emergency Response System

The SA Police will be the coordinating agency for emergency incidents associated with BIPS, as is currently the case for the existing facilities. The SA Metropolitan Fire Service will be the controlling agency if the emergency is a fire or hazardous substance incident.

Emergency Response Plan(s)

The existing site emergency procedures will be reviewed to include the potential impact of the new facilities. Suitable Emergency Response Plan(s) will be developed in conjunction with government authorities for the construction and operation phases prior to those activities commencing.

All new staff will receive emergency procedures training as a requirement of the emergency response plan. The emergency procedures will include responses to emergency evacuation, injury, major asset damage or failure, critical power failure, spillages, major fire and threats.

Emergency shut-down system

An emergency shut-down system will be provided for the BIPS. This will shut off natural gas sources in the event of an emergency. Both remote operated manual and automatic initiation of the system will be included. The emergency shut-down system will be designed to be fail-safe.

Existing fire protection and detection system

A comprehensive fire protection and detection system is in operation on the existing power station site and is monitored from the control room. The fire protection system includes external and internal facilities including fire hydrants, water pumps, hose reel outlets, fire extinguishers and automated deluge controls. This system includes an alarm and indication system that provides a visual and audible alarm on the fire panel in the control room in the event of a fire, a failure of part of the system or non-availability of part of the automatic fire protection system. Routine maintenance checks and training of staff is conducted on site to ensure operational preparedness in fire-fighting situations.

New fire protection and detection systems

Details on fire protection and detection for the new power station will be developed during detailed design. The water supplies from the existing system are planned to be extended to cater for the fire protection of the new facilities. The design of the fire protection and detection system will be in accordance with appropriate statutory and other standards. Hydrants and sprinklers are likely to be installed around higher hazard areas containing combustibles (i.e., transformers, diesel and lube oil tanks). Electrical rooms will be protected with VESDA early warning detection and inert gas suppression systems. A fire indicator panel will also be located in the TIPS control room.

5 Stakeholder engagement

This section provides an overview of the stakeholder engagement activities conducted for the Barker Inlet Power Station (BIPS). It outlines the legislative requirements (Section 5.1) and objectives for the stakeholder engagement strategy (Section 5.2), the stakeholder identification and prioritisation process (Section 5.3), the engagement that has been conducted to date (Section 5.4) and the strategy for ongoing engagement (Section 5.5).

A development application for a preceding project, termed the Torrens Island Energy Park Project (comprising of an expansion of the existing power station and a gas storage facility) was submitted by AGL and approved with conditions under the *Development Act 1993* (Development Act) in November 2010 (010/V008/10). The BIPS project location is within the same parcel of land previously proposed for the Energy Park.

The project's development application underwent the statutory consultation process in 2010 and aspects which were raised included:

- Potential for impacts to the rare bitterbush and the associated bitter-bush blue butterfly (*Theclinesthes albocincta*) raised by the South Australian Butterflies group.
- Potential to impact the shorebird wader habitat located outside of the project area.
- Potential to impact on pre-existing site contamination.

These aspects have been addressed within Chapter 6.

5.1 Requirements for engagement

5.1.1 South Australian legislation

The BIPS project will be assessed under Part 4, Division 3 of the *Development Act 1993* (the Act), which provides for the assessment of Crown Development and public infrastructure. The BIPS project will be assessed under the public infrastructure provisions of Section 49 of the Act.

With respect to engagement, Section 49 (7d) stipulates the following:

> *If an application is for a development that involves construction work where the total amount to be applied to the work will, when all stages are completed, exceed $4 000 000, other than an application for a variation to an approved development that, in the opinion of the Development Assessment Commission, is of a minor nature, the Development Assessment Commission must—*
>
> *(a) by public advertisement, invite interested persons to make written submissions to it on the proposal within a period of at least 15 business days; and*
>
> *(b) allow a person who has made a written submission to it within that period and who, as part of that submission, has indicated an interest in appearing before it, a reasonable opportunity to appear personally or by representative before the Development Assessment Commission to be heard in support of his or her submission; and*
>
> *(c) give due consideration in its assessment of the application to any submissions made by interested persons as referred to in paragraph (a) or (b).*

The State Commission Assessment Panel (SCAP) will facilitate a process which invites public submissions and, if deemed necessary, hold a public hearing to hear from submitters. This will occur after the Environment and Social Assessment Report (ESAR) is submitted in October 2017.

The SCAP requires that a public notice be issued inviting all interested persons to make written submissions on the application and ESAR within a period of at least 15 days. In addition to this SCAP notice, AGL Energy (AGL) will contact key stakeholders with whom it has engaged with through the project and specifically advise them of the SCAP notice and the opportunity to provide a formal submission to SCAP.

The detailed description of the statutory consultation process under the Act is provided in Chapter 2.

5.1.2 AGL's approach to stakeholder engagement

AGL maintains a company-wide engagement policy and management standard that applies to stakeholders and the community. AGL's approach to stakeholder engagement is outlined in the 2017 Sustainability Report (www.agl.com.au/sustainabilityreport), and can be summarised in terms of leaving a positive legacy; AGL will strive to make a net positive social, economic and environmental contribution to the communities in which we operate. AGL's community engagement commitments that operate under this framework are that AGL will:

- **Be proactive:** we will engage with communities early and often, so that we understand and respond to their interests and concerns.
- **Be flexible and inclusive:** we will offer a range of engagement opportunities that are tailored to the variety of needs and preferences of the communities in which we operate.
- **Be transparent:** we will act honestly and ethically in all our dealings with the communities in which we operate.
- **Support our employees and contractors to engage well:** we will provide tools, peer support and training to enable our staff to deliver on our commitment.
- **Continuously improve our engagement:** we will evaluate the effectiveness of our engagement and modify it as needed to ensure that our activities address community needs and expectations.

5.2 Stakeholder identification and categorisation

The development of the present stakeholder engagement strategy and preliminary scoping of potential issues began with a review of the 2009 workshop that identified and mapped stakeholders. This workshop, facilitated by Coffey Environments (now named Coffey) in May 2009, was conducted as a central element of the stakeholder and SWOT (strengths, weaknesses, opportunities, threats) workshop. The workshop involved AGL personnel, Coffey Environments personnel, Planager Pty Ltd (risk management consultant), Specialised Native Title Consultants, Central Queensland Cultural Heritage Management, and South Australian government representatives.

The outcomes of the 2009 workshop were reviewed to establish a basis for the present stakeholder engagement strategy and address current stakeholder interests.

From both the review of the 2009 workshop and current work undertaken, more than fifty distinct stakeholders have been identified as likely to have an interest in, or potential influence upon, the project. A summary of meetings with key stakeholders is detailed at Table 5.1, and future stakeholder engagement activities are outlined at Section 5.3.1.

5.3 Stakeholder engagement strategy

The stakeholder engagement strategy was developed to satisfy legislative requirements and AGL's engagement policy and management standards.

Engagement with government – at a political and departmental level – is central to the strategy and appropriate to the Section 49 Crown Development assessment pathway. While the initial strategy was developed by Coffey Environments in 2009, the implementation of the updated strategy will be overseen by a team of AGL personnel representing the operation at the Torrens Island Power Station (TIPS), and the new BIPS project.

Some potentially affected stakeholders, including the City of Port Adelaide Enfield and the Kaurna people, were included in the initial strategy. AGL re-engaged with Kaurna representatives through the City of Port Adelaide Enfield and the Minister for Aboriginal Affairs and Reconciliation in August 2017.

5.3.1 Objectives

The stakeholder engagement strategy describes activities that will occur through the early phases of project development, including activities conducted prior to lodging the development application, during the government approvals process, and during construction activities.

AGL is committed to maintaining its reputation as a responsible company in the energy sector and ensuring that the project has the broad acceptance of its stakeholders i.e., that the project has a 'social license to operate' that will support its construction and ongoing operation.

To help obtain acceptance of the project by its stakeholders, the objectives of the engagement process for the project are to:

- Identify relevant stakeholders.
- Provide balanced and objective information to assist stakeholders in understanding the project, and its possible impacts and opportunities.

A list of engagement activities conducted to date is provided in Section 5.3.4.

5.3.2 Approach

The stakeholder engagement strategy was implemented through an action plan. The plan employed a range of methods to inform targeted stakeholders of AGL's development intentions and the process being implemented to obtain development approval.

5.3.3 Stakeholder engagement

Engagement with Government

Across the initial planning phase (2008-2010) and the current 2017 planning phase, AGL has engaged elected members from local, state and federal government, particularly local Members of Parliament and Ministers with responsibilities for state development, energy security, and planning. Similarly, AGL has engaged State government agencies and regulatory authorities with responsibility for energy development, state development, infrastructure, and planning.

AGL, Coffey Environments and other specialist consultants attended workshops with South Australian government agencies convened by the Department of Trade and Economic Development (now the Department of State Development) in 2009.

AGL provided a description of the project and development rationale and obtained preliminary views from government on issues to be assessed and mitigated in the environmental assessment for the project. Further workshops were held with a cross-section of government agencies to identify key stakeholders and potential issues. These discussions also informed stakeholder engagement throughout the environmental assessment process and in the preparation of the original ESAR (Coffey Environments, 2010).

AGL re-engaged with government departments and agencies with respect to the development application, approval and environmental assessment in 2017. The matters dealt with during the initial planning phase in 2009 were reviewed and re-raised with the relevant departments and agencies.

A summary of the engagement activities is provided in Table 5.1.

Engagement with the City of Port Adelaide Enfield

Project briefings have been held for the executive management and elected members of the City of Port Adelaide Enfield (Council). Given the specific zoning of Torrens Island for public purpose (power station), the land on which the development is proposed is not within the Council's jurisdiction and the Council has no specific role in the development approval process. However, AGL has engaged with the Council to ensure that there is an awareness of the project and AGL has an opportunity to hear the Council's perspectives on potential community views and expectations.

AGL has provided project information and details on how additional information can be obtained, and requested opportunities to further meet with elected members and executive management to discuss the proposed development, project rationale and assessment process.

AGL will continue a dialogue with the Council throughout the approval and development process.

Engagement with Traditional Owners and Kaurna Representatives

As discussed in Section 5.3.1, the Traditional Owners of Torrens Island, the Kaurna people, were engaged by AGL with the assistance of Specialised Native Title Consultants and Central Queensland Cultural Heritage Management during the preliminary planning phase in 2009.

Preliminary Indigenous cultural heritage surveys were commissioned and conducted in collaboration with Kaurna representatives in December 2009.

Engagement activities centred on Native Title and cultural heritage management matters. AGL is committed to ongoing, long-term engagement with the Kaurna people, including dialogue regarding:

- Identification of sites of cultural heritage significance.
- Development of a cultural heritage management plan.
- Broader acknowledgement of Kaurna heritage and support for reconciliation activities.

AGL and specialist consultants met with Kaurna representatives in September and November 2009, and have commenced re-engagement with Kaurna representatives through the City of Port Adelaide Enfield and the Minister for Aboriginal Affairs and Reconciliation in August 2017.

5.3.4 Engagement to date

Table 5.1 summarises the engagement to date with key BIPS project stakeholders.

5.3.5 Future stakeholder engagement

Other Stakeholders identified have been formally offered opportunities to be briefed on the proposed development. These stakeholder groups include:

- State Aboriginal Heritage Committee.
- Kaurna Community and Heritage Association.
- Employees of AGL based at Torrens Island, including representatives of relevant union bodies.
- Dolphin Explorer.
- Adelaide International Bird Sanctuary.
- Boat clubs that utilise the North Arm and Angas Inlet in the vicinity of Garden Island and Torrens Island.
- Port River Dolphin Cruises.

AGL will continue to engage stakeholders at key project milestones including:

- Development Application and ESAR lodgement with SCAP.
- Government approvals process mid-way through construction.

The subsequent engagement will provide an opportunity to inform stakeholders about how the project is addressing any identified stakeholder concerns.

Section 5.4 summarises the planned mechanisms through which ongoing stages of the engagement activities will be implemented.

5.4 Engagement methods

5.4.1 Face to face

Face to face meetings and briefings were offered to a range of stakeholders. These meetings and briefings have generally taken place at the stakeholders' premises.

Fact sheets and presentations were prepared to augment face to face briefings and provide information about the proposed development. The summary of information about AGL, the proposed development, and the assessment pathway were presented to meet the needs of the stakeholders and conform to other factors, e.g., length of meeting, number of participants. Fact sheets and other printed resources were also provided to stakeholders.

5.4.2 Phone contact

Phone contact was utilised in combination with face to face meetings, for purposes such as providing subsequent information and planning further engagement. This engagement activity is particularly intended for use by stakeholders with a high level of interest in the project.

Additionally, AGL operates a toll free telephone Complaints and Enquiries Line (1800 775 329) for all AGL assets, planned projects and activities. All calls made to the hotline will be diverted to the appropriate team member following a series of voice and keypad prompts.

AGL endeavours to answer all calls made during standard business hours, Monday to Friday, 8 am to 6 pm. Callers who make contact outside of standard business hours may need to leave a voice message. All calls will be returned within 24 business hours.

Callers reporting an emergency will be encouraged to contact their local emergency service provider.

5.4.3 Email updates

Stakeholders with minimal direct contact with the project are primarily engaged through email, providing information about the BIPS project, links to online resources, and points of contact for future correspondence.

A project-specific website for the project will include functionality for interest stakeholders to sign up for email updates, which will be provided at critical milestones throughout the project as well as information via AGL's digital and social media channels will be available.

Through these emails, stakeholders will provide project updates throughout the life of the project and maintain regular contact with stakeholders, particularly those that are unavailable to attend, or not inclined to seek briefing meetings and direct contact with AGL.

Stakeholders with a high degree of interest in the project will be advised via email when the SCAP issues a notice calling for submissions.

All stakeholders can utilise AGLCommunity@agl.com.au, the centralised email address for feedback about all AGL assets, planned projects and activities.

Table 5.1 Summary of meetings with key stakeholders

Date	Stakeholders	Forum	Matters discussed
May – December 2009	Planning SA	Meeting	Project concept
	Department of Transport, Energy and Infrastructure	Meeting	Project concept / community consultation
	Department of Environment and Heritage	Meeting	Project concept
	Department of Trade and Economic Development	SWOT workshop	Project concept / native title and Indigenous cultural heritage
	Coffey Environments	SWOT workshop	Project concept
	Risk and Hazard Management	SWOT workshop	Identification and prioritisation of stakeholders
	Specialised Native Title Consultants Central Queensland Cultural Heritage Management Hawker Britton Department of Primary Industries and Resources		Project strengths, weaknesses, opportunities and threats Consideration of potential project impacts
	SafeWork SA Department of Planning and Local Government Department of Premier and Cabinet Crown Solicitor's Office	Workshop	Objectives for projects stakeholder consultation
	Environment Protection Authority	Meeting	Air emission modelling
	South Australia Police South Australian Metropolitan Fire Service SafeWork SA Planager Pty Ltd	Meeting	Risk and hazard management / emergency response
	Kaurna Representatives Blake Dawson Lawyers	Meeting	Native Title and cultural heritage discussions
	City of Port Adelaide Enfield Council	Meeting	Community communication and strategy

Table 5.1 Summary of meetings with key stakeholders (cont'd)

Date	Stakeholders	Forum	Matters discussed
	National Parks and Wildlife Service Donato Environmental Services Sonus PAE Holmes	Workshop	Consideration of environmental studies
March 2017	The Department for Planning, Transport and Infrastructure	Briefing	Project introduction
March 2017	The Environment Protection Authority	Briefing	Project Introduction
March 2017	ElectraNet	Meeting	Project introduction and discussion of connection options
May 2017	The Department of Premier and Cabinet	Briefing	Project Introduction
June 2017	Project announcement via ASX, local and national media	Media conference	Project announcement
July 2017	The office of the Minister for Mineral Resources and Energy	Briefing	Compliance costs and processes / interagency coordination
July 2017	Australian Marine Wildlife Research Rescue Organisation (AMWRRO)	Briefing	Possible increase of traffic, noise, dust and emissions adjacent to AMWRRO during construction and operation
July 2017	Friends of Torrens Island	Briefing	Road access and traffic movements, community engagement, environmental considerations
July 2017	The office of the Minister for Sustainability, Environment and Conservation	Briefing	Project concept, fuel sources, liaison with other agencies, and other current projects
July 2017	The office of the Minister for Planning	Briefing	Planning matters, fuel sources, and compliance processes
July 2017	The Department of Planning, Transport, Infrastructure	Briefing	Planning pathways and process
July 2017	Workshop session with representatives from the following agencies: • The office of the Minister for Mineral Resources and Energy • Essential Services Commission of South Australia • Office of the Technical Regulator • Department of the Premier and Cabinet	Meeting	Technical guidelines for new generators

Table 5.1 Summary of meetings with key stakeholders (cont'd)

Date	Stakeholders	Forum	Matters discussed
July 2017	Meeting with representatives from the following agencies: • Department of Planning, Transport and Infrastructure (DPTI) • Department of Premier & Cabinet • Environment Protection Authority (EPA) • Coastal Protection Board • Department of Environment, Water and Natural Resources (DEWNR) • City of Port Adelaide Enfield	Inter-agency meeting (pre-lodgement meeting)	Planning pathways and process Sea level rise and flood protection Air quality, noise and amenity aspects
August 2017	Senior executive staff from the City of Port Adelaide Enfield	Briefing	Project concept, community engagement, environmental considerations, public notification
August 2017	The office of the Member for Port Adelaide, Susan Close MP	Briefing	Project concept, community engagement, environmental considerations, public notification
August 2017	The office of the Federal Member for Port Adelaide, Mark Butler MP	Briefing	Project concept, community engagement, environmental considerations, public notification
August 2017	The Commodore of the Garden Island Yacht Club	Briefing	Road access and traffic movements, community engagement, environmental considerations
August 2017	Owner/Operator of Adventure Kayak SA	Briefing	Road access and traffic movements, community engagement, environmental considerations
August 2017	Representatives of Estuary Care Foundation SA	Briefing	Environmental considerations, road access and traffic movements, community engagement
August 2017	Representatives from SafeWork SA	Meeting	Work, health, safety, hazard considerations
August 2017	Representatives from the South Australian Liberal Party	Briefing	Progress of project
August 2017	The Mayor and senior members of the executive team from the City of Port Adelaide Enfield		Project concept, community engagement, environmental considerations, public notification
August 2017	The Office of the Technical Regulator	Briefing	Technical generator guidelines

Table 5.1 Summary of meetings with key stakeholders (cont'd)

Date	Stakeholders	Forum	Matters discussed
September 2017	Office of the Minister for Aboriginal Affairs and Reconciliation	Briefing	Engagement with relevant indigenous representatives
September 2017	Port Adelaide Enfield Aboriginal Advisory Panel	Briefing	Project concept, community engagement, environmental and cultural heritage considerations, public notification
September 2017	Whale and Dolphin Conservation	Briefing	Project concept, community engagement, environmental considerations, public notification

5.4.4 Website and digital

A dedicated page on the AGL website is under construction to support engagement in the project. The website will be maintained beyond the completion of the approval process and into the construction phase of the project. The website will host user-friendly resources including a project overview, project updates, contact details, and functionality for stakeholders to register for project updates via email. The site will include current information, including upcoming engagement events, and the outcomes of engagement.

The website will direct interested parties to utilise AGLCommunity@agl.com.au to ask questions and provide feedback about the project. AGL is committed to ensuring the email mechanism is staffed, monitored and appropriately responded to consistently and in a timely manner. Service standards (timeframes for initial acknowledgement and final response) will be established regarding responding to queries, and these will be posted on the website.

The website content will be reviewed and revised as required as the project reaches particular milestones.

AGL is present on multiple social media platforms including Facebook, Twitter and YouTube and managed centrally. These digital platforms can be used to inform users of the project and direct online stakeholders to the BIPS website, as well as manage community feedback.

5.4.5 Public notices

With the support of the City of Port Adelaide Enfield Council, project information will be displayed as public notices at selected locations in the proximity of the project area. Notices will be updated from time to time aligned with critical milestones for the project. The public notices will be summarised forms of the project fact sheets and newsletters and will provide initial awareness of the project and key milestones and direct people to the project website. Public notices will be displayed at:

- Community centres.
- Libraries.
- City of Port Adelaide Enfield Civic Centre.

5.4.6 Stakeholder contact database

A stakeholder contact database for the project has been established. The database records contact details for all identified stakeholders and will be maintained to provide a real-time summary of all contact made with stakeholders about the project.

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6 Environmental and social impact assessment

To support the development application for the Barker Inlet Power Station (BIPS) the potential environmental and social impacts of the project have been assessed. A number of specialist baseline reports, impact assessments and predictive modelling reports have been prepared for the project. Supporting specialist studies are provided in the appendices.

This chapter describes the potential environmental and social impacts of the BIPS. The following information is provided for each environmental aspect:

- Description of the existing environment and establishing the baseline conditions prior to construction and operation of the project.
- Description of the potential, credible environmental and social impacts (or issues), both positive and negative, that may be associated with the project. Identification of the potential impacts is based on knowledge of the existing environment, experience with similar operations elsewhere and issues of concern (perceived and actual) for stakeholders. The initial description of impacts does not take into consideration the measures that will be employed by AGL to address these impacts (i.e., it is the pre-mitigated impact).
- Avoidance, mitigation and/or management measures. These reflect AGL's commitment to good practice in project development and environmental management, and are technically and economically feasible for the project.
- The level of residual risk associated with each potential impact, assuming the effective implementation of the proposed control measures.
- A monitoring program, if required to provide early warning if mitigation or management measures are ineffective.

6.1 Impact assessment method

The impact assessment used a risk based assessment method where the potential environmental impacts from the project were identified, and the risk of these potential impacts occurring was reviewed using the approach outlined in Section 6.1.1.

The residual risk assessment describes the remaining potential impacts once the proposed mitigation and management measures have been implemented.

6.1.1 Risk based approach

The risk based assessment approach was conducted by examining the potential consequences (i.e., the severity of environmental impact) and the likelihood that those impacts will occur. The assessment of 'likelihood' rating applies specifically to the resulting environmental impact.

As part of the risk assessment process, a number of Standards Australia risk management assessment processes were considered. These include:

- Australian/New Zealand Standard Risk Management – Principles and guidelines AS/NZS ISO 31000:2009 (Standards Australia, 2009) and the associated guidelines:

– HB 436:2013 (Standards Australia, 2013).

– HB 158:2010 (Standards Australia, 2010).

- Standards Australia's Managing environment-related risk (HB 203:2012) (Standards Australia, 2012).

The assessment was based on those used in the Standards Australia's HB 203:2012 (Standards Australia, 2012). Minor amendments to the definitions have been made to accommodate specific power station issues or to further clarify definitions (Table 6.1).

Table 6.1 Descriptors used to classify likelihood and consequence measures of impact

Descriptor	Definition
Likelihood	
Almost certain	Is expected to occur in most circumstances, or is of a continuous nature, or likelihood is unknown.
Likely	Will probably occur during project lifetime.
Possible	Could occur in most similar operations.
Unlikely	Could occur in some similar operations, but not expected to occur.
Rare	Occurs only in exceptional circumstances.
Consequence	
Catastrophic	Health – death or widespread health effects, or toxic release off-site with detrimental effect. Environmental – extreme permanent changes to the natural environment (not able to be practically or significantly rehabilitated or alleviated), extending offsite. Financial – huge financial loss (greater than A$500 million). Or the consequences are unknown.
Major	Health – extensive injuries, loss of production capability, off-site release contained with outside assistance. Environmental – substantial and significant changes to the natural environment or only partially able to be rehabilitated or alleviated. Financial – major financial loss (A$100 to $500 million). Or changes will be substantial if cumulative effects are considered.
Moderate	Health – medical treatment required, on-site release contained with outside assistance. Environmental – significant local changes, but can be rehabilitated or alleviated with difficulty at significant cost and with outside assistance. Financial – high financial loss (A$10 to $100 million).
Minor	Health – first aid treatment required, on-site release immediately contained. Environmental –very local consequence with no significant long-term changes or may be simply rehabilitated. Financial – medium financial loss (A$1 to $10 million).
Insignificant	Health – no injuries. Environmental – negligible environmental impact. Financial – low financial loss (less than A$1 million).

(Standards Australia, 2012)

The level of risk for each potential impact is then determined by combining consequence and likelihood using the risk matrix shown in Table 6.2.

Table 6.2 Qualitative risk analysis matrix

		Severity of Consequence				
		Catastrophic	***Major***	***Moderate***	***Minor***	***Insignificant***
Likelihood of Consequence	***Almost Certain***	Extreme	Extreme	Extreme	High	High
	Likely	Extreme	Extreme	High	High	Moderate
	Possible	Extreme	Extreme	High	Moderate	Low
	Unlikely	Extreme	High	Moderate	Low	Low
	Rare	High	High	Moderate	Low	Low

The evaluation of residual risks is based on the findings from specific investigations conducted in support of this report, knowledge of the existing environment likely to be affected, experience at similar operations elsewhere and professional judgement. It is expected that all residual risks will be managed by AGL to 'as low as reasonably practicable' (ALARP).

6.1.2 Monitoring

A proposed monitoring program is provided in the relevant sections following the assessment of the residual risk of impacts. The monitoring program will enable early detection of any failure of management and mitigation measures. The monitoring program contains measurable performance indicators that can be used by AGL and others (such as external environmental auditors or regulators) to assess progress towards, or compliance with, the performance criteria. Where possible, the criteria are based on standards, guidelines, monitoring results or similar that allows numerical comparison (e.g., air and noise aspects).

6.2 Air quality

Existing air quality conditions in the project area are described in Section 6.2.2. Potential, credible project-related impacts on air quality are described in Section 6.2.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.2.4. The resulting residual air quality impacts are discussed in Section 6.2.5. The monitoring program is outlined in Section 6.2.6. Greenhouse gas emissions are described in Section 6.3.

The information in this section is based upon the Pacific Environment air modelling report provided in Appendix G.

The project was also referred to the Civil Aviation Safety Australia (CASA) to assess the potential plume rise impacts to aircraft, with the results provided in Appendix H and in Section 6.2.3.

6.2.1 Study methods

Air quality

An air quality study was conducted by Pacific Environment to investigate potential air quality impacts due to the operations of BIPS. The report in its entirety is included as Appendix G. The study described existing TIPS air quality information, assessed the likely impacts of the BIPS project (including operational and cumulative impacts on existing air quality), and detailed management and mitigation measures to ameliorate impacts.

Meteorological data was sourced from a range of Australian Bureau of Meteorology (BOM) stations surrounding Adelaide. Other air quality baseline information was sourced from the South Australian Environment Protection Authority (EPA). Ambient air monitoring data from Northfield, Elizabeth Downs, Northfield, Christie Downs, Le Fevre 2 and Netley were used as this data was assumed to include sources within the Adelaide airshed, including the existing TIPS. These locations are shown in Figure 6.1.

Hourly varying air quality data was sourced from the SA EPA for the year 2009 to establish the existing baseline and for use in the predictive air quality model. The 2009 data was selected as it was identified as suitable comparator to assess the project against. The Le Fevre 1 monitoring station is closer in proximity to the project area than Netley, however as it was not established until 2013 it was omitted as it did not possess monitoring records consistent with the modelling year. The Golden

coffey (A TETRA TECH COMPANY)	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.01_GRA	AGL Energy Limited Barker Inlet Power Station	Locations of SA EPA air quality monitoring sites
agl			Figure No: 6.1

AI Reference: 202225_02_GRA007.ai_4 MXD Reference: 202225_GIS001_4AI.mxd

Grove monitoring site only contained short term data from 2014 to 2015 and was therefore of no use to the modelling year (2009).

Data sourced for the baseline included:

- Hourly varying nitrogen dioxide (NO_2), ozone (O_3) and particulate matter ($PM_{2.5}$ and PM_{10}) data from Netley for 2009.
- Hourly varying sulfur dioxide (SO_2) data from Northfield for 2009.
- Hourly varying carbon monoxide (CO) data from Elizabeth Downs for 2009.

Pacific Environment reviewed the proposed generation technology and relevant emission controls for the project to identify the key air pollutants as carbon monoxide, nitrogen oxides (NO_x), sulfur dioxide and sulfate particulates. Modelling results for the BIPS were then added to the hourly varying background levels of NO_2 (established in the baseline data) and the cumulative results were then compared to the SA EPA assessment criteria.

Manufacturer data, fuel specifications and industry references were used to quantify project emissions estimates which were applied to the dispersion modelling process. The stack emission parameters and emission rates used for the modelling are provided in Appendix G. Modelling was conducted on site specific meteorological dataset from CALMET with the dispersion modelling package CALPUFF. CALMET is a meteorological pre-processor which develops micro-meteorological variables to produce three-dimensional meteorological fields utilised by CALPUFF. CALPUFF considers complex flow situations, such as those found in coastal environments, giving a more accurate model of predicted conditions. CALPUFF simulates the effects of space and time varying meteorological conditions on pollutant transport, transformation and removal. The CALMET dataset was based on surface observations from approximately 21 BOM weather stations and upper air meteorological data for the year 2009 in a nested configuration.

Five separate emission sources were included into the dispersion modelling:

- BIPS Stack A: Stage 1, Clustered stack – Serving reciprocating engines 1 to 6.
- BIPS Stack B: Stage 1, Clustered stack – Serving reciprocating engines 7 to 12.
- BIPS Stack C: Stage 2, Clustered stack – Serving reciprocating engines 13 to 18.
- BIPS Stack D: Stage 2, Clustered stack – Serving reciprocating engines 19 to 24.
- TIPS B Stack: TIPS B – Serving boilers 1 to 4 (modelled at both 25% and 100% load).

The modelled stack locations are within the BIPS project area, however these are subject to change pending the final design of the power station. Refining the location of the stacks within the project area will not have significant effect on the results of the modelling.

Six modelling scenarios were prepared for both natural gas and diesel operation:

1. Stage 1, Project only.
2. Stage 1 and Stage 2, Project only.
3. Stage 1, Project with TIPS B emissions (typical operations: 25% load).
4. Stage 1 and Stage 2, Project with TIPS B emissions (typical operations 25% load).
5. Stage 1, Project with TIPS B emissions (maximum operations: 100% load).
6. Stage 1 and Stage 2, Project with TIPS B emissions (maximum operations: 100% load).

TIPS B emissions have been included due to the close proximity to the BIPS and the similar pollutant profile. The two scenarios (25% load and 100% load) were considered to be reflective of typical operations and the upper limit of operations. The 100% load scenario is considered highly conservative and the 25% scenario typical of non-peak operating conditions.

The effect of 'building downwash', where aerodynamic wakes are produced as air travels over irregular objects and causes turbulence and vertical mixing was also assessed.

The building downwash can cause locally elevated concentrations when the exhaust plumes interact with the wakes and are mixed downward to ground level. Emission sources were screened for potential interaction with the building wakes where the wakes extend:

- By a distance of 5 x L from the leeward edge of a wake producing structure (where L is the lesser of the structure height or the projected structure width).
- To a height of 2.5 times the height of the structure.

The BIPS stacks have been sized to avoid building downwash from the BIPS engine hall structures. Due to the proximity of the existing TIPS B turbine hall and boiler structure, these have been incorporated into the calculation of building downwash effects using the Building Profile Input Program, with treatment of these effects using the Plume Rise Model Enhancement (PRIME) building downwash algorithms.

During operation at peak load, each plume will possess a sensible heat flux in the vicinity of 100MW. Given the scale of the heat release, it is anticipated that the buoyant plumes will rise rapidly in the atmosphere, and merge with neighbouring plumes. At the point of merging the combined buoyancy of the merged plume would produce an accelerated rate and extent of the plume rise, beyond that which would occur for an individual plume. Plume merging effects have been ignored for the assessment, which is considered conservative in the context of the local air quality impact assessment.

CASA plume rise assessment

Civil Aviation Safety Australia (CASA) assess the potential hazard to aviation posed by vertical exhaust plumes in excess of 4.3 metres per second (m/s) velocity. Relevant legislation includes the potential hazard, under Regulation 139.370 of the Federal *Civil Aviation Safety Regulations 1998* and the potential danger, under Regulation 6 of the *Airspace Regulations 2007*. The assessment by CASA provides a standard method of determining the critical velocity of a vertical exhaust plume so that the impact of a plume near aircraft can be assessed in a consistent and reliable manner.

The project was referred to the CASA to assess the potential for plume rise impacts to affect aircraft. This assessment was undertaken by CASA with information provided by AGL.

6.2.2 Baseline

The existing ambient air quality in the project area and immediate surrounds is largely dominated by industrial and transport sources related to the port operations and urban traffic (see Section 6.5 for further discussion of land use).

The EPA measures air pollution in South Australia in accordance with the Environment Protection (Air Quality) Policy 2016. The policy came into effect in July 2016 and provides a statutory foundation for the regulation and management of air quality in South Australia. The EPA criterion are presented in Table 6.3.

Table 6.3 Summary of adopted background data and EPA criterion

Pollutant	Averaging Period	Adopted background concentration (µg/m^3)	EPA criterion (µg/m^3)
Nitrogen dioxide (NO_2)	1 hour 1 year	Time varying 15	250 60
Carbon monoxide (CO)	1 hour 8 hour	35 39	31,240 11,250
Sulfur dioxide (SO_2)	1 hour 1 day 1 year	59 5 0.2	570 230 60
PM_{10}	1 day	21	50
$PM_{2.5}$	1 day 1 year	9.3 8.1	25 8
Formaldehyde	1 hour	n/a	20
Benzene	3 minutes 1 year	n/a n/a	58 10
PAHs	3 minutes 1 year	n/a n/a	0.8 0.003

Summary reports from the EPA for the year 2009 indicate that generally air quality for the Adelaide region is considered to be good. However, there have been occasions of exceedances of the NEPM goal for PM_{10}, in summary:

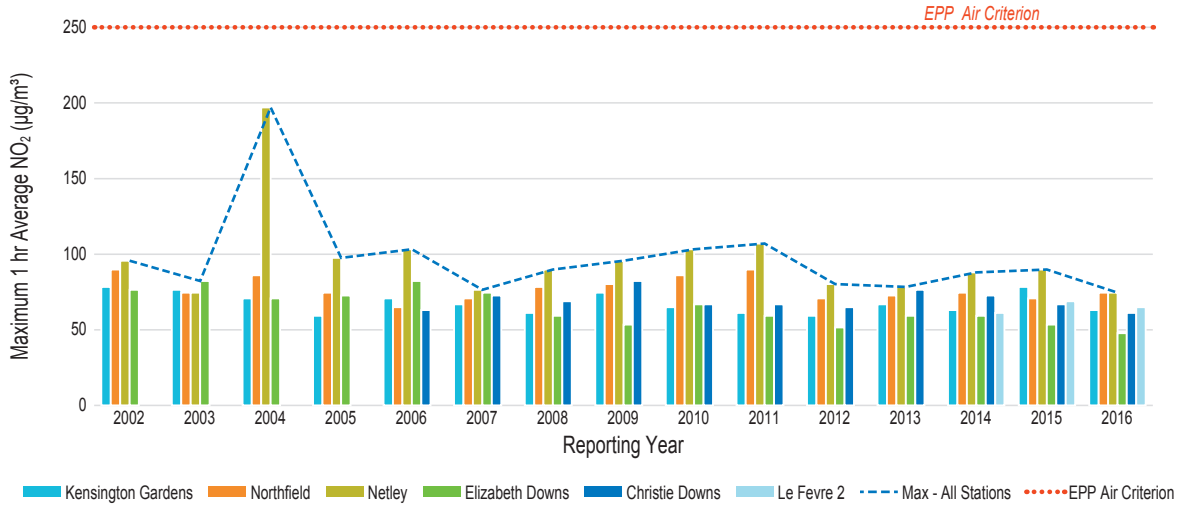
- Background concentrations of NO_2 are approximately 43% (107.5 µg/m^3) of the SA EPA criterion of 250 µg/m^3 for one hour concentrations and 27% (0.015 µg/m^3) of the annual SA EPA criterion of 60 µg/m^3.
- Background concentrations of CO are low, approximately 6% (1874 µg/m^3) of the SA assessment criterion of 31,240 µg/m^3 for one hour concentrations, and 7% (788 µg/m^3) of the SA assessment criterion of 11,250 µg/m^3 for 8-hour concentrations.
- Background concentrations of SO_2 are low when compared to the SA assessment criteria 60 µg/m^3 (annual average), 230 µg/m^3 (24-hour average), and 570 µg/m^3 (1-hour average).
- There were six exceedances of PM_{10} and one exceedance of $PM_{2.5}$ in the Netley in 2009. The dominant contributor to these exceedances is dust storms or bushfires.

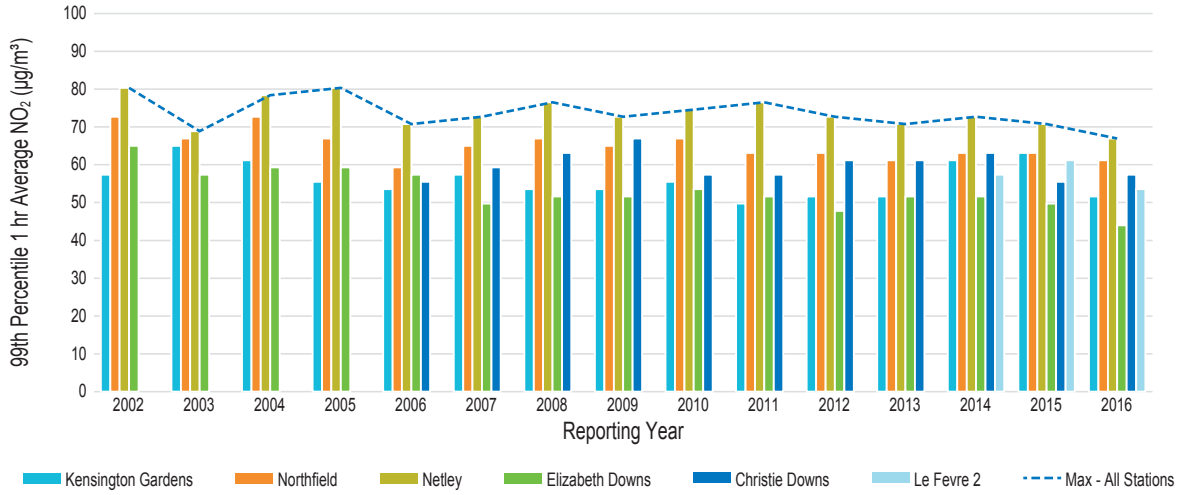
Figure 6.2 presents the long term trends in NO_2 concentrations for the years 2002 to 2016. Background NO_2 concentrations were highest at the Netley monitoring station, which reported the highest annual results across 38 of the 39 percentile/year combinations presented in Figure 6.2.

