ALINTA ENERGY REEVES PLAINS POWER STATION

DEVELOPMENT APPLICATION

12 OCTOBER 2017

APPENDIX H – CONCEPT STORMWATER MANAGEMENT PLAN

SMEC
Member of the Surbana Jurong Group

Reeves Plains Power Station

Concept Stormwater Management Plan

Prepared for: Alinta
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Executive Summary

Alinta Energy has proposed a new gas fired power station and associated infrastructure at 1629 Redbanks Road on a 41ha greenfield site located in Reeves Plains, approximately 12 km south-east of Mallala and 50 km north of Adelaide. A concept stormwater management plan for this development is sought to outline an appropriate philosophy, suitable for aiding in the project approvals process and to inform designers in a future engineering procurement and construction (EPC) contract.

A stormwater management philosophy and conceptual arrangement is outlined herein to provide suitable controls, particularly with respect to local standards and requirements.

The Stormwater Management Plan outlines controls and provides a concept for design of a stormwater management system which:

- Identifies the site and plant area with respect to regional drainage lines, and considers a relatively low risk of floodwaters reaching the proposed site. This could be confirmed by extension of 1% AEP flood modelling undertaken within the combined Gawler/Light River flood study, further up the branches of Templers Creek adjacent to the site.
- Manages the quantity of stormwater flow from the developed site so as to mimic pre-development hydrological response, through the implementation of a retention basin for low flow conditions and detention storage above to throttle discharge in high flow conditions.
- Manages nuisance surface water for site operations through gutter flows and underground drainage systems.
- Mitigates the risk of spills from impacting on water quality by isolating higher risk areas within bunds for localised clean-up and treatment.
- Separates wastewater streams and site runoff based on relative water quality to provide appropriate treatment.
- Complies with Environment Protection (Water Quality) Policy based on the water quality treatment and retention outlined, subject to confirmation of infiltration losses and reuse capacity, and interpretation of targets.
- Incorporates stormwater reuse, firstly as a resource for beneficial uses, and then through irrigation of planted areas or soakage as a means to aid disposal of excess stormwater.

1. Background

The Reeves Plains Power Station Project involves the construction and operation of a gas fired power station and associated infrastructure (the Project). The project proponent is Alinta Energy (Reeves Plains) Pty Limited (Alinta Energy). The power station will be located at 1629 Redbanks Road on a 41ha greenfield site located in Reeves Plains, approximately 12 km south-east of Mallala and 50 km north of Adelaide.

The power station will operate as a 'peaker', providing electricity during periods of high demand, and is designed to generate up to 300 megawatts (MW) of power. The Project will be staged, with up to 150MW provided initially and further build out as required by prevailing market conditions. The Project includes the following infrastructure:

- A gas receival station
- Up to six (6) dual fuel (gas and diesel) turbines each capable of generating 50MW of power
- Three (3) transformers designed to convert low voltage electricity into high voltage electricity
- Connection to the electricity network including a new substation, transmission tower and communications tower
- Water supply and storage including:
    - Water treatment plant
    - Water storage tanks
    - Firefighting system
- Wastewater evaporation pond
- Diesel storage.

Also included within the Project are the following:

- Control rooms, workshop and maintenance facilities and administration building
- Security fencing and lighting
- Onsite drainage works
- Upgrade to the Redbanks Road and Day Road intersection and sealing of Day Road from Redbanks Road to the Project entrance
- Carparking for employees and contractors
- Demolition of existing buildings onsite
- Landscaping.

The Project is required to obtain development consent from the State Commission Assessment Panel before proceeding. Construction of the Project is scheduled to commence in 2018 with operation of the power station occurring in Q1 2020 at the earliest.

A concept stormwater management plan is sought to outline an appropriate philosophy, suitable for aiding in the project approvals process and to inform designers in a future engineering procurement and construction (EPC) contract.

2. Objectives and Design Criteria

2.1. Objectives

The objective of the Stormwater Management Plan for the proposed Reeves Plains power station is to outline the controls and provide a concept for design of a stormwater management system that:

- Limits the risk of flooding of the site, and particularly plant areas
- Manages the quantity of stormwater flow from the site so as not to exacerbate flow rates downstream
- Manages nuisance surface water for site operations
- Isolates higher risk areas of pollution / spills for localised clean-up within bunds
- Separates wastewater streams and site runoff based on relative water quality
- Mitigates pollutants in stormwater discharge to comply with Environment Protection (Water Quality) Policy
- Considers potential for stormwater reuse.

This concept plan is focused on the operational phase of the project. The EPC Contractor will develop stormwater management procedures as part of their Construction Environment Management Plan.

2.2. Standards

- Australian Rainfall and Runoff (AR&R)
- SA Environmental Protection (Water Quality) Policy 2015
- Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry, SA EPA
- Bunding and Spill Management Guideline, South Australian EPA 080/16
- Council development requirements
- AS3500.3 Plumbing and drainage: Stormwater drainage

2.3. Inputs and Assumptions

The concept stormwater management plan developed has been based on the power station layout plan shown on drawing 2269717A-MEC-0001 drawing check print dated 17/05/17, and revised based on subsequent drawing 5589-01 revision A dated 25/8/17. It is noted that site layouts may alter during design development, and it would be intended that this stormwater management plan can be adjusted accordingly, based on the same design criteria and stormwater management principles.

It is assumed that the power station site will be on a prepared pad that is raised above the surrounding natural ground, and enables runoff to be directed as required independent of existing ground levels. Given that plant levels have not yet been established, the grading of site areas is indicative only. Drainage systems are assumed to grade at approximately 0.5% until this can be better defined.

Design standard of 10% Annual Exceedance Probability (AEP) for site stormwater drainage systems, previously referred to as 10 year Average Recurrence Interval (ARI).

Rainfall intensity frequency duration data (IFD) from Bureau of Meteorology website has considered both 1987 and 2016 data, dependent on assessment methods. It is noted that the 2016 data is slightly higher at this location for more frequent events, roughly matching at 10% AEP, and slightly lower for infrequent events.

Site runoff coefficients have been assumed to be 0.8-0.9 adjacent plant, 0.5 for switchyard and other areas with blue metal screenings, and 0.1 for grassed areas.

3. Site Definition

3.1. Site Description

The proposed power station site is in the Reeves Plains region, adjacent the Gawler-Mallala Road (Redbanks Road). The site is within a farming region, bounded to the west by Day Road.

The Moomba-Adelaide natural gas pipeline crosses through the western side of the site, and existing overhead transmission power lines extend across the site also. The proposed power station operations are intended to be contained between these two services.

The site area is approximately 41ha in total, and falls generally from east to west internally (typically in the order of 1-2%), towards a shallow depression and a slight fall toward the south in the eastern side, at grades less than 0.5%. The current fall of the land would indicate that most site runoff (over and above infiltration and depression storage) would cross the southern boundary in the region of the existing gas transmission line. A smaller portion of the site around the north and west boundary may discharge from the north-west corner across Day Road.

3.2. Site Condition

The site is currently farmland, largely paddocks with homestead and sheds to the eastern corner. It is understood that the structures will ultimately be demolished, but the surrounding area to be left in rural form.

The area is currently zoned primary production. It is noted that wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within the zone and constitute a component of the zone's desired character.

The geological survey of South Australia “Adelaide’ sheet (1:250,000 Department of Mines 1969) indicates that the Reeves Plains site may be underlain by:

- The Pooraka Formation (Qpp); The Pooraka Formation typically comprises alluvial deposits described as red brown and brown sandy clay/clay, typically of medium or high plasticity, containing carbonate of Loveday soil and lenses of clayey sand, sand, gravel and some calcareous silt. The Pooraka Formation is underlain by Hindmarsh Clay, which typically comprises over-consolidated mottled clay or sandy clay of generally medium or high plasticity, with lenses of sand and gravel. A number of stratigraphic bores to the north-west, south-west and south-east of the site suggest that where Pliestocene aged Pooraka Formation and Hindmarsh Clay soils are present, they extend to a depth of at least 30 m below the site.
- Calcrete material (Qca), potentially to the south of the site.

Further reference to the online database ‘Location SA Map Viewer’ suggests that the most common soil types at the site comprise:

- Loam over clay
- Calcareous loam.

3.3. Regional Drainage

The general fall of the area is toward the south-west, with localised variations. Drainage from the area generally heads along drainage lines parallel to Day Road, joining to form Templers Creek, which ultimately connects into Salt Creek to the east of Two Wells. The area lies between the Light River (to the west) and the Gawler River (to the south).

The Council Development Plan does not identify flood risk areas beyond the Gawler River flood plain.

Flood mapping of 1% AEP events exists for the Light and Gawler River, and is publically available. Templers Creek is shown in these flood maps as flow lines heading south-west along Day Road, and another branch approximately 1km east of Day Rd. Both of these lines start just north of Richter Road and do not extend up as far as the project site. Templers Creek also appears on topographic maps as intermittent, with some interpretation required to connect sections of watercourse. Further interrogation of available contours indicates that drainage lines with significant catchment areas cross Redbanks Road approximately 500m from the site boundaries on both north-east and south-west sides.

It is expected that new development will not increase the potential for blockage of floodways or alter regional drainage flow paths, and will not significantly affect regional drainage line flood storage (through filling, etc) and thereby impact on localised flood levels and flow paths.

Earthworks platforms, buildings and structures will be located and designed to prevent entry by floodwaters. Some further clarification during detailed design may be prudent to understand the extents and inputs to the combined Gawler/Light River flood study, so as to understand whether the 1% AEP flood extents are representative at this location. An extension of this modelling may be sought in order to clarify flood extents further up the branches of Templers Creek adjacent to the site.

Based only on the elevation difference in the order of 2m, and a wide available flow section along the regional drainage lines, it would appear to be a relatively low risk of floodwaters reaching the proposed site, however this could be confirmed during detailed design.

4. Site Stormwater Management Plan

4.1. Site Formation

Based on the current site plan, the proposed plant area is noted to be in the order of 11ha. The remainder of the site is expected to remain in rural form, with its drainage lines diverted around the plant area via localised swales or bunds.

External drainage is to be routed around the site, to exclude it from internal stormwater management systems, and to separate notionally clean external runoff from site surface water. The diversion bunds may also provide for some small amount of flood storage behind them, to replace the shallow depression within the existing site. Level spreaders may be required to disperse concentrated flows from the ends of bunds, to a wider sheet flow to manage the risk of downstream erosion.

Plant platform / site levels are to be set above regional 1% AEP flood levels. Flood levels for the drainage lines near both sides of the site leading into Templers Creek need to be confirmed in detailed design.

While the civil design has yet to be established, it is assumed that bulk earthworks would create a platform, with plant likely to be sited at one common level, and fall generated around site areas to provide flow paths for drainage.

4.2. Plant Stormwater Drainage Layout

The point of discharge from the plant area should ideally replicate where existing drainage exits the site, at the southern boundary. There are no defined watercourses nor stormwater drainage systems either in the downstream property, nor along Days Road. This reflects the rural landscape and suggests that initial losses and then sheet flow of runoff are to be mimicked. The site drainage system should therefore incorporate retention and detention measures to meet Council development requirements, with ultimate discharge managed by level spreaders or similar, to mitigate the potential for erosion downstream. Subject to discussions with landholders and Council, the point of discharge could potentially be directed to Day Road, if final site levels are high enough and a formalised outfall swale is provided in the road reserve. It is noted that to achieve a discharge to Day Road, a greater quantity of fill would need to be placed across the platform area.

Grading of earthworks and site levels around the plant would be guided by positioning of stormwater treatment measures and basins. Based on the current site plan, the plant area would grade generally from north to south, to incorporate stormwater control measures near the existing low point between Day Road and the southern boundary.

A wastewater evaporation pond is currently indicated to be on the northern side of the plant area, which would be isolated from general stormwater inputs, and have separate wastewater drainage systems to it.

Stormwater drainage within the plant area is likely to include:

- Blue metal or similar surface treatment around plant areas. This provides a finished surface cover and is porous which enables initial infiltration of rainfall events on those areas.
- Kerbed internal roadways to control the collection of surface runoff.
- Underground (pit and pipe/culvert) drainage system to manage nuisance surface water around plant areas in regular rainfall events.

- Overland flow paths along roadways to provide a safe route for runoff between structures and/or equipment in major rainfall events, in excess of the underground drainage system capacity.

The intent is to provide stormwater drainage by gravity systems without need for pumping as far as is practical.

4.3. Water Sensitive Urban Design

The general philosophy for stormwater management is based on the following hierarchy:

- Avoid/minimise the generation of runoff;
- Avoid accidental spillages to the environment;
- Minimise the pollution of stormwater;
- Treatment to a level fit for purpose and reuse;
- Treatment to reduce potentially degrading environmental impacts;
- Disposal in an environmentally sound manner.

4.3.1. Water Quality

Stormwater is proposed to be managed according to the risk of contamination in each area of the plant, and therefore the likely runoff water quality. Separation of runoff based on risk and likely level of pollutants is intended to provide efficient and targeted treatment.

- **Site areas around the power plant** which are to be maintained as pasture, would be diverted around the site, as outlined above.
- **Roof water from the buildings** is proposed to be captured in rainwater tanks adjacent each building, and used for toilet flushing and area washdown where appropriate.
- Areas of the site considered to be **at highest risk of contamination**, most likely by spillage in chemical storage or handling areas will be bunded in accordance with EPA Bunding and Spill Management guidelines. These are likely to include around transformers, fuel storage areas, and chemical areas associated with the water treatment plant. Bunded areas will be isolated from stormwater systems. Some of these areas may be roofed to minimise water collection within them. All water collected within bunds will need to be handled as waste, unless sufficient assessment and treatment is provided to deem it suitable for reuse on site.

  Washdown of site areas is expected to be limited to areas of higher risk of pollution, which will generally be bunded or within a workshop environment. Such water would be managed such that washdown is directed to designated waste water systems, not to stormwater.
- A separate **oily water system** may be provided from areas of medium risk around some equipment, particularly generators and stacks, and carpark. These areas could either be treated through coalescing plate oil-water separators for discharge to stormwater, or combined with oily process waste and washdown of equipment areas, as a part of the wastewater system to the evaporation pond.
- **General site 'working' areas** including roadways, hardstand and the switchyard will have stormwater runoff directed to a first flush treatment area. This could either be a separation basin or proprietary stormwater interceptor for removal of silt and traces of oil. This runoff would be treated through the sedimentation process in the basin/tank, and oil separation by gravity behind baffles. A risk assessment could be undertaken during detailed design to consider whether gravity separation alone is sufficient, or if coalescing plates are warranted based on the level of risk associated with connected catchments, treatment configuration, intended water reuse and discharge criteria.

A basin would nominally be sized for rainfall events up to 0.5 EY (2 year ARI) 1 hour duration, effectively the first 15mm of rainfall. Treatment and discharge would be at a rate such that the basin would be emptied (from full) within a period of nominally 12 hours without further inflow. Larger (rarer) rainfall events may overflow at a diversion weir, and thereby bypass the first flush treatment, minimising the risk of scouring and entrainment of captured sediment in a high flow situation.

This process enables the sediment from plant area washoff to settle out. Heavy metals are also usually attached to particulate matter, so a significant portion would also be removed in this process.

With catchment areas at high risk for oil contamination being isolated around the source, the need for spill capture in the downstream system should be mitigated. Treatment for oil traces in stormwater would typically be through gravity interceptors, and can be fitted with coalescing plate separators if required.

- All remaining areas on the plant platform not otherwise captured would be directed into a separate siltation pond. This is in place primarily for the removal of sediment from the lower risk areas. This pond also enables some sediment removal from larger stormwater flows that bypass the first flush pit. The pond would target finer sediment fractions than common gross pollutant traps do. This pond should also be in place to serve the whole works area during construction.

It needs to be accepted, and is normal practice, that all stormwater treatment systems are designed to deal with the smaller more frequent rainfall events which make up of the order of 95% of annual rainfall, and the less frequent large storm events may overflow the system. The largest pollutant loads would be expected to be within the 'first flush' at the start of a storm, so any subsequent overflow would be a lesser risk.

The above treatment measures also need to be maintained to perform effectively, and monitored to ensure that water quality is suitable given that discharge is returned to the environment.

4.3.2. Retention

To reflect the existing rural landform, which currently only generates runoff in significant rainfall events, it is intended to retain water on site for rainfall events up to at least 40mm to mimic the existing hydrological response. This matches both an initial loss on pervious area on the Adelaide Plains (AR&R data hub suggests initial loss of 36mm for this location for rural use), and rainfall from a long duration 1 exceedance per year (also denoted as 1EY or 1 year ARI) rainfall event.

Following consultation with the EPA, further retention of runoff for up to 10% AEP rainfall events for subsequent reuse on site would deem that Environment Protection (Water Quality) Policy requirements are met. A long duration 10% AEP event provides the worst case, effectively providing retention for up to 73mm rainfall, and this is adopted for concept design purposes.

Based on assumed surface treatments and runoff factors for the various plant areas, this is estimated to generate in the order of 3250m^3 to be retained on site. Values may also be reduced by infiltration and evaporation losses within the basin and should be refined during detailed design.

The basin need not be lined, which can allow for infiltration losses through the floor and batters.

The retention of water on site provides opportunities and a need for reuse which can be further investigated. Sufficient reuse of stormwater needs to be determined to ensure the retention storages are drained in a reasonable timeframe to provide storage of the next rainfall event. Water quality will need to be fit for purpose, and could be utilised for:

- Watering of planted areas, whether existing or new areas in buffer zones and screening from surrounding areas. Further planting could assist with uptake of water to minimise waterlogging of ground during winter.
- Washdown around the plant.
- Other feed into process systems if the water quality can practically be treated to suitable levels.

It would be preferable to combine the siltation basin with retention storage, though will require confirmation of the water quality for reuse, which in turn depends on how/where it is used.

4.3.3. Detention

Surface water from land surrounding the proposed plant area is assumed to be diverted around the outside, using bunds and/or swales as required. Those areas effectively remain rural in nature, and are considered not to require detention.

Initial stormwater calculations have been undertaken to compare the existing and developed site run-off from the proposed plant area. Calculations have been based on 10% AEP and 1% AEP events. This criterion should be formally confirmed with Council prior to detailed design.

Runoff from the plant area in the existing undeveloped state has been used to set the maximum discharge rates for 10% and 1% AEP events.

Runoff from the developed plant area will be significantly greater flow rates, hence the need to throttle back to existing levels. The 1% AEP event is larger, and based on assumed surface treatments and runoff factors, preliminary calculations suggest that stormwater detention storage in the order of 2500m^3 would be required to maintain the existing level of discharge in those events. The detention volumes would be lower if say a 10% AEP event could be adopted as the design standard. The level of discharge and stage/storage discharge relationship would need to be confirmed at the detailed design stage, and figures refined accordingly.

For concept purposes, a detention basin has been assumed as the most cost effective approach to providing the required storage within the site area. The basin design would need to be integrated with the site civil design to clarify site areas, batter slopes, integration with landscaping and any safety requirements.

4.3.4. Plant Area Discharge

The approach outlined above is considered suitable to achieve flow reductions to mimic existing quantities of discharge, as well as manage water quality for the protection of the downstream agricultural environment. In particular, the concept provides for:

- Retention of runoff more than compensates for existing pervious area losses to mimic hydrological response.
- Discharge flow rates limited to not exceed existing runoff in 10% and 1% AEP rainfall events.
- Treatment of flows from plant areas for up to 0.5 EY rainfall events to capture approximately 95-99% of traces of free oil in stormwater. Where higher risk areas are treated and discharged to stormwater, separators would limit discharge concentration of oils to 5mg/L.
- Treatment of flows to provide more than 95% reduction in total suspended solids (annual average).

The concept arrangement with sedimentation, then infiltration losses from the retention basin and reuse, is expected to also reduce nutrient concentrations in stormwater discharge and satisfy the requirements of the Environment Protection (Water Quality) Policy (EPP) (EPA, 2015). By providing

retention for runoff from general site working areas for events up to the 10% AEP, and separating runoff as per Section 4.3.1, potential impacts to environmental values, including irrigation and livestock drinking water values, (as identified in Schedule 1 of the EPP) can be appropriately mitigated and managed.

4.3.5. Integration of Landscaping

The retention of water on site provides opportunities for reuse which can be further investigated. Water quality will need to be fit for purpose, and could be utilised for watering of planted areas, whether existing or new areas in buffer zones and screening from surrounding areas.

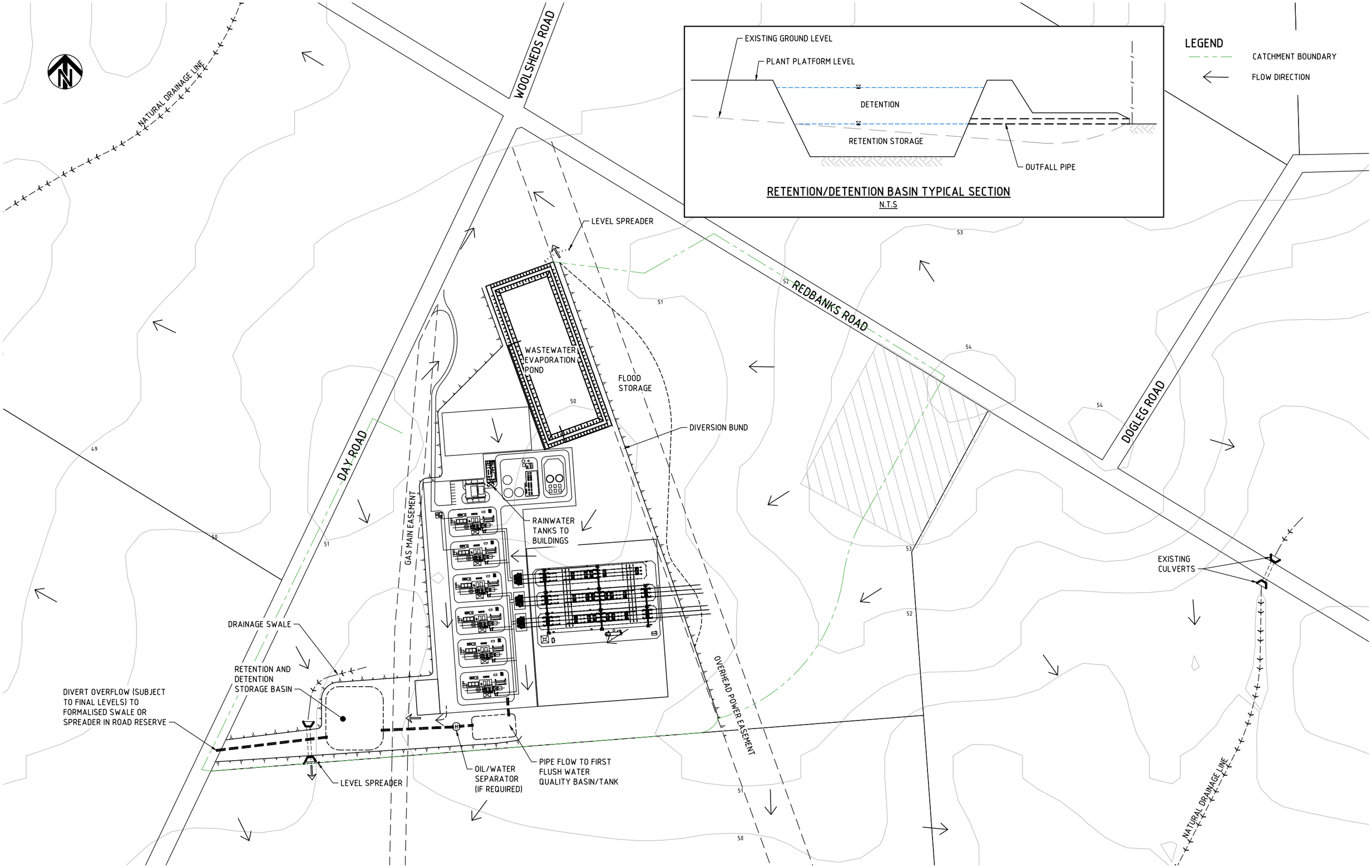
Other WSUD measures could be considered around the site if desired to provide more 'green' treatments such as vegetated swales or biofiltration for plant area stormwater, and potentially enable some reductions to sizing of basins.

