

APPLICATION ON NOTIFICATION – CATEGORY 3

Applicant:	Monash Station Pty Ltd
Development Number:	010/L052/18
Nature of Development:	Change of land use from agriculture to horticulture. Construction of a freestanding solar photovoltaic array (6MW); 1.3GL dam with associated irrigation pumps; diesel power plant (6MW); on-site fuel storage (140KL); control and switch rooms, and; underground 11KV power lines.
Type of Development:	Merit
Zone / Policy Area:	Primary Production Zone (including Horticulture Policy Area 1) & Rural Landscape Protection Zone (Berri Barmera Council). Remote Areas Zone (Land Not Within a Council Area - Riverland).
Subject Land:	Sections 613, 614 & 685 in HD 740800 and Allotment 100 in FP 44626, Golledge Road MONASH
Contact Officer:	Matthew Fielke
Phone Number:	7109 7048
Start Date:	18 September 2018
Close Date:	3 October 2018

During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders St, Adelaide, during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).

Written representations must be received by - and can either be posted, faxed, hand-delivered or emailed to the State Commission Assessment Panel.

Any representations received after the close date will not be considered.

Postal Address:

The Secretary State Commission Assessment Panel GPO Box 1815 ADELAIDE SA 5001

Street Address:

Development Division Department of Planning, Transport and Infrastructure Level 5, 50 Flinders St ADELAIDE SA 5000

Email Address:

<u>scapreps@sa.gov.au</u>

Fax Number: (08) 8303 0753



Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

CATEGORY 3 DEVELOPMENT

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

Notice is hereby given that an application has been made by **Monash Station Pty Ltd** for consent to undertake a change in the use of land from agriculture to horticulture; construction of a freestanding solar photovoltaic array (6MW); 1.3GL dam with associated irrigation pumps; diesel power plan (6MW); on-site fuel storage (140KL); control and switch rooms, and; underground 11KV power lines. (**Development Number: 010/L052/18**).

The land is situated at Lot 100 and Sections 613, 614 & 685 Golledge Road MONASH being Certificates of Title 5896/224 & 5924/968.

The subject land is located within the Primary Production Zone (including Horticulture Policy Area 1) and Rural Landscape Protection Zone of the Berri Barmera Council Development Plan (Consolidated on 8 December 2016), and the Remote Areas Zone of the Land Not Within a Council Area (Riverland) Development Plan (Consolidated on 18 October 2012).

The application may be examined during normal office hours at the office of the State Commission Assessment Panel (SCAP), Level 5, 50 Flinders Street and at the office of Berri Barmera Council. Application documentation may also be viewed on the SCAP website http://www.saplanningcommission.sa.gov.au/ scap/public_notices.

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide SA 5001 **NOT LATER THAN WEDNESDAY 3 OCTOBER 2018.** Submissions may also be emailed to: scapreps@sa.gov.au

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the SCAP to further explain the representation.

Submissions may be made available for public inspection.

If you have any questions relating to this matter please contact **Matthew Fielke** of this office by telephone on **7109 7048** or email **matthew.fielke@sa.gov.au**.

Alison Gill SECRETARY STATE COMMISSION ASSESSMENT PANEL

www.sa.gov.au

South Australian DEVELOPMENT ACT, 1993 REPRESENTATION ON APPLICATION – CATEGORY 3

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Applicant:	ivionas		
Development Number:	010/LC	J52/18	
Nature of Development:	Chang solar p diesel and; u	e of land use from agriculture to horticulture. C photovoltaic array (6MW); 1.3GL dam with asso power plant (6MW); on-site fuel storage (140K inderground 11KV power lines.	Construction of a freestanding iciated irrigation pumps; L); control and switch rooms,
Zone / Policy Area:	Primai Protec	ry Production Zone (including Horticulture PA 1 ction Zone (Berri Barmera Council). Remote Are) and Rural Landscape as Zone (LNWCA - Riverland).
Subject Land:	Section Road N	ns 613, 614 & 685 in HD 740800 and Allotment MONASH	100 in FP 44626, Golledge
Contact Officer:	Matth	ew Fielke	
Phone Number:	7109 7	7048	
Close Date:	5:00 P	M 3 October 2018	
My Name:		My phone number:	
Primary method(s) of conta	ct:	Email:	
	Postal	I Address:	
			Postcode:
You may be contacted via yo	ır nominate	d PRIMARY METHOD(s) OF CONTACT if you inc	dicate below that you wish to
pe heard by the State Comm	ssion Assess	sment Panel in support of your submission.	
My interests are: (please tick one)	owner	of local property	
	occupi	ier of local property	
I	a repr	esentative of a company/other organisation aff	fected by the proposal
I	a priva	ate citizen	
The address of the propert	v affected is		
	y anected is		Postcode
My interests are: (please tick one)	l supp	ort the development	
I	l supp	ort the development with some concerns	
I	І орро	se the development	
The specific aspects of the an	nlication to	which I make comment on are:	
The specific aspects of the ap			

South Australian DEVELOPMENT ACT, 1993 REPRESENTATION ON APPLICATION – CATEGORY 3

l:	wish to be heard in support of my submission
(please tick one)	do not wish to be heard in support of my submission (<i>Please tick one</i>)
Ву:	appearing personally
(please tick one)	being represented by the following person (Please tick one)
Signature:	

Date:

Development Application Form



This development application form is only to be used for applications lodged directly with the Development

Office Use Only

Application Number

Lodgement Date

Council Area

APPLICATION TYPE

Development Plan Consent

Building Rules Consent

Notes:

Development Approval

Development Plan consent - Planning only Building Rules consent - After a Development Plan Consent is granted by DAC, the building rules assessment must be undertaken by your Local Council or a Private Certifier (as authorized under the Development Act 1993)

Assessment Commission.

Development Approval - DAC will only issue a final Development Approval in Out of Council/ unincorporated areas or where no building rules assessment is required.

LOCATION OF PROPOSED DEVELOPMENT 2.

Unit/Level/Street No.:

Street/Road Name:

Suburb/Town/Locality:

*Note: Property Identifier refers to the Plan + Parcel/Section No. and Certificate of Title. Your application must include a copy of the latest Certificate of Title(s) for the land upon which the development is proposed.

Section/Hundred	Lot No.	Plan/Parcel	Volume	Folio
	Allotment 100	D Filed Plan 44626	5896	224
613, 614 & 685 Cobdogla Irrigation Area			5924	968

DESCRIPTION OF PROPOSED WORKS 3.

Construction of water storage dam (1.3GL), irrigation pumps & excavation works; construction of solar farm (6MW) and associated infrastructure; construction of Energy Hub comprising diesel power plant (6MW), diesel fuel tanks, control and switch rooms; Change of land use to horticulture in Remote Areas Zone of the Land Not Within a Council Area (Riverland) Development Plan and Primary Production Zone of the Berri Barmera Council Development Plan.

APPLICANT 4.

John Gallard; CEO/Director Monash Station Pty Ltd Name:

PO Box 2004; Berri SA 5342 Address:

Telepho	one:	Mobile:	+61 428 761 798	
Email:	john@gallardservices.com.au	Fav:	······································	

LAND OWNER 5.

Name: John Gallard

Address: PO Box 2004; Berri 5342

Telephone:

Email: john@gallardservices.com.au

+61 428 761 798 Mobile:

Fax:

6. CONTACT PERSON

Name: Donna Ferretti	
Address:	
Telephone:	Mobile: +61 416 142 738
Email: donnaferretti@bigpond.com;	Fax:

7. BUILDING DESIGNER / ARCHITECT

Name: N/A	
Address:	
Telephone:	Mobile:
Email:	Fax:

8. DEVELOPMENT COST

\$ 19.35 million (approximately)

Note: 'Development cost' excludes building fit-out costs

9. PLANNING FEES

Please Refer to Schedule 6 of the *Development Regulations 2008*. The application lodgment fee and development plan assessment fee must be paid at time of lodgment. Additional fees may also be required in respect to non-complying applications and those requiring public notification (including advertising) and mandatory referrals (listed under Schedule 8).

10. LAND USE INFORMATION

Current Land Use: Agricultural & grazing land uses

Current Occupier: John Gallard / Monash Station

11. BUILDING CLASSIFICATION

Current Class: N/A

Proposed Class:

12. OTHER INFORMATION

Does Schedule 21 or 22 of the Development Regulations 2008 apply?

Has the Construction Industry Training Fund Act 1993 levy been paid?

Has a signed declaration form for clearances to electrical infrastructure (i.e. overhead power lines) been provided with the application?

|--|

I acknowledge that the consent of the landowner will be required to undertake the proposed works, and all relevant rights holders to reproduce documents in support of this development application.

Signature:
oignatute.

 Date:	30		7
		_	

2018

Yes 🗹

Yes 🗖

Yes 🗹

No 🗖

No 🔲

No 🗖

N/A 🗖

N/A 🖸

N/A 🛛

For further information about the lodgement process or application fees, please contact the Development Assessment Commission on 8303 0771 or via email to dacadmin@sa.gov.au

Donna Ferretti and Associates Pty Ltd

Urban Planning | Social Planning | Impact Assessments

ABN 47 413 689 624 **M** 0416 142 738 **E** donnaferretti@bigpond.com



20 August 2018

Mr Matthew Fielke Planning Officer I Development Assessment Development Division Department of Planning, Transport and Infrastructure GPO Box 1815 ADELAIDE, SA 5001

Dear Matthew

Monash Reward Project DA – Extension of Time

On behalf of the proponent of the above-named development proposal (Mr John Gallard), I write to formally request an extension of time.

Should this proposal be approved by the State Commission Assessment Panel, the proponent respectfully requests a timeline of two (2) years for commencement of the project and five (5) years for completion of the works.

Please feel free to contact the undersigned should you have any queries with regard to the proposed development.

Yours sincerely

 \mathcal{D}

Donna Ferretti; PhD, RPIA (Life Fellow).



Development Application to State Commission Assessment Panel

Monash REWARD Project

Renewable Energy, Water, Agriculture, Regional Development

AUGUST 2018

RECEIVED 23 Aug 2018 SCAP









Document Control

Revision	Details of review or changes	Date Created	Document Reference
V1	Draft report	12/07/2017	GP&E_17009_2
V2	Final draft report	9/8/2017	GP&E_17009_2
V3	Final report	20/08/2017	GP&E_17009_2
V4	Revised report	04/12/2017	GP&E_17009_2
V5	Draft SCAP application	24/04/2018	GP&E_17009_2
V6	Revised SCAP development application	30/07/2018	DFA_001
V7	Amendment to SCAP development application	22/08/2018	DFA_001

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Donna Ferretti Donna Ferretti ¥ Associates Pty Ltd M: 0416 142 738 E: donnaferretti@bigpond.com





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EXECUTIVE SUMMARY

The proposed Monash REWARD Project is a 2,840 hectare (ha) mixed use horticulture, regional development, water and renewable energy project to establish new almond, citrus, pistachio, vineyard and avocado industries at Monash Station located within the Riverland region of South Australia.

This significant infrastructure development broadly comprises the following components:

- water supply (river) pump station (800 square metres (m²)), pipework (DN1200 x 3 buried) and ancillary works to extract and distribute water from the River Murray;
- approximately 7.8 kilometre (km) underground pipeline (DN1200 x 3) to facilitate pumping of water from the river to Monash Station;
- approximately 7.8 kilometre (km) underground 11kV powerline to provide electricity connection from Monash Station to the river pump station infrastructure;
- water storage dam (1 x 1.3 gigalitres (GL)) and associated irrigation pumps;
- one (1) solar farm generating up to 6 Megawatts (MW) to provide power for irrigation purposes;
- Energy Hub (approximately 8,000m²) comprising:
 - diesel power plant (6MW) comprising six (6) gensets as supplementary power supply to service peak power demand (particularly during summer months) housed within containers
 - two (2) 70 kilolitres (kL) self bunded diesel tanks
 - underground high voltage powerlines i) from solar farm and gensets and ii) from energy hub to irrigation pumps and river pump station
 - space for future battery energy storage
 - control and switch rooms.

The purpose of this report is to seek development approval from the State Commission Assessment Panel (as the relevant planning authority) pursuant to Section 33 of the *Development Act 1993* for the following project components:

- The proposed power generation infrastructure located in the Land Not Within a Council Area (Riverland) - that has a capacity in excess of 5MW and that requires approval from the Office of the Technical Regulator (OTR). A certificate confirming approval from the OTR for the proposed power infrastructure is attached in Appendix E; and
- 2. A change of land use to Horticulture in the Remote Areas Zone of the Land Not Within a Council Area (Riverland) Development Plan and the Primary Production and Rural Landscape Protection Zones of the Berri Barmera Council Development Plan.

A separate development application was lodged with the Berri Barmera Council for the water and transport related project infrastructure components. These infrastructure components were approved by the Council on 27 March 2018. A copy of the Decision Notification Form is contained in Appendix C.

The investigations and analysis for this development application have been underpinned by extensive site and route selection processes supported by a number of specialist technical reports and concept designs, including ecology (fauna and flora) and cultural heritage surveys. The proponent has carried out an extensive stakeholder engagement program, particularly with government assessment authorities, to identify and address relevant issues and opportunities associated with the project. As part of this process, the proponent has secured approval from the Native Vegetation Council for removal of native vegetation associated with the project (see Section 2.5 below).

The proposed new horticulture, regional development, water and renewable energy project is considered appropriate for the subject site and is deemed to satisfactorily accord with the relevant Development Plan





provisions. The proposed horticultural activities will facilitate productive use of the subject land and, in so doing, contribute to ongoing economic growth of the Riverland region consistent with the objectives of South Australia's Strategic Plan and the South Australian Planning Strategy (Murray Mallee Region Plan).

The assessment of the proposal against the relevant provisions of the Land Not Within a Council Area (Riverland) and the Berri Barmera Council Development Plans in Section 4 of this report demonstrates its general compliance with the land use activities and form of development envisaged for the site and location more generally. In summary, the proposed development, when considered on its merits, warrants the granting of development consent.





1.0 INTRODUCTION

The proposed Monash REWARD Project (the project) is a 2,840 hectare (ha) mixed use horticulture, regional development, water and renewable energy project to establish new almond, citrus, pistachio, vineyard and avocado industries at Monash Station located within the Riverland region of South Australia.

The purpose of this report is to obtain the necessary development approval under the Development Act 1993.

1.1 Applicant details

Mr John Gallard - CEO / Director Monash Station Pty Ltd ABN: 52 608 635 641 PO Box 2004 Berri SA 5342

Monash Station Pty Ltd forms part of the Gallard Group of Companies and was registered on 8 October 2015.

1.2 Project elements subject to this proposal

Development approval is sought from SCAP for the following project components:

- water storage dam, irrigation pumps and ancillary (in particular excavation) works;
- 6MW solar farm and associated infrastructure, including underground 11kV powerlines connecting the solar farm and diesel gensets with the proposed Energy Hub and the Energy Hub with the proposed water storage dam irrigation pumps and river pump station;
- Energy Hub comprising the diesel power plant (gensets), diesel fuel tanks, control and switch rooms; and
- horticultural activities (change of use) within the Remote Areas Zone of the Land Not Within a Council Area (Riverland) and the Primary Production and Rural Landscape Protection Zones of the Berri Barmera Council area.

Development has been obtained from the Berri Barmera Council for the remaining project components, including the proposed river pump station and ancillary works, water pipeline and ancillary works (including the underground crossing of the Sturt Highway), 11kV underground powerline servicing the river pump station, access road (Santos Road) and intersection with the Goyder Highway and the construction offices, amenities and accommodation camp.

The subject land for this development application is located in the Remote Areas Zone in the Land Not Within a Council Area (Riverland) Development Plan and the Primary Production and Rural Landscape Protection Zones in the Berri Barmera Council Development Plan. A range of land use activities are envisaged within these zones, including pastoral, grazing, farming and horticultural activities, renewable energy facilities and ancillary development. The proposed development is considered to be compatible with these envisaged uses with both the land use and infrastructure components broadly supported by the relevant Development Plan provisions.

However, it should be noted that the proposed horticultural land use is considered to be a non-complying use in the Rural Landscape Protection Zone if it is to involve clearance of native vegetation. While the project has secured approval from the Native Vegetation Council for clearance of native vegetation across the subject site, there is to be no clearance of native vegetation in the Rural Landscape Protection Zone. Accordingly, the non-complying trigger does not apply.





1.3 Site layout

A plan of the proposed site layout illustrating each of the project components subject to assessment (indicated in blue text) and additional plans and information is contained in Appendix A.

1.4 Background

Monash Station Pty Ltd own Monash Station situated in close proximity to the River Murray within the Riverland region of South Australia.

The proposed Monash REWARD Project seeks to take advantage of the size of the agricultural property and its strategic location close to water from the River Murray to irrigate large scale horticultural industries, while the proposed solar farms and hydro pump system will enable renewable energy to be generated for on-site use and export to the South Australian electricity grid.

The subject site has been identified as prime agricultural land in the Murray Darling Basin Salinity and Drainage Agreement (1988) and the South Australian Government's Regional Development Strategy (1994). Soil surveys and drainage modelling completed for the proposed project confirm the land's suitability to support the proposed horticultural land uses.

1.4.1 Project objectives

The Riverland is one of the State's major primary production regions with the horticultural commodities derived from the project to make a significant contribution to regional economic growth, in particular for Australian exports and employment opportunities for local people.

In this regard the project will help strengthen the prosperity of the region by:

- stimulating investment;
- generating short and long term employment opportunities (particularly for young people in the region);
- encouraging small to medium sized business enterprises;
- providing efficient, sustainable water and renewable energy to consumers;
- enabling development to have staged harvesting periods throughout the year;
- ensuring reliability and cost effective rates for the end user;
- creating a sustainable impact on the local economy;
- maximising the use of renewable energy to support horticultural production; and
- contributing to the capacity and stability of the South Australian power system.

1.5 Government strategic context

A number of State and Local Government strategic plans and policy documents are of relevance in providing context and justification for the Monash REWARD Project. These are summarised below.

1.5.1 State Government Strategies

Our Energy Plan, 2017

The State Government released the *Our Energy Plan Policy* in 2017 to provide the State with greater local control of energy security by generating capacity, greater competition, increased public ownership of assets, more renewable energy with battery storage, more gas supplies and more job opportunities.

Of relevance to the project is the Plan's new energy security target to increase South Australia's energy self reliance by requiring more locally generated, cleaner, secure energy to be used in South Australia. The goal of the target is to stimulate new investment in cleaner energy to increase competition, put downward pressure on prices and provide more energy system reliability.





The proposed solar farm will maximise the use of renewable energy to support horticultural production. Specifically, the proposed solar farm will generate sufficient renewable energy to support irrigation of the horticultural land uses. The Office of the Technical Regulator (OTR) has examined and subsequently approved the proposed development, confirming that the project will contribute to the State's clean energy capacity and system stability¹. A copy of the OTR certificate/letter of approval is attached in Appendix E.

South Australia's Strategic Plan, 2011

South Australia's Strategic Plan (2011) is the key planning document of the Government of South Australia. It sets the strategic direction for the State across a range of social, economic and environmental areas. A key target (target 40) of relevance to the proposal is to 'grow the contribution made by the South Australian food industry to \$20 billion by 2020'. To that end, the Monash Project seeks to establish 2,750 hectares of new almond, citrus, pistachio, vineyard and avocado horticultural activities on the subject land for domestic and export markets.

In addition, the proposal is expected to contribute to the realisation of job (target 47) and regional population (target 46) targets of the Plan. Up to 400 FTE jobs each year would be created by the proposed horticultural land uses for both operational and harvest activities. This is likely to increase should there be a higher proportion of citrus commodities produced than initially projected. As a result, the project will make a significant contribution to ongoing employment opportunities in the Riverland region and, associated with this, regional population growth.

Murray Mallee Region Plan, 2011

The Murray Mallee Region Plan is a regional volume of the South Australian Planning Strategy and provides strategic guidance for land use and development, provision of services and infrastructure, and the management of population and climate change. Recognised as one of the most economically and ecologically diverse regions in South Australia, the Plan seeks to promote this diversity to provide the region with a strong platform for ongoing growth and development.

The following key issues are identified as critical to the region's future:

- Environment and culture
 - \circ managing salinity levels and salinity impacts within the River Murray system;
 - \circ $\$ managing increasing salinity of agricultural land and key water supplies;
 - o ensuring development protects and preserves the region's environmental assets;
 - ensuring development is appropriately located and does not adversely affect environmentally significant areas, scenic landscapes and heritage places; and
 - managing land to prevent soil loss.