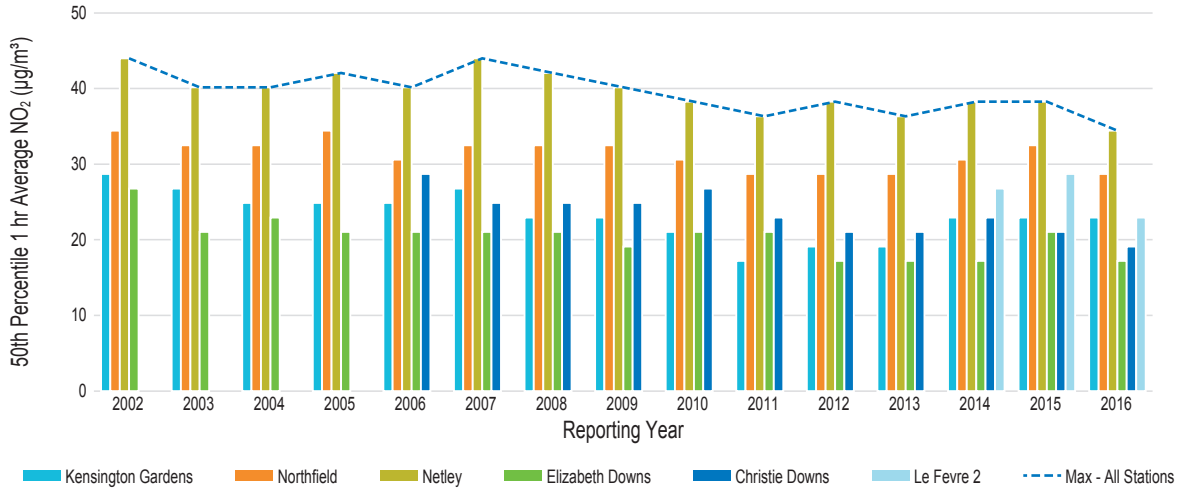
CALMET meteorological modelling indicates the wind speeds and directions at the site of the site are very similar to the BOM sites. Wind speeds in the model are dominated annually by moderate to strong wind speeds from the northeast and south-southwest (Figure 6.3). The estimated percentage of calm conditions (less than 0.5 m/s) annually is 1.9%.

6.2.3 Potential impacts

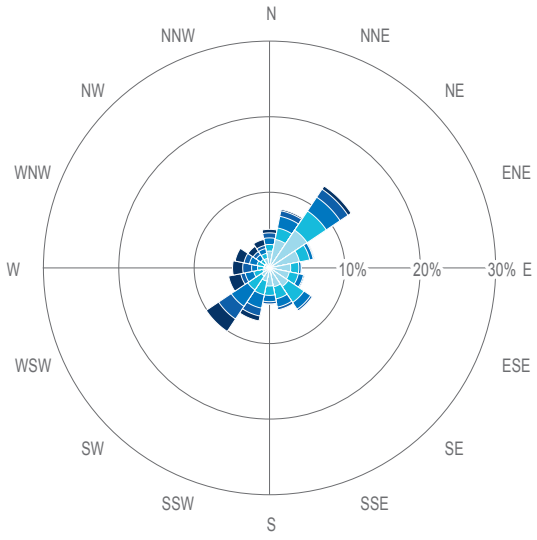
Fugitive dust will be the main emission to air during construction and combustion gases will be the main emissions to air during operation of BIPS.







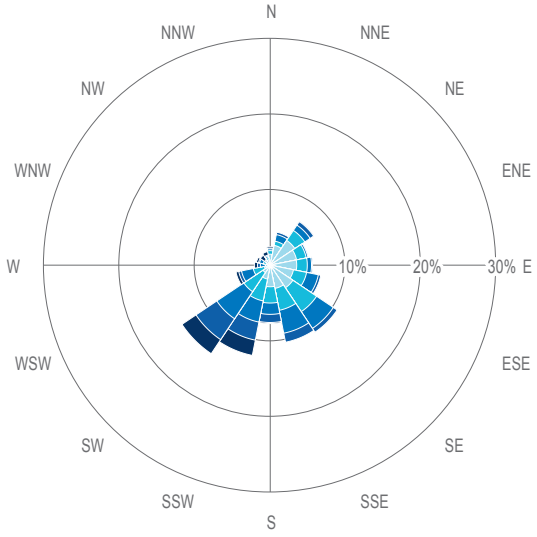
coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.02_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Long term trends in maximum, 99th percentile and 50th percentile NO_2 concentrations	Figure No: 6.2



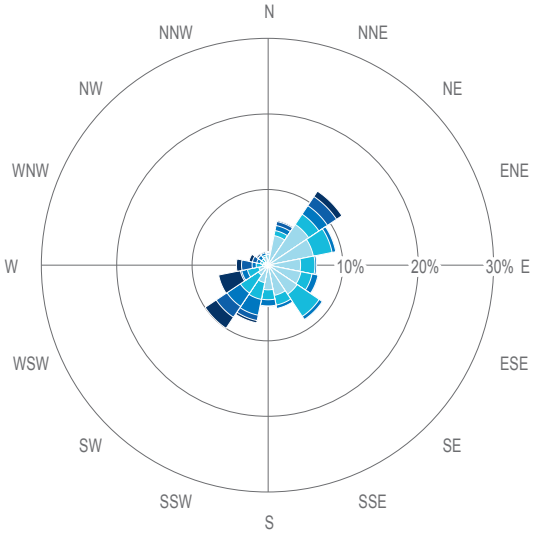
Annual Calms = 1.9%

LEGEND
Wind speed (m/s)

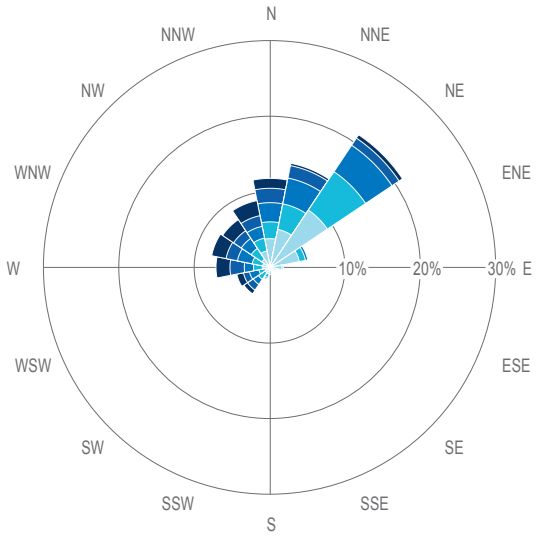
- >0.5 - 1.5
- >1.5 - 3.0
- >3.0 - 4.5
- >4.5 - 6.0
- >6.0 - 7.5
- >7.5



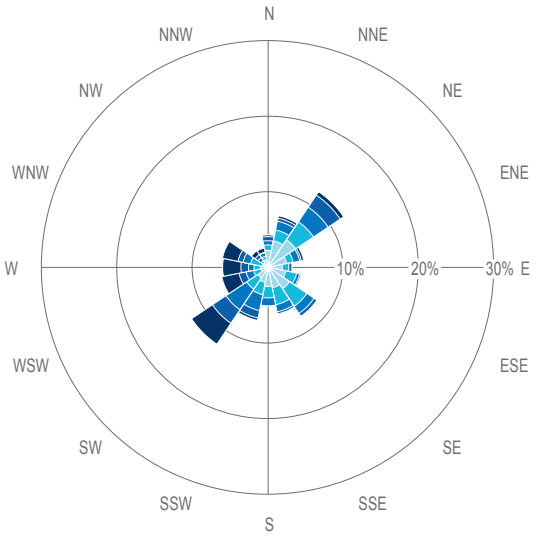
Annual Calms = 1.2%



Annual Calms = 2.9%



Annual Calms = 1.6%



Annual Calms = 1.7%

coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.03_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Prevailing wind direction and speed generated for CALMET model	Figure No: 6.3

Air emissions during construction

Construction of the power station will generate fugitive dust and air emissions for the following sources:

- Road works associated with construction activities.
- Site preparation and excavation, including the construction of access roads around the power station site and earthworks.
- Delivery of power station components to site.

The fugitive emissions may impact on the air quality for surrounding land users (see Section 6.5 for further discussion of surrounding land users).

Air emissions during operations

Operation of BIPS will emit exhaust gases, principally NO_2 and CO, with lower levels of organic compounds, SO_2 and particulate matter expected.

Plume rise impacts to aircraft

The closest airport to the site is the Adelaide Airport located 14.5 km to the south of the BIPS. The existing TIPS operates two sections of boilers (TIPS A and TIPS B) which are each serviced by a dedicated 160 m high stack.

The stack parameters proposed for BIPS were provided to CASA for assessment (Table 6.4) which enabled modelling and identification of any regions of space where the vertical plume velocity exceeded 4.3 m/s.

Table 6.4 Stack parameters

Parameter	BIPS Stack 1	BIPS Stack 2	BIPS Stack 3	BIPS Stack 4
Easting (m MGA)	273,446	273,500	273,477	273,532
Northing (m MGA)	6,145,983	6,145,948	6,146,032	6,145,996
Height (m)	30	30	30	30
Effective Diameter (m)	3.92	3.92	3.92	3.92
Temperature (K)	651	651	651	651
Velocity (m/s)	28.9	28.9	28.9	28.9
Volumetric Flow (Am^3/s)	349	349	349	349

Note. The final stack locations will be subject to detail design and may be adjusted slightly from the locations shown.

The assessment used a screening tool to determine the height of the 10.6m/s plume from BIPS. The result was 15 m above the stack top (45 m above ground level). This result is lower than the existing TIPS plume, which is already represented by a plume symbol on aviation charts. The assessment also considered the potential for the BIPS plume to merge with the existing TIPS plume. Due to the predicted BIPS plume height of 45 m above ground level, being lower than the existing TIPS plume (approximately 180 m above ground level) and the distance between the stacks, it is not considered possible for the plumes to merge.

The results of the CASA assessment (Appendix H) indicated that there would be no potential hazard to aviation posed by vertical exhaust plumes in excess of 4.3 m/s velocity. CASA advised that no

further mitigation is required for the plume rise from BIPS. This potential impact has therefore not been assessed further.

6.2.4 Avoidance, management and mitigation

Air emissions during construction

AGL will implement the following control measures to minimise dust and impacts to air quality during BIPS construction:

- During dry windy conditions relevant areas of construction sites will be routinely watered to suppress dust. Areas to be watered may include excavated areas, soil stockpiles and unsealed roads, when required.
- Activities likely to generate dust will be scheduled to be conducted during favourable meteorological conditions, where practicable.
- Vegetation clearance will be minimised to reduce the areas of exposed soil and dust generating potential.
- Earth moving vehicles will be loaded to less than the height of the side and tail board, and loads covered during transport.
- During earthworks the site will be routinely watered for dust suppression.
- All major access roads will be sealed and vehicle speed limits on unsealed roads set to reduce dust generation.

With the implementation of these management initiatives, the risk of dust related impacts during the project is considered low.

Air emissions during operations

Operation of the BIPS will emit pollutants which have the potential to impact on the surrounding air quality. The principal mitigation measure is the use of selective catalytic reduction (SCR) units to reduce NO_x emissions in the exhaust gases and the use of standard low sulfur automotive distillate when operating on diesel.

6.2.5 Residual impacts

Modelling predictions for all scenarios (for natural gas and diesel operation) were conducted for maximum 1-hour NO_2 concentrations for new sources at the BIPS with background concentrations added to the model predictions to account for existing sources of NO_2. All other pollutants were modelled for “Stage 1 and Stage 2, Project with TIPS B emissions (maximum operations: 100% load)” natural gas and diesel operation scenarios (scenario #11 and #12). These are considered to be the two worst-case scenarios.

A summary of potential air quality impacts is provided in Table 6.5

Table 6.5 Summary of air quality impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I001	Reduction in air quality outside of the BIPS boundary due to fugitive dust from construction activities.	Unlikely	Minor	Low
I002	Exceedance of EPA assessment criteria.	Rare	Minor	Low

Air emissions during construction

The project proposes to manage air quality by established technology and practice. The main construction-phase air quality issue is fugitive dust from construction activities. Management plans for construction works will include dust control measures. These measures will entail additional watering, and could include stopping dust-raising activities during unfavourable meteorological conditions. The likelihood of the impact has therefore been assessed as **unlikely** and the consequence **minor**, and so ranks the overall residual risk as **low**.

Air emissions during operations

NO_2

The modelling involved preparing a full suite of contour isopleths for NO_2, for the 1 hour incremental NO_2 for the 12 scenarios (see Appendix G). The annual average NO_2 were also calculated for the two worst case scenarios #11 and #12.

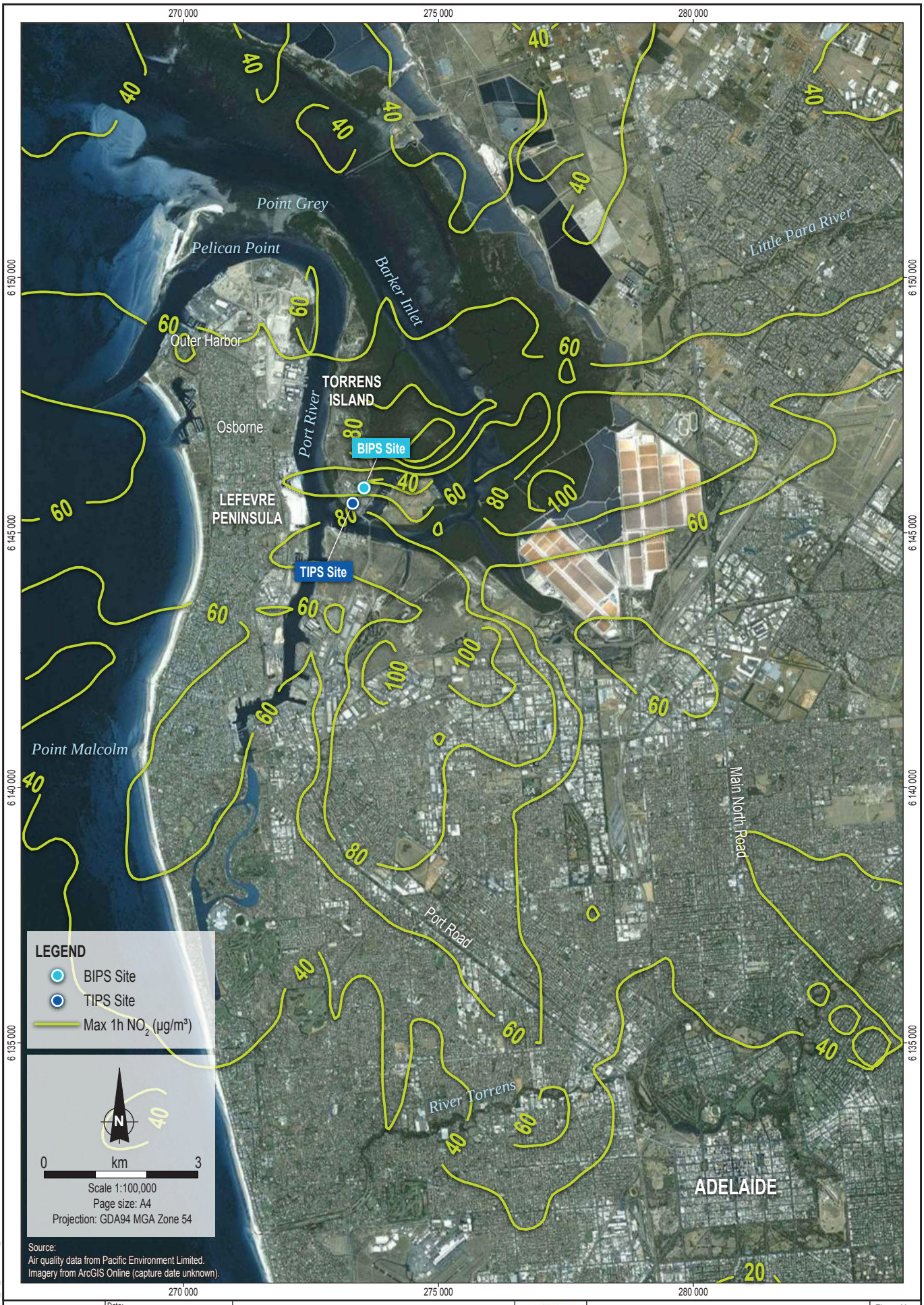
Figure 6.4 shows the incremental maximum 1-hour NO_2 (µg/m³) result of the modelling for Stage 1 + Stage 2, Project – Natural Gas Operation, with TIPS B (maximum load), and Figure 6.5 shows the Stage 1 + Stage 2, Project – Diesel Operation with TIPS B (maximum load). When assessed against regulatory criteria, all predictions were found to be within the EPA impact assessment criteria.

$PM_{2.5}$

Modelling of $PM_{2.5}$ was undertaken for a number of scenarios and is provided in Appendix G. The maximum 24-hour and annual average for the two worst case scenarios “Stage 1 and Stage 2, Project with TIPS B emissions (maximum operations: 100% load)” natural gas and diesel operation scenarios (scenario #11 and #12) is discussed here.

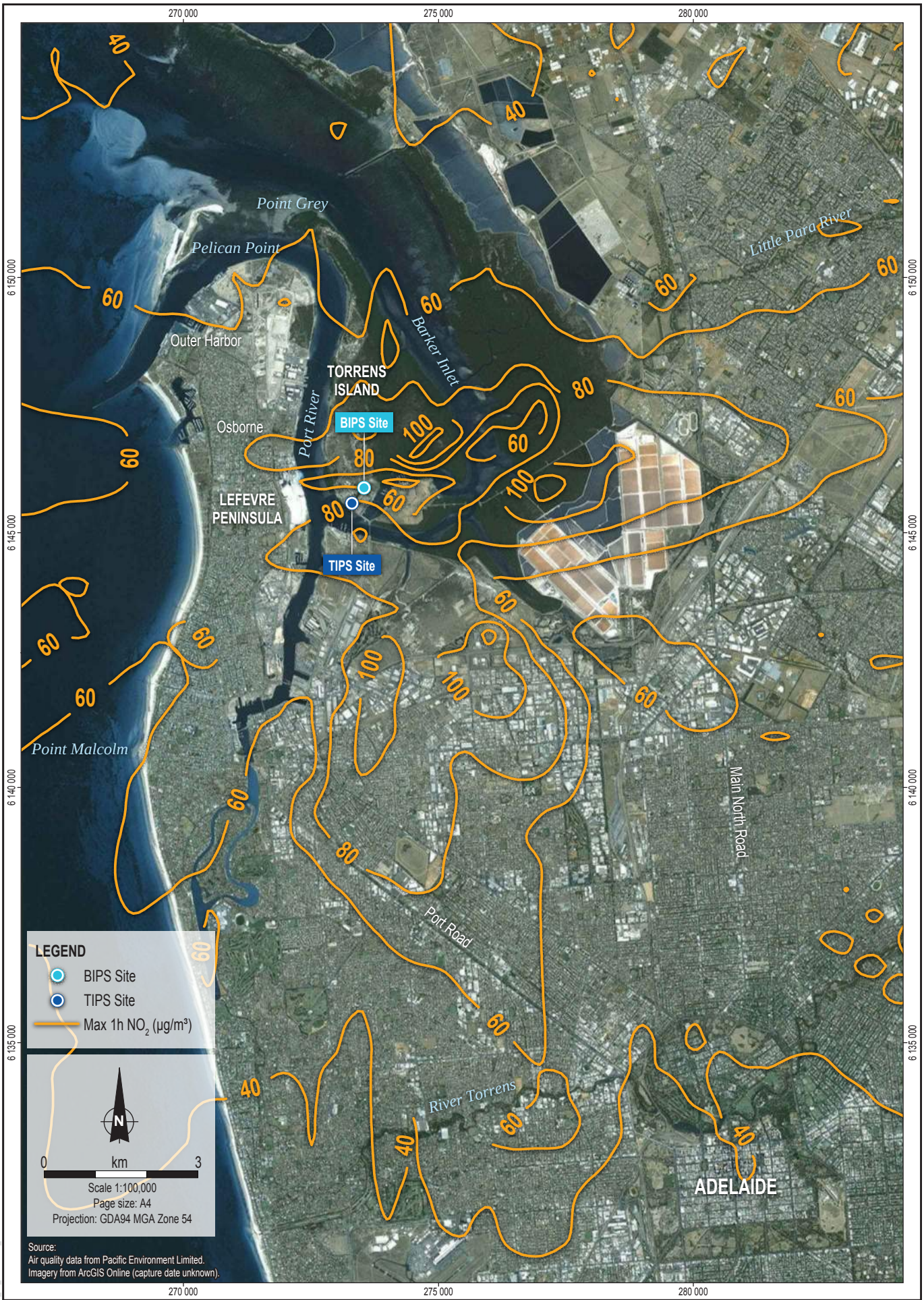
It should be noted that $PM_{2.5}$ and PM_{10} results are identical given that all PM_{10} will fall into the $PM_{2.5}$ particle fraction. Accordingly, incremental $PM_{2.5}$ results are identical to PM_{10} results, and the corresponding $PM_{2.5}$ contour plots should be interrogated for an understanding of the spatial variation of PM_{10} model predictions.

The predictions were found to exceed the EPA impact assessment criteria for the annual average $PM_{2.5}$, for which the background was estimated to be exceeding the annual criterion. Noting this, the scale of peak annual predictions (0.3 µg/m³), when considered in conjunction with conservative assumption around operating frequency, implies that the likelihood of the project resulting in a measurable contribution to cumulative $PM_{2.5}$ concentrations is minor. The EPA has advised that this would not be considered a predicted breach as the derived background is almost at the criterion and the incremental predicted increase is small and the background and worse case scenarios are all conservatively derived to ensure the risks are conservative. As a result, the potential for the project to result in adverse air quality impacts is considered minor.



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.04_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Stage 1 + Stage 2, Project – Natural Gas Operation, with TIPS B (maximum load), incremental maximum 1 hour NO_2 (µg/m³)	Figure No: 6.4

AI Reference: 202225_02_GRA010.ai_3



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.05_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Stage 1 + Stage 2, Project – Diesel Operation with TIPS B (maximum load), incremental maximum 1 hour NO_2 (µg/m³)	Figure No: 6.5

AI Reference: 202225_02_GRA028.ai_2

Figure 6.6 shows the annual average result of the $PM_{2.5}$ modelling for Stage 1 + Stage 2, Project – Natural Gas Operation, with TIPS B (maximum load) and Figure 6.7 the diesel operation.

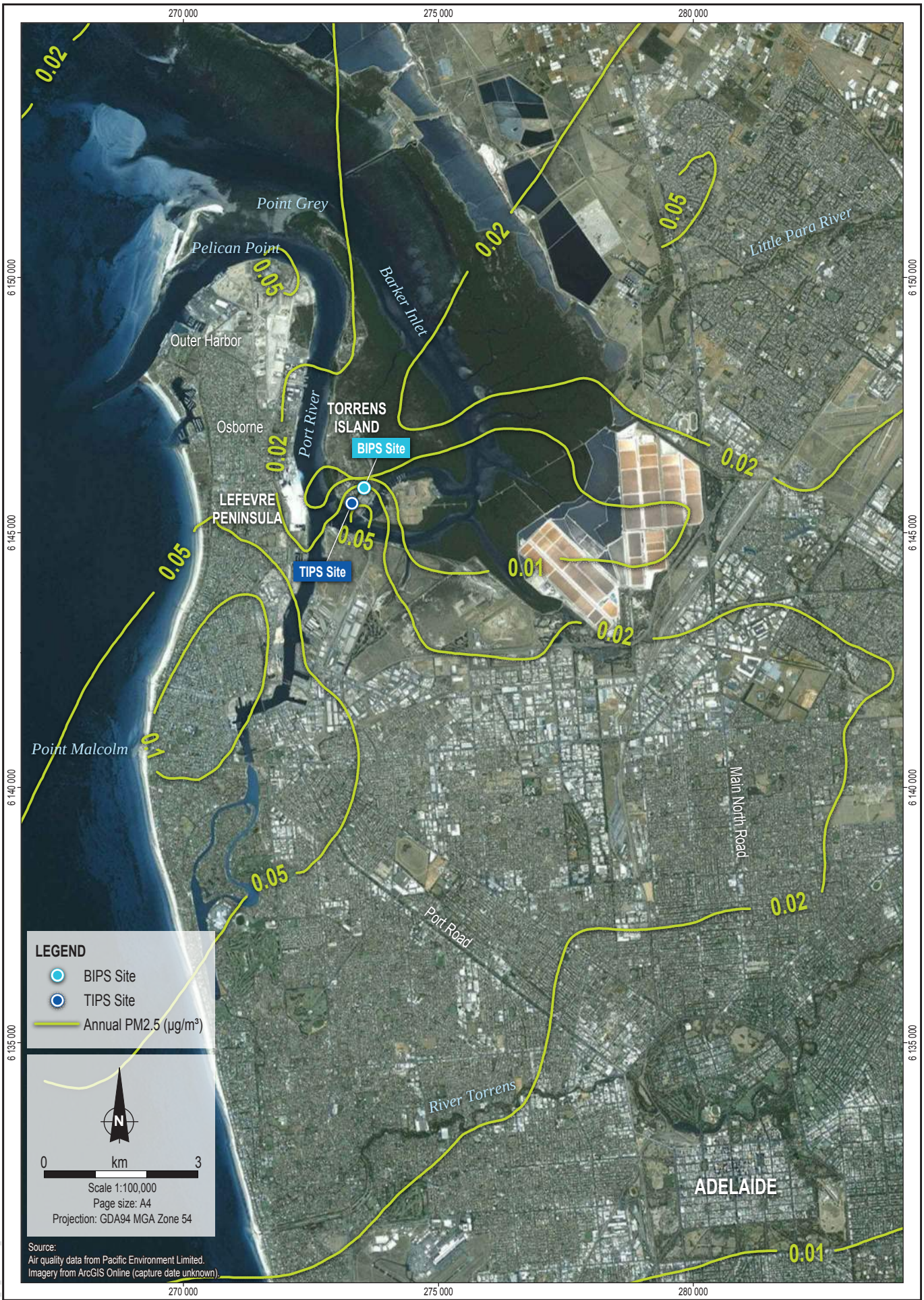
Other pollutants

Modelling predictions for other pollutants, including CO, SO_2 and formaldehyde, benzene and total polycyclic aromatic hydrocarbons (PAH), indicate that emissions from the BIPS are minor. With predicted formaldehyde emissions from natural gas operation of most significance, comprising approximately 45% of criterion. Both benzene and PAHs were less than 1% their respective annual average criteria. There are no predicted exceedances of the criteria.

The operational air quality issues are the emissions of pollutants from gas combustion at the power station. The likelihood of exceedance of the EPA air quality criteria has been assessed as of **rare**, with a **minor** consequence. The overall residual risk is therefore ranked as a **low**.

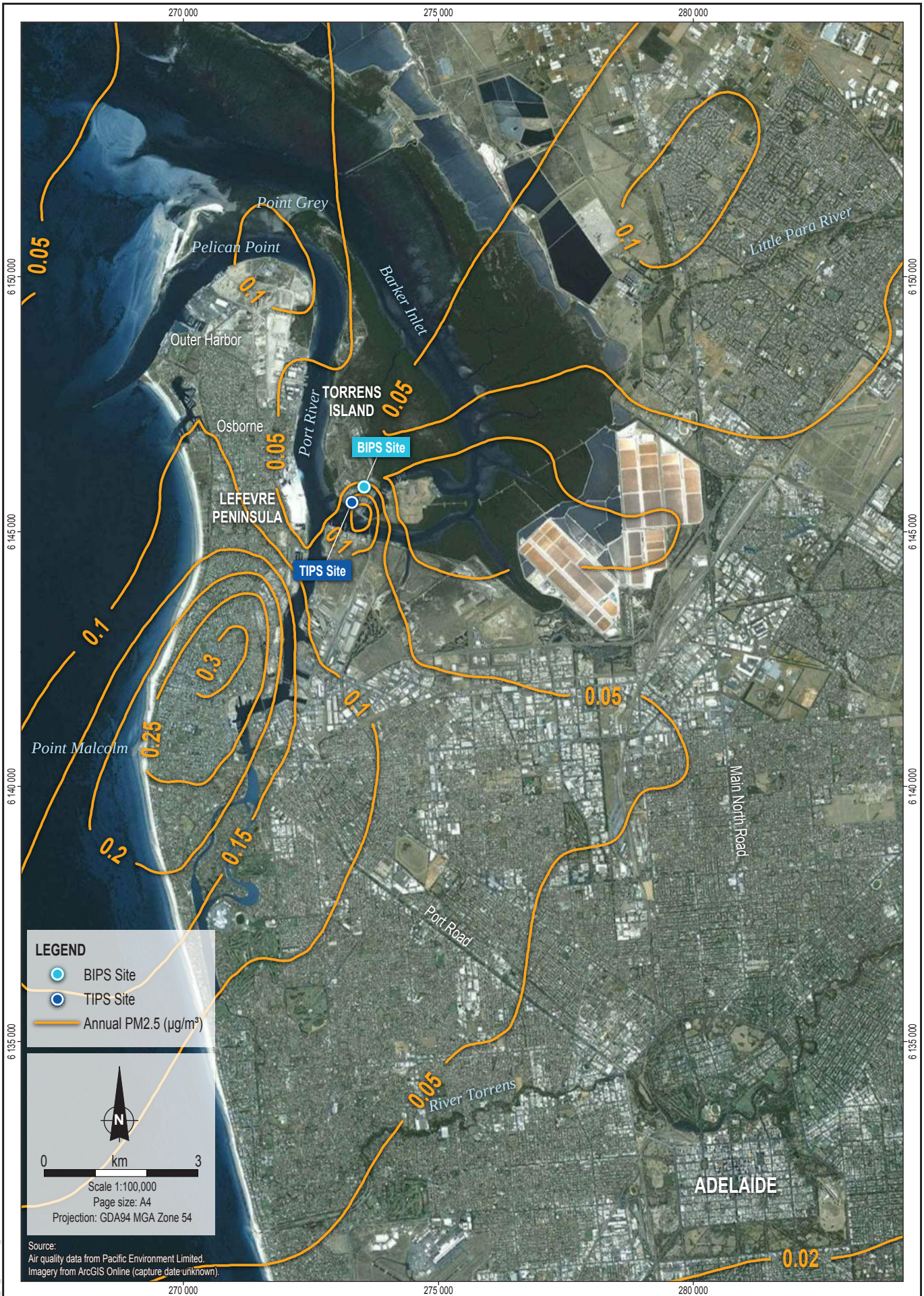
6.2.6 Monitoring and reporting

Monitoring of BIPS emissions will be in accordance with EPA licence requirements. Current emissions for pollutants that are the subject of the air quality impact assessment are reported annually in the NPI using relevant industry emission estimation techniques. These results are publicised on the NPI website.



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.06_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Stage 1 + Stage 2, Project – Natural Gas Operation with TIPS B (maximum load), incremental Annual PM2.5 (µg/m³)	Figure No: 6.6

AI Reference: 202225_02_GRA029.ai_2



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.07_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Stage 1 + Stage 2, Project – Diesel Operation with TIPS B (maximum load), incremental Annual PM2.5 (µg/m³)	Figure No: 6.7

AI Reference: 202225_02_GRA030.ai_3

6.3 Greenhouse gas

Overall Australian greenhouse emissions are described in Section 6.3.2. Potential, credible project-related greenhouse gas emissions are described in Section 6.3.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.3.4. The resulting residual greenhouse gas emissions are discussed in Section 6.3.5. The monitoring and reporting program is outlined in Section 6.3.6.

The information in this section is based upon the Pacific Environment greenhouse gas assessment report provided in Appendix I.

Greenhouse gas emissions associated with the stationary power generation industry in Australia form a large part of Australia's overall greenhouse gas emissions. Any significant reduction in Australia's greenhouse emissions inventory requires a substantial reduction in greenhouse emissions from power generation across the country. Power generated by reciprocating engines is a more appropriate, economic (using 20-30% less fuel than commonly used gas turbines) and less emission intensive solution for peaking power generation.

6.3.1 Study methods

An assessment of greenhouse gas emissions associated with BIPS was conducted by Pacific Environment. The assessment quantified both the direct and indirect greenhouse gas emissions associated with the BIPS and identified mitigation measures.

The greenhouse gas emissions estimates considers BIPS Stage 1. The timing of Stage 2 will be dependent upon market conditions and as such has not been finalised at this time. The Stage 2 greenhouse gas emissions have not been estimated.

The staging of development is important to understand in order to estimate the greenhouse gas emissions. Two units of the TIPS A Station will be mothballed when Stage 1 of BIPS commences operation. When Stage 1 is in commercial operation the fuel oil firing capacity at TIPS B will be decommissioned. Liquid fuel operation capacity will be transferred from TIPS B to BIPS (e.g., TIPS B heavy fuel oil firing will no longer be in operation when the BIPS is in operation).

Greenhouse gas emissions from the operation of BIPS Stage 1, in addition to the existing TIPS were estimated and expressed in values of carbon dioxide equivalent (CO_2-e) in accordance with the international protocol for reporting. Greenhouse gas emissions generated during construction of the BIPS will be relatively minor compared to the production of greenhouse gas emissions during operations and therefore have not been assessed.

Greenhouse gases included in the emissions inventory for the Project are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) which are associated with the combustion of natural gas and diesel fuel.

Quantification of greenhouse gas emissions was made in accordance with the Greenhouse Gas Protocol (WRI & WBCSD, 2004), Intergovernmental Panel on Climate Change (IPCC) and Australian Government greenhouse gas accounting/classification systems. Greenhouse gas emissions have been estimated based on the following:

- The Greenhouse Gas Protocol, which establishes an international standard for accounting and reporting of greenhouse gas emissions. There are three scopes of greenhouse gas emissions that have been defined for accounting and reporting purposes. These are:

- Scope 1: Direct greenhouse gas emissions from sources owned or controlled by the reporting entity (i.e., generation of electricity, heat or steam, physical or chemical processing, transportation of products, waste or employees and fugitive emissions).
- Scope 2: Indirect emissions from the generation of purchased energy products by the entity (i.e., purchased electricity, steam and heat).
- Scope 3: Indirect emissions that are a consequence of the activities of the entity but arise from sources not controlled by the reporting entity. The determination of Scope 3 emissions is difficult, since in modern economies there is a large degree of interconnectivity. In the greenhouse assessment the evaluation of Scope 3 emissions was confined to direct inputs (i.e., fuel cycle emissions).

- The National Greenhouse and Energy Reporting (Measurement) Determination 2008 under Subsection 10(3) of the National Greenhouse and Energy Reporting Act 2007, and the 2015 amendment (DoE, 2015) which provides instructions for the estimation of emissions from the operation of facilities.
- National Greenhouse and Energy Reporting Scheme Measurement Technical Guidelines for the estimation of emissions by facilities in Australia (DEE, 2016).

The operation of BIPS will result in the release of Scope 1 and Scope 3 emissions only.

Due to the staged approach of the project, the greenhouse gas emissions estimates have accounted for the decommissioning of the fuel oil firing capacity at TIPS B, the combustion of diesel fuel (BIPS Stage 1) and mothballing of two units of TIPS A.

The greenhouse gas assessment considered emissions associated with fuel consumption and electricity generation during operation of the project for two separate scenarios as shown in Table 6.6. The two scenarios are:

- **Scenario 1.** Represents forecasted operations based on AGL's current understanding of the electricity market conditions, and the anticipated interaction between the BIPS and TIPS in fulfilling market demand.
- **Scenario 2.** Represents an adaptation of Scenario 1, in which the BIPS operation is prioritised such that TIPS operation is primarily limited to cases where the combined TIPS/BIPS output is in excess of the capacity of that offered by the BIPS alone.

Table 6.6 Summary of estimated fuel consumption and electricity output

Scenario	Description	Estimated fuel consumption (PJ)		Estimated Electricity Output (GWh)
		Natural gas	Diesel	
1	Forecasted operations Stage 1 + TIPS B (typical operations)	15.9	0.16	1,409
2	BIPS maximum share Stage 1 + TIPS B (BIPS operation prioritised)	20.1	0.16	1,865

The emission factors used in the greenhouse gas emission assessment are provided in Table 6.7.

Table 6.7 Adopted emission factors per unit of electricity

Emission type	Emission factor (kg CO_2-e/GJ)		
	Scope 1	**Scope 3**	**Scope 1 + 3**
Natural gas	50.91	10.4	61.3
Diesel	70.2	3.6	73.8

Source: Appendix I

6.3.2 Baseline

Australia's net greenhouse gas emissions totalled 534.7 Mt CO_2-e in 2016 (excluding land use, land use change and forestry). The electricity sector has experienced the largest growth in greenhouse gas emissions, increasing by 59.5 Mt CO2-e between 1990 and 2016, with emissions from electricity generation increasing by 45.9%.

In 2016 energy-related emissions (including transport) in Australia comprised approximately 78.5% (421.3 Mt CO_2-e) of the net greenhouse gas emissions with emissions from agriculture (approximately 12.5%), industrial processes, waste and land use and forestry contributing to the remaining emissions. In 2016, electricity was the largest contributor to the energy sector contributing 35% of Australia's total greenhouse gas emissions.

6.3.3 Potential impacts

Significant increase in greenhouse gas emissions

The project will emit greenhouse gases that will contribute to anthropogenic climate change. Direct and indirect greenhouse gas emissions will vary over the life of the project. During operations, direct emissions from the BIPS will result from the consumption of natural gas and diesel in the engines.

6.3.4 Avoidance, management and mitigation

The design and construction of the BIPS will be in line with proven energy-efficient technology. Natural gas has advantages over other fossil fuels with respect to greenhouse emissions. Each unit of electricity provided by the combustion of natural gas results in less greenhouse emissions in comparison with other fossil fuels, particularly coal, producing the same unit of electricity.

Design and construction

To reduce greenhouse gas emissions during design and construction, AGL will:

- Plan the layout of the site to avoid locating sources of waste heat near reciprocating engine inlets.
- Ensure company-owned and contractor's vehicles are well-maintained to maximise their fuel efficiency.
- Include initiatives that focus on energy efficiency within the project design.

Operations

To reduce greenhouse gas emissions during operations, AGL will:

- Implement the AGL climate change policy, including lowering the carbon intensity of its products, through the Health, Safety and Environment Management System (HSEMS). This system is driven by AGL commitments documented in the AGL Greenhouse Gas Policy (see Chapter 7). Greenhouse abatement initiatives will be adopted at all levels of the company.
- Develop a maintenance and operational culture focused on optimisation and efficiency.
- Develop a strong performance indicators based around plant efficiency.
- Prevention of fugitive releases of natural gas where this can be done safely.

6.3.5 Residual impacts

A summary of potential greenhouse gas impacts is provided in Table 6.8.

Table 6.8 Summary of greenhouse gas impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I003	Substantial increase in Australian greenhouse gas emissions	Unlikely	Insignificant	Low

Significant increase in greenhouse gas emissions

The prediction of project-related greenhouse gas emissions needed to consider the emission estimates from BIPS in isolation, but also the reduction in greenhouse gas emissions from the mothballing of TIPS A and the transferring of fuel oil capacity from TIPS B to the more efficient BIPS.

The annual Scope 1 emissions from BIPS for Scenario 1 are estimated to be 830 kt/CO_2-e and 1,045 kt/CO_2-e for Scenario 2. The emissions estimates for the two scenarios are provided in Table 6.9.