5. Further Investigations

Given the preliminary nature of these concepts, there remain a few technical areas, for which assumptions have been made, which will need to be clarified as the design progresses.

- Extension of the combined Gawler River and Light River regional flood modelling or assessment of its input hydrology to review flood risk adjacent the site. To utilise the existing model setup, this work could potentially be sought from the Gawler River Floodplain Management Authority and the consultants who developed the current model.
- Design development of the power station site, particularly with respect to bulk earthworks and site grading.
- Identifying and quantifying reuse of water from rainwater tanks, and from treated site stormwater retention storage. As well as opportunities to reduce demand on other water supplies, sufficient reuse of stormwater needs to be determined to ensure the retention storages are drained in a reasonable timeframe to provide storage of the next rainfall event.
- Geotechnical investigation to clarify soil type, permeability, and groundwater levels. The sizing of systems, and particularly the retention basin will be sensitive to infiltration losses across the site, and particularly from the batters and floor of the retention basin.
- Liaison with the gas authority to confirm acceptance for extension of an earthworks platform and pipe crossing above the transmission gas main easement.
- The point of discharge is shown indicatively, and remains subject to final design levels as well as discussions with landholders and Council. At the southern end, discharge could be either via level spreader to the natural drainage line crossing through neighbour's property as it does now, or if at a suitable level, diverted to Day Road where an outfall swale would need to be formalised.
- Liaison with Council to confirm the design approach and/or any other requirements.

Appendix A Conceptual Stormwater Drainage Systems



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REEVES PLAINS POWER STATION SMP

CONCEPT STORMWATER MANAGEMENT PLAN

INFORMATION DOCUMENT

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APPENDIX I – TRAFFIC IMPACT ASSESSMENT

ARCADIS Design & Consultancy for natural and built assets

REEVES PLAIN POWER STATION

Traffic Assessment Report prepared for Alinta Energy

26 SEPTEMBER 2017

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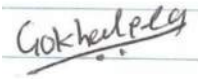
REEVES PLAIN POWER STATION

Traffic Assessment Report

Author	Siddharth Gokhale	
Checker	Kwong Ng	
Approver	Marcus van der Velden	

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Revision 6

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3	26/06/17	Final Draft	Siddharth Gokhale	Marcus Van Der Velden
4	24/07/17	Final Draft for designer review	Siddharth Gokhale	Marcus Van Der Velden
5	08/08/17	Final Draft for designer review	Siddharth Gokhale	Marcus Van Der Velden
6	26/09/17	Final Report	Siddharth Gokhale	Marcus Van Der Velden

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APPENDICES

1 INTRODUCTION

1.1 Background

Arcadis has been engaged by Alinta Energy Pty. Ltd. to provide traffic and transport services in relation to a development application for a proposed power station. This commission provides a Traffic and Transport Assessment for the proposed development of a Reeves Plains Power Station located in Reeves Plains in South Australia. The report has considered both the internal movement within the subject site and the traffic impacts on the surrounding road network and intersections.

The Reeves Plains Power Station Project involves the construction and operation of a gas fired power station and associated infrastructure (the Project). The project proponent is Alinta Energy (Reeves Plains) Pty Limited (Alinta Energy). The power station will be located at 1629 Redbanks Road on a 41-ha greenfield site located in Reeves Plains, approximately 12 km south-east of Mallala and 50 km north of Adelaide.

The power station will operate as a 'peaker', providing electricity during periods of high demand, and is designed to generate up to 300 megawatts (MW) of power. The Project includes the following infrastructure:

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- Up to six (6) dual fuel (gas and diesel) turbines each capable of generating 50MW of power
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- Water supply and storage including:
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    - Firefighting system
- Evaporation pond
- Diesel storage

Also, included within the Project are the following:

- Control rooms, workshop and maintenance facilities and administration building
- Security fencing and lighting
- Onsite drainage works
- Upgrade to the Redbanks Road and Day Road intersection and sealing of Day Road from Redbanks Road to the Project entrance
- Carparking for employees and contractors
- Demolition of existing buildings onsite
- Landscaping

The Project is required to obtain development consent from the State Commission Assessment Panel before proceeding. Construction of the Project is scheduled to commence in 2018 with operation of the power station occurring in Q1 2020 at the earliest.

1.2 Study Aims and Objectives

The purpose of this report is to investigate the proposed access arrangements to the development and assess the traffic and safety implications of the development on the surrounding road network.

This report assesses traffic routes under the maintenance of both the Department of Planning Transport and Infrastructure (DPTI) and Adelaide Plains Council.

Further, this report sets out an assessment of the anticipated traffic, transport and parking implications of the proposed Reeves Plains Power Station including consideration of the following:

- Existing traffic and parking conditions surrounding the subject site;
- Parking demand likely to be generated by the proposed development;
- Suitability of the proposed parking supply and layout;
- Traffic generation characteristics of the proposed development;
- Proposed access arrangements; and
- Transport impact of the proposed development on the surrounding road network.

1.3 References

The following references were used in the preparation of this report:

- Traffic Volumes (DPTI 205);
- AS1742 – Manual of uniform traffic control devices;
- Austroads guide to road design (Austroads 2009);
- RAVnet – South Australian Heavy Vehicle Access Network;
- DPTI Restricted Vehicle Access Framework (DTEI 2011);
- DPTI Code of Practice for the Transport of Oversize and Overmass Indivisible Loads and Vehicles (DTEI 2008);
- Location SA map viewer dataset website; and
- Final Crown Sponsorship Application Report.

1.4 Report Structure

The report is structured as follows:

- Section 1 provides background information, study objectives and references;
- Section 2 assesses existing conditions, land use, and the existing road network
- Section 3 details traffic conditions, including existing traffic volumes, heavy vehicle routes, construction vehicle requirements, estimated construction traffic volumes and the likely traffic impact during construction stage;
- Section 4 details the traffic assessment. This section provides information about access points for proposed development, and the likely impact on surrounding road network at operational stage;
- Section 5 details the proposed road network improvements. This section provides information about any improvements required on surrounding road network intersection; and
- Section 6 discusses conclusions based on the high level of traffic assessment undertaken.

2 EXISTING CONDITIONS

2.1 Site location

The proposed 300MW power station facility comprises of six gas turbines, It is located at 1629 Redbanks Rd, Reeves Plains. The power station will be developed on freehold land located within the Adelaide Plains Council. The subject site is approximately 60km north of Adelaide CBD.

The site is bounded by Redbanks Road to the north, Day Road to the west and vacant land to the south and the east. The proposed location of the site is shown in Figure 1.

The major townships surrounding the proposed site are Mallala (12km west of proposed site) and Gawler (20km east of proposed site).

The subject site is located in the primary production zone. The surrounding land uses are predominately agricultural and a small rural living enclave is located at Fischer, north east of the subject site. Refer to Figure 2 for the site location and surround zoning

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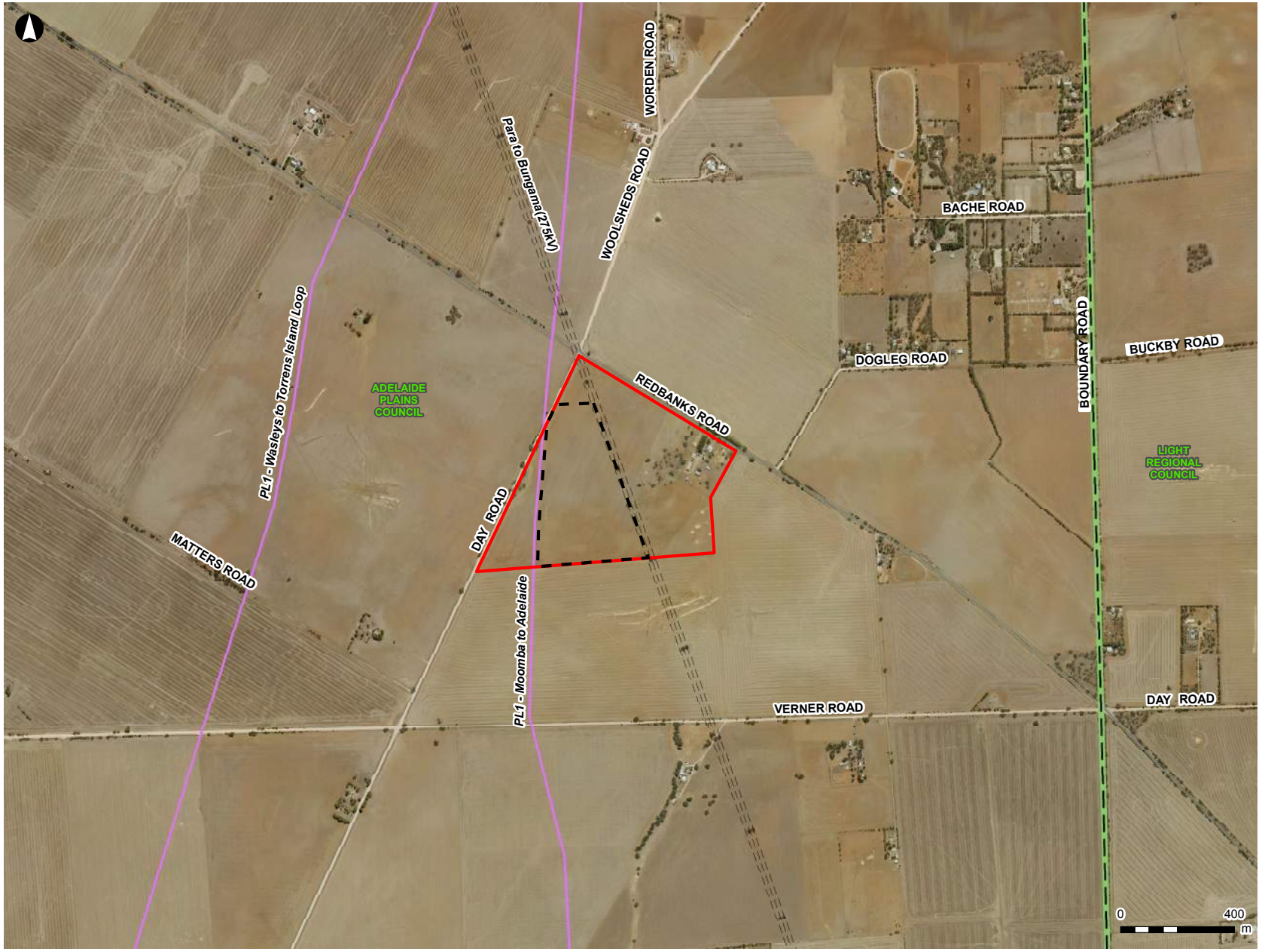

LEGEND

- Subject Site
- Reeves Plains Power Station Footprint
- Gas pipeline
- High Voltage Electricity Transmission line
- Local Government Area

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Figure 1 - Site Location

Date: 6/09/2017 Path: F:\10005589\L-GIS\A_Current\B_Maps\10005589_034_TransportReport_SiteLocality_A4L_v2.mxd
Created by : LH
QA by : RB

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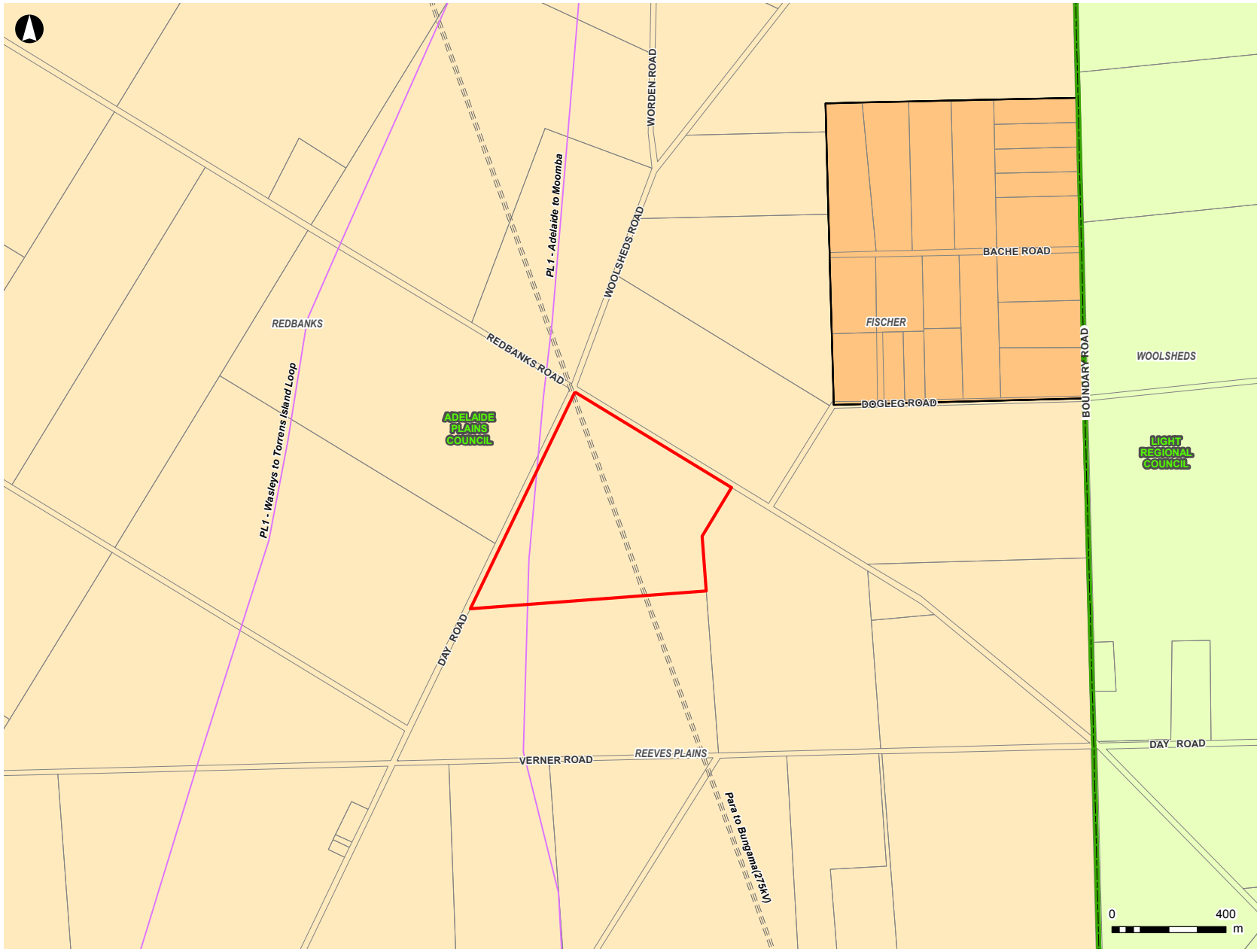

LEGEND

- Subject Site
- Gas pipeline
- High Voltage Electricity Transmission line
- Cadastre
- Local Government Area

Land Development Zone

- Primary Production
- Primary Production - General Farming
- Rural Living

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Figure 2 - Land Development Zones

Date: 6/09/2017 Path: F:\10005589\L-GIS\A_Current\B_Maps\10005589_054_TransportReport_Planning_A4L_v1.mxd
Created by : LH
QA by : RB

2.2 Existing road network

The existing road network has been assessed based on publicly available aerial photography (Google earth and street view).

2.2.1 Redbanks Road

Redbanks Road is a sealed two-lane two-way sub-arterial road under the jurisdiction of the DPTI. The road runs in a north-west and south-east direction between Stuart Highway to the east and Mallala Road to the west. It serves as the main road connecting the townships of Mallala and Gawler.

Redbanks Road is located along the northern boundary of the subject site and consists of a sealed pavement width of approximate 12m with 2.5m sealed shoulders on both sides. The road alignment in the vicinity of the subject site is straight and flat.

The posted speed limit on Redbanks Road is 100km/h.

Photo 1 – Redbanks Road

2.2.2 Day Road

Day Road is a Category 1 Road – Arterial Sheeted Road (road category supplied by Adelaide Plains Council) under the jurisdiction of the Adelaide Plains Council. Day road runs in a north-south direction between Redbanks Road to the north and Jenkins Road to the south. It serves as a local access road and forms part of the local road connection to the township of Two Wells south of Mallala.

Day Road is located west of the subject site and consists of a carriageway with approximately 8.5m formation width. The road alignment adjacent to subject site is straight and flat.

There is no posted speed limit on Day Road. Therefore, the default rural speed of 100km/hr applies to this road.

Photo 2 – Day Road

2.2.3 Woolsheds Road

Woolsheds Road is an unsealed two-lane, two-way collector road under the jurisdiction of the Adelaide Plains Council. This road runs in a north-south direction between Wasleys Road to the north and Redbanks Road to the south.

Woolsheds Road serves as a local access road. It forms part of the local road connection to the township of Hamley Bridge located northeast of Mallala, and the township of Wasleys located north of Gawler. It consists of a carriageway with approximately 8.5m formation width. The alignment is straight and flat.

There is no posted speed limit on Woolsheds Road. Therefore, the default rural speed of 100km/hr applies to this road.

Photo 3 – Woolsheds Road

2.3 Existing intersection

2.3.1 Redbanks Road/ Day Road / Woolsheds Road

The intersection of Redbanks Road/ Day Road / Woolsheds Road is a 4-leg unsignalised intersection with the side roads (i.e. Day Road and Woolsheds Road) controlled under ‘give way’ conditions. Redbanks Road forms the eastern and western legs with Woolsheds Road forming the northern leg and Day Road forming southern

leg. Turning movement at this intersection is assumed to be minimal given the low traffic volume of the intersecting roads.

Photo 4 – Redbanks Road/ Day Road / Woolsheds Road intersection

3 TRAFFIC CONDITIONS

3.1 Traffic data

3.1.1 Existing traffic volumes

Existing midblock traffic volumes (Base year 2015) for the road network surrounding the proposed development were obtained from the “Location SA Map Viewer” dataset. Analysis of the weekday traffic indicates the following daily two-way traffic volumes;

- Redbanks Road – 1,500 vehicles per day, 10.5% heavy vehicle composition
- Day Road – It is noted that there no AADT data available for this road.

Although there is a high proportion of heavy vehicle volumes on Redbanks Road, the truck volume is still considered to be low given the two way AADT on Redbanks Road is only 1500 veh/day. It is noted that Mallala is not serviced by a major highway. While Redbanks Road is the main connection between Stuart Highway / Gawler and Mallala, it may explain the high proportion of heavy vehicles on Redbanks Road.

Whilst historical traffic growth data is currently unavailable, it is expected the traffic growth on Redbanks Road would be minimal (less than 1%) on the basis that the road is classified as a sub-arterial road connecting regional towns. The likely traffic impact of the proposed development on the surrounding road network and intersections is discussed in the following section.

3.1.2 Casualty accident statistics

“Location SA Map Viewer” dataset indicates that two casualty crashes have been recorded along Redbanks road in the vicinity of the site, in the three-year period between January 2013 to December 2015.

One crash occurred along Redbanks Road located approximately 500m east of Day Road/ Redbanks Road intersection, involving ‘car hit on the fixed object’ (i.e. tree). One crash occurred along Redbanks Road located approximately 500m west of Day Road/ Redbanks Road intersection, involving car hit on the animal. Refer to Figure 3 for road crash locations

No crash trend is identified in the road network abutting the proposed subject site.

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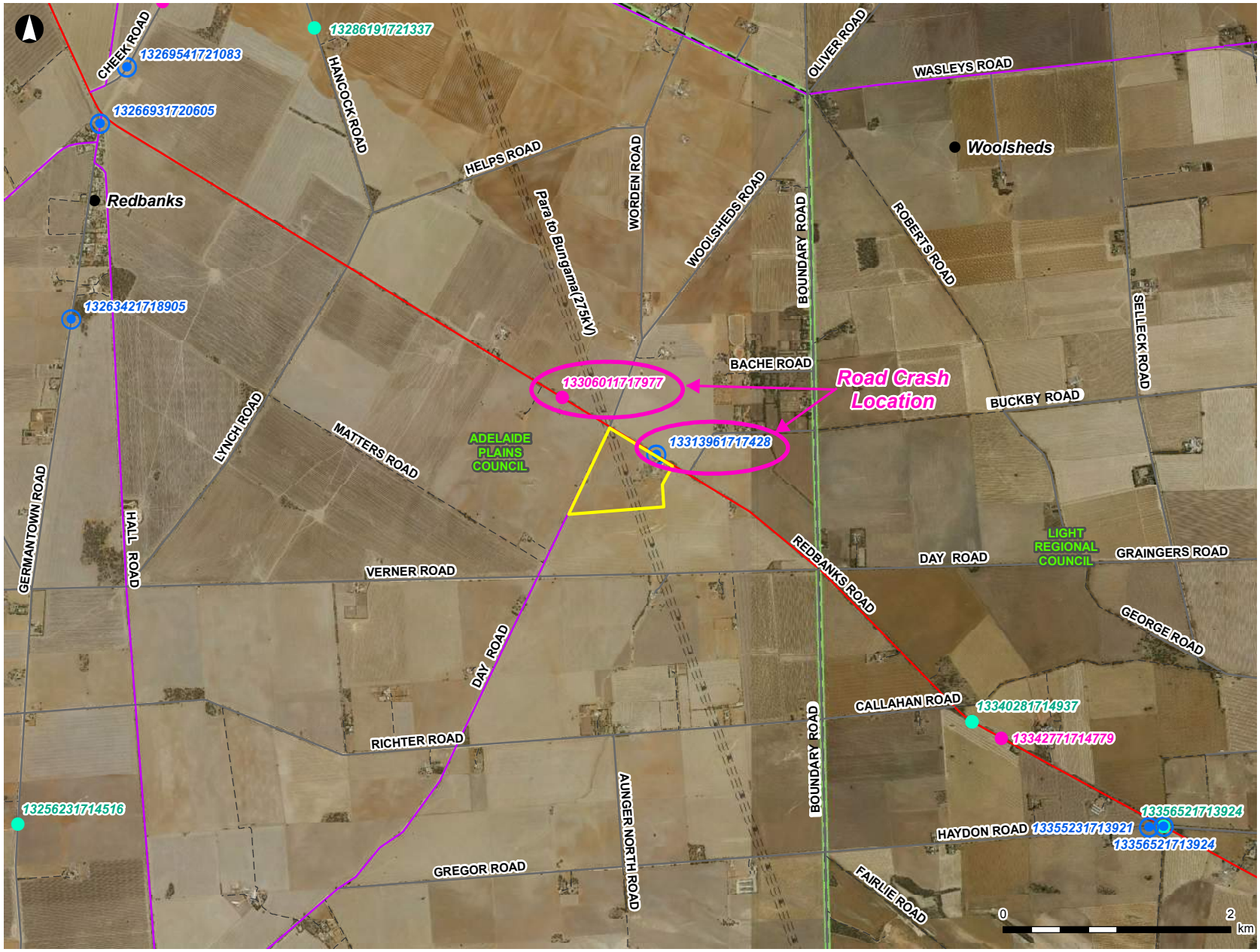

LEGEND

- Subject Site
- Road Incident (2015)
- Road Incident (2014)
- Road Incident (2013)
- Locality
- High Voltage Electricity Transmission line
- Sub Arterial road
- Collector road
- Local road
- Track 2WD
- Track 4WD
- Local Government Area

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Figure3 - Road Crash Incidents

Date: 6/09/2017 Path: F:\10005589\L-GIS\A_Current\B_Maps\10005589_035_TransportReport_Casuality_A4L_v2.mxd
Created by : LH
QA by : RB