The project area has been identified as prime low salinity agricultural land in the Murray Darling Basin Salinity and Drainage Agreement (1988) and as part of the South Australian Government's Regional Development Strategy (1994).

Soil survey and drainage modelling completed by the proponent has shown the land is suitable to support various commodities, with crop use proposed to match soil and terrain by applying basic irrigation drainage management principles. Utilising the proposed irrigation potential improves the project's commercial outcome, whilst minimising potential impacts to the environment.

- Economic development
 - encouraging the development of alternative energy industries (for example, solar, wind, geothermal and bio-fuels);

¹ The OTR examined a previous version of the proposed development which had included a significantly larger renewable energy component. Its assessment of the stability of the proposed system nonetheless applies.





- attracting industry to the region, particularly where there is infrastructure capacity for growth (for example, electricity, gas, roads, rail, wastewater re-use and telecommunications infrastructure); and
- fostering development and diversification of primary industries, and planning for sustainable adaptation to climate change and unpredictable river flows.

The proposed solar farm development will provide sufficient renewable energy supply to meet on-site demand while the proposed horticulture activities will make an important contribution to the Riverland's economy through commodity sales and employment growth (particularly for local youth).

It should be noted that the Murray Mallee Region Plan is currently under review but its strategic directions, as applicable to the project and project area, are unlikely to change.

1.6 Land tenure

Monash Station forms the primary land holding upon which the majority of the project infrastructure will be located and is freehold land owned by Monash Station Pty Ltd. A copy of the certificates of title is contained in Appendix B.





2.0 LOCALITY

2.1 Existing environment

The Riverland district covers 7,500 square kilometres (km²) and has a population of approximately 35,000 people.

The biophysical landscape of the region consists of a series of primarily longitudinal siliceous dunes embedded within a matrix of primarily calcareous loams. Rainfall is low with a mean annual rainfall of 240 to 300 millimetres (NRM Board, 2015). The combination of low rainfall and sandy soil texture means that soils have a high inherent risk of wind erosion that needs to be managed by maintaining vegetation cover, particularly through summer.

Approximately 18% of the area's remaining vegetation is fragmented, with much of this vegetation protected as public reserves or under private Heritage Agreements. The general landform of the area is deep sands present as an extant dune system and extensive Mallee vegetation located immediately to the north and east of the project site. The primary land use in the region is horticulture along the River Murray scroll belt and surrounds with pastoral land use dominant beyond the river corridor.

2.2 Project area

The project area is contained within the Murray High Plain (MHP) comprising a vast, essentially flat lying surface extending beyond the incised Murray River corridor.

Vegetation consists of semi-arid woodlands of Black Oak/Belah, Bullock Bush/Rosewood and Acacia spp., mallee shrublands and heathlands, savanna woodlands, low open bluebush and saltbush shrubland cover (EBS, 2017) – (refer Photos 2.2 to 2.3).



Photo 2.1 – Mallee woodland and spinifex grassland



Photo 2.2 - Mallee woodland and chenopod shrubland



Photo 2.3 – Cleared pastoral land to accommodate proposed large scale agri-industries





2.2.1 Soil profile

The region's soil profile characteristics include brown calcareous earths, highly calcareous loamy earths, cracking clays, yellow grey and hard setting loamy soils with red clayey subsoils.

2.2.2 Groundwater and salinity

The project is located with a low salinity impact zone with the State Government having implemented a salinity zoning policy to maximise the potential for further irrigated agricultural development while minimising the associated salinity impacts.

2.3 Subject land

The subject land currently accommodates agricultural land uses with sheep grazing and cropping prominent. For the most part the subject land has been cleared of vegetation although the land also includes large areas of mallee scrub. Cooltong Conservation Park, which shares a boundary with the eastern extent of the project area, was proclaimed under the *National Parks and Wildlife Act 1972* in 1993 to preserve quality mallee vegetation and habitat for the mallee bird species that frequent the area, in particular the Malleefowl (Leipoa ocellata).

The proposed horticultural land uses are located on that part of the project area that will not impact on these important habitat areas. The construction of the water pipeline (for which development consent has been obtained from Berri Barmera Council) will require some vegetation removal in close proximity to the Conservation Park. As discussed in Section 2.5 below, the proponent has secured approval to clear this native vegetation and will provide and manage a significant vegetation offset area in line with Native Vegetation Council requirements.

2.4 Land and agricultural capability

Soil surveys and drainage modelling completed by the proponent has shown the land is suitable to support various horticultural commodities, with crop use proposed to match soil and terrain. Utilising the proposed irrigation potential further improves the commercial outcome arising from the project, whilst minimising potential impacts to the environment.

2.4.1 Salinity impact zones

Salt is a natural part of the region with the application of water to the land through irrigation resulting in drainage to the underlying groundwater, which can increase the movement of salt into the river.

Increased River Murray salinities can have adverse impacts on:

- irrigated crops resulting in damage and reduced yields;
- equipment, appliances and infrastructure by reducing their lifespan;
- the environment; and
- water for drinking supplies.

The project is located within a low salinity impact zone with the State Government having implemented a salinity zoning policy to maximise the potential for further irrigated agricultural development while minimising the associated salinity impacts.

The amount of water that can be utilised for irrigation within salinity impact zones is regulated in accordance with the Water Allocation Plan for the River Murray Prescribed Watercourse. This policy is implemented through the granting of site use approvals which provide an authorisation to use water for the purpose of irrigation at a particular site. A site use approval application for new irrigation development will be submitted separate to this development application.





2.5 Native vegetation

As noted, the applicant has secured approval from the Native Vegetation Council for the clearance of native vegetation arising from the development of the Monash project in its entirety. This follows an extensive ecological survey of the subject land to determine the likelihood of the project having a significant impact on Matters of National Environmental Significance under the Environment Protection and Biodiversity (EPBC) Act.

The ecological assessments found that the project is unlikely to have a significant impact on EPBC listed ecological flora and fauna communities.

The vegetation to be cleared is related primarily to the construction of infrastructure (in particular the water pipeline) and is not related to the areas proposed to be devoted to horticultural use. In line with the legislative requirements, a large vegetation offset area (357 hectares) has been provided and is to be managed on an ongoing basis by the proponent to ensure it remains protected from weeds and pests.

A copy of the native vegetation clearance approval is contained in Appendix D.





3.0 NATURE OF DEVELOPMENT

3.1 Description of development

This proposal seeks approval for two key elements – a construction element for the infrastructure noted below and a change of use element to horticulture within the Remote Areas Zone of the Land Not Within a Council Area (Riverland) and the Primary Production Zone of the Berri Barmera Council area.

In relation to the construction element, development approval is sought from SCAP for the following project components:

- water storage dam, irrigation pumps and ancillary (in particular excavation) works;
- 6MW solar farm and associated infrastructure, including underground 11kV powerlines connecting the solar farm with the proposed Energy Hub; and
- Energy Hub comprising the diesel power plant (gensets), diesel fuel tanks, control and switch rooms, and underground powerlines connecting the Energy Hub with the proposed irrigation pumps on the water storage dam.

In relation to the change of use element, it is proposed to apply this change of use to the land identified in the site plan (refer Appendix A) for horticultural activities.

The proposed horticultural land uses are to be supported by a significant investment into water pumping and piping infrastructure. As noted, development approval has been obtained from the Berri Barmera Council for this infrastructure, including:

- a river pump station located on the banks of the River Murray;
- a water pipeline extending from the River to the subject site, including an underground crossing of the Sturt Highway; and
- ancillary infrastructure, including an 11kV underground powerline servicing the river pump station, access road (Santos Road) and intersection with the Goyder Highway, and the construction offices, amenities and accommodation camp.

A copy of the Decision Notification Form is contained in Appendix C.

3.2 Site selection and water pipeline/powerline alignment

A Multi Criteria Analysis (MCA) was undertaken during the project feasibility phase to identify the preferred location of the water storage dams and route alignment of the water pipeline. The MCA process included an analysis across engineering, economic (including constructability), environmental and cultural heritage indicators of a number of concept design options.

The outcome of the MCA process supports the proposed siting and location of all project infrastructure, including the water supply pipeline and water storage dams. The location of these elements has minimised environmental and cultural heritage impacts by avoiding areas of high value native vegetation/fauna habitat as far as practicable as well as a known Aboriginal heritage site.

3.3 Irrigation design

Soil survey and crop suitability mapping of Monash Station has identified that approximately 2,750 ha of land is well suited to irrigated horticulture. Based on an analysis of irrigation requirements and an approved 33.4 GL per annum water licencing, a conservative approach assuming high water use crops has been adopted (i.e. almonds, avocados and citrus) for the project.





The proposed irrigation system to meet peak evapotranspiration requirements will be designed to pump up to 1.6 litres per second (lps) / hectare. To service the 2,750 hectares of horticultural activities, the total system design flow rate will be 4,350 lps or 15,660 m³/hr (15.66 ML/hr). At typical 20 hours operation per day, daily peak use would be approximately 313.2 ML/day, while the proposed water storage dam would enable 4 days or 1,300 ML (1.3 GL) of storage.

Horticultural crops have a progressive increase in water demand as trees mature. This maturation is generally up to 6-10 years dependent upon final selection of crop types planted at the site. Such a typical plant growth scenario lends itself to a staged development with rising main delivery consisting of 3 parallel 1,200mm nominal diameter (ND) GRP pipelines to enable the transfer of water from the pump station to Monash Station. As noted, development consent has been secured from the Berri Barmera Council for these water-related infrastructure components.

A total peak irrigation power requirement at full development of the project is calculated at approximately 5,100 kW. An objective of the project planning has been to run the operation independently of the local power grid. This is proposed through a combination of solar farming (6MW) and back-up diesel gensets (6MW) to meet the irrigation demand.

3.4 Functional description

The following sections describe each component of the proposed development and are sequenced in a way to facilitate a comprehensive understanding of the project's operation. While sections 3.4.1 and 3.4.2 are strictly not relevant to this development application (as approval for these elements has been secured from Berri Barmera Council) the detail contained within each section provides the context for the proposed power generation, water storage and horticultural activities.

3.4.1 River pump station (River Murray)

The proposed river pump station intersects the northern bank of the River Murray adjacent, and east of, the Santos Readymix Concrete facility and quarry, at Spring Cart Gully on the southern side of the Sturt Highway. Pipework will descend above ground along a narrow gully to the river bank, with the pump house to be sited on a bench near the head of the gully.

Access to the site will be via Santos Readymix Concrete's vehicle entrance (i.e. shared use) to avoid the need to establish a new site access onto the Sturt Highway at this location. The small volume of predominantly light vehicles needing to access the proposed pump station during operation will not affect or disrupt traffic at this location.

The pump station site is situated in an area that has been extensively disturbed by previous quarrying activities, including the placement of overburden spoil in the gully, and is situated above the 1956 flood level. The layout of the building structure and above ground pipework ensures that established trees at the river's edge are avoided, whilst the site's topography provides effective screening from the Sturt Highway and river (refer Photos 3.1 and 3.2).

All building materials will be of a neutral tone to enable the pump station to blend into the landscape and not cause any glare or navigational disturbance.

As noted, the proposed pump station will comprise three (3) x 1200mm diameter stainless steel pipes extending into the river to extract water for pumping and supply purposes. The pipes will be located above normal pool level to facilitate navigational safety and safe maintenance of pump station assets and extend into the river at this location. Submersible lift pumps will be fitted to the pipes with each comprising stainless steel cages (surround) with a 10mm aperture mesh to prevent blockages. The pipes will head back towards and connect to the pump station building.







Photo 3.1 – Proposed pump station site – looking south



Photo 3.2 – Pump station pipework intake / extraction point from the river – established trees to be retained

The use of submersible lift pumps eliminates the need to construct a traditional deep concrete bunker style station near the water edge and therefore will eliminate the need for a large construction footprint and minimises site disturbance during construction.

It is anticipated that the pump station capacity will be approximately 375 ML per day and extract approximately 33 GL of river water per annum (to be licenced separately) at full development in 8-10 years. The pump station would operate to meet irrigation requirements and is not anticipated to need to run all year round (i.e. typically there is minimal requirement in winter, subject to actual rainfall and frost protection water requirements).

Development Plan Consent for the proposed pump station and associated infrastructure has been obtained from the Berri Barmera Council.

3.4.2 Water pipeline and electricity powerline

To enable water transfer from the pump station to Monash Station, the installation of a rising main delivery system consisting of 3 parallel 1,200mm nominal diameter (ND) GRP buried pipelines is required.

The proposed pipe work will be contained within a 22 metre pipeline construction corridor approximately 7.8 km in length which will traverse private land, public road reserve and Crown Land.

The buried water pipeline will traverse from the pump station across the Sturt Highway (for a length of 50-100m – as approved by DPTI), along Santos Road (3.7km), along the southern boundary of the Cooltong Conservation Park (2.5km) and through Monash Station to the proposed water storage dam (1.6km).

The water pipeline will require a construction corridor of 22 metres and will typically comprise a trench dimension of approximately 2m wide and 1.5 - 3m deep for each parallel pipe. The water pipeline will be installed underground, surrounded in bedding/engineered materials (sand/cement backfill), in accordance with industry requirement for underground pipe work.

Within the pipeline corridor it is also proposed to run an 11kV electricity powerline to connect the river pump station to site supplied electricity. Specifically, the size of the river pump station infrastructure (3 x horizontal sit case pumps) and submersible pumps will create an electricity demand requirement of approximately 300kW and 500kW respectively that will be supplied independent of the local power grid by the proposed on-site solar farm.

The single powerline will be buried within the 22m pipeline corridor with a 3m metre space maintained between the powerline and pipeline for the length of the entire corridor.

Development Plan Consent has been obtained for the proposed water pipeline from the Berri Barmera Council. The electricity powerline servicing the river pump station was deemed as exempt.





3.4.3 Water storage dam

One (1) water storage dam is proposed with a total capacity of around 1.3 GL. This dam has been purposely located on cleared / cultivated land currently used for cereal cropping and sheep / cattle grazing. Photos 3.3 and 3.4 show the general location of the proposed storage dam and the nature of the vegetation that will be removed.

The siting of the water storage dam responds to existing topography and elevation as well as the extent and quality of impacted native vegetation. The native vegetation at the proposed dam location is generally of a poor quality and condition compared to vegetation located further to the east (the optimal dam site), and has the added advantage of minimising the volume of cut and fill required to construct the dam.

Plans showing the location of the proposed dam, the volume of cut and fill required, a section through the inletoutlet system, a section through the dam wall and various construction elements are contained in Appendix A.

In summary, the total volume of fill required to construct the dam is approximately 402,870m³. The dam is to be 'poly-lined' to prevent leakage while the dam banks are to be planted with native grasses to facilitate stabilisation and prevent soil erosion. A 2.1m high security fence is also proposed along the dam crest.



Photo 3.3 – Water storage dam (northern) - looking west

Photo 3.4 – Water storage basin (southern) – looking south

3.4.4 Solar system

A 6MW solar solar farm is proposed to generate sufficient renewable energy to service the project irrigation system, comprising the river pump station and various irrigation pumps used to water the horticultural plantings spread across the project site. The site plan shows the location of the proposed solar farm while an additional plan shows the proposed layout of the solar farm and a typical cross section of the single-axis tracking photovoltaic panels to be used to optimise exposure to the sun / power generation potential (refer Appendix A).

The solar farm will be in the order of 12 hectares in area and comprise a series (or modules) of solar panels mounted on steel frames. Figure 3.1 provides an indicative example of how the proposed solar farm will appear and illustrates access tracks running between solar modules that will be sufficiently wide to accommodate small servicing vehicles (tractors and trucks) with a typical degree of site coverage in the order of 50%.

The proposed solar farm has been purposely located within a watercourse catchment area that will enable water (including run-off from the solar panels) to be captured and re-used. The access tracks between solar modules have been designed to accommodate piping to facilitate the collection and transfer of water to the proposed water storage basins. This will improve the efficiency of water use across the site while helping to offset the loss of water from the proposed dam through evaporation.







Figure 3.1 – Typical layout of each solar farm

3.4.5 Energy Hub

It is proposed to establish a small Energy Hub as a central part of the project which is to accommodate a small diesel supplementary power plant (to be activated only if on-site generation from the solar system is deficient of need or fails), diesel fuel tanks, underground powerlines, a control and switch room as described below.

A plan showing the proposed layout of the Energy Hub with each of the hub components to be containerised, (with the exception of the diesel fuel tanks and underground powerlines) is contained in Appendix A. The Energy Hub will measure approximately 8,100m² and will be encircled by a formed access road capable of accommodating B-Double fuel trucks. A 2.1m high security fence will contain the Energy Hub.

3.4.5.1 Diesel gensets

A diesel power plant comprising up to six (6) gensets is proposed capable of delivering around 6MW of installed power for peak pumping operations to support the horticultural development (refer Photo 3.5). The gensets are proposed for installation to ensure that the proposed horticultural activities will continue to have access to water should there be a failure of the proposed solar farm.

Each genset will incorporate low noise generators designed to satisfy EPA noise emissions criteria, noting that the nearest sensitive receptor is located over 2km away to the south (see Section 5.5 below). The proposed gensets will be housed within containers measuring 12m x 2.4m.



Photo 3.5 – Typical 800 kVA skid mounted diesel generator





3.4.5.2 Diesel tanks

Two (2) self-bunded diesel tanks, each with a capacity of 70kL and measuring 12m x 2.4m are proposed to support the gensets and will be located in close proximity to the gensets (refer Appendix A). The diesel tanks will be sited adjacent the access road encircling the Energy Hub which will be designed to accommodate B-Double fuel tankers.

3.4.5.3 Control and switch rooms

A control room and switch room is proposed to support the Energy Hub. Both rooms will be housed within a 12m long container (refer Appendix A). These rooms will contain circuit breakers and other equipment required to safely connect the power coming into/generated within the Energy Hub (from the solar farm and gensets respectively) and the power transmitted from the Energy Hub (to the irrigation pumps and the river pump station).

3.4.6 Site access

A new access to the project site is proposed which is located off the Goyder Highway, approximately 1.3 km north of the Sturt Highway. Plans for this new access have been lodged with DPTI, through the Berri Barmera Council assessment process, who have approved the proposal in principle and have specified a number of conditions that have been included as part of the Council approval process for the water pipeline and river pump station.

A Traffic Impact Statement prepared by Tonkins is attached as Appendix F.





4.0 PLANNING ASSESSMENT

The proposed development is subject to the provisions of the Land not within a Council Area (Riverland) Development Plan (consolidated 18 October 2012) and the Berri Barmera Council Development Plan (consolidated 8 December 2016).

The following sections provide a planning analysis of the project against the relevant Objectives and Principles of Development Control (PDC) within both Development Plans.

4.1 Land not within a Council Area (Riverland) Development Plan

The following General and Zone policy provisions are considered relevant to the assessment of the proposed development:

- hazards (flooding, bushfire, salinity);
- infrastructure;
- interface between land uses
- natural resources (biodiversity and native vegetation, soil conservation);
- renewable energy facilities;
- siting and visibility; and
- Remote Areas Zone.

4.1.1 General provisions

4.1.1.1 Hazards (flooding, bushfire, salinity) - Objectives 2, 4, 5 & PDCs 4, 11, 15, 17.

- *Obj* 2 Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from the risk of natural hazards.
- *Obj* 4 *Development located and designed to minimise the risks to safety and property from flooding.*
- *Obj* 5 *Development located to minimise the threat and impact of bushfires on life and property.*
- PDC 4 Development should not occur on land where the risk of flooding is likely to be harmful to safety or damage property or the environment.
- PDC 11 Buildings and structures should be designed and configured to reduce the impact of bushfire through using designs that reduce the potential for trapping burning debris against the building or structure, or between the ground and building floor level in the case of transportable buildings.
- PDC 15 Development should not increase the potential for, or result in an increase in, soil and water salinity.
- PDC 17 Irrigated horticulture and pasture should not increase groundwater-induced salinity.

The proposed development, including the river pump station pipework, would not impede the flow of floodwaters through land, increase the potential hazard risk to public safety of persons during a flood event, aggravate the potential for erosion during a flood, cause any adverse effect on the floodway function or obstruct any watercourse. All site infrastructure has been located and designed to ensure the risk of potential inundation is avoided.