Table 6.9 Estimated annual greenhouse gas emissions associated with the BIPS

Source	Annual greenhouse gas emissions kt CO_2-e		
	Scope 1	**Scope 3**	**Scope 1 + 3**
Scenario 1 – Forecasted operations			
Natural gas combustion	819	165	984
Diesel combustion	11	0.6	166
Total	**830**	**166**	**996**
Scenario 2 – BIPS maximum share			
Natural gas combustion	1,033	209	1,242
Diesel combustion	11	0.6	12
Total	**1,045**	**209**	**1,254**

The overall contribution of the Stage 1 BIPS and TIPS operation (Scope 1 and Scope 3) would be 0.19% and 0.23% of national emissions for Scenarios 1 and 2 (respectively). It is noted that a large proportion of these emissions would not be additional given that the existing TIPS operation has been included within accounting totals.

A substantial increase in emission of greenhouse gases in Australia due to project development is therefore **unlikely** to occur, the severity of consequence is **insignificant** and the residual risk is **low**.

6.3.6 Monitoring and reporting

In accordance with the *National Greenhouse and Energy Reporting Act 2007*, AGL will be required to report on greenhouse gas emissions, energy production and energy consumption. Greenhouse gas emissions will be monitored and reviewed on an annual basis.

Greenhouse gas emissions, energy consumption and energy production data are reported as part of the AGL Greenhouse Footprint in the annual sustainability report, available on the AGL website.

6.4 Noise

Study methods employed to consider the existing baseline noise conditions and to assess potential project impacts are described in Section 6.4.1. The existing baseline noise conditions in the project area are described in Section 6.4.2. Potential, credible, project-related impacts on noise are described in Section 6.4.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.4.4. The resulting residual noise impacts are discussed in Section 6.4.5. The monitoring program is outlined in Section 6.4.6.

6.4.1 Study methods

An environmental noise assessment was conducted by Sonus Pty Ltd in 2017 (Appendix J). The aim of the environmental noise assessment was to determine the existing baseline conditions, the relevant environmental noise criteria at the nearest residential area to the west and the feasibility of applying acoustic treatment to the BIPS to achieve these criteria, if required.

To assess the existing ambient environment, noise levels at the nearest residences to the BIPS were logged over a seven day period between 25 August 2017 and 31 August 2017. During the measurement period, existing background noise levels were continuously logged in 15 minute intervals at Mersey Road, Taperoo, at the location shown in Figure 6.8. This location is representative of the closest residences.

Construction

The South Australian Environment Protection (Noise) Policy 2007 provides criteria for an objective assessment of the noise from construction. The policy includes provisions for construction activity to avoid adverse impacts on amenity. The provisions require:

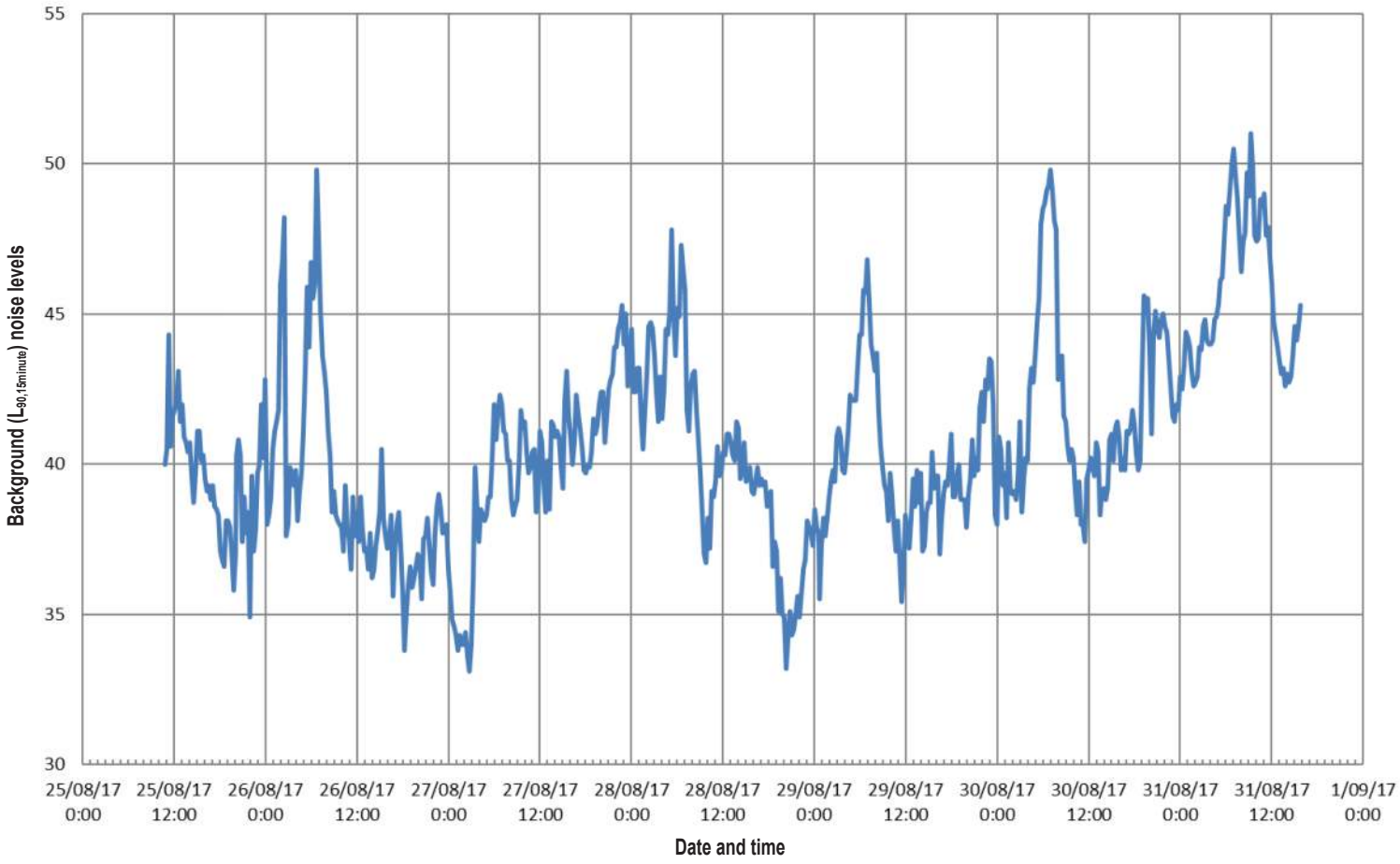
- All reasonable and practicable measures be taken to minimise noise resulting from construction activity.
- The sleep disturbance criteria of 45 L_{Aeq} and 60 L_{Amax} be achieved where construction occurs at night.

Operations

Noise assessment was based on the South Australian Environment Protection (Noise) Policy 2007, which is based on the recommendations of the World Health Organisation to protect against sleep disturbance at night and annoyance during the day. The policy provides maximum noise levels at the noise-affected premises based on the Development Plan zones in which the noise source (in this case the BIPS) and the sensitive receptors (the nearest residences) are located.

Assessment under the policy sets a lower critical noise level for new developments than those set for existing developments. This noise assessment is based on the lower, more stringent noise

Noise levels continuously monitored on Mersey Road between 25 and 31 August 2017



Source:
From Sonus: Barker Inlet Power Station – Environmental Noise Assessment Appendix A

coffey
A TETRA TECH COMPANY

Date: 15.09.2017
Project: 754-BNEEN202225
File Name: 202225_02_F06.08_GRA

AGL Energy Limited

Barker Inlet Power Station

agl

Ambient noise levels recorded

Figure No: 6.8

AI Reference: 202225_02_GRA037.ai_2

requirements proposed for new developments. Further, the proposed BIPS site is located within a public purpose zone of Land Not Within a Council Area Development Plan, while the nearest residences are located within a residential zone of the City of Port Adelaide Enfield Council development plan. The area between the BIPS and the nearest residences is within the general industry and light industry zones. Where there is an intervening area such as this between the noise source and noise receiver, the policy defines the criteria based on the receiving zone (residential) alone. Again, residential zoning is the more stringent, lower noise criteria relative to any industry criteria.

For a development in a residential zone, the policy recommends a maximum noise level of 47 dB(A) during the day (7 a.m. to 10 p.m.) and 40 dB(A) at night (10 p.m. to 7 a.m.) when predicted at the sensitive receptors.

The BIPS noise impacts have been modelled using the internationally recognised CONCAWE noise propagation model and SoundPLAN noise modelling software. The CONCAWE model takes account of noise attenuation, terrain, locations of sensitive receptors and meteorological conditions.

The modelled meteorological conditions have been based on the CONCAWE system and classified into six weather categories:

- Category 1, 2 and 3: wind blowing from the sensitive receptor towards the noise source during daytime with little or no cloud cover.
- Category 4: neutral weather conditions of no wind and an overcast day or night.
- Category 5: no wind on a clear night (typical of a temperature inversion and greater noise propagation than during Category 4 conditions).
- Category 6: ‘worst case’ conditions, when wind is blowing from the source toward the sensitive receptor on a clear night (typical of a temperature inversion).

Wind blowing from the source to a receptor (i.e., Category 5 or 6) will generate higher noise levels at the receptor than during Category 1 to 4 conditions at speeds up to 5 m/s. At higher speeds, the noise of operating equipment is typically masked by the noise of wind in trees.

Noise was modelled using the SoundPLAN modelling software. The modelling used specifications based on Wartsila reciprocating engines, however the final decision of the engine manufacturer has not yet been decided.

In accordance with the policy, the noise levels predicted at the nearest residences are from the BIPS solely, without inclusion of existing noise. This is based on the lower critical noise level set for new developments.

6.4.2 Baseline

The ambient noise levels recorded at the nearest residential area to the west of the BIPS are typical of a residential and industrial interface. At times the ambient noise level was higher than 50 dB(A) but the background noise level reduced to as low as 35 dB(A) during the day and 34 dB(A) at night (Figure 6.8).

6.4.3 Potential impacts

Noise emissions during construction

Construction of the BIPS will generate noise from the following activities:

- Site preparation.
- Excavation, preparation and pouring of concrete foundations.
- Construction of the BIPS components including installation of structural, mechanical and electrical components.
- Construction of ancillary buildings and facilities.

Noise emissions during operations

Operational BIPS equipment will make noise as follows:

- Operation of reciprocating engines.
- Vehicle movement.

Transient noise may also occur during unscheduled events such as equipment de-pressurisation.

6.4.4 Avoidance, management and mitigation

Noise emissions during construction

During construction of the power station AGL will follow general principles of the South Australian Environment Protection (Noise) Policy 2007 regarding community consultation, work scheduling and work requirement recommendations. AGL will:

- Inform potentially noise-affected neighbours about the nature of construction stages and noise reduction measures.
- Give notice as early as possible for periods of noisier works such as excavation, describe the activities and how long they are expected to take and keep affected neighbours informed of progress.
- Appoint a principal contact person for community queries.
- Provide 24-hour contact details through the website and site signage.
- Record complaints and follow a complaint response procedure suitable to the scale of works (which may involve following up on the complaint within 24 hours).

Within normal working hours, where it is reasonable to do so AGL will:

- Schedule noisy activities for less sensitive times (for example, schedule pile driving activities to the later morning or afternoon).
- Provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise).
- Where practicable, ensure that high noise generating construction activity does not occur on a Sunday or other public holiday and only occurs between the hours of 7:00 a.m. and 7:00 p.m. on any other day, unless the activity can be reasonably expected not to cause off site disturbance.
- If construction activities outside of the above hours are needed, assess the noise from the proposed activities to confirm that the noise will not exceed the sleep disturbance criteria. The assessment might be in the form of predictions of the noise from the activities actually proposed or monitoring of the noise during these times.

- Ensure that all construction activity incorporates all reasonable and practicable measures that minimises noise resulting from the activity, including:

- Locate noise equipment such as masonry saws or cement mixers, or processes so that their impact on the nearest residences is minimised. This can be achieved by maximising the distance to the nearest residences, or using structures or elevations to create barriers.
- Shut or throttle down equipment when not in actual use.
- Ensure noise reduction devices such as mufflers are fitted and operate effectively.
- Ensure machinery or equipment is not operated if maintenance or repairs would eliminate or significantly reduce a characteristic of noise from its operation that is audible at the nearest residences.
- Operate equipment and handle material so as to minimise impact noise.
- Use off-site or other alternative processes that eliminate or lessen resulting noise.

Noise emissions during operations

Noise modelling of the BIPS operations has incorporated commercially available, noise attenuation options for the proposed equipment. For the power station, attenuation options such as exhaust gas outlet silencers, low noise cooling radiator and enclosures will be incorporated. Minimum noise attenuation requirements that will be built into the project design to ensure noise criteria are met, are provided in Section 6.4.5 and should be read in conjunction with the manufacturer's engine noise data in Table 6.12.

6.4.5 Residual impacts

Table 6.10 summarises the residual noise impacts of the project, considering the likelihood and consequence of the predicted impact after the successful implementation of control and mitigation measures.

Table 6.10 Summary of noise impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I004	Noise levels exceeding policy guidelines due to construction of the BIPS.	Possible	Minor	Moderate
I005	Noise levels exceeding policy guidelines due to operations of the BIPS.	Unlikely	Minor	Low

Noise emissions during construction

Based on the sound levels of general construction equipment (Table 6.11) used during the BIPS construction and the 'worst case scenario' of all equipment operating simultaneously and continuously, the noise levels will be greater than the 45 dB(A).

Table 6.11 Construction equipment sound power levels

Equipment	Sound Power Level dB(A)
Hand-held grinder	106
Loader	120
Truck	120
Excavator	118

Table 6.11 Construction equipment sound power levels (cont'd)

Equipment	Sound Power Level dB(A)
Generator	119
Air compressor	107
Dewatering pump	108
Crane	123

Assessment of potential construction noise impacts was conservative, given:

- During any given period, machinery will only operate at maximum sound levels for brief periods.
- It is unlikely that all equipment will be operating at full power at the same time.
- Some types of equipment will only be on site for limited periods.
- Worst-case propagation conditions have been assumed.

Given the possibility that the 'worst case scenario' may result in noise levels greater than the 45 dB(A), it is therefore necessary and appropriate to take all reasonable measures to reduce the impact of construction noise by implementing the mitigation and management measures outlined in Section 6.4.4. The implementation of these measures will reduce the noise from construction activity at the nearest residences. Therefore with these measures in place it is considered reasonable and practical that noise levels from construction activities satisfies the provisions of the Environmental Protection (Noise) Policy 2007.

This conclusion is based on construction work normally taking place between 6:00 a.m. and 6:00 p.m., with noisy activities should not normally start before 7:00 a.m. Activities that could cause noise levels above the adopted criteria after hours may occasionally occur and could lead to actual noise levels above the criteria if the weather were unfavourable at the same time.

Therefore, the likelihood of exceeding construction noise limits has been assessed as **possible**. However, the consequence of this is expected to be **minor** due to the short duration of the activity, resulting in a **moderate** overall residual impact.

Noise emissions during the operation of the power station

The modelled configuration for the proposed power station incorporates acoustic treatment such as insulated exhaust gas ducting, exhaust gas outlet with silencer and building enclosures.

The treatment is part of a noise attenuation option provided by the manufacturer. With this option, the manufacturer provides the resultant overall sound power level for each of the components of the power station. These sound power levels are detailed in Table 6.12 along with a frequency spectrum based on similar equipment.

With the attenuation treatments applied in Table 6.13. the noise level at the nearest residences due to noise from continuous operation of the proposed power station has been predicted based on the above sound power levels under worst case weather (Category 6) conditions. Predictions indicate that the noise levels at the nearest residences would be approximately 40 dB(A) (Figure 6.9), which is within the Environment Protection (Noise) Policy guidelines.

Table 6.12 Noise data for each component of the power station

Octave band (Hz)	Number/length of noise sources per stage	Noise descriptor	Sound level / transmission loss in band octave centre frequencies									Overall noise level	
			31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Total (dB)	Total (dB(A))
Noise level within engine hall	-	Sound pressure level, L_p, (dB re 20 µPa)	96	102	100	101	103	102	104	104	98	111	110
Transmission loss of engine hall steel sandwich panel	-	Transmission loss (dB)	8	14	20	26	32	36	30	48	58	-	-
Exhaust gas outlet with silencer + SCR	12	Sound power level, L_w, (dB re 1 pW)	125	113	105	94	84	78	79	90	0	125	95
Insulated exhaust gas duct	700 m	Sound power level, L_w, (dB/m re 1 pW)	63	71	70	76	85	91	79	79	66	93	92
Charge air intake with silencer	24	Sound power level, L_w, (dB re 1 pW)	116	112	99	79	71	85	84	84	94	118	96
Ventilation intake	24	Sound power level, L_w, (dB re 1 pW)	100	95	96	87	85	80	78	72	66	103	87
Ventilation outlet roof monitor	115 m	Sound power level, L_w, (dB/m re 1 pW)	114	109	109	108	103	96	99	94	82	117	106
Gas pressure reduction station	1	Sound power level, L_w, (dB re 1 pW)	-	-	-	-	72	84	91	93	93	97	98
Low noise 7-fan cooling radiator	48	Sound power level, L_w, (dB re 1 pW)	115	102	99	101	100	98	95	92	91	115	103

Table 6.13 Minimum level of noise attenuation for power station components

	Minimum Noise Level Attenuation (dB)								
Octave band (Hz)	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Power station noise source									
Insulated exhaust gas ducting	0	0	0	0	7	15	0	0	0
Ventilation outlet roof monitor	0	7	16	24	27	22	19	0	0
Low noise 7-fan cooling radiator	0	0	0	2	9	9	0	0	0

Figure 6.9 shows the predicted sound level pressure at sensitive receptors in the vicinity of power station, for worst case weather (Category 6) conditions with the acoustic treatment applied. Depending on meteorological conditions, residual noise at the closest receptor will be audible, but well below the levels recommended by the World Health Organisation guidelines to protect against 'sleep disturbance' at night and to protect the majority of people from being 'moderately annoyed' during the day. Noise levels at any future residences to the east of the project area would be below the recommended levels. Therefore, the likelihood of exceeding noise limits at the closest sensitive receptor is **unlikely** and the consequence of this is expected to be **minor**, resulting in **low** overall residual risk.

6.4.6 Monitoring and reporting

Noise monitoring programs will be developed as part of the project environmental management plans (EMPs). Monitoring of staff and contractor exposure to noise will be conducted as required as part of AGL's health and safety system, to ensure that the workplace complies with occupational health and safety noise limits.

coffey A TETRA TECH COMPANY	Date: 18.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.09_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Predicted noise due to the BIPS and baseline noise locations	Figure No: 6.9

AI Reference: 202225_02_GRA012.ai_4

6.5 Land use

This section identifies the land uses potentially affected by the project, with existing land uses in the project area described in Section 6.5.2. Potential, credible project-related impacts on land use are described in Section 6.5.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.5.4. The resulting residual impacts are assessed in Section 6.5.5.

6.5.1 Study methods

Coffey has conducted various contamination assessments on Phase 1; March 2010 (Coffey, 2010a) and Phase 2; (April 2010 and August 2010 (Coffey, 2010b) of the previously proposed Torrens Island Energy Park and the current proposed BIPS (July 2017) (refer to Appendix F). The purpose of these assessments was to assess the potential presence of site contamination associated with past and present uses of the site and immediately adjacent land in the context of the proposed development. The scope of work for each assessment was carried out with reference to the best practice documents for Australia which, at that time, included the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013), Australian Standard (AS4482.1-2005) The Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1 and Part 2 (Standards Australia, 2005) and the South Australia Environment Protection Authority Site Contamination: “Guidelines for the Assessment and Remediation of Groundwater Contamination” (SA EPA, 2009a).

The study method included, but was not limited to a review of previous environmental and geotechnical reports for the site and immediate vicinity, local government zoning, geological records, government registers and databases and a detailed inspection and walkover of the site and surrounding areas.

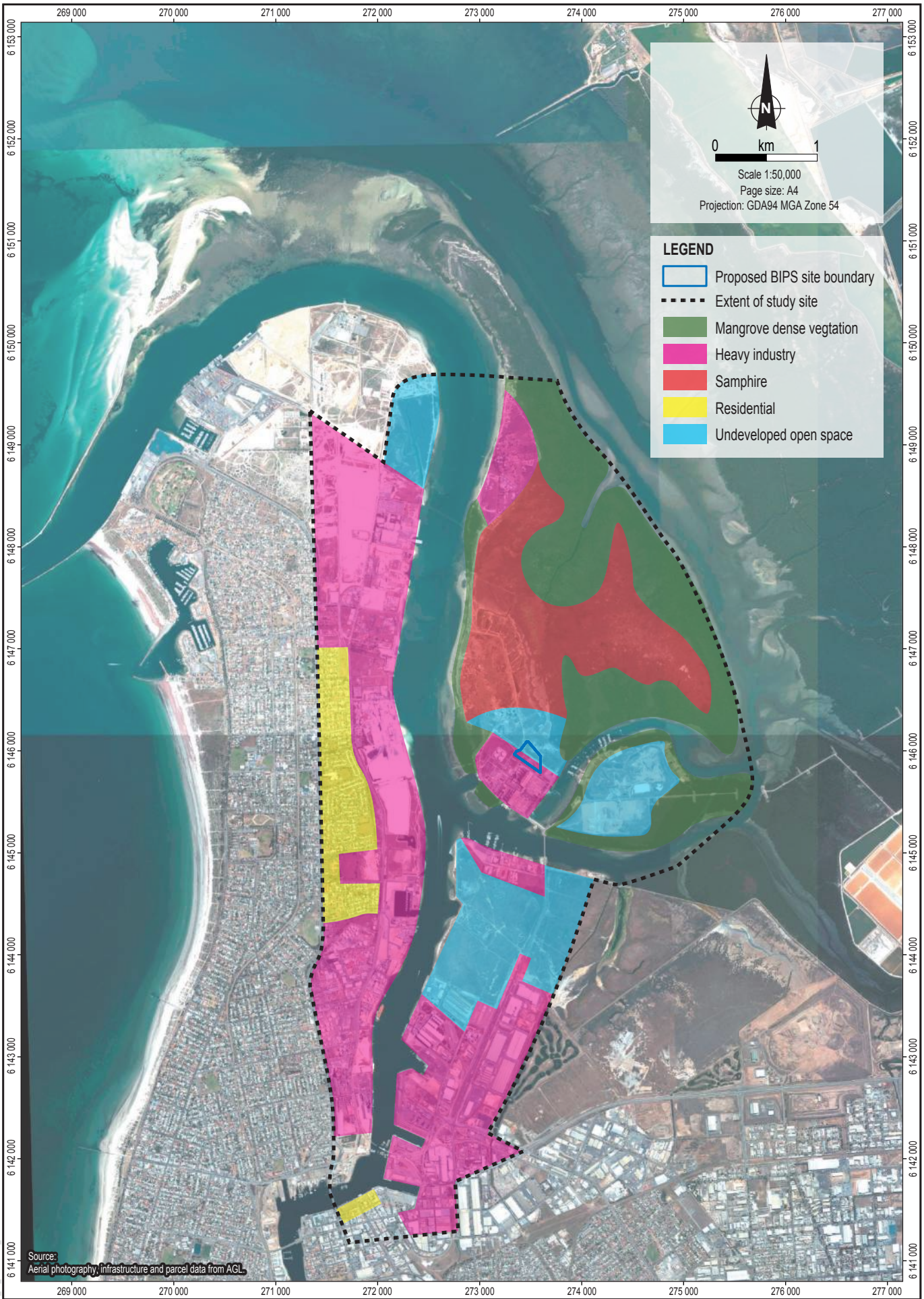
The study area includes land allotment 302 which is the proposed site for the BIPS. Refer to Table 1.1 and Figure 1.2 in Section 1.2 for details of all allotments in the area. In addition, the land uses of Torrens Island as a whole have been considered. Figure 6.10 shows the current land use within the general area.

6.5.2 Baseline

Historical land use of the study area

Since European settlement in 1836, land use and activities on Torrens Island, have included:

- A dairy farm.
- Two human quarantine stations.
- Three animal quarantine stations (one avian quarantine station remains).
- Two internment camps.
- Two electricity generating stations (still present).
- Sand extraction.
- Dumping of dredged muds.
- Historical burial of hard waste associated with previous construction projects (still present).



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A TETRA TECH COMPANY

Date: 15.09.2017
Project: 754-BNEEN202225
File Name: 202225_02_F06.10_GRA

AGL Energy Limited

Barker Inlet Power Station

agl

Land use on and surrounding Torrens Island

Figure No:
6.10

AI Reference: 202225_02_GRA016.ai_3

All of these activities have been located along the dune formation forming the western side of the island. Several of them have succeeded each other on the same site on the highest dunes at the southern end of the island, overlooking the North Arm. Some of these historical activities are considered to be activities that have the potential to contaminate land or are associated with industries or commercial activities which have demonstrated a greater likelihood of giving rise to contamination.

A search of the South Australian Heritage Places Database (DEWNR, 2017) and the Australian Heritage Database (DEE, 2017) for known non-indigenous historical archaeological and heritage sites and places (see Section 6.12 for more information) indicated three listed sites in the surrounding area:

- **Torrens Island Quarantine Station Complex including jetty, cemetery and mortuary**. It is listed on the State Heritage Register (ID No 13931) and previously listed as an Indicative Place on the Register of the National Estate as an Indicative Historic Place (No 14866).
- **Torrens Island Conservation Park**. It was previously listed as Registered on the Register of the National Estate (No. 6255). The extreme northern tip of the area was declared a Conservation Park. The boundaries of the park were extended southward to take in the rest of the inter-tidal zone in 2005, so that it now covers most of the island except for the dune formation along the western shore.
- **Penrice Area.** It was previously listed as an Indicative Place on the Register of the National Estate (No. 19765). The Penrice Area includes salt fields and mangroves which has been identified as an important roosting and feeding habitat for migratory wading birds. The site is approximately 3,300 ha and includes the Chapman Creek and Barker Inlet – St Kilda Aquatic Reserves.

Another site listed under the South Australian *Historic Shipwrecks Act 1981* is the:

- **Santiago Shipwreck**. The Santiago was shipwrecked in 1945 in the Garden Island ships graveyard situated in the north arm of the Port River approximately 1.1 km to the southeast of the project area. Santiago's mostly intact hull is exposed above the river level. The masts have been cut off and lay next to other fittings lying within the structure and outside the hull. The Santiago is the oldest vessel in the graveyard.

Existing land use in the location of the BIPS

The BIPS is located outside the jurisdiction of any local government body, including City of Port Adelaide Enfield Council. The existing TIPS and the BIPS site are zoned for the proposed use (public purpose (power station)) under the Land Not Within A Council Area (Metropolitan) Development Plan 2009.

Current land use in the general area is a combination of:

- The existing Torrens Island Power Station with two sections, TIPS A and TIPS B.
- Lot 302, where BIPS will be located consists of a car park, road and vegetation consisting of plantings of indigenous and non-indigenous tree species and exotic grasses.
- Lot 303, comprising approximately 63 ha owned by the Generation Lessor Corporation (State Government) and leased to AGL. Lot 303 is currently is declared a ‘private sanctuary’ area under the *National Parks and Wildlife Act 1972*, Section 44. This is outside of the BIPS project area.

TIPS A, consisting of four units, was constructed on the southern end of Torrens Island with the first bridge to the island being built for the construction project. The power station was officially opened on

28 February 1968. The first two units of TIPS B began construction in 1973 and all four units were completed by 1981. The first of the two 160 m stacks was built in 1967, the second in 1975.

The private Torrens Island Sanctuary was gazetted in 1998 and includes all of Lot 303, which is outside the BIPS project area. Initially the original owner, South Australian Generation Corporation was interested in the reintroduction of bettongs and bilbies to the property. However, adequate control of fox populations was not achieved, making the area unsuitable for the introduction of these species. The Minister for Environment, Sustainability and Conservation has the power to revoke the sanctuary declaration and must revoke the declaration upon the request of the land owner.

Existing land use of Torrens Island

In addition to AGL, other occupants of Torrens Island are located at the northern end of the TIPS and include the Australian Quarantine and Inspection Service site and Origin Energy's Quarantine Power Station. The Torrens Island Conservation Park, which encompasses the majority of Torrens, is accessed on a regular basis by rangers and officers of the Department of Environment, Water and Natural Resources (DEWNR).

Origin Energy currently owns and operates the Quarantine Power Station on Torrens Island, a five unit gas-turbine power station with a capacity of 224MW, located a few kilometres north of the existing TIPS. Built in 2002, the power station was expanded by 120MW in 2009.

South East Australia Gas Pty Ltd (SEAGas) and Epic both have subterranean gas pipelines that run across the island. The EPIC pipeline sources gas from gas fields in the Cooper Basin and connects with the QSN Link pipeline, which delivers gas from the southwest methane fields in Queensland. The MAP transports the gas to the Moomba production facility prior to transport to Adelaide. The Moomba gas facility is located approximately 770 km north of Adelaide.

SEAGas operates the high pressure natural gas transmission pipeline system that transports natural gas sourced from the offshore Otway Basin via Port Campbell and Iona in Victoria to markets in South Australia and Victoria.

The Australian Marine Wildlife Research & Rescue Organisation (AMWRRO) facilities are located on Torrens Island and include office buildings and a 450,000 L aquatic facility for seabird, seal and turtle rehabilitation.

Existing land use in the proximity of Torrens Island

To the east of Torrens Island, across Angas Inlet, is Garden Island. The infrastructure and facilities on the island include small boat and yacht clubs and facilities such as the Garden Island boat ramp for recreational water usage. The island has one residence, a caretaker whose residence is adjacent to the boat club. The Western Region Waste Management Authority, representing local councils in the west of metropolitan Adelaide, operated a waste disposal facility on Garden Island from 1982 until 2001 and has since been remediated.

There are a range of buildings and infrastructure that would normally be associated with developed areas in the suburbs surrounding Torrens Island, including:

- Industrial, transport and logistics operations and premises.
- Residential premises.
- Commercial properties.
- Associated roads and bridges.

The nearest residential area to the site is located approximately 1.5 km at the closest point west of BIPS, on Mersey Road in Taperoo, on the Le Fevre Peninsula.

Cheetham Salt previously operated solar salt pans to the east of Torrens Island stretching from Dry Creek to St Kilda Beach and further northward to Webb Beach at Port Parham. During its peak, the salt pans spanned approximately 4,000 ha and produced on average 285,000 tpa of salt (Hough, 2008). Harvested salt was redissolved and pumped to Penrice Soda Holdings Ltd's Osborne plant for the manufacture of sodium carbonate and sodium bicarbonate. Cheetham Salt ceased operation in 2012 due to international acquisition. Whilst the plant has been removed the salt pans are still present.

6.5.3 Potential impacts

Potential, credible project-related impacts to land use are described in the following sections. These do not take into consideration the proposed avoidance, mitigation and management measures that will be implemented by AGL during all stages of project development and which will result in the residual impacts discussed in Section 6.5.5.

Potential impacts to land use as a result of the project include:

- Potential to disturb existing contaminated sites.
- Disturbance to historical buried asbestos.

Potential to disturb contaminated sites

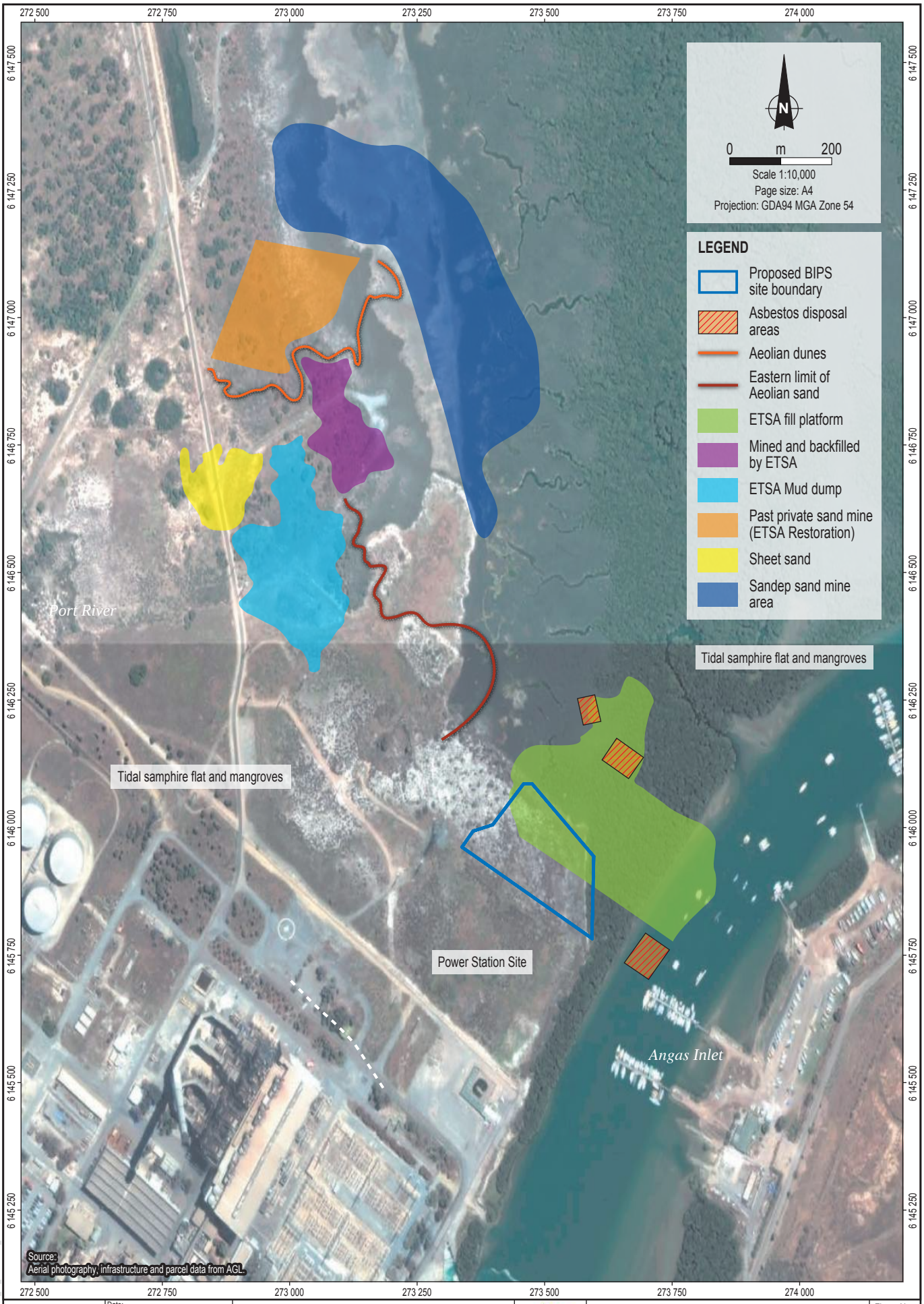
Torrens Island has historically been used for activities that have the potential to contaminate land.

The potential contaminants and key sources of contamination identified by Coffey (Appendix F) comprised the contaminants present in imported fill used on site. These include polycyclic aromatic hydrocarbons (PAHs) associated with ash and other combustion products and chemicals related to the potential use of herbicides, pesticides, insecticides and fungicides. The potential off-site sources identified from surrounding properties included contaminants from former domestic landfill and waste bitumen. While these activities have taken place outside the BIPS disturbance area (see Figure 6.11), it is recognised that land within the disturbance area may include areas of contamination.

The contamination report (Appendix F) demonstrates that the site contamination assessment has been carried out in general accordance with the National Environment Protection (Assessment of Site Contamination) Measure, 1999 (NEPC, 2013) as amended in 2013 and the SA EPA (2014) Site Contamination: Guidelines for the Assessment and Remediation of Groundwater Contamination.

Project activity disturbance to historical buried asbestos

Early construction activities associated with the power station on Torrens Island included the extensive use of asbestos and the burial of asbestos waste (see Figure 6.11). Exposure to unearthed asbestos could result in health risks to personnel working on site, particularly given the likelihood that the asbestos will be friable due to breakage and degradation. The BIPS construction will not be within the vicinity of the buried asbestos sites and therefore there will be no potential for impacts. These areas are physically marked as 'no go zones'.



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.11_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Historical land use of the study area	Figure No: 6.11

AI Reference: 202225_02_GRA017.ai_5

6.5.4 Avoidance, management and mitigation

AGL will implement avoidance, mitigation and management measures to address the potential impacts on land use. These measures will reflect current good practice at similar power stations operating in similar environments and are described in the following sections.

Potential to disturb contaminated sites

Prior to construction activities commencing, a site assessment will be conducted to determine if any contaminated soils are within the area to be disturbed during construction of the BIPS. If contaminated soils are identified, appropriate management and mitigation measures will be implemented for the type of contaminated soil identified. Management and mitigation measures implemented will comply with the SA EPA Guidelines for the assessment and remediation of site contamination (SA EPA, 2014).

6.5.5 Residual impacts

Table 6.14 summarises the residual impacts of the project on land use, considering the likelihood and consequence of the predicted impacts after the successful implementation of control and mitigation measures.

Table 6.14 Summary of land use impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I006	Potential to disturb contaminated sites.	Unlikely	Minor	Low

Potential to disturb contaminated sites

Given the historical land uses of Torrens Island there is potential of contaminated sites to exist on the Island. However, given the location of these activities in relation to the BIPS it is **unlikely** that contaminated sites exist within the disturbance area of the BIPS. As a site contamination assessment will be conducted prior to construction activities commencing, any contaminated sites that may potentially exist will be identified and the appropriate management and mitigation measures will be implemented. Therefore the consequences are considered to be **minor**, giving an overall residual risk as **low**.

6.5.6 Monitoring and reporting

Although no specific monitoring plan will be put in place for land use impacts AGL will continue consultation with the surrounding land users and act on any queries accordingly.

6.6 Geology and soils

Existing geology and soils in the project area are described in Section 6.6.2. Potential, credible project-related impacts on soils are described in Section 6.6.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.6.4. The resulting residual impacts are discussed in Section 6.6.5. The monitoring program is detailed in Section 6.6.6.

6.6.1 Study methods

Geology and soils were assessed by Coffey based on a desktop study of the area (Appendix F). The study area includes the BIPS as well as the wider area to provide a regional context where appropriate.

6.6.2 Baseline

This section describes the existing geology and soils of the project area.

Geology

The regional geology of the project area is composed predominantly of Holocene age marine sands and muds of the St Kilda Formation. The St Kilda Formation can be described as light-grey shelly stranded beach ridge deposits and shelly silts and sands overlain in places by modern intertidal and swamp deposits.

The Holocene age landforms overlie older Pleistocene clays (Pooraka Formation and Hindmarsh Formation) and in parts there is a discontinuous Bakara Calcrete horizon associated with the Glanville Formation. The Glanville Formation has been identified from previous studies at Gillman, Le Fevre Peninsula sites and Torrens Island.

Hindmarsh clays have been intersected at a depth of approximately 10 m below the natural surface. The Hindmarsh clays are as thick as 70 m in the Adelaide plains region, which includes Torrens Island.

Soils

Acid sulfate soils (ASS) are naturally occurring soils, sediments or organic substrates that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, ASS are benign. ASS occur naturally along the coastal areas of Australia, typically where land elevation is less than 5 m Australian height datum (AHD). Under anaerobic conditions maintained by permanent groundwater, iron sulfides are stable and the pH is often weakly acid to alkaline (DLGP and DNR, 2002). ASS can be described as either actual acid sulfate soils (AASS) or potential acid sulfate soils (PASS). ASS only becomes a problem when they are disturbed and exposed to air.