3.1.3 Heavy vehicle routes

For this analysis, it is assumed that the materials delivered and/ or collected from site will be transported from Port Adelaide to the proposed site through the following routes;

- A9 Port River Expressway;
- A13 Salisbury Highway
- A1 Princes Highway;
- M20 Northern Expressway;
- A20 Stuart Highway; and
- Redbanks Road

Refer to Figure 4 for the proposed route (highlighted in blue colour)

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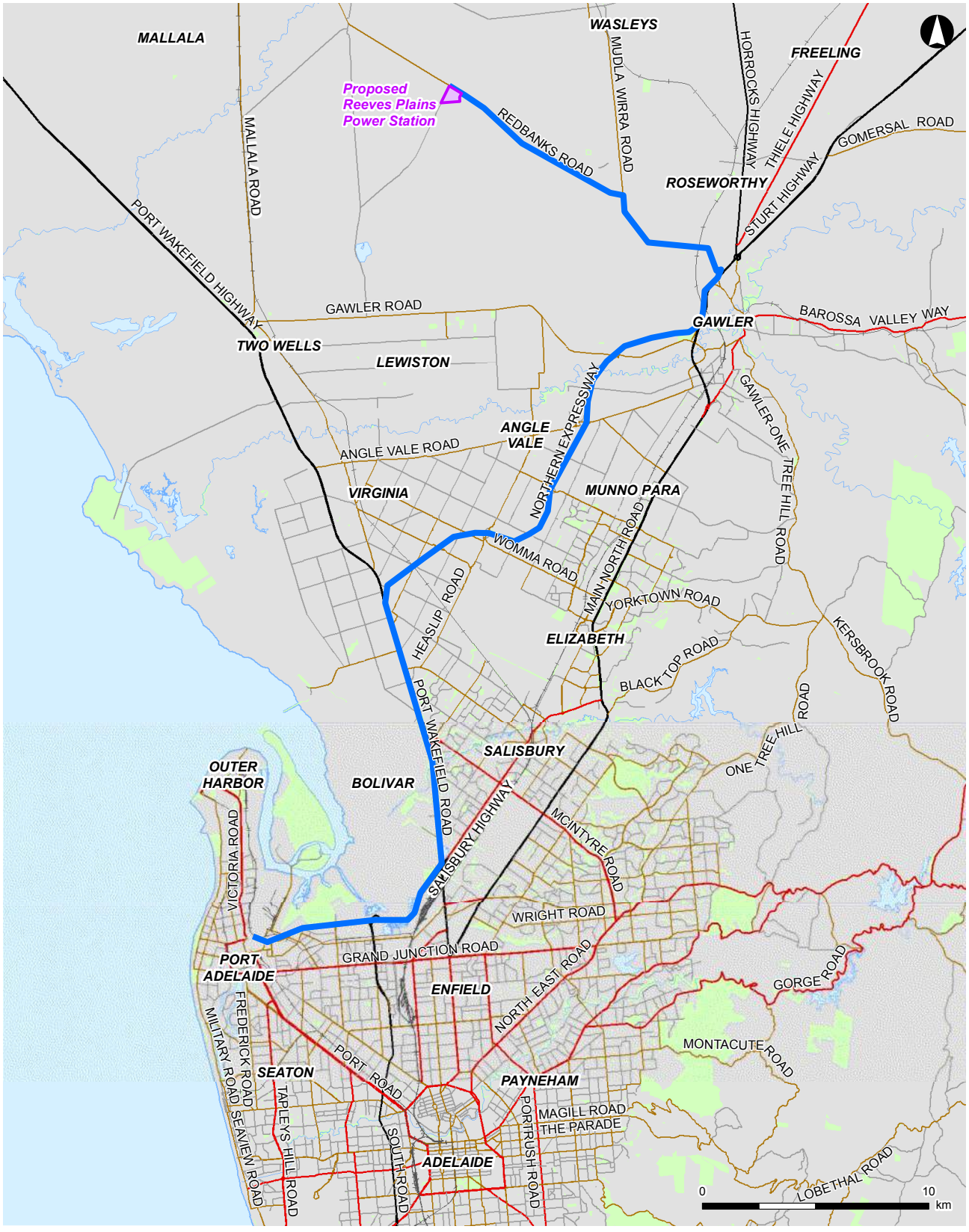

LEGEND

- Subject Site
- Railway line
- Watercourse
- Waterbody
- Reserve
- Proposed Material Delivery Route
- Highway
- Arterial road
- Sub Arterial road
- Collector road

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Figure 4 - Transport Routes

Date: 6/09/2017 Path: F:\10005589\L-GIS\A_Current\B_Maps\10005589_036_TransportReport_TransportRoutes_A4P_v2.mxd
Created by : LH
QA by : RB

The data obtained from “RAVNET - Heavy Vehicle Routing” for South Australia is presented in the table below. Table 1 below shows the type of routes and heavy vehicles that are allowed to utilise the above heavy vehicle routes to and from the subject site.

Table 1 - Types of heavy vehicle routes

Type of routes	Type of heavy vehicles
GML[1] Routes	▪ 23m B Double ▪ 26m B Double ▪ 23m Vehicle Carrier ▪ Rigid Truck and Dog (23m)
HML[2] Routes	▪ 23m B Double ▪ 26m B Double ▪ 23m Vehicle Carrier ▪ 19m Network
OSM[3] Routes	▪ 23m 42.5t Low Loader 24hr ▪ 23m 42.5t Low Loader Day Only ▪ 25m 49.5t Low Loader ▪ 25m 59.5t Low Loader ▪ Controlled Access Bus up to 14.5m ▪ 3 Axle Crane Network ▪ 4 Axle Crane Network ▪ 5 Axle Crane Network - Level One ▪ 40t Special Purpose Vehicle
PBS[4] Routes	▪ Level 1A ▪ Level 2A
Commodity Routes (B Double GML and Road Train GML)	▪ Grain ▪ Fertilizer ▪ Hay & Bulk Stock Feed ▪ Dairy Milk ▪ Livestock ▪ Logging & Timber ▪ Wine ▪ Wool ▪ Fruit & Veg

[1] GML – General Mass Limits
[2] HML – Heavy Mass Limits
[3] OSM – Oversize Mass
[4] PBS – Performance Based Standards

3.2 Construction vehicle requirements

The type of vehicles used in the construction phase for the Reeves Plains Power Station will be determined by the appointed Engineering Procurement Construction (EPC) Contractor. However, based on advice from Alinta Energy, it is expected B-double trucks will be used for transporting components, construction vehicles (e.g. earth moving equipment) and other large equipment and light vehicles will be used daily to transport personnel and equipment.

It is assumed that a sufficient number of parking space will be provided within the site to accommodate delivery and staff vehicles during construction. No parking on DPTI or Council roads will be required.

3.2.1 Oversized vehicles and / or heavy construction vehicles

While oversized vehicles may be required for transporting major components, it is noted that any oversized and overmass vehicles shall abide by the DPTI Code of Practice for the Transport of Oversize and Overmass Indivisible Loads and Vehicles (DTEI 2008) and have appropriate permits in place.

Heavy construction vehicles (e.g. vehicles exceeding 4.50 tonnes Gross Vehicle Mass delivering aggregate, sand, cement and water, etc.) that use DPTI or Council roads will need to be road registered otherwise they shall be required to be transported using an appropriate road registered transporter.

3.2.2 Light vehicles

Alinta Energy confirms that no on-site accommodation will be provided during construction period Therefore, it is assumed that light vehicles will be used on daily basis for travelling to and from proposed site during construction

Alinta Energy has identified workforce requirements and is outlined in Table 2. The employment levels are shown as a proportion of full time jobs over a year. These figures are based on the peak construction period.

Table 2 Employment generation

Phase	Employment Generation
	Annual Full Time Equivalent - Maximum
Construction	100 construction jobs
Operation	Up to 6 full time staff on site

Based on the above, a construction workforce has been taken as 100 persons during the peak construction period. Assuming a vehicle occupancy rate of 1.2, approximately 170 trips will be made daily to and from the construction site. It is envisaged the vehicles will originate from Adelaide and nearby townships including Gawler, Mallala and Two Wells surrounding the subject site. It is likely that these trips will be spread throughout the peak periods (6-9am and 3-6pm). On this basis, the existing arterial and local road network should have sufficient capacity to accommodate the additional trips generated during the construction stage of the proposed development.

Based on the number of vehicles accessing the site during a work day, it is envisaged that multiple parking areas will be required during construction stage to ensure traffic impact on Redbanks Road is managed. One access point will be required along Day Road located between Gas transmission pipe line and the electricity powerlines that will allow construction vehicles to avoid crossing over and under these liner assets. Location of access point will be determined at the construction stage in consultation with Epic and ElectraNet. It is envisaged that a traffic management plan would be prepared by the selected EPC Contractor and provided to DPTI for approval prior to commencement of construction.

Alinta Energy confirms that no on-site accommodation will be provided for the workforce during construction period.

3.3 Estimated heavy vehicle traffic volumes during construction stage

It is noted that 50 large deliveries per turbine unit (with 6 turbine units in total) will be expected throughout the construction period (Data supplied by Alinta Energy). It is noted that the construction period will last for approximately 52 weeks (based on construction schedule dated 20170612). The estimated number of heavy vehicles that will access the site during construction is listed in Table 3. Based on this, the additional heavy vehicle traffic generated by the development during construction would be negligible (less than 1% increase). It is expected that the heavy vehicles will utilise Redbanks Road and are unlikely to create a maintenance burden to the road, providing that the gross weight limit (per truck) for the road is not exceeded.

Table 3 Estimated construction traffic volumes

Vehicle types	Estimated number of vehicles during 12 months' construction period (for 6 units)	Vehicles per week	Vehicles per day
B-Double Trucks – Construction materials	600	11.5	2.30*

* It is assumed that construction will continue for 5 days per week

4 TRAFFIC ASSESSMENT

4.1 Proposed site access points

Figure 5 shows the proposed power station site layout option with the land development area of approximately 9ha (90,000m^2).

The road alignment of Redbanks Road and Days Road is straight and flat along the frontage of the subject site. It is anticipated that future access points can be provided in accordance with relevant design standards and Austroads Guidelines.

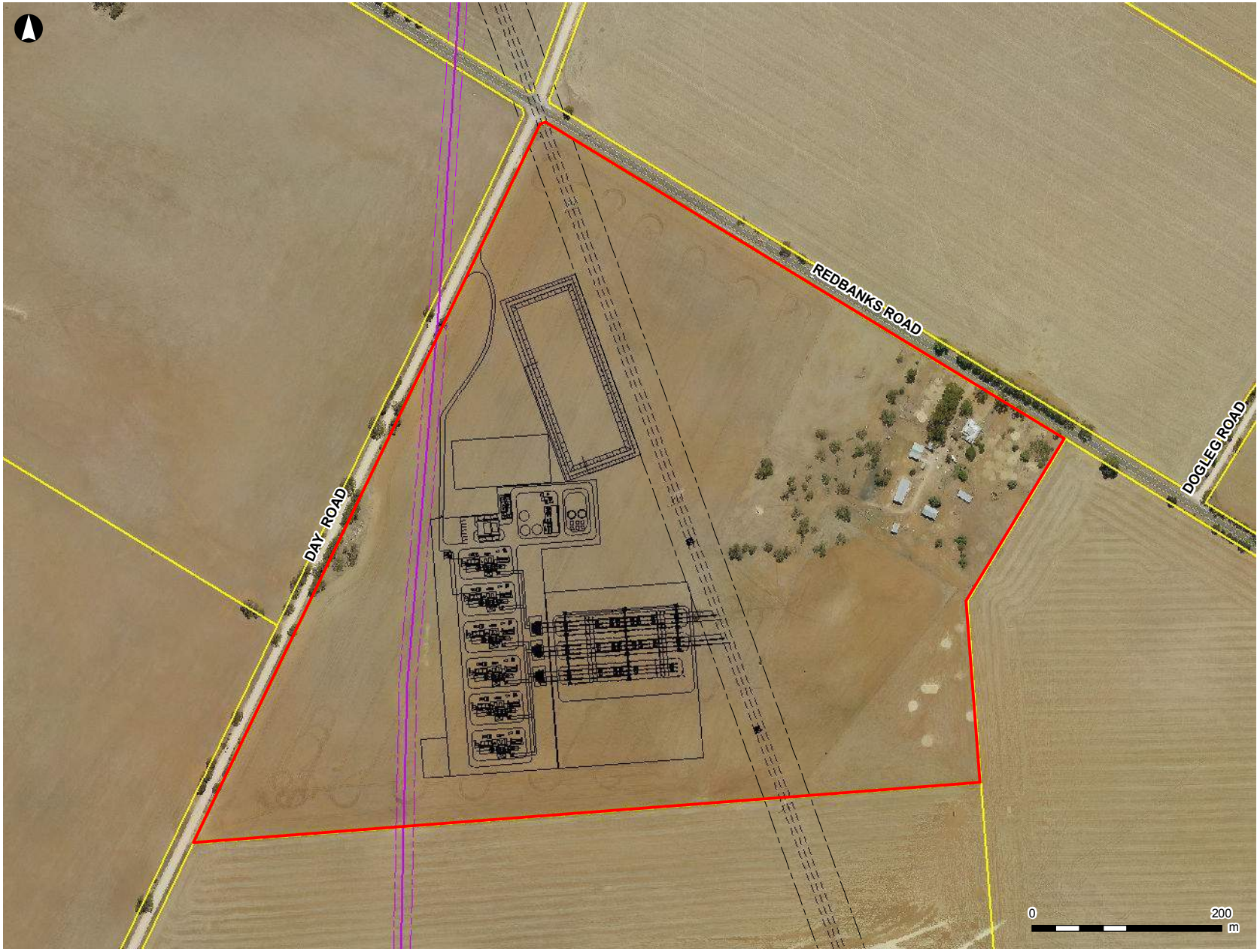
Alinta Energy confirms that the proposed site access point will be located along Day Road, refer Appendix A for the layout plan of the proposed power station.

4.2 Trip generation at operational stage

The ongoing operation of the power station will generate significantly less traffic than the construction phase of the project. The primary traffic generated during operational phase will be vehicle trips generated by 6 full time employees (i.e 12 trips per day) based on data supplied by Alinta Energy. It is envisaged that these employees will travel to work from nearby townships including Gawler, Mallala and Two Wells surrounding the subject site.The traffic generated from the scheduled maintenance requirements will be infrequent and significantly less than construction phase.

It is expected that operational traffic will have negligible impact to the adjacent road network.

Alinta Energy - Reeves Plains Power Station



LEGEND

- Subject Site
- Proposed Site Layout
- Electricity Easement (from Land Title)
- High Voltage Electricity Transmission line
- Gas pipeline Easement (from Land Title)
- Gas pipeline
- Cadastre

Land Title reference: DP22848 Plan, dated 9 Nov. 1987

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Figure 5 - Site Layout

Date: 26/09/2017 Path: F:\10005589\L-GIS\A_Current\B_Maps\10005589_037_TransportReport_SiteLayout_A4L_v5_Fig5.mxd
Created by : LH
QA by : RB

5 FUTURE ROAD IMPROVEMENTS

5.1 Road improvements

5.1.1 Redbanks Road

Redbanks Road is a sealed two-lane two-way sub-arterial road under the jurisdiction of the DPTI. Redbanks Road carries only 150 vehicles (10% of AADT volume) in both directions during the peak periods and it is mainly used by localised traffic travelling between Mallala and Gawler.

Provisions for road network upgrades to Redbanks Road in the form of road widening is not required. As the traffic function of Redbanks Road will not change as a result of the proposed development, it is therefore anticipated that Redbanks Road is functionally and geometrically adequate of servicing additional traffic generated by the subject site.

5.1.2 Day Road

Day Road is Category 1 Road and primarily used to access local rural properties typically used for agricultural activities and hence it has a minimal amount of traffic during the peak periods.

It is noted that the access to development will be via Day Road. Currently Day Road is unsuitable for use by standard commercial vehicles and over dimension vehicles and will require upgrades, such as re-grading and widening to meet safety standards. Refer to Appendix B for intersection upgrade concept plan.

5.2 Intersection improvements

5.2.1 Redbanks Road/ Day Road/ Woolsheds Road

The intersection of Redbanks Road-Day Road-Woolsheds Road is an established intersection that is currently operating well under capacity. It is expected that the additional traffic generated by the 6 full time employees (i.e 12 trips per day) will have negligible impact on the intersection.

Heavy vehicle turning movements at the Redbanks Road- Day Road- Woolsheds Road intersection has been reviewed using AutoTurn. Detailed drawings showing swept paths are attached to Appendix B for reference. The tuning movement check is based on a passenger car and a B-Double turning concurrently at the intersection. As discussed in Section 3.1.3, all B-Double vehicles will enter and exit the project site via Day Road and Redbanks Road intersection. Therefore, only these turning movements have been analysed.

The analysis shows that a B-Double can adequately turn into Day Road from Redbanks Road. However, the wheel path of a B-double may encroach the edge of shoulder on the south-west corner of the intersection when completing a left turn into a Day Road.

It is proposed that EPC contractor will seal the Day Road and Woolsheds Road with approved pavement surface treatment in consultation with project stakeholders (i.e. DPTI, Adelaide Plains Council and Alinta Energy). Refer to Appendix B for intersection upgrade concept plan.

6 ANCILLARY TRAFFIC IMPACTS

6.1 Site access points

There is a single entry and exit access point to the site from Day Road for all vehicles entering and exiting the site. The site access point is provided approximately 160 m south of Day Road Intersection. The main access to subject site (during operation stage) should be minimum 6 m wide formed with an all-weather surface capable of accommodating 21 tonne truck (minimum). The Concept Site Plan in Appendix A shows the location of the site access and egress point.

The existing Day Road is unsealed with constant width formation and is straight and generally flat. Therefore, the safe intersection sight distance (SISD) on approaches to the main access/ egress point is considered to be sufficient.

Heavy vehicle turning movements utilising the access point has been reviewed using AutoTurn. Detailed drawings of the turning path assessment is attached in Appendix C. The analysis shows minor modification in terms of widening of an access point may be required for safe manoeuvres of large vehicles.

It is also noted that this section of Day Road is a low traffic volume road, as such there are minimal for vehicle conflicts with other traffic movements at the access point.

6.2 Internal vehicle circulation

The concept layout plan that the site has been designed in such a way that internal movements for heavy vehicles will occur as a one-way circulation movement throughout the site where large vehicles can enter the site and are not required to turn around at any point before exiting the site. The access point width will be designed to accommodate two heavy vehicles to pass.

Vehicle access and driveways to properties will be designed and constructed to:
(a) facilitate safe and effective operational use for firefighting and other emergency vehicles and residents
(b) provide for two-way vehicular access between areas of fire risk and the nearest public road.

6.3 Emergency services vehicle access

Consultation with The Country Fire Service and Alinta Energy's operations team highlighted the need for an emergency access track around the power station infrastructure as well as allowing for secondary access points to the subject site.

The final location of secondary access points will be confirmed during the detailed design and take into account landscaping and bushfire protection requirements. However, it is recommended that secondary emergency access points should located on Redbanks Road and at the south-west corner of the subject site on Day Road. Each access should be a minimum of 3 metres wide and provide 6-metre-wide passing bays at 200 metre intervals and be formed using an all-weather surface capable of accommodating a 21 tonne (GVM) truck.

6.4 Bus stop review

There is currently one bus route operating along Day Road and Redbanks Road within vicinity of subject site. This route runs between from Redbanks Road/ Haydon Road intersection to Gawler Primary School during morning hours and vice versa during evening hours as presented in Figures 6 and 7. This bus service operates during school hours between approximately 7:30 to 8:30 AM during morning and 3:15 to 4:15 Pm during evening.

The nearest bus stops are located at corner of Day Road and Redbanks Road intersection. The bus service is likely to be impacted during construction stage and EPC contractor should consult with stakeholders (e.g. DPTI, Adelaide Plains Council and relevant schools including Gawler and District College) about how to maintain the bus service.

It is proposed that the bus stops will be formalised as part of intersection upgrade works. Refer to Appendix B for intersection upgrade concept plan including the future bus stop locations. It should be noted that these bus

stop locations are for reference only and the detailed design of the bus stops need to be determined by EPC contractor in consultation with DPTI.

Figure 6 - School Bus Route (Morning Run)

Figure 7 - School Bus Route (Afternoon Run)

7 PARKING REQUIREMENTS

7.1 On-site parking

The design of car parking facilities should consider the parking requirements specified under the General Section – (refer to the table for parking rates) of the Mallala Development Plan and Australian Standard AS 2890 Parking Facilities. It is assumed that parking provision will be required for small number of large vehicles. The majority of which will be completing round trips, with loading and unloading occurring on site before moving to their next location. Alinta has advised that there will be on-site parking available for both construction and operational phases.

The concept site plan proposes an on-site car park that can accommodate 8 staff car spaces (refer appendix A for layout plan), which satisfies the requirements of Australian Standard AS 2890 Parking Facilities. There is no provision for large vehicle parking.

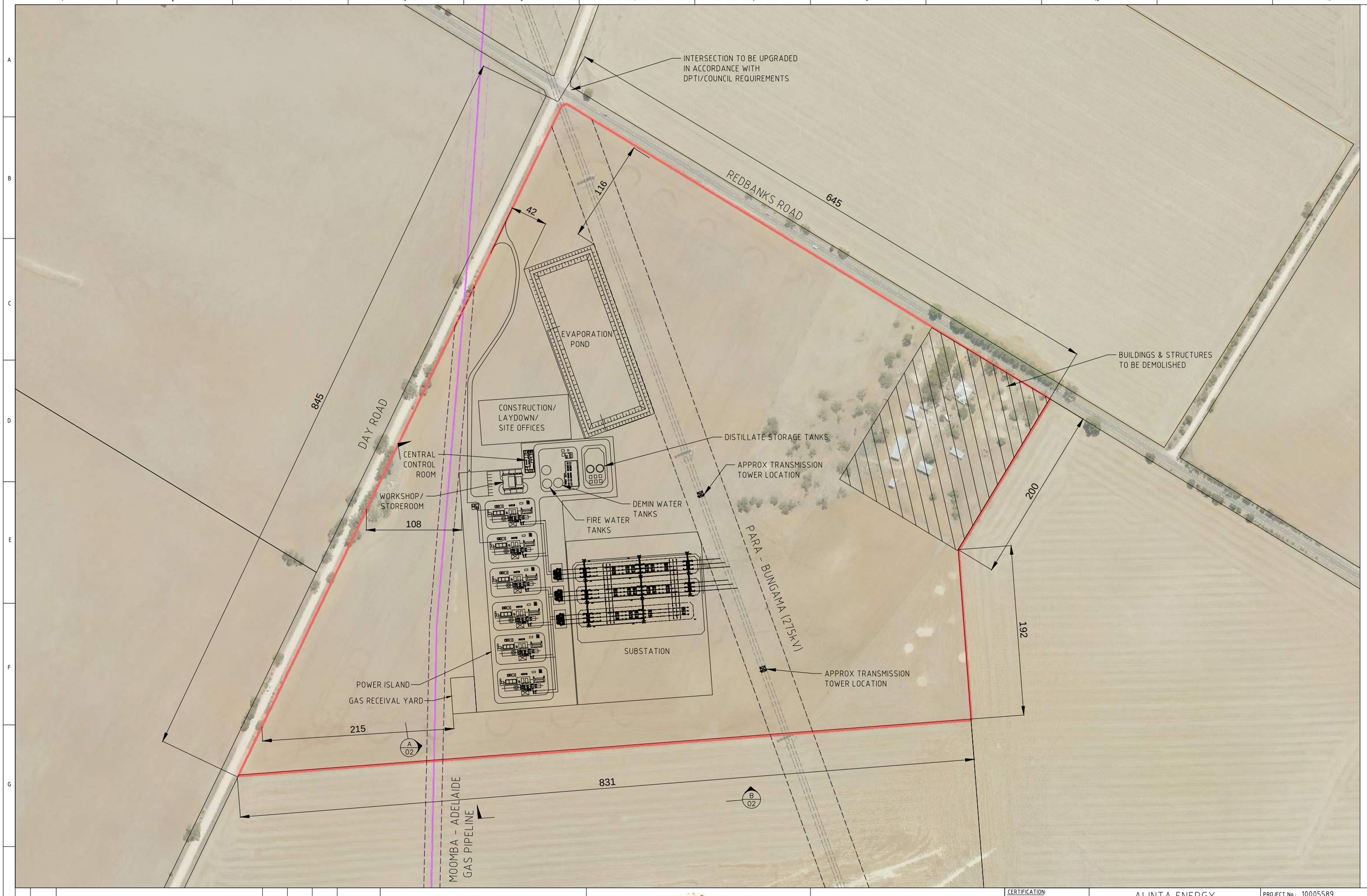
The parking area provided during the construction period can be transformed into light vehicle parking for the operation phase, this will accommodate contractor's vehicles and any overflow from the formalised parking area

8 CONCLUSION

Based on the traffic assessment undertaken for the proposed power station, the proposed development will provide safe and convenient access for all anticipated modes of transport. Traffic generation by the proposed development is expected to be minimal, and it can be effectively and safely accommodated by the existing road network. The proposed development:

(a) avoids unreasonable interference with the flow of traffic on adjoining roads;
(b) provides appropriate separation distances from existing roads and crossings;
(c) accommodates the type and volume of traffic likely to be generated by the development

APPENDIX A CONCEPT SITE PLAN



REV	DATE	DETAILS	DRAWN	CHECKD	APPRVD	DRAWING No.	REFERENCE DRAWING TITLE
B	25-09-17	ISSUED FOR DA LODGEMENT	A.S.	S.W.			
A	25-08-17	ISSUED AS CONCEPT	A.B.	S.W.			