Similarly, project infrastructure and the proposal more generally has been located and designed to minimise the threat of bushfire. The proposed solar farms and 132kv transmission line have been designed in accordance with the *Minister's Code: Undertaking development in Bushfire Protection Areas* given that they are located within areas identified as being of Medium bushfire risk. Specific mitigation measures are also to be put in place during construction (refer Section 5.9.1).

The proposed development has also been designed to ensure that soil and water salinity is averted. The purposeful location of the proposed solar farm in a catchment area allowing for the capture of additional water resources to then be piped to the water storage dam for re-use and evaporation offset will assist in the





management of water salinity. Ongoing monitoring of soil salinity will also be undertaken to ensure the continued productivity and viability of the proposed horticultural activities.

4.1.1.2 Infrastructure - Objectives 1, 4, 5 & PDCs 5, 6.

- *Obj* 1 Infrastructure provided in an economical and environmentally sensitive manner.
- *Obj4* The visual impact of infrastructure facilities minimised.
- *Obj* 5 *The efficient and cost-effective use of existing infrastructure.*
- *PDC* 5 *Electricity infrastructure should be designed and located to minimise its visual and environmental impacts.*
- PDC 6 Utilities and services, including access roads and tracks, should be sited on areas already cleared of native vegetation. If this is not possible, their siting should cause minimal interference or disturbance to existing native vegetation and biodiversity.

Infrastructure associated with the project has been designed and located to minimise its visual and environmental impacts. The proposed development is located some distance from Monash township with most infrastructure components obscured from view by virtue of existing native vegetation, topography and distance.

While the development of the proposed water pipeline will require the removal of native vegetation, the proponent has secured approval from the Native Vegetation Council for vegetation clearance and offset plantings. In addition, all access roads and tracks servicing the project are existing, although some will be upgraded to accommodate project design traffic (refer Section 5.6). These upgrades have sought to minimise disturbance to existing native vegetation and biodiversity as far as practicable.

4.1.1.3 Interface between land uses - Objective 1 & PDCs 1, 6, 7, 9.

- *Obj* 1 Development located and designed to minimise adverse impact and conflict between land uses.
- PDC 1 Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:

(a) the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants (b) noise

- (c) vibration
- (d) electrical interference
- (e) light spill
- (f) glare
- (g) hours of operation
- (h) traffic impacts.
- PDC 6 Development should be designed, constructed and sited to minimise the negative impacts of noise and to avoid unreasonable interference on sensitive land uses.
- PDC 7 Development should be consistent with the relevant provisions in the current Environmental Protection (Noise) Policy.
- PDC 9 Traffic movement, spray drift, dust, noise, odour, and the use of frost fans and gas guns associated with primary production activities should not lead to unreasonable impact on adjacent land users.

As previously stated, the proposed development is located in an area where primary production activities are envisaged and some distance away from other, in particular residential, land uses. As a result, the conduct of the proposed horticultural activities will not cause any unreasonable impact on adjacent land users and will be minimised through the use of appropriate setbacks and vegetative plantings.

Noise associated with the operation of the pumping infrastructure on-site and backup power plant will comply with the relevant Environmental Protection (Noise) Policy requirements and will not cause any disturbance to the nearest noise sensitive receptor which is located some distance away (refer Section 5.7).

Accordingly, it is considered that the proposed development will not detrimentally affect the amenity of the locality.





4.1.1.4 Natural resources - Objectives 1, 5, 7, 9, 10 & PDCs 1, 5, 7, 11, 16, 17, 20, 29, 30, 33, 34, 39, 42.

- *Obj* 1 *Retention, protection and restoration of the natural resources and environment.*
- *Obj* 5 *Development sited and designed to:*
 - (a) maximise the use of stormwater
 - (b) protect stormwater from pollution sources
 - (c) protect or enhance the environmental values of receiving waters
 - (d) prevent the risk of downstream flooding
 - (e) minimise the loss and disturbance of native vegetation.
- *Obj* 7 *Native flora, fauna and ecosystems protected, retained, conserved and restored.*
- *Obj 9 Minimal disturbance and modification of the natural landform.*
- *Obj* 10 *Protection of the physical, chemical and biological quality of soil resources.*
- PDC 1 Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas.
- *PDC 5* Development should be appropriate to land capability and the protection and conservation of water resources and biodiversity.
- *PDC 7* Development should be designed to minimise consumption, maximise conservation and encourage reuse of water resources.
- PDC 11 Development should be sited and designed to: (g) not contribute to an increase in salinity levels.
- PDC 16 The location and construction of dams, water tanks and diversion drains should: (a) occur off watercourse
 - (b) not take place in ecologically sensitive areas or on erosion prone sites.
- PDC 17 Irrigated horticulture and pasture should not increase groundwater-induced salinity.
- PDC 20 Development should, where practical, capture and re-use stormwater.
- PDC 29 Development should be designed and sited to minimise the loss and disturbance of native flora and fauna, including marine animals and plants, and their breeding grounds and habitats.
- PDC 30 The provision of services, including power, water, effluent and waste disposal, access roads and tracks should be sited on areas already cleared of native vegetation.
- PDC 33 Development that proposes the clearance of native vegetation should address or consider the implications that removing the native vegetation will have on the following:
 - (a) provision for linkages and wildlife corridors between significant areas of native vegetation
 - (b) erosion along watercourses and the filtering of suspended solids and nutrients from runoff
 - (c) the amenity of the locality
 - (d) bushfire safety
 - (e) the net loss of native vegetation and other biodiversity.
- PDC 34 Where native vegetation is to be removed, it should be replaced in a suitable location on the site with locally indigenous vegetation to ensure that there is not a net loss of native vegetation and biodiversity.
- PDC 39 Development should not have an adverse impact on the natural, physical, chemical or biological quality and characteristics of soil resources.
- PDC 42 Development should minimise the loss of soil from a site through soil erosion or siltation during the construction phase of any development and following the commencement of an activity.

The proposed development has been sited and designed to afford as much protection as possible to the region's natural resources. There will be some disturbance to the natural landform across the site through construction of the water storage dam, however this dam has been purposefully sited to avoid areas of sensitive native vegetation, whilst balancing the volume of earthworks (i.e. cut and fill) required against the potential water storage capacity achieved. The proponent has worked directly with DEWNR (and Berri Barmera Council) staff to determine an appropriate water pipeline alignment and storage dam location so as to minimise native vegetation clearance and ensure that observed mallefowl habitat is protected while providing suitable vegetation offsets and pest animal (goat) management.





It is in the interests of the project to protect and enhance the quality of soil resources. All vegetation clearance associated with the development of the site will be undertaken so as to not cause or exacerbate erosion or sediment, decrease soil stability or cause any deterioration in the quality of surface water runoff or create a local salinity problem.

The amount of water to be extracted from the River Murray (for which a licence is required) will be within existing sustainability limits, while the use of water on-site will follow best-practice irrigation techniques, as well as allow for the generation of renewable energy. In addition, the design and siting of the proposed solar farms allows for the capture and subsequent re-use of stormwater, thus improving the efficiency of the proposed irrigation system.

4.1.1.5 Renewable energy facilities - *Objectives 1, 2, 3 & PDC 1.*

- *Obj* 1 *Development of renewable energy facilities that benefit the environment, the community and the state.*
- *Obj 2* The development of renewable energy facilities, such as wind farms and ancillary development, in areas that provide opportunity to harvest natural resources for the efficient generation of electricity.
- *Obj* 3 *Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses.*
- PDC 1 Renewable energy facilities, including wind farms and ancillary development, should be:
 (a) located in areas that maximise efficient generation and supply of electricity; and
 (b) designed and sited so as not to impact on the safety of water or air transport and the operation of ports, airfields and designated landing strips.

The proposed development promotes the generation and use of renewable energy for the benefit of the environment, local and regional communities.

The location of the proposed solar farm has been designed to minimise impacts on the natural environment, other land uses in the district, transport systems and natural resources. The potential to interfere with other land uses is minimal given the location of the project infrastructure away from residences, community facilities and the Monash township. Quality photovoltaic panels will be used on the proposed solar farm, optimising the generation and transmission of energy whilst ensuring that any potential impacts associated with glare will be eliminated.

4.1.1.6 Siting and visibility - Objectives 1 & PDC 1, 3, 4, 5.

- *Obj* 1 *Protection of scenically attractive areas, particularly natural, rural and coastal landscapes.*
- PDC 1 Development should be sited and designed to minimise its visual impact on:
 (a) the natural, rural or heritage character of the area
 (b) areas of high visual or scenic value, particularly rural areas.
- PDC 3 Buildings and structures should be designed to minimise their visual impact in the landscape, in particular:

(a) the profile of buildings should be low and the rooflines should complement the natural form of the land.

- PDC 4 The nature of external surface materials of buildings should not detract from the visual character and amenity of the landscape.
- PDC 5 The number of buildings and structures on land outside of urban areas should be limited to that necessary for the efficient management of land.

The siting of the project infrastructure has been designed to minimise any visual impact and effectively screen the development from the view of the general public and adjacent landholders by virtue of established native vegetation, topography and distance. Accordingly, the proposed development will not impact on the natural or rural character of the locality.

The proposed buildings supporting the project infrastructure include containers and sheds housing the irrigation pumps, diesel gensets and control room. These buildings are a necessary component of the proposed





development and will have a generally low profile and incorporate non-intrusive surface materials so as not to detract from the visual amenity of the locality.

4.1.2 Zone provisions

4.1.2.1 Remote Areas Zone - Objectives 1, 3, 8 & PDCs 1, 4, 7.

- *Obj* 1 *A zone accommodating the remote areas of the state suited to pastoral, conservation, mining and remote townships, settlements and Aboriginal lands, and accommodating defence related facilities.*
- *Obj 3 Protection of the conservation value of the region with a variety of environments including arid and wetland environments, ranges and riverine environments.*
- *Obj 8* Development that contributes to the desired character of the zone.
- PDC 1 The following forms of development are envisaged in the zone:pastoral, grazing and farming activities.
- PDC 4 The natural features and scenic beauty of the zone should be protected.
- PDC 7 Development should not be undertaken unless it is consistent with the desired character for the zone.

The water storage dam, Energy Hub and associated works are located within the Remote Areas Zone of the Development Plan. The zone encompasses significant parts of the remote areas of the State which include established pastoral and grazing activities with parts of the River Murray and its catchments also included.

The zone envisages development for pastoral, grazing and farming activities, whilst recognising the need to protect the conservation value of the region. The proposed development will facilitate the continuation and intensification of agricultural and horticultural activities in the zone as envisaged by the Development Plan.

While the proposal is to be located in close proximity to the Cooltong Conservation Park, the proponent has been working closely with regional officers of DEWNR to ensure that impacts on the Park will be minimised. Indeed, there are some advantages associated with the proposed development being adjacent to the Cooltong Conservation Park via the establishment of a firebreak which DEWNR has sought to implement for some time.

Similarly in relation to native vegetation clearance associated with the proposed development, the proponent has been liaising with DEWNR and Berri Barmera Council to minimise the amount of clearance required and to ensure that appropriate offsets are applied within the region.

4.2 Berri Barmera Council Development Plan

The following General and Zone policy provisions are considered relevant to the assessment of the proposed development:

- hazards (flooding, bushfire, salinity);
- infrastructure;
- interface between land uses
- natural resources (biodiversity and native vegetation, soil conservation);
- siting and visibility;
- Primary Production Zone, including Horticulture Policy Area 1; and
- Rural Landscape Protection Zone.

4.2.1 General provisions

4.2.1.1 Hazards (flooding, bushfire, salinity) - Objectives 2, 4, 5 & PDCs 3, 6, 7, 11, 16, 18.

- *Obj 2* Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from the risk of natural hazards.
- *Obj* 4 *Development located and designed to minimise the risks to safety and property from flooding.*
- *Obj* 5 *Development located to minimise the threat and impact of bushfires on life and property.*





- PDC 3 Development should not occur on land where the risk of flooding is likely to be harmful to safety or damage property or the environment.
- PDC 6 The 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.
- PDC 7 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.
- PDC 11 Buildings and structures should be designed and configured to reduce the impact of bushfire through using designs that reduce the potential for trapping burning debris against the building or structure, or between the ground and building floor level in the case of transportable buildings.

The proposed development of the horticultural activities located within the Berri Barmera Council area will not impede the flow of floodwaters through land, increase the potential hazard risk to public safety of persons during a flood event, aggravate the potential for erosion during a flood, cause any adverse effect on the floodway function or obstruct any watercourse. All site infrastructure has been located and designed to ensure the risk of potential inundation is avoided.

Similarly, project infrastructure and the proposal more generally has been located and designed to minimise the threat of bushfire, in accordance with the *Minister's Code: Undertaking development in Bushfire Protection Areas.* Since the project is located within an area identified as being of Medium bushfire risk, specific mitigation measures are to be put in place during construction (refer Section 5.9.1).

The proposed development has also been designed to ensure that soil and water salinity is averted. Ongoing monitoring of soil salinity will be undertaken to ensure the continued productivity and viability of the proposed horticultural activities.

4.2.1.2 Infrastructure - Objectives 1, 4, 5 & PDCs 7, 9.

- *Obj* 1 Infrastructure provided in an economical and environmentally sensitive manner.
- *Obj4* The visual impact of infrastructure facilities minimised.
- *Obj* 5 *The efficient and cost-effective use of existing infrastructure.*
- PDC 7 Electricity infrastructure should be designed and located to minimise its visual and environmental impacts.
- PDC 9 Utilities and services, including access roads and tracks, should be sited on areas already cleared of native vegetation. If this is not possible, their siting should cause minimal interference or disturbance to existing native vegetation and biodiversity.

The proposed solar farm, water storage dam and Energy Hub have been designed and located to minimise visual and environmental impacts. These infrastructure components are located some distance from Monash township and, for the most part, obscured from view by virtue of existing native vegetation, topography and distance.

While the development of the proposed water storage basin will require the removal of some low condition native vegetation, the proponent has secured the necessary approvals. In addition, all access roads and tracks servicing the project are existing, with some to be upgraded to accommodate project construction traffic (refer Section 5.6). These upgrades have sought to minimise disturbance to existing native vegetation and biodiversity as far as practicable.

4.2.1.3 Interface between land uses - Objective 1 & PDCs 1, 8, 15.

- *Obj* 1 Development located and designed to minimise adverse impact and conflict between land uses.
- PDC 1 Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:

(a) the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants (b) noise





(c) vibration
(d) electrical interference
(e) light spill
(f) glare
(g) hours of operation
(h) traffic impacts.

- PDC 8 Development that emits noise (other than music noise) should include noise attenuation measures that achieve the relevant Environment Protection (Noise) Policy criteria when assessed at the nearest existing noise sensitive premises.
- PDC 15 Traffic movement, spray drift, dust, noise, odour, and the use of frost fans and gas guns associated with primary production activities should not lead to unreasonable impact on adjacent land users.

The proposed development is located in an area where primary production activities are envisaged and some distance away from other, in particular residential, land uses. As a result, the conduct of the proposed horticultural activities will not cause any unreasonable impact on adjacent land users and will be minimised through the use of appropriate setbacks and vegetative plantings.

Noise associated with the operation of the on-site pumping infrastructure and backup power plant will be housed within buildings designed to attenuate noise emissions in order to comply with the relevant Environmental Protection (Noise) Policy requirements. It is considered that these activities will not cause any disturbance to the nearest noise sensitive receptor which is located some distance away (refer Section 5.7).

4.2.1.4 Natural resources - Objectives 1, 3, 6, 8, 9, 10, 11 & PDCs 1, 2, 4, 5, 7, 26, 27, 28, 32, 35, 36, 41, 42, 43, 44.

- *Obj* 1 *Retention, protection and restoration of the natural resources and environment.*
- *Obj 3* The ecologically sustainable use of natural resources including soil and water resources (including underground water, surface water and watercourses as defined in the current Environment Protection (Water Quality) Policy).
- *Obj* 6 *Development sited and designed to:*
 - (a) protect natural ecological systems
 - (b) achieve the sustainable use of water
 - (c) protect water quality, including receiving waters
 - (d) reduce run off and peak flows and prevent the risk of downstream flooding
 - (f) maximise the harvest and use of stormwater.
- *Obj 8* Native flora, fauna and ecosystems protected, retained, conserved and restored.
- *Obj* 10 *Minimal disturbance and modification of the natural landform.*
- *Obj* 11 *Protection of the physical, chemical and biological quality of soil resources.*
- PDC 1 Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas.
- PDC 2 Development should ensure that South Australia's natural assets, such as biodiversity, water and soil, are protected and enhanced.
- *PDC 4 Development should be appropriate to land capability and the protection and conservation of water resources and biodiversity.*
- PDC 5 Development should be designed to maximise conservation, minimise consumption and encourage reuse of water resources.
- PDC 7 Development should be sited and designed to: (a) capture and re-use stormwater, where practical (f) not contribute to an increase in salinity levels.
- PDC 26 The location and construction of dams, water tanks and diversion drains should: (a) occur off watercourse

(b) not take place in ecologically sensitive areas or on erosion prone sites.

PDC 27 Irrigated horticulture and pasture should not increase groundwater-induced salinity.



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- PDC 28 Development should comply with the current Environment Protection (Water Quality) Policy.
- PDC 32 Development should be designed and sited to minimise the loss and disturbance of native flora and fauna, including riparian and riverine animals and plants, and their breeding grounds and habitats.
- PDC 34 Native vegetation should not be cleared if such clearing is likely to lead to, cause or exacerbate any of the following:
 - (a) erosion or sediment within water catchments
 - (b) decreased soil stability
 - (d) deterioration in the quality of water in a watercourse or surface water run off
 - (e) a local or regional salinity problem.
- PDC 35 Development that proposes the clearance of native vegetation should address or consider the implications that removing the native vegetation will have on the following:
 - (a) provision for linkages and wildlife corridors between significant areas of native vegetation
 - (b) erosion along watercourses and the filtering of suspended solids and nutrients from runoff
 - (c) the amenity of the locality
 - (d) bushfire safety
 - (e) the net loss of native vegetation and other biodiversity.
- PDC 36 Where native vegetation is to be removed, it should be replaced in a suitable location on the site with locally indigenous vegetation to ensure that there is not a net loss of native vegetation and biodiversity.
- PDC 41 Development should not have an adverse impact on the natural, physical, chemical or biological quality and characteristics of soil resources.
- PDC 42 Development should be sited and designed to prevent erosion.
- PDC 43 Development should take place in a manner that will minimise alteration to the existing landform.
- PDC 44 Development should minimise the loss of soil from a site through soil erosion or siltation during the construction phase of any development and following the commencement of an activity.

As noted, the proposed development has been sited and designed to afford as much protection as possible to the region's natural resources. While there will be some disturbance to the natural landform across the site through construction of the water storage dam, this has been purposefully sited to avoid areas of sensitive native vegetation. The dam has also been designed to balance the volume of earthworks (i.e. cut and fill) required with the potential water storage capacity achieved. The proponent has worked directly with DEWNR (and Berri Barmera Council) staff to determine an appropriate water pipeline alignment and storage dam location so as to minimise native vegetation clearance and ensure that observed mallefowl habitat is protected while providing suitable vegetation offsets and pest animal (goat) management.

It is in the interests of the project to protect and enhance the quality of soil resources. All vegetation clearance associated with the development of the site will be undertaken so as to not cause or exacerbate erosion or sediment, decrease soil stability or cause any deterioration in the quality of surface water runoff or create a local salinity problem.

The amount of water to be extracted from the River Murray (for which a licence is required) will be within existing sustainability limits, while the use of water on-site will follow best-practice irrigation techniques. In addition, the design and siting of the proposed solar farm allows for the capture and subsequent re-use of stormwater, thus improving the efficiency of the proposed irrigation system.

4.2.1.5 Siting and visibility - Objectives 1 & PDC 1, 2, 4, 5, 6, 7.

- *Obj* 1 *Protection of scenically attractive areas, particularly natural, rural landscapes.*
- PDC 1 Development should be sited and designed to minimise its visual impact on: (a) the natural, rural or heritage character of the area
 - (b) areas of high visual or scenic value, particularly rural areas.
- PDC 2 Buildings should be sited in unobtrusive locations and, in particular, should:
 - (a) be grouped together
 - (b) where possible be located in such a way as to be screened by existing vegetation when viewed from public roads.





PDC 4 Buildings and structures should be designed to minimise their visual impact in the landscape, in particular:

(a) the profile of buildings should be low and the rooflines should complement the natural form of the land.