The Phase 1 ESA (Coffey, 2010a) identified the possible presence of natural PASS and AASS to exist in the subsurface.

ASS are relatively stable and generally in equilibrium in an unoxidised state. However, if these soils are exposed to air, for example due to disturbance as a result of excavation or dewatering, the oxygen reacts with iron sulfides in the sediment, producing sulfuric acid. The release of sulfuric acid has the potential to contaminate surrounding land and water resources, as well as impact upon the integrity of infrastructure. The release of sulfuric acid as a result of ASS has been known to:

- Acidify groundwater.
- Release of heavy metals and nutrients into surrounding surface water and marine environments.
- Fish kills and algal blooms.
- Iron staining of infrastructure and the ground surface.

- Noxious odours.
- Degradation or corrosion of concrete and steel structures.
- Cracking, shrinking and subsidence of PASS that are allowed to dry out.

Acid sulfate soils risk mapping has been produced for the Gillman area, which includes the southern section of Torrens Island (Thomas et al, 2003). PASS has been identified in the southern section of Torrens Island (Figure 6.12).

The site has been extensively filled, with fill generally extending to 1.8 m below ground surface (bgs). The natural soil profile at the site is classified as quaternary aged fossiliferous sand, mud and organic gypseous clay.

6.6.3 Potential impacts

Construction and operation of the project will involve the excavation of soil and/or filling of land within the project area. Excavation of material will be required for the placement of footings and foundations and fill will be required to provide a stable, level ground upon which to build. The only issue related to the disturbance of soil is the disturbance of PASS.

Disturbance of potential acid sulfate soils

Potential acid sulfate soils are known to occur within sections of the Torrens Island. Disturbance to PASS typically results from excavating or otherwise removing soil or sediment, extracting groundwater or filling land. As the project will include both excavation of soil or sediment and filling, there is potential to disturb PASS material as a result of the project.

If PASS material is disturbed, it has the potential to:

- Damage infrastructure.
- Result in acidification of surface water.
- Affect the survival and growth of vegetation.

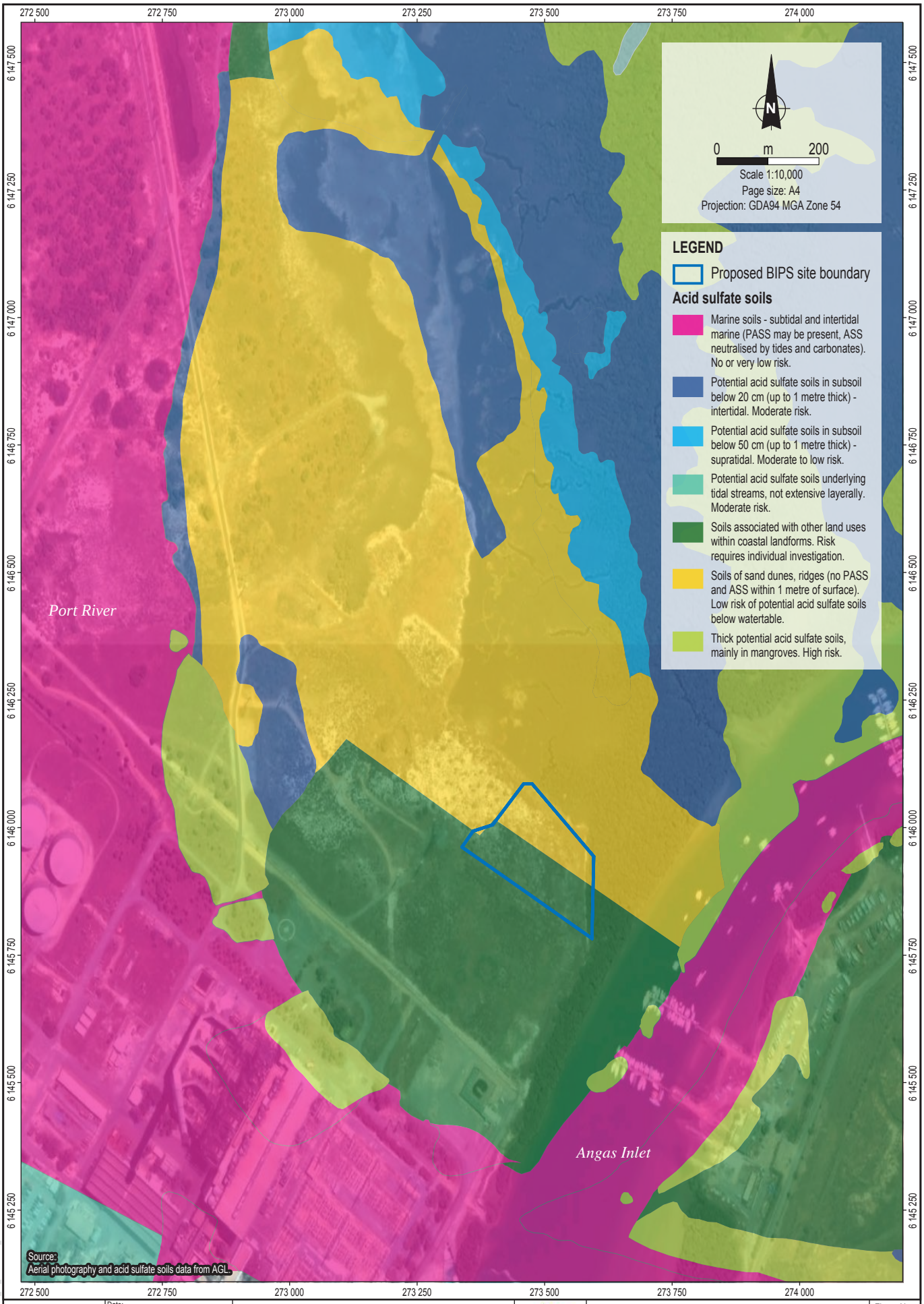
Previous analysis of the soils at the site indicated that the acid neutralising capacity (ANC) of soils is greater than the acid generating capacity which suggests a low potential for ASS generation within the BIPS project area. Therefore ASS and PASS materials are not considered to pose a significant environmental hazard for the project, however a precautionary approach will be adopted as detailed in the section below.

6.6.4 Avoidance, management and mitigation

AGL will implement avoidance, mitigation and management measures to address the potential impacts on soils.

Disturbance of potential acid sulfate soils

Accurate identification of PASS and implementation of management measures will ensure that acid sulfate soils and their associated impacts will be successfully managed. There are a variety of management measures available to treat ASS and the selection of the most appropriate option depends on the physical and chemical characteristics of the ASS, hydrological circumstances and the environmental sensitivity of the site (DERM, 2009).



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.12_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Potential acid sulfate soils	Figure No: 6.12

AI Reference: 202225_02_GRA023.ai_2

As PASS is inert when left undisturbed in waterlogged conditions, AGL will adopt a strategy to avoid disturbance of PASS wherever possible. If disturbance of ASS is unavoidable, there are a range of management strategies that can be implemented. The most appropriate management strategy for ASS will be dependent upon the type and duration of disturbance and the level of environmental risk posed by the AASS or PASS within the area of disturbance. Where avoidance is not possible, AGL will minimise disturbance of PASS by:

- Locate infrastructure so that disturbance of PASS with high levels of sulfides are avoided or minimised.
- Limit the depth of disturbance wherever possible and design diversion and drainage channels so they are wide and shallow and do not penetrate sulfidic layers.

ASS Management Plan

In addition to the above, AGL will also prepare and implement an ASS Management Plan as part of the Health, Safety and Environment Management System (HSEMS) (Chapter 7).

6.6.5 Residual impacts

Table 6.15 summarises the residual impacts of the project on the soils, considering the likelihood and consequence of the predicted impact after the successful implementation of control and mitigation measures.

Table 6.15 Summary of soil impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I007	Disturbance of PASS	Unlikely	Minor	Low

Disturbance of potentially acid sulfate soils

By following the management and mitigation measures to identify, avoid, treat or bury ASS, it is **unlikely** that the project will result in exposure of PASS and release of sulfides. Should it occur, the impacts of this oxidisation and release of sulfides will be **minor** as the ASS can be treated by the addition of alkaline materials, such as agricultural lime. Where disturbance of ASS is unavoidable, AGL will adopt a management strategy of treating ASS via one of the following preferred treatment processes:

- Separation of acid sulfate fines from sand by mechanical methods such as sluicing or hydrocloning techniques.
- Rapid replacement of excavated soils or sediment into the excavation.
- Treatment of disturbed ASS to neutralise the acid producing potential.

Excavated ASS material

ASS material will be kept separate from non-ASS material at all times. A designated ASS treatment area will be constructed on site and sufficient supplies of neutralising agent (e.g., aglime) will be available to treat excavated ASS. Where possible, excavation that involves ASS will be conducted during dry weather to minimise that potential for acid to be transported offsite. Trucks used to transport ASS material to the treatment area will be lined with a layer of lime and the load sealed. Any vehicles used to transport or treat ASS will be cleaned prior to leaving the site to ensure that ASS material is not transported off site.

6.6.6 Monitoring and reporting

Disturbance of potentially acid sulfate soils

The identification of the location, depth and potential acid generation capacity of soils within the project area will be mapped. If the disturbance of ASS cannot be avoided, ASS will be mixed with alkaline materials. Mixing will occur on compacted pads within appropriately bunded areas. During treatment of ASS, the pH of surface water from the treatment area will be monitored to ensure it is not acidic and the pH remains between 6.5 and 8.5 before being released into the environment. Once treatment of the soil is complete, verification testing of the soil will be conducted. Once the soil is confirmed to have an acceptable pH it will be used as fill within the project area.

Reporting

All disturbances, storage, neutralisation and disposal of ASS will be recorded. Information required to be recorded will include:

- Global positioning system (GPS) coordinates.
- Estimated volume of ASS material excavated.
- The date and time the ASS material was excavated and treatment commenced.
- A description of the type of disturbance (i.e., footings, trenches and sedimentation basin).
- Type of management strategy used.
- Results of verification testing.

The Project Environmental Manager will notify the EPA if the ASS disturbance or non-compliance with the ASS management strategies has potentially caused or could cause environmental harm.

6.7 Flora and fauna

Donato Environmental Services (DES) prepared a baseline and impact assessment flora and fauna report for the site in 2009. A subsequent assessment has been undertaken in 2017 (Appendix D) to verify that the site conditions and that the 2009 baseline and impact assessment reports were still relevant to the BIPS project.

The proposed development (for the previous Torrens Island Energy Park) was referred to the Australian Department of the Environment, Water, Heritage and the Arts (now the Department of the Environment and Energy) under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Notification of the referral decision was received in April 2010 (refer to Appendix C). Using the EPBC self-assessment process within the 'Significant impact guidelines 1.1' (DoE, 2013) and the advice of flora and fauna specialist, DES (Appendix D), it was determined that the proposed BIPS will not affect any matters of national environmental significance.

The results of the study are provided in Appendix D confirm that the baseline extent of the flora and fauna species has not changed since the 2009 flora and fauna report was prepared.

Existing flora and fauna in the project area are described in Section 6.7.2. Potential, credible, project-related impacts on flora and fauna are described in Section 6.7.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.7.4. The resulting residual impacts are discussed in Section 6.7.5.

6.7.1 Study methods

In 2009 DES (Appendix D) conducted an ecological assessment of the site to characterise flora and fauna and assess potential impacts of the previously proposed Energy Park development. The assessment included a desktop review, database searches, site visits and communication with relevant stakeholders.

During July 2017 DES (Appendix D) conducted an ecological assessment of the proposed BIPS site to characterise flora and fauna and assess potential impacts of the proposed development. The study area for the terrestrial ecology assessment was defined as all areas that may be affected by the BIPS project and includes Lot 302 (see Figure 6.13).

The objectives of the ecology surveys were to:

- Characterise the terrestrial biodiversity and ecological values of the study area, including significant species of flora and fauna.
- Characterise the potential impacts on terrestrial ecological values associated with the proposed works and to identify measures to avoid, minimise or mitigate these potential impacts through design and management.

Considerable variations and additions to the natural history databases and species listed under legislation have occurred since the 2009 report was prepared. The 2017 addendum searched the revised databases and legislative listings.

6.7.2 Baseline

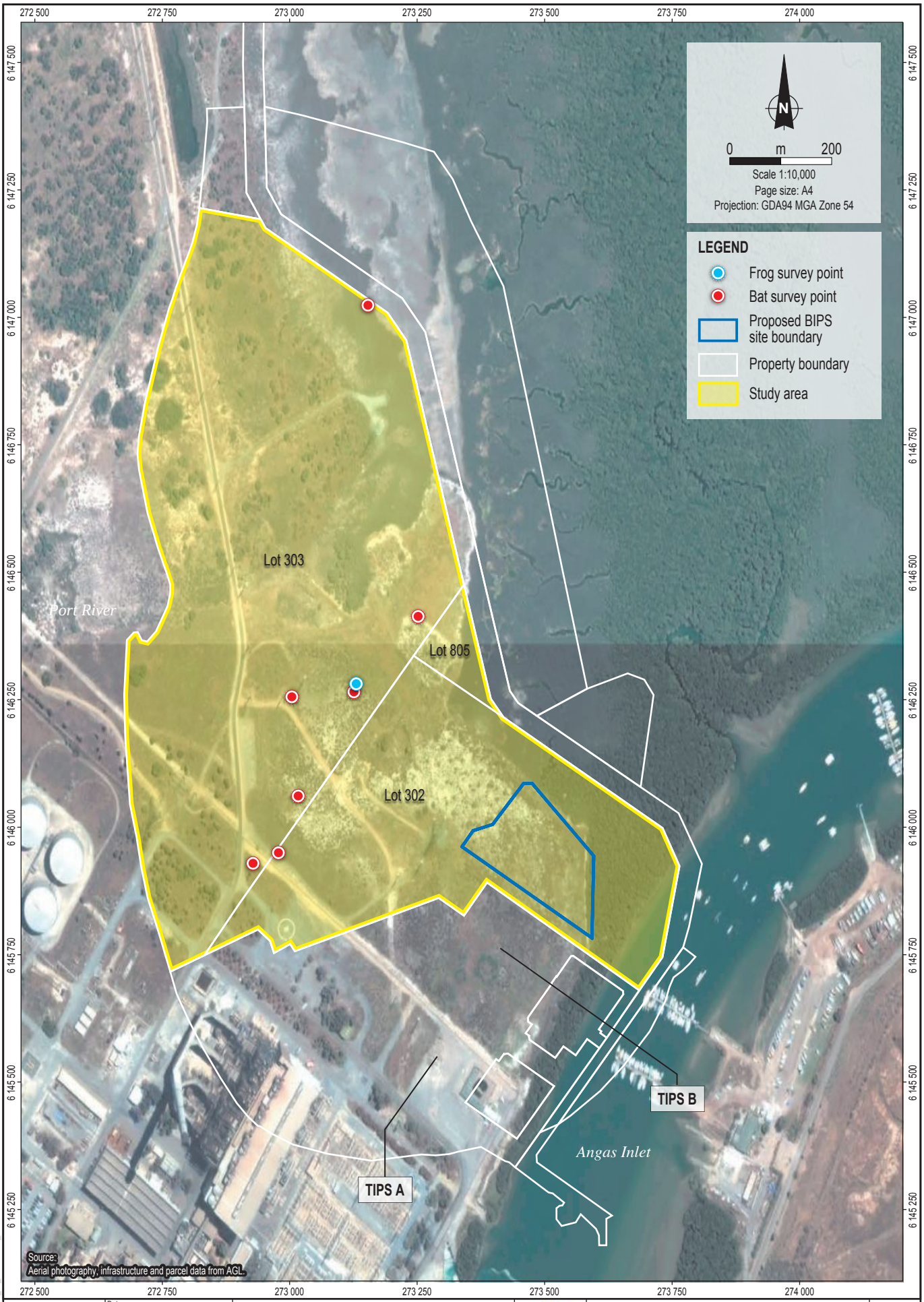
The ecological diversity of Torrens Island has been significantly influenced by historical land uses that include sand mining and dumping of dredged materials (see Section 6.5). These land uses have altered the topography and soil composition in the study area. Floral habitat such as the mangroves, sheoak and native pine woodlands have been significantly reduced or removed altogether. Plates 6.1 to 6.3 show the vegetation within the BIPS project site and surrounding area. This past removal of habitat, combined with the introduction of feral species such as the rabbit, fox and cat, has influenced the decline of native fauna in the study area.

Flora

Vegetation communities

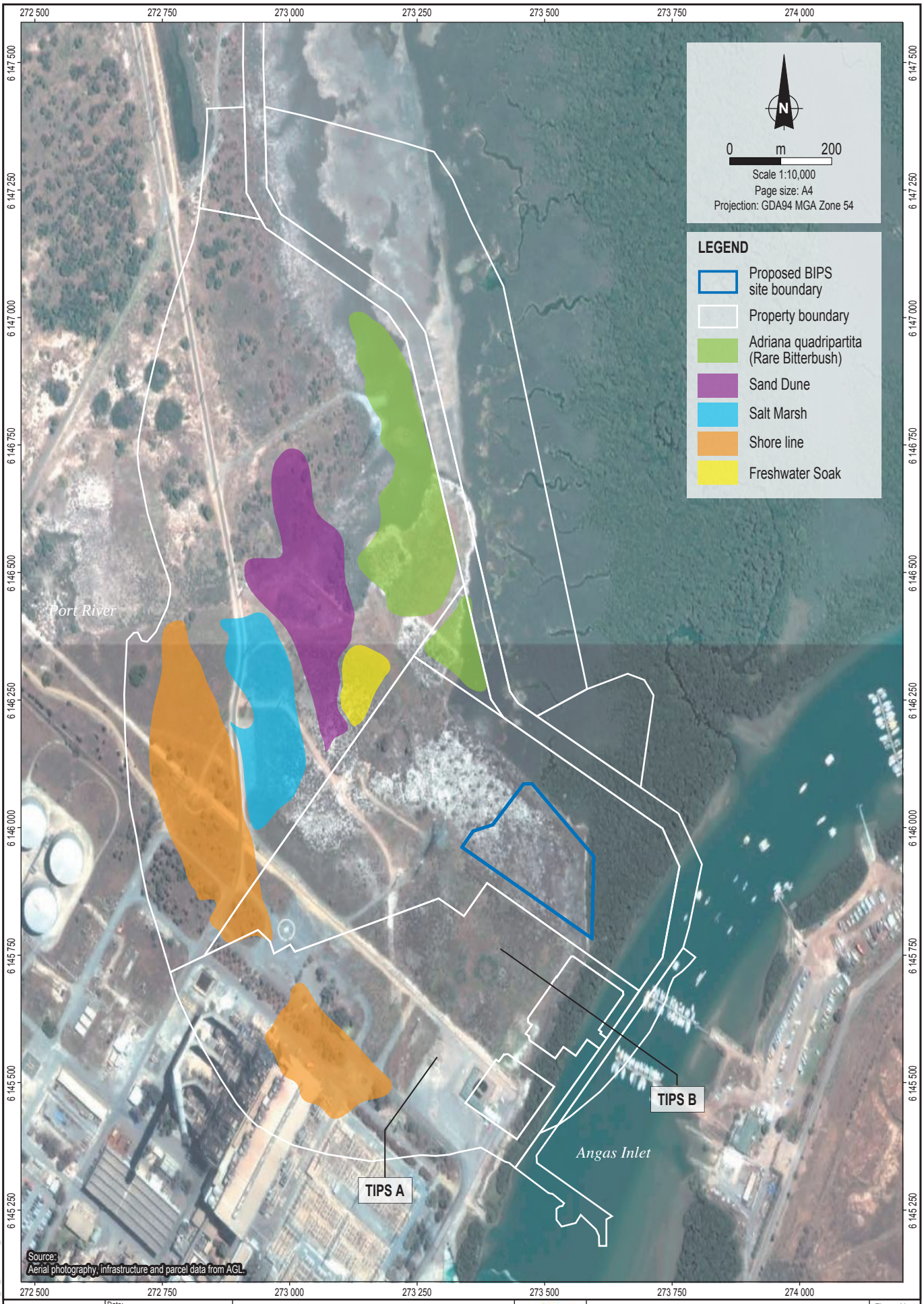
Three main ecological communities were identified within the study area (Figure 6.14), defined as the shoreline, salt marsh and sand dune. Within the study area, the shoreline community is restricted to the southeast corner of Lot 303 and is dominated by the grey mangrove (*Avicennia marina var resinifera*). This community covers 2,139 ha within the Barker Inlet.

The salt marsh community is adjacent to the shoreline community in the southeast corner of Lot 303 and is dominated by shrubby glasswort (*Sclerostegia arbuscula*) and beaded glasswort (*Sarcocornia quinqueflora*). Within the Barker Inlet the salt marsh community covers 612 ha. The sand dune community, which covers 106 ha in the Torrens Island region, occurs within Lot 303, Lot 805 and Lot 302 (where BIPS is located) within the study area. The sand dune community is interspersed with bare saline flats and is a mixture of vegetation types ranging from low woodland to open low scrub. The overstorey in the woodland is dominated by golden wattle (*Acacia pycnantha*) and coastal wattle (*Acacia longifolia sophorae*) and in the rest of the dune community the upper stratum consists of shrubs species such as coastal daisy (*Olearia axillaris),* boobialla *(Myoporum insulare*) and sandhill wattle (*Acacia ligulata*).



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.13_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Flora and fauna survey study area	Figure No: 6.13

AI Reference: 202225_02_GRA0024.ai_2



coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.14_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Ecological communities present within the study area	Figure No: 6.14

AI Reference: 202225_02_GRA018.ai_4

A freshwater soak was identified in Lot 303 (outside of the BIPS project area). The soak contains bulrush (*Typha domingensis*) and is surrounded by coastal wattle (*Acacia longifolia sophorae*) and individuals of drooping sheoak *Allocasuarina verticillata*, the introduced species tobacco plant (*Nicotiana glauca*) and evening primrose (*Oenothera stricta*). The salinity level of the soak was measured on two occasions and ranged from 2,010 mg/L (a level considered to be brackish) to 3,600 mg/L (a level considered saline).

Vegetation condition

The vegetation in the study area is extremely disturbed with an understorey that mostly comprises invasive weed species. The BIPS project area is largely altered, consisting of hard stand areas, exotic grasses and plantings of indigenous and non-indigenous tree species.

Flora species

A total of 92 species of plants were identified within the study area during desktop surveys. Indigenous taxa represented approximately 45% of the total (i.e., 42 species).

Ten noxious weed of national significance (WONS) have been recorded in the study area. In addition there are 21 weed species that are declared under the South Australian N*atural Resources Management Act 2004* (NRM Act) (Table 6.16). The 2017 site walkover did not include a formal survey, therefore the table only indicates desktop results.

Flora species of national conservation significance

The ecological community peppermint box grassy woodland of South Australia and the species *Tecticornia flabelliformis* are both identified under the EPBC Act as being nationally significant flora that may occur within the study area. As they were not identified in the study area or BIPS project area during the flora surveys, it is certain that they are not present.

One ecological community has been declared under the EPBC Act since the writing of the 2009 DES report. The Subtropical and Temperate Coastal Saltmarsh, was listed as Vulnerable in August 2013. The community is outside the development footprint, located approximately 160 m north east of the BIPS project area.

The database searches identified two EPBC Act listed species both orchids, one as Endangered, *Caladenia tensa* (greencomb spider-orchid) and one, *Prasophyllum validum* (sturdy leek-orchid) as Vulnerable (Table 6.17). The timing of the field survey (July 2017) is unsuitable to conclusively establish whether the two orchid species, recorded from the EPBC Act protected matters search as present on Torrens Island. Surveys for both of these species are best conducted from September to October for greencomb spider-orchid and October to November for sturdy leek-orchid. However, it is unlikely that either of these species are present on the island due to lack of suitable habitat.

Flora species of state conservation significance

Two species of state conservation significance under the NPW Act, were identified in the desktop study. Large-fruit crassula (*Crassula exserta*) listed as Rare and an orchid, sturdy leek-orchid (*Prasophyllum validum*) listed as Vulnerable.

The large-fruit crassula, was last recorded in 1988 on the adjacent land west of Torrens Island in Osborne. The species is a succulent annual herb growing on sandy and clayey soils on Granite outcrops, swamps, depressions and saline mud flats. The species may occur on Torrens Island.

Photo credit: Donato Environmental Services

Plate 6.1
Highly modified vegetation at the BIPS site looking towards TIPS

Photo credit: Donato Environmental Services

Plate 6.2
Knobby Club-grass in the surrounding area

Photo credit: Donato Environmental Services

Plate 6.3
Vegetation in the surrounding area – wader roost habitat

Table 6.16 Listed weed species likely to occur within the study area (2009 and 2017)

Species Name	Common Name	Weed Significance			
		National (WONS)	State (NRM Act)	Present	May Be Present
Asparagus asparagoides	Bridal creeper	X	X	X	-
Lyceum ferocissimum	African boxthorn	-	X	X	-
Marrubium vulgare	Horehound	-	X	-	X
Asphodelus fistulosus	Onion weed	-	X	-	X
Oxalis pes-caprae	Soursob	-	X	-	X
Cynara cardunculus	Artichoke thistle	-	X	X	-
Tribulus terrestris	Caltrop	-	X	-	X
Euphorbia terracina	False caper	-	X	X	-
Olea europaea cuspidate	Olive	-	X	X	-
Suaeda baccifera	-	-	-	-	X
Mesembryanthemum crystallinum	Common iceplant	-	-	X	-
Carpobrotus edulis edulis	Hottentot fig	-	-	X	-
Ehrharta villosa var. maxima	Pyp grass	-	-	X	-
Juncus acutus	Sharp rush	-	-	-	X
Opuntia stricta	Erect prickly pear	X	X	NA	NA
Chrysanthemoides monilifera	Bitou bush, boneseed	-	X	NA	NA
Chrysanthemoides monilifera ssp. monilifera	Boneseed	X	X	NA	NA
Genista linifolia	Flax-leaved broom, mediterranean broom, flax broom	-	X	NA	NA
Lantana camara	Lantana, wild Sage	X	X	NA	NA
Nassella neesiana	Chilean needle grass	X	X	NA	NA
Rubus fruticosus aggregate	Blackberry, European blackberry	X	X	NA	NA
Salix spp.	Willows	X	X	NA	NA
Solanum elaeagnifolium	Silver nightshade	X	X	NA	NA
Tamarix aphylla	Athel pine	X	X	NA	NA
Ulex europaeus	Gorse, furze	X	X	NA	NA

Flora species of regional and local significance

Two species regarded as uncommon in the Adelaide and Mount Lofty Region (AMLR) are present on Torrens Island (Table 6.17). Silky wilsonia (*Wilsonia humilis*) has been identified within the salt marsh community in the study area and BDSA records from 1990 identify 11 records on the eastern margin of Lot 605, outside of the BIPS area. In addition this species is also common in the Barker Inlet and other areas of Torrens Island.

For the AMLR an additional 13 species were identified in the desktop study. These species have non-legislative interim regional conservation ratings. Five species are vulnerable, three species are rare, three near threatened and three least concern.

The rare bitterbush (*Adriana quadripartita*) has been identified in the southeast corner of Lot 303 and within Lot 805 (Figure 6.14) outside of the BIPS project area. An individual of the species was recorded 120 m to the north of the BIPS site. This species has an important association with the bitter-bush blue butterfly (*Theclinesthes albocincta*) that only occurs in coastal regions and is limited to three isolated populations, including one at Torrens Island. During consultation concerns were raised by the 'South Australian Butterflies' group regarding the potential to impact on the flora rare bitterbush and subsequently the butterflies in the area.

Stakeholders have expressed concern over the potential impacts to the rare bitterbush due to direct disturbance and from potentially altering the fresh groundwater, which may assist in supporting the species. A freshwater soak was identified in Lot 303 (outside of the BIPS project area), which stakeholder believe may provide freshwater to the bitterbush species.

Conservation Volunteers Australia (CVA) and Friends of Torrens Island group have been actively revegetating areas of the Torrens Island Conservation Park with this species and several hundred rare bitterbush plants now exist within the park.

Table 6.17 Flora species of national, state and regional significance

Species Name	Common Name	EPBC Act	NPW Act	Status in AMLR	Occurrence on Torrens Island
CYPERACEAE *Bolboschoenus caldwellii*	Salt club-rush			Rare	X
Gahnia filum	Thatching grass			Vulnerable	X
AIZOACEAE *Carpobrotus rossii*	Native pigface			Least concern	X
CRASSULACEAE *Crassula exserta*	Large-fruit crassula		Rare	Rare	X
LILIACEAE *Dianella brevicaulis*	Short-stem flax-lily			Near Threatened	X
MYRTACEAE *Eucalyptus leucoxylon ssp. leucoxylon*	South Australian blue gum			Near Threatened	X
ZANNICHELLIACEAE *Lepilaena cylindrocarpa*	Long-fruit water-mat			Vulnerable	X

Table 6.17 Flora species of national, state and regional significance (cont'd)

Species Name	Common Name	EPBC Act	NPW Act	Status in AMLR	Occurrence on Torrens Island
EPACRIDACEAE *Leucopogon parviflorus*	Coast beard-heath			Near Threatened	X
CHENOPODIACEAE *Enchylaena tomentosa var. tomentosa*	Ruby saltbush			Least concern	X
Rhagodia candolleana ssp. candolleana	Sea-berry saltbush			Least concern	X
Tecticornia arbuscula	Shrubby samphire			Vulnerable	X
Tecticornia pergranulata ssp. pergranulata	Black-seed samphire			Vulnerable	X
CONVOLVULACEAE *Wilsonia rotundifolia*	Round-leaf wilsonia			Vulnerable	X
ORCHIDACEAE *Caladenia tensa*	Greencomb spiderorchid, Rigid Spider Orchid	Endangered		Rare	
Prasophyllum validum	Sturdy leek-orchid	Vulnerable	Vulnerable		
Wilsonia humilis	Silky wilsonia			Uncommon	X
Adriana quadripartita	Rare bitterbush			Uncommon	X

Fauna species

Existing literature recognises that Torrens Island has relatively low biodiversity of native fauna, other than bats, rodents and birds. The EPBC Act database and SA biological survey database recorded 374 potential species of terrestrial vertebrates in the local area, including four introduced species (Table 6.18).

Table 6.18 Terrestrial fauna species recorded during field surveys and desktop searches

Fauna Group	Species Recorded in Local Area
Birds	305
Reptiles	39
Mammals	23
Amphibians	7

Amphibians

The desktop review identified seven frog species that may occur in the region, including two species listed under the South Australian *National Parks and Wildlife Act* 1972 (NPW Act) (Table 6.19). Both of these species have been observed in the region surrounding Torrens Island. However, no frogs (of any species) were detected during monitoring activities conducted in and around the soak (Figure 6.13), where salinity levels were found to be unsuitable for amphibians (electrical conductivity of

6,000 units). Given the lack of fresh water habitat in native habitat sections of the island it is unlikely that frogs will be present unless they are associated with artificial habitats formed with infrastructure and watered gardens.

Table 6.19 Frog species recorded during field surveys and desktop searches

Species Name	Common Name	Conservation Status	
		NPW Act	AMLR
Litoria reniformis	Golden bell frog	Vulnerable	-
Pseudophryne bibroni	Brown toadlet	Rare	Vulnerable

Reptiles

A total of 22 reptile species have been identified from past surveys conducted within the southern Torrens Island area, in addition there are 14 other reptile species that are likely to occur within the habitat types on the island. Of the 36 reptile species that may occur in the study area, two are regarded as having conservation significance within the Adelaide and Mount Lofty Region (Table 6.20).

Neither of the species identified as having conservation significance have been reported within the study area. However, the southern grass skink (*Pseudemoia entrecasteauxii*) is found in a variety of habitats within the Adelaide Plains including samphire and reed bed communities. As these habitats are present adjacent to the study area it is likely this species could be present. Likewise the eastern tiger snake (*Notechis scutatus*) has an association with open sclerophyll and river floodplains and may also occur in the study area.

Table 6.20 Reptile species of conservation significance that may occur in the study area

Species Name	Common Name	Conservation Status (AMLR)	Identified in southern Torrens Island	May occur in the study area
Pseudemoia entrecasteauxii	Southern grass skink	Vulnerable	X	-
Notechis scutatus	Eastern tiger snake	Vulnerable	-	X

Mammals

According to the desktop surveys and bat surveys conducted within the study area, there are 13 native mammals that are or may be present in the study area, comprising one flying fox, ten bat species and two rat species (Appendix D). One species, the yellow-tailed sheathtail bat, is listed as rare in South Australia. Ten introduced mammals are also likely or known to be present in the study area, three are listed as key threatening processes (feral species) under the EPBC Act (Table 6.21).

Five bat species were identified during surveys of bat calls conducted by DES. The yellow-tailed sheathtail bat (*Saccolaimus flaviventris*) was not detected during the survey, but has been reported as possibly occurring in the area.

Fox and rabbit populations are well documented on Torrens Island and active eradication programs have been in place since 1989. CVA considers that populations for both species are currently under control.

Table 6.21 Mammal species of significance that may occur in the study area

Species Name	Common Name	Conservation Status		May Occur in Study Area
		EPBC Act	NPW Act	
Saccolaimus flaviventris	Yellow-tailed sheathtail bat	-	Rare	X
Pteropus poliocephalus	Grey-headed flying fox	X		No habitat exists
		Invasive mammals		
*Vulpes vulpes**	European red fox	X	-	X
*Felis catus**	Feral cat	X	-	X
*Oryctolagus cuniculus**	European wild rabbit	X	-	X
*Lepus capensis**	Brown hare		X	X
*Bos Taurus**	Domestic cattle		X	X
*Canis lupus familiaris**	Domestic dog		X	X
*Capra hircus**	Goat		X	X
*Sus scofa**	Pig		X	X

* Introduced species

Birds

Desktop surveys identified 305 bird species that may be present within the study area, as provided in Appendix D. Of these birds:

- 130 are threatened or of conservation significance at a state or regional level.
- 60 are listed under various international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).
- 104 are listed under the EPBC Act (2 critically endangered, 6 endangered, 15 vulnerable, 8 threatened, 16 migratory and 57 listed marine birds).
- Of the State or regional listed birds only four have been recorded in the study area. Baillon's crake (*Porzana pusilla*), Horsefield's bronze-cuckoo (*Chalcites basalis*), shining bronze-cuckoo (*Chalcites lucidus*) and the whimbrel (*Numenius phaeopus)* have all had opportune sightings recorded through Birds Australia or the South Australian Ornithological Association.
- The EPBC Act listed species, the Australian painted snipe (*Rostratula australis*) is considered potentially to occur in the study area, although there have been no recorded sightings. It is unlikely that the remaining species occur in the BIPS area, based on the absence of appropriate habitats.
- The EPBC Act listed species, the slender-billed thornbill *Acanthiza iredalei rosinae* was recorded as a 'species or species habitat likely to occur within the area' from the EPBC Act protected matters search and was recorded in all other database searches. One individual of this species was observed during the 2017 site visit on the samphire community (described as Subtropical and Temperate Coastal Saltmarsh under the EPBC Act) approximately 350 m north east of the development area. Up to four birds were heard during the site walkover. The habitat for the species is not present within the development area and it not plausible that the species will inhabit the non-saline modified habitats within the development area.

- DES conducted a visual assessment of wader roosting habitat to the north of the study area. All of the roosting sites they identified are located outside of the project boundary to the east of the project area (within the proximity of the old aquaculture lease) and are not likely to be impacted by project activities.

Butterflies

The rare bitterbush has an important association with the bitter-bush blue butterfly (*Theclinesthes albocincta*) that only occurs in coastal regions and is limited to three isolated populations, including one at Torrens Island. During consultation concerns were raised by the South Australian Butterflies group regarding the potential to impact on the butterflies in the area including the cynone skipper (*Anisynta cynone*).

The 'South Australian Butterflies' also notified that butterfly species *Hesperilla flavescens flavia* (extinct) and *Hesperilla chrysotricha* (vulnerable) have been lost from the area due to the historical total removal of the larval hostplant sedge *Gahnia filum*.

6.7.3 Potential impacts

Potential, credible project-related impacts to flora and fauna are described in the following sections. These do not take into consideration the proposed avoidance, mitigation and management measures that will be implemented by AGL during all stages of project development and which will result in the residual impacts discussed in Section 6.7.5.

Loss of rare bitterbush and bitter-bush blue butterfly

Rare bitterbush has been identified as uncommon in the SLR and is regarded as a significant host species for the bitter-bush blue butterfly. It has been observed in the south-east corner of Lot 303 and in Lot 805, which are outside of the BIPS project area. An individual species was sighted during the 2017 survey approximately 120 m to the north east of the development area.

Vegetation and habitat loss

The vegetation community within Lot 302 (BIPS site) of the study area is severely degraded with a considerable loss of habitat and structural complexity. Infrastructure development on Lot 302 would have an insignificant effect on flora and fauna populations. The vegetation community within Lot 303 is reasonably intact and is experiencing regeneration from some plant species. The development footprint will not occur within Lot 303 and therefore will not have an impact on the population of fauna and flora. The EPBC Act listed Subtropical and Temperate Coastal Saltmarsh is located outside the development footprint, approximately 160 m north east of the BIPS project area. The project will not have an impact on this community.

Sediment runoff and stormwater discharge

If not managed appropriately, stormwater discharge from infrastructure can carry contaminants and sediments to salt marsh or shoreline communities.

Contamination of groundwater and subaqueous water

Contamination of groundwater and subaqueous water resources, i.e., the freshwater soak in Lot 303, can cause detrimental effects on fauna and associated vegetation communities. The development

footprint will not occur within Lot 303 and therefore will not have a direct impact on the freshwater soak.

Dust emissions

Dust from construction may temporarily cover vegetation and reduce habitat integrity.

Materials handling, disposal and pollution

Spills from the handling, storage and disposal of fuels, oils, chemicals, and management of hard waste may impact on biodiversity through the loss of vegetation and habitat integrity with adverse effects on fauna. Contaminants are readily absorbed by tidal communities.

Noise emissions and artificial light sources

Bats and nocturnal bird species can be affected by lights and tall structures. Noise may cause changes in fauna behaviour, e.g., breeding and nesting behaviour in birds.

Weed infestation

Much of the study area is already heavily impacted by a diverse range of weed species. The import of materials and the movement of vehicles in the study area pose the risk of introducing additional weed species to the study site and Torrens Island.

Pest animal infestation

The BIPS site is an existing industrial area with ongoing human presence and is already populated with pest animal species such as foxes, rabbits, black rats and cats typically drawn to such sites. The BIPS activities will not introduce additional factors that attract pest animals and the proposed development will consequently not impact on these populations. However, the CVA pest animal management program will continue to ensure that pest animal populations remain under control.

6.7.4 Avoidance, management and mitigation

AGL will implement avoidance, mitigation and management measures to address the potential impacts on flora and fauna. These measures will reflect current good practice at similar power stations operating in similar environments.