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DRAWN	
CHECKED	
APPROVED	

ALINTA ENERGY
REEVES PLAINS POWER STATION

PROPOSED CONCEPT LAYOUT

PROJECT No.: 10005589
DRAWING NUMBER
5589-01
SHEET 1 OF 2 REVISION B
SCALE : AS SHOWN A1

APPENDIX B INTERSECTION UPGRADE PLAN

REV	DATE	DETAILS	DRAWN	CHECKD	APPRVD	DRAWING No.	REFERENCE DRAWING TITLE
A	07-09-17	ISSUED AS CONCEPT	J.G	S.G			

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ALINTA ENERGY
REEVES PLAINS POWER STATION

INTERSECTION CONCEPT DESIGN

PROJECT No: 10005589
DRAWING NUMBER
SHEET 1 OF 1 REVISION A
SCALE: AS SHOWN A1

APPENDIX C AUTO TURN SWEPT PATHS

REV	DATE	DETAILS	DRAWN	CHECKD	APPRVD	DRAWING No.	REFERENCE DRAWING TITLE
A	07-09-17	ISSUED AS CONCEPT	JG	SG			

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AUTO TURN PATHS

PROJECT No: 10005589
DRAWING NUMBER
SHEET 1 OF 1 REVISION A
SCALE: AS SHOWN A1

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AUTO TURN PATHS

PROJECT No.	10005589
DRAWING NUMBER	
SHEET 1 OF 1	REVISION A
SCALE : AS SHOWN	A1

REV	DATE	DETAILS	DRAWN	CHECKD	APPRVD	DRAWING No.	REFERENCE DRAWING TITLE
A	07-09-17	ISSUED AS CONCEPT	JG	SG			

alintaenergy

ARCADIS Design & Consultancy for natural and built assets

Level 5, 120 Edward Street, Brisbane QLD 4000 Phone (07) 3337 0044
www.arcadis.com

CERTIFICATION:
RPEQ No:
Document No: P07??-CS

DESIGNED	
DRAWN	
CHECKED	
APPROVED	

ALINTA ENERGY
REEVES PLAINS POWER STATION

AUTO TURN PATHS

PROJECT No: 10005589
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ALINTA ENERGY
REEVES PLAINS POWER STATION

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PROJECT No: 10005589
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APPENDIX J – BUSHFIRE ASSESSMENT

Bushfire Assessment
Reeves Plains Power Station
1629 Redbanks Road, Reeves Plains

August 2017

xwb consulting
Town Planning and Bushfire Consultants

1 Introduction

XWB Consulting has been engaged by Acradis to prepare a bushfire assessment for Reeves Plains Power Station proposal (the Project) at 1629 Redbanks Road, Reeves Plains.

The Project proponent is Alinta Energy (Reeves Plains) Pty Limited (Alinta Energy) and development consent is required from the State Commission Assessment Panel before proceeding. Construction of the Project is scheduled to commence in 2018 with operation of the power station occurring in Q1 2020 at the earliest.

The bushfire assessment has been prepared by:

Phil Walton
XWB Consulting
PO Box 752
Beaconsfield 3807

mail@xwbconsulting.com.au
Ph: 0408 517 143

As part of the assessment, a site inspection was conducted on Wednesday 9 August 2017 and a phone conference was held with Julian Aggiss and Leah Bertholini from the Country Fire Service on Monday 14 August 2017.

1. Site Description

The subject site is located at 1629 Redbanks Road, Reeves Plains, on the south east corner of Day Road. The site is owned by Alinta Energy and has an area of 41ha. The site contains a dwelling on Redbanks Road and the site has previously been used for cropping. A 275Kv electricity transmission line (pink line below) passes north south through the property as does the Moomba Adelaide gas transmission pipeline (green line below). The land is generally flat with a slight drainage depression through the site. The site is within a Primary Production Zone under the Mallala Development Plan and is identified as being within an area of General Bushfire Risk.

The site is shown on the aerial photograph below:

The photograph below shows the view of the site from the intersection of Redbanks Road and Day Road:

The land to the north of the site is used for cropping save for a small rural residential area to the north west along Dog Leg Road, Boundary Road and Bache Road. Redbanks Road is a sealed road which provides an important connection between Gawler and Mallala. The photograph below shows crops on the north side of Redbanks Road:

The land to the west of Day Road which is a local gravel road is a large grazing property with open paddocks.

The land to the south and east is also used for cropping.

2. Proposal

The Reeves Plains Power Station Project involves the construction and operation of a gas fired power station and associated infrastructure. The power station will be located at 1629 Redbanks Road on a 41 ha greenfield site located in Reeves Plains, approximately 12 km south-east of Mallala and 50 km north of Adelaide. The advantage of the subject site is access to existing infrastructure in the form of the 275Kv electricity transmission line and Moomba Adelaide gas transmission pipeline.

The power station will operate as a 'peaker', providing electricity during periods of high demand, and is designed to generate up to 300 megawatts (MW) of power and will be delivered in two stages with up to 150MW installed initially with further build out as required by prevailing market conditions. The Project includes the following infrastructure:

- A gas receival station
- Up to six (6) dual fuel (gas and diesel) turbines each capable of generating 50MW of power
- Three (3) transformers designed to convert low voltage electricity into high voltage electricity
- Connection to the electricity network including a new substation, transmission tower and communications tower
- Water supply and storage including:
    - Water treatment plant
    - Water storage tanks
    - Firefighting system
- Evaporation pond
- Diesel storage

Also included within the Project are the following:

- Control rooms, workshop and maintenance facilities and administration building
- Security fencing and lighting
- Onsite drainage works
- Site access from Day Road (north-west of the subject site)
- Upgrade to the Redbanks Road and Day Road intersection and sealing of Day Road from Redbanks Road to the Project entrance
- Carparking for employees and contractors
- Demolition of existing buildings onsite
- Landscaping

The preliminary configuration of the power station is shown in the plan attached as Appendix A.

3. Planning Context

The subject site is covered by the Mallala Development Plan (April 2006) and the site is included in a Primary Production Zone and General Bushfire Risk Area.

The Mallala Development Plan identifies that following bushfire protection principles of development control apply to development of land identified as General, Medium and High bushfire risk areas as shown on the *Bushfire Protection Area BPA Maps - Bushfire Risk*. The bushfire risk in the area is shown on the plan attached as Appendix B.

The Development Plan specifies that development in a Bushfire Protection Area should be in accordance with those provisions of the *Minister's Code: Undertaking development in Bushfire Protection Areas* that are designated as mandatory for Development Plan Consent purposes.

The development plan also specifies that buildings and structures should be located away from areas that pose an unacceptable bushfire risk as a result of one or more of the following:

(a) vegetation cover comprising trees and/or shrubs
(b) poor access
(c) rugged terrain
(d) inability to provide an adequate building protection zone
(e) inability to provide an adequate supply of water for fire fighting purposes.

The Ministers Code is published under Regulation 106 of the *Development Regulations 2008.* A development application for a Development Plan Consent in relation to development (including land division) in a Bushfire Protection Area must be assessed taking into account the mandatory provisions of this Code. The Ministers Code is primarily directed at land division, dwellings and habitable buildings in bushfire risk areas and provides little guidance in relation to the proposed power station facility.

5. Bushfire Hazard Site Assessment

A bushfire hazard site assessment describes the bushfire hazard within 100 metres of the proposed development in accordance with Sections 2.2.3 to 2.2.5 of AS3959:2009 Construction of Buildings in Bushfire Prone Areas (Standards Australia).

The site plan attached as Appendix C shows the bushfire hazard within 100m of the proposed power station.

All of the land surrounding the proposed power station would be considered grassland under AS3959 Construction of Buildings in Bushfire Prone Areas. The slope of the land under the vegetation would be considered flat under AS3959. Any bushfire attack level under AS3959 would be dependant on the extent of vegetation management undertaken around the power station.

6 Bushfire Hazard Landscape Assessment

The site and surrounding landscape context is shown on the plan attached as Appendix D. It shows extensive areas of cropping and grazing area around the site. The cropping and grazing areas would be considered grasslands under AS3959. Grassfires are typically fast moving intense fires under extreme conditions due to the fuels being fine fuels which are readily combusted. The fire behaviour in grasslands is heavily influenced by the fuel moisture, fuel structure and wind speed. In particular the structure of the grassland in relation to height and continuity is critical to fire behaviour. Changes in the fuel moisture, fuel structure and wind will significantly change fire behaviour.

This is clearly illustrated by the Pinery fire which occurred on 25 November 2015 in close proximity to the site. On that day there was extreme fire weather conditions and it was during the harvesting period meaning that fuel conditions were at their optimum in terms of fuel structure and continuity. The fire started at Pinery and was driven a strong north westerly wind before a south westerly wind change took the fire east towards the Barossa Valley. A plan of the area impacted by the fire is attached as Appendix E. The fire burnt 82,500ha, claimed two lives, destroyed 91 homes and caused significant economic losses in terms of crops, stock and machinery.

The fire effectively ran on the north side of Redbanks Road parallel to the road under the north west wind narrowly missing the site. This fire clearly informs the fire scenarios under severe to extreme weather conditions likely to impact on the site, being a fire from the north west impacting the site, or a fire from the north west burning to the south of the site and impacting the site under a south westerly wind change.

6 Recommended Bushfire Mitigation Measures

6.1 Mallala Development Plan

The development plan also specifies that buildings and structures should be located away from areas that pose an unacceptable bushfire risk as a result of one or more of the following:

(a) vegetation cover comprising trees and/or shrubs
(b) poor access
(c) rugged terrain
(d) inability to provide an adequate building protection zone
(e) inability to provide an adequate supply of water for fire fighting purposes.

The table below sets out the context of the site in relation to these criteria:

Criteria	Response
Vegetation cover comprising trees and/or shrubs	As indicated earlier in this report, the site and surrounding areas comprise grasslands. There are no forest or bushland areas within proximity to the site.
Poor access	The site has good access adjoined by Redbanks Road to the north and Day Road to the west. These roads are not affected by significant curves or gradients. Access to and from the site can be achieved from a number of directions.
Rugged terrain	The site and surrounding land is flat to slightly undulating plains and is not affected by rugged terrain.
Inability to provide an adequate building protection zone	Subject to the relocation of the power station further north from the southern boundary, there is adequate space within the site to provide a building protection zone around the facility.
Inability to provide an adequate supply of water for fire fighting purposes.	An adequate static water supply can be provided on site for fire fighting purposes.

6.2 Asset Protection Buffer

The risk of a grassfire impacting on the power station should be mitigated by providing an asset protection buffer around the facility. The asset protection buffer should comprise two zones, an inner zone with no fuel and an outer zone with reduced fuel conditions. Having regard to Table 2.4.3 of AS3959 it is recommended that a 50m asset protection zone be provided to achieve an equivalent bushfire attack level (BAL) rating of low.

The inner zone should comprise a minimum of 10m around the facility which is non combustible (eg: crushed rock). This would prevent a fire burning up to the facility and would prevent ignitions in the immediate vicinity of the facility as a result of embers.

The outer zone should comprise managed grassland which is regularly mown so that the grass is no higher than 100mm particularly during the fire danger season. The reduced fuel conditions in the outer zone will reduce the flame height and intensity of grassfire allowing for more effective suppression of a fire including the inner zone acting as a fire break.

The preliminary plans for the power station showed the facility adjoining the southern boundary. The power station has been relocated further to the north to allow for the asset protection zone to be located wholly with the land owned and managed by Alinta Energy.

The asset protection zone would need to be provided around all facilities except for the evaporation pond.

A plan of the asset protection zone / bushfire buffer is attached as Appendix F.

6.3 Landscaping Buffer

I understand that a landscaping buffer is to be provided around the power station facility and that from discussions with the landscape architect, this buffer is to be provided around the boundary of the property. From a bushfire perspective, the landscaping buffer should:

- Be setback as far as possible from the power station facility.
- Be discontinuous both horizontally and vertically. In this regard there should be separation between tree canopies and clumps of shrubs horizontally and shrubs should not be located under trees to create a separation between the near surface level and the tree canopy level.
- Not exceed a total width of 20m.

The landscaping buffer on the perimeter of the property will provide a wind break which will assist in mitigating the rate of spread and intensity of a grassfire which is heavily influenced by the strength of the wind.

6.4 Access

The main access is provided from Day Road at the northern end of the site. Secondary or emergency access points should be provided from Redbanks Road and the southern end of Day Road to allow access by the Country Fire Service in the event of a grassfire impacting on the site. Depending on the final configuration of security fencing on the site, if there is an inner security fence and a rural farm fence on the property boundary, access should be available to the area between the inner security fence and the property boundary for the Country Fire Service to suppress a fire heading towards the site, or originating within the site.

The main access to the site should be a minimum width of 6m, formed with an all weather surface capable of accommodating a 21 tonne (GMV) truck.

Secondary accesses may be a minimum width of 3m, provided that a passing bay 6m in width is provided at intervals no greater than 200m. Such accesses should also be formed with an all weather surface capable of accommodating a 21 tonne (GMV) truck.

6.5 Water Supply

While the site has fire water tanks for internal fire suppression systems, an independent static water supply should be provided for bushfire suppression. From discussions with the Country

Fire Service, a concrete or steel tank with a minimum capacity of 36,000 litres should be provided. The tank should be located close to the entrance to the site, but outside the security fence for the site to allow for ease of access by the Country Fire Service. Fire trucks should be able to get within 4m of the outlet/s of the tank which should be compatible with standard fittings on Country Fire Service trucks.

6.6 Facility Specific Risks

The plans provided for this bushfire assessment are preliminary plans of a general nature. They are not detailed mechanical or operational plans of the facility. Once detailed plans are available, a risk assessment should be undertaken by a person with sufficient competence in the operation of the facility in relation to the possible impacts (if any) from a grassfire including smoke, embers and wind blown debris. This is beyond the scope of the current assessment.

7 Conclusion

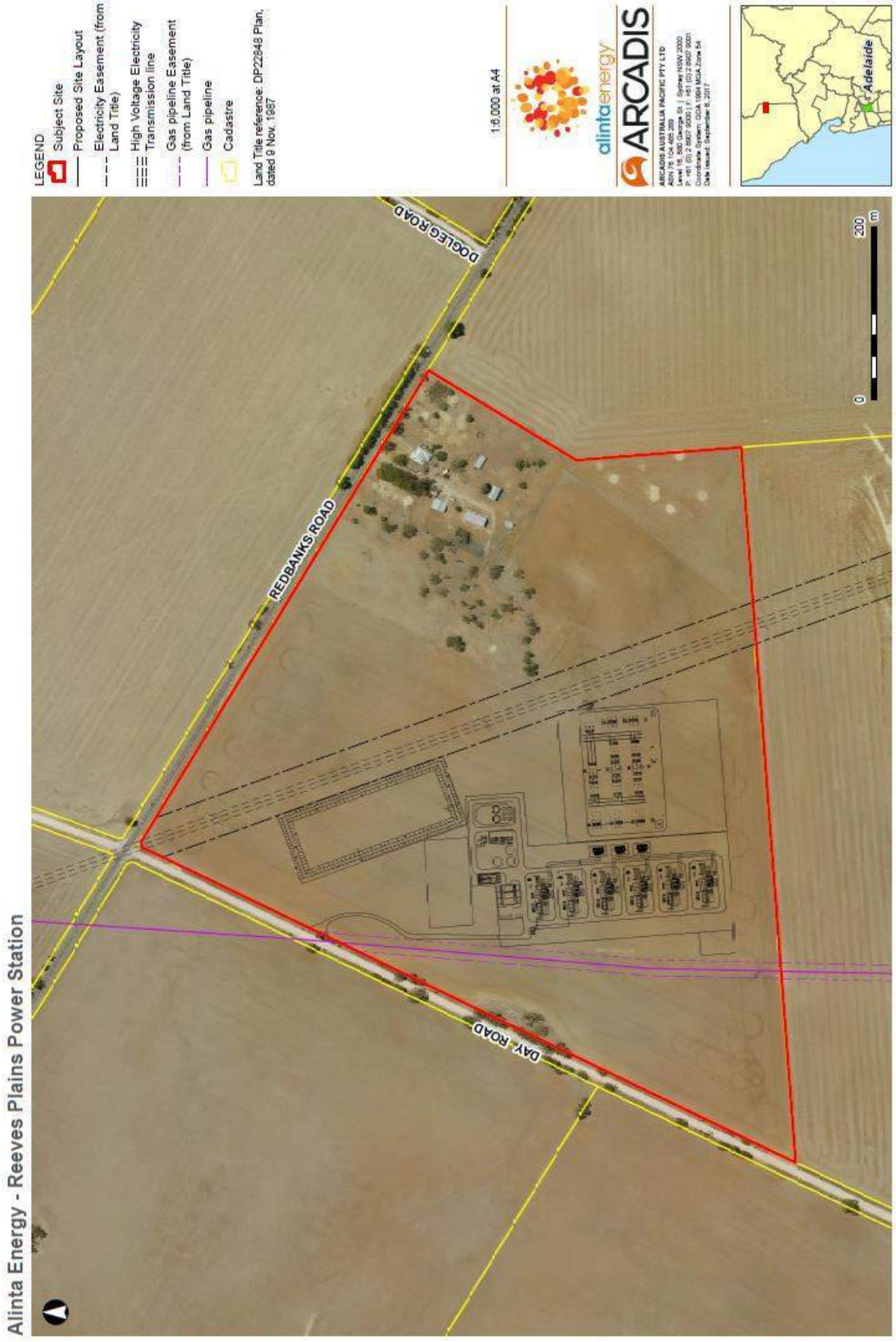
The proposal involves a gas fired power station on 1629 Redbanks Road, Reeves Plains.

The risk to the facility is from a grassfire given the crop land and grazing land in the surrounding landscape. This is evidenced by the Pinery fire which occurred in November 2015.

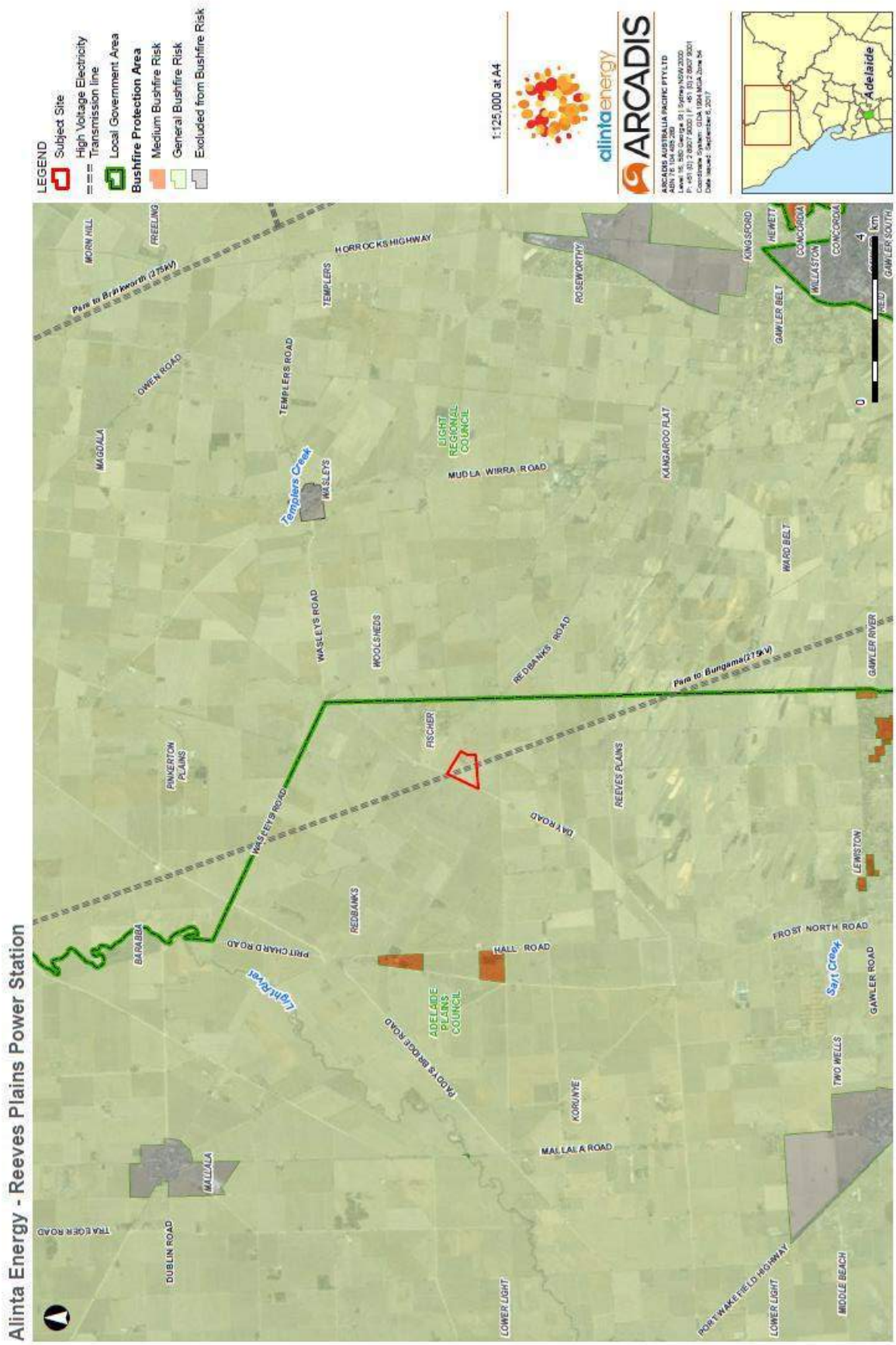
The risk to the facility can be appropriately mitigated through:

- The provision and maintenance of a 50m asset protection buffer around the facility.
- The provision of appropriate access points to the facility for the Country Fire Service.
- The provision of minimum static water supply of 36,000 litres for bushfire purposes.
- Ensure bushfire risk is addressed in construction and operational management plans.