- PDC 5 The nature of external surface materials of buildings should not detract from the visual character and amenity of the landscape.
- PDC 6 The number of buildings and structures on land outside of urban areas should be limited to that necessary for the efficient management of land.
- PDC 7 Driveways and access tracks should be designed and surfaced to blend sympathetically with the landscape and to minimise interference with natural vegetation and landforms.

The siting of the project infrastructure has been designed to minimise any visual impact and effectively screen the development from the view of the general public and adjacent landholders by virtue of established native vegetation, topography and distance. Accordingly, the proposed development will not impact on the natural or rural character of the locality.

The proposed buildings supporting the project infrastructure include containers and sheds housing the irrigation pumps, diesel gensets and control room. These buildings are a necessary component of the proposed development and will have a generally low profile and incorporate non-intrusive surface materials so as not to detract from the visual amenity of the locality.

Access tracks across the site have also been sited to avoid areas of native vegetation and to not affect natural landforms.

4.2.2 Zone provisions

4.2.2.1 Primary Production Zone - Objectives 1, 5 & PDCs 1, 6, 11.

- *Obj* 1 *Economically productive, efficient and environmentally sustainable primary production.*
- *Obj* 5 *Development that contributes to the desired character of the zone.*
- PDC 1 The following forms of development are envisaged in the zone:solar photovoltaic panels (ground or roof mounted).
- PDC 6 Buildings, other than where required to support wind farms and ancillary development, should primarily be limited to farm buildings, a detached dwelling associated with primary production or a tourist related use on the allotment.
- PDC 11 Development should not be undertaken unless it is consistent with the desired character for the zone.

The proposed development is consistent with the desired character for the zone in that it will provide a highly productive and sustainable new primary production enterprise that will make a significant contribution to the region's economy.

Horticulture Policy Area 1 – Objectives 1, 3 & PDCs 1, 4, 5, 6.

- *Obj* 1 *A policy area primarily for horticulture.*
- *Obj 3* Development that contributes to the desired character of the area.
- PDC 1 The following forms of development are envisaged in the policy area: • horticulture
 - solar photovoltaic panels (ground or roof mounted).
- PDC 4 Horticulture not to be established on land that has significant tracts of native vegetation.
- PDC 5 Development should not be undertaken unless it is consistent with the desired character for the policy area.
- *PDC 6 Industry, tourism accommodation or other development not involving primary production should not occur unless:*

(a) no detriment or nuisance to the locality is likely to arise




(b) there is no disfigurement of the land's appearance.

Similarly, the project's horticultural development is consistent with the desired character for the policy area and an anticipated form of development in the locality. As previously noted, the proposed horticultural activities have been sited to avoid areas of high value native vegetation.

4.2.2.2 Rural Landscape Protection Zone - Objectives 1, 4 & PDCs 2, 6.

- *Obj* 1 *Preservation of the natural and rural character and scenic features of the zone.*
- *Obj* 4 *Development that contributes to the desired character of the zone.*
- PDC 2 No development should impact the conservation value of existing native vegetation.
- PDC 6 Development should not be undertaken unless it is consistent with the desired character for the zone..

Significantly there is no project infrastructure to be located in this zone although there is an area earmarked for a change of use to horticulture. The zone provisions specify that horticulture is a non-complying use except where it does not involve the removal of native vegetation. The applicant has confirmed that there will be no native vegetation removal associated with the horticultural activities in this zone, ensuring that the character and scenic features of the zone will be preserved. It is also worth noting that much of the existing vegetation in this area is of low value from a biodiversity conservation perspective.

4.3 Other state and local government approvals

4.3.1 National Parks and Wildlife Act 1972

This development application has taken into consideration potential impacts (i.e. siting, design and construction) of all relevant State listed endangered, rare or threatened flora and fauna species. Whilst not anticipated, a secondary licence/permit will be obtained if removal of or interference with protected plants or animals is required.

4.3.2 Native Vegetation Act 1991

All native vegetation clearance associated with the project has been assessed in accordance with the *Native Vegetation Act 1991* with an SEB offset provided.

4.3.3 Environment Protection Act 1993

Given the nature of activities associated with installing pipe work within and adjacent to the River Murray and the proposed water storage dam, the proponent has, and will continue to, engage with the EPA on any requirements for its contractors to hold earthworks, drainage and dredging licences for the associated works.

4.3.4 River Murray Act 2003

Given the project proposes activities within and adjacent the River Murray that may involve embankment works and stabilisation, which could potentially affect the riverine environment, all such activities will be undertaken in accordance with Site Work Approvals to ensure the ongoing maintenance of river health and water quality through the protection and restoration of impacted habitat and by minimising the impact of salinity and sedimentation that could affect native animals, fish and vegetation.

4.3.5 Natural Resources Management Act 2004

As previously stated, the project proposes activities within and adjacent the River Murray that will involve embankment works and stabilisation which could potentially impact the riverine environment. Activities affecting the River Murray are regulated under the Act and the proponent will engage with DEWNR





representatives to discuss the proposed construction method (i.e. embankment stabilisation) to limit the impacts and confirm assessment and permitting requirements for this water affecting activity.

4.3.6 Aboriginal Heritage Act 1988

The proponent has engaged an experienced archaeologist to complete an assessment and survey of the project infrastructure footprint to identify and record any potential places or sites of Aboriginal significance and any associated approval requirements under the Act.

4.3.7 Native Title Act 1993

The proponent has undertaken due diligence to all matters related to Aboriginal cultural heritage under both State and Commonwealth legislation.

4.3.8 Road Traffic Act 1961

The installation of the proposed water supply pipeline will impact on the Sturt Highway and local road network to varying degrees, and these impacts will be managed to the satisfaction of DPTI and Berri Barmera Council, being the bodies responsible for the construction, safe and efficient operation and maintenance of the road system.

The pipeline installation process will impact on traffic operations and these impacts will also be managed to the satisfaction of the relevant agencies in the form of detailing how trenching or under-boring of roads is to be undertaken, and how impacts on traffic operations are to be managed to acceptable levels.

4.3.9 Local Government Act 1999

Pursuant to the provisions of Section 221 (Alteration of road) of the *Local Government Act 1999* an authorisation is not required under this section of the Act for an alteration to a road if *…the person who proposes to make the alteration has some other statutory authorisation to make the alteration*' (e.g. development approval secured under the *Development Act 1993*).

4.4 Environment Protection and Biodiversity Conservation Act

The proponent has undertaken ecological and targeted Threatened Species surveys for the Monash project to determine the likelihood of the project having a significant impact on Matters of National Environmental Significance under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999.

The ecological assessments completed to date confirm that the project is unlikely to have a significant impact on EPBC listed ecological flora and fauna communities, while the recently approved 357 hectare Significant Environmental Benefit Management Plan for Monash Station will ensure environmental offsets for vegetation clearance are achieved on site.

A project decision on an EPBC referral to the Commonwealth will be made during the assessment of this development application.





5.0 DESCRIPTION AND MANAGEMENT OF ENVIRONMENT IMPACTS

5.1 Environmental risk assessment

A preliminary environmental risk assessment was undertaken to determine potential environmental impacts of the project. The results of the environmental risk assessment without mitigation are provided in Table 5.1.

	, , , , , , , , , , , , , , , , , , ,										
Potential sources of impact	Likelihood	Consequence	Risk Ranking								
Ecology											
Adverse impacts to flora and fauna	5 (Almost certain)	1 (Minor)	6 (Moderate)								
Aboriginal cultural heritage											
Adverse impacts to Aboriginal and non- Aboriginal cultural heritage	3 (Possible)	3 (Possible) 1 (Minor)									
Air emissions (dust)											
Short-term nuisance impacts off-site during construction	3 (Possible)	1 (Minor)	4 (Low)								
Adverse impacts off-site during operation	3 (Possible)	1 (Minor)	4 (Low)								
Visual											
Adverse impacts to the amenity of nearby properties	2 (Unlikely)	1 (Minor)	3 (Low)								
Noise and vibration											
Site noise impacts including sleep disturbance during construction	3 (Possible)	1 (Low)	4 (Low)								
Site noise impacts including sleep disturbance during operations	3 (Possible)	3 (Possible) 1 (Minor)									
Traffic and transport											
Traffic delays and congestion on public roads during construction	3 (Possible)	1 (Minor)	4 (Low)								
Traffic delays and congestion on public roads during operation	3 (Possible)	1 (Minor)	4 (Low)								
Construction management											
Presence of contamination	2 (Unlikely)	1 (Minor)	3 (Low)								
Embankment stabilisation	3 (Possible_	1 (Minor)	4 (Low)								
Acid sulphate soil management	2 (Unlikely)	1 (Minor)	3 (Low)								
Water quality	3 (Possible)	1 (Minor)	4 (Low)								
Adverse impacts to the existing surface flow regime	3 (Possible)	2 (Medium)	5 (Moderate)								
Hazardous material storage and management	2 (Unlikely)	1 (Minor)	3 (Low)								

Table 5.1 – Environmental risk rating within mitigation



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Potential sources of impact	Likelihood	Consequence	Risk Ranking
Waste management	2 (Unlikely)	1 (Minor)	3 (Low)
Compliance planning and management	3 (Possible)	1 (Minor)	4 (Low)

All risks without mitigation were rated as low to moderate. The level of risk associated with each environmental attribute was considered in the context of the Development Plan requirements to determine the level of assessment that should be undertaken.

The identification of risks enabled the determination of assessment priorities for the development application and further amelioration measures to be incorporated into the design of the project. Standalone technical reports assessing potential impacts and proposed mitigation measures have been prepared for ecology, Aboriginal cultural heritage, noise and traffic. These reports are summarised below.

5.2 Ecology (flora and fauna)

EBS Ecology (EBS) was commissioned to complete an ecological assessment of the Monash REWARD project site. The assessment focused on terrestrial flora and fauna, with the key objective being to identify potential ecological constraints for the project and assess native vegetation clearance requirements for proposed infrastructure.

The objectives of the study were to:

- inspect and assess native vegetation requiring clearance against regulation exemption 5(I)(b) under the Native Vegetation Act 1991;
- identify areas of biodiversity significance;
- identify and map the native vegetation associations (composition and condition);
- identify and map any threatened species or communities that may be present;
- identify the extent and significance of wildlife habitat;
- identify species of national and state conservation significance known or likely to occur in the area and provide details on possible impacts;
- record opportune fauna sightings;
- identify significant pest plants and animals; and
- undertake Significant Environmental Benefit (SEB) calculations for proposed clearance areas and investigate potential for a SEB on the property.

5.2.1 Assessment approach

The ecological assessment approach comprised the following key tasks:

Background research

- EPBC Protected Matters and Biological Databases of South Australia database searches for the area within the project boundary;
- review existing biological surveys undertaken in the area;
- review existing mapping data (vegetation communities, vegetation condition and aerial photographs);
- review existing information on flora and fauna species likely to occur in the area; and
- research threatened species that may occur in the area.

Field survey

The project site was surveyed on 6 to 10 April 2017 as follows:





- Vegetation associations and vegetation condition were mapped across the project site. A flora species list was compiled for each of the associations with a focus on threatened species. Declared weeds, listed under the Natural Resources Management Act 2004, were recorded where observed. All data was recorded to the required standards under the Native Vegetation Act 1991;
- Each vegetation community where clearance was proposed was traversed on foot to record individual species, known as a ramble survey. Each vegetation community was assigned an SEB condition rating;
- Opportunistic sightings of fauna species with a particular focus on avian species were recorded. The fauna assessment was used to verify the level of habitat being utilised by species onsite as well as for transient species visiting temporarily. Observations were also made on the quality of the habitat for fauna species within the project area (e.g. presence of hollows, fallen logs, leaf litter, wetlands, dense shrubby refuge etc).

5.2.2 Assessment results

The following summarises EBS's ecological assessment results. For the purpose of this report, threatened ecological communities and flora and fauna species listed by Commonwealth and South Australian legislation have been collectively identified and an assessment of potential impacts and mitigation measures is presented below.

Environment Protection and Biodiversity Conservation Act 1999

The following Matters of National Environmental Significance (NES) under the EPBC Act have been assessed:

Ramsar wetlands of international importance

The proposed activity location forms part of the catchment for the following three wetlands of international significance (i.e. Ramsar sites):

- the Riverland Ramsar site, located approximately 26 km north-west of Berri;
- Banrock Station wetland complex, located 29 km north-west of the project area; and
- The Coorong and Lakes and Alexandrina and Albert wetlands, located 100-150 km downstream of the project area.

The above Ramsar sites will not be impacted due to their distance from the proposed project.

Threatened Species and Ecological Communities / Migratory Species

Two threatened ecological communities, including the River Murray and Buloke Woodlands of the Riverina and Murray-Darling Depressions Bioregions, were identified in the Protected Matters Search as likely to occur within the project area. Given the proposed pipework and pump station within the River Murray riverine environment a small portion of this TEC will be impacted, while the Buloke Woodlands was not recorded during the survey by EBS.

Two threatened flora species, including the Greencomb Spider-orchid / Rigid Spider-orchid, Yellow Swainsonpea, were identified as potentially occurring or having habitat potentially occurring within the vicinity of the project area. EBS did not record any of these species or consider that they are likely to occur within the project area.

Twelve threatened fauna species (comprising eleven bird and one mammal species) were identified in the EPBC Protected Matters Search as potentially occurring or having habitat potentially occurring within the vicinity of the project area. EBS identified that four out of the eleven bird species, including the Australian Bittern, Malleefowl, Red-lored Whistler and Regent Parrot (eastern), were determined as likely to occur to within the project area (refer Section 5.2.6).

Fourteen migratory bird species were identified in the EPBC Protected Matters Search as potentially occurring or having habitat potentially occurring within the vicinity of the project area. EBS did not record any of the 14 species





during their survey however the Fork-tailed Swift, Great Egret, Cattle Egret and Rainbow Bee-eater were considered to possibly occur as occasional visitors to the project area.

All EPBC listed threatened species / habitat and migratory species have been assessed based upon the likelihood of occurrence and potential impact associated with the proposed project (refer Section 5.2.6).

5.2.3 South Australian threatened flora and fauna species

The following databases, records and reports have been assessed to identify threatened flora and fauna species in South Australia, migratory species, endangered populations and Endangered Ecological Communities (EECs) with the potential to occur within the project area.

Biological Database of South Australia (BDBSA)

The BDBSA search for all flora species records within 20 kilometres of the project area identified the presence of two nationally and 33 State threatened flora species (refer Figure 5.1). Most species were associated with the river corridor and Cooltong Conservation Park meaning the potential impact as a result of the project would be low.

The BDBSA search highlighted 14 nationally and 55 State listed threatened fauna species as previously recorded within 20 kilometres of the project area (refer Figure 5.1). Once again most species were associated with the river corridor and Cooltong Conservation Park meaning the potential impact as a result of the project would be low.

Threatened flora and fauna species considered most likely to be potentially impacted by the project are outlined in Sections 5.2.4 to 5.2.6.

Monash REWARD Project field surveys

Flora and fauna field survey work was conducted by EBS Ecology on 6 to 10 April 2017.

A total of seven indigenous vegetation associations were observed within the project area in addition to extensive pastoral and cropping areas. Four of the vegetation associations occur within 300m of the River Murray corridor with two being woodland associations.

One nationally threatened ecological community occurs along the river corridor and falls within a small portion of the project footprint, being the River Murray and associated wetlands, floodplains and groundwater systems. This very small portion encompasses the proposed River pump station and pipework infrastructure.

A summary and description of the dominant species and structures associated with indigenous association is provided in Table 5.2 and illustrated on Figure 5.1.





Table 5.2 – Vegetation associations recorded within project area

Association#	Description	Condition Range	Area (Ha)	% of Area surveyed	Conservation Significance / Habitat Value
1	Dodonaea viscosa ssp. angustissimus (Sticky Hop Bush) Senna artemisioides ssp. (Senna) Low Open Shrubland	3:1	25.17	34.73	No conservation significant species record. Low to moderate habitat value due to high cover of exotic annual grass species
2	<i>Eucalyptus socialis</i> (Red Mallee) Mixed Mallee	8:1	0.13	0.18	No conservation significant species record. Low to moderate habitat value due to high cover of exotic annual grass species
3	Eucalyptus largiflorens (Black Box) Woodland	6:1	17.27	23.84	No conservation significant species record. Low to moderate habitat value due to high cover of exotic annual grass species
4	Eucalyptus camaldulensis (River Red Gum) Woodland	6:1	0.04	0.06	No conservation significant species record. High habitat value in proximity to river with numerous hollows
5	Maireana pyramidata (Black Bluebush) Shrubland	2:1	4.19	5.78	No conservation significant species record. Low to moderate habitat value due to high cover of exotic annual grass species
6	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.13	0.18	No conservation significant species record. Low to moderate habitat value due to high cover of exotic annual grass species
7	<i>Myoporum platycarpum</i> (False Sandalwood) Low Open Woodland over <i>Aristida holathera</i> (Wire Grass)	2:1	25.53	35.23	No conservation significant species record. Low to moderate habitat value due to high cover of exotic annual grass species
		Total	72.46	100%	

5.2.4 Flora species distribution and richness

No threatened flora species at a National or State level were recorded within the project area. A total of 91 flora species were observed during the survey and represented a full range of lifeforms, including grasses, herbs, shrubs and trees with high structural diversity recorded within most habitats.

In some patches, the understorey was highly modified with loss of perennial plants and annual weeds and this was often correlated with the level of grazing disturbance from cattle which disturb the microbiotic soil crust.



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Figure 5.7 – Vegetation associations within project area





Microbiotic crusts are assemblages of non-vascular plants (mosses, liverworts, algae, lichens, fungi, bacteria and cyanobacteria) which form intimate associations with surface soils.

Other areas have been previously disturbed either through rolling or altered fire regimes which have reduced the aged trees that would generally appear in natural mallee communities and as a result reduce hollow abundance and dense cover of smaller multi stemmed trees than an undisturbed area.

The proposed water pipeline alignment within Monash Station utilises a previously used pipeline corridor that is highly disturbed with a large trench and spoil heap remaining which is considered to disturb the natural movement of resources through the landscape.

5.2.5 Fauna species distribution and richness

A total of 46 bird species were recorded within the project area, 43 of which were commonly occurring and widespread, while three have a State rare conservation significance within South Australia:

- Chestnut Quail-thrush (Cinclosoma castanotus castanotus);
- Little Egret (Egretta garzetta); and
- Striped Honeyeater (*Plectorhyncha lanceolata*).

The Chestnut Quail-thrush was observed foraging in leaf litter in Mallee woodland with a flock of White-browed Babbler (*Pomatostomus superciliosus*). The Little Egret was recorded on the edge of open cropping land and mallee woodland and the Striped Honeyeater was observed in River Red Gum (*Eucalyptus camaldulensis*) at the river's edge (refer Figure 5.2). These species are described in more detail, with regard to potential impact from the proposed development below.

5.2.6 Potential Impacts

No endangered ecological communities listed or threatened flora species have been identified within the project area.

The following threatened fauna and bird species are discussed in more detail in relation to whether the proposed project may significantly impact on the species, or on potential habitat for the species.

Black-eared Miner

Critical habitat for the Black-eared Miner (*Manorina melanotos*) has been listed within 20 km of the project area and identified as Gluepot Reserve, Taylorville Station and Calperum Station (excluding the area of Calperum Station south and east of the Main Wentworth Road).

No observations of this species were made during the EBS survey and no suitable habitat was mapped within the project area.

Malleefowl

The Murray Mallee is the stronghold for Malleefowl that can be found in scattered locations through semi-arid rangelands and dry-land cropping zones. The species is principally found in mallee eucalypt woodland and scrub, as well as dry forest dominated by other eucalypts, Mulga, and other Acacia sp. They feed on seeds and herbage, and build nest mounds in sandy substrates with leaf litter.

The nearest record for Malleefowl from the BDBSA search in relation to the project area was within the Cooltong Conservation Park, approximately 2 km north of the proposed water pipeline alignment. No Malleefowl mounds were recorded within the project area.

All efforts to minimise vegetation clearance and micro site infrastructure outside of mallee eucalypt woodland and scrub have been implemented to limit the potential impact on the habitat that this species may utilise with the potential impact to Malleefowl considered low.