As described in Chapter 2, the allotment subject to the BIPS are outside the *Native Vegetation Act 1991* jurisdictional boundary. Therefore, approval for clearance under the Native Vegetation Act is not required.

Loss of rare bitterbush and bitter-bush blue butterfly

To reduce or avoid impacts associated with loss of the rare bitterbush AGL will:

- Minimise the footprint of the project during the design phase to reduce the amount of vegetation to be cleared in the first instance.
- Map the location of rare bitterbush plants as ‘no-go’ areas.
- Limit the amount of disturbance during the construction phase by ensuring vehicles keep to designated tracks and flagging any ‘no-go’ areas.

- Contain habitat clearance within the project footprint by flagging the project area.

Stakeholders from the South Australian Butterflies group have suggested that to assist in protecting the bitterbush species, fresh rainwater runoff from the site could be diverted towards the surrounding environment to supply freshwater to the flora species or groundwater. At this stage the surface water management system (Section 4.2.8) does not propose to discharge clean water to the surrounding environment, however this may be considered at a later date.

Vegetation and habitat loss

Given the degraded nature and existing land uses of the project area it is unlikely that the project will have a significant impact on flora or fauna species of conservation significance. Any specialised or specific measures are not warranted. However, AGL will introduce general measures to minimise any impacts the project may have on the surrounding environment.

Sediment runoff and stormwater discharge

Measures designed to avoid, minimise and manage the impacts associated with surface water runoff are addressed in Section 4.2.8 and Section 6.8.

Contamination of groundwater and subaqueous water

Measures designed to avoid, minimise and manage the impacts associated with groundwater use and contaminants are addressed in Section 6.9.

Dust emissions

Measures designed to avoid, minimise and manage the risks associated with dust generation are provided in Section 6.2.

Materials handling, disposal and pollution

Measures to avoid, minimise and manage the risks associated with waste management are provided in Section 4.2.9.

Noise emissions and artificial light sources

Given the proximity of the BIPS to the existing TIPS, it is unlikely that fauna will be additionally influenced by noise and lights.

Weed infestation

To avoid, minimise and manage the risks associated with weed infestation AGL will:

- Manage weed populations on the project area and monitor for outbreaks of any new species.
- Provide continued support to organisations such as CVA for the control of weeds in the study area and on Torrens Island.

6.7.5 Residual impacts

Residual impacts that occur after implementing the measures described in Section 6.7.4 are assessed in terms of a likelihood and consequence risk assessment. Risks have been assessed in terms of the increased risk over and above the current level of risk.

Overall, the project has been assessed to have a minimal impact on the surrounding flora and fauna. This is based on the consideration that the study area is already severely degraded and has experienced considerable habitat loss in the past. In addition, most of the development will occur within the confines of existing AGL infrastructure. Subject to implementation of the mitigation procedures outlined in Section 6.7.4 construction and operation activities of the project are expected to have a limited impact to flora and fauna in the study area.

The residual impacts are summarised in Table 6.22 and assessed in the following sections.

Table 6.22 Summary of impacts to flora and fauna

ID	Impact	Likelihood	Consequence	Residual Risk
I008	Significant loss of rare bitterbush (*A. quadipartita*) habitat and bitter-bush blue butterfly.	Rare	Minor	Low
I009	Vegetation and habitat loss.	Unlikely	Minor	Low
I010	Introduction of a new weed infestation.	Unlikely	Minor	Low

Loss of rare bitterbush and bitter-bush blue butterfly

Given the location and small footprint of the BIPS which avoids the rare bitterbush species, the loss of any significant amount of habitat for the rare bitterbush is **rare**. Given the replanting of this species on Torrens Island by CVA, the consequence of any impacts to individual plants is considered to be **minor**, resulting in a residual risk level of **low**.

Vegetation and habitat loss

Given the degraded nature and existing land uses of the project area it is **unlikely** that the project will have a significant impact on flora or fauna species. The significance of any loss would be regarded as **minor** and therefore the overall consequence is regarded as **low**.

Weed infestation

Given the presence of a range of important weed species already on Torrens Island, and the minimal amount of disturbance required for the development of the BIPS the likelihood of a new weed infestation is regarded as **unlikely**. The consequence of a weed infestation, given the already degraded state of the study area would be **minor** requiring some management. The overall consequence is **low**.

6.7.6 Monitoring and reporting

Inspection and monitoring will be conducted to ensure the proposed management and mitigation measures are effectively implemented and to ensure residual impacts to terrestrial ecology are low. Monitoring activities will include:

- Monitor open sections of trench daily for trapped animals such as reptiles and small ground-dwelling mammals.

- Continue CVA monitoring and management of pest species, reporting to AGL's environmental coordinator.
- Continue CVA monitoring and management of populations of the rare bitterbush, reporting to AGL's environmental coordinator.
- Continue with revegetation programs on Torrens Island, in conjunction with CVA. The progress of replanting will be monitored quarterly initially until plants are established and no longer require management.

More detailed monitoring measures, if required, will be developed as part of the project EMPs.

6.8 Surface water, hydrology and water quality

Existing surface water conditions in the project area are described in Section 6.8.2. Potential, credible project-related impacts on surface waters are described in Section 6.8.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.8.4. The resulting residual surface water impacts are discussed in Section 6.8.5. The monitoring program is outlined in Section 6.8.6.

6.8.1 Study methods

The surface water, hydrology and water quality assessments of the proposed BIPS were based on desktop studies conducted by Coffey Environments (Appendix K) and a water management plan prepared by Tonkin Consulting (Appendix E). Details of the surface water management proposed for the site is provided in Section 4.2.8.

Two options for development of the site are currently being considered by AGL (as described in Chapter 2). While each option involves a different layout, the components of each proposal are similar with comparable overall site areas. As a result, it is envisaged that the general principles to be applied for management of runoff for each option will also be similar. Option 1, was selected by Tonkin Consulting (Appendix E) for more detailed analysis as a part of surface water investigation. The approximate areas occupied by each site component are provided in Table 6.23. The final areas for each site element is subject to final detailed design.

Table 6.23 BIPS option 1 site elements

Site element	Approximate area (m^2)
Power house (enclosed facility)	4,300
Tank yard and unloading area	900
Reagent tank yard	200
Radiator area (assumed to be gravel)	1,500
Asphalt Roads and hardstand areas (assumed to include SCR units, unloading zone and other supporting infrastructure)	9,100
Exhaust gas silencer area (assumed to be gravel)	2,500
Total	**18,500**

Tonkin Consulting (Appendix E) also undertook water quality modelling using the MUSIC (Model for Urban Stormwater Improvement Conceptualisation). By simulating the performance of water quality improvement measures, MUSIC determines if proposed systems can meet specified water quality

objectives. The model took into account the predicted groundwater seepage velocity of 0.72 – 7.4 m/yr (0.08 – 0.84 mm/hr).

The model also used estimated catchment areas for the conceptual layout option 1 as provided in Table 6.24.

Table 6.24 Estimated stormwater catchment areas (option 1)

Catchment type	Area (m^2)	Receiving nodes
Bunded areas for tank storage and unloading zone	1,300	Not part of the stormwater drainage system. Water is managed in accordance with Section 4.2.8
Roads and hardstand	8,900	Oil and grit separator, GPT and bio-retention basin
Roofs	4,300	Bio-retention basin
Gravel	4,000	Infiltration with any runoff directed to the oil and grit separator, GPT and bio-retention basin
Total	**18,500**	

Source: Tonkin Consulting (Appendix E)

The bio-retention basin was also sized and modelled using MUSIC. The proposed sediment/bio-retention basin would reduce the runoff that is discharged to the marine environment to a level approaching the predevelopment runoff estimates (approximately 80% assuming 0.46 mm/hr - the average groundwater seepage velocity).

The MUSIC model was also used to predict the reductions in pollutants that are discharged through the outfall over the modelling period. The actual results that are achieved will depend on the interaction between the bio-filtration basin and the underlying groundwater table.

6.8.2 Baseline

The proposed site is located close to the following local surface water bodies:

- Central segment of the Port River – Barker Inlet estuary comprises waterways of the Angas and Barker Inlets, the North Arm and the Port River.
- Mangrove swamps and ephemeral wetlands within Torrens Island.
- Areas of stormwater collection within the existing TIPS.

Information regarding waterways in the central segment of the Port River – Barker Inlet estuary was sourced from available literature, information provided by AGL and previous investigations in the vicinity of Torrens Island. Water quality data was obtained from the SA EPA (SA EPA, 2009b).

Information regarding the ephemeral wetlands within Torrens Island was obtained from available literature, previous investigations in similar areas and aerial photos. Information regarding stormwater on Torrens Island was sourced from AGL and the Australian Government Bureau of Meteorology.

The existing environment for the identified surface waters is described in the following sections.

Ephemeral wetlands within Torrens Island

Numerous small ephemeral tidal lakes and creeks are present within the area of mangrove swamps surrounding the study area. Water from these bodies will either flow into the waterways located around Torrens Island or filter through the soil into the groundwater. These water bodies tend to be

located in the lower lying areas of Torrens Island adjacent to the coastline and the eastern and northern parts of the island which is covered by mangrove swamps.

Waterways

The waterways surrounding the study area in Central Barker Inlet Segment include the Port Adelaide River, North Arm Creek, Barker Inlet and Angas Inlet. Angas Inlet and Port River lie adjacent to the south eastern and south western boundaries of the TIPS site respectively. Cooling water for the power station is currently extracted from the North Arm/Port River and discharged into Angas Inlet.

The waters of Central Barker Inlet Segment are currently used for recreation (including swimming, boating and fishing) and primary production (including collection of shellfish and fish for human consumption). They also provide an ecosystem that supports dolphin and fish breeding and are a source of industrial cooling water for power stations.

Water quality and nutrient status in the Port Waterways is monitored by the SA EPA. The major contributor to the nutritional load is the Bolivar Wastewater Treatment Plant. TIPS is not considered a contributor to the nutrient load. Water quality is generally considered poor due to elevated concentrations of nutrients and heavy metals. Concentrations of ammonia, oxidised nitrogen and chlorophyll exceed the National Water Quality Management Strategy: Australian Water Quality Guidelines for Fresh and Marine Waters, Australian and New Zealand Environment Conservation Council (ANZECC) guidelines (ANZECC/ARMCANZ, 2000).

Total nitrogen concentrations are around or below the nominated ANZECC guidelines. Copper and zinc concentrations are high, probably due to urban runoff containing heavy metals washing off roads and galvanised iron roofs into the marine environment during rain events (SA EPA, 2009a). Monitoring of the Barker Inlet is included in the EPA Aquatic Ecosystem Condition Reports for the Adelaide metropolitan waters (Adelaide Metropolitan Nearshore Marine Biounit). However information is limited to 2010 and 2011. Publicised water quality data from the EPA ceased in 2008 (EPA, 2017).

As part of TIPS SA Environment Protection license, AGL is required to monitor cooling water discharge temperatures. The cooling water discharge is 5 to 10 ^{0}C above the inlet temperature.

Stormwater

The average annual rainfall in the vicinity of Torrens Island (Bureau of Meteorology station 023018) is approximately 430 mm/year with the majority of rain being received in the late autumn, winter and the middle of spring (May to October). The average rainfall for the Torrens Island station is shown in Table 6.25.

Table 6.25 Average rainfall recorded at Torrens Island

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Average rainfall (mm)	18.9	19.6	20.5	35.3	48.2	53.9	53.4	49.9	43.9	37.4	26.2	25.0
Highest daily (mm)	72.6	93.5	66.6	46.0	37.6	51.8	28.7	29.5	34.6	66.2	62.7	58.0

Currently stormwater at TIPS is collected in drainage systems and delivered to a central treatment pond with oil/water separator, before discharge into the waterways of Angas Inlet.

Runoff from the undeveloped site has been estimated by Tonkin Consulting (Appendix E) at around 1000 m^3/year.

6.8.3 Potential impacts

If not managed appropriately, potential impacts to waterways may occur during both the construction process and during operations.

The EPA is the custodian of water quality in South Australia and aims to minimise pollutants entering the states' waters including groundwater. The EPA require that water resources are protected and that the potential for impacts such as the increased stormwater flows above pre-development flows and potential for increased pollutants in the stormwater that flows off site are managed.

The stormwater performance targets provided in the DEWNR guidelines (DEWNR, 2013) are shown in Table 6.26.

Table 6.26 DEWNR stormwater performance targets

Pollutant	Current best practice performance targets
Total suspended solids	80 % reduction of the untreated urban annual load
Total phosphorus	60 % reduction of the untreated urban annual load
Total nitrogen	45 % reduction of the untreated urban annual load
Litter	90 % reduction of the untreated urban annual load
Flows	Maintain discharges to within the capacity of the existing receiving stormwater infrastructure

The Environmental Protection (Water Quality) Policy (2015) states that:

> *'A person must not discharge a class 1 pollutant into any waters or onto land in a place from which it is reasonably likely to enter any waters (including by processes such as seepage or infiltration or carriage by wind, rain, sea spray or stormwater or by the rising of the water table).'*

Class 1 pollutants that are likely to come off the site include oils and grease which are possible contaminants on the roadways and hardstand areas or pollutants captured from within bunded areas.

Altered flow regimes

Potential impacts to ephemeral wetlands are unlikely to occur as there is a lack of any natural drainage systems across the proposed BIPS site.

Cooling water discharge from TIPS is currently not identified as affecting the water quality within the Central Barker Inlet Segment of the Port Waterways. The BIPS development does not propose to increase the volume of cooling water either extracted or discharged into these waterways. TIPS B will continue to extract and discharge water without change from current operations. The BIPS will not use cooling water in the generation process. Therefore the potential impact to water regimes and water quality is considered insignificant.

Stormwater from roadways and hardstand areas will be directed, using kerb and gutter or concrete spoon drains to the underground drain via inlet pits. The drainage system would grade towards the stormwater treatment train as shown on Figure 4.4 in Chapter 2. The drain will have a flat grade to reduce the invert of the downstream treatment system.

The BIPS will increase the surface area for stormwater collection and the overall runoff from the proposed development by approximately 4,660 m^3/year. The runoff characteristics are outlined in Table 6.27. Stormwater from the BIPS will tie-in to the existing TIPS drains systems and there will be a bio-retention pond developed as part of the project.

A large volume of stormwater entering the Barker Inlet Central Segment Waterways may impact on the aquatic ecosystem of the Port Waterways if not dispersed appropriately.

Table 6.27 Stormwater runoff characteristics

Catchment type	Runoff (m^3/year)	Runoff water quality
Roads and hardstand	3,000	Typically contaminated with suspended solids, hydrocarbon residues, heavy metals and other contaminants associated with suspended solids brought in by vehicles, dust and through erosion of the finished surface.
Roofs	1,500	Water considered clean.
Gravel	160	Gravel areas will be located in non-trafficable areas and would generate low runoff volumes with any runoff produced having low levels of suspended solids.
Total	**4,600**	

Surface water contamination

Construction and operation of the BIPS has the potential to affect the ephemeral wetlands, the Barker Inlet Central Segment and stormwater through fuel or chemical spills or exposure to contaminated soils. Spills or contaminated soil may be washed into the stormwater with rain events, increasing contaminant levels in the stormwater if not managed correctly.

There may be some washdown activities within the engine hall. These areas will be bunded in accordance with the Bunding and Spill Management Guidelines (EPA, 2016) to prevent contamination of receiving waterways. As outlined in Section 4.2.8 water from bunded areas will be directed through an interceptor system designed to remove any oil and grease, and minimise suspended solids to an acceptable level prior to discharge to the sedimentation pond or bio-retention pond.

6.8.4 Avoidance, management and mitigation

This section describes the proposed management measures to be implemented by AGL and is designed to avoid, minimise or mitigate the potential impacts of the project. The surface water management proposed as part of the project description is outlined in Section 4.2.8 (as these features will be constructed as part of the project).

Site surface water management will be based on the principles of:

- Divert clean surface water runoff away from disturbed areas and into existing natural watercourses and drainage lines or to a bio-retention pond.
- Intercept runoff from disturbed areas and direct it through sediment control structures or for treatment prior to discharge to the downstream environment.

AGL's surface water management objectives for the BIPS include:

- Minimise the potential project impacts such as changes in the stream flow regime, alteration of habitat, pollution or increased erosion and sedimentation.
- Where feasible, maintain the shape and composition of the natural watercourse geometry, natural biological indicator conditions and flow conditions.
- Employ protection measures to prevent adverse hydrological and water quality impacts, for all recognised watercourses within the project area.

Altered flow regimes

Construction

To avoid erosion or earthworks interfering with the ephemeral creeks and wetlands within Torrens Island, appropriate planning is required for construction works during dry weather, e.g., designing the layout of temporary access roads if required.

Appropriate stormwater channelling during the construction phase will prevent excess stormwater flow from impacting directly on the ephemeral wetlands and prevent a potential source of soil erosion. There will be no direct discharge to the marine environment.

Operation

BIPS infrastructure will be placed to minimise changes to the flow regime, wherever practicable. To minimise the volume of stormwater runoff from the project, clean runoff from undisturbed areas surrounding the BIPS will be diverted around facilities into existing drainage lines or soakage areas by providing suitable diversion drains.

Surface water contamination

Measures to minimise downstream impacts due to contamination of surface water generally relate to the containment of potentially contaminated water and its subsequent controlled release.

Storage areas for chemicals, oils and hazardous material will be designed in accordance with relevant codes, standards and guidelines (see Chapter 4). To minimise the potential for oil leaks into watercourses during operation, oily water separators will be installed where necessary. Water collected within the bunds will be analysed prior to release. If the water quality is suitable, the water will be released to the water treatment pond. Water that does not meet water quality criteria will be returned to the process for further treatment or removed to a licenced disposal facility.

A water quality monitoring program will be implemented to identify any changes to water quality as a result of project-related contamination (Section 6.8.6). This will include event-driven sampling to gain an understanding of water quality effects at different phases of flow. In the unlikely event that a release of contaminants occurs, AGL will implement the spill response plan (to be developed prior to construction).

All stormwater with potential for contamination or sedimentation will be collected through a dedicated stormwater system designed to minimise impacts on the ephemeral wetlands, local marine aquatic ecosystem and Central Barker Inlet Segment Waterways. Water will be directed to a gross pollutant trap and spill control system designed to remove any oil and minimise suspended solids and removal of trash before entering the bio-retention basin.

A Soil Erosion and Drainage Management Plan (SEDMP) will be prepared and implemented in accordance with the Code of Practice for the building and construction industry to prevent soil sediment and pollutants leaving the site or entering water bodies during development of the site. The plan will include details of how all the stormwater runoff from the site will be contained. Vehicles and equipment leaving the site will need to pass through control points where excess silt material will be removed using shaker bars and wash down facilities, where deemed necessary. It is not intended to transport excavated material from the site unless specifically required for the management of contaminated material. Any contaminated materials will be disposed of in accordance with any guidelines applicable at the time.

A bio-retention basin will be designed to hold the treated stormwater with the majority of the water dispersing through infiltration and evaporation. Runoff generated within dedicated bunds will not be directed to the stormwater drainage system. Water will either evaporate or be collected in a dedicated drainage system and treated on or off site or pass to a Class 1 separator designed to achieve a concentration of less than 5 mg/l of oil, under standard test conditions, with an emergency shut off and alarm system. Discharges from the bio-filtration basin to the marine environment to be monitored regularly to ensure that EPA water quality requirements are met.

The drainage system would consist of underground drains that would direct stormwater to the treatment system. It is proposed that the final operational stormwater treatment system would include:

- Gross pollutant trap(s) (GPT) to capture trash and coarse sediment.
- Oil separator(s) to capture hydro carbon based pollutants.
- A bio-retention basin, designed to reduce direct storm water discharges to the Port River through evaporation and infiltration and minimising the volume of stormwater released to waterways by approximately 80% (assuming the average groundwater seepage velocity of 0.46 mm/hr).
- Continuous monitoring of discharge to the waterway for flow and regular sampling for key parameters.

6.8.5 Residual impacts

The avoidance, mitigation and management measures described will avoid or reduce the potential adverse impacts on surface water environments and their beneficial uses. The residual risks associated with the construction and ongoing operations of the project development are described in the following sections and summarised in Table 6.28. These assume the implementation of the proposed avoidance, mitigation and management measures.

Table 6.28 Summary of surface water impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I011	Impacts to vegetation and aquatic ecosystems due to sedimentation movement as part of construction	Rare	Moderate	Low
I012	Contamination of surface waters due to leaks and spills during construction	Possible	Minor	Moderate
I013	Adverse impacts to waterways due to altered flow regime	Rare	Minor	Low
1014	Reduction in water quality off site due to the BIPS operations	Rare	Minor	Low

Construction

Sedimentation impacts on the surrounding waterways associated with runoff from the power station site or stormwater discharge would occur only in **rare** circumstances, given the mitigation measures to be developed at the site. The consequence of increased sedimentation in the surrounding waters would be **moderate**, due to the potential for impacts to extend off site. The residual risk is therefore **low**.

The likelihood of spills (especially fuel) from equipment used in the construction equipment is **possible**. However, given the amount of hazardous materials required for construction purposes the

size of any spill is most likely to be small in volume giving a resultant consequence of **minor**, with the resultant risk being **moderate**.

Operation

MUSIC modelling of this surface water system indicates that the results exceed the objectives for stormwater quality performance objectives, even if a lower bound value for infiltration is adopted. The outflow volume for the lower bound infiltration rate of 0.08 mm/hr exceeds predevelopment volumes. However, given that the discharge is direct to the sea, the increased flows (if they do in fact occur given the conservative value of infiltration) are unlikely to affect drainage system performance outside the site. The provision of a gross pollutant trap will ensure that the discharge requirements for gross pollutants are met.

A bio-retention basin will be designed to reduce direct storm water discharges to the Port River through evaporation and infiltration and minimising the volume of stormwater released to waterways by approximately 80% (assuming the average groundwater seepage velocity of 0.46 mm/hr). It is **rare** that adverse impacts to waterways due to altered flow regime would occur given the mitigation measures to be developed at the site. The consequence of increased flow in the surrounding waters would be **minor**. The residual risk is therefore **low**.

Given the stormwater management system, environmental management procedures, and spill response procedures that will be in place for the project, the likelihood is **rare** that chemicals, contaminated water or fuels will be spilled or leaked in sufficient volumes to reach the surrounding waters and cause deterioration in water quality. Considering the condition of the Central Barker Inlet and the degree of dilution of any discharge to the waters, the consequence of degrading water quality and affecting suitability for the beneficial water uses, is predicted to be **minor**. The risk of this impact is therefore **low**.

6.8.6 Monitoring and reporting

Surface water monitoring programs will be developed as part of the project EMPs to identify any changes to water quality as a result of project-related contamination. AGL will develop a spill response plan specific to the BIPS site prior to construction. A Soil Erosion and Drainage Management Plan (SEDMP) will also be developed.

6.9 Groundwater

Existing groundwater in the project area is described in Section 6.9.2. Potential, credible, project-related impacts on groundwater are described in Section 6.9.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.9.4. The resulting residual impacts are discussed in Section 6.9.5.

Groundwater-related issues associated with the construction and operation of the proposed development project generally relate to the potential for adverse impacts to existing users of groundwater and groundwater dependent ecosystems. Impacts could result from a reduction in levels/supply or a reduction in quality of groundwater.

6.9.1 Study methods

The groundwater baseline and assessment was based on a desktop study (Appendix K) and groundwater monitoring at the site undertaken in May 2017. The full results are provided in the contamination assessment report (Appendix F). The contamination assessment was performed general accordance with the National Environment Protection Council (NEPC) (1999) *National*

Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013) as amended in 2013 and the SA EPA (2014) Site Contamination: Guidelines for the Assessment and Remediation of Groundwater Contamination.

Groundwater monitoring was undertaken in May 2017 and included the following:

- Gauging of existing groundwater monitoring wells (MW1 to MW8) for depth to water and total well depth using an oil/water interface probe and visual observations for light non aqueous phase liquid (LNAPL) using a new clear disposable bailer at each well.
- Measurement of groundwater quality field parameters (EC, DO, Eh, pH) was undertaken at each well location during purging. Groundwater samples were collected when field water quality parameters stabilised, or three well volumes of water were removed, whichever occurred first.
- Groundwater samples were collected into laboratory prepared containers, preserved for the relevant analyses, and stored in an ice-filled cooler during transport to the selected NATA accredited laboratories for analysis.
- All groundwater samples collected (8) were transported to the laboratories under chain of custody documentation and submitted for chloride, sulphate, pH, total dissolved solids, metals and petroleum hydrocarbons (including silica gel clean-up for TRH) analysis.
- Quality assurance/quality control procedures during sampling were undertaken in-line with the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013).

It is noted that existing monitoring well GW6 could not be located during the 2017 investigation.

6.9.2 Baseline

Depth to groundwater

Groundwater in the area is inferred to be confined in three shallow aquifers as outlined in Table 6.29.

Table 6.29 Inferred shallow aquifer descriptions

Water Bearing Unit	Approximate Extent (m AHD)	Description
Perched shallow groundwater – St. Kilda Formation and Semaphore Sands	0 to -7	Possible unconfined, discontinuous water table within fill material or semi-confined natural, regionally extensive aquifer, occurring within grey/brown silty/sandy clays to clayey sands with shell grit and organic fibres. This unit may become more clayey with depth. Possibly hydraulically isolated from underlying Glanville Formation by Bakara Calcrete.
Intermediate Natural – Glanville Formation	-7 to -10	Semi-confined/confined natural, regionally extensive aquifer typically comprising abundant shelly fragments within beige sandy clay to clayey sand. This intermediate aquifer is likely to be confined to semi-connected with overlying St. Kilda and Semaphore Sands Formation aquifer depending on thickness/presence of the Bakara Calcrete and clay content of sediments between the two units.
Hindmarsh Clay	-10 to -18	Confined natural, probably regionally extensive aquifer system within the Hindmarsh Clay. Deeper water bearing zones within the Hindmarsh Clay are likely to be present within sandy/gravel lenses.

The depth to groundwater beneath the site varies from 0.9 to 3.7 m below ground surface reported in Appendix F. There can be a marked difference in groundwater levels with a combination of tidal and seasonal influence, with the highest levels occurring in late spring following recharge by winter rainfall and the lowest levels occurring in late summer.

Groundwater flow and discharge

Groundwater flow and yield estimates from Appendix F are summarised below:

- Hydraulic conductivity (K) is based on published information from Heath (1983) and ranged between 1 m per day to 10 m per day.
- The hydraulic gradient (i) was calculated to be 0.00061 (MW1 to MW4) to the north and 0.0012 (MW4 to MW6) to the east.
- The effective porosity of the aquifer was estimated from published information from Domenico & Schwartz (1998) and estimated at approximately 0.3 for a medium grained sand.
- Groundwater flow direction is inferred to be to the north and east radially away from MW4.
- Based on the above values, the seepage velocity of the aquifer during the current assessment was calculated to range between 0.742 and 7.422 metres per year (m/year).

The groundwater flow beneath the site is expected to be influenced by the tides. Discharge from the shallow aquifers is likely to be through evapotranspiration, groundwater extraction, or through baseflow into the Central segment of the Port River, Barker Inlet.

Bore locations and the inferred groundwater flow is shown in Figure 6.15.

Groundwater quality

Groundwater quality parameters measured during field activities in May 2017, are summarised below:

- Dissolved oxygen (DO) measurements ranged between 0.46 mg/L (MW1) and 4.00 mg/L (MW5).
- Redox potential (Eh) measurements ranged between -157 mV (MW8) and 55 mV (MW7).
- Electrical conductivity (EC) measurements ranged between 698µS/cm (MW7) and 9,640 µS/cm (MW6) and 454 mg/L (MW7) and 6,266 mg/L (MW6), confirming groundwater is not suitable for potable and domestic purposes given the average TDS values being greater that 2,000 mg/L (ANZECC/ARMCANZ, 2000).
- Field pH measurements ranged between 7.08 (MW1) to 7.77 (MW5).
- Temperature measurements ranged between 19.3 ^{o}C (MW4) and 24.1 ^{o}C (MW2).

Groundwater quality parameters analysed from the groundwater samples collected are summarised below:

- Laboratory chloride concentrations ranged between 48 mg/L (MW2) to 2,300 mg/L (MW6).
- Laboratory pH measurements ranged between 7.5 (MW4) to 8.4 (MW2).
- Laboratory sulphate concentrations ranged between 25 mg/L (MW7) to 350 mg/L (MW4).
- Laboratory TDS measurements ranged from 320 mg/L (MW7) to 4,800 mg/L (MW6).

coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.15_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Location of bores and inferred groundwater flow direction	Figure No: 6.15

AI Reference: 202225_02_GRA019.ai_4

Groundwater users

There are approximately 130 registered groundwater bores within 1 km of the BIPS site, including 112 monitoring wells, 16 engineering wells and one registered water well drawing water from a deep aquifer.

This extraction well is located near the south eastern boundary of the current Torrens Island Power Station and is for registered industrial use. Torrens Island Power Station is currently using this registered well for the production of demineralised water used as boiler feedwater to produce steam. The water from this well is of a suitable quality to potentially be used for potable water supplies, irrigation, stock watering, recreational activities (such as filling of swimming pools), industrial cooling and wash down.

Ongoing groundwater extraction is expected to continue for the TIPS use. The BIPS will not increase groundwater requirements.

Discharge features and groundwater dependent ecosystems

Groundwater is usually expressed at the surface in the form of wetlands, freshwater meadows, springs or baseflow in rivers. Ecosystems that have their species composition and natural ecological processes influenced by groundwater are termed groundwater dependent ecosystems. Two types of groundwater dependent ecosystems may occur in the vicinity of the project area: wetlands and river baseflow systems.

6.9.3 Potential impacts

Groundwater-related issues associated with the construction and operation of the BIPS relate to the potential for the adverse impacts to existing users of groundwater and groundwater dependent ecosystems. The project could result in a reduction in levels/supply or a reduction in quality of groundwater through:

- Groundwater extraction and disposal.
- Groundwater contamination.
- Disruption of groundwater discharge.
- Disruption of groundwater recharge and flow.

Groundwater extraction and disposal

Only a minimal increase of groundwater extraction is proposed for the BIPS. Extraction would be limited to the potential interception of a perched or shallow aquifer during the construction activities. If construction intercepts a shallow aquifer, localised groundwater from the uppermost zones may seep into the trench. Groundwater abstraction from the trench via pumping (‘dewatering’) would be required to create a safe work area.

The dewatering activity is unlikely to draw down local aquifers or affect surrounding areas, given that:

- Construction of the new development will be designed allowing for the shallow depth to groundwater.
- Low groundwater inflow rates can be effectively managed by the use of caissons or trench shoring to reduce or stem the flow of water into the trench. Trench breakers and stabilised backfill provide a more permanent solution to groundwater ingress.

- The inflow rates into temporary construction trenches are unlikely to depress the water table or dewater local aquifers.

Through appropriate management, sufficient groundwater volumes will not be extracted to cause impacts to local groundwater users or groundwater dependent ecosystems.

Dredging and dewatering are activities that require a licence under the Environmental Protection Act 1993. There are no proposed plans to undertake dredging for the construction of the power station. If required, a licence will be sought in accordance with the Act for the groundwater dewatering for the excavation work.

If large scale dewatering were to occur in unconsolidated, compressible sediments, this could cause subsidence and differential settlement of soils. The occurrence of subsidence or differential settlement of soils is not considered a potential impact to groundwater in this project as construction activities are above the level of the regional shallow aquifers.

Disposal of abstracted groundwater and its management is a potential issue due to possible variable groundwater quality. Potential effects include damage to native aquatic life and vegetation. The quality of abstracted groundwater will determine the disposal and discharge methods to the surrounding land or water bodies, the beneficial use (such as irrigation) and/or an appropriate off-site disposal method.

Initial groundwater testing results indicate that the samples from all eight of the wells tested were within the upper criteria for fresh aquatic ecosystems as listed in the SA EPA Environment Protection (Water Quality) Policy criteria for assessing underground water. Further groundwater quality testing will be carried out during the design phase to confirm the results and assess if there would be any impacts if the water was released to the marine environment. During the dewatering process, water could be filtered through hay bales and then directed to a sedimentation holding basin (possibly the same bio-retention basin that is used for stormwater drainage). The water would then evaporate and infiltrate back into the groundwater table. If the rate of dewatering is likely to exceed the storage capacity and infiltration rate, then the water could be released to the marine environment following testing and receiving appropriate approvals from the EPA (Tonkin Consulting, Appendix E).

Groundwater contamination

Contamination of groundwater may result in reduction of groundwater quality and could impact on existing or future use of groundwater. A reduction in groundwater quality may extend to existing users or groundwater dependent ecosystems.

Bulk liquid chemicals, including solvents, primers, fuels and lubricants, may be stored and transferred on site. During construction and operation of the proposed development, the use of fuels and chemicals could pose a threat to groundwater quality if not managed appropriately. Pollution of the groundwater could occur if significant quantities of these fuels, chemicals or other substances were accidentally released from contained areas.

The EPA raised concerns regarding the existing buried contaminants located within the TIPS area being mobilised by surface water infiltration causing contaminants to migrate offsite through the sandy fill. The concern was that there could be potential for the proposed bio-retention pond to exacerbate site contamination that has been identified on the adjacent TIPS site (i.e., facilitating migration of a contaminate plume). The Phase 2 assessment (Coffey, 2010b) demonstrated that there was no contamination existing within the area of proposed development.

The groundwater beneath the development site is expected to be tidally influenced and the estimated hydraulic conductivity ranged between 1 m per day to 10 m per day. The seepage velocity is estimated to range between about 0.742 m and 7.422 m per year.

The Screening Risk Assessment - Phase 2 (April 2010 and August 2010 (Coffey, 2010b)) concluded that the site contamination assessment has been carried out in accordance with Schedule A and B of the NEPM and in regards to site contamination the site does not pose unacceptable risks to human health and the environment taking into account the proposed future land use.

Disruption of groundwater discharge

Potential impacts on groundwater discharge environments may be direct or indirect. Direct disturbance may occur if construction work intersects springs, wetlands or other groundwater discharge-related features, causing degradation of these features. Indirect impacts may arise when disruptions to natural groundwater patterns are significant enough to cause a reduction in groundwater availability for discharge features. This may occur when earthworks intersect the water table, and could result in a temporary reduced contribution to groundwater discharge features and baseflow.

Disruption of groundwater recharge or flow

Vegetation removal, surface sealing, topography changes and earthworks for the BIPS have the potential to disrupt existing groundwater recharge mechanisms.

During construction, the fill material used may have an effect on local groundwater conditions and could consequently impact on aquatic ecosystems if:

- The final backfill is more permeable than the surrounding materials, allowing preferential groundwater flow.
- The backfill is more impervious than the surrounding materials, restricting the shallow lateral groundwater movement.

6.9.4 Avoidance, management and mitigation

This section describes the proposed management measures designed to avoid or minimise the potential impacts of the project on groundwater resources, users and groundwater dependent ecosystems.

Dewatering and disposal of extracted groundwater

Where practicable, any excavation work will be scheduled for the dry months of the year to reduce the risk of encountering high water tables after winter rainfall and the need for dewatering. If groundwater abstraction from a pit or trench is required, appropriate measures will be implemented for the disposal of abstracted groundwater, including:

- Obtaining approval from the relevant authority to discharge.
- Analysing extracted groundwater to determine disposal options.

Groundwater contamination

Design features at the BIPS site will be installed to reduce the potential for groundwater contamination to occur (see Section 4.2.8).

Bulk chemicals will be stored in appropriate storage vessels, in a controlled and secure environment, in accordance with the product material safety data sheets and Australian Standard AS1940. Drainage will be installed to enable the collection and treatment of chemical spills and any stormwater collecting in bunded chemical storage areas. Accidental spills of fuel from road tankers transporting fuel will be avoided by ensuring road tankers coming on-site are well maintained with appropriate spill containment facilities and that road surfaces are well maintained.

To minimise the potential for chemical or fuel spills to infiltrate and contaminate groundwater AGL will:

- Store the minimum practicable volume of chemicals on site.
- Store and, where practicable, handle of fuels and chemicals within containment facilities (e.g., bunds, spill mats) designed to prevent the release of spilt substances to the environment.
- Avoid storage and use of chemicals in areas of natural vegetation or near watercourses.
- Maintain Safety Data Sheets (SDS) on site for all chemicals and fuels stored and handled.
- Maintain spill response equipment on site.
- Train relevant staff in chemical handling, spill response and recovery procedures.
- Document detailed spill prevention and response procedures in the project EMPs.

If a spill occurs which breaches containment areas, the contaminated material will be removed and the area rehabilitated.

Acid sulfate soils are anticipated to exist near the north western edge of the current TIPS site. If excavation of potential acid sulfate materials is required during the BIPS project development works, separate stockpiles will be established behind adequate stockpile berms to prevent acid leachate run-off. Acid sulfate soils will be managed as outlined in Section 6.6 and any associated leachate will be treated or disposed according to EPA requirements.

Disruption of groundwater discharge

Direct and indirect impacts on discharge features will be avoided by ensuring the design of the construction work does not intersect any springs, wetlands, other groundwater discharge-related features or the water table.

Disruption of groundwater recharge or flow

To minimise the potential for impact on the groundwater recharge or change in groundwater flow conditions AGL will:

- Minimise the area of intrusive construction work to reduce impact to surrounding recharge areas.
- Compact soils around disturbed areas, such that the backfill density is comparable to that of the surrounding in situ material to reduce the likelihood of increasing recharge to the system.
- Revegetate areas cleared or damaged during the construction process.
- Document backfilling and rehabilitation measures in the project EMPs.

6.9.5 Residual impacts

Table 6.30 provides a summary of the potential groundwater impacts from BIPS.

Table 6.30 Summary of potential groundwater impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I015	Impacts on local flora due to dewatering and disposal of groundwater.	Rare	Insignificant	Low
I016	Groundwater contamination due to leaks and spills.	Unlikely	Moderate	Moderate
I017	Disruption of groundwater discharge due to project operations and construction.	Unlikely	Minor	Low
I018	Disruption of groundwater recharge due to project operations and construction.	Unlikely	Minor	Low

The avoidance, management and mitigation measures described will reduce the severity of any adverse impacts on groundwater resources or groundwater dependent ecosystems. The residual risks associated with construction and operation of the project in relation to groundwater, are described in the following sections.

Dewatering and disposal of extracted groundwater

Since dewatering of incidental inflows into excavations is unlikely to affect the surrounding aquifers, the greatest residual effect is associated with how extracted groundwater is handled.

Damage to the surrounding environment due to discharge of brackish groundwater from dewatering has been assigned a **low** risk rating. The likelihood of causing damage to vegetation is **rare** as it is a coastal environment**.** Any impacts would be localised and short-term, hence the consequence of this impact is **insignificant** and the resultant risk is **low.**

Groundwater contamination

Deterioration in groundwater quality, affecting suitability for water uses (including maintenance of ecosystems) may occur as a result of spills or leaks, or due to the disturbance of acid sulfate soils.