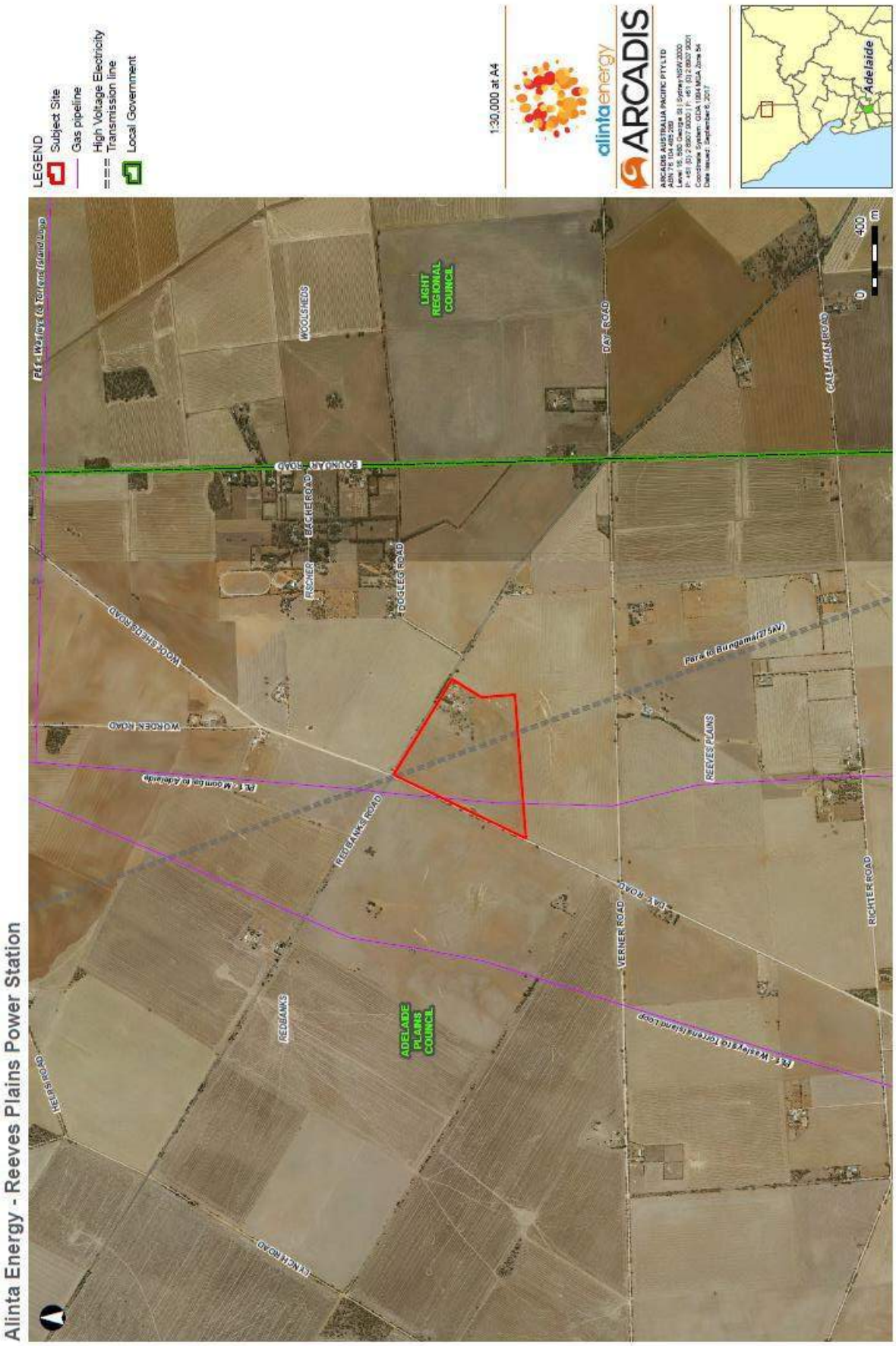
Appendix A – Proposed Power Station



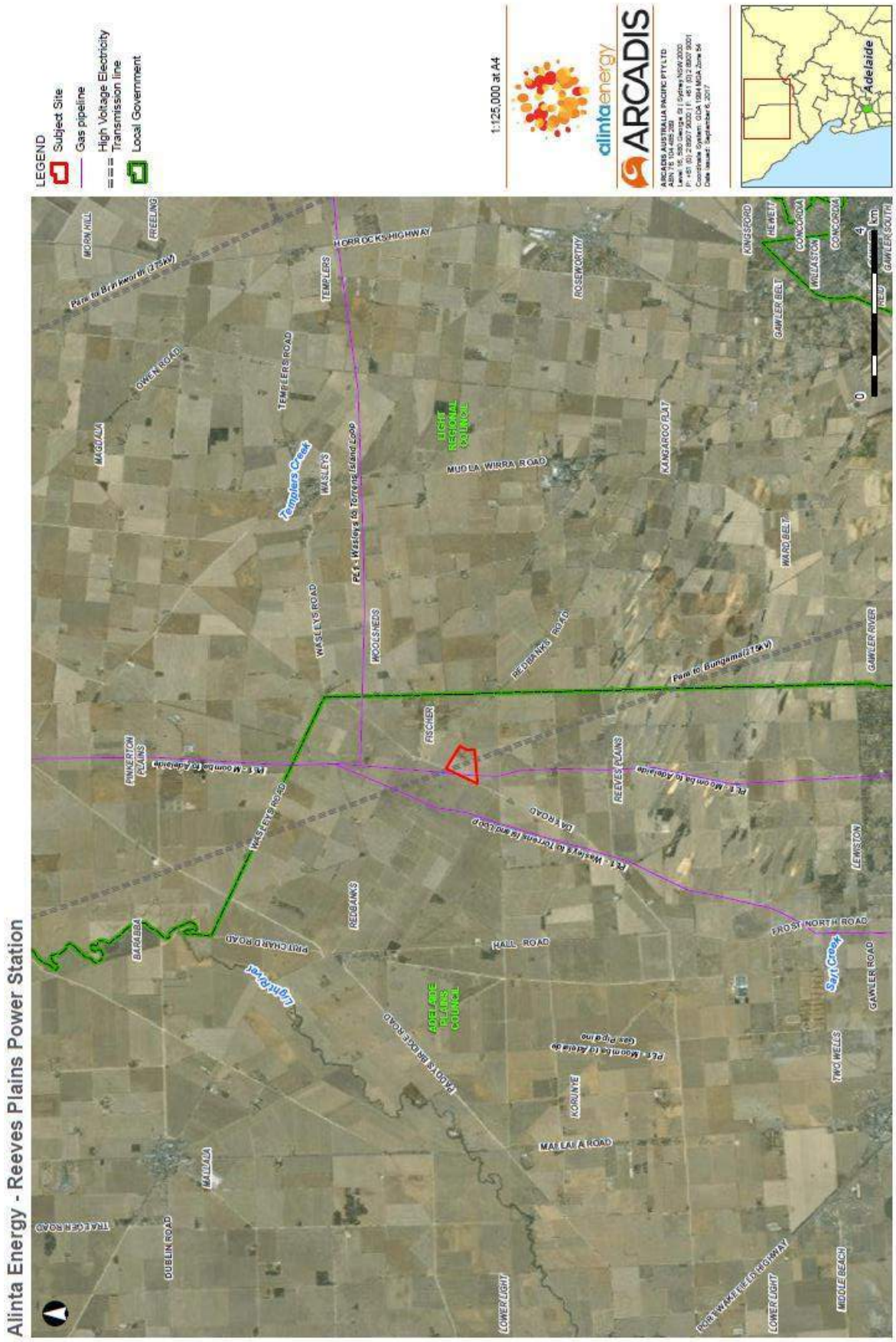
Appendix B – Bushfire Risk Map



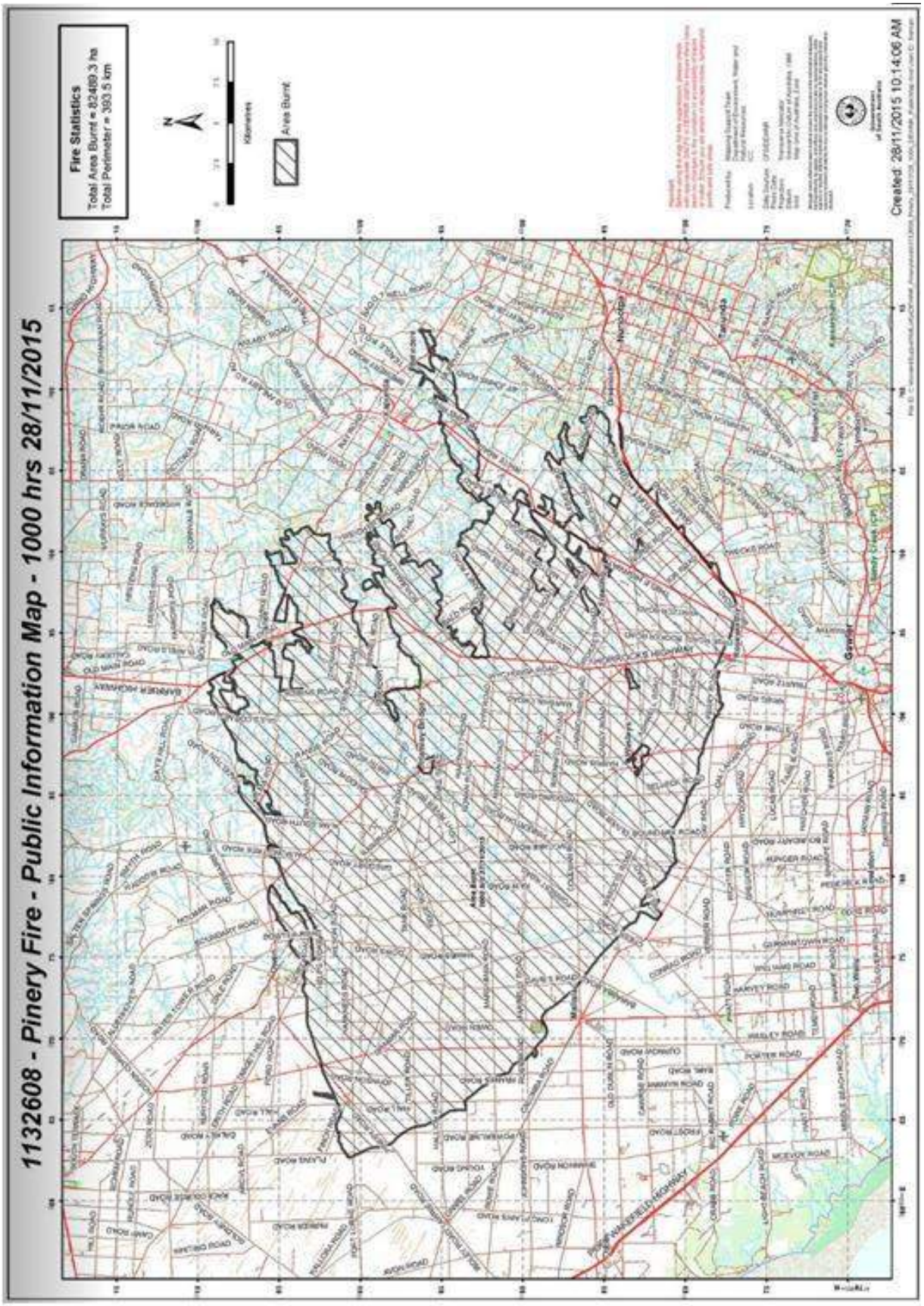
Appendix C – Site Context



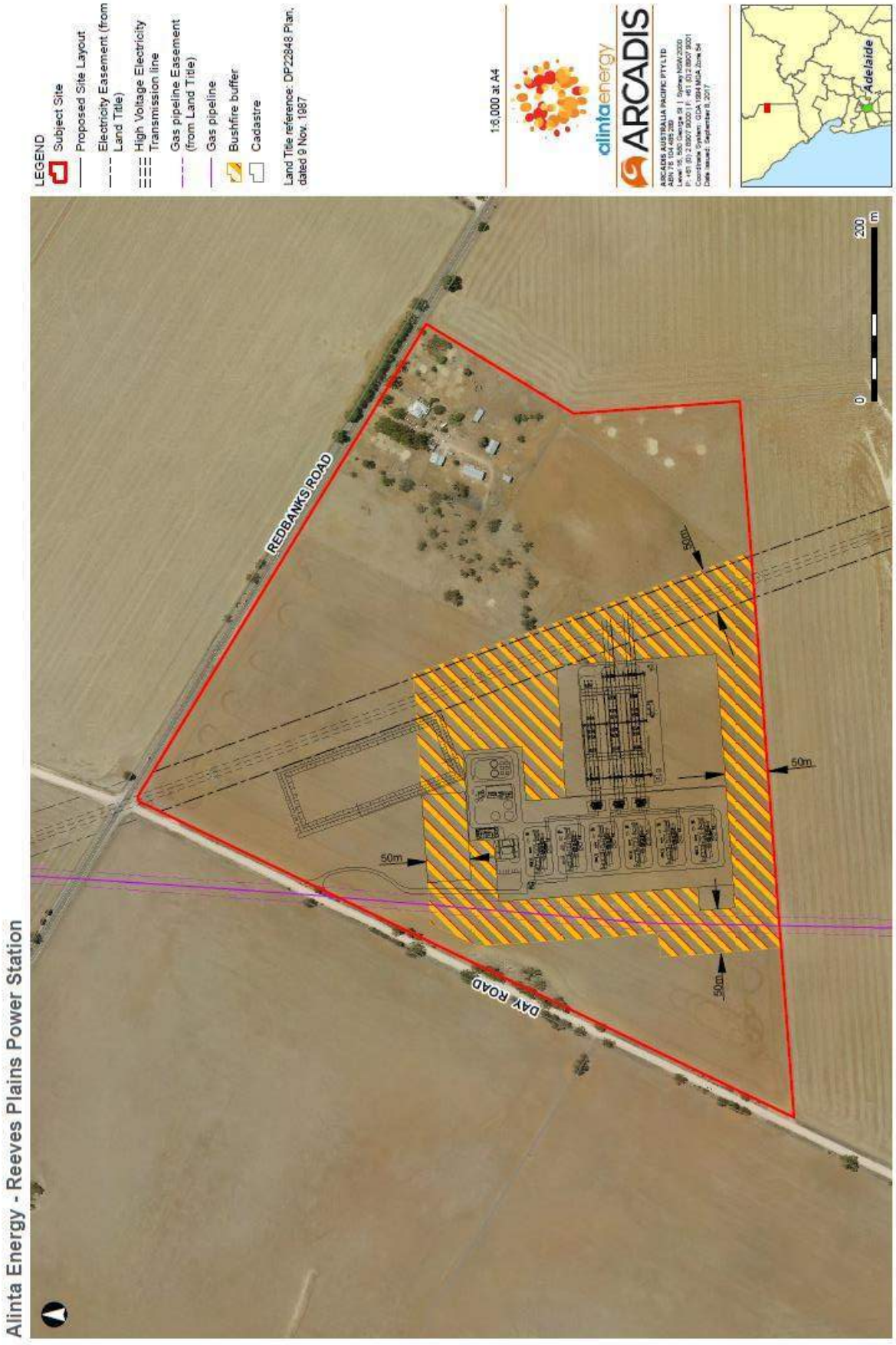
Appendix D – Landscape Context



Appendix E – Pinery Fire



Appendix F – Asset Protection Zone / Bushfire Buffer



APPENDIX K – WASTE MANAGEMENT PLAN

ARCADIS Design & Consultancy for natural and built assets

REEVES PLAIN POWER STATION PROJECT

Waste Management Plan

20 SEPTEMBER 2017

Incorporating Hyder

REEVES PLAIN POWER STATION

Waste Management Plan

Author	Dharshi Hasthanayake	
Checker	Sam Withers	
Approver	Sam Withers	
Report No	10005589-R01A-02	
Date	8/09/2017	
Revision Text	02	

REVISIONS

Revision	Date	Description	Prepared by	Approved by
01	14/08/2017	Report for comment	DH	SW
02	20/09/2017	Final report	DH	SW

CONTENTS

1 INTRODUCTION

The Reeves Plains Power Station Project involves the construction and operation of a gas fired power station and associated infrastructure (the Project). The project proponent is Alinta Energy (Reeves Plains) Pty Limited (Alinta Energy). The power station will be located at 1629 Redbanks Road on a greenfield site located in Reeves Plains, approximately 12 km south-east of Mallala and 50 km north of Adelaide.

The power station will operate as a 'peaker', providing electricity during periods of high demand, and is designed to generate up to 300 megawatts (MW) of power and will be delivered in two stages with 100MW installed initially with the remaining 200MW installed at a later date. The Project includes the following infrastructure:

- A gas receival station
- Up to six (6) dual fuel (gas and diesel) turbines each capable of generating 50MW of power
- Three (3) transformers designed to convert low voltage electricity into high voltage electricity
- Connection to the electricity network including a new substation, transmission tower and communications tower
- Water supply and storage including:
  - Water treatment plant
  - Water storage tanks
  - Firefighting system
- Evaporation pond
- Diesel storage

Also, included within the Project are the following:

- Control rooms, workshop and maintenance facilities and administration building
- Security fencing and lighting
- Onsite drainage works
- Upgrade to the Redbanks Road and Day Road intersection and sealing of Day Road from Redbanks Road to the Project entrance
- Carparking for employees and contractors
- Demolition of existing buildings onsite
- Landscaping and associated earthworks.

The Project is required to obtain development consent from the State Commission Assessment Panel before proceeding. Construction of the Project is scheduled to commence in 2018 with operation of the power station occurring in Q1 2020 at the earliest.

1.1 Scope of works

The purpose of this Waste Management Plan (WMP) is to describe the approach to construction and operational waste management at the facility.

The objectives and scope of this WMP are to:

- Consider the criteria and requirements stipulated in the *Environment Protection (Waste to Resources) Policy 2010* and the *Mallala Council Development Plan (April 2016).*
- Identify the waste generating activities across the construction and operational phase and the likely streams.
- Identify mitigation measures aligned with the waste management hierarchy.

Arcadis note that this WMP is reflective of a preliminary concept design and the development of the detailed design and construction methodologies employed by the Engineering Procurement Construction (EPC) Contractor will influence actual waste management requirements. Therefore quantities of waste generated have not been estimated at this stage. However, the likely waste streams and points of generation and their management has been provided.

2 RELEVANT LEGISLATION

Arcadis has prepared this WMP in accordance with state and local government legislation, regulations, guidance, and strategies.

A summary of the key applicable legislative, regulatory and policy documents which have been referred to as part of the WMP are provided in Table 1. The Environment Protection Act 1993 (EP Act), Environment Protection (Waste to Resources) Policy 2010 (Waste Policy) and the Waste and South Australian Planning System position statement are the principal pieces of State legislation governing the Reeves Plains Power Station waste management practices.

In South Australia, the EPA considers the following in the decision-making process:

- Risks of environmental harm associated with the activity type
- Level of complexity or specificity of management requirements for the activity to avoid unacceptable harm and/or to support sustainable development
- Need to act according to the 'polluter-pays' principle

Table 1: Summary of relevant documents

Document	Description
Environment Protection Act 1993 (EP Act)	The EP Act provides the regulatory framework to protect South Australia's environment, including land, air and water. The South Australian EPA is the main administer of the Act, which is implemented through a suite of legislative and non-legislative policies and regulatory tools.
Environment Protection (Waste to Resources) Policy 2010 (Waste Policy)	Environment Protection (Waste to Resources) Policy 2010 provides the regulatory framework that underpins the governance of South Australia's management of wastes. It aims to achieve sustainable waste management by apply the waste management hierarchy consistently with the principles of ecologically sustainable development set out in objects of the EP Act.
South Australia's Waste Strategy 2015-2020 (2016)	The waste management hierarchy underpins South Australia's Waste Strategy 2015-2020. It refers to an order of priority for the management of waste, being: avoidance of the production of waste, minimisation of the production of waste, reuse of waste, recycling of waste, recovery of energy and other resources from waste, treatment of waste to reduce potentially degrading impacts, and disposal of waste in an environmentally sound manner.
2009 Draft Guidelines for the Assessment, Classification, and Disposal of Solid Waste (updated in 2010)	The 2009 Draft Guidelines for the Assessment, Classification and Disposal of Solid Waste (updated in 2010), together with the current criteria for the classification of waste including Industrial and Commercial Waste (Listed) and Waste Soil, provides the detail regarding how to manage and deal with hazardous wastes. The Guidelines were developed to clarify the application of the criteria for both waste soils and industrial wastes containing listed wastes. It describes in detail the relevant quality assurance and quality controls needed in the assessment, classification, and certification of waste for disposal, and the process and circumstances under which treatment of waste may be required.
Waste and the South Australian Planning System (EPA 1097/16) (November 2016)	This position statement describes how wastes are to be addressed at each stage of the South Australian planning system to ensure that the requirements of the EP Act and the Waste Policy are met. It also informs how the EPA assess actual and potential waste impacts at the various stages of the South Australian planning system. EPA's interest is in ensuring that the waste management hierarchy is applied and that any waste produced during the undertaking of an activity is properly managed. The EPA also have an interest in understanding the waste management measures that are proposed to minimise environmental impacts of referred activities, and to prevent land-use conflicts between waste depots and sensitive land uses.

Document	Description
	When a Development Application (DA) and any major development or project is prepared, it is EPA's position that: • The waste management hierarchy be used to guide decisions on proposed development to avoid waste generation and ultimately prevent or minimise environmental harm • Propose sensitive land uses not impact on operating waste depots.
Bunding and spill management (EPA 080/16) (May 2016)	This guideline is provided to assist facilities that store liquids above ground with ensuring that they have appropriate bunds or spill containment systems to minimise the risk of environmental harm from liquid spills and leaks. It provides guidance with respect to the Environment Protection Act 1993 and the Water Quality Policy, and the specific requirements on the construction and maintenance of bunds, which includes storage of materials that are of relevance to this site, such as oil, grease and lubricants.
Mallala Council Development Plan (April 2016)	Development Plans are the key on-the-ground development assessment documents in South Australia. They contain the rules that set out what can be done on any piece of land across the state, and the detailed criteria against which development applications will be assess. Each of the local council areas in South Australia has their own separate Development Plan, and this provides the zones, maps and policies which form the criteria against which development applications are assessed. The Project is located within the Adelaide Plains Council and therefore the Mallala Council Development Plan is of relevance to this Project. The two main objectives with regards to waste planning in the Mallala Council Development Plan are ensuring that: • The development avoids the production of waste, minimises the production of waste, reuses waste, recycles waste for reuse, treats waste and disposes of waste in an environmentally sound manner. • The development includes the treatment and management of solid and liquid waste to prevent undesired impacts on the environment including, soil, plant and animal biodiversity, human health, and the amenity of the locality.

3 PRINCIPLES GUIDING WASTE MANAGEMENT

The objective for waste management across the Project is to prioritise the prevention and minimisation of waste generation, followed by the effective management of wastes (storage, handling, transport and disposal) in a manner that minimises impact on the environment, while being cost effective.

The South Australian EPA waste management hierarchy has been adopted as the guiding framework for waste management of this Project, depicted in Figure 1.This hierarchy is one of the guiding principles in the South Australian Waste Strategy 2015- 2020 and is a key element for guiding waste management practices in South Australia. It is also the first *Principle of Development Control* under the waste section in the Mallala Council Development Plan.

Figure 1: Waste management hierarchy (Zero Waste SA)

A summary of the waste management hierarchy in application across the waste supply chain for this Project through construction and operational activity is provided in Figure 2.