Notwithstanding this, the proponent proposes active management measures during construction to minimise potential impacts, including pre-clearance surveys along the pipeline alignment along the boundary of the Cooltong Conservation Park, maintaining a 100m buffer to any identified new malleefowl location and restricting construction activities to daylight hours only.

Australasian Bittern

The Australasian Bittern is found largely in coastal and sub-coastal areas of south-eastern and south-western mainland Australia. Their preferred habitat is reedbeds, and other vegetation in water such as cumbungi, lignum and sedges (Marchant and Higgins 1991). This species is listed as endangered under the EPBC Act and state Vulnerable under the NPW Act. Australasian Bitterns forage mainly at night on a wide range of small animals, including birds, mammals, fish and frogs. The nearest record for Australasian Bittern in relation to the project area was 5 km according to the BDBSA search results.

All efforts to minimise vegetation clearance and micro site the River pump station infrastructure away from the water's edge and habitat such as reedbeds and sedges has been implemented to limit the potential impact on the habitat that this species may utilise. It is unlikely that this species will utilise the project area as a fly over path way, but rather utilise passage along the river and remain within the reedbeds for camouflage and protection.

If present, given only a small habitat area may be affected to enable the establishment of the water intake pipeline from the river and presence of extensive areas of similar habitat in adjoining areas and elsewhere means the project impact to the Australasian bittern's habitat is low.

Regent Parrot

The Regent Parrot primarily inhabit riparian or littoral River Red Gum (*Eucalyptus camaldulensis*) forests or woodlands and adjacent Black Box (*E. largiflorens*) woodlands. They often occur in farmland, especially if the farmland supports remnant patches of woodland along roadsides or in paddocks. They seldom occur in extensively cleared areas.

The Regent Parrot breeds exclusively in hollows in large, senescent or dead Eucalyptus camaldulensis within the river floodplain, so this habitat is highly significant to its long-term survival. Important non-breeding areas include large stands of mallee, which tend to be used for foraging. Preferred areas often comprise of Christmas Mallee (*Eucalyptus socialis*) and Yellow Mallee (*E. incrassata*). Numerous records have also been made of Regent Parrots feeding in open ground near remnant vegetation.

The nearest record for Regent Parrot in relation to the project area was 1 km according to the BDBSA search results (Figure 5.1). Mallee situated within Cooltong Conservation Park may provide suitable foraging habitat; *Eucalyptus camaldulensis* within the river floodplain may also provide suitable breeding hollows and breeding habitat for this species.

All efforts to avoid established tree and vegetation clearance within the riverine environment and micro siting of the River pump station infrastructure away from the water's edge and remnant patches of woodland has been implemented to limit the potential impact on the habitat that this species may utilise with the potential impact to Regents Parrot considered low.

Red-lored Whistler

The Red-lored Whistler occurs in semi-arid regions of New South Wales, Victoria and South Australia. The core of the population is centred on the South Australia-Victoria border, where it occurs in the Murray-Mallee region and Upper South-East region. The Red-lored Whistler inhabits low mallee shrublands, heathlands and woodlands that have an open canopy and a moderately dense but patchy understorey.

A record for the Red-lored Whistler was listed as south of Berri in April 2013, from the Atlas of Living Australia. Given that their preferred habitat borders the project area, as well as the fact that a record was listed nearby, it is likely that this species could occur within the project area, although no individuals were observed by EBS during their survey.





If present, the limited areas of potential habitat to be removed and presence of extensive areas of similar habitat in adjoining areas and elsewhere means it is unlikely to be significantly impacted. All efforts to minimise vegetation clearance and microsite infrastructure outside of mallee eucalypt woodland and scrub has been implemented to limit the potential impact on the habitat that this species may utilise with the potential impact to Red-lored Whistler considered low.

Chestnut Quail-thrush (Cinclosoma castanotus castanotus)

The Chestnut Quail-thrush is largely mallee-dependent Eucalyptus spp. and extends throughout the Great Victoria Desert (GVD) and into the central Australian ranges. It mainly occurs in low shrubs and undergrowth of mallee scrub, but also in Acacia shrubs, dry sclerophyll woodland, heath and native pine.

This species is generally considered as patchy, sedentary and locally nomadic and was observed within mallee woodland in the project area (Figure 5.2).

Given the limited areas of potential habitat to be removed and presence of extensive areas of similar habitat in adjoining areas and elsewhere, it is unlikely to be significantly impacted. All efforts to minimise vegetation clearance and microsite infrastructure outside of mallee eucalypt woodland and scrub has been implemented to limit the potential impact on the habitat that this species may utilise with the potential impact to Chestnut Quail-thrush considered low.

Little Egret (Egretta garzetta)

The Little Egret frequents tidal mudflats, mangroves, salt works and shallow margins of tidal estuaries and inland rivers and lakes. They are found mainly in coastal and inland areas of northern, eastern and south-eastern Australia.

The Little Egret is nomadic, depending on water levels in wetlands. This species was observed within cropping land, most likely occurring as a fly over species from the River Murray situated south of the project area (Figure 5.2).

All efforts to minimise vegetation clearance and microsite the River pump station infrastructure away from the water's edge and habitat such as reedbeds and sedges has been implemented to limit the potential impact on the habitat that this species may utilise. If present, given only a small habitat area may be affected from the establishment of the water intake pipeline from the river, and presence of extensive areas of similar habitat in adjoining areas and elsewhere, means the project impact to the Little Egret's habitat is low.

Striped Honeyeater (Plectorhyncha lanceolata)

The Striped Honeyeater is found in eastern Australia, mainly inland, from the Yorke Peninsula, South Australia to the coast of New South Wales and Queensland. It is listed as Rare under the *National Parks and Wildlife Act in* South Australia, mainly because the western extreme of its range extends into eastern South Australia.

The Striped Honeyeater inhabits a wide range of habitats including drier open forests, woodlands, mallee, mulga, heathlands along rivers, and mangroves. This species was observed by EBS near the river's edge, in proximity to the original proposed pumping station location. Given the limited area of potential habitat to be removed an adverse effect on the life cycle or local population presence is unlikely. It is considered unlikely that the proposed development will have an impact on this species.

All efforts to minimise vegetation clearance and microsite the River pump station infrastructure away from the water's edge and habitat such as reedbeds and sedges has been implemented to limit the potential impact on the habitat that this species may utilise. Given only a small habitat area may be affected to enable the establishment of the water intake pipeline from the river, and presence of extensive areas of similar habitat in adjoining areas and elsewhere means the project impact to the Striped Honeyeater's habitat is low.



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Figure 5.2 – Threatened fauna





5.2.7 Summary

Given the project has sought to minimise site clearance requirements and will not substantially modify, destroy or isolate any areas of important habitat the likelihood of any potential impact to threatened fauna species is considered to be low.

No known area of habitat for any threatened flora or fauna species would become fragmented or isolated as a result of the Monash REWARD Project. The proposed small areas and narrow width of proposed vegetation clearance, particularly associated with the water pipeline corridor, will further reduce the likelihood of impact to flora and fauna therefore any significant impact to threatened species is unlikely to occur.

Disturbance to flora and fauna may be direct or indirect impacts during construction. There are a number of potential direct fauna impacts, including impacts to habitat, entrapment of fauna through excavation works, site infrastructure and vehicle impact. To minimise potential direct fauna impacts, vegetation removal has been minimised (as far as practicable).

Low speed limits and opportunities to reduce vehicular traffic will be considered to minimise impact to fauna from vehicles. The proponent will implement a vehicle inspection procedure as part of pre-mobilisation to minimise the risk of spreading weeds.

Indirect impacts include noise and air quality. Noise and air quality are a transient issues, as is habitat impact given the good rehabilitation results seen elsewhere in the region from previous construction activities. Consequently the impacted area will be much more isolated amongst a vast background of non-disturbance.

5.2.8 Management and mitigation measures

To mitigate potential impacts to flora and fauna the following management measures are proposed:

- vegetation removal has been minimised (as far as practicable);
- pre-clearance surveys will be undertaken for Malleefowl along the pipeline alignment along the boundary of the Cooltong Conservation Park and a 100m buffer will be maintained to any identified new malleefowl location;
- construction activities will be restricted to daylight hours only;
- low speed limits and opportunities to reduce vehicular traffic will be considered to minimise impact to fauna from vehicles; and
- the proponent will implement a vehicle and machinery hygiene and inspection procedure as part of premobilisation to minimise the risk of spreading weeds.

5.3 Aboriginal cultural heritage

Vivienne Wood was commissioned to undertake an Aboriginal cultural heritage survey and assessment in consultation with the First Peoples Native Title Claimants in accordance with the requirements of the *Aboriginal Heritage Act 1988*.

For the purpose of this development application the findings and recommendations of the report have been summarised below.

5.3.1 Assessment approach

The Aboriginal cultural heritage assessment included:

• Review of Aboriginal Affairs and Reconciliation (AAR) database and any relevant past cultural heritage studies in the area.





- Field survey of the project area and surrounds over three days, 14 to 16 June 2017, to identify places or items of Aboriginal cultural heritage significance, by Craig Westell (archaeologist Vivienne Wood Heritage Consultant Pty Ltd), two representatives of the First Peoples of the River Murray and Mallee Region Native Title group, namely Timmy Johnson and Beatrice Wilson, together with Rhondda Harris (archaeologist/historical researcher).
- An assessment of cultural significance of Aboriginal cultural heritage items or places identified during the field survey.
- A cultural assessment to investigate whether there are any living cultural knowledge holders who may have cultural knowledge relevant to the assessment of cultural values or cultural landscapes of the project area.
- Development of measures to avoid, reduce and mitigate potential impacts.

5.3.2 Assessment results

The Aboriginal heritage survey identified the regionally significant Membdelbuik Chert Quarry (AAR 7029-624) in close proximity to the original river pump station location near the Lyrup ferry intersection of the Sturt Highway.

The survey team subsequently met with the proponent and Phil Strachan (District Manager Public Lands, DEH) onsite to discuss potential impacts and to determine an alternative, more suitable location 850m downstream adjacent the Santos Readymix Concrete facility (i.e. as proposed).

The Aboriginal heritage assessment identified:

- Five archaeological sites, two of which are listed in the AAR Site Register, that are protected under the *Aboriginal Heritage Act 1988* (i.e. 3 sites were located at the original River pump station location).
- The survey results were consistent with Archaeologists' expectations, with all five sites located either at, or within a short distance of, the River Murray.
- The proposed river pump station and pipework adjacent to the Santos Readymix Concrete facility is able to be sited and designed to avoid impacts to recorded Aboriginal heritage sites.
- No cultural material was identified within the high mallee plains and dune field north of the river.

5.3.3 Management and mitigation measures

To avoid potential impacts to Aboriginal heritage sites the following management measures are proposed:

- A cultural heritage management plan will be prepared for construction.
- Aboriginal heritage sites will be physically demarcated prior to any construction activities and under the supervision of First Peoples representatives.
- Sediment control measures will be put in place to avoid materials excavated in the area of the River pump station and above ground water pipeline from spilling downslope and impinging on Aboriginal heritage sites.
- First Peoples representatives will be engaged to monitor all ground disturbance works between the River Murray and Santos Road.
- Undertake additional survey of any new beyond survey coverage will be undertaken, if required.

5.4 Visual

An assessment of potential visual impacts of the project from public vantage points and private receptors was undertaken as follows.

5.4.1 Assessment approach

The visual assessment approach comprised:





- a review of the landscape setting;
- an assessment of the visibility of proposed infrastructure from public vantage points and private receptors; and
- determination of the potential visual impacts of the project based upon an analysis of the visual absorption capacity and visual sensitivity of the locality.

5.4.2 Assessment results

Visual absorption capacity and sensitivity to change

The visual absorption capacity of an area is expressed as the level of visual contrast (i.e. form, shape, pattern, line, texture and colour) of the proposed development to the visual setting within which it is placed.

The visual sensitivity of the locality is a measure of the potential level of concern attached by surrounding land users to a change in the existing landscape or visual setting and largely based upon visibility and distance from viewing areas, but is also influenced by the land use, current degree of exposure to the type of development proposed.

The Monash REWARD Project is situated greater than 3 km from Monash township with the majority of all proposed above ground infrastructure (e.g. water storage dams, hydro pump station, water pipeline) sited in relatively remote locations away from adjacent properties, residences and some distance from main tourist roads (i.e. Sturt Highway and Goyder Highway).

The visual landscape of the locality is characterised by primary production with large cleared paddocks used for pastoral and cropping. Rural properties comprise large parcels of land with the three (3) nearest residences setback approximately 100-150m from the southern boundary of Monash Station along Golledge Road. Extensive native vegetation around each of these residences effectively screens views towards, and from, the project site.

All other proposed infrastructure on Monash Station is screened from public and private receptor locations by the undulating topography and established vegetation within land parcels and road reserve corridors that are not proposed to be disturbed by the project.

ElectraNet's existing high voltage transmission lines and the High Voltage Direct Current Murraylink Interconnector form a physical feature of the landscape with electricity towers and overhead lines intersecting the project site and traversing adjacent private properties (refer Photos 5.1 and 5.2).



Photo 5.1 – Existing 132kV North-West Bend to Monash Substation transmission line



Photo 5.2 – Existing side-by-side single circuit 132kV transmission lines from Monash Substation





The subject site is considered to have a high visual absorption capacity given the minimal contrast and high level of integration between the proposed agricultural and horticultural project infrastructure and the existing primary production visual setting.

The proposed River pump station will be a low profile building setback from the Sturt Highway (to the south) within a gully that will help screen the building structure and pipework from the public road. The pump station intake pipework will be sited above ground with submersible pumps extending into the water. To minimise visual impacts the siting of the pipework will ensure established vegetation is retained at this location (refer Photos 5.3 and 5.4), whilst their placement between existing stands of willows along the embankment (both upstream and downstream) will ensure navigational impacts or disruption to riverine users is avoided.

All proposed building structures for the project will be low profile and incorporate materials of a neutral tone to ensure they blend into the landscape. The placement of new overhead electricity powerlines will not introduce new physical features or detract from the amenity of the landscape, whilst the underground nature of the water pipeline will avoid visual impacts post construction.

The proposed solar farm photovoltaic panels will use quality products and best practice design guidelines to ensure any potential impacts associated with glare will be eliminated. The removal of all native vegetation will be appropriately offset in accordance with the requirements of the *Native Vegetation Management Act 1991*.





Photo 5.3 – Proposed River Pump Station site – looking towards the river

Photo 5.4 – Existing established vegetation to be retained – view looking from the river up towards the Pump Station site

Overall the visual impact of the project is considered to be minor and able to be appropriately managed through infrastructure siting, while the use of neutral tone building materials will further assist in blending the development into the landscape.

5.4.3 Management and mitigation

The following management measures are proposed to minimise potential visual impacts:

- the project proposes agricultural and horticultural infrastructure within a primary production area that anticipates and encourages development of this nature;
- the siting and placement of project infrastructure on Monash Station (e.g. water storage dams, hydro pump station, water pipeline) is setback away from adjacent properties, residences and main tourist roads;
- all building structures will be low profile and incorporate neutral tone materials to ensure they blend into the landscape;





• native vegetation will be retained as far as practicable to maintain the amenity of the area and provide landscape screening.

5.5 Noise

Resonate Acoustics were commissioned to complete desktop noise assessment of the proposed project infrastructure.

5.5.1 Assessment approach

The noise assessment approach comprised:

- a review of the proposed water pump station details and noise levels;
- an assessment of relevant environmental noise policy and noise criteria within the Berri Barmera Council Development Plan; and
- an assessment of the resulting noise levels at the nearest noise sensitive receptors.

5.5.2 Assessment results

The primary source of noise emissions from the proposed pump stations will be from the motors associated with the water pumps. As the motors had not been selected at the time the noise assessment was undertaken, a conservative sound power level of 99 dB(A) per pump was assumed on the basis of empirical data used by Resonate Acoustics for similar projects. This yields a total sound power level of 107 dB(A) for all six (6) pumps associated with the proposed development.

In addition, the following operational and environmental conditions were considered:

- the pump station will run continuously over a 15 minute period;
- CONCAWE meteorological condition 6 in accordance with the *Environment Protection (Noise) Policy* 2007;
- hard reflective ground (with ground absorption set to 0); and
- no barrier effects from ground topography.

Importantly, the assessment did not consider the reduction in noise that would result from an enclosure around the pump station. The proponent has confirmed that an enclosure will form part of the proposed pump station which will have the effect of suppressing noise levels emanating from the pump motors and lowering the noise levels at the nearest receptor.

The nearest noise sensitive receptor from the proposed development is a residence located approximately 500m south-west of the River pump site. The assessment indicates that a noise level of 46 dB(A) would be expected at this receptor. While this level exceeds the night criterion specified in the *Environment Protection (Noise) Policy* 2007 by 1 dB(A), it is based on the estimated sound power level of 99 dB(A) noted above. Since this assessment was undertaken, it has been confirmed by the proponent that the sound power level for the pump motors will be 77 dB(A). Given that the proposed pump station will also be enclosed, noise levels emanating from the pump station will be significantly less than 46 dB(A) and, according to Resonate Acoustics, will "easily achieve the most stringent night criterion" set by the *Environment Protection (Noise) Policy* 2007.

In conclusion, the noise assessment demonstrates that the noise emissions from the proposed water pump station will easily comply with the relevant environmental noise criteria (*Environment Protection (Noise) Policy* 2007) and the requirements of the Berri Barmera Development Plan.

5.5.3 Management and mitigation

As previously stated, the Monash REWARD Project infrastructure is situated some distance from sensitive receptors. As the dominant land uses in the project area are agricultural, background noise levels are expected





to be low and associated with agricultural machinery and ambient wildlife noise. Properties closer to the Sturt Highway may be subject to some road noise.

Noise generated directly from the pump station and backup power plant infrastructure, as well as temporary noise generated by traffic during the construction phase, is not expected to generate significant noise impacts. Accordingly, no specific noise mitigation measures are proposed.

5.6 Traffic and transport

Tonkin Consulting (Tonkin) were engaged to complete a traffic impact assessment of the proposed project. A copy of their report is provided in Appendix F and summarised below.

5.6.1 Assessment approach

Tonkin's traffic impact assessment considered:

- the proposed construction of a new site access intersection off the Goyder Highway based upon the following assumptions;
 - maximum of 20 in and out heavy vehicle movements, totalling 40 heavy vehicle movements (B-Doubles) per day during peak harvest times;
 - approximately 50 staff on site each day during peak harvest times, creating a maximum of 150 movements per day.

5.6.2 Assessment results

Annual Average Daily Traffic Estimates along the Goyder Highway are 300 vehicles per day (DPTI, 2015).

The project and proposed site access will increase traffic volumes entering and exiting the Goyder Highway and is expected to have an impact on safety due to vehicles needing to slow down/stop and accelerate in a high speed rural environment. Sight distances at the proposed site access location are sufficient to meet Austroads stopping sight distance requirements.

The proposed development is expected to create a maximum of 200 additional movements per day. In accordance with Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections (Figure 4.9) traffic volumes of this magnitude only warrant a Basic Left Turn (BAL) / Basic Right Turn (BAR) treatment. Given most traffic will be entering and exiting to/from the Sturt Highway to the south and may be of higher intensity at particular times of the day (i.e. shift changes), Tonkin have recommended a BAL / Channelised Right Turn (CHR) treatment to improve safety at this location (refer Figure 5.2).

Negligible impact is expected on the Sturt Highway intersection or the Highway itself as this junction is already configured as a AUL/CHR intersection along the Sturt Highway, with the Goyder Highway approach design as a CHL.

5.6.3 Management and mitigation

The following management measure is proposed to minimise potential traffic impacts:

• installation of a new BAL/CHR treatment to facilitate safe access and egress from the project site onto/from the Goyder Highway, located approximately 1.3 km north of the Sturt Highway, designed in accordance with Austroads Guidelines.



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Figure 5.2 – Proposed site access intersection layout





5.7 Socio-economic impacts

The Riverland is a major primary production region of the State with the agriculture and saleable commodities derived from the Monash REWARD Project to have significant bearing on economic growth, in particular for Australian exports.

Accordingly, it is anticipated that the project will help strengthen the prosperity of the region by:

- encouraging small to medium sized enterprises;
- simulating investment;
- generating short and long term employment opportunities;
- providing efficient, sustainable water and energy use to the consumer;
- enabling development to have staged harvesting periods throughout the year;
- ensuring reliability and cost effective rates for the end user;
- creating a sustainable impact on the local economy;
- maximising the use of renewable energy to support agricultural production;
- connecting surplus generated electricity into South Australia grid; and
- enhancing local energy-system security.