Given the design features of the power station site, the proposed environmental management and spill response procedures, it is **unlikely** that chemicals or fuels will be spilled or leaked in sufficient volumes to infiltrate to groundwater and cause deterioration in quality, beyond the spillage zone. Any spills will be remediated by the appropriate contractors in accordance with the project EMPs. The consequence of degrading groundwater quality and affecting suitability for water uses is **moderate,** as impacts may extend offsite and there could be public concern about the incident**.** The risk of this impact occurring is **moderate**.

Disruption of groundwater discharge

Impacts associated with the disturbance of groundwater discharge are degradation of discharge features and disruption of baseflow contribution to surface water flows.

Project infrastructure will avoid significant groundwater discharge features, including wetlands with high ecological values. No extraction of groundwater is proposed for this project except the incidental flows of water into excavations. It is possible that some lower significance discharge environments will be temporarily disturbed during construction works. However, the duration of the disturbance is likely to be short. Therefore the likelihood of degrading these features is **unlikely.** These features are unlikely to support ecosystems, and any disturbance would be short-term and localised; therefore the consequence of this impact is **minor**, and the resultant risk is **low**.

Disruption of groundwater recharge or flow

Interpolated depth to groundwater data suggests that construction works are unlikely to intersect the water table. The likelihood of permanently disturbing the recharge area, causing an increase in recharge and subsequently affecting land quality, through water logging or salinity effects, is **unlikely**. Any impacts would be short term and **minor**. This impact is therefore a **low** risk.

6.9.6 Monitoring and reporting

Groundwater monitoring programs will be developed, if required, as part of the project EMPs.

6.10 Landscape and visual amenity

Existing visual amenity in the project area is described in Section 6.10.2. Potential, credible, project-related impacts on visual amenity are described in Section 6.10.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.10.4. The resulting visual amenity impacts are discussed in Section 6.10.5.

6.10.1 Study methods

A visual impact assessment was conducted by Wax Design (Wax) Pty Ltd in November 2009 (Wax Design, 2009) for the previous Torrens Island Energy Park development application. The facilities at the Energy Park were proposed at a vertical elevation of 35 m and a larger project footprint (power station and LNG plant) and visual expanse than the proposed BIPS. The previous study concluded that the visual effect of the Energy Park was considered to be negligible to slight and that the visual change would be in context with the industrial landscape character of the area.

Visual impact predictions and photomontages were prepared by Coffey in 2017 for the BIPS project and are provided in Section 6.10.5. The two conceptual location options for the project were considered in the photomontages and impact predictions for Stage 1. As the Stage 2 for both options would encompass the remaining area of the BIPS site boundary, it is considered that the photomontages for both Option 1 and Option 2 of Stage 1 provide an indication of the potential visual impact for the range of scenarios.

The following assessment criteria were used to quantify the baseline landscape character and the visual effect from specific viewpoints within the landscape (Wax Design, 2009):

1. Topographic relief (the complexity of the land that exists as part of the underlying landscape character).
2. Vegetation cover (the extent to which vegetation is present and its potential to screen and filter views).
3. Infrastructure and built form (the impact of development on landscape and visual character).
4. Cultural and landscape value (quantification of recognised planning overlays).
5. Percentage of visual absorption (ability of landscape to absorb and screen the visual change).
6. Horizontal visual effect (spread of the development in the visual landscape).
7. Vertical visual effect (height of the development in the active visual landscape) with reference to the existing landscape elevation variance from the viewpoint.
8. Distance of visual effect (distance between viewpoint and closest waypoint of the proposed development).

The selected viewpoints represent locations where the majority of the development is visible and are locations of typical landscape character, for example positions near public areas, boat ramps, road or important areas of vegetation where the effect of the development may potentially be more pronounced.

The visual impact assessment was developed over two stages:

- **Preliminary impact assessment** – Wax Design (2009) recorded the physical and visual characteristics of the landscape surrounding site. This analysis considered the landscape in terms of 'character zones', areas that exhibit similar or consistent landscape characteristics in relation to land cover, land use, visibility, topography and cultural value. Initially, a desktop study reviewed the design drawings. This provided a contextual analysis for potential landscape character assessment of the area. Following the desktop study, an on-site assessment was conducted to identify and describe the landscape character zones and special landscape features within a 1 km to 5 km radius (Wax Design, 2009).
- **Visual impact assessment** – The previous study concluded that the visual effect of the Energy Park was considered to be negligible to slight. The BIPS project is proposed to have a much smaller footprint, but with a similar vertical elevation. Therefore the visual impact assessment for BIPS used the same viewpoints as Wax Design (2009) to develop photomontages for the assessment of the visual effect on the existing environment. These montages were developed from the perspective of publicly accessible viewpoints from which the infrastructure is most prominent, and depict the general visual experience from landscape character zones.

6.10.2 Baseline

Torrens Island is characterised by areas of understorey vegetation over which sits vertical industrial development (Plates 6.4 and 6.5). Visually the landscape is expansive with distant views over the mangroves and samphire plains providing a visual offset to the scale of the industrial development. The industrial component to the Island is largely determined by the power station, transmission lines, Adelaide Brighton Cement, ABB Grain, Australian Submarine Corporation (ASC) and other various warehouse buildings in the area.

The deliberate retention and protection of the mangrove edge ensures that the visual amenity of the open water areas associated with the Port River and associated estuaries have been retained. The underlying landscape character is made up of three distinct components:

- Underlying natural areas of mangroves, samphire and the Port River estuaries.
- Expansive open water views of the Port River estuary.
- Prominent industrial areas.

Surrounding the existing TIPS are a number of landscape character zones associated with land use. These zones have been broadly divided into north, south, east and west. Each zone possesses particular characteristics that will interact with the proposed development to produce a range of visual effects:

- **North** – north of the BIPS site the landscape is dominated by mangrove and samphire vegetation. Industrial developments dominate the northern end of the Island, including the Origin Energy Quarantine Power Station and Australian Quarantine Inspection Service (AQIS), although these are generally obscured by vegetation (Plate 6.6).

- **East** – to the east is an open landscape character of the low lying samphire vegetation punctuated areas of mangroves which create pronounced bands of vegetation to the south. Beyond is the elevated ridgeline of the Mt Lofty Ranges creating a distinct backdrop that defines the visual envelope to the east (Plate 6.7).
- **South** – to the south of the BIPS site there is distinctly industrial land use (Plate 6.8).
- **West** – views across the Port River to the west of Torrens Island is defined by mangrove vegetation of the coastal edge extending from the Origin Energy power station south to the TIPS (Plate 6.9 shows the view from the west looking toward the TIPS).

6.10.3 Potential impacts

Development of the BIPS has the potential to cause a permanent change in the landscape character and visual amenity. From a visual perspective, the BIPS will consist of:

- Power station engine house, including two stages with a vertical scale of approximately 30 to 35 m.
- Lay down area, access road and associated small scale buildings for operational control.

The views are already dominated by the vertical infrastructure of TIPS and overhead transmission lines in the project area, which gives the proposed project components scope to blend with the existing landscape character. The change to the landscape is, in part, very similar to the existing features with a small increase in the number of structures.

Photo credit: Coffey

Plate 6.4
Views of TIPS from the north

Photo credit: Coffey

Plate 6.5
Views of ASC to the west from the northern end of Torrens Island

Photo credit: Coffey

Plate 6.6
Northern landscape character zone

Photo credit: Coffey

Plate 6.7
Eastern landscape character zone

Photo credit: Coffey

Plate 6.8
Southern landscape character zone

Photo credit: Coffey

Plate 6.9
Western landscape character zone

6.10.4 Avoidance, management and mitigation

To minimise potential impacts experienced by sensitive receptors and to ensure that buildings at BIPS are compatible with the surrounding landscape character, AGL will consider the following measures:

- Develop a screen planting buffer to provide additional visual relief to the engine hall.
- Where possible, the landscaping plan will be developed to help in the preservation and re-establishment of native vegetation and habitat for identified fauna species of local, state and national significance (specifically the rare bitterbush (*A. quadripartita*). The plan will also demonstrate the use of local native coastal species to enhance biodiversity and amenity values.

6.10.5 Residual impacts

Table 6.31 summarises the residual visual impacts of the project, considering the likelihood and consequence of the predicted impact after the successful implementation of control and mitigation measures.

Table 6.31 Summary of visual impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I019	Reduction in visual amenity due to the BIPS	Unlikely	Insignificant	Low

Overall the visual character of Torrens Island can be described as having an underlying naturalistic vegetated land cover of mangroves and samphire punctuated by large industrial development. The landscape is significantly impacted by existing development and infrastructure and the visual amenity associated with these areas is limited. However, the combination of the coastal vegetation, dense belts of mangroves and the open water of the Port River create significant local areas of visual amenity that have the potential to mitigate the impact of existing industrial land use of the area.

Four viewpoints (Table 6.32) have been considered as part of the assessment process. The viewpoint identification process identifies locations where the development will be visible and where there will be a noticeable degree of visual change to the existing landscape character. These locations represent the typical visual effect that will occur in the landscape character zones around the proposed development site.

Table 6.32 Visual impact assessment viewpoints

Viewpoint		Description
Number	**Taken from**	
1	Small boat club– Garden Island	The viewpoint is taken from the pontoon access walkway adjacent to the boat ramp at the sailing club. The viewpoint looks directly west towards the proposed development site across Angas Inlet towards the AGL Torrens Island Power Station (Figure 6.16).
2	Torrens Island fruit and vegetable market, North Arm Wharf	The viewpoint is orientated north towards the existing Power Station and proposed development and includes a panorama of the majority of the Port River to the north, North Arm Inlet and Fisherman's Wharf area surrounding the Power Station (Figure 6.17).
3	Marina Adelaide boat ramp	The viewpoint at the Marina Adelaide Boat Ramp is located on the eastern edge of Le Fevre Peninsula in Largs North. The boat ramp provides public access to the estuary and directly overlooks the TIPS and proposed development site (Figure 6.18).
4	Techport, eastern extent of Veitch Rd, Osborne.	The open water character that is created by the Port River defines the viewpoint. This provides panoramic views through almost 180 degrees along the coast line of Le Fevre Peninsula (Figure 6.19).

Viewpoint 1

The proposed development provides a slight degree of visual change (Figure 6.16) to viewpoint 1. From this viewpoint the dense mangrove vegetation to the foreground, coupled with the presence of the existing power station infrastructure limits the degree of visual change to the existing landscape character and field of view. Assessment descriptions are given in Table 6.33.

Table 6.33 Viewpoint 1: visual impact assessment

Assessment	Description
Relief	There is limited topographic variance. The coastal mangrove landscape context and lower lying samphire are characteristic of Torrens Island and the adjacent Port River and estuarine context.
Vegetation Coverage	The linear belt of mangroves to the waters edge provides a dense canopy structure, which defines the visual character of the aquatic environment. The vegetation is described as occupying approximately 45% of the field of view.
Infrastructure and Built Form	The presence of the power station stacks for both Option 1 and 2 projecting above the mangrove vegetation creates a moderate visual effect.
Cultural and Landscape Value	The cultural overlay of the conservation reserve on Torrens Island and the estuarine water body creates a moderate degree of value, particularly landscape value.
Landscape Character	
Landscape Absorption	The dense mangrove vegetation to the foreground screens the majority of the proposed development with only the stacks visible.
Horizontal	The horizontal visual effect is minimal with only the stacks visible over the mangroves.
Vertical	Due to the existing furnace stacks, providing a vertical visual element of approximately 160 m, the proposed new development provides minor visual impact within the landscape. The vertical visual effect is negligible.

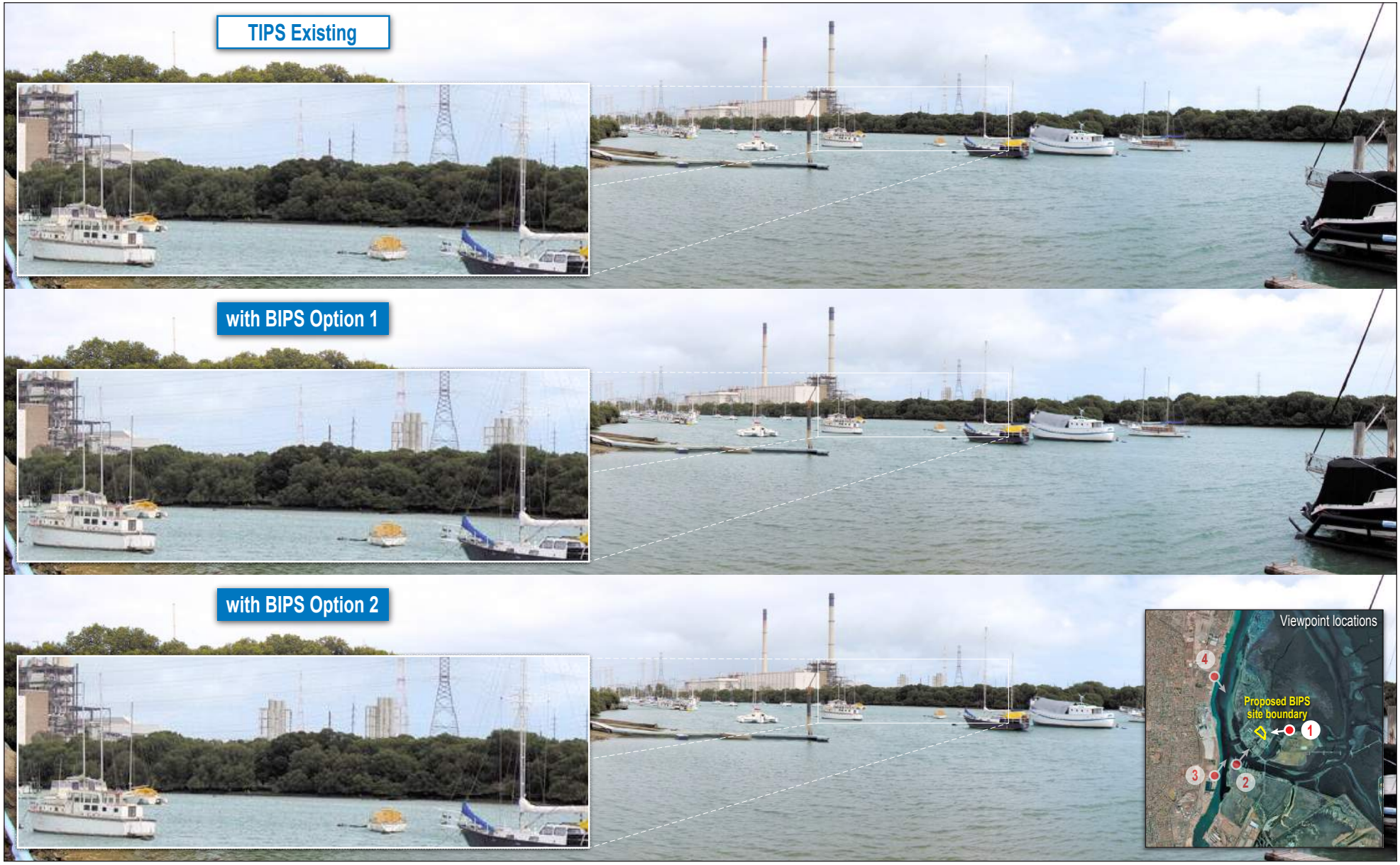
Distance	The distinct separation between foreground and background has the effect of increasing the perceived depths of field. In this regard, objects appear further away because the distance over which they are set cannot be perceived due to the solid screen provided by the mangroves.
Visual Effect	**Overall, the degree of visual change is described as slight.**

Viewpoint 2

The visual change produced by the BIPS to viewpoint 2 is described as negligible (Figure 6.17). The presence of the existing power station, fishing wharfs and mooring, coupled with the associated infrastructure limits the amount of visual contrast between the new development and the river corridor. The unique qualities of the river corridor and mangrove vegetation are seen as foreground to mid ground overlays, which softens the dominance of infrastructure. The preservation of the existing vegetation will be important in maintaining the amenity value of the estuary. Assessment descriptions are given in Table 6.34.

Table 6.34 Viewpoint 2: visual impact assessment

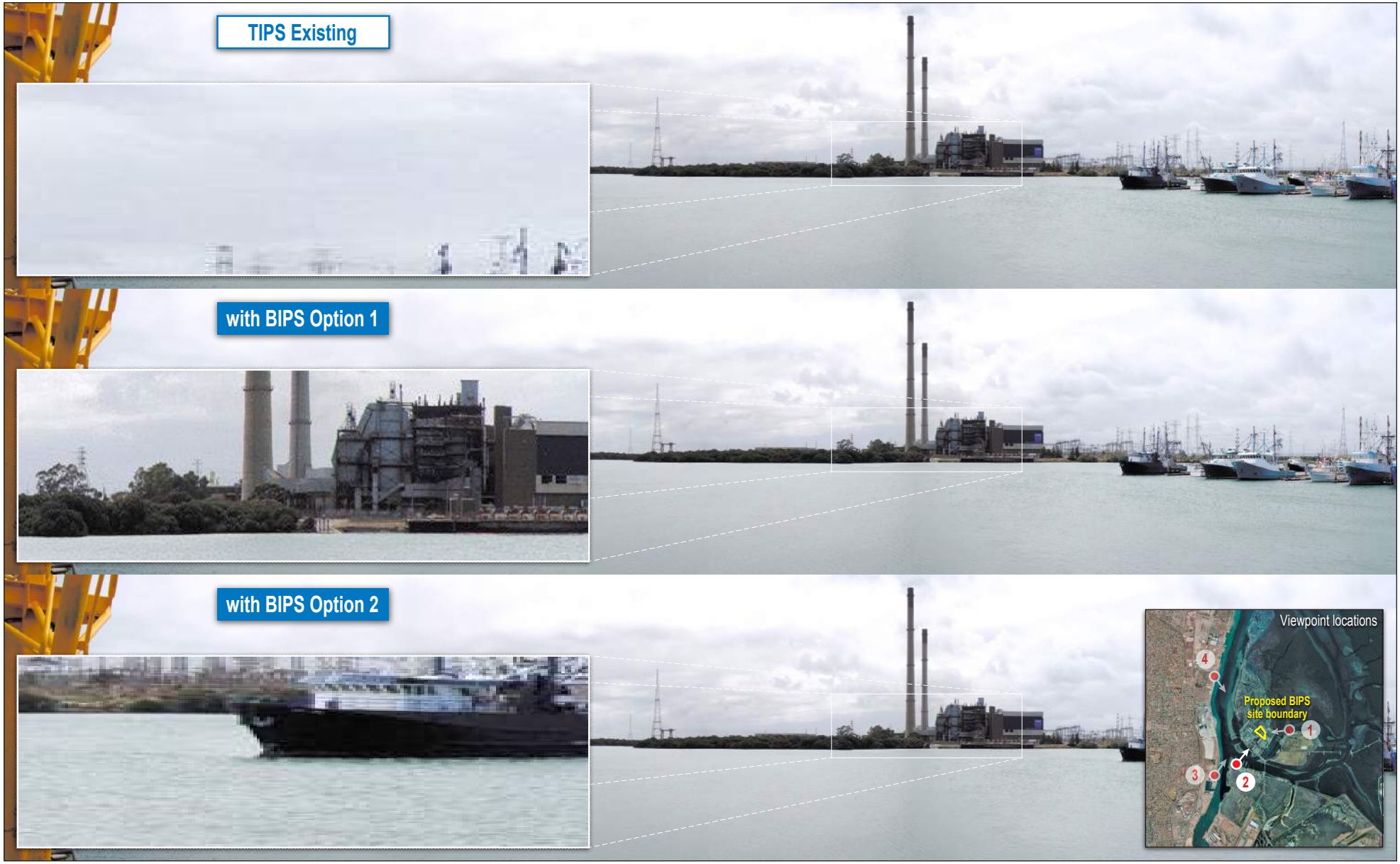
Assessment	Description
Relief	There is limited topographic variance. The coastal mangrove landscape context and lower lying samphire are characteristic of Torrens Island and the adjacent Port River and estuarine context.
Vegetation Coverage	Due to the mid ground vegetation on the south to south western edge of Torrens Island, the hard industrial edge of wharfs and moorings are softened with a natural overlay. The degree of vegetation is described as 30%.
Infrastructure and Built Form	The presence of moorings, wharfs, the TIPS and associated shipping and heavy industry to the Port River edge create a significant industrial character.
Cultural and Landscape Value	The cultural overlay of the conservation reserve on Torrens Island and the estuarine water body creates a moderate degree of cultural and landscape value.
Landscape Character	
Landscape Absorption	From this viewpoint the vegetation coverage to the south of the proposed development screens the majority of the development. The scale and fragmented nature of the Eucalypt trees provides a vertical scale proportionate to the development. The mangroves to the foreground screen the lay down areas and associated operational infrastructure.
Horizontal	The proposed development a small degree of the field of view.
Vertical	Due to the existing furnace stacks, providing a vertical visual element of approximately 160 m, the proposed new development provides minor visual impact within the landscape. The vertical visual effect is considered negligible.
Distance	The power station features are located within a 4 ha area, and do not cover a large expanse.
Visual Effect	**Overall, degree of visual change is described as negligible.**



	coffey A TETRA TECH COMPANY	Date: 25.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.16_GRA	AGL Energy Limited Barker Inlet Power Station	agl	View of TIPS and simulated view of BIPS (Stage 1) from viewpoint 1 - Small boat club, Garden Island

Figure No: **6.16**

AI Reference: 202225_02_GRA033.ai_3



	coffey A TETRA TECH COMPANY	Date: 25.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.17_GRA	AGL Energy Limited Barker Inlet Power Station	agl	View of TIPS and simulated view of BIPS (Stage 1) from viewpoint 2 - Torrens Island fruit and vegetable market, North Arm Wharf	Figure No: 6.17

AI Reference: 202225_02_GRA034.ai_3

Viewpoint 3

The visual effect of the development will be derived by the visible stacks from the BIPS to the east for the Option 1 (Stage 1). Overall, the visual change is described as slight (Figure 6.18). The existing visual character of the landscape will be retained. Assessment descriptions are given in Table 6.35.

Table 6.35 Viewpoint 3: visual impact assessment

Assessment	Description
Relief	There is limited topographic variance. The coastal mangrove landscape context and lower lying samphire are characteristic of Torrens Island and the adjacent Port River and estuarine context.
Vegetation Coverage	From this aspect, the vegetation is more isolated with smaller pockets of vegetation evident along the western edge of Torrens Island. Le Fevre Peninsula has minimal vegetation to the eastern edge. The Port River has been heavily modified with levy banks and wharfs to the extent of the western edge.
Infrastructure and Built Form	The presence of the power station and substantial infrastructure to the south of Torrens Island and to the west on Le Fevre Peninsula.
Cultural and Landscape Value	The cultural overlay of the conservation reserve on Torrens Island and the estuarine water body creates a moderate degree of cultural and landscape value.
Landscape Character	
Landscape Absorption	The presence of mangrove vegetation to the south to south west produces a moderate degree of screening of BIPS.
Horizontal	The BIPS is located close to the TIPS for Option 2. The stacks are more visible to the west of TIPS in Option 1.
Vertical	Due to the existing furnace stacks, providing a vertical visual element of approximately 160 m, the proposed new development provides minor visual impact within the landscape. The vertical visual effect would be considered slight.
Distance	The stacks of the BIPS for Option 1 are located 200 m to the north from the existing TIPS.
Visual Effect	**Overall, the visual change is described as slight.**

	coffey A TETRA TECH COMPANY	Date: 25.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.16_GRA	AGL Energy Limited Barker Inlet Power Station	agl	View of TIPS and simulated view of BIPS (Stage 1) from viewpoint 3 - Marina Adelaide boat ramp, Largs North

Figure No: **6.18**

AI Reference: 202225_02_GRA035.ai_3

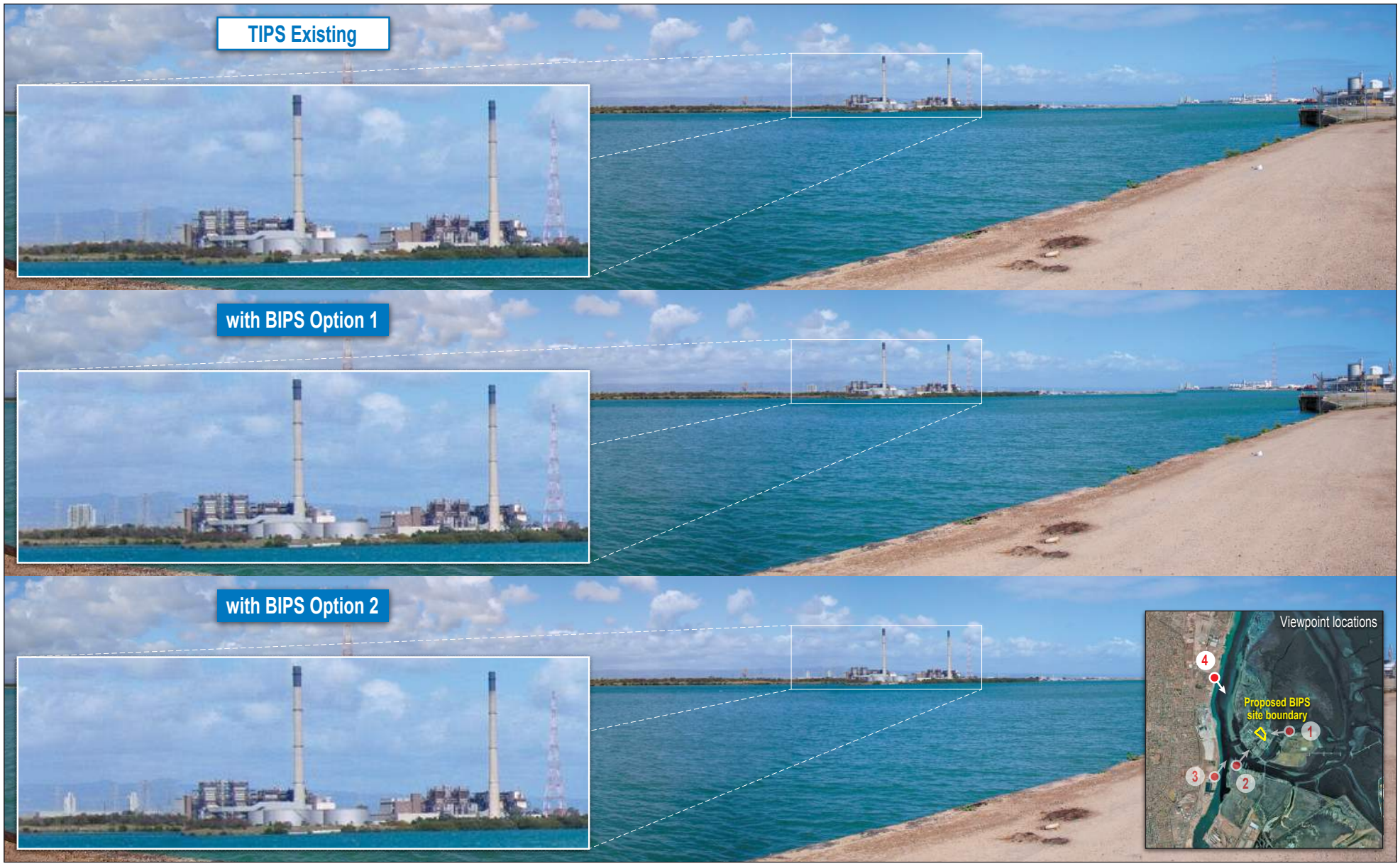
Viewpoint 4

From this viewpoint the field of view has a slight visual change (Figure 6.19). The existing visual character of the landscape will be retained. Assessment descriptions are given in Table 6.36.

Table 6.36 Viewpoint 4: visual impact assessment

Assessment	Description
Relief	There is limited topographic variance. The coastal mangrove landscape context and lower lying samphire are characteristic of Torrens Island and the adjacent Port River and estuarine context.
Vegetation Coverage	From this viewpoint there is limited vegetation within the field of view. To the north of the development on Torrens Island there are sporadic clumps of vegetation.
Infrastructure and Built Form	TIPS presents a dominant visual element to the mid ground. However, this is seen in proportion to an expansive natural character on the horizontal plane to the north and Mt Lofty Ranges to the background.
Cultural and Landscape Value	The cultural overlay of the conservation reserve on Torrens Island and the estuarine water body creates a moderate degree of cultural and landscape value.
Landscape Character	
Landscape Absorption	Due to the flat low lying profile of the river corridor and Torrens Island, there is no topographic screening. There is less landscape absorption capacity from this viewing perspective.
Horizontal	The visual effect of the development is described as minor.
Vertical	Due to the existing furnace stacks, providing a vertical visual element of approximately 160 m, the proposed new development provides minor visual impact within the landscape.
Distance	The stacks of the BIPS for Option 1 are located 200 m to the north from the existing TIPS. As this viewpoint is located to the north of the site, these features are in the foreground, with the TIPS in the background.
Visual Effect	**Overall, the visual change is described as slight.**

Overall, the visual effect of the proposed development is considered to be negligible to slight and does not appear at odds with the existing visual or landscape character of the area. While change will occur, this visual change is in context with the industrial landscape character of the area. The likelihood that BIPS will reduce the visual amenity is considered to be **unlikely**. Given the existing industrial landscape, the mitigation measures to be implemented and the slight to negligible degree of impact the consequence is considered to be insignificant, giving an overall residual risk of **low**.



	coffey A TETRA TECH COMPANY	Date: 25.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F03.19_GRA	AGL Energy Limited Barker Inlet Power Station	agl	View of TIPS and simulated view of BIPS (Stage 1) from viewpoint 4 - Techport, eastern extent of Weitch Road, Osborne	Figure No: 6.19

AI Reference: 202225_02_GRA036.ai_3

6.11 Indigenous cultural heritage

Study methods employed to identify the Indigenous cultural heritage on site and to assess potential project impacts are described in Section 6.11.1. Indigenous cultural heritage in the project area is described in Section 6.11.2. Potential, credible, project-related impacts associated with Indigenous cultural heritage are described in Section 6.11.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.11.4. The resulting residual impacts of the project to Indigenous cultural heritage are discussed in Section 6.11.5. The monitoring program is outlined in Section 6.11.6.

6.11.1 Study methods

An assessment of Indigenous cultural heritage associated with the site and surrounding area was conducted by Blake Dawson (2009). The assessment included a search of the Central Archive (which includes the Register of Aboriginal Sites and Objects) in February 2009 for the project area to determine whether the details of any Aboriginal sites, objects or remains have been entered.

Site surveys were conducted within the project area on 9 December 2009 by the Traditional Owners (the Kaurna People) with the assistance of their technical advisers (archaeological and anthropological) provided by Australian Cultural Heritage Management (ACHM). The field team consisted of ten representatives of the Kaurna People, their archaeologist and two anthropologists (to cater for potential gender business issues).

Australian Cultural Heritage Management (ACHM), on behalf of the Kaurna People, provided a Current Status and Preliminary Advice statement (Appendix L) to AGL. The following information is largely based on this statement.

The *Aboriginal Heritage (Miscellaneous) Amendment Act 2016* passed into law on 24 March 2016. The amendments require the establishment of two additional registers; Register of Recognised Aboriginal Representative Bodies and Register of Agreements. A Recognised Aboriginal Representative Bodies is a person or organisation that can ascertain and represent the views of the relevant traditional owners in relation to a specific area, Aboriginal site, object or remains. There are currently no appointed Recognised Aboriginal Representative Bodies. These are expected to be proclaimed before the end of 2017. The Register of Agreements is under development and will come into effect once the amendments to the *Aboriginal Heritage Act 1988* have begun.

6.11.2 Baseline

Sacred sites

No specific anthropological site, including those of a sacred nature, was identified within the project area. However, the study identified a range of specific ethnographic information relating to Torrens Island: Emu Dreaming, Seven Sisters and Tjilbruke Dreaming and in particular the Black Swan story. Whilst these stories are associated with the island more generally, its entirety (including the project area) has been noted as being of significance to the Kaurna People.

It was not possible to detail the stories within the Current Status and Preliminary Advice statement as ACHM had not had an opportunity to ratify the provision of such information with the Kaurna National Cultural Heritage Association. The divulgence of such information without such ratification would be a potential breach of Section 35 of the Aboriginal Heritage Act.

Archaeological sites and objects

The Central Archive has multiple entries for Aboriginal archaeological sites on Lot 303 to the west of the BIPS project area (see Figure 6.20).

The archaeological survey did not identify any archaeological sites or objects within the BIPs project area. Despite this, six such places have been identified and are entered on the Aboriginal Affairs and Reconciliation Division (AARD) Central Archive, to the west of the project area on Lot 303. These are summarised in Table 6.37.

Table 6.37 AARD Central Archive search results in proximity to the project area

AARD Site Number	AARD Site Name	AARD Site Type	Easting (GDA94)	Northing (GDA94)
8069	Torrens Island Artefact Site 1	Artefact Scatter	272815	6146215
8071	Torrens Island Artefact Site 2	Artefact Scatter	272817	6146376
8073	Torrens Island Artefact Site 3	Artefact Scatter	272724	6146567
8075	Torrens Island Artefact Site 4	Artefact Scatter	272857	6146601
8077	Torrens Island Artefact Site 15	Artefact Scatter	272900	6146652
8081	Torrens Island Artefact Site 7	Artefact Scatter	272918	6146132

The project area does not intersect or impact upon any of these sites, the nearest being located at least 200 m from the western edge of the project area. The remaining places are located at least a further 400 m to the northwest of the project area and beyond (Figure 6.20).

The South Australian Museum Anthropological Database details the content of human remains and other cultural items held by the South Australian Museum. An initial search of this database conducted by ACHM returned three results with location information consistent with the broader Torrens Island (Table 6.38).

Table 6.38 South Australian Museum Anthropological Database search results

Registry Number	Description	Region	Locality
A38864	Skull, and skeleton, part of	Adelaide	Torrens Island
A11510	Skull with jaw and part skeleton	Adelaide	Torrens Island
A11528	Skull and jaw	Adelaide	Torrens Island

6.11.3 Potential impacts

Construction and operation of the project will involve the excavation and movement of soil within the BIPS proposed footprint, including removal and storage of topsoil, excavation for footings and foundations and construction of an extension to an existing road. These activities have the potential to affect the sacred sites that have not yet been identified or sites of archaeological significance, by either disturbing or destroying them.

Disturbance of identified archaeological site or objects

The archaeological survey did not identify any archaeological sites or objects within the project area. This was expected considering the relatively high level of physical disturbance to the general project area.

coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.20_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Archaeological sites in the general area	Figure No: 6.20

AI Reference: 202225_02_GRA020.ai_4

No archaeological sites or objects identified and entered on the AARD Central Archive lie within the project area and as such will not be impacted by construction activities.

Disturbance or destruction of unidentified archaeological sites of significance

There is potential for the project to disturb sites that are as yet unidentified and their significance unassessed. It should be noted that the soils at the site have already been disturbed (most of the land is fill). Therefore the potential for this is unlikely.

6.11.4 Avoidance, management and mitigation

AGL will implement avoidance, mitigation and management measures to address the potential impacts on Aboriginal archaeology and cultural heritage. These measures will reflect current best practice.

One of the primary measures implemented by AGL to avoid, mitigate and manage all potential impacts to Aboriginal cultural heritage will be to develop and implement a cultural heritage management plan. Management and mitigation measures will include:

- Maintain an inventory of cultural and archaeological sites, including those already identified in the Aboriginal Affairs and Reconciliation Division (AARD) Central Archive.
- Record all sacred and archaeological sites in the project's geographic information system (GIS) throughout construction and operations.
- Ensure regular monitoring of implementation of the cultural heritage management plan and relevant legislation.
- Induct and train all employees and contractors in the cultural heritage management plan to ensure that employees and contractors are aware of their obligations under the *Aboriginal Heritage Act 1988*.
- Establish procedures, based on Guideline 2: Section 20 of the Aboriginal Heritage Act (undated) (Figure 6.21), to be followed should archaeological sites, objects and/or remains be unearthed during site development.

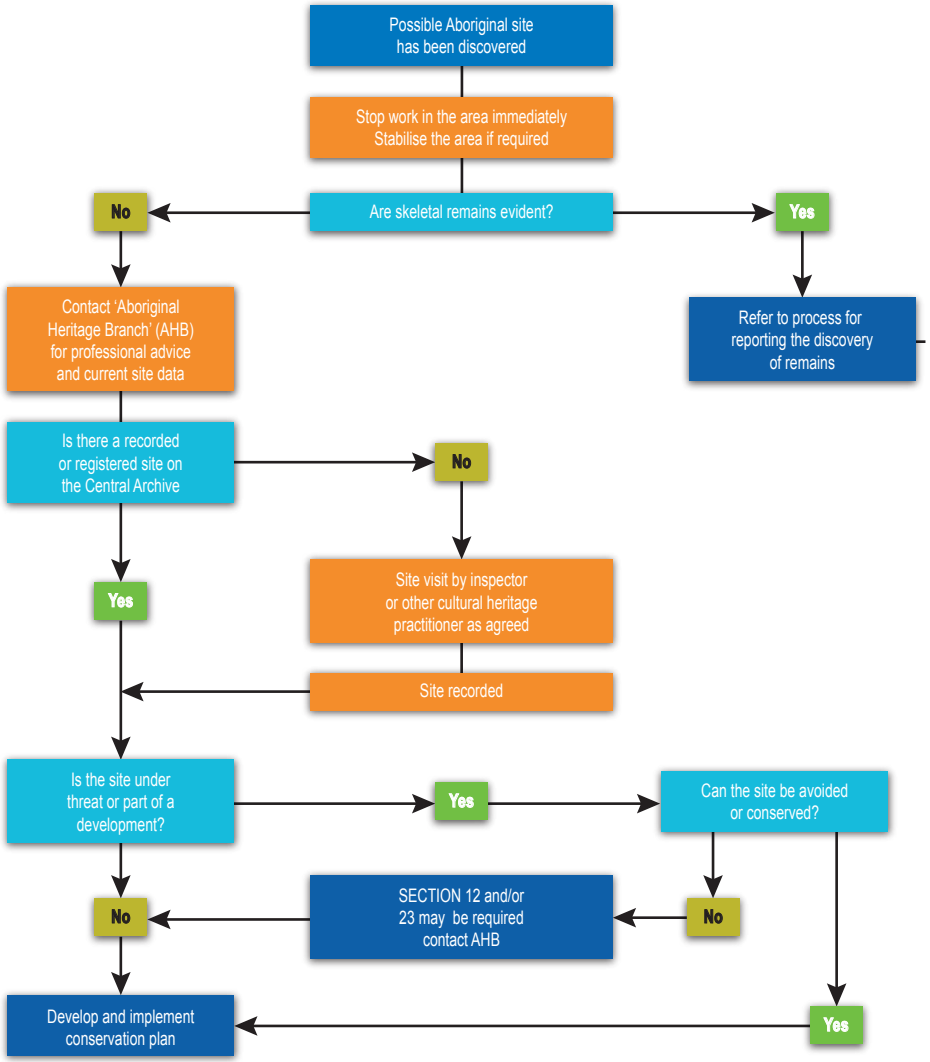
The cultural heritage management plan will be developed and agreed directly with the Kaurna People, the relevant traditional owners for the area and will be based on the results of the final report on the work done to date and the completion of the archaeological field assessment in the project area.