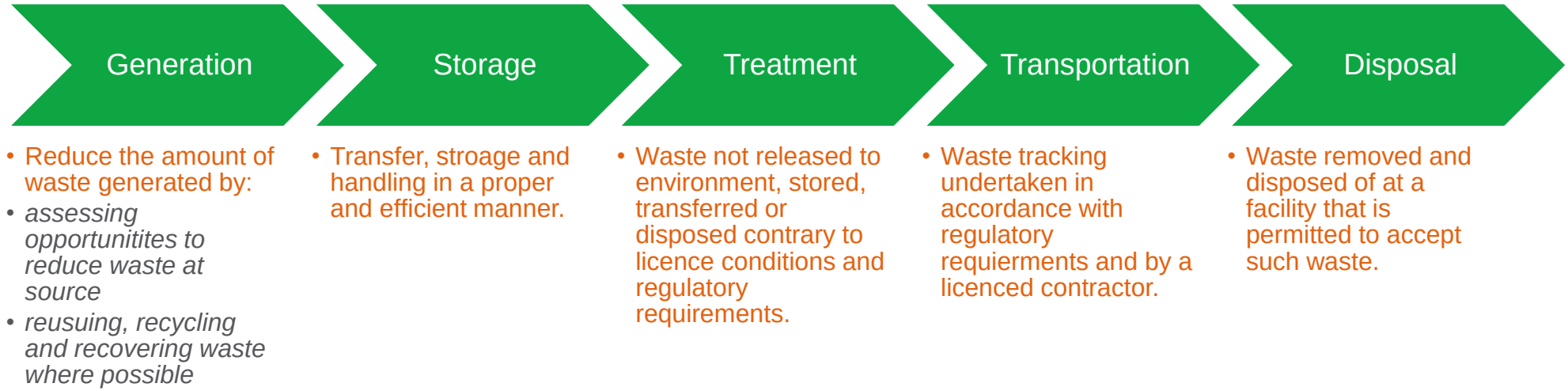


Figure 2: Waste management hierarchy across the waste supply chain

4 WASTE GENERATION AND DISPOSAL

The principal waste generating activities can be broadly classified as:

- Project construction activities,
- Activities incidental to construction and operation, such as operation of office facilities
- Operation of Project (the power station).

Waste types are broadly classified under three streams, Municipal Solid Waste (MSW) which are domestic sources of waste, Commercial and Industrial (C&I) which are wastes sourced from private company and industry operations, and Construction and Demolition (C&D) which are wastes sourced from building and demolition activity. The wastes generated from the Project will be classed under the C&D sector during construction and C&I sector during the operational phase.

To minimise the risk of harm from wastes generated, it is important that they are managed appropriately and that wastes are classified and disposed of accordingly. Where materials do not have suitable recovery avenues or treatment options, they may be disposed of to landfill, in accordance with their classification. Disposal to landfill should occur at suitably designed, constructed and authorised landfill facilities. The South Australian Guidelines outline the process for determining the waste classification and relevant disposal requirements based on risk. Waste classification is based first on determining the category of waste and whether there is a need for further assessment or treatment prior to disposal. The classification of wastes determines the appropriate landfill or facility that is suitable for receive the waste. Management of wastes generated involves consideration of the following separate aspects:

- Categorisation of the waste – This initial categorisation determines if testing of chemical substances is required to classify the waste, based on the nature and origin of the waste. Wastes can be categorised as either waste Category A or B initially, and C following classification.
- Classification of waste – this determines the treatment and disposal requirements and is required if Listed Wastes are produced to determine if the waste is Category B Level 1 or Level 2, or Category C. This involves testing and assessment of the total concentrations and leachate concentrations of chemical substances in the waste.
- Treatment and disposal options – Based on the categorisation and classification of the waste, the appropriate disposal avenue (based on landfill classes) can be determined. Where wastes are highly contaminated or hazardous, treatment options may need to be considered.

A summary of this system and framework is provided in Table 2 overleaf.

The specific waste generation streams that are expected to be generated across construction and operation activities are discussed in more detail below. Hazard level identification and details of the specific nature of the individual waste streams will be determined prior to construction and operation, with specific management procedures to be implemented, identified in the Construction Environment Management Plan (CEMP) and the Operational Environmental Management Plan (OEMP).

Table 2: Summary of categorisation and classification framework in South Australia

Category	Classification	Relevant Waste Types	General Disposal Requirements
A	General	• Commercial and Industrial Waste (General) • Construction and Demolition Waste (Inert) • Construction and Demolition Waste (Mixed) • Less than 100 tonnes of waste soil from a single non-domestic source provided: – It is not reasonably likely to contain Listed Waste at levels above natural background concentrations; and – It is not from a site where a potentially contaminating activity (PCA) has taken place, as prescribed in the *Environment Protection (Site Contamination) Regulations 2008.* – Compostable Organic Waste	Disposal to facilities authorised to receive the waste
	Special	• Asbestos-containing material including friable and non-friable asbestos • Non-domestic sources of CCA or creosote treated timber	• Obtain relevant approvals • Disposal to facilities approved to receive the waste • Implement specific management procedures.
B	Level 1 or Level 2	Listed C&I Wastes, which includes water treatment residues, sludges from surface coating, treatment plant residues, and filter cake from industrial waste treatment plants, and hydrocarbons/oils. Refer to Appendix 1 of the Guidelines or the EP Act for a full list of Listed Wastes.	• Classified according to concentrations of chemical substances as listed in the Guidelines (Level 1 or Level 2). Relevant total concentration and leachability tests undertaken. • Disposal to facilities authorised to receive the specifically classified waste. – Landfills with specifically designed cells to receive Level 1 and Level 2 wastes.
	Waste Fill Intermediate Waste Soil Low Level Contaminated Soil	More than 100 tonnes of waste soil from a single non-domestic source, or any amount of waste soil from a source that is likely to have contamination with Listed Waste above natural background concentrations or from a site where a potentially contaminated activity (PCA) has taken place.	
C	Hazardous Waste	Hazardous Waste is defined as any wastes listed in Schedule A, List 2 of the *National Environment Protection (Movement of controlled waste between States and Territories) Measure.*	No direct disposal to landfill.

Category	Classification	Relevant Waste Types	General Disposal Requirements
	High Level Contaminated Waste	Commercial and Industrial Waste (Listed) exceeding Level 2 classification	Treat and store or dispose after treatment as appropriate. Treated Category C wastes not exceeding Level 2 disposal criteria may be able to be disposed with written permission from the EPA.
	High Level Contaminated Soil	Waste soil exceeding Low Level Contaminated Soil classification	

4.1 Construction

The construction phase of the Project will involve some initial demolition works to remove the dwelling and outbuildings in the north-east corner of the subject site, followed by site preparation and earthworks, construction of civil and building structures, finishing works and landscaping. Potential streams that may be generated during the construction phase of the Project may include:

- Inert construction and demolition wastes – this may include the following:
  - Waste soils – testing will indicate whether soils excavated are waste fill, low level contaminated soil or intermediate soil, and this will dictate the level of treatment required and suitable disposal avenue.
  - Asbestos – traces of asbestos may be present in existing buildings which are to be demolished prior to construction.
  - Vegetation/green waste from clearing and grubbing
  - Surplus building material and packaging wastes from installation of temporary construction compounds.
  - Concrete, brick, timber and other construction and demolition material from construction activity.
- General residual waste – most residual and food wastes generated from ancillary facilities across the construction and operation phase will be general waste. Material will be source separated where possible, otherwise residual material will be disposed of at an appropriate landfill.
  - Temporary toilet and washing facilities will be serviced by pump-out tanker trucks, and transported for off-site disposal by a licensed contractor.
- General recyclable material - recyclable materials will be generated from ancillary facilities, and through packaging wastes from materials used across the operational phase.

The specific materials to be generated and their initial categorisation, subsequent classification (if required), and disposal avenue should be detailed in the waste management sub-plan of the CEMP the will be developed by the selected Engineering Procurement Construction (EPC) Contractor. From this initial review, the following are noted:

- Most wastes generated are likely to be Category A wastes (inert, mixed C&D wastes), which are not likely to require further classification and should be disposed of at facilities authorised to receive the waste type generated.
- Should any asbestos be found to be present at any of the existing sites, the relevant approvals and specific management procedures that would be detailed in the CEMP would be followed. The wastes should be disposed of at facilities authorised to receive asbestos.
- Should waste soils be excavated and there be potential risk that the soils have historical contamination with listed wastes above natural background concentrations (or there is history of Potentially contaminated activity (PCA) occurring on site), the soils will be Category B and need to be tested and classified accordingly, prior to determining the appropriate landfill for disposal.
  - A Phase 1 Preliminary Site Assessment has been undertaken and suggested that herbicides and pesticides associated with agricultural land use would be the most likely potential contaminant associated with soil at the subject site.
- No Category C (hazardous wastes or high level contaminated wastes/soils) are expected to be generated from the construction of the Project. However, a full risk-assessment should be undertaken prior to commencement of construction to re-evaluate and assess this.

4.2 Operation

The operation of the Project involves the production of electricity and waste produced during this phase will stem from ancillary and supporting infrastructure such as:

- Control and amenities building, which will include control room, meeting room, offices, kitchen and toilets)
- Wastewater treatment facilities which will include wastewater evaporation basin, and oil/water separator.
- Workshop / warehouse, which will include lubricant and oil storage facilities (including diesel fuel and oils), and waste storage areas. This area will be bunded according to the EPA guideline EPA 080/07.

The main wastes generated that will require special handling, will be used lubricating oil and coolant. A summary of the streams of waste that are likely to be generated across the operational phase of this project are provided in Table 3.

Table 3: Summary of waste generation across operational phase

Waste Generating Activity	Potential Wastes Generated
Workshop/warehouse	• Used lubricating oil and filters • Oily rags • Surplus chemicals
Wastewater treatment facilities	Wastewaters that might contain oil residues will be collected in a 18,000 m^2 evaporation pond will contain wastewater and allow for evaporation. No wastewater will be released off the site boundary. A wash water tank will contain wastewaters which will be periodically emptied by a 'sucker truck' for offsite disposal to an authorised facility by a licensed carrier.
Control and amenities building, which will include control room, meeting room, offices, kitchen and toilets)	• Residual waste • Recyclable waste (containers and paper/cardboard) • Used spill kit consumables Onsite toilet and washing facilities will be serviced through a connection to an onsite septic system given there is not sewer connection at the subject site.

The specific materials to be generated and their initial categorisation and subsequent classification (if required), and disposal avenue should be detailed in the waste sub-plan of the OEMP. From this initial review, the following are noted:

- Most wastes generated are likely to be Category A wastes (general C&I wastes), which are not likely to require further classification and should be disposed of at facilities authorised to receive the waste type generated.
- Waste oils are a Listed Waste and are Category B wastes and will need to be classified and disposed of at facilities authorised to receive waste oils.
- Generation of any other Listed Wastes will need to be considered prior to operations, to determine if classification and testing is required and to determine the appropriate facility where the waste can be disposed of.
- No Category C (hazardous wastes or high level contaminated wastes/soils) are expected to be generated from the operations of the Project. However, a full risk-assessment should be undertaken prior to commencement of operations to re-evaluate and assess this.

5 MANAGEMENT MEASURES

This Section outlines management measures to address the impacts of waste management during the construction and operational phases. Management measures should be guided by the principles as outlined in Section 3.

5.1 Construction

Measures to mitigate the effect of waste arising during construction of the facility would be incorporated into the CEMP prior to commencement of construction. A summary of the best-practice waste avoidance and waste management principles which should be considered across the detailed design phase and incorporated in the CEMP are presented in Table 4.

Table 4: Best-practice waste avoidance and management principles in construction

Best-practice principles	
Best-practice waste avoidance	**Avoidance** • Avoidance and reuse of material to have priority over recycling • Recycling to have priority over disposal • Waste generation to be minimised by ordering the correct quantity of materials • Coordinate and sequence trades-people to minimise waste • Selection of materials to maximise recycled content, while having low embodied water and energy use • Selection of materials to maximise durability and lifespan • Use of pre-fabricated materials where possible • Use modular construction to reduce waste where practical and feasible • Selection of landscaping which reduces green waste • Engagement with the supply chain to supply products and materials that use minimal packaging • Establishment of schemes with suppliers to ‘take back’ packaging materials. **Re-use** • If possible, construction and demolition waste products are to be crushed and re-used onsite, with the remainder sent to a recycling facility • Vegetation removed to either be preserved for use in the new development, or mulched for inclusion in erosion and sediment control or landscaping activities. The remainder to be sent to a composting facility. • Excavated earth to be used for infill and landscaping where feasible, the remainder to be sent to a recycling facility • Separation of off-cuts to facilitate re-use, re-sale and/or efficient recycling
Best-practice waste management principles	• All waste and recyclable streams shall be stored separately on site • All storage areas / containers for each waste and recycling stream shall be kept on the site at all times and shall be indicated on the site plans / drawings as part of the CEMP • Stockpiles will be maintained in accordance with the erosion and sedimentation control plan • Waste to be stored so as to avoid airborne litter, vermin and storm water pollution • Reprocessing, recycling and/or removal of waste materials for disposal should be scheduled to limit stockpiling and associated impacts • Appropriate signage will be used in the waste storage area to ensure correct separation of recyclables

Best-practice principles	
	• Convenient and safe vehicular access to waste and recycling material storage areas shall be provided • Selection of reputable waste removal contractors who will guarantee that recyclable material will be recycled and will provide any relevant certificates • The removal, handling and disposal of asbestos or other hazardous materials shall be carried out in accordance with South Australian EPA asbestos guideline *Wastes containing asbestos – removal, transport and the Code of Practice for the Safe Removal of Asbestos 2nd Edition.* • Putrescible materials to be removed from site as soon as possible to avoid odour impacts. Non-putrescible materials to be reprocessed or removed from site on an 'as-needs' basis to limit logistical, health and safety and dust impacts. Hazardous waste materials, should they arise, must be immediately removed to limit environmental and health and safety risks. • Waste materials to only be transported to their next destination using a licensed contractor • Waste materials to only be transported to an appropriately licensed facility for recycling or disposal • Records to be maintained on all waste exiting the construction site.

5.2 Operation

Measures to mitigate the effect of waste arising during operation of the facility would be incorporated into the OEMP prior to commencement of operations. This policy would include measures to encourage recycling behaviour and increase the diversion of waste into recycling streams.

For the ancillary activity areas, these would include requirements such as:

- Addressing waste management requirements and goals in staff inductions
- Providing staff access to documentation outlining the facility's waste management requirements
- Locating recycling bins in kitchen areas beside general waste bins to prevent contamination of recycling
- Positioning paper recycling bins close to printer / photocopying equipment
- Minimising general waste bins at desks but providing adequate container and paper recycling to encourage sorting of recyclables
- Providing adequate bin storage for the expected quantity of waste.

For the gas plant activity areas, these would include requirements such as:

- Minimising manual handling of processing waste generated
- Safe transfer of waste materials by trained personnel to allocated and clearly marked bunded and contained areas, with secure access.
- Appropriately licenced contractors engaged to transport material from the site to the end destination
- Identifying appropriate end destinations that are compliant with their EPA licence and can handle the waste streams generated
- Tracking of transfer of material to and from site and wastes generated
- Source separation of the various materials

Waste arising from maintenance would be dealt in part by the asset management strategy and the OEMP which should adhere to the waste hierarchy. Where feasible, from a safety and cost perspective, assets should be refurbished. If a replacement is required the maintenance contractor

would be responsible for ensuring any waste is recycled; if this is not possible arrangements for disposal at an appropriately licensed facility should be made.

Overall, the following mitigation and quality control measures would be incorporated into the OEMP:

- Waste management planning incorporating principles of the waste hierarchy
- Selection of materials used in operations with recycled content, low embodied energy and durability
- Appropriate areas shall be provided for the storage of waste and recyclable material
- Standard signage on how to use the waste management system and what materials are acceptable in the recycling will be posted in all waste collection and storage areas
- All waste shall be collected regularly and disposed of at licensed facilities
- An education program and on-going monitoring for training personnel to properly sort and transport waste into the right components and destinations.
- Ensuring there are spill kits in the workshop area in case of the occurrence of any spillage.
- Ongoing monitoring and evaluating against performance metrics identified in the OEMP.

6 CONCLUSIONS

A Waste Management Plan (WMP) has been developed for the Reeves Plains Power Station Project. This WMP has been developed following consideration of the criteria and requirements stipulated in the Environment Protection (Waste to Resources) Policy 2010 and the Mallala Council Development Plan (April 2016).

Potential waste streams that may be generated across the construction and operational phase have been identified, with potential mitigation measures aligned with the waste management hierarchy recommended. In summary:

- Construction Phase: Most wastes generated are likely to be Category A wastes (inert, mixed C&D wastes), which are not likely to require further classification and should be disposed of at facilities authorised to receive the waste type generated. Testing and classification of soils should be undertaken after consideration of the volume likely to be generated and sampling to determine whether the soils may contain any Listed Wastes.
- Operational Phase: Waste oils are a Listed Waste and as a Category B waste, will need to be classified and disposed of at facilities authorised to receive this waste type. Most other wastes generated are likely to be Category A wastes (general C&I wastes), which are not likely to require further classification and should be disposed of at facilities authorised to receive the waste type generated.

Hazard level identification and details of the specific nature of the individual waste streams will be determined prior to construction and operation, with specific management procedures to be implemented identified in the Construction Environment Management Plan (CEMP) and the Operational Environmental Management Plan (OEMP). Principles from the waste management hierarchy will be followed in developing the Plans.

APPENDIX L – BACKGROUND ECOLOGICAL REPORT

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BACKGROUND ECOLOGICAL REPORT

for

Arcadis

Reeves Plains Power Station, Reeves Plains

Version 3

Prepared by
Roger Playfair

Sept 6, 2017

CONTENTS

Executive Summary

The Reeves Plains Power Station Project involves the construction and operation of a gas fired power station and associated infrastructure approximately 50 km north of Adelaide.

A field assessment of the project site and the adjacent Day Road roadside was undertaken on 29 June, 2017 to assess compliance with the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999, and South Australian Native Vegetation (NV) Act 1991, National Parks and Wildlife (NPW) Act 1972 and Natural Resources Management (NRM) Act 2004.

The project area has been subject to long-term agricultural land use, which has involved historical clearance of the majority of the native vegetation on the site. The only remnants are in the house paddocks near the dwelling, a few trees around a disused dam on the western boundary, more recently used as a farm rubbish pit, and a small patch on the adjacent Day Road roadside. Within the project boundary, native understorey has been severely reduced through livestock grazing practices.

Proposed clearance within the project site is entirely within the area covered by open cultivated cereal cropping and pasture. No native vegetation is proposed for removal, and the majority of vegetation to be cleared consists of non-indigenous species originally planted for agricultural purposes.

As assessed against the provisions of the EPBC Act, NPW Act and NV Act, no impacts are expected to any populations of any flora and fauna species listed at State or National level. No referral under the EPBC Act is required. No specific actions are required with regard to the protection of any threatened species.

As assessed against the provisions of the NRM Act, there are minor occurrences of three Declared plants within the overall project area, and none within the construction zone. Care should be exercised during construction to ensure these species are not spread to other areas.

1. PROJECT DESCRIPTION

The Reeves Plains Power Station Project involves the construction and operation of a gas fired power station and associated infrastructure (the Project). The project proponent is Alinta Energy (Reeves Plains) Pty Limited (Alinta Energy). The power station will be located at 1629 Redbanks Road on a 41 ha greenfield site located in Reeves Plains, approximately 12 km south-east of Mallala and 50 km north of Adelaide.

The power station will operate as a 'peaker', providing electricity during periods of high demand, and is designed to generate up to 300 megawatts (MW) of power and will be delivered in two stages with up to 150MW installed initially with further build out as required by prevailing market conditions. The Project includes the following infrastructure:

- A gas receival station
- Up to six (6) dual fuel (gas and diesel) turbines each capable of generating 50MW of power
- Three (3) transformers designed to convert low voltage electricity into high voltage electricity
- Connection to the electricity network including a new substation, transmission tower and communications tower
- Water supply and storage including:
    - Water treatment plant
    - Water storage tanks
    - Firefighting system
- Evaporation pond
- Diesel storage

Also included within the Project are the following:

- Control rooms, workshop and maintenance facilities and administration building
- Security fencing and lighting
- Onsite drainage works
- Upgrade to the Redbanks Road and Day Road intersection and sealing of Day Road from Redbanks Road to the Project entrance
- Carparking for employees and contractors
- Demolition of existing buildings onsite
- Landscaping

The Project is required to obtain development consent from the State Commission Assessment Panel before proceeding. Construction of the Project is scheduled to commence in 2018 with operation of the power station occurring in Q1 2020 at the earliest.

Figure 1 Location of project area showing IBRA subregions

Figure 2 Location of project area

Figure 3 Proposed site layout

2. EXISTING ENVIRONMENT

SOILS and LANDSCAPE

Soil and landscape features are associated with the Mallala Environmental Association as defined by Laut *et al.* (1977) which is characterised by an undulating plain with occasional dunes used for rotational cereal cultivation and livestock grazing.

Generalised soil type is "La1" (Ashton & McKenzie, 2001), characterised by dark highly calcareous loamy earths (Gc1.11) with shallow forms of hard alkaline red soils (Dr2.23) and small areas of cracking brown clays (Ug5.3) interspersed with dune tracts of brown calcareous earths (Gc1.21) and brown sands (Uc5.11).

Land use in and around the surveyed area is mainly agricultural (mixed farming, cereal cropping and pastoralism), with grazing by sheep, cattle and horses on improved (non-native) pasture and rural living.

VEGETATION ASSOCIATIONS

The vegetation and habitat types that exist in the project area have been highly altered from their original botanical composition through many years of agricultural land use. Prior to European settlement, the area would have been covered with an open mallee vegetation type, generally dominated by *Eucalyptus porosa,* with occasional patches of *E. largiflorens* in the less well-drained areas. The native shrubby understorey that originally occurred beneath the tree canopy has now been replaced, and the majority of the plant species that exist now consist almost entirely of introduced grasses and herbs.

Along the road reserve areas bounding the project site, where long-term grazing has not taken place, there are some occasional remnants of a sparse native shrub layer, including *Senna artemisioides* ssp., *Enchylaena tomentosa* and *Maireana brevifolia*, but the ground layer is almost exclusively introduced species. Species lists are in Appendix A.

Plant Association 1

***Triticum aestivum* (wheat) Grassland** with no emergent shrubs or trees. This is not considered a Native Vegetation association under the Native Vegetation Act 1991.

Plant Association 2

***Eucalyptus largiflorens* (river box) Very Open Tall Woodland** over occasional chenopods, introduced grasses and herbs. This is considered Native Vegetation under the Native Vegetation Act 1991, though the understorey is very degraded.

Plant Association 3

Plantation of mixed introduced tree and shrub species over introduced grasses and herbs. This is not considered a Native Vegetation Association under the Native Vegetation Act 1991.

Field survey determined the extent of these vegetation associations within and adjacent to the project area, as shown in Figure 4.

Figure 4 Mapped Extent of Vegetation Associations (outlined in magenta) within the project area (outlined in red)

3. LEGISLATIVE REQUIREMENTS

Legislation that may be relevant to the project in relation to vegetation communities, and flora and fauna species and their habitat include:

- Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
- Native Vegetation Act 1991 (South Australia)
- National Parks and Wildlife Act 1972 (South Australia)
- Development Act 1993 (South Australia)
- Aboriginal Heritage Act 1988 (South Australia)
- Native Title Act 1993 (South Australia)
- Local Government Act 1999 (South Australia)
- Natural Resources Management Act 2004 (South Australia)

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) applies to any action which is likely to have a significant impact on a Matter of National Environmental Significance. There are seven matters of National Environmental Significance that act as "triggers" for the Commonwealth assessment and approval process. Matters potentially affecting vegetation include:

- World heritage properties
- Nationally Threatened Species and/or Ecological Communities
- Wetlands of international importance i.e. Ramsar Wetlands
- Migratory Species
- National Heritage Places

Approval may be required if species or places listed under the Act are affected. The species and places listed under the EPBC Act are listed on the Commonwealth Department of Environment and Energy internet site.