The socio-economic impacts of the project are outlined below.

5.8 Industry engagement

The proponent has engaged with the Almond Board of Australia, Citrus Australia, Riverland Almonds and Nut Producers Australia who have all indicated their general support for the project. The Principal of the contracted Almond Grower and Developer – Australian Nut Management Services are involved as Directors on several different almond organisations including Riverland Almonds, the Australian Almond Board, Century Orchards and Laragon Pty Ltd.

The Australian Almond Board believe there is great potential to develop and grow the Almond Industry. Discussions have also been had with Riverland Almonds for processing and marketing and Laragon for hulling and shelling with both companies interested to work with the proponent to ensure that they can process and market the Almond crop (refer Section 6 that summaries engagement with all relevant industry stakeholders).

5.9 Construction management

A Construction Environmental Management Plan (CEMP) will be prepared for the project following the granting of development consent to outline the environmental management systems and procedures to be implemented during construction to ensure activities comply with relevant statutory requirements and provide adequate protection for the environment.

The purpose of the CEMP is to provide guidance to the contractor(s) and will outline the need for a number of management plans to be developed for specific areas of potential impacts during construction, such as dust and air quality, water quality, traffic management, erosion control and stormwater management and weed and pest management.

5.9.1 Construction activities

The general construction activities envisaged as part of the project includes a number of aspects taking place consecutively as outlined in Tables 5.9 and 5.10.





Table 5.9 – Major civil works (pump stations, water storage dams,)

Activity	Description
Survey, Fencing and set up of temporary facilities	Locate and accurately survey the infrastructure footprint. Delineate the construction corridor and areas of disturbance outside the corridor.
Clear and Grade	Removal and stockpiling of vegetation, topsoil and subsoil material from the infrastructure footprint. Removal and separate stockpiling of topsoil for use during rehabilitation.
Excavation and Earthworks	Earthworks excavations for infrastructure foundations, pipe trenches, stormwater management,
	etc. in accordance with detailed design engineering plans.
Infrastructure Delivery	Delivery of infrastructure components to the construction area.
Construction	Construction and building works in accordance with detailed design engineering, manufacturer's
	specifications and building certification requirements.
Rehabilitation	Removal of all waste materials and respreading the topsoil, etc to blend disturbed area into the
	surrounding landform – this may include stabilisation, seeding, planting works, etc in accordance
	with DPTI and / or Berri Barmera requirements.

Table 5.10 – Water pipeline

Activity	Description
Survey, Fencing and set up	Locate and accurately survey the pipeline alignment and offsets along the alignment. Delineate the
Clear and Grade	Removal and stockpiling of vegetation and/or excavated gravel subgrade material from the pipeline construction corridor. Removal and separate stockpiling of topsoil for use during
	rehabilitation.
Trenching and Excavation	Trenching machine /excavator dig trench for pipeline in accordance with predefined depths of burial.
Pipe Stringing and Joining	Delivery of the pipe to the construction area. Lowering in of pipes into excavated trench by cranes / excavators and joining into continuous lengths known as pipe strings to form the pipeline.
Backfill and compaction (reinstatement)	Backfilling and compacting using engineered material in accordance with DPTI, Berri Barmera and engineering design requirements and specifications.
Rehabilitation	Respreading the topsoil and/or gravel on the reinstated, backfilled trench. In areas not within road reserve this may include stabilisation, seeding, planting works, etc in accordance with DPTI and / or Berri Barmera requirements.

Key environmental considerations and management measures to be implemented during construction will include (but are not limited to):

- Vegetation clearance vegetation removal is kept to a minimum; no vegetation (native and non-native) disturbance or clearance occurs without approval; the stockpiling of vegetation / topsoil profiles for rehabilitation works
- Cultural heritage A cultural heritage management plan will be prepared for construction; First Peoples
 representatives will be engaged to monitor all ground disturbance works between the River Murray and
 Santos Road; Aboriginal heritage sites will be physically demarcated prior to any construction activities
 and under the supervision of First Peoples representatives; sediment control measures will be put in place
 to avoid materials excavated in the area of the River pump station and above ground water pipeline from
 spilling downslope and impinging on Aboriginal heritage sites; additional survey of any new beyond survey
 coverage will be undertaken, if required.
- Noise and vibration construction hours Monday to Saturday (i.e. 7.00am to 7.00pm), unless out of hours works approved; plant, vehicles and construction equipment would be properly maintained to reduce the potential of excessive noise emissions and comply with regulatory requirements; work generating high vibration levels would be scheduled during less sensitive time periods;
- **Traffic and transport** preparation of Traffic Management Plans to address traffic and safety arrangements during construction; developing routes for the delivery of materials and parking of vehicles;





vehicle and machinery movements during construction to be restricted to designated areas; traffic movements to be monitored if any community complaints/concerns are received.

- Air quality vegetation clearance and disturbance areas will be stabilised as soon as possible to prevent or minimise wind-blown dust; dust generating activities (particularly clearing and excavating) will be avoided or minimised during dry and windy conditions; water will be applied to aggregate storage piles, internal unsealed access roadways and work areas with application rates reflective of weather conditions and the intensity of construction operations; vehicles transporting material to and from the site will be covered to prevent wind-blown dust emissions and spillages;
- Water quality preparation of a Sediment, Erosion and Drainage Management Plan to mitigate erosion and stormwater management issues during construction.
- **Bushfire** no construction work of any kind to be conducted on days rated as Catastrophic; for days rated as Extreme or Severe, consideration must be given to suspending activities or changing plans work hours, work location, alternative access routes; establishment of a site evacuation plan which includes muster points, communication schedule, access and escape routes and emergency services notification forms to be prepared; all equipment bought to site will be inspected to ensure no faults which may pose an ignition source.
- **Waste** all waste requiring offsite disposal will be sent to appropriately licensed facilities; all waste would be recycled/disposed at an appropriately licensed facility
- **Stakeholders** a mechanism for receiving and responding to any complaints to be put in place for the duration of the construction phase.





6.0 STAKEHOLDER ENGAGEMENT

6.1 Background

Monash Station Pty Ltd recognises that engagement and consultation with stakeholders is integral to the successful development and operation of the proposed Monash REWARD Project and associated infrastructure. Accordingly, stakeholder engagement has been, and will continue to be, a key aspect of the project.

The objectives of the stakeholder engagement strategy has been to:

- identify all relevant stakeholders who have an interest in the project;
- provide stakeholders with accurate and timely information on the project;
- inform stakeholders of elements of the project that are likely to affect them;
- seek feedback from stakeholders of the issues of concern and the proposed approach to minimise impacts; and
- establish mutually respectful relationships with stakeholders and community members.

6.2 Key issues and responses

6.2.1 State Government consultation

Table 6.1 provides an overview of the key State Government stakeholders that have been consulted on the project and their comments / feedback and how they have been addressed in the development application.

Agency	Feedback / comments
DPC	Identified need to consider State Government 'Energy Plan' and requirement to ensure grid stability for project generating power – OTR approval for the project has been obtained.
PIRSA	Identified a range of land use and primary industry requirements for consideration – PIRSA has provided ongoing support for the proposed development.
DEWNR	Identified a range of environmental matters for consideration, including native vegetation clearance, offsets and cultural heritage requirements – these matters have been the subject of separate studies. Native Vegetation Clearance Approval obtained on 18 April 2018.
EPA	Identified future project environmental licensing requirements – this will be appropriately managed following development approval.
Coordinator General's Office	Identified a range of planning requirements for consideration – the Office has provided ongoing support for the proposed development.

Table 6.1 - State Government consultation





6.2.2 Local Government engagement

The proponent has undertaken extensive consultation with Berri Barmera Council on the project (refer Table 6.2).

Table 6.2 - Local Government consultation

Agency	Feedback / comments
Berri Barmera Council	Council's Mayor has confirmed overall support for the project in recognition of its potential to provide sustainable economic growth for the Riverland and the social benefits that will flow into the district. Council staff have provided planning and approvals advice with opportunities for further collaboration on SEB projects and roadworks associated with the construction phase being discussed. Development Plan consent obtained from the Riverland Regional Assessment Panel for project infrastructure (river pump station, water pipeline and associated infrastructure) on 27 March 2018.

6.2.3 Industry engagement

As outlined in Section 5.8.3, the proponent has undertaken consultation with key industry stakeholders on the project with specialist operators for the almond and pistachio plantations (representing approximately 80% of the potential planted hectage) with their comments / feedback outlined in Table 6.3.

Table 6.3 – Industry consultation

Agency	Feedback / comments
Almond Board of Australia	The Almond Board of Australia have expressed support for industry expansion through orchard development given increasing domestic and export market demand.
Riverland Almonds & Nut Producers Australia	Riverland Almonds has welcomed the opportunity to work with the proponent to process and market the future annual almond crop to be produced from the project and the opportunity to expand such initiatives into the Riverland to capture the increasing economic benefits of the industry sector.

6.2.4 Community

The proponent is not aware of any known community concerns or opposition towards the project with the positive views and feedback received from Berri Barmera Council considered to be reflective of the community sentiment across the region.

Consultation with affected community members is envisaged to occur subsequent to approval being obtained with a Stakeholder Engagement Plan to be developed and implemented.





7.0 CONCLUSION

The Monash REWARD Project is strategically important to agri-industry development in the Riverland region and will provide significant opportunity, through the project's solar farm infrastructure and horticultural development, to contribute to the State's renewable energy and regional economic development objectives.

The investigations and analysis for this development proposal have been underpinned by extensive site and route selection processes supported by a number of specialist technical reports and concept designs, including ecology (fauna and flora) surveys, soil surveys and drainage modelling which demonstrates the land's suitability for the proposed change to horticultural use.

In addition, a scope Construction Environment Management Plan framework has been developed by the proponent, which forms part of this development application, to provide guidance to Monash's contractors to address environmental and cultural heritage management during construction.

The proposed horticulture, regional development and renewable energy project is considered appropriate for the subject site and is not deemed at variance with the relevant Development Plan provisions. The proposed development will provide reliable infrastructure to facilitate economic growth for the region, consistent with South Australia's Strategic Plan. The purposeful location of large infrastructure away from sensitive receptors and heritage sites effectively minimises the potential impacts on residents of, and visitors, to the region, as well as the First Peoples of the River Murray and Mallee.

In summary, the proposed development, when considered on its merits, warrants the granting of development consent.





8.0 APPENDICES

- Appendix A Plans and supporting information
- Appendix B Certificates of Title
- Appendix C Decision Notification Form, Berri Barmera Council
- Appendix D Native Vegetation Clearance Approval
- Appendix E Office of the Technical Regulator (OTR) Certificate / Letter of Support
- Appendix F Traffic Impact Statement



Overview Plans for SCAP Development Approval





Council Boundary Irrigated Horticulture Road Service/ Corridor **Proposed Mainlines** Proposed HV Proposed Solar Existing EML (Quarry) Parcel ID

Berri Barmera Council Consent 752/123/17



Reward Project Locality Plan Proposed 1.3GL Dam

Monash Station

> Monash Township

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		- <u>X</u>		A.	-	1

1.5

23/7/18	ISSUED FOR CONSENT REVIEW
13/6/17	ISSUED FOR INFORMATION
DATE	DESCRIPTION

ORIGINAL SHEET SIZE A1 COORDS: MGA Z54 DATUM : AHD DESIGN : EXACT DRAFTED: SM

2.0 2.5km



Proposed 1.3GL Dam and Irrigation Pump Station

Sturt Highway



Monash REWARD Project



Project Name and Address Monasl Concep PROPO

Renmark Airstrip

Sturt Highway



2018 Microsoft Corporation $\mathbb C$ 2018 DigitalGlobe $\mathbb C$ CNES (2018) Distribution Airbus I

River Pumps

Monash REWARD Project Concept Plans for Development Approval PROPOSED DAM

SHEET NUMBER	01	OF	06	
DRAWING NUMBER				

REVISION #



Section through Inlet-Outlet, Underdrainage **Collection System and Proposed Pump Station**

	/ Intlet Structure																																
VERT EXAG 1 Datum 40.00	:5 0																																
CHAIN	IAGE	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.06	100.0	110.00	120.00	130.00	14.0.00	150.00	160.00	170.00	180.00	190.00	200.0	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.0	310.00	
NATURAL SURFACE	52.00	51.61	51.19	50.87	50.55	50.22	49.91	49.65	49.39	49.07	48.84	48.65	48.62	48.58	48.52	48.51	48.51	48.56	48.60	48.55	48.47	48.42	48.34	48.35	48.36	48.27	48.19	48.22	48.25	48.15	48.09	48.06	
DESIGN SURFACE			52.96	55.00	53.04	49.74	47.82	44.74	47.06	46.68	46.30	45.92	45.54	45.47	45.44	45.41	45.38	45.35	45.32	45.29	45.25	45.22	45.19	45.16	45.13	45.10	45.07	45.04	45.00	44.97	44.94	44.91	
CUT OR FILL DEPTH			-1.76	-4.13	-2.49	0.49	2.09	2.21	2.32	2.39	2.54	2.73	3.08	3.10	3.08	3.10	3.14	3.21	3.28	3.27	3.22	3.20	3.15	3.19	3.23	3.17	3.13	3.18	3.24	3.17	3.15	3.15	9

		0 20 40 60 80 100m	
		H SCALE: 1:2000	
		ORIGINAL SHEET SIZE A1	
		COORDS: MGA Z54	
		DATUM : AHD	
13/6/17	ISSUED FOR INFORMATION	DESIGN : EXACT	
DATE	DESCRIPTION	DRAFTED: SM	









Proposed Dam Total Cut and Fill CUT = 398,435 bcm FILL* = 402,870 bcm *Swell Factor = 1.10 Total Capacity = 1,345 ML

Cut (-) / Fill (+) Summary Table				
Band	Minimum	Maximum	Colour	
1	-6.92	-4.00		
2	-4.00	-2.00		
3	-2.00	-0.30		
4	-0.30	0.30		
5	0.30	2.00		
6	2.00	4.00		
7	4.00	7.00		
8	7.00	12.00		

23/7/18

13/6/17

DATE

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	H SCALE: 1:2000		K
	ORIGINAL SHEET SIZE A	A1	
	COORDS: MGA Z54		
ISSUED FOR CONSENT REVIEW	DATUM: AHD		
ISSUED FOR INFORMATION	DESIGN : EXACT		
DESCRIPTION	DRAFTED: SM		









		0 <u>20 40 60 80 100</u> m H SCALE: 1:2000	
		ORIGINAL SHEET SIZE A1	
		COORDS: MGA Z54	
		DATUM : AHD	
13/6/17	ISSUED FOR INFORMATION	DESIGN : EXACT	
DATE	DESCRIPTION	DRAFTED: SM	















Typical Solar Tracking System Cross Section

			0 200	100 600 800 1000m	t above righ	
			H SCA	LE: 1:20,000		
1 0 REV	29/01/2018 05/09/2017 DATE	UPDATE FOR DA REVIEW ISSUED FOR INFORMATION DESCRIPTION	COORDS DATUM : SURVEY: DESIGN :	: MGA Z54 AHD VARIOUS EXACT	CHECKED: S Mat	schoss









Proposed 6MWac Tracking Solar Facility Details

SHEET NUMBER 003 OF 003

DRAWING NUMBER REWARDJUL2018.DWG



APPENDIX B


Product Date/Time Customer Reference Order ID Cost

Register Search (CT 5896/224) 03/04/2017 10:14AM Monash Station 20170403002672 \$27.75

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.



Registrar-General

Certificate of Title - Volume 5896 Folio 224

Parent Title(s) CL 1422/37

RLG 9567124

Dealing(s) Creating Title Title Issued 06/06/2003 Edition 4

Edition Issued 18/02/2016

Estate Type

FEE SIMPLE

Registered Proprietor

MONASH STATION PTY, LTD. (ACN: 608 635 641) OF PO BOX 2004 BERRI SA 5343

Description of Land

ALLOTMENT 100 FILED PLAN 44626 IN THE AREA NAMED MONASH COBDOGLA IRRIGATION AREA (MCINTOSH DIVISION)

Easements

NIL

Schedule of Dealings

Dealing Number Description

-	•
5113003	LEASE COMMENCING ON 26/5/1983 AND EXPIRING ON 25/5/2082 OF AN EASEMENT OVER PORTION AS TO THE SHARES SPECIFIED THEREIN (SUBJECT TO LEASE 9061500 OF THE INTERESTS OF TRANSMISSION LESSOR CORPORATION) PURSUANT TO THE ELECTRICITY CORPORATIONS (RESTRUCTURING AND DISPOSAL) ACT 1999
11532312	HERITAGE AGREEMENT PURSUANT TO SECTION 23 OF NATIVE VEGETATION ACT 1991 OVER PORTION (A IN GP 48/2010)
12465346	MORTGAGE TO NATIONAL AUSTRALIA BANK LTD. (ACN: 004 044 937)
Notations	

Dealings Affecting Title

NIL

Priority Notices





Product Date/Time Customer Reference Order ID Cost Register Search (CT 5896/224) 03/04/2017 10:14AM Monash Station 20170403002672 \$27.75

NIL

Notations on Plan

NIL

Registrar-General's Notes

PLAN FOR HERITAGE AGREEMENT PURPOSES VIDE G48/2010 APPROVED FILED PLAN FOR LEASE PURPOSES FX58132 APPROVED F44626

Administrative Interests

NIL

Land Services

Page 2 of 4



Land Services

Page 3 of 4



Land Services

Product Date/Time Customer Reference Order ID Cost Register Search (CT 5896/224) 03/04/2017 10:14AM Monash Station 20170403002672 \$27.75



Page 4 of 4



Product Date/Time Customer Reference Order ID Cost Register Search (CT 5924/968) 03/04/2017 10:21AM Monash Station 20170403002862 \$27.75

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.



Registrar-General

REAL PROPERTY ACT, 1886

uth Australia

Certificate of Title - Volume 5924 Folio 968

Parent Title(s) CL 1594/24, CL 1596/65

Dealing(s) RLG 10002543 Creating Title

Title Issued 18/09/2004

Edition 3

Edition Issued 18/02/2016

Estate Type

FEE SIMPLE

Registered Proprietor

MONASH STATION PTY. LTD. (ACN: 608 635 641) OF PO BOX 2004 BERRI SA 5343

Description of Land

SECTIONS 613, 614 AND 685 COBDOGLA IRRIGATION AREA (MCINTOSH DIVISION) IN THE AREA NAMED MONASH

Easements

NIL

Schedule of Dealings

Dealing Number	Description
3984785	LEASE COMMENCING ON 21/9/1976 AND EXPIRING ON 20/9/2075 OF AN EASEMENT OVER THE PORTION OF THE WITHIN SECTION 613 AS TO THE SHARES SPECIFIED THEREIN (SUBJECT TO LEASE 9061500 OF THE INTERESTS OF TRANSMISSION LESSOR CORPORATION)
5071936	LEASE COMMENCING ON 26/5/1983 AND EXPIRING ON 25/5/2082 OF AN EASEMENT OVER THE PORTION OF THE WITHIN SECTION 613 AS TO THE SHARES SPECIFIED THEREIN (SUBJECT TO LEASE 9061500 OF THE INTERESTS OF TRANSMISSION LESSOR CORPORATION)
6683717	LEASE COMMENCING ON 10/2/1989 AND EXPIRING ON 9/2/2088 OF AN EASEMENT OVER PORTION OF SECTION 613 HELD APPURTANENT TO C.T. 5616/ 707
10226064	TRANSFER OF LEASE 6683717 TO GIUSEPPE RECCHIA AND JOAN LORRAINE RECCHIA AS JOINT TENANTS (LESSEES COPY LOST)
11660176A	TRANSFER OF LEASE 6683717 TO KYM JOHN AINSLIE

Land Services

Page 1 of 3



Product Date/Time Customer Reference Order ID Cost Register Search (CT 5924/968) 03/04/2017 10:21AM Monash Station 20170403002862 \$27.75

12465346

MORTGAGE TO NATIONAL AUSTRALIA BANK LTD. (ACN: 004 044 937)

Notations

Dealings Affecting Title

NIL

Priority Notices

NIL

Notations on Plan

NIL

Registrar-General's Notes

CONTROLLED ACCESS ROAD VIDE PLAN 121 PLAN FOR LEASE PURPOSES VIDE G668/1987 APPROVED FX44443

Administrative Interests

NIL

Land Services

Page 2 of 3



Page 3 of 3

APPENDIX C

Berri Barmera

COUNCIL Building a Better Community

MS:cp 752/123/17, A2058, A5975

27 March 2018

John Gallard Monash Station Pty Ltd PO Box 2004 BERRI SA 5343

Dear Sir/Madam

Development No:	752/123/17		
Applicant:	John Gallard, Monash Station Pty Ltd		
Proposal:	Monash REWARD Project specifically a river pump station and water pipeline		
ā.	access road and intersection with Goyder Highway construction amenities		
	offices and accommodation camp.		
Subject Land:	Section 685, Sturt and Goyder Highways, Monash SA 5343		
an e contra con en en contra contra con 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1 Contra contra contra Contra contra con Contra contra cont	Allotment 52, DP31911, Sturt Highway Monash SA 5342		

Please find attached the decision notification issued by Council in relation to the above development application.