6.11.5 Residual impacts

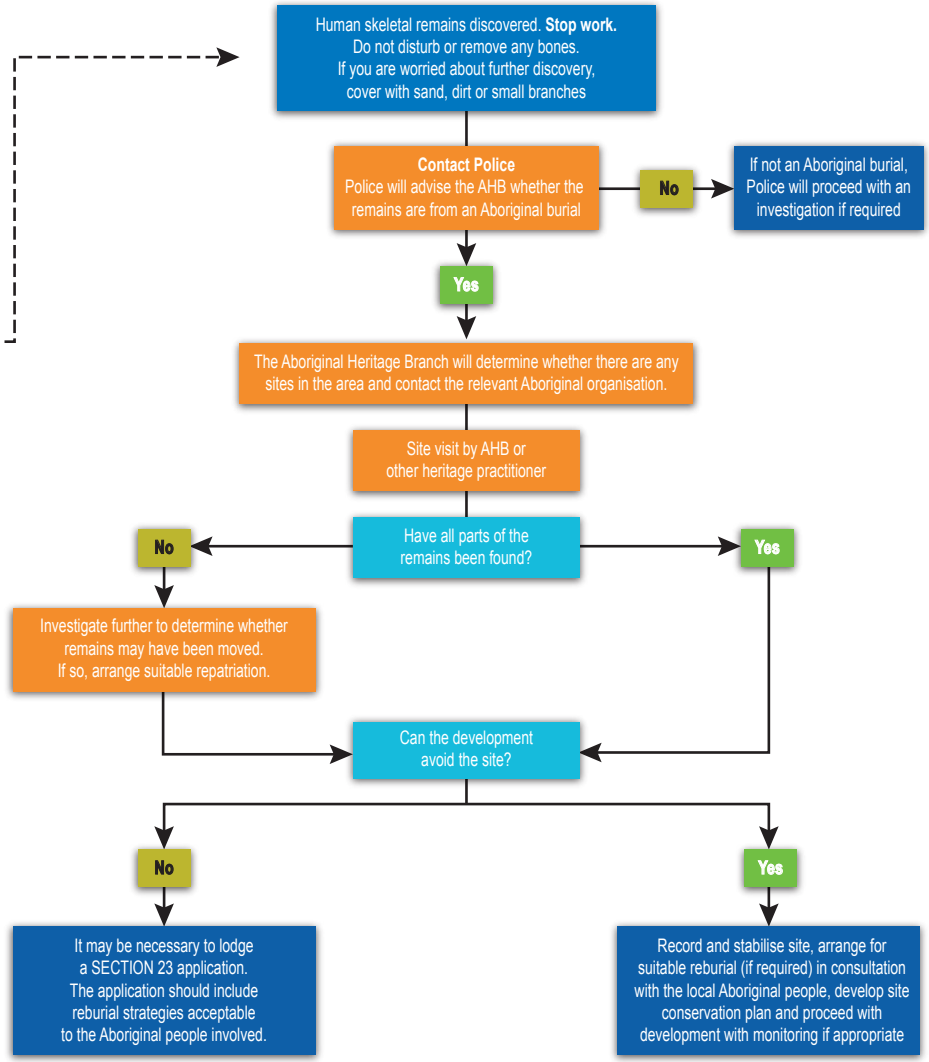
Physical disturbance of the land as a result of project related activities is inevitable. However, active management measures will be adopted to identify and avoid areas of Indigenous cultural heritage or archaeological significance. If disturbance is unavoidable, AGL will seek prior approval under the Aboriginal Heritage Act to disturb these sites.

Table 6.39 summarises the residual impacts of the project on Indigenous cultural heritage and archaeological sites, considering the likelihood and consequence of the predicted impacts after the successful implementation of control and mitigation measures.

Process for the discovery of Aboriginal sites or objects



Process for managing the discovery of Aboriginal ancestral remains



	coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.21_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Process for the discovery of Aboriginal sites, objects or remains.	Figure No: 6.21

AI Reference: 202225_02_GRA025.ai_2

Table 6.39 Summary of Indigenous cultural heritage impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I020	Disturbance to unidentified archaeological sites of significance	Unlikely	Minor	Low

Disturbance or destruction of unidentified archaeological sites of significance

The field surveys identified the potential for archaeological deposits within the Torrens Island area. Information ascertained, along with the nearby presence of previously identified cultural heritage places containing stone artefacts, make it is a reasonable inference that Aboriginal people used Torrens Island more generally. Given the sandy soils within the project area and the history of subsoil disturbance (e.g., sand dredging, asbestos burial and fill), AGL will adopt a precautionary approach.

Given the current knowledge, it would be expected that any unidentified cultural material would principally be in the form of stone artefacts either as isolated items or as scatters with limited scientific significance. Therefore it is **unlikely** that construction of the BIPS may disturb unidentified archaeological sites of significance. The consequence of impacts to this material may be a **minor** reduction in their cultural value to the Aboriginal community. The resulting overall residual effect is **low**.

Additionally, both the records of the South Australian Museum and anecdotal evidence collected during the anthropological study indicate that there is potential for human remains to be present within the project area. The management of such discoveries will be guided by the Aboriginal Heritage Act.

6.11.6 Monitoring and reporting

Arrangements for monitoring and reporting will be included in the cultural heritage management plan to be developed with the Kaurna People following future stakeholder engagement activities. This will allow for compliance auditing of the provisions of the cultural heritage management plan.

6.12 Non-Indigenous historical and cultural heritage

Existing non-Indigenous sites of historical and cultural heritage significance in the project area are described in Section 6.12.2. Potential, credible, project-related impacts on non-Indigenous historical and cultural heritage sites are described in Section 6.12.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.12.4. The resulting residual impacts are discussed in Section 6.12.5.

6.12.1 Study methods

Austral Archaeology Pty Ltd was engaged to conduct a study on non-Indigenous historical and cultural heritage within the project area for the previously proposed Energy Park. The objectives of the study were to provide baseline information on sites of non-Indigenous historical and cultural significance and to identify areas of known and potential sensitivity in relation to such sites. The report is included as Appendix M. The description of the existing non-Indigenous historical and cultural heritage environment is relevant for the BIPS project, although the references to the Energy Park project description are not relevant.

The study included:

- A search of statutory and non-statutory heritage registers for known non-Indigenous historical archaeological and heritage sites located in the immediate vicinity.

- Background research including historical research and a review of heritage assessments of sites in the area and of sites of similar type.
- Liaison with AGL to obtain relevant mapping and any other available background material.
- A field inspection to confirm and clarify the results of the desktop study.
- Compilation and reporting of the results of the heritage register searches, background literature, historical research and site inspection.
- An assessment of the significance of identified sites using the *Australia ICOMOS Charter for the Conservation of Places Cultural Significance* (the Burra Charter). This assessment informed the management and mitigation recommendations presented.
- Management and mitigation recommendations that respond to the assessed level of significance.

6.12.2 Baseline

Since European settlement in 1836, there have been a number of episodes of activity on Torrens Island more or less continuously to the present. These include:

- A dairy farm.
- Two human quarantine stations.
- Three animal quarantine stations.
- Two internment camps.
- Two electricity generating stations.

All of these activities have been located along the dune formation forming the western side of the island. Several of them have succeeded each other on the same site on the highest dunes at the southern end of the island, overlooking the North Arm.

The research indicated that development within the Torrens Island area prior to the construction of the power station had included a dairy farm (1847-75), possibly the site of the first quarantine station (1850s to 1860s/1870s), the second site of the First World War internment camp (March to August 1915), and animal paddocks for quarantine purposes associated with the Quarantine Station (1879 to 1909).

Heritage listings

A search of statutory and non-statutory heritage registers for known non-Indigenous historical archaeological and heritage sites and places located in the immediate vicinity showed three important sites. The Register of the National Estate was closed in 2007 and it no longer a statutory list, however the sites that were previously listed are still considered to be important sites:

- Torrens Island Quarantine Station, listed on the State Heritage Register (No. 13931) and on the Register of the National Estate as an Indicative Historic Place (No. 14866).
- Torrens Island Conservation Park. The extreme northern tip of the area was declared a Conservation Park in the Schedule to the SA *National Parks and Wildlife Act 1972*. The boundaries of the park were extended southward to take in the rest of the inter-tidal zone in 2005, so that it now covers most of the island except for the dune formation along the western shore.

- Santiago Shipwreck. The Santiago was shipwrecked in 1945 in the Garden Island ships graveyard situated in the north arm of the Port River approximately 1.1 km to the southeast of the project area. Santiago's mostly intact hull is exposed above the river level. The masts have been cut off and lay next to other fittings lying within the structure and outside the hull. The Santiago is the oldest vessel in the graveyard.

The background research indicated that there were no known or listed historic heritage sites within the BIPS project area.

Information obtained from the Maritime Heritage Officer, Heritage Branch of DEH in 2009, identified protected historical shipwrecks recorded in the vicinity of Torrens Island. These shipwrecks are the Seale, the Psyche Lady Wellington and the Stag. Their approximate locations are shown in Figure 6.22 and it appears unlikely they are located within the BIPS site.

Field survey

Two new sites were identified during the 2009 field survey as shown in Figure 6.22.

Site 1 comprises two heavy machinery footings and a row of concrete piles; the function of these items has not been ascertained but they are believed to date to the construction period of the power station and to post-date 1963. These items are considered to have neither heritage significance nor archaeological potential.

Site 2 comprises the collapsed remains of a small timber pile driver and a survey marker. The period of use of the pile driver has not been ascertained. These items are considered to have neither heritage significance nor archaeological potential.

These sites and features are not considered to meet any criteria for heritage listing as either state or local heritage items.

Archaeological potential

The potential for archaeological material within the proposed BIPS site depends on the anticipated likelihood for survival of buried structural fabric and cultural deposits and an estimation of their archaeological integrity.

The potential for archaeological resources within the study area has been estimated in terms of the potential for buried structural fabric and the potential for cultural deposits. Structural fabric refers to what is generally regarded as building or civil engineering remnants while cultural deposits refer to archaeological deposits, i.e., deposited sediments containing artefacts.

Summary

In summary it is concluded that there are no significant non-Indigenous cultural or historical items or areas of potential sensitivity that will be impacted by the proposed development.

6.12.3 Potential impacts

The BIPS site is likely to require significant structural works. Although construction details are not yet available, major preparatory works prior to construction are likely to include clearing, levelling, excavation, filling and compaction.

Damage or removal of sites of non-Indigenous cultural heritage significance

It is considered unlikely that either of the historically noted developments within the project area (the dairy farm and animal quarantine paddocks) would have left significant or tangible structural or archaeological surface evidence. No evidence of these activities was noted during the field survey. If any surface materials exist, they would likely be damaged or removed during the construction process.

Similarly it is considered unlikely that any sub-surface material associated with previous land uses remains. However, if it does, it is likely that it would be damaged or removed during the construction process.

The two new surface sites noted in the survey are not likely to be removed during the construction process.

Damage to nearby sites of non-Indigenous cultural heritage significance

No known nearby sites are expected to be impacted. However, there is the unlikely prospect that an unknown site could be disturbed.

The former Quarantine Station is located approximately 1.5 km to the north of the study area and is listed on the State Heritage Register. Due to the distance between this site and the project area, the proposed works will not have any impacts on this heritage item.

The Santiago Shipwreck is 1.1 km to the southeast of the project area. Given the project does not involve disturbance to the waters surrounding the BIPS the proposed works will not have any impacts on this shipwreck.

6.12.4 Avoidance, management and mitigation

As required by Section 27(2) of the SA *Heritage Places Act 1993*, if historical archaeological relics not predicted by this report are found during any future works within the study area, all works in the immediate vicinity should cease immediately and the SA Heritage Council be notified and consulted. Penalties apply for breaches of this provision.

6.12.5 Residual impacts

Table 6.40 summarises the residual impacts of the project on the non-Indigenous cultural heritage, considering the likelihood and consequence of the predicted impact after the successful implementation of control and mitigation measures.

Table 6.40 Summary of non-Indigenous cultural heritage impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I021	Damage and/or removal of sites of non-Indigenous cultural heritage significance within the project area	Unlikely	Insignificant	Low
I022	Damage of nearby sites of non-Indigenous cultural heritage significance on or near Torrens Island	Unlikely	Insignificant	Low

coffey A TETRA TECH COMPANY	Date: 15.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.22_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Non-aboriginal heritage sites	Figure No: 6.22

AI Reference: 202225_02_GRA021.ai_4

Damage or removal of sites of non-Indigenous cultural heritage significance

The 2009 study found that prior to the construction of the power station, historic activities in the study area included a dairy farm, possibly the site of the first quarantine station and paddocks for quarantining animals. It is considered **unlikely** that any of the identified historical activities within the project area would have left significant or tangible structural or archaeological surface evidence, given the disturbed nature of the project area. No evidence of these activities was noted in the field survey. Similarly it is considered **unlikely** that any sub-surface material associated with previous land uses remains. If any material remains of these features have survived, their archaeological potential is considered to be low, meaning that the consequence of any damage is **insignificant.** The residual risk is considered to be **low**.

The two surface sites identified in the field survey are not considered to be culturally or historically significant and therefore any damage to or removal of these sites is not considered a risk.

Damage to nearby sites of non-Indigenous cultural heritage significance

It is **unlikely** that any known or unknown nearby sites of non-Indigenous cultural heritage will be impacted by the proposed development works, and the consequences of any damage would be considered **insignificant**, giving a **low** overall residual risk.

The nearby Torrens Island Quarantine Station is listed on the State Heritage Register (No 13931) and previously listed on the Register of the National Estate as an Indicative Historic Place (No 14866). It is considered that the proposed works in the study area will not have adverse impacts on the heritage values of this place given the substantial distance between the project area and the Quarantine Station.

It is considered that the proposed works will not have any adverse impacts on the waters surrounding Torrens Island and therefore will not adversely impact the Santiago Shipwreck.

6.13 Traffic, roads and infrastructure

Existing traffic conditions in the project area are described in Section 6.13.2. Potential, credible, project-related impacts on traffic are described in Section 6.13.3. The proposed avoidance, mitigation and management measures that AGL will employ during all stages of project development are described in Section 6.13.4. The resulting residual impacts to traffic, roads and associated infrastructure are discussed in Section 6.13.5. The monitoring program is outlined in Section 6.13.6.

6.13.1 Study methods

The study method involved a desktop review of traffic volume data from the Department for Planning, Transport and Infrastructure (DPTI). The estimate of additional traffic that will be generated by the project was based on conceptual logistics estimates provided by AGL.

The impact assessment was based on the total forecast traffic load (i.e., the additional traffic generated by the project during the construction and operational stages, plus the existing traffic load).

6.13.2 Baseline

The causeway that leads up to the bridge and the road network on Torrens Island (outside of the AGL boundaries) are owned by the Generator Lessor Corporation (SA Government) (GLC). There is currently a lease agreement between the GLC and Torrens Island road users (AGL, Origin Energy

and AQIS), which states that road maintenance responsibility is determined according to the ratio of usage.

The road network adjacent to the study area includes state managed roads (Grand Trunkway, Eastern Parade, Port River Expressway, Port Wakefield Road, South Road and a section of Grand Junction Road), which are managed and operated by DPTI, and the local road network which is managed and operated by the City of Port Adelaide Enfield and City of Salisbury councils (City of Port Adelaide Enfield, 2015).

Traffic volumes along much of the State road network in the project area are greater than 35,000 vehicles per day, comprising approximately 12-30% commercial vehicles (Austroads Classes 3 to 12) (DPTI, 2015a; DPTI, 2015b).

The local road network provides access to surrounding properties and connections to the State road network. Roads within the local road network are classified by relevant municipalities according to the function of the road, the types of users and the volume of traffic. Within the local road network, project vehicles requiring access to the power station will use the Grand Trunkway (which is the current access to TIPS). The Grand Trunkway is a two-way sealed road that in addition to providing vehicle access for businesses in the Port Adelaide area provides access to the causeway that crosses the Angas Inlet, and joins Garden Island and Torrens Island to the mainland. The off-island section of the Grand Trunkway carries approximately 3,400 vehicles a day (20% commercial vehicles) (DPTI, 2015a; DPTI, 2015b). Grand Trunkway traffic that crosses the causeway is significantly less, with only 320 vehicles per day accessing Garden Island (28% commercial) and approximately 284 vehicles accessing Torrens Island (Coffey Environments, 2010).

The main access road from the causeway to the central part of Torrens Island including the AQIS facility is a sealed road. There are also sealed roads outside the TIPS (on the northern and western boundaries). Most other roads on Torrens Island are also sealed roads including the roads within the TIPS boundary. Roads to the north of TIPS are mainly used by staff from the AQIS facility to the north of the island, Origin Energy personnel attending the Quarantine Power Station at the northern end of Torrens Island, Department of Environment, Water and Natural Resources (DEWNR) staff who access the Torrens Island Conservation Park, SEAGas and Epic Energy staff, and volunteers from AMWRR. Public access to Torrens Island is restricted and is controlled by a security check-point at the end of the causeway.

6.13.3 Potential impacts

During the construction and operational phase of BIPS the volume of vehicle traffic will increase between the Grand Trunkway and Torrens Island. Traffic volumes will also increase on roads surrounding the site that lead onto the Grand Trunkway. Potential impacts relating to project-related traffic include:

- Increased traffic volume and change in traffic composition.
- Risk of traffic accidents.
- Changes to internal road network infrastructure.

The primary issue relating to traffic arising from the proposed project are a greater volume of traffic and change in the traffic composition (i.e., greater proportion of heavy vehicles particularly associated with construction activities).

These changes may indirectly cause secondary issues and potential effects such as changes to road safety (particularly relating to intersections), decreased level of road service (speed, travel time, manoeuvrability and delay) and effects on the road infrastructure (such as degradation of road surfaces and upgrading of access roads).

Construction traffic volume and composition

Construction activities associated with the various components of the project and the size of the construction workforces are described in Chapter 4. The traffic generation estimation has assumed the worst-case scenario. This is considered worst case due to the directions of generated traffic and assessment of the existing road network.

The project will increase the volume of vehicle traffic between the Grand Trunkway and Torrens Island, during construction. Traffic volumes will also increase on roads surrounding the BIPS that lead onto the Grand Trunkway. Project related traffic will peak during construction, due to movement of up to 200 to 300 additional personnel, construction materials and equipment. Project construction will also increase the number of heavy vehicles and equipment on local roads due to the transport of materials and equipment.

These changes during construction have the potential to impact on road safety (particularly relating to intersections), decrease the level of road service (speed, travel time, maneuverability and delay) and affect road infrastructure (such as degradation of road surfaces and upgrading of access roads).

Traffic generated during operation of the BIPS will be similar to current levels as it is not expected that there will be a material change to the permanent workforce of the combined TIPS and BIPS, as workers from the mothballed TIPS A station will move to the BIPS project. Most traffic will be employee transport in light vehicles from the surrounding metropolitan area. Once the power station is operational, diesel trucks will also contribute to the traffic using the roads. It is anticipated that approximately 1-2 additional trucks per week will be accessing the BIPS site.

Risk of a motor vehicle accident

During the construction phase there will be approximately 200 to 300 additional people on site and as a consequence, the traffic intensity is expected to be substantially higher due to movement of personnel, construction materials and equipment. Therefore there is an increased risk of motor vehicle accidents occurring at (or on route to) the development site at Torrens Island.

Road network infrastructure and access

Increased traffic from the project has the potential to affect the existing road network infrastructure on Torrens Island. The likelihood of any such impacts, such as degradation of road surfaces, is dependent on the existing pavement and infrastructure condition and change in use due to the project.

One additional internal road will be constructed on Torrens Island to provide access to the new facilities and allow for access to the north of the island (see Figure 6.23).

All traffic entering Torrens Island must cross the causeway located at the south-eastern tip of the island. The Grand Trunkway bridge was refurbished in 2004/05 and it has sufficient capacity to carry the 1992 Austroads Bridge Design Code HLP400 loading. It is able to withstand a maximum gross vehicle weight of 400 t.

Intersections

Increased traffic volumes, as well as altered traffic composition have the potential to affect the operation and/or safety of road intersections. The intersection of the Grand Trunkway, Eastern Parade and Perkins Drive is a key intersection in the vicinity of the project area. This intersection receives traffic flow from Port Adelaide via Francis Street and Perkins Street and traffic that diverts off the Port River Expressway travelling in an easterly direction over the Tom ‘Diver’ Derrick opening bridge or from a westerly direction along the Expressway from Port Wakefield Road. The intersection

coffey A TETRA TECH COMPANY	Date: 18.09.2017 Project: 754-BNEEN202225 File Name: 202225_02_F06.23_GRA	AGL Energy Limited Barker Inlet Power Station	agl	Existing and new road infrastructure surrounding the site	Figure No: 6.23

AI Reference: 202225_02_GRA0026.ai_4

also receives traffic from Eastern Parade – traffic heading in an easterly direction from the industrial and port facilities of Port Adelaide and traffic heading west along Eastern Parade from Grand Junction Road. The intersection also receives traffic via the Grand Trunkway from the north – the direction of Torrens Island.

The Grand Trunkway is a two-lane, two-way road, with a speed limit of 60 km/h between Eastern Parade and Torrens Island. The off-island section of the Grand Trunkway carries approximately 3,400 vehicles per day with approximately 20% commercial vehicles (based on a 2015 survey). Eastern Parade and the Port River Expressway are four-lane, two-way roads. The speed limit on Eastern Parade is 60 km/h and the Port River Expressway initially has a speed limit of 60 km/h increasing to 90 km/h approximately 200 m after the Eastern Parade overpass. The section of the Expressway closest to the project area carries approximately 36,100 vehicles per day with approximately 12% commercial vehicles (DPTI, 2015a; DPTI, 2015b).

The intersection at the northern end of the Grand Trunkway, where traffic diverts to either Garden Island (veer to the right when travelling north along the Grand Trunkway) or Torrens Island (veer to the left) is another key intersection in the vicinity of the project.

Access routes

On Torrens Island, the road that currently runs to the east of the existing power station is jointly accessed by other occupants including staff and visitors to AQIS, DEWNR, Origin Energy, SEAGas, Epic Energy, ElectraNet and other volunteers. Continued safe access to other occupants' facilities will need to be maintained during the construction phase.

6.13.4 Avoidance, management and mitigation

This section describes the proposed management measures designed to avoid or minimise the potential impacts associated with a greater volume of traffic and changes to traffic composition, on road intersections.

Traffic volume and composition

As BIPS is located within a predominantly industrial area, a high percentage of the existing local daily traffic consists of commercial vehicles (over 20%) (DPTI, 2015a; DPTI, 2015b). There will be an increase in the number of commercial vehicles during the construction phase of the BIPS within the project area.

Management measures for traffic and road works will be conducted in accordance with the *South Australian Road Traffic Act 1961*. Traffic management measures will include:

- Development of an overarching Traffic Management Plan.
- Notification and coordination with the emergency services including police, fire and ambulance for any road closures and the provision of mechanisms to allow access for emergency vehicles.
- Avoidance and management of traffic impacts in residential areas (such as trucks to avoid using exhaust brakes where appropriate, heavy vehicles to adhere to preferred road networks and access routes and road safety infrastructure to be upgraded/implemented where appropriate).
- Provision of designated safe parking locations for construction workers.
- Stakeholder liaison that provides details of key traffic contacts and contingency arrangements.

It is anticipated that some loads associated with large equipment, will exceed the dimension limits outlined by DPTI and therefore the movement of these over dimensional loads will require a permit. AGL will adhere to any permit conditions required by DPTI. Routes for over dimensional loads will be determined in consultation with the heavy haulage contractor, DPTI and affected councils, likely to include the City of Port Adelaide Enfield.

Minimising risk of a traffic accident

To minimise the risk of traffic accidents occurring during construction, a multi-faceted management approach and risk controls will be implemented. A management and policy framework will be developed outlining the management strategies and controls in place to ensure staff, contractor and public safety relating to vehicle transport on Torrens Island and in the surrounding area. In developing the framework and management approach, the following elements will be considered:

- Development and application of safe driver conduct policies and standards to be applicable to all AGL and contractor personnel.
- Driver and pedestrian safety awareness programs, to be integrated with broader health, safety and security requirements for staff and contractors. The programs will include emphasis on individual and management responsibilities, consideration of advanced driver training programs and the use of appropriate signage on-site.
- A review of speed limits on Torrens Island for all vehicles during the construction period.
- Random alcohol and drug testing program, to be integrated with broader health, safety and security requirements for staff and contractors.
- Regular communication between road users on the island.

Road network infrastructure

All new roads constructed within the site to provide access to the new facilities will be constructed in line with Austroads and the appropriate Road Design Standards and Guidelines. In addition AGL will ensure that road management is in line with the terms and conditions of the GLC lease agreement. Consideration of these measures will reduce the risk of the road network infrastructure and other Island road users, being negatively affected by the project.

Intersections

The intersection of Grand Trunkway, Eastern Parade and Perkins Drive is currently utilised by significant numbers of heavy commercial vehicles and trains. It is controlled by traffic signals and railway crossing lights.

Access routes

AGL has considered the effect the construction phase will have on other road users on the Island. Regular communication between road users on the island would provide a forum through which access routes and associated impacts could be kept under review.

6.13.5 Residual impacts

Impacts relating to project-related traffic stem from a small increase in traffic volumes and altered traffic compositions. Residual impacts that occur after implementing the measures described in Section 6.13.4, Avoidance, Mitigation and Management Measures, are assessed in terms of a

likelihood and consequence risk assessment. Risks have been assessed in terms of the increased risk over and above the current level of risk.

Overall, the project has been assessed to have a minimal and largely temporary impact on the surrounding road network during construction and operation. This is based on consideration that the additional traffic caused by the project is well within the theoretical roadway capacities, and that the existing declared road network and local road network are generally in good condition and meet the relevant standards. The existing heavily industrialised nature of the surrounding region means that the presence of heavy vehicles for construction will not be out of character with the region and will not lead to heavy vehicle traffic in a residential area unaccustomed to traffic of this type.

The residual impacts are summarised in Table 6.41 and assessed in the following sections.

Table 6.41 Summary of traffic, roads and infrastructure impacts

ID	Impact	Likelihood	Consequence	Residual Risk
I023	Change in traffic volume and composition	Possible	Minor	Moderate
I024	Construction resulting in increased risk of motor vehicle accident	Rare	Major	High
I025	Degradation of road network infrastructure and reduced road access	Unlikely	Minor	Low

Traffic volume and composition

During construction, there will be a temporary increase in traffic volumes. The traffic management measures will set out procedures for road use and will be employed during construction.

The use of existing heavy-vehicle approved routes will minimise potential issues related to the presence of heavy vehicles. The routes to be used by construction vehicles already carry a high proportion of commercial/heavy vehicles and the likelihood of the proposed development having a material impact on existing traffic volume and composition is assessed as **possible.** Given the existing industrial nature of the area surrounding the project site the consequence of a change in traffic volume and composition is assessed as **minor.** As a consequence, the resulting residual impact of a change in traffic volume and composition is assessed as **moderate**. However, the life of this impact is only for the construction period and no significant changes to traffic flows in the longer term are expected.

Construction resulting in increased risk of a motor vehicle accident

During the construction phase, the traffic intensity is expected to be substantially higher around Torrens Island due to movement of personnel and construction materials and equipment. After avoidance, mitigation and management measures have been implemented, the likelihood of serious accidents attributable to increased traffic associated with the project construction has been rated as a **rare** occurrence, with a **major** consequence due to the potential for injury. Therefore, the residual impact of an increased risk of a motor vehicle accident is assessed as **high.** However, when the risk of traffic accidents is placed into context of normal day-to-day driving by the general public, the risk will most likely be lower.

Degradation of road network infrastructure and reduced road access

During construction, existing access routes may be disrupted and construction traffic will place an increased load on the road network infrastructure on Torrens Island and in the area surrounding the

island. During operation, traffic volumes within the study area will generally revert to the volumes that occurred prior to construction.

The development of a new road extension within the site and the implementation of other mitigation and management measures will minimise the risk of reduced level of service to existing road users during project construction and operations. The likelihood of adverse impacts arising as a result of the road being extended is therefore **unlikely** and the consequence has been assessed as **minor**. Therefore, the residual impact associated with a degradation of the existing roads and reduced access has been assessed as **low**.

6.13.6 Monitoring and reporting

The condition of road infrastructure on Torrens Island will be maintained as per the requirements of the GLC lease agreement. The regular communication between road users on the island would provide a forum through which access routes and associated impacts could be kept under review and the effectiveness of traffic related mitigation strategies monitored.

6.14 Socio-economic environment

This section outlines the current socio-economic environment of the communities in the vicinity of the proposed BIPS.

It is a summary of the socio-economic baseline characterisation study that was completed in 2009 (Coffey Environments, 2010) and updated in 2017 within this ESAR.

This section will define the objectives for the socio-economic baseline characterisation, describe the methods used to profile the existing environment (Section 6.14.1) and briefly outline local council policies that are relevant to the socio-economic development of the area (Section 6.14.2). It will then discuss the following key indicators of the socio-economic environment:

- History and community values.
- Population and demography.
- Economy, industry and governance.
- Physical and social infrastructure.

This section will also describe potential impacts of the BIPS on the socio-economic environment in which it will be developed (Section 6.14.3), relevant avoidance, management and mitigation measures (Section 6.14.4). Residual impacts will be addressed in Section 6.14.5.

The objectives of the socio-economic characterisation are to:

- Define project stakeholders.
- Provide a high-level characterisation of the existing socio-economic conditions of the region.
- Establish a demographic and economic profile of the study area.
- Describe the potential impacts of the project on the socio-economic environment including lifestyle, employment and workforce impacts.
- Recommend strategic-level mitigation measures to manage project impacts

6.14.1 Study methods

The socio-economic characterisation is limited to a comprehensive desktop review of available secondary information sources about the project area, a review and analysis of the project

stakeholder and strengths, weaknesses, opportunities and threats (SWOT) workshop undertaken in 2009, liaison with AGL project personnel and a high-level consideration of potential impacts identified by the specialist report prepared in 2009 (Coffey Environments, 2010).

Desktop analysis

The sources reviewed in developing the socio-economic baseline characterisation include the Australian Bureau of Statistics (ABS) 2011 census data, information from the South Australian Government, documentation produced by the City of Port Adelaide Enfield Council and an internet-based search of literature relating to the project, the project areas and similar projects in the area.

SWOT

As part of the previous socio-economic baseline characterisation study completed in 2009 (Coffey Environments, 2010), a workshop was conducted which considered the project strengths, weaknesses, opportunities and threats (SWOT) from the perspectives of identified stakeholders to the project. The activity was a central element of the identification of potential impacts. These impacts have been reviewed in addition to the identification of additional impacts as part of the 2017 stakeholder engagement activities (described further in Chapter 5).

Stakeholder engagement

Stakeholder liaison for the socio-economic baseline characterisation study was limited to liaison with AGL personnel, South Australian Government personnel and potentially affected stakeholders, including the City of Port Adelaide Enfield Council and the Kaurna people representatives. Refer to Chapter 5 for information on stakeholder interviews and meetings.

Limitations

A full impact assessment involving quantitative and qualitative assessment of stakeholder perceptions and values has not been undertaken. The socio-economic impact assessment has been prepared on a desktop basis as the stakeholder engagement initiatives to discuss the potential impacts were limited and therefore the analysis of perceptions and values was not undertaken.

Description of potential impacts

To identify the potential impacts of the project, the aforementioned data outlining the existing socio-economic situation of the project area, was assessed against the project design. Any predicted changes to the existing conditions have been identified in this section (Section 6.14.3).

6.14.2 Baseline

Community values

Historically the communities in the Port Adelaide area have been collectively referred to as ‘blue collar’ or ‘working class’. The residents of the Port Adelaide Enfield area, in particular the Coast and suburbs located nearby Torrens Island, have a long history of employment in the manufacturing, trade and waterside industries. These industries are known to have had historically high levels of union membership and despite this decreasing in recent years, an ongoing union movement remains in the area.

Environmental advocacy is strong in the Port Adelaide Enfield area. Several high-profile protests against development have been conducted in the region, including the development of the Pelican Point power station in 1999.

Many residents of the Port Adelaide Enfield area have a long connection to the area. A high proportion of the population has lived within the area for an extended period of time. Typically, communities showing this degree of stability place high value on community assets, for example amenity and sites of historical or cultural importance, and may be resistant to change or redevelopment.

Although the area has remained largely focused on heavy industry and maritime trade channels, the area across the Port River from Torrens Island is also being developed as a site of national strategic importance for defence industry innovation and is home to the defence precinct, Techport Australia a naval industry hub.

Residential and commercial developments particularly along the waterfront and the Port River, have also changed the character and land use in the Port Adelaide region. The major redevelopment projects in the Port area – particularly the residential redevelopments –have been met with mixed reactions from the local community.

Population and demography

Table 6.42 provides a summary of the demographic features of the Adelaide metropolitan, Port Adelaide Enfield and Coasts area as reported in the suburb profile data sheets, compiled in 2011 (ABS, 2011).

Table 6.42 Demographic summary (2011)

	Adelaide	Port Adelaide Enfield	Coast
Total population	1,225,235	112,815 (9.21% of Adelaide population)	28,560 (2.33% of Port Adelaide Enfield population)
Area	1826.9 km²	97 km²	21.6 km²
Median age	39 years	37 years	42 years
Average household size	2.4 persons	2.4 persons	2.3 persons
Aboriginal / Torres Strait Islander population (percentage of total population)	15,595 (1.27% of Adelaide population)	2,722 (2.41% of Port Adelaide Enfield population)	745 (2.61% of Coast population)
Population change (2006 to 2011)	+1.95%	+1.8%	+1.2%

Source: ABS, 2011

The Port Adelaide Enfield district has a growing population, as reflected in the 1.80% growth over five years to 2011. In comparison, the Coast area saw a slower growth in population of 1.2% between 2006 and 2011. The average growth from 2006 to 2011 in metropolitan Adelaide was 1.95%. A common trend across the Coast area is a gradually ageing population. The median age of residents in the areas is 37 years (Port Adelaide Enfield), 42 years (Coast area) and 39 years (metropolitan Adelaide).

The population density of the district is clustered around the coastal suburbs of North Haven, Largs Bay, Taperoo, Largs North and Semaphore and in the predominately housing trust non-coastal suburbs of Mansfield Park, Woodville Gardens, Ferryden Park, Angle Park and Kilburn. Higher densities can also be found in newly developed areas in the north-east of the Council area in suburbs

such as Oakden and Northgate where medium density dwellings have been incorporated into the development.

Indigenous population

The Indigenous population is approximately 2.41% of the total Port Adelaide Enfield population and 2.61% of the total Coast population, compared to 1.27% of the Metropolitan Adelaide area. The Indigenous population of Port Adelaide Enfield comprises approximately 18% of metropolitan Adelaide's total Indigenous population. The Indigenous population of the Coast area comprises approximately 27% of the total Indigenous population in the City of Port Adelaide Enfield Council area. Collectively, this data demonstrates a comparatively high proportion of Indigenous residents in areas adjacent and peripheral to the development.

Migrant population

Between 2006 and 2011, the community of Port Adelaide Enfield saw approximately 9,000 residents migrate to the area from overseas. Following the trend of many new migrant groups, these newly arrived migrants tend to settle around areas with available housing and social services, as well as persons of similar backgrounds. In the City of Port Adelaide Enfield Council area, this is seen around the Parks area (ABS, 2011).

Household size and structure

In 2011, average household size in both metropolitan Adelaide and Port Adelaide Enfield was 2.4 persons per household. In Port Adelaide Enfield household composition was constituted predominately of family groups and single person households, accounting for 91.7% of all households (the remaining 6.3% comprising group, visitor only and not classifiable households).

Economy and industry

Economic profile

The City of Port Adelaide Enfield Council area plays a key role in the economy of metropolitan Adelaide. At the 2016 Census, there were approximately 70,000 jobs in the area with approximately 8,000 local businesses. The area is one of the seven significant employment nodes in metropolitan Adelaide. The area has representation across the following industry and service sectors (SGS, 2009):

- Road freight transport.
- Supermarket and grocery stores.
- Non-residential care services.
- Shipbuilding.
- Manufacturing.
- Primary education.
- Household appliance manufacturing.
- Basic Iron and steel manufacturing.
- Machinery and equipment wholesaling.
- Police services.
- Technical and further education.
- Hospitals.
- Automotive repair and services.
- State government administration.
- Electricity generation.

The diversity of industry that exists in the Port Adelaide Enfield area is likely to mean that the community is well placed to absorb the potential economic and industry impacts and benefits of the BIPS development.

Labour force participation

Table 6.43 and Table 6.44 provides the statistical data on labour force participation collected from the 2011 Census. Participation in the labour force by persons aged over 15 years in the broader Port Adelaide Enfield Council area is 56.5% of total potential labour force.

It should be noted that the ABS definition of participation in the labour force includes employed and unemployed persons seeking work. In 2011, the unemployment rate for Port Adelaide Enfield was 6.8%, significantly higher than for the Port Adelaide Coast area (5.3%) and metropolitan Adelaide (5.8%).

Table 6.43 Labour force (2011)

Labour Force – Population*	Metropolitan Adelaide	Percentage of labour force	Port Adelaide Enfield	Percentage of labour force	Port Adelaide Enfield Coast Area	% of labour force
Employed	576,822	-	49,202	-	-	-
Employed full-time	348,427	56.9	30,462	57.7	8,748	59.9
Employed part-time	193,321	31.6	17,667	33.5	4,234	29.0
Away from work	35,074	5.7	-		841	5.8
Employed hours not stated	-		1,073	2.0	-	
Unemployed	35,404	5.8	3,566	6.8	779	5.3
Total	**612,226**	**-**	**52,768**	**100**	**14,602**	**-**

*aged 15 years and over
Source: ABS, 2011

Table 6.44 Port Adelaide Enfield Labour force status (2011)

Labour Force – Population*	Port Adelaide Enfield	% of labour force
Labour force	52,768	56.5
Not in the labour force	35,474	38
Labour force status not stated	5,174	5.5
Total potential labour force†	**93,416**	**100**

*aged 15 years and over
†includes employed and unemployed persons.
Source: ABS, 2011

Employment

Table 6.45 shows the employment by occupation in metropolitan Adelaide, the City of Port Adelaide Enfield Council area and the Coast area. There are a number of manufacturing and transport industries present, which contributes to the higher proportion of machinery operators, drivers and

labourers. In the broader Port Adelaide Enfield district there is a higher proportion of labourers (12.7%) compared with metropolitan Adelaide (9.9%) and the Port Adelaide Coast area (10.0%).

Table 6.45 Employment by occupation

Occupation	Metropolitan Adelaide	Percentage	Port Adelaide Enfield	Percentage	Coast	Percentage
Managers	64,312	11.1	4,536	9.2	1,448	10.5
Professionals	124,684	21.6	9,562	19.4	2,539	18.4
Technicians & trades workers	80,592	14.0	7,015	14.3	2,099	15.2
Community & personal service workers	61,552	10.7	5,542	11.3	1,612	11.7
Clerical & administrative workers	89,015	15.4	7,272	14.8	2,256	16.3
Sales workers	57,036	9.9	4,363	8.9	1,230	8.9
Machinery operators & drivers	33,296	5.8	3,663	7.4	1,029	7.4
Labourers	56,938	9.9	6,256	12.7	1,377	10.0
Total*	**567,425**	**100**	**48,209**	**100**	**13,590**	**100**

*does not include data for “Inadequately described/ Not stated”
Source: PAE, 2011

As Table 6.45 outlines, the Port Adelaide Enfield area has a high number of skilled workers of the nature likely to be required for the construction of the BIPS. The project is likely to be able to source a high proportion of its workforce locally, thus benefiting the local economy. However, given the employment diversity and level of industry that occurs in the area, competition for the skills required for the BIPS is likely to be high.