There are no "Matters of National Environmental Significance" that require referral under this Act.

Native Vegetation Act 1991

In South Australia, native vegetation is protected by the Native Vegetation Act 1991. The Act is administered by the Native Vegetation Council (NVC) with the support of the Native Vegetation Secretariat and the Native Vegetation Assessment Panel (NVAP).

The Act applies to the clearance of terrestrial and marine native vegetation in all areas of the State except defined parts of the Adelaide metropolitan area.

Clearance of Native Vegetation is prohibited unless approved by the Native Vegetation Council in accordance with Section 29 of the Act or undertaken in accordance with a Regulation under the Act.

Any native vegetation clearance associated with infrastructure developments such as the Reees Plains Power Station Prooject is covered by Regulation 12(34) (Native Vegetation Regulations, 2017) that requires that a significant environmental benefit must be achieved to compensate for the native vegetation to be cleared.

Further detail regarding compliance with the Native Vegetation Act is given in Sections 5 and 6.

National Parks and Wildlife Act 1972

The National Parks and Wildlife Act provides for the establishment and management of reserves for public benefit and enjoyment and provides for the conservation of wildlife in a natural environment. Schedules 7, 8 and 9 list flora and fauna species assigned "Rare", "Vulnerable" and "Endangered" status at State level, and the statute defines the conservation measures necessary for these species.

Further detail regarding compliance with the National Parks and Wildlife Act is given in Sections 5 and 6.

Development Act 1993

The Development Act 1993 requires that approval be sought prior to removing or damaging 'Regulated' trees (including 'Significant' trees) in an area subject to the Act or for any development that will affect a registered State Heritage Place. A State Heritage Place may include a garden or trees. Approval is required from the Development Assessment Commission (DAC).

The Development Act 1993 requirements with respect to 'Regulated' trees do not apply in the Adelaide Plains Council area.

Aboriginal Heritage Act 1988

Aboriginal sites, objects and remains are protected under the Aboriginal Heritage Act 1988. Section 23 of the Act makes it an offence to damage, disturb or interfere with any Aboriginal site, object or remains without the prior authority of the Minister for Aboriginal Affairs. Aboriginal "scarred trees" and "canoe trees", including dead trees, are sites of Aboriginal significance and therefore may not be pruned or removed without prior approval under this Act.

Cultural Heritage aspects of proposed development are covered in a separate assessment undertaken by Archaeological and Cultural Heritage consultants.

Native Title Act 1993

The main purpose of the Commonwealth Native Title Act 1993 is to recognise and protect native title. Native title comprises the rights and interests in land and waters that Aboriginal and Torres Strait Islanders have under their traditional laws and customs.

Cultural Heritage aspects of proposed development are covered in a separate assessment undertaken by Archaeological and Cultural Heritage consultants.

Local Government Act 1999

Within local government districts, management of public roads is vested in the local council. Alterations to public roads must be negotiated through the Local Government. Section 221 of the Local Government Act requires that a person without some other statutory authority (e.g. Section 26 notice) must not make an alteration to a public road unless authorised to do so by the council. This includes planting a tree or other vegetation, interfering with vegetation, or removing vegetation.

No vegetation removal is proposed for any areas of vegetation on ropadsides administered by Local Government. Other planning aspects of the proposed development are covered in a separate assessments undertaken by Planning consultants.

Natural Resources Management Act 2004

The Natural Resources Management Act 2004 promotes sustainable and integrated management of the State's natural resources, making provisions for the protection of the State's natural resources. This Act lists feral animals and noxious weeds and provides for their control. Chapter 8, Part 2, Division 1 outlines specific controls. Species that are "declared" in one of 3 categories by notice in the Gazette attract certain requirements or provisions for their control.

Further detail regarding compliance with the Natural Resources Management Act is given in Section 7.

4. METHODS

Following review of the background information and literature, a field survey of the site was undertaken between 9 am and 12 noon on 29 June, 2017 by Roger Playfair. This survey involved a general assessment of the site and identification of habitat for species of conservation significance.

An online search was undertaken for EPBC Act "Matters of Environmental Significance" and an interrogation of Department of Environment Water and Natural Resources (DEWNR) mapping and databases, and the Atlas of Living Australia (ALA 2017) was completed as background to the field assessment.

The project area (shown in red in Figure 4) was surveyed for:

- remnant and regrowth native vegetation
- introduced plant species
- habitat for all vertebrate faunal groups, especially native threatened species

Representative photographs of key features of the site were compiled and are presented in Appendix C.

All fauna observations, calls and evidence of presence were recorded as field notes. Bird species were recorded when heard calling, when observed within or adjacent to the site and when observed flying over the site. Evidence of bird species presence such as nests was also recorded when observed.

Due to the level of disturbance and lack of potentially suitable habitat, a comprehensive fauna survey was not considered warranted.

Data Limitations

Weather conditions preceding the survey period were cool and rainfall for the early winter below average. Many annual plant species, including orchids are not in evidence or easily detected during early winter.

Ambient air temperature was low and consequently bird and reptile activity was correspondingly low.

5. SOUTH AUSTRALIAN NATIVE VEGETATION ACT, 1991

Native vegetation should not be cleared if in the opinion of the Native Vegetation Council, it is likely to be considered seriously at variance with the following Principles of Clearance:

a) it comprises a high level of diversity of plant species;

b) it has significance as a habitat for wildlife;

c) it includes plants of a rare, vulnerable or endangered species;

d) the vegetation comprises the whole, or part, of a plant community that is rare, vulnerable or endangered;

e) it is significant as a remnant of vegetation in an area which has been extensively cleared;

f) it is growing in, or in association with, a wetland environment;

g) it contributes significantly to the amenity of the area in which it is growing or is situated;

h) other variance issues are likely to be highlighted by the NRM Board or the Local Government Council.

6. NATIVE VEGETATION CLEARANCE

Assessment was undertaken within the project area (Figure 4) of the Plant Associations with respect to listing under the Environment Protection and Biodiversity Conservation Act 1999, and the relevant Principles of Clearance under the Native Vegetation Act, 1991. Each of the Principles are discussed below.

Under the Native Vegetation Act, native vegetation should not be cleared if, in the opinion of the Native Vegetation Council –

a) It comprises a high level of diversity of plants;

The native vegetation associations in the overall project area are very poor remnants of the original vegetation in the area, the botanical composition having been severely altered and the diversity of native species severely depleted. A total of 10 indigenous plant species were recorded in the entire proposed project area, including the adjacent roadside (see Appendix A for species lists). This species count is considered to represent very low indigenous plant species diversity for the *Eucalyptus largiflorens* Very Open Tall Wooodland native plant association.

As the proposed clearance does not include any *Eucalyptus largiflorens* very open tall woodland, there will be no detrimental impacts on the species diversity of this plant association. Therefore, the proposed vegetation clearance is not considered to be seriously at variance with Principle (a).

b) It has significance as a habitat for wildlife;

The surveyed area has been highly disturbed through a long history of cultivationa and livestock grazing, and botanical composition has been significantly altered through preferential grazing and pasture improvement practices. The vegetation proposed for removal may provide suitable habitat for some fauna species, primarily common birds and reptiles. The vegetation clearance required to accommodate works will be of previously cleared, open cereal cropped land with very few, if any native plant species present, and no habitat for any of these species is likely to be affected.

An EPBC Protected Matters search was undertaken for the study area and the species of conservation concern that may be present if habitat is suitable are summarised in Tables 1 and 2. These include EPBC Act-listed species potentially present, as recorded in previous surveys, or suggested by the EPBC Act Protected Matters Search Tool (DoEE 2017). In the wider St. Vincent IBRA Subregion (EYB2), 18 fauna species are listed as Critically Endangered, 26 Endangered, 58 Vulnerable, and 97 Rare (Gillam and Urban, 2008).

It is highly unlikely that any of these threatened fauna species will be found in the degraded habitat provided by the open cropped area.

Table 1 Threatened Species potentially occurring near the surveyed area (EPBC Act database; DoEE 2017)

Fauna Type	Name	Conservation status*		Plant Association	Noted Y/N	Comments
		SA	EPBC			
Bird	*Botaurus poiciloptilus* Australasian Bittern	**V**	**E**	wetlands	N	In Australia, the species occurs from south–east Queensland to south–east South Australia, Tasmania and in the south–west of Western Australia. The Australasian Bittern's preferred habitat is wetlands with tall dense vegetation. No habitat occurs in or near the surveyed area (DoEE 2017). No suitable habitat.
Bird	*Calidris ferruginea* Curlew Sandpiper		**CE**	coastal and subcoastal areas	N	The breeding range of the Curlew Sandpiper is mainly restricted to the Arctic of northern Siberia. During the non-breeding period, they occur around the Australian coasts and are also quite widespread inland, though in smaller numbers. In South Australia, Curlew Sandpipers occur in widespread coastal and subcoastal areas east of Streaky Bay. Important sites include ICI and Price Saltfields, and The Coorong. Occasionally they occur in inland areas south of the Murray River and elsewhere. No suitable habitat.
Bird	*Grantiella picta* Painted Honeyeater	**R**	**V**	woodlands	N	The Painted Honeyeater is widespread, uncommon and nomadic throughout eastern Australia and is particularly attracted to mistletoe in woodland areas (DoEE 2017).The development site is on the south-western extremity of its known range, and it is very unlikely to be found.

Fauna Type	Name	Conservation status*		Plant Association	Noted Y/N	Comments
		SA	EPBC			
Bird	*Pedionomus torquatus* Plains-Wanderer	**E**	**CE**	grasslands	N	The primary 'stronghold' of the species is the Riverina region of south-western NSW. In South Australia, there have been recent records on the Willochra Plain north-east of Quorn, and in some adjacent areas of the southern Flinders Ranges, and north of the Barrier Highway (and west of Broken Hill) on Kalabity, Boolcoomatta and Mulyungarie Stations. The Plains-wanderer also irregularly occurs in the arid regions of northern South Australia during seasons of good rainfall Plains wanderers inhabit sparse native grasslands and are often absent from areas where grass becomes too dense or too sparse. No suitable habitat.
Bird	*Numenius madagascariensis* Eastern Curlew	**V**	**CE**	coastal and subcoastal areas	N	The eastern curlew takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflats. It is extremely shy and will take flight at the first sign of danger (DoEE 2017). No suitable habitat.
Bird	*Rostratula australis* Australian Painted Snipe		**V**	shallow inland wetlands	N	The Australian Painted Snipe is infrequently and irregularly recorded from throughout much of Australia, excluding Tasmania. The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum or canegrass or sometimes tea-tree, particularly shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. (DoEE 2017). No suitable habitat occurs in or near the surveyed area.
Mammal	*Pteropus poliocephalus* Grey-headed Flying-fox	**R**	**V**	coastal lowlands	N	The Grey-headed Flying-fox occurs in the coastal belt from Rockhampton in central Queensland to Melbourne. It sometimes ranges into South Australia (DoEE 2017). No suitable habitat in the proposed project area.

SA = South Australian National Parks & Wildlife Act 1972; EPBC = Commonwealth Environmental Protection & Biodiversity Conservation Act, 1999 **U** = Uncommon; **R** = Rare; **V** = Vulnerable; **E** = Endangered; **CE** = Critically Endangered

Table 2 Migratory and Marine birds potentially occurring near the surveyed area (EPBC Act database; DoEE 2017)

Species	EPBC Status	Comments
Hirundapus caudacutus White-throated Needletail	**Mi**	A visitor to South Australia from South-east Asia, mostly from October to April. It is almost exclusively aerial when present in Australia. The White-throated Needletail is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. Further south on the mainland, it is widespread in Victoria, though more so on and south of the Great Divide, and there are few records in western Victoria outside the Grampians and the South West. The species occurs in adjacent areas of south-eastern South Australia, where it extends west to the Mount Lofty Ranges and Yorke Peninsula (DoEE 2017). Species has very large foraging range and unlikely to be affected by the proposed development.
Merops ornatus Rainbow Bee-eater	**Mi**	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches (Higgins 1999). Southern populations spend non-breeding, winter season in the North of Australia. The Rainbow Bee-eater is currently considered to be a low priority for management. The population size and population trends have not been quantified, but the population size is assumed to be reasonably large, and there is little documented evidence of population declines (DoEE 2017). Species has large foraging range and unlikely to be affected by the proposed development.
Motacilla cinerea Grey Wagtail	**Mi**	This species has an extremely large range and the population trend appears to be stable. It breeds in the northern hemisphere and has been recorded in Queensland (DoEE 2017). Species has large foraging range and unlikely to be affected by the proposed development.
Motacilla flava Yellow Wagtail	**Mi**	This species breeds in the northern hemisphere and a few individuals are occasional visitors to northern Australia (DoEE 2017). Species has large foraging range and unlikely to be affected by the proposed development.
Myiagra cyanoleuca Satin Flycatcher	**Mi**	The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand. In South Australia, they are occasionally recorded, mostly in the lower south-east, occasionally as far north as Naracoorte. There have been six records at scattered sites in the area from Langhorne Creek, west to eastern Kangaroo Island and north to Sandy Creek. Satin Flycatchers are mainly recorded in eucalypt forests, especially wet sclerophyll forest (DoEE 2017). Suitable habitat is not available, and species is unlikely to be affected by the proposed development.
Apus pacificus Fork-tailed Swift	**Mi, Ma**	In South Australia, the Fork-tailed Swift is widespread from the Victorian border west to the Spencer Gulf. Only two records exist within 10 km of the surveyed area, from 1928 and 1963 (Historical Bird Atlas). Almost exclusively an aerial species and summer visitor (October-April) (DoEE 2017). Species has very large foraging range and unlikely to be affected by the proposed development.
Ardea alba White Egret	**Mi, Ma**	In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies, are located in near-coastal regions of the Northern Territory. Minor breeding sites are widely scattered across the species' distribution and include sites in western Cape York Peninsula, the central coast of Queensland, north and north-eastern NSW, south-eastern South Australia. No breeding sites known to occur in vicinity of study area. The White Egret has been reported feeding in a wide range of wetland habitats including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands (DoEE 2017). Very unlikely to occur in the project area.
Ardea ibis Cattle Egret	**Mi, Ma**	In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg (DoEE 2017). In South Australia breeding has been recorded around Lakes Albert-Alexandrina (Marchant & Higgins 1990). No breeding sites known to occur in vicinity of study area. May forage in coastal areas, tidal flats and salt fields. Very unlikely to occur in the project area.
Gallinago hardwickii Latham's Snipe, Japanese Snipe	**Mi, Ma**	Breeding in Japan and adjacent parts of Siberia this species forages in freshwater wetlands on inland, upland and coastal plains, preferring soft moist ground or shallow flooded areas (DoEE 2017). No Australian sites have been identified as internationally important (DEH 2005). Very unlikely to be found in the project area.

Most of the migratory birds listed above are shorebirds and waterbirds that generally inhabit tidal mudflats, estuaries, sandy and rocky beaches, saltfields, samphire swamps, sewage ponds and mangroves, though some species have preferential habitat types (Pizzey and Knight 1997, Marchant and Higgins 1993). Suitable habitat for these waders and deep water feeders exists in coastal areas of Gulf St. Vincent, 20 km to the west.

Marchant and Higgins (1993) suggest that there are no immediate threats to their survival. The development within terrestrial vegetation in open agricultural land is unlikely to directly affect birds that frequent coastal wetlands, sand flats or those that feed over the open water. Migratory marine or terrestrial birds including the Fork-tailed Swift (*Apus pacificus*), Rainbow Bee-eater (*Merops ornatus*), White Egret (*Ardea alba*), Cattle Egret (*Ardea ibis*) may occasionally fly over the area, but the potentially impacted area provides no foraging or nesting habitat for any of them.

There are a small number of large well-established *Eucalyptus largiflorens* along Day Road, and in a sparse patch near the existing dwelling and outbuildings. Some of these trees contain hollows that potentially may be used by a variety of native parrots, possums or gliders. None of the trees with hollows are proposed for removal.

The proposed vegetation clearance is not considered to be at variance with Principle (b).

c) It includes plants of a rare, vulnerable or endangered species;

No species listed under the EPBC Act 1999 or in Schedules 7 (endangered), 8 (vulnerable) and 9 (rare) of the National Parks and Wildlife Act, 1972 have been noted in surveys conducted at or near the site.

Species	**Conservation status***		**Noted Yes/No**	**Comments**
	SA	**EPBC**		
Caladenia (Arachnorchis) macroclavia Large-club Spider-orchid	**E**	**E**	N	This is part of the *Arachnorchis dilatata* complex and previously included under that name. Distribution is unsure in South Australia. It occurs in the South East, Murraylands, Northern Lofty region and Flinders Ranges, perhaps on Kangaroo Island. Habitat is dry woodland, low scrub and about rock outcrops in a variety of soil types. The remaining populations are threatened by weed invasions, browsing by introduced and native herbivores and human interference (Bates 2011). Given the level of human and weed influences in the project area, this species is unlikely to occur.
Caladenia (Arachnorchis) tensa Greencomb Spider Orchid	**n/a**	**E**	N	This is part of the *Arachnorchis dilatata* complex and previously included under that name. Distribution is unsure in South Australia. It is probably not on Eyre Peninsula but certainly in the South East, Murraylands, Northern Lofty region and Flinders Ranges, and perhaps on Kangaroo Island. Habitat is dry woodland, low scrub and about rock outcrops in a variety of soil types. The remaining populations are threatened by weed invasions, browsing by introduced and native herbivores and human interference (Bates 2011). Given the level of human and weed influences in the project area, this species is unlikely to occur.
Oligochaetochilus (Pterostylis) lepidus (Pterostylis sp. Halbury (R.Bates)) Halbury Greenhood	**E**	**E**	N	Previously included in *Pterostylis boormanii* this species is Endemic to South Australia and restricted to the Adelaide Plains as far north as Snowtown (Bates 2011). The Halbury Greenhood is thought to only occur in two small locations in South Australia: in the Halbury Parklands (90 km north of Adelaide) in an area of about 1 km^2; and near Moonta. Very unlikely to occur in the project area.
*SA = South Australia; **U** = Uncommon; **R** = Rare; **V** = Vulnerable; **E** = Endangered; **CE** = Critically Endangered Note - if species is listed on the Commonwealth EPBC Act, 1999, then that Act will apply				

In the wider St Vincent IBRA Subregion (EYB2), 49 flora species are listed as Critically Endangered, 68 Endangered, 98 Vulnerable, and 172 Rare (Gillam and Urban, 2008). It is highly unlikely that any of these species will be found in the degraded habitat dominated by exotic species provided by the cropped project area, and no habitat for any of these species is likely to be affected.

None of the plants listed above occur within or near the project site and the proposed vegetation clearance is therefore not considered to be seriously at variance with Principle (c).

d) The vegetation comprises the whole, or a part, of a plant community that is rare, vulnerable or endangered;

None of the plant associations occurring at the project area are considered threatened on a National, State, or regional level, according to Neagle (1995) and DEH (2005). All plant associations are common in the region, highly altered from their original state and are considered to be adequately conserved in the State and region. Clearance will not impact a listed rare, vulnerable or endangered plant community, therefore the vegetation clearance is not considered to be seriously at variance with Principle (d).

e) It is significant as a remnant of vegetation in an area which has been extensively cleared;

The project area is in the Hundred of Grace and the Mallala (4.6.6) Environmental Association (Laut *et al.* 1977), which in 2002, were estimated to retain 1.6% and 3.2% respectively of their original native vegetation cover.[1]

The proposed clearance will only affect non-native vegetation, and is therefore not considered to be seriously at variance with Principle (e).

f) It is growing in, or in association with, a wetland environment;

The site is not near a Ramsar wetland or a wetland of State, regional or local significance.

Clearance of vegetation within the project area is therefore not considered to be seriously at variance with Principle (f).

g) It contributes significantly to the amenity of the area in which it is growing or is situated;

The proposed clearance per se will not affect the current level of visual amenity, however, once developed, the site is going to be visually significantly altered.

Clearance of vegetation in the project area is therefore not considered to be seriously at variance with Principle (g).

7. DECLARED[2] AND/OR ENVIRONMENTAL WEEDS

The main potential problem plants, declared and environmental weeds (see Appendix A for a more complete list) noted within the project area are listed in the table below.

	Scientific Name	Common Name	Comments
**	*Arctotheca calendula*	Capeweed	Common around edge of cultivated area
**	*Asphodelus fistulosus*	Onion Weed	Occasional around edge of cultivated area
**	*Avena barbata*	Bearded oat	Common around edge of cultivated area
**	*Brassica tournefortii*	Wild turnip	Common around edge of cultivated area
**	*Bromus diandrus*	Great Brome	Common around edge of cultivated area
+	*Echium plantagineum*	Salvation Jane	Occasional around edge of cultivated area
+	*Lycium ferrocissimum*	African Boxthorn	Individual plants around house
**	*Malva parviflora*	Marshmallow	Common around house and house padddocks
+	*Marrubium vulgare*	Horehound	Occasional around house and house padddocks
**	*Medicago polymorpha*	Burr-medic	Common throughout
**	*Oxalis pes-caprae*	Soursob	Common around house and house padddocks
**	*Polygonum aviculare*	Wireweed	Common around house and house padddocks
**	*Vicia sativa*	Common vetch	Common around house and house padddocks

\+ Plants that are declared under the Natural Resources Management Act 2004

** Plants that are considered aggressive or very aggressive environmental weeds (Appendix B)

Construction will not be undertaken in areas that support populations or individuals of Declared species, however, care should be exercised during construction to ensure these species are not spread to other areas.

[1] *Department of Environment and Heritage, SA, Updated December 2002*

[2] *Natural Resources Management Act 2004*

8. IMPACT OF PROPOSED WORKS

Direct Impacts

Vegetation

Removal of a total of approximately 9 hectares of non-native vegetation is proposed in the cereal cropped area.

Fauna

The cereal cropped area is regularly disturbed by cultivation and removal of the temporary vegetation cover will not affect any significant native fauna habitat.

Indirect Impacts

Removal of covering vegetation has the potential to:

- Provide a disturbed area with microclimate that favours colonisation by vigorous invasive species,
- Destabilise soil surface leading to locally increased soil erosion.

Implementation of vehicle hygiene measures and runoff control through a comprehensive Construction Environment Managent Plan should minimise these indirect impacts.

9. DISCUSSION AND CONCLUSIONS

The project area has been subject to long-term agricultural land use, which has involved historical clearance of the majority of the native vegetation on the site. The only remnants are in the house paddocks near the dwelling, a few trees around a disused dam on the western boundary, more recently used as a farm rubbish pit, and a small patch on the adjacent Day Road roadside. Within the project boundary, native understorey has been severely reduced through livestock grazing practices.

Within the overall project area, and the adjacent roadside, the dominant biological feature is the sparse large well-established old river box trees, remnants of a much more biologically diverse environment before long-term agricultural use brought about the removal of most of the native understorey and its replacement with introduced pasture grasses and herbs. These trees are all mature, many senescent, and generally in poor health. The potentially high biological value of these large trees as nesting, foraging and roosting sites has been further diminished through soil compaction, bark removal and nutrient status changes brought about by long-term pastoral land use. There is no evidence of regeneration of these tree species in any part of the project area. No vegetation removal is proposed in this vegetation association.

The proposal involves the removal of approximately 9 ha. of non-indigenous, annual and herbaceous vegetation in a part of the project area currently used for cereal cropping. No vegetation removal is proposed in other vegetation associations.

The proposed clearance is not considered to be native vegetation as defined by the Native Vegetation Act, and provisions for native vegetation protection are not applicable.

This project was assessed against the provisions of the Commonwealth Environment Protection and Biodiversity Conservation Act, State National Parks and Wildlife Act and State Native Vegetation Act, and no impacts are expected to any populations of any flora and fauna species listed at State or National level.

Every effort should be made to minimise the overall disturbance to vegetation outside the extent of works areas.

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APPENDICES

A – Species lists

B – Aggressive Weeds

C – Site Photographs

APPENDIX A

Plant Species List from site visit June, 2017 (Taxonomy after Barker et al. 2005)

* introduced species

R – outside project area on eastern roadside, Day Road

Family/Scientific Name	**Common Name**	**Assoc 1**	**Assoc 2**	**Assoc 3**
ANACARDIACEAE				
**Schinus molle*	Pepper-tree	✓		
BORAGINACEAE				
**Echium plantagineum*	Salvation Jane	✓	✓	✓
CHENOPODIACEAE				
**Chenopodium album*	Fat Hen		✓	✓
Enchylaena tomentosa var.	Ruby Saltbush		**R**	
Rhagodia parabolica	Mealy Saltbush		**R**	
Salsola australis	Buckbush	✓	✓	✓
COMPOSITAE				
**Arctotheca calendula*	Cape Weed	✓		✓
**Centaurea calcitrapa*	Star Thistle		**R**	
CRUCIFERAE				
**Brassica tournefortii*	Wild Turnip	✓	✓	✓
**Carrichtera annua*	Ward's Weed	✓	✓	✓
**Cruciferae sp.*	Cress Family		**R**	
GRAMINEAE				
Austrostipa sp.	Spear-grass		**R**	
**Avena barbata*	Bearded Oat	✓	✓	✓
**Bromus diandrus*	Great Brome		✓	✓
**Eragrostis minor*	Small Stink-grass	✓		✓
**Gramineae sp.*	Grass Family	✓		✓
**Panicum capillare var. brevifolium*	Witch-grass		✓	✓
**Piptatherum miliaceum*	Rice Millet		**R**	
**Triticum aestivum*	Wheat	✓		
LABIATAE				
**Marrubium vulgare*	Horehound	✓	✓	✓
**Salvia verbenaca var.*	Wild Sage	✓	✓	✓
Teucrium racemosum	Grey Germander		**R**	
LEGUMINOSAE				
Acacia oswaldii	Umbrella Wattle		**R**	
**Acacia sp.*	Wattle			✓
**Ceratonia siliqua*	Carob			✓
**Medicago polymorpha*	Burr-medic	✓		✓
Senna artemisioides ssp. artemisioides	Silver Senna		**R**	
**Vicia sativa ssp.*	Common Vetch	✓	✓	✓
LILIACEAE				
**Asphodelus fistulosus*	Onion Weed	✓	✓	✓
MALVACEAE				

Family/Scientific Name	**Common Name**	**Assoc 1**	**Assoc 2**	**Assoc 3**
**Malva parviflora*	Small-flower Marshmallow	✓	✓	✓
MELIACEAE				
**Melia azedarach*	White Cedar			✓
MYOPORACEAE				
Eremophila longifolia	Weeping Emubush		**R**	
MYRTACEAE				
**Eucalyptus cladocalyx ssp.*	Sugar Gum			✓
Eucalyptus largiflorens	River Box		✓	
**Eucalyptus sp.*				✓
OXALIDACEAE				
**Oxalis pes-caprae*	Soursob	✓	✓	✓
PINACEAE				
**Pinus halepensis*	Aleppo Pine			✓
POLYGONACEAE				
**Pokygonum aviculare*	Wireweed	✓		✓
SOLANACEAE				
**Lycium ferocissimum*	African Boxthorn		✓	✓
TAMARICACEAE				
**Tamarix aphylla*	Athel Pine			✓
ZYGOPHYLLACEAE				
Nitraria billardierei	Nitre-bush		**R**	

Historical Fauna Species Lists – from Living Atlas of Australia (http://www.ala.org.au/ accessed 1 July 2017)

Mammal species recorded within 5 km (Taxonomy after Robinson et al. 2000)

Species	Common Name
Chalinolobus gouldii	Gould's Wattled Bat
Lepus capensis	Brown Hare

Reptile species recorded within 5 km (Taxonomy after Hutchinson 2010a)

Species	Common Name
Hemiergis decresiensis	Three-toed Earless Skink
Lerista bougainvillii	South-eastern Slider
Lerista frosti	Centralian Slider
Menetia greyii	Common Dwarf Skink
Morethia adelaidensis	Adelaide Snake-eye
Tiliqua rugosa	Sleepy Lizard

Amphibian species recorded within 5 km (Taxonomy after Hutchinson 2010b)

Species	Common Name
Crinia signifera	Common Eastern Froglet
Limnodynastes tasmaniensis	Spotted Marsh Frog

Bird species recorded within 5 km (Taxonomy after Christidis & Boles, 2008)

Species	Common Name
Tachybaptus novaehollandiae	Australasian Grebe
Anas gracilis	Australasian Grey Teal
Anthus novaeseelandiae	Australasian Pipit
Accipiter fasciatus	Australian Goshawk
Falco longipennis	Australian hobby
Falco cenchroides	Australian Kestrel
Cracticus tibicen	Australian Magpie
Aegotheles cristatus	Australian Owlet-nightjar
Vanellus tricolor	Banded Lapwing
Falco subniger	Black Falcon
Milvus migrans	Black Kite
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Elanus axillaris	Black-shouldered Kite
Northiella haematogaster	Blue Bonnet
Egretta novaehollandiae	Blue Crane
Falco berigora	Brown Falcon
Cincloramphus cruralis	Brown Songlark
Accipiter cirrocephalus	Chicken-hawk
Phaps chalcoptera	Common Bronzewing
Anas platyrhynchos	Common Mallard
Sturnus vulgaris	Common Starling
Ocyphaps lophotes	Crested Pigeon
Platycercus elegans	Crimson Rosella
Artamus cyanopterus	Dusky Woodswallow

Species	Common Name
Tyto javanica	Eastern Barn Owl
Alauda arvensis	Eurasian Skylark
Eolophus roseicapillus	Galah
Rhipidura albiscapa	Grey fantail
Colluricincla harmonica	Grey Shrike-thrush
Melanodryas cucullata	Hooded Robin
Chrysococcyx basalis	Horsfield's Bronze-cuckoo
Mirafra javanica	Horsfield's Bushlark
Passer domesticus	House Sparrow
Corvus mellori	Little Raven
Grallina cyanoleuca	Magpie-lark
Vanellus miles	Masked Lapwing
Dicaeum hirundinaceum	Mistletoebird
Glossopsitta concinna	Musk Lorikeet
Manorina melanocephala	Noisy Miner
Anas superciliosa	Pacific black duck
Cacomantis pallidus	Pallid Cuckoo
Falco peregrinus	Peregrine Falcon
Phalacrocorax varius	Pied Cormorant
Parvipsitta porphyrocephala	Purple-crowned Lorikeet
Lichenostomus cratitius	Purple-gaped Honeyeater
Merops ornatus	Rainbow Bee-eater
Anthochaera carunculata	Red Wattlebird
Todiramphus pyrrhopygius	Red-backed Kingfisher
Petroica goodenovii	Red-capped Robin
Psephotus haematonotus	Red-rumped Parrot
Columba livia	Rock Dove
Cincloramphus mathewsi	Rufous Songlark
Zosterops lateralis	Silvereye
Gavicalis virescens	Singing Honeyeater
Ninox novaeseelandiae	Southern Boobook
Acanthagenys rufogularis	Spiny-cheeked Honeyeater
Streptopelia chinensis	Spotted Dove
Circus assimilis	Spotted Harrier
Pardalotus punctatus	Spotted Pardalote
Pardalotus striatus	Striated Pardalote
Coturnix pectoralis	Stubble Quail
Podargus strigoides	Tawny Frogmouth
Petrochelidon nigricans	Tree Martin
Aquila audax	Wedge-tailed Eagle
Smicrornis brevirostris	Weebill
Hirundo neoxena	Welcome Swallow
Haliastur sphenurus	Whistling Kite
Cheramoeca leucosterna	White-backed Swallow

Species	Common Name
Pomatostomus superciliosus	White-browed Babbler
Artamus superciliosus	White-browed Woodswallow
Epthianura albifrons	White-fronted Chat
Ptilotula penicillata	White-plumed Honeyeater
Lalage sueurii	White-winged Triller
Rhipidura leucophrys	Willie Wagtail
Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Manorina flavigula	Yellow-throated Miner
Taeniopygia guttata	Zebra Finch

APPENDIX B

Aggressive Weeds

There are many more species that could be on this list that are most likely to be non-aggressive. It is intended as a guide for the most common weeds. Aggressiveness based on species ability to invade areas of native vegetation and difficulty of eradication once established (adapted from Croft *et al.* 2004). Some plants are declared (D) under the Natural Resources Management Act 2004. Shaded species are those recorded at the surveyed site.

Very aggressive (***) – Highly invasive in either disturbed or intact native vegetation. Spreads rapidly producing very dense stands and a blanket cover. Potential to eliminate native understorey species. Very difficult to control.

Aggressive (**) – Invasive in intact native vegetation with moderate potential to reduce native species diversity. Once present, will persist and threaten native plant diversity. May produce dense stands, but can be controlled with sustained effort.

Non-aggressive (*) – generally only invade disturbed areas. Often widespread and abundant but not considered a serious threat to biodiversity unless present at very high densities.

	FAMILY	GENUS	SPECIES	COMMON NAME
**	LEGUMINOSAE	*Acacia*	*baileyana*	Cootamundra Wattle
**	LEGUMINOSAE	*Acacia*	*saligna*	Golden wreath wattle
**	LILIACEAE	*Allium*	*triquetrum*	Three-cornered garlic (D)
**	AMARANTHACEAE	*Amaranthus*	*retroflexus*	Red-root amaranth
**	BORAGINACEAE	*Amsinckia*	*intermedia*	Yellow burrweed (D)
**	PRIMULACEAE	*Anagallis*	*arvensis*	Scarlet pimpernel
**	COMPOSITAE	*Arctotheca*	*calendula*	Capeweed
***	LILIACEAE	*Asparagus*	*declinatus*	Bridal veil (D)
***	LILIACEAE	*Asparagus*	*asparagoides*	Bridal creeper (D)
**	GRAMINEAE	*Avena*	*barbata*	Bearded oat
**	GRAMINEAE	*Avena*	*fatua*	Wild oat
**	CRUCIFERAE	*Brassica*	*tournefortii*	Long-fruited wild turnip
**	GRAMINEAE	*Briza*	*minor*	Shivery grass
**	GRAMINEAE	*Bromus*	*diandrus*	Jabbers
**	GRAMINEAE	*Bromus*	*catharticus*	Prairie grass
**	GRAMINEAE	*Bromus*	*rubens*	Red brome
**	BORAGINACEAE	*Buglossoides*	*arvensis*	Sheepweed
*	CANNABACEAE	*Cannabis*	*sativa*	Indian hemp, marijuana
**	CRUCIFERAE	*Capsella*	*bursapastoris*	Shepherds purse
**	COMPOSITAE	*Carduus*	*tenuiflorus*	Slender thistle (D)
*	CRUCIFERAE	*Carrichtera*	*annua*	Wards weed
**	COMPOSITAE	*Carthamus*	*lanatus*	Saffron thistle
**	GRAMINEAE	*Cenchrus*	*ciliaris*	Buffel grass
**	GRAMINEAE	*Cenchrus*	*longispinus*	Innocent weed (D)
**	COMPOSITAE	*Centaurea*	*melitensis*	Maltese cockspur
**	COMPOSITAE	*Centaurea*	*calcitrapa*	Star thistle (D)
*	CHENOPODIACEAE	*Chenopodium*	*album*	Fat hen
**	GRAMINEAE	*Chloris*	*virgata*	Feathertop Rhodes
**	GRAMINEAE	*Chloris*	*gayana*	Rhodes grass
**	COMPOSITAE	*Chondrilla*	*juncea*	Skeleton weed (D)
***	COMPOSITAE	*Chrysanthemoides*	*monilifera*	Boneseed (D)
**	COMPOSITAE	*Cichorium*	*intybus*	Chicory
**	COMPOSITAE	*Cirsium*	*vulgare*	Spear thistle
*	CUCURBITACEAE	*Citrullus*	*lanatus*	Bitter melon
**	CONVOLVULACEAE	*Convolvulus*	*arvensis*	Field bindweed
*	RUBIACEAE	*Coprosma*	*repens*	New Zealand Mirror-bush

	FAMILY	GENUS	SPECIES	COMMON NAME
**	ROSACEAE	*Cotoneaster*	sp.	Cotoneaster
*	ROSACEAE	*Crataegus*	*monogyna*	Hawthorn (D)
**	CUCURBITACEAE	*Cucumis*	*myriocarpus*	Paddy melon
**	GRAMINEAE	*Cynodon*	*dactylon*	Couch-grass
***	LEGUMINOSAE	*Cytisus*	*scoparius*	Scotch broom (D)
**	GRAMINEAE	*Dactylis*	*glomerata*	Cocksfoot
**	CRUCIFERAE	*Diplotaxis*	*tenuifolia*	Lincoln weed (D)
***	ORCHIDACEAE	*Disa*	*bracteata*	Brown finger orchid
*	COMPOSITAE	*Dittrichia*	*graveolens*	Stinkwort
**	CUCURBITACEAE	*Ecballium*	*elaterium*	Squirting cucumber
**	BORAGINACEAE	*Echium*	*plantagineum*	Salvation Jane (D)
**	GRAMINEAE	*Ehrharta*	*longiflora*	Annual veldt grass
**	GRAMINEAE	*Ehrharta*	*calycina*	Perennial veldt grass
**	POLYGONACEAE	*Emex*	*australis*	Three-cornered Jack (D)
***	ERICACEAE	*Erica*	*lusitanica*	Portuguese heath
***	ERICACEAE	*Erica*	*arborea*	Tree heath
**	GERANIACEAE	*Erodium*	*cicutarium*	Common storks bill
**	GERANIACEAE	*Erodium*	*botrys*	Long storks bill
**	EUPHORBIACEAE	*Euphorbia*	*paralias*	Coast spurge
**	EUPHORBIACEAE	*Euphorbia*	*terracina*	False caper (D)
**	UMBELLIFERAE	*Foeniculum*	*vulgare*	Fennel
*	OLEACEAE	*Fraxinus*	*rotundifolia*	Desert ash
**	IRIDACEAE	*Freesia*	*hybrid*	Freesia
***	FUMARIACEAE	*Fumaria*	*densiflora*	Dense-flowered fumitory
***	FUMARIACEAE	*Fumaria*	*parviflora*	Small-flowered fumitory
**	COMPOSITAE	*Galenia*	*pubescens*	Carpet weed
**	RUBIACEAE	*Galium*	*aparine*	Cleavers
**	COMPOSITAE	*Gazania*	*rigens*	Gazania
***	LEGUMINOSAE	*Genista*	*monspessulana*	Cape broom (D)
***	ARALIACEAE	*Hedera*	*helix*	English ivy
**	BORAGINACEAE	*Heliotropium*	*europaeum*	Heliotrope
**	CRUCIFERAE	*Hirschfeldia*	*incana*	Buchan weed (D)
*	GRAMINEAE	*Holcus*	*lanatus*	Yorkshire fog
**	GUTTIFERAE	*Hypericum*	*perforatum*	St Johns wort
*	COMPOSITAE	*Hypochaeris*	*radicata*	Deep-rooted cats ear
*	IRIDACEAE	*Iris*	*unguicularis*	Winter flowering iris
*	JUNCACEAE	*Juncus*	*bufonius*	Toad rush
**	COMPOSITAE	*Lactuca*	*serriola*	Prickly lettuce
**	CRUCIFERAE	*Lepidium*	*africanum*	Peppercress
**	MYRTACEAE	*Leptospermum*	*laevigatum*	Coast Tea-tree
**	LIMONIACEAE	*Limonium*	*lobatum*	Winged sea-lavender
**	GRAMINEAE	*Lolium*	*rigidum*	Annual ryegrass
**	GRAMINEAE	*Lolium*	*perenne*	Perennial ryegrass
**	SOLANACEAE	*Lycium*	*ferocissimum*	African boxthorn (D)
**	MALVACEAE	*Malva*	*parviflora*	Marshmallow
**	LABIATAE	*Marrubium*	*vulgare*	Horehound (D)
**	LEGUMINOSAE	*Medicago*	*truncatula*	Barrel medic
**	LEGUMINOSAE	*Medicago*	*polymorpha*	Burr-medic
**	LEGUMINOSAE	*Medicago*	*sativa*	Lucerne, alfalfa
**	LEGUMINOSAE	*Medicago*	*minima* var *minima*	Woolly burr-medic
**	LEGUMINOSAE	*Melilotus*	*indica*	King Island melilot
**	AIZOACEAE	*Mesembryanthemum*	*crystallinum*	Ice plant
**	IRIDACEAE	*Moraea*	*flaccida*	One-leaved Cape tulip (D)
**	IRIDACEAE	*Moraea*	*miniata*	Two-leaved Cape tulip (D)
*	ONAGRACEAE	*Oenothera*	*stricta* ssp *stricta*	Evening-primrose
***	OLEACEAE	*Olea*	*europaea*	Olive (D)
*	CRUCIFERAE	*Oncosiphon*	*suffruticosum*	Calomba daisy (D)

	FAMILY	GENUS	SPECIES	COMMON NAME
**	COMPOSITAE	*Onopordum*	*acaulon*	Stemless thistle
***	OXALIDACEAE	*Oxalis*	*pes-caprae*	Soursob (D)
**	COMPOSITAE	*Asteriscus*	*spinosa*	Golden Pallenis
**	GRAMINEAE	*Panicum*	*capillare*	Witchgrass
*	PAPAVERACEAE	*Papaver*	*dubium*	Long-headed poppy
*	PAPAVERACEAE	*Papaver*	*hybridum*	Rough poppy
**	GRAMINEAE	*Paspalum*	*distichum*	Water couch
**	GRAMINEAE	*Pennisetum*	*villosum*	Feathertop grass
**	GRAMINEAE	*Pennisetum*	*clandestinum*	Kikuyu
**	GRAMINEAE	*Phalaris*	*aquatica*	Phalaris
**	PINACEAE	*Pinus*	*radiata*	Radiata pine
**	GRAMINEAE	*Piptatherum*	*miliaceum*	Rice millet
*	PITTOSPORACEAE	*Pittosporum*	*undulatum*	Sweet pittosporum
*	PLANTAGINACEAE	*Plantago*	*coronopus*	Bucks-horn plantain
**	PLANTAGINACEAE	*Plantago*	*lanceolata* var *lanceolata*	Ribgrass
**	POLYGALACEAE	*Polygala*	*myrtifolia*	Myrtle-leaved milkwort
**	POLYGONACEAE	*Polygonum*	*aviculare*	Wireweed
**	CRUCIFERAE	*Raphanus*	*raphanistrum*	Wild radish
**	CRUCIFERAE	*Rapistrum*	*rugosum* ssp *rugosum*	Short-fruited wild turnip
**	RESEDACEAE	*Reseda*	*lutea*	Cutleaf mignonette (D)
**	RHAMNACEAE	*Rhamnus*	*alaternus*	Blowfly bush
**	EUPHORBIACEAE	*Ricinus*	*communis*	Castor Oil Plant
**	IRIDACEAE	*Romulea*	*rosea* var *australis*	Guildford grass
**	IRIDACEAE	*Romulea*	*minutiflora*	Lesser Guildford grass
**	ROSACAE	*Rosa*	*rubiginosa*	Sweet briar (D)
**	ROSACAE	*Rosa*	*canina*	Dog rose (D)
***	ROSACEAE	*Rubus*	sp.	Blackberry (D)
**	POLYGONACEAE	*Rumex*	*crispus*	Curled dock
**	LABIATAE	*Salvia*	*verbenaca*	Wild sage
**	DIPSACACEAE	*Scabiosa*	*atropurpurea*	Scabious
**	ANACARDIACEAE	*Schinus*	*molle*	Pepper-tree
*	GRAMINEAE	*Secale*	*cereale*	Rye, Cereal rye
**	COMPOSITAE	*Senecio*	*pterophorus*	African daisy
**	COMPOSITAE	*Senecio*	*mikanioides*	Cape ivy
**	GRAMINEAE	*Setaria*	*verticillata*	Whorled pigeon-grass
**	COMPOSITAE	*Silybum*	*marianum*	Variegated thistle (D)
**	CRUCIFERAE	*Sisymbrium*	sp.	Hedge mustard
**	SOLANACEAE	*Solanum*	*nigrum*	Black nightshade
**	SOLANACEAE	*Solanum*	*elaeagnifolium*	Silver-leaf nightshade (D)
**	CARYOPHYLLACEAE	*Stellaria*	*media*	Chickweed
**	TAMARICACEAE	*Tamarix*	*aphylla*	Athel pine
*	COMPOSITAE	*Taraxacum*	*officinale*	Dandelion
**	GRAMINAE	*Thinopyrum*	*elongatum*	Tall wheat grass
**	ZYGOPHYLLACEAE	*Tribulus*	*terrestris*	Caltrop (D)
**	LEGUMINOSAE	*Trifolium*	*angustifolia*	Hares foot clover
**	LEGUMINOSAE	*Trifolium*	*arvense*	Hare's foot clover
**	LEGUMINOSAE	*Trifolium*	*subterraneum*	Subterranean clover
***	LEGUMINOSAE	*Ulex*	*europaeus*	Gorse (D)
*	URTICACEAE	*Urtica*	*urens*	Stinging nettle
**	LEGUMINOSAE	*Vicia*	*sativa*	Common vetch
***	APOCYNACEAE	*Vinca*	*major*	Periwinkle
*	LILIACEAE	*Asphodelus*	*fistulosus*	Onion weed (D)
**	GRAMINEAE	*Vulpia*	sp.	Fescue
***	IRIDACEAE	*Watsonia*	*meriana* var. *bulbillifera*	Bulbil Watsonia (D)
*	COMPOSITAE	*Xanthium*	*spinosum*	Bathurst burr (D)
**	ARACEAE	*Zantedeschia*	*aethiopica*	White Arum Lily

APPENDIX C

Photographs

Photograph locations

Photo 1 – looking southwest along Day Road, outside project site – Association 1 ungrazed on roadside; some native chenopod shrubs under

Photo 2 – looking northeast across farm rubbish pit – Association 2 grazed in paddock; understorey almost entirely introduced grasses and herbs

Photo 3 – looking northeast along Day Road outside project site – Association 2 ungrazed on roadside; some native chenopod shrubs under

Photo 4 – looking northeast towards farm rubbish pit – Association 2 grazed in paddock; understorey almost entirely introduced grasses and herbs

Photo 5 – looking southeast across proposed construction area – Association 1

Photo 6 – looking northeast across proposed construction area – Association 1

Photo 7 – looking northeast along Day Road outside project site; *Senna* spp. patch over introduced grasses and herbs; underground gas pipeline crosses boundary into project site

Photo 8 – looking south to dwelling – Association 3; introduced plantation/garden

Photo 9 – looking southwest to house paddocks – Association 3; introduced plantation

Photo 10 – looking southwest to house paddocks – Association 2; highly altered understorey

Photo 11 – looking northwest to house paddocks – Association 2; highly altered understorey

Photo 12 – looking southwest to house paddocks – Association 2; highly altered understorey

Photo 13 – looking northeast to house paddocks – Association 2; highly altered understorey

Photo 14 – looking northeast to house paddocks – Association 3; pepper tree plantation; highly altered weedy understorey

Photo 15 – looking northeast to house paddocks – Association 3; *Acacia* sp. plantation, *Pinus halepensis*; highly altered weedy understorey

Photo 16 – looking northwest across house paddocks – Association 3; introduced spp. plantation/garden; highly altered weedy understorey