You are reminded that Section 86(1)(a) of the *Development Act* 1993 provides for a right of appeal to the Environment, Resources and Development Court against a refusal to grant an authorisation or the imposition of conditions in relation to an authorisation. Such an appeal must be lodged with the Court *within two months* after receipt of this notice (Section 86(4) of the Act).

Please contact me should you wish to discuss this matter further.

Yours sincerely,

MYLES SOMERS MANAGER ENVIRONMENTAL SERVICES/MAJOR PROJECTS

19 Wilson Street, Berri SA 5343; Postal Address: PO Box 229, Berri SA 5343; Telephone: (08) 8582 1922 - Facsimile: (08) 8582 3029 Email: bbc@bbc.sa.gov.au Website: www.berribarmera.sa.gov.au Facebook: www.facebook.com/bbcouncil

Berri Barmera

COUNCIL Building a Better Community

SM:cp 752/123/17 A2058 A5975

27 March 2018

Minister for Environment & Heritage C/O Crown Lands PO Box 231 BERRI SA 5343

Dear Sir/Madam

Development No:	752/123/17			
Applicant:	Monash Station Pty Ltd			
Proposal:	Monash REWARD Project, specifically a river pump station and water pipeline access road and intersection with Goyder Highway, construction amenitie offices and accommodation camp			
Subject Land:	Section 685, Sturt and Goyder Highways, Monash SA 5343 Allotment 52, DP31911, Sturt Highway Monash SA 5342			

As the owner of the above land, you are hereby advised pursuant to Regulation 44 of the *Development Regulations 2008* that a decision on this application has now been made by the Council.

A copy of the Decision Notification Form is attached for your information.

Please contact me should you wish to discuss this matter further.

Yours sincerely,

1 Ames

MYLES SOMERS MANAGER ENVIRONMENTAL SERVICES/MAJOR PROJECTS

DECISION NOTIFICATION FORM

	Development No:	DEVAPP 752/123/17	A2058, A5975	
ä	For Development A	Application Dated:	09.08.2017	
		Registered on:	09.08.2017	
		To: John Gallard		
		Monash Station Pty	Ltd	
		Berri SA 5343		
	-			
	LOCATION	OF PROPOSED DEVELOR	PMENT:	
Section 685	Sturt and G	Boyder Highways, Monash SA 53	43 CT 5924/968	
	DP31911 Sturt Highw	way Monash SA 5342	CR 6004/927	

Monash REWARD Project - specifically a river pump station and water pipeline, access road and intersection with Goyder Highway, construction amenities, offices and accommodation camp

In respect of this development you are informed that:

Nature of Decision	Nature of Decision	No. of Conditions	Date of Decision	Not Applicable
Development Plan Consent	Approved	24	27/03/2018	
Land Division				N/A
Land Division (Community)				N/A
Building Rules Consent	Still Required			~
Public Space				N/A
Other				N/A
DEVELOPMENT APPROVAL	Still Required	1		

If there were third party representations, any consent/approval with conditions does not operate until the periods specified in the Act have expired. Reasons for this decision, any conditions imposed, and the reasons for imposing those conditions are set out on the attached sheet.

No work can commence on this development unless a Development Approval has been obtained. If one or more consents have been granted on this Notification Form, you must not start any site works or building work or change the use of the land until you have also received notification of a Development Approval.

Momen -eEOT Delegate Signed:

Date:

2018 Sheets Attached YES (5 pages in total)

THE BERRI BARMERA COUNCIL



BERRI OFFICE (Head Office)

19 Wilson Street BERRI SA 5343

Postal Address: PO Box 229 BERRI SA 5343

Ph: (08) 8582 1922 Fx: (08) 8582 3029

BARMERA OFFICE

4c Barwell Avenue BARMERA SA 5345

Ph: (08) 8588 2031 Fx: (08) 8588 3330

Email: bbc@berribarmera.sa.gov.au

Website: www.berribarmera.sa.gov.au

ATTACHMENT SHEET PLANNING DECISION NOTIFICATION

Development Plan Consent Development Application No. 752/123/17

CONDITIONS:

Development Plan Consent (DPC):

Council conditions:

 Development is to take place in accordance with the supporting documentation and plans relating to Development Application Number 752/123/17 except as modified by any conditions attached to this Decision Notification, specifically:

Plan type	Reference	Dated	Prepared By
Development Application to Berri Barmera Council – Monash REWARD Project – Renewable Energy, Water, Agriculture, Regional Development	GP&E_17009_2, version 6	5/2/18	Paul Gibbons and Donna Feretti
Covering letter		5/2/18	Donna Ferretti and Associates
Letter - DA 752/123/17 - Extension of Time		15/3/18	Donna Ferretti and Associates

- The external finishes of all building materials for the shed must be non-reflective in nature, and constructed of new materials. The floor plan and elevations are to be provided to Council's satisfaction prior to Development Approval being issued.
- 3. Storm water from the pump shed and the construction amenities and accommodation units must be managed to prevent pollution of the site, and the River Murray.
- 4. The short term workers accommodation must be developed in accordance with Figure 3.5 of the Development Application documentation, and removed on completion of the development of the project.
- Prior to establishing the site offices and short term workers accommodation, approvals must be sought and gained for the waste water system to service the site.
- 6. A construction environmental management plan must be developed and the sites developed in accordance with that plan.
- 7. A cultural heritage management plan is to be prepared prior to construction, and the sites managed in accordance with that plan. Management and mitigation measures as outlined at Item 5.3.3 of the Development Application report are to be implemented.
- All vehicle access and egress from the Monash Station site must be gained in accordance with the Traffic Management Report.

The following conditions are attached at the direction of Minister for Water and the River Murray, in accordance with Section 37 of the *Development Act 1993* and Schedule 8, Item 19 of the *Development Regulations 2008*:

- 9. During construction activities the subject land must be managed in a manner as to prevent erosion and pollution of the subject site and the environment, including keeping the area in a tidy state and ensuring any waste materials are appropriately contained to ensure no pollutants (including excavation or fill material) enter the River Murray system.
- 10. Any fill material brought to the site must be clean and not contaminated by construction or demolition debris, industrial or chemical matter, or pest plant or pathogenic material.
- 11. Any excavation or fill material surplus to the requirements of the development must be disposed of such that it will not:
 - a. be located within the 1956 floodplain:
 - b. impede the natural flow of any surface waters;

- c. allow sediment to enter any water body;
- d. adversely impact native vegetation;
- e. facilitate the spread of pest plant and pathogenic material.
- Appropriate measures must be undertaken to minimise water quality impacts during works on or near the riverbed. The use of a silt curtain, coffer dam or similar device or measure may assist in complying with this condition.
- 13. Any exposed areas created or exacerbated during the works must be appropriately stabilised to minimise the potential for erosion and the entry of sediment into the River Murray.
- 14. The navigational lateral mark which features on the seaward end of the submersible pump support structure shall be of the following specification:
 - a. The top mark of the Port Marker shall be three-dimensional and of minimum 750 millimetres high and 750 millimetres in width;
 - b. It shall be mounted such that its base is 3.5 metres above normal pool level for the location.

The following conditions are attached at the request of the Safety and Service Division of the Department of Planning, Transport and Infrastructure, in accordance with Section 37(4)(b) of the *Development Act 1993* and Schedule 8 of the *Development Regulations 2008*.

- 15. The development shall have a single access on the Goyder Highway, located approximately 1.3 kilometres north of the Goyder Highway / Sturt Highway junction. The access shall incorporate a level platform extending at least 30 metres from the existing edge of seal on Goyder Highway and be sealed (minimum spray seal) for the extents of the level platform (including any flaring to the road required to accommodate the simultaneous two-way movements of the largest vehicle expected on-site).
- 16. A Channelised Right Turn (CHR) lane and Rural Basic Left Turn (BAR) treatment (consistent with Austroads Guide to Road Design Parts 4 and 4A shall be constructed on Goyder Highway at the site access to minimise disruption to the free flow of traffic and maximise road safety on the Highway.
- 17. Sight lines at the access shall achieve SISD in accordance with Austroads Guide to Road Design Part 4A. Any vegetation removal/trimming shall be undertaken by the applicant on an 'as needs' basis.
- 18. All vehicles shall enter and exit the site in a forward direction.
- 19. All road works required to accommodate the development shall be designed and constructed in accordance with Austroads Guides/Australian Standards and to DPTI's satisfaction prior to operation of the development. All associated costs (including project management and any necessary road lighting and drainage upgrades) shall be borne by the applicant. The applicant shall contact DPTI, Roads and Marine Assets Section, Asset Enhancement Engineer, Mr Justin Henderson on (08) 7223 6029 or via email <u>Justin.Henderson@sa.gov.au</u> to discuss the proposed road works prior to undertaking any detailed design.
- 20. The turning treatments on Goyder Highway shall be fully completed prior to the commencement of on-site construction works (including site preparation) requiring access by heavy machinery.
- 21. The installation of the pipeline under Sturt Highway shall be undertaken using under-road boring. This work shall be undertaken to the satisfaction of DPTI and in accordance with departmental requirements. All costs shall be borne by the applicant.
- 22. During the installation of the pipeline, Sturt Highway shall remain open to two-way traffic at all times.
- 23. The applicant shall enter into a Developer Agreement for the road works prior to the commencement of construction.
- 24. No storm water from this development shall be permitted to discharge on-surface to the Goyder Highway or Sturt Highway. In addition, any existing drainage of the Goyder Highway and Sturt Highway is to be accommodated in the development and any alterations to road drainage infrastructure as a result of this development are to be at the expense of the applicant.

Building Rules Consent:

Building Rules Consent still required

NOTES FOR APPLICANT:

- a. The development must be substantially commenced within 36 months of the date of this Notification, and completed within 60 months of commencement, unless this period has been extended by Council.
- b. The applicant is reminded of its general environmental duty, as required by section 25 of the Environment Protection Act 1993, to take all reasonable and practical measures to ensure that the activities on the whole site, including during construction, do not pollute the environment in a way which causes or may cause environmental harm.
- c. The applicant is reminded of the general duty to comply with the Environmental Protection Noise Policy.

The following notes are attached at the request of Minister for Water and the River Murray:

- d. The applicant is advised of their general duty of care under the *River Murray Act 2003* to take all reasonable measures to prevent any harm to the River Murray through his or her actions or activities.
- e. If there is an intention to clear native vegetation on the land at any time, the applicant should consult the Native Vegetation Council to determine relevant requirements under the *Native Vegetation Act 1991* and its Regulations, which may include the provision of a Significant Environmental Benefit. Note that 'clearance' means any activity that could cause any substantial damage to native plants, including cutting down and removing plants, earthworks, burning, poisoning, slashing of understorey, removal or trimming of branches, severing roots, drainage and reclamation of wetlands, and in some circumstances grazing by animals. For further information contact the Native Vegetation Council on telephone 8303 9777 or visit: http://www.nvc.sa.gov.au.
- f. If the applicant wishes to use water (other than for firefighting purposes) from the River Murray Prescribed Watercourse, then pursuant to the *Natural Resources Management Act 2004*, they will be required to apply to the Department of Environment, Water and Natural Resources (DEWNR) for a Water Allocation Account, Water Resources Works Approval and Site Use Approval, and will also be required to source a water allocation from an existing licensee and apply to DEWNR to have the water transferred to their Water Allocation Account. DEWNR will assess the applications against the principles of the *Water Allocation Plan for the River Murray Prescribed Watercourse*. Upon issue of a Water Resources Works Approval the applicant will also be required to install a water meter compliant with the DEWNR meter installation and specification standard. For further information contact DEWNR (Water and Fauna Permits Program, Berri) on telephone 8595 2203 or visit: http://www.environment.sa.gov.au/licences-and-permits/water-licence-and-permit-forms.
- g. Prior to the commencement of any works, the applicant will be required to seek the approval of the Minister for Sustainability, Environment and Conservation in the form of an application for a Licence to Occupy to enable continued occupation of Crown land, pursuant to the Crown Land Management Act 2009. In addition, Native Title notification may be required as a pre-requisite to the issue of any licence, pursuant to the provisions of the Native Title Act 1993 (Cth). If required, the notification process is a minimum of 8 weeks – in addition to the assessment of the licence application. For further information please contact the Department of Environment, Water and Natural Resources (Crown Lands Program, Berri) on telephone 8595 2111 and quote the Development Application number, or visit: http://www.environment.sa.gov.au/managing-natural-resources/Land/Crown_lands.
- h. For further guidance regarding navigational safety and marker requirements please contact the Department of Planning, Transport and Infrastructure's Marine Operations Section on telephone 8260 0088 or visit: http://www.sa.gov.au/topics/boating-and-marine.
- i. The applicant is advised that the Central Archive, which includes the Register of Aboriginal Sites and Objects, has entries for Aboriginal sites (two archaeological sites) near the location of the pumping infrastructure. It is recommended that the applicant consult with the First Peoples of the River Murray and Mallee Aboriginal Corporation prior to the commencement of any works. Contact: Christina Abdulla (Chair) on telephone 0428 220 231 or email: <u>abdulla.christine@yahoo.com.au</u>.
- j. The River Murray and many of its tributaries and overflow areas have abundant evidence of Aboriginal occupation and Aboriginal sites, objects or remains may be present on the subject land. Under section 20 of the Aboriginal Heritage Act 1988 (the Act), an owner or occupier of private land, or an employee or agent of such an owner or occupier, must report the discovery on the land of any Aboriginal sites, objects and remains to the Minister responsible for the administration of the Act, as soon as practicable, giving the particulars of the nature and location of the Aboriginal sites, objects or remains. It is an offence to damage, disturb or interfere with any Aboriginal site or damage any Aboriginal object (registered or not) without the authority of the Minister for Aboriginal Affairs and Reconciliation (the Minister). If the planned activity is likely to damage, disturb or interfere with a site or object, authorisation of the activity must be first obtained from the Minister under Section 23 of the Act. Penalties may apply for failure to comply with the Act.

k. This approval does not obviate any considerations that may apply to the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth). For further information visit: <u>http://www.environment.gov.au/epbc</u>.

REASON FOR DECISION:

The proposed development fulfils the criteria set down for the Zone, having no anticipated detrimental impact on adjoining
properties or the surrounding environment.

REASON FOR THE CONDITIONS:

• The Conditions are imposed so as to maintain the amenity of the area and to attain the Objectives of the Zone.

estores MYLES SOMERS MANAGER ENVIRONMENTAL SERVICES/MAJOR PROJECTS

APPENDIX D



Native Vegetation Council

Graham Carpenter

8207 7714

2017/3037/752

Contact: Telephone:

File:

Level 4 81-95 Waymouth St ADELAIDE SA 5000

GPO Box 1047 Adelaide SA 5001

18 April 2018

John Gallard Monash Station P.O. Box 2004, BERRI SA 5342 Ph| 08 8303 9777 nvc@sa.gov.au

Dear Sir,

Re: Native Vegetation Removal Request - Monash Reward irrigation development

I refer to application dated 23 March 2018, in which approval was sought from the Native Vegetation Council (NVC) for the removal of native vegetation associated with establishing an irrigation and renewable energy project under Native Vegetation Regulation 5(1)(d).

At its meeting of 11 April 2018 the Native Vegetation Assessment Panel (NVAP) considered your application in conjunction with the presentation by yourself, Shaun Matschoss and Paul Gibbons of EMM consulting together with reports from both EBS Ecology and the Native Vegetation Management Unit. The application for the development, as detailed in the EBS Ecology report dated July 2017, was considered against Regulation 5(1)(d) - Clearance of native vegetation associated with the building or provision of infrastructure.

NVAP considered that the proposed clearance of up to 73.4 ha and 16 scattered trees satisfies the requirements of Native Vegetation Regulation 5(1)(d).

NVAP resolved to endorse the use of NV Regulation 5(1)(d) as described in the *Monash Reward Project Flora and Fauna Assessment* prepared by EBS Ecology dated July 2017, subject to:

- 1. No clearance to occur until planning approval for the proposed development has been obtained;
- 2. Written consent is required from the landowner of any land not owned by the applicant prior to the clearance of native vegetation;
- 3. Clearance to be confined to those areas as described in the *Monash Reward Project flora and fauna assessment* prepared by EBS Ecology dated July 2017 and as shown in the attached Regulation Advice Plans 2017/3037/752 numbered 7 of 7;
- No clearance or other activity (Conditions 5 and 6) is to occur adjacent the boundary of Cooltong Conservation Park without consultation with of the District Manager, Riverland Region, Dept Environment and Water, Berri office;
- 5. Clearance adjacent the boundary of Cooltong Conservation Park is be undertaken using low impact methods to limit soil disturbance, limit the spread of weeds and ensure

Website: http://www.environment.sa.gov.au/Conservation/Native_vegetation/Native_Vegetation_Council

regeneration of native understorey species throughout the clearance corridor, excluding a 5 m wide vehicle access track;

- Gates and other appropriate means of preventing unauthorised vehicle access to be installed at either end of the clearance corridor adjacent the southern boundary of Cooltong Conservation Park;
- 7. The landowner is to permanently set aside a minimum area of land totalling 220 ha within the 357 ha area marked "set-aside area" in the attached Overview Plan numbered 2017/3037/752 for the growth of native vegetation and for no other purpose;
- 8. The landowner is to manage the set-aside area in accordance with the Native Vegetation Management Plan for the Monash Reward Project set-aside area prepared by EBS Ecology dated March 2018 so as to permanently maintain that land for the purpose of growth of native vegetation. In particular, the landowner must:
 - (a) undertake an effective and ongoing weed, rabbit and feral goat control program within the set-aside area to ensure the successful regeneration of native vegetation in the area;
 - (b) erect a stock proof fence to exclude stock from the set-aside area, to be completed prior to undertaking the clearance. (Note: Where the adjoining land is to be kept free of stock, no fencing is required unless grazing of the adjacent land is proposed);
 - (c) maintain and if necessary upgrade fences around the set-aside area so that stock or other domestic grazing animals are excluded from the set-aside area;
 - (d) not allow access to the set-aside area by any vehicles or machinery unless that access will assist in promoting growth or regeneration of native vegetation;
 - (e) not cause or permit the construction of any buildings or other structures, other than approved signs, on the set-aside area;
- 9. The landowner is to enter into a Heritage Agreement over the set-aside area as described in Condition 7, to be signed within four weeks of receiving the relevant Heritage Agreement documentation.
- 10. Members of the Council or a person who is an authorised officer under the Native Vegetation Act may at a reasonable time enter the property of the landowner for the purpose of assessing and recording any matter relevant to this consent. A person undertaking such an assessment may be assisted by other suitable persons. Any such inspection will only be taken after there has been an attempt to contact the landowner; and
- 11. The landowner must adequately inform any prospective purchaser, lessee or occupier of the land affected by conditions in this consent, of the relevant conditions.
- 12. This endorsement shall be for a period of 2 years, after which time a new endorsement will be required under Native Vegetation Regulation 12(34).

Please contact Graham Carpenter on 8207 7714 if you have any questions.

Yours sincerely,

SAEZ

Graham Carpenter Assessment Officer Native Vegetation Branch







Native Vegetation Regulation 5(1)(d) Application











APPENDIX E



Government of South Australia

Department of the Premier and Cabinet

> Energy and Technical Regulation

Office of the Technical Regulator

Level 8, 11 Waymouth Street Adelaide SA 5000

GPO Box 320 Adelaide SA 5001

Telephone: 08 8226 5500 Facsimile: 08 8226 5866

www.sa.gov.au/otr

Ref: 2017/01873.01 D18010612

24 January 2018

John Gallard Monash Station Pty Ltd PO Box 2004 Berri SA 5342 By email: john@gallardservices.com.au

Dear John,

RE: CERTIFICATE FOR DEVELOPMENT OF THE MONASH REWARD PROJECT

The development of the Monash REWARD Project has been assessed by the Office of the Technical Regulator (OTR) under Section 37 of the Development Act 1993.

Regulation 70 of the *Development Regulations 2008* prescribes if the proposed development is for the purposes of the provision of electricity generating plant with a generating capacity of more than 5 MW that is to be connected to the State's power system – a certificate from the Technical Regulator is required, certifying that the proposed development complies with the requirements of the Technical Regulator in relation to the security and stability of the State's power system.

In making a decision on your application, our office has taken the following information into account:

- Gallard Group's letter 'Monash REWARD Project Request for Office of the Technical Regulator Approval Certificate', emailed by Tina Williamson of Gallard Group to the OTR on 23 January 2018;
- Previous meetings between yourself, Clutch Consulting, Exact Contracting and a OTR Representative regarding your proposed project.

After assessing the information provided, I advise that approval is granted for the proposed project.

Energy and Technical Regulations

Level 8, 11 Waymouth Street Adelaide SA 5000 | GPO Box 320 Adelaide SA 5001 | DX541 Tel (+61) 8 8226 5500 | Fax (+61) 8 8226 5866 | www.dpc.sa.gov.au | ABN 83 524 915 929



Government of South Australia Department of the Premier and Cabinet

Should you have any questions regarding this matter, please do not hesitate to call David Bosnakis on (08) 8226 5521.

Yours sincerely

1 J hot

Rob Faunt TECHNICAL REGULATOR

cc: Jezac Crowe – Clutch Consulting Shaun Matschoss – Exact Contracting

Energy and Technical Regulations

Level 8, 11 Waymouth Street Adelaide SA 5000 | GPO Box 320 Adelaide SA 5001 | DX541 Tel (+61) 8 8226 5500 | Fax (+61) 8 8226 5856 | www.dpc.sa.gov.au | ABN 83 524 915 929

APPENDIX F

TRAFFIC IMPACT STATEMENT AND ENDORSEMENT

PROJECT: Monash REWARD project, Goyder Highway, Monash

DRAWINGS / ATTACHMENTS: Attachment A - Concept intersection layout

COUNCIL: Berri Barmera Council

ROAD AUTHORITY: Department of Planning Transport and Infrastructure

LOCATION: Goyder Highway (-34.226291, 140.515727)

BACKGROUND

Monash REWARD Project is planning to develop a large parcel of land for irrigation to the north and west of Monash, see below figure. The development is expected to consist of approximately 4,000 hectares of irrigated land producing a variety of horticultural crops. Associated infrastructure such as offices, on-site processing, stormwater and utilities infrastructure is also expected to be constructed.



PROPOSAL

The Monash REWARD project is planning to construct a new access off the Goyder Highway, approximately 1.3km north of the Sturt Highway. This access is proposed to be the primary access for freight and staff vehicles. Times of operation are to be predominately during daylight hours.

The access is proposed to consist of a Basic Left Turn and Channelised Right Turn, as discussed below.

Both the Sturt Highway and Goyder Highways are gazetted B-Double routes.

IMPACTS

The development is expected to create a maximum of 20 in and out heavy vehicle movements, totalling 40 heavy vehicle movements (B-Doubles) per day during peak harvest times. Furthermore, the development will have approximately 50 staff on site each day during peak harvest times. This is expected to create a maximum of 150 movements per day, however it has been noted that staff members are likely to attend site via bus or carpooling so this is considered a conservative estimate.

Page 1 of 3

The proposed intersection will increase traffic volumes on the Goyder Highway. The vast majority of heavy vehicle traffic and light vehicle traffic will most likely head south towards Sturt Highway. At this stage it is unknown the distribution of traffic along the Sturt Highway as this will be market driven.

Peak additional movements along the Goyder Highway are shown on Attachment A.

The additional traffic entering and exiting the Goyder Highway is expected to have an impact on safety due to vehicles stopping in a high speed rural environment. However, this section of road is relatively flat and straight (with a minor crest located 450m to the south and a bend located 1.3km to the north). As a result, sight distance around the intersection is more than sufficient to meet Austroads stopping sight distance requirements.

Negligible impact is expected on the Sturt Highway intersection or on the highway itself. This junction is already configured as a AUL/CHR intersection along the Sturt Highway, with the Goyder Highway approach designed as a CHL.

Lane widths of the Goyder Highway are approximately 2 x 3.2m with a 2.5m unsealed shoulder on each side. While slightly less than the desired minimum, the relatively low traffic volumes and wide shoulder provide sufficient width. The development is not expected to impact on these factors and road widening is not considered to be required, apart from any intersection treatment discussed below.

Annual Average Daily Traffic Estimates along the Goyder Highway are quoted as 300 vehicles per day (DPTI, 2015).

The proposed development is expected to create a maximum of 200 movements per day (150 staff movements + 40 HV movements + allowance for service vehicles). In accordance with Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections (Figure 4.9) volumes of this magnitude would only warrant a BAL/BAR treatment.

However, it is noted that most traffic will be entering and exiting to/from the Sturt Highway to the south. Furthermore, traffic may be of higher intensity at particular times of day (i.e. shift changes) and as a result a CHR treatment may be warranted. This will also improve safety considering the increased volume of heavy vehicles the development proposes to introduce.

On this basis the proposed concept layout is for a BAL/CHR intersection as shown in Attachment A.

OUTCOME

The proposed construction of a new junction on Goyder Highway, approximately 1.3km north of the Sturt Highway, consisting of a Basic Left turn and Channelised Right Turn Lane in accordance with Austroads Guidelines.

CONSULTATION

None undertaken to date.

ENDORSEMENT

In accordance with the Minister for Transport and Infrastructure's *Instrument of General Approval* and *Delegation to Council*, this Traffic Impact Statement has been prepared by a person the Council deems to be an experienced traffic engineering practitioner, and endorsed by a person authorised by Council.

	Name: Paul Simons	
(Experienced Traffic Engineering Practitioner) Signed:	Date: Position: Senior Transport Planner	
Traffic Impact Statement		Page 2 of 3

ENDORSED: (Person authorised by Council)	Name:	Date:
Signed:	Position:	

NOTE: If this proposal only contains devices that meet Council's *Instrument*, approval from the Commissioner of Highways is **not** required. Otherwise continue below.

APPROVAL FROM THE COMMISSIONER OF HIGHWAYS or authorised delegate is required for devices not conforming to the requirements of, or used in accordance with, the Australian Standards or DPTI's *Code of Technical Requirements* ('the Code'), or for devices listed in Appendix A of the Code as requiring a separate approval.

Applications for approval shall be addressed to:

Commissioner of Highways % Manager, Technical Services Department of Planning, Transport and Infrastructure GPO Box 1533 Adelaide SA 5001 Email: <u>DPTI.TASSAdminSupport@sa.gov.au</u>

and must include this traffic impact statement, any plans and relevant supporting documentation.

APPROVAL FROM COMMISSIONER OF HIGHWAYS (or authorised delegate) – DPTI USE ONLY			
TECHNICAL ENDORSEMENT	Name:	Date:	
(Recognised Tranic Engineering Practitioner) Signed:	Position:		
APPROVED	Name:	Date:	
Signed:	Position:		
File No:	KNet Ref:		

CONDITIONS

(Additional conditions may be added to this list)

Approval to install, alter or remove those traffic control devices listed as requiring separate approval from the Commissioner of Highways that are proposed in this traffic impact statement and its attachments is granted subject to the following:

- Devices shall be installed, altered or removed in accordance with the Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices where there is no conflict with this traffic impact statement and its attachments, and the conditions of this approval, and
- Devices shall be installed by a council employee or contractor with experience in the placement
 of traffic control devices, and
- Council must keep records of the times and dates the devices are installed, altered or removed, and
- For speed limit and end speed limit signs, Council shall notify the Commissioner of Police before signs are installed, altered or removed.



Appendix B – EBS Ecological Assessment


May 2017

12 July 2017

Version 4

Prepared by EBS Ecology for Gibbons Planning and Environmental

Document Control					
Revision No.	Date issued	Authors	Reviewed by	Date Reviewed	Revision type
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EBS Ecology Project Number: E70202

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CITATION: EBS Ecology (2017) Monash REWARD Project Flora and Fauna Assessment May 2017. Report to Gibbons Planning and Environmental. EBS Ecology, Adelaide.

Cover photograph: Old pipeline easement in south eastern portion of project site.

EBS Ecology 3/119 Hayward Avenue Torrensville, South Australia 5031 t: 08 7127 5607 http://www.ebsecology.com.au email: info@ebsecology.com.au



GLOSSARY AND ABBREVIATION OF TERMS

BDBSA	Biological Database of South Australia (managed by DEWNR)
DEWNR	Department of Environment, Water and Natural Resources
DoEE	Department of the Environment and Energy
EBS	EBS Ecology
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
HA	Heritage Agreement
NPW Act	National Parks and Wildlife Act 1972
NRM Act	Natural Resources Management Act 2004
SEB	Significant Environmental Benefit
ssp.	Sub-species
spp.	Species (plural)
Project area	proposed project area as outlined by the client
var.	Plant variety



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1 INTRODUCTION

EBS Ecology was engaged by Monash Station Pty Ltd to undertake an assessment of the Monash REWARD project site. The assessment was focused on terrestrial flora and fauna, with the key objective being to identify potential ecological constraints for the project and assess the clearance requirements associated with the project.

The Monash REWARD project area is located north of Monash in the Murray Darling Basin Region of South Australia, approximately 200 km north east of the Adelaide CBD. The project encompasses a 3,300 hectare (ha) mixed use renewable energy, water, agriculture and regional development project located within the Riverland region of South Australia. The Monash REWARD development proposes to establish new almond, citrus, vineyard and avocado agri-industries at Monash Station, whilst providing increased electricity capacity, securing a local energy supply and enabling future electricity reinforcement to the Riverland and Regional South Australia (Figure 1).

This significant infrastructure development broadly comprises:

- Water supply pump station, pipework and ancillary works to extract and distribute water from the River Murray;
- 7.8 km pipeline and overhead powerline to facilitate pumping of water from the river and electricity connection to Monash Station;
- water storage dams [2 x 1 gigalitre (GL)], water supply pump station, hydro pump station (14.7 megawatt (MW)) and ancillary works to enable storage and distribution of water and generation and distribution of electricity to support the agricultural activities; and
- solar farms [1 x 15MW] and substations [x1] to generate and distribute electricity to agricultural activities and high voltage electricity connection to ElectraNet's Monash substation."
- proposed site infrastructure has sought to be located within cleared or previously disturbed areas as far as practicable to limit potential impacts to flora and fauna species

The general landform of the area is deep sands present as an extant dune system and extensive Mallee vegetation located immediately north and east of the project site. Proposed site infrastructure has sought to be located within cleared or previously disturbed areas as far as practicable to limit potential impacts to flora and fauna species.

1.1 Objectives

The objectives of the study were to:

- Inspect and assess native vegetation, requiring clearance, against regulation exemption 5(I)(b) under the Native Vegetation Act, 1991;
- Undertake Significant Environmental Benefit (SEB) calculations as required under the Native Vegetation Act 1991 for the proposed clearance areas and investigate potential for a SEB on the property;
- Identify areas of biodiversity significance;



- identify and map the native vegetation associations (composition and condition);
- identify and map any threatened species or communities that may be present;
- identify the extent and significance of wildlife habitat;
- identify species of national and state conservation significance known or likely to occur in the area and provide details on possible impacts;
- record opportune fauna sightings; (i.e. ramble survey)
- identify significant pest plants and animals.





Figure 1. Location of Monash REWARD project site.



2 COMPLIANCE AND LEGISLATIVE SUMMARY

The conservation status of flora and fauna species is specified at three geographic scales: national (Environment Protection and Biodiversity Conservation Act 1999) (EPBC Act), state (National Parks and Wildlife Act 1972) (NPW Act) and regional. National and state conservation ratings are recognised under legislation. Regional conservation ratings are informal ratings assigned by DEWNR. Whilst regional ratings are not recognised under legislation, they can give a better understanding of the status and trend of a species within the local area, and hence help assess the potential impact of proposed developments.

Threatened ecological communities are recognised under the EPBC Act. There are no formal ratings for threatened ecological communities under the NPW Act, however informal state and regional ratings were developed by the Department for Environment and Heritage (DEH in progress).

This report focuses on flora and fauna species recognised as threatened under legislation. A summary of relevant Commonwealth and state environment legislation is provided below.

2.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides protection for matters of national environmental significance. The matters of national environmental significance protected under the EPBC Act are:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)

Under the EPBC Act, any actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for Environment and Energy. The minister will decide whether assessment and approval is required under the EPBC Act.

2.2 Native Vegetation Act 1991

Native vegetation within the project area is protected under the Native Vegetation Act 1991 and Regulations 2003. Any proposed clearance of native vegetation in South Australia (unless exempt under the regulations) is to be assessed against the Principles of Clearance under the Act, and requires approval from the Native Vegetation Council (NVC). A net environmental benefit is generally conditional on an approval being granted.

An assessment against the Native Vegetation Clearance Principles may not be required if the clearance is considered to comply with Regulation 5(1)(d) Building or provision of infrastructure in the Public Interest.



However, even if this is the case, an application for approval under Regulation 5(1)(d) is still required to the NVC.

There was one existing Heritage Agreement 1081 in the project area managed under the Native Vegetation Act 1991. Heritage Agreements are established by agreement between the landholder and the Minister for Environment and Conservation. This area will be avoided and is not proposed to be impacted by the development.

2.3 National Parks and Wildlife Act 1972

Native plants and animals in South Australia are protected under the National Parks and Wildlife Act 1972. Under this Act, it is an offence to take a native plant or protected animal without approval. Conservation significant flora and fauna species listed on Schedules 7, 8, or 9 of the National Parks and Wildlife Act 1972 are known from the proposed project area.

Cooltong Conservation Park is protected under this Act and managed by DEWNR.

2.4 Natural Resources Management Act 2004

Under the *Natural Resources Management Act 2004* (NRM Act), landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

This Act will have relevance in relation to the ongoing control of pest plant and animal species during construction and site remediation. The project area falls within the Natural Resources SA Murray-Darling Basin region.



3 BACKGROUND INFORMATION

The project site extends over the boundaries of the Pastoral Unincorporated Areas (PUA) and the Berri Barmera Council. It falls under the stewardship of the South Australian Murray Darling Basin NRM Board (SAMDB NRM). The primary land use in the region is horticulture along the River Murray scroll belt and surrounds with pastoral land use dominant beyond the river corridor.

3.1 Environmental setting

Cooltong Conservation Park shares a boundary with the eastern extent of project area and is located 6 km west of Renmark, South Australia. The conservation park was proclaimed under the *National Parks and Wildlife Act 1972* in 1993 to preserve quality mallee vegetation and habitat for the mallee bird species that frequent the area, in particular the Mallee fowl. As of 2011, the conservation park was described as "dominated by Mallee vegetation", with undulating dunes and swales and that it is popular among birdwatchers eager to catch a glimpse of elusive mallee birds. Services provided within the conservation park include bushwalking, picnic grounds and vehicle tracks only accessible by 4WD vehicles. The conservation park is classified as an IUCN Category VI protected area

Calperum Station and Taylorville Station are pastoral leases which share the northern boundary of the project site, comprised of 242,800 and 92,600 hectares respectively of predominantly open mallee bushland and River Murray floodplains. Calperum and Taylorville are important locally, nationally and internationally because of their intact mallee vegetation, the presence of several threatened bird species, and their wetlands and related species. The properties form critical habitat for the endangered black-eared miner (*Manorina melanotos*). They are also important for the conservation of the nationally vulnerable Mallee fowl (Leipoa ocellata), the regionally vulnerable bush stone-curlew (*Burhinus grallarius*) and the nationally vulnerable southern bell frog (*Litoria raniformis*) (DoEE 2017a).

3.1.1 IBRA

The Interim Biogeographical Regionalisation of Australia (IBRA) identifies geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The bioregions are further refined into subregions and environmental associations. The Monash reward project is located within the Murray Darling Depression IBRA bioregion, the South Olary Plain IBRA subregion and falls outside the area where the environmental associations have been updated.

Native vegetation remnancy figures for IBRA subregions and environmental associations are useful for setting regional landscape targets and guiding restoration projects. Ninety-seven percent (97%) (or 1,179,139 ha) of the subregion is mapped as remnant native vegetation, of which 33% is formally conserved (394,391ha) protected within NPW reserves and private Heritage Agreements under the Native Vegetation Act 1991). A full summary is provided below (Table 1).

Table 1. IBRA bioregion, subregion, and environmental association environmental landscape summary. IBRA Region MDD01, Murray Darling Depression

An extensive gently undulating sand and clay plain of Tertiary and Quaternary age frequently overlain by Aeolian dunes. Vegetation consists of semi-arid woodlands of Black Oak / Belah, Bullock Bush/ Rosewood and Acacia spp., mallee shrublands and heathlands and savanna woodlands.



South Olary Plain Sub region		
This subregion comprises an undulating Calcreted plain with shallow soils supporting a low woodland or tall open shrubland with a ground cover of bluebush or saltbush. This plain is overlain in many places by low easterly trending dunes or sand sheets with a cover of degraded mallee over saltbush or porcupine grass. Relict alluvial terraces with low open woodland of black oak form well defined flat-topped ridges and rise locally some 5-20 m above the plain. Near the western margin there is a small transition zone with fans shed from the ranges. A very low open shrubland cover of bluebush and saltbush is prominent, but never extends far into the plain.		
Landform	Depositional or Bare rock Depositional plain, Plains with variable dune cover, from dune formations with relatively small plains between to plains with isolated tracts of dunes. Clay pans, saline soils, swamps, and intermittent lakes in low-lying areas	
Geology	Exposed caliche & crusty loamy soils; colluvial sand, silt, clay & gravel along foot slopes of Olay Spur. Evaporite deposits; gypsum & halite	
Soil	Brown calcareous earths, Highly calcareous loamy earths, Cracking clays, yellow grey, Hard setting loamy soils with red clayey subsoils	
Climate	E6: Semi-arid climate that is too dry to support field crops. Soil moisture tends to be greatest in winter	
Vegetation	Mallee with an open shrubby understorey	
Remnancy	The subregion covers an area of 1,214,067ha of which 1,179,139 (97%) is native vegetation. 394,341 ha (33%) of this is protected in formal reserves and heritage agreements. 52 threatened fauna species and 33 threatened flora species have been recorded within the sub region.	

3.2 Climate

The nearest weather station for the site is Renmark, South Australia. The Murray lands are characterised by a Mediterranean climate, having predominantly winter rains and hot dry summers (Figure 2). Typically summer temperatures average 32°C and winter days average 16°C with around five hours of sunshine per day.





Figure 2. Average monthly mean maximum temperature and mean rainfall data from Renmark AERO. (Source: Australian Government – Bureau of Meteorology 2017).

3.3 Threatening processes

The major threats to biodiversity in and around the local area may include:

- Grazing with lack of regeneration;
- weed invasion e.g. competition with environmental weeds such as *Lycium ferocissimum* (Boxthorn), *Asparagus asparagoides* (Bridal Creeper), *Eragrostis curvula (African Lovegrass)* and *Ehrharta longifolia* (Veldt Grass);
- pest animals (e.g. rabbits, foxes, cats and goats) presenting a threat to native plant and animal species through grazing, competition and predation.



4 METHODS

4.1 Database searches

The online Protected Matters Search Tool was used to identify any flora species or ecological communities of national environmental significance under the EPBC Act that may occur or may have suitable habitat within the project area. A 20 km buffer was applied to the search.

A search of the Biological Database of South Australia (BDBSA) maintained by the Department of Environment, Water and Natural Resources (DEWNR) was obtained to identify threatened flora species previously recorded within a 20 km buffer around the project area (DEWNR 2017). The BDBSA is comprised of an integrated collection of corporate databases which meet DEWNR standards for data quality, integrity and maintenance. In addition to the DEWNR biological data, the BDBSA also includes data from partner organisations. This data is included under agreement with the partner organisation for ease of distribution but they remain owners of the data and should be contacted directly for further information.

An assessment of the likelihood of each threatened fauna species occurring was undertaken. A likelihood of occurrence rating was