Income

Table 6.46 provides a breakdown of the number of households within defined income brackets. All three areas have a similar distribution of income with majority of household incomes earning between $400-$999. Metropolitan Adelaide has the highest proportion of incomes over $1,000 a week (56%). Comparison the Coast region has the highest proportion of incomes between $0-399 (17.5%). With respect to the commencement of activities at the BIPS, wage parity with local opportunities is likely to be expected by employees, therefore requiring consideration of employment packages designed to attract local resources.

Table 6.46 Weekly household income

Income	Metropolitan Adelaide	Percentage	Port Adelaide Enfield	Percentage	Coast	Percentage
Negative/Nil income	5,769	1.2	119	1.0	589	1.3
$1-$399	57,672	12.1	1,612	13.9	7,208	16.1
$400-$999	134,825	28.4	3,197	27.6	13,368	29.9
$1,000-$1999	130,053	27.4	3,126	27.0	11,778	26.4
$2,000-$2,999	67,786	14.3	1,703	14.7	5,463	12.2
$3000 or more	35,141	7.4	762	6.6	2,138	4.8
Partial income stated	33,095	7.0	776	6.7	2,790	6.2
All incomes not stated	11,087	2.3	283	2.4	1,319	3.0
Total	**475,428**	100	**41,478**	100	**11,051**	100

Source: ABS, 2011

Industry

Approximately 30% of Adelaide's industrial land is located in Port Adelaide Enfield area. The area accounts for around 20% of Adelaide's overall industrial output. The area has a particularly solid manufacturing base, with businesses operating in all areas of manufacturing including wood products, basic metals, non-metal products and food and beverage products. The businesses in the district are wide ranging from manufacturing pasta to cement, to state of the art wine bottling and storage, to construction of high-tech naval vessels.

Port Adelaide serves as a major hub for the export and import of goods from around Australia and internationally.

There is a significant industrial presence throughout the suburb of Gillman which is located adjacent to Torrens Island, and also in the mid to north-eastern portion of the Le Fevre Peninsula in the suburbs of Birkenhead, Taperoo and Osborne. Much of this area is zoned for general industry and is the site for several major industrial facilities (PAE, 2009). Examples of the local industrial presence include Adelaide Brighton Cement works, ASC ship building, Osborne Cogeneration Facility, Pelican Point power station, Origin Energy's gas-fired power station and fuel import terminals at Birkenhead.

Heavy industry development in the area, particularly in the Coast area and adjacent to the Gilman Industrial Park, is likely to have led to broad tolerance of new developments amongst the residential community.

Social infrastructure

Emergency services

With respect to the BIPS, the project site and the communities surrounding Torrens Island are serviced with well-equipped local emergency response capabilities. In addition to services in the immediate local area, given the site is located in the greater metropolitan Adelaide the full range of emergency services and state and federal disaster response capabilities are readily accessible should the occasion arise.

The Port Adelaide Enfield area is serviced by local police stationed at the Port Adelaide Police Station. Police functions operating from these areas include mobile patrols, intelligence, criminal justice, traffic, criminal investigation, administration, community programs and victim support services.

There are four metropolitan fire services located in the City of Port Adelaide Enfield Council area, located at Oakden, Angle Park, Largs North and Port Adelaide. Largs North and Port Adelaide are located within close proximity to the BIPS. Both of these stations provide a full-range of firefighting and emergency response capability on a 24-hour a day basis.

Community groups and organisations

There are a vast range and diversity of community organisations and clubs within the area in interest areas including, but not limited to, places of worship and religious groups, service groups, social groups for men and women, migrant groups, environmental interest groups and business and progress associations.

These groups and organisations show evidence of a strong social fabric and the capacity to welcome new arrivals to the district and provide community-based initiatives to encourage integration with the existing community.

Accommodation and housing services

The suburbs immediately adjacent to the Torrens Island site, and peripheral suburbs in the broader region have extensive and well developed residential areas. The City of Port Adelaide Enfield Council area and the Coast area have in excess of 41,000 and 11,000 residential dwellings emphasising the presence of widespread historical, current and future residential development.

Developments include the Westwood Urban Regeneration Project which commenced in 1999 and was completed in 2011 and the Port Adelaide Waterfront which included a $1.5 billion Newport Quays Stages 1 and 2 development of approximately 400 homes including 24 berth marina, parklands and recreational facilities. More recently in 2016 the Port Adelaide historic maritime precinct commenced a $280m transformation into approximately 1,300 homes as part of the Port Renewal Plan.

The ongoing development in the region is an initiative to encourage economic and population growth in the area, through attracting new residents and providing alternative housing options for modern-style living and access to housing for both the existing population and new arrivals.

The potential impacts of the project on housing and accommodation are discussed in Section 6.14.3.

Sporting and recreational infrastructure

The Port Adelaide area and the broader western suburbs of Adelaide have a well-established sporting culture and high levels of participation in a range of sporting activities. There are over 90 clubs providing services for social and competitive sporting activities across all age groups. The land and

waterways in the area surrounding Torrens Island are ideal for recreational activities. Recreational uses of the waterways of the Port River, Angas and Barker Inlets include fishing and boating (particularly from the Garden Island boat ramp and board walk) and Port River dolphin cruises (several tour operators are based in the Port Adelaide inner harbour and operate tours in the waterways proximal to Torrens Island). The Port River system hosts the largest and most diverse ships' graveyard in Australia accessible to non-divers.

Environmental, heritage and local community groups are demonstrably committed to the protection of the river system, particularly given that the Gillman Industrial Area is located in close proximity to these waterways and the Port River is used extensively for industrial and commercial shipping.

The Torrens Island produce and fish markets are located on the wharves off Moorhouse Road, Port Adelaide, directly opposite the southern aspect of the existing Torrens Island power station. The Torrens Island Markets have traded at that site since 1976 when they moved from the original location on the wharves near the Birkenhead Bridge in Port Adelaide which had hosted produce and fish markets since the 1930s.

6.14.3 Potential impacts

During the construction and development phase of the BIPS potential (positive and negative) impacts relating to the socio-economic environment include:

- In-migration of workers affecting population and demographics.
- Direct and indirect employment opportunities for the local community.
- Local economy injection.
- Intermittent decreased availability of accommodation.

There are a number of aspects of the project that have a positive influence on elements of the socio-economic impact of the project (i.e., the injection into local and regional economy as a result of project expenditure and an increase in employment). Potential negative impacts have been deemed negligible and are able to be adequately mitigated against as outlined in Section 6.14.4.

6.14.4 Avoidance, management and mitigation

AGL is committed to maintaining its reputation as a responsible company in the energy sector and ensuring that the project has the broad acceptance of its stakeholders i.e., that the project has a ‘social license to operate’ that will support its construction and ongoing operation. AGL will implement avoidance, mitigation and management measures to address the potential socio-economic impacts on the community. These measures will reflect current good practice at similar power stations operating in similar environments and are described in the following sections. The development of a stakeholder engagement plan and subsequent stakeholder engagement process will be implemented by AGL. The plan provides details of identified stakeholders, engagement methods and contingency arrangements. Details on stakeholder engagement for the project is detailed in Chapter 5.

To maximise the positive effects from the project and minimise the potential negative impacts AGL will:

- Aim to maximise employment opportunities for the local community where possible, however this is dependent upon the type of skills and experience available.
- Source goods and services locally wherever practicable, based on local capacity, ability to supply, quality and cost competitiveness.

- Ensure that injury prevention, first aid, emergency response and injury management systems applicable to AGL personnel and all contractors are established and meet relevant Australian standards to ensure that project-related injuries and illnesses do not create additional burden on local health services.
- Establish a dialogue with the City of Port Adelaide Enfield Council to ensure that impacts on social infrastructure as result of the construction are monitored and, if required, managed to reduce the negative impacts and enhance the positive impacts of the development.

6.14.5 Residual impacts

A full impact assessment involving quantitative and qualitative assessment of stakeholder perceptions and values has not been undertaken. This section outlines a range of potential issues that may arise from the project's impact, based on a desktop assessment and findings of stakeholder engagement. Where necessary, high level mitigation measures to reduce negative impacts and maximise positive benefits for the community are recommended in Section 6.14.6. Table 6.47 provides a summary of the potential residual impacts.

Table 6.47 Summary of socio-economic impacts and positive effects

ID	Impact/*Positive effect [within italics]*	Likelihood	Consequence	Residual Risk / *positive effect*
Population and demographics				
I026	In-migration leading to increased population resulting in pressure on community infrastructure and resources during construction.	Unlikely	Insignificant	Low
Employment				
I027	*Direct and indirect employment opportunities of locals for up to three years during construction.*	*Likely*	*Moderate*	*High*
Local and regional economy				
I028	*Injection into local and regional economy as a result of project expenditure and investment in additional infrastructure.*	*Likely*	*Moderate*	*High*
Accommodation and housing				
I029	Increased demand for housing during construction resulting in increase in rental prices and reduced availability.	Unlikely	Insignificant	Low
Social infrastructure				
I030	Increased pressure of social and community infrastructure through increased population.	Unlikely	Insignificant	Low

Population and demographic profile

As the majority of the workforce is expected to be sourced from within the Adelaide region, the BIPS is unlikely to have a significant impact on the local or regional population. Any possible change in population will depend on precisely where the construction personnel reside and whether any proportion of the workforce will relocate to the project area and surrounding districts as opposed to commuting from their existing residential base. The proximity of Port Adelaide and the project to the broader Adelaide district, combined with the extensive road networks and transport infrastructure servicing the area will reduce the need for large numbers of construction employees to move on a permanent basis to the immediate and surrounding project areas. The short-term nature of the construction employment is also likely to serve as a disincentive for construction personnel to move to

the region from other areas of Adelaide (or indeed from within the State) purely for employment reasons.

Given the large population base of the region and the relatively small projected construction workforce, the population impacts are likely to be negligible. If an assumption was made that peak construction activities occurred concurrently and that 100% of the construction workforce relocated to reside within the project region (noting this to be unlikely), and that each of those construction workers brought with them 1.8 dependents (based on average Australian family sizes in 2011, according to the ABS), the projected maximum population movement would be 396 people. If this population increase was contained to within the coastal suburbs with a population of approximately 28,560 this would represent a population increase of 1.39%. If the migration was dispersed across the City of Port Adelaide Enfield Council of approximately 112,815 this would represent a population increase of 0.35%. Either of these scenarios is likely to dramatically overstate the expected population change given the expectation that the workforce will be sourced from within Adelaide and will have limited reason or motivation to move to the region for the short-term construction activities. It is very likely that any population change below these estimates would be accommodated readily within these already-large population centres and that any resultant impact would be minimal.

Once developed, the BIPS operational workforce will be operated and maintained by personnel from the existing TIPS operations whose employment will be continued by transitioning from the mothballed TIPS A Station to the new BIPS plant.

Consequently the long-term impact of the project on the demographic profile of the region is expected to be **low** or **negligible**.

Indirect impacts

The development of the project is likely to lead to increased procurement requirements and business opportunities on a regional and local level. There is a possibility that businesses may grow, or emerge, to seek to exploit these opportunities. For similar reasons to those outlined above, it is unlikely that large numbers of people would be required to migrate to the project area to take advantage of these opportunities.

Employment

The BIPS development will deliver positive impacts through substantial employment opportunities, particularly during the construction phase of the project. The direct employment opportunities are centred around the development site at Torrens Island. In addition to the substantial direct employment opportunities, there is likely to be follow-on indirect employment benefits arising in the supply-chain to the project and in local and regional goods and service providers. AGL will take steps to maximise the employment opportunities available in the local project area and greater metropolitan Adelaide to ensure the project delivers positive benefits within the region. The impact of increased local employment opportunities and the flow-on effect of economic participation in the area is likely to be minimal.

The workforce associated with the construction of the BIPS and related facilities will be approximately 200-300 people for 18 months.

Based on similar previous projects, it is AGL’s expectation and intention to have the construction workforce sourced from within the metropolitan Adelaide area. This intention demonstrates a commitment to maximising local opportunities, but is also driven by economic considerations (avoiding relocation and living-away-from-home allowances, as well as the often difficult matter of accommodating a large, temporary construction workforce). The heavily industrialised nature of the area, appropriately skilled workers exist within and around the Port Adelaide and Adelaide area.

In addition to adopting a preference for sourcing local labour through the construction contractor, AGL also expects to utilise local construction machinery and equipment suppliers and maintenance operators, adding to the potential employment opportunities associated with the development.

The only obstacle to achieving this strategy of local employment and procurement will be the increasing demand on such skills within Australia and the tightening labour market. Unavailability of the necessary skills with the region may cause AGL and/or its construction subcontractors to look further afield to supplement its construction workforce. If significant supplementation is required from outside of Adelaide, further consideration would be required of the employment and accommodation options for the construction workforce.

The employment opportunities during construction are likely to deliver positive benefits with a moderate consequence, resulting in an overall **high** positive effect.

Local and regional economy

Capital expenditure

The BIPS development will deliver positive impacts through significant investment of capital in South Australia. The total capital expenditure estimated for the Stage 1 is $295 million. The distribution of capital input through construction activities in the local, regional, state and national economies have not been forecast at this stage and is dependent on the construction contracts established for the project and the geographical sourcing of goods and services. It is fair to say that project activities will lead to a moderate degree of economic stimulation in and around the City of Port Adelaide Enfield Council area and greater metropolitan Adelaide.

Procurement requirements

Based on experience with similar developments, AGL expects that in the order of 55% of expenditure on construction for the power station will be expended in overseas markets due to specific plant requirements and the limited procurement sources. The 45% balance of expenditure on construction is expected to be expended in Australia. Of this 45% balance, AGL estimates that about 75% of the total expenditure on construction can be expected to be expended within South Australia. This equates to approximately 30% of the overall expenditure on construction being spend in Adelaide.

Apart from the supply of large-scale industrial infrastructure, the provision of goods and services to the project is likely to arise in areas including trade services, the supply of hardware for construction and maintenance, temporary and permanent fencing and associated supplies, occupational health and safety and personal protective equipment, transport (freight and people-moving), additional support services and maintenance, waste disposal and a range of professional consultants providing services such as surveying and civil engineering.

Local business opportunities

As outlined in Procurement Requirements, above, in the order of 30% of total expenditure on construction-related materials for the project is expected to be sourced from within metropolitan Adelaide – a portion of which would be sourced from suburbs adjacent to Torrens Island in the Port Adelaide Enfield Council area. These procurement opportunities are likely to result in local business growth creating secondary economic activity within the broader community.

The flow-on workforce (supplying goods and services to the project) can also create secondary general economic activity in the broader community, further increasing labour demand. Depending on the structure of the construction contracts established by AGL, there may be an opportunity for local

and regional businesses to be awarded contracts for goods or services either on an individual basis, or as a collective business cooperative.

Personnel employed during the construction phase may contribute to the local economy via expenditure of the disposable portion of their salaries in the local area on goods and services such as food, fuel and entertainment. This impact is likely to be less obvious if the workforce is largely sourced from the region. If a large proportion of the workforce does not reside in the local area, expenditure in the local economy can still be expected as a result of the workforce commuting through this region.

The project is likely to deliver positive benefits to the local and regional economy with a moderate consequence, resulting in an overall **high** positive effect.

Accommodation and housing

Typically in energy and resource sector project developments, the arrival of a large-scale project workforce can lead to impacts on housing and accommodation. These impacts include increased demand for housing during construction resulting in increase in rental prices and reduced availability. Whilst this may deliver an economic benefit for landlords, this has the potential to increase housing affordability stress for households on low or fixed incomes and may prevent low income households from obtaining or retaining local rental housing. These typical circumstances are less likely to arise within the social and operating context of the BIPS development.

The impact on accommodation and housing as a result of the project will be determined by where the workforce will be located. Given the project workforce requirements and the location of the development in a well-established metropolitan area, the likelihood of material impact on accommodation and housing is expected to be minimal.

If the workforce is sourced from within the community and/or region, within a reasonable commute, then there will be minimal impact of demand for accommodation and housing. If a high number of contractors are sourced from outside of the region, then there is the possibility that accommodation for the workforce will be difficult to obtain in the council area or there may be an inflationary impact on rental prices. These impacts are however likely to be dispersed within a large area and therefore lessened as the areas in which the migrating project workforce could seek accommodation is widespread.

The potential for long-term impacts from the project on accommodation and housing is expected to be **low** or **negligible**.

Social infrastructure

Similar to housing, the arrival of a large-scale project workforce can lead to increased demand on social infrastructure and services. The extent of the impact on these services is a function of the existing (pre-development) demand and any surplus capacity that can be deployed to meet new demands. Conversely, increased population can act as a trigger for access to additional funding sources (meeting specified population thresholds) that can be directed towards increased service provision and can lead to improvements in the capacity of the community infrastructure through activities such as school expansions or construction and the expansion of health facilities and personnel.

Impacts of this type are accentuated for projects in remote regions where there are basic levels of infrastructure that are designed and staffed to meet the demands of the small population bases. These typical circumstances are unlikely to arise within the social and operating context of the BIPS development.

As described in the baseline Section 6.14.2, there is extensive education, health and community infrastructure and services in the coastal suburbs in close proximity to Torrens Island and the broader Port Adelaide Enfield Council area. The range and extent of services available in these areas is characteristic of a highly developed and urbanised region.

The population growth that may occur as a result of the BIPS is not expected to be significant in the context of the existing large population base (particularly considering the short-term nature of construction activities). The estimated minimal degree of change is not expected to place pressure on social infrastructure. Additionally, any increased demand on existing infrastructure and services that may arise from population change are likely to be dispersed within a large area and therefore lessened as the areas in which the migrating project workforce could access services is widespread.

The potential for long-term impacts from the project on social infrastructure is **unlikely** with an overall **low** residual risk to increasing pressure on social and community infrastructure through increased population.

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7 Health, safety and environmental management framework

This chapter outlines the health, safety and environmental management framework that will be applied to the Barker Inlet Power Station (BIPS) project throughout design, construction, operations and decommissioning. The key elements of the framework are:

- Health, Safety and Environment Management Systems which provide the structure for AGL Energy Limited (AGL) to manage social, environmental, health, safety and security aspects of the project.
- Environmental principles which set out the issues, objectives and performance criteria required to deliver a high standard of environmental management for all aspects of the project during the construction and operation phases.
- Management plans, policies and codes which describe management processes and procedures to manage health, safety and security on site.

BIPS will operate under the AGL Health, Safety and Environment Management System (HSEMS), which will form the basis for managing the environmental aaspects of the operation of the power station and associated infrastructure. The contracting strategy for the construction of the project infrastructure will require the major contractors for these components of the project to have and maintain systems of work. The health, safety, environmental and security systems of the major contractors will be reviewed prior to final contractor selection and engagement. AGL will ensure that the contractors' systems and meet the high standard of health, safety, environmental and security management that AGL expects in addition to all statutory requirements.

Environmental management of the construction and operation of the BIPS and associated infrastructure will be in accordance with the conditions of approval determined through the Environmental and Social Assessment Report (ESAR) process and the equivalent standards, as a minimum. These conditions and standards, along with commitments made in the ESAR, will be incorporated into the project-specific environmeantal management plans (EMPs). The HSEMS and EMPs for the power station and associated infrastructure are described in more detail in this chapter.

A separate project health, safety and security management plan will also be prepared to address all construction, operation and decommissioning work proposed for the project.

7.1 Health, Safety and Environmental Management System

AGL's aspiration for Health, Safety and Environment is Zero Harm, both to people and to the operating environment. AGL's HSE Systems form the framework by which HSE risks are managed across the business. The HSE systems begin with the HSE policy and flow down to local level procedures and tools that help to keep people and the environment safe.

The AGL HSE Management Systems are based on the following standards to enable continuous improvement:

- ISO 14001: 2004 Environmental Management Systems (Standards Australia, 2004a).
- AS/NZS 4801: 2001 Occupational Health & Safety Management Systems (Standards Australia, 2001).

The AS/NZS 14001:2004 EMS outlines the five key components of an effective EMS:

- Policy.

- Planning.
- Implementation and operation.
- Checking.
- Management review.

These key components are underpinned by 17 guiding elements:

1. Environmental policy: a commitment to the environment and a framework for planning and action.
2. Environmental aspects (and impacts): environmental attributes of operations, particularly those that could have a significant impact on the environment.
3. Legal and other requirements: relevant laws, regulations and other self-imposed and non-legal requirements that are adhered to.
4. Objectives, targets and environmental management program: environmental actions or goals in keeping with the environmental policy, environmental impacts and other factors to achieve objectives and targets.
5. Resources, roles, responsibility and authority: roles, responsibilities and resources for environmental management.
6. Competence training and awareness: employee training to ensure an awareness of and a capability to carry out environmental responsibilities.
7. Communication: processes for internal and external communications on environmental management issues.
8. Documentation: information on the EMS and related documents
9. Control of documents: management of EMS procedures and other system documents.
10. Operational control: management of operations and activities in keeping with the environmental policy, objectives and targets.
11. Emergency preparedness and response: potential emergencies and procedures for preventing and responding to them.
12. Monitoring and measurement: monitoring of key activities and tracking performance.
13. Evaluation of compliance: periodic verification of compliance with legal requirements
14. Nonconformity, corrective action and preventive action: problem correction and prevention of recurrences.
15. Control of records: records of EMS performance.
16. Internal audit: periodic verification of the EMS to assess whether it is operating as intended.
17. Management review: periodic review of the EMS to assure continual improvement.

These guiding elements define the requirements necessary to ensure that health, safety and environmental risks are systematically managed to an acceptable level.

The environmental aspects of the management system assist AGL to proactively manage environmental risks and compliance issues, define environmental responsibilities, and measure and benchmark its environmental performance. The management system applies to all sites over which AGL has operational control, including the proposed BIPS.

7.2 AGL environmental principles

Based on the precautionary principle, AGL has developed key environmental principles to guide health, safety and environmental management:

- Compliance – AGL will meet or exceed statutory obligations and relevant codes of conduct and company standards.
- Monitoring, reporting and communication – AGL's environmental performance measurement and reporting will be consistent with recognised national and global reporting standards. AGL will apply the assurance and verification principles of materiality and completeness and responsiveness when measuring, monitoring and reporting environmental performance.
- Impact minimisation – AGL will reduce risk to the environment and minimise its environmental impact, by integrating considerations of environmental sustainability in all activities. Key considerations for AGL and its' stakeholders in minimising environmental impact include pollution prevention, promotion of waste minimisation, reuse and recycling, the efficient use of resources such as water and energy and protecting cultural heritage. AGL will provide products, services and information to help customers make informed energy choices to benefit their home, business and the environment. Contractors and suppliers are expected to demonstrate consistency with AGL's approach by fulfilling their environmental responsibilities.
- Climate change and renewables – Consistent with business objectives and AGL's Greenhouse Gas Policy, AGL will work in consultation with its external stakeholders to improve greenhouse gas emission outcomes.
- Stakeholder engagement – AGL will provide leadership and actively participate in the policy debate on energy and environmental matters. AGL will consult with government, industry and community, its own people and other stakeholders about how to achieve sustainability in the energy sector. AGL's employees are encouraged to contribute to improving the company's environmental performance. AGL will aim to build knowledge, capability and understanding of environmental management issues for its employees.

7.3 Code of conduct

AGL's Code of Conduct (AGL, 2016) sets out overarching principles of ethical behaviour aligned with AGL's core values. It applies to Directors, employees and contractors working on behalf of AGL. The Code is administered by the AGL Ethics Panel.

The AGL Ethics Panel comprises the:

- General Counsel and Company Secretary.
- Executive General Manager, People and Culture.
- Head of Group Audit section.
- An independent person with expertise in the management of employee grievances.

The Ethics Panel is responsible for:

- Reviewing the effectiveness of the Code and recommending any changes to the Board.
- Putting in place procedures for the effective dissemination of, and compliance with, the Code.
- Investigating any breaches of the Code.
- Reporting breaches of the Code to the Board (or a Committee of the Board to which that responsibility has been delegated).

7.4 Related policies, plans and procedures

AGL's environmental, greenhouse gas, and health and safety policies are integral parts of the HSEMS. These policies outline overall environmental, health and safety objectives and state AGL's commitment to improving its environment, health and safety performance. AGL's policies related to health, safety and the environment include:

- Environment Policy (Figure 7.1).
- Health and Safety Policy (Figure 7.2).
- Risk Management Policy.
- Greenhouse Gas Policy (Figure 7.3).
- Compliance Management Policy.

7.4.1 Environment Policy

The Environment Policy (Figure 7.1) outlines the commitment AGL has to the environment. In addition to the Environment Policy, AGL extend their commitment to environmental protection and sustainability in the energy sector by adopting environmental principles that apply to all aspects of business operations, including new business development. These principles are summarised below:

- AGL will meet or exceed statutory obligations and relevant codes of conduct and Company standards.
- AGL's environmental performance measurement and reporting will be consistent with recognised national and global reporting standards.
- AGL will reduce risk to the environment and minimise our environmental impact, by integrating considerations of environmental sustainability in all activities. Key considerations for AGL and our stakeholders in minimising environmental impact include pollution prevention, promotion of waste minimisation, reuse and recycling, the efficient use of resources such as water and energy and protecting cultural heritage.
- Contractors and suppliers are expected to demonstrate consistency with AGL's approach by fulfilling their environmental responsibilities.
- Consistent with business objectives and AGL's Greenhouse Gas Policy, AGL will work in consultation with its external stakeholders to improve greenhouse gas emission outcomes.
- AGL will provide leadership and actively participate in the policy debate on energy and environmental matters; we will engage with government, industry and community, our people and other stakeholders about how to achieve sustainability in the energy sector.
- AGL's employees are encouraged to contribute to improving the Company's environmental performance.
- AGL will aim to build knowledge, capability and understanding of environmental management issues for our employees.

7.4.2 Greenhouse gas

AGL measure the greenhouse gas footprint and energy use across all business operations. AGL meet the reporting obligations under National Greenhouse and Energy Reporting (NGERS) and Energy Efficiency Opportunities (EEO).

AGL Environment Policy

AGL Vision

To protect the environment and minimise our environmental footprint in the areas we operate, in collaboration with our stakeholders.

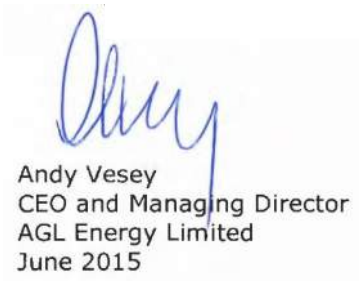
AGL Policy Scope

This policy applies to all AGL employees, contractors, products, services, sites and joint ventures under AGL's operational control. Our Health, Safety and Environment Management System sets out how we will implement this policy.

AGL Commitments

AGL will:

- Adhere to high standards to protect the environment where we do business;
- Strengthen our business by integrating environmental considerations into all business activities;
- Meet or exceed our regulatory obligations;
- Analyse and improve the way we do business to reduce environmental risks and impacts;
- Continuously improve our environmental performance through developing and reviewing effective management systems, measurement and targets;
- Share our environmental objectives and commitments with employees and stakeholders;
- Minimize the risk of environmental incidents;
- Respond quickly and effectively to environmental incidents from our operations;
- Actively participate in the development of regulations, codes of practice, standards and policies to share scientific knowledge and support informed decision-making;
- Contribute to research and adaptation to new technologies that improve environmental outcomes;
- Use resources and energy efficiently, minimising emissions and waste; and
- Educate our employees, our contractors and suppliers and hold them accountable for complying with this policy.



Andy Vesey
CEO and Managing Director
AGL Energy Limited
June 2015

Health
Safety &
Environment
Look. Think. Act.

Health and Safety Policy

AGL's Vision

AGL's aspiration for Health and Safety is Zero Harm to our people.

Policy Scope

This policy applies to all AGL employees, contractors, products, services and joint ventures under AGL's operational control. Our Health, Safety and Environmental (HSE) Management System sets out how we implement this policy.

AGL's Health and Safety Commitment

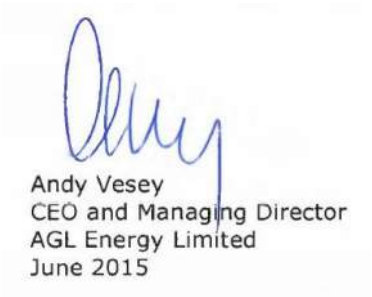
AGL will:

- Lead, train and motivate our people and our contractors to work in a safe and responsible manner;
- Enable our people and contractors to understand that at AGL, safety is everyone's responsibility;
- Prioritise Health and Safety considerations when setting business objectives;
- Meet or exceed the requirements of our compliance obligations;
- Perform work safely and with proper regard for the environment;
- Proactively identify health and safety hazards, assess risks and implement appropriate controls;
- Provide our people with sufficient resources for the management of health and safety activities;
- Improve our health and safety performance by establishing goals and targets at all levels within the company while ensuring that AGL is accountable for the achievement of these goals; and
- Consult with our employees, contractors and the community on health and safety issues.

AGL's Injury Management Commitment

AGL will:

- Commence the rehabilitation process as soon as practicable after an injury and in a manner that is consistent with medical opinion;
- Promote and facilitate the earliest return to work possible of injured employees; and
- Provide suitable duties based on individual injury management plans formulated by the nominated provider or injury management coordinator.



Andy Vesey
CEO and Managing Director
AGL Energy Limited
June 2015

Health
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AGL Greenhouse Gas Policy

AGL agrees that deteriorating air quality and climate change are critical issues facing the global community. Currently, fossil fuels provide 88% of Australia's electricity generation. However, with the development of new technologies such as embedded solar PV, battery storage, large-scale renewables and carbon capture and storage (CCS), the electricity sector is likely to undergo significant change over the coming decades.

AGL is an integrated energy company providing reliable and affordable energy to millions of homes and businesses. AGL's assets include large emitters of greenhouse gases (GHG). However, AGL is also Australia's largest private owner and operator of renewable energy assets.

AGL is committed to responsibly engaging with all our stakeholders (customers, investors, communities, policymakers and employees) to develop a shared understanding of the best ways for Australia to reduce its GHG emissions.

Climate Change Science

The Intergovernmental Panel on Climate Change AR5 Report states:

- warming of the climate is unequivocal;
- anthropogenic emissions are extremely likely to be the cause; and
- risks associated with climate change are reduced substantially if warming is limited to less than 2˚C above pre-industrial levels.

Achieving this outcome would require complete decarbonisation of the world economy by 2100 and emission reductions of up to 70% by 2050.

Emission Reductions

AGL supports the Commonwealth Government's commitment to work towards a global agreement to limit global warming to less than 2˚C above pre-industrial levels (2˚C goal). Continued use of coal and gas for power generation by mid-century is likely to be dependent upon cost-effective deployment of very low emissions technology, such as Carbon Capture & Storage (CCS).

Long-term policy certainty is a pre-requisite for decarbonisation to occur efficiently and affordably for consumers. Both renewable and lower-emission fossil fuel generation will form an integral part of the energy generation mix throughout the transition to a low-emission global economy.

AGL Commitment

AGL commits to being a transparent and constructive stakeholder. Our public policy advocacy and internal approach to GHG mitigation will be reported in our Annual Sustainability Report. AGL specifically makes the following commitments:

- AGL will continue to provide the market with safe, reliable, affordable and sustainable energy options.
- AGL will not build, finance or acquire new conventional coal-fired power stations in Australia (i.e. without CCS)[1].
- AGL will not extend the operating life of any of its existing coal-fired power stations.
- By 2050, AGL will close all existing coal-fired power stations in its portfolio.
- AGL will improve the greenhouse gas efficiency of our operations, and those in which we have an influence.
- AGL will continue to invest in new renewable and near-zero emission technologies.
- AGL will make available innovative and cost-effective solutions for our customers such as distributed renewable generation, battery storage, and demand management solutions.
- AGL will incorporate a forecast of future carbon pricing into all generation capital expenditure decisions.
- AGL will continue to be an advocate for effective long-term government policy to reduce Australia's emissions in a manner that is consistent with the long-term interests of consumers and investors (see Appendix 1 for AGL's approach to public policy).

Appendix 1 – AGL and Public Policy

Australia currently produces 88% of its electricity from the combustion of fossil fuels. Meeting Australia's emission reduction commitments that are consistent with a '20 goal' will require a transition over several decades. Government policy should reflect the transitional nature of the problem and the essential service nature of a reliable and affordable supply for electricity users.

As a significant exporter of fossil fuels, Australia also has a strategic interest in managing risks and opportunities associated with international climate change policy. Development and deployment of new or improved near-zero emission technologies (e.g. CCS) should be a focus of domestic GHG reduction policy due to the value at risk of reduced Australian exports.

It is important that governments set both binding and aspirational medium and long-term emission reduction targets. AGL supports the use of both regulatory and market-based policy mechanisms to deliver the required emission reductions. Importantly, a range of policies are likely to be needed.

Governments should consider targeted policies for key industries such as electricity generation, specifically:

- emissions standards for all new power stations[2];
- regulation which drives the progressive closure of older, emissions-intensive power stations or retrofitting with CCS technology[3]; and
- continued incentives for renewable energy with increased scope to include all zero and near-zero emission energy sources[4].

Such policies would facilitate a gradual but meaningful reduction in electricity sector emissions, which comprise around one-third of the Australian total.

1.The term conventional is used to refer to coal-fired power plants that have a higher lifecycle emissions intensity than a combined cycle gas turbine (CCGT).

2 This policy has been implemented in the US through the *Climate Action Plan and Clean Air Act*.

3 This policy has been implemented in Canada through the *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations* which require power stations that have reached the end of their useful life (i.e. 50 years) to retire or retrofit CCS technology.

4 This policy was an election commitment in 2007 of the incumbent Commonwealth Government.

AGL set ambitious strategic goals in relation to carbon and energy management. The core aspects of this strategy are under the AGL Greenhouse Gas Policy (Figure 7.3) and “We Mean Business” commitments. AGL will:

- Continue to provide the market with safe, reliable, affordable and sustainable energy options.
- Not invest in conventional coal-fired power stations.
- Not extend operating life of existing coal-fired power stations.
- Close all existing coal-fired power stations by 2050.
- Improve the greenhouse gas efficiency of our operations.
- Continue to invest in renewable and near-zero emission technologies.
- Make innovative and cost-effective solutions available to our customers.
- Incorporate carbon pricing into capital expenditure decisions
- Align with the UN Global Compact’s Business Leadership Criteria on Carbon Pricing
- Continue to be an advocate for effective long-term government policy
- Commit to responsible corporate engagement on climate policy
- Report climate change information in mainstream corporate reports.

AGL recognise the business risks presented by legislation and climate change mitigation policies (example - renewable energy targets, carbon pricing) could become significant over time. To pre-emptively manage these risks and work towards minimising exposure, the emissions-intensity of electricity generated by AGL is included as a key performance indicator across the operations. Underpinning this indicator is a range of strategies, including strategies and management plans to respond to renewable energy and carbon related regulation and policies.

AGL’s business strategy is to cement a leadership position in sustainable electricity generation sources - low-greenhouse gas emitting energy generation and supply. AGL has been progressively making significant investments in developing renewable energy sources.

7.5 Environmental Management Plan

AGL proposes to develop a series of EMPs to address each stage and each component of the project (including the power station and the associated infrastructure). These will be developed at the appropriate time in the project development cycle, once decisions are taken about the precise nature of the facilities and infrastructure.

The functions of the EMPs are to:

- Address environmental objectives, commitments and conditions of approval resulting from the environmental approvals process.
- Set out the framework for management of environmental issues during construction and operation of the project.
- Provide procedures for the avoidance, minimisation, mitigation and management of potential environmental impacts on a site-specific and/or issues-specific basis.
- Provide a basis for developing and improving environmental management procedures during the life of the project.

To ensure that AGL proactively identify and manage environmental risks, a standard Environmental Management Plan template has been developed that sets out minimum requirements to be addressed in an EMP.

If required AGL will prepare and implement an acid sulfate soil Management Plan.

The cultural heritage management plan will be developed and agreed directly with the Kaurna People and will be based on the results of the final report on the work done to date and the completion of the archaeological field assessment in the project area.

7.6 Construction and Environmental Management Plan

Prior to the commencement of any works on the site a Construction and Environmental Management Plan (CEMP) will be prepared for all site activities. The CEMP will include details on:

- How the contractor will comply with legislative requirements, the requirements of any relevant authority, the project requirements, the requirements of the Barker Inlet Power Station site requirements in relation to the human and natural environment in performing the work under the contract.
- How the contractor will minimise or mitigate any adverse environmental effects of construction work that may result from the performance of the work at the site.
- The site induction program to ensure all employees, consultants, subcontractors, suppliers and any other person visiting or performing work on or near the site receive appropriate instruction in relation to site environmental issues and any site environmental protocols.
- The monitoring and reporting process to ensure that the contractor, consultants, subcontractors and suppliers comply with the CEMP.
- The on-site store of materials required to manage any spill of environmentally damaging materials (e.g., oil or chemicals).
- Incident reporting procedures.

The contractor will ensure that its employees, agents and subcontractors are provided with a copy of the CEMP and all documents relevant to its implementation prior to any of them performing any work at the site.

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8 Conclusion

This Environmental and Social Assessment Report (ESAR) accompanies the development application, which is the principal documentation used to seek development approval from the State Commission Assessment Panel (SCAP) in consultation with other relevant agencies.

This ESAR characterises the environment of the proposed Barker Inlet Power Station (BIPS) site, assesses the environmental and social impacts and describes how the impacts can be managed and mitigated. The following information summarises how this ESAR addresses its objectives (set out in Section 1.4).

The first objective of the ESAR is to provide details of the project to the regulatory authorities, the general public and other stakeholders. The provision of the ESAR to the South Australian Government, and making the ESAR available through public advertisement meets this objective.

The second objective of the ESAR is to identify, quantify and assess the potential environmental and social impacts associated with the development of the project. Chapter 6 provides an assessment of the potential environmental and social impacts associated with the development and identifies the residual risk once management and mitigation measures have been implemented. Specialist studies contained within the appendices and material referenced in the body of the ESAR have been used to support this impact assessment.

The third objective of the ESAR is to outline the proposed mitigation and management measures AGL intends to implement for each potential impact. These are also detailed in Chapter 6 along with the monitoring programs that will be implemented to provide early warning to highlight that further management and mitigation measures may be required. Chapter 7 also provides details about AGL's health, safety and environmental management framework for the project.

The fourth and final objective of the ESAR is to provide an assessment of the effectiveness of the mitigation measures and the residual impacts following their implementation. The residual impact assessments for each potential impact are provided in Chapter 6.

The objectives for the ESAR have therefore been met by the information presented in the ESAR chapters.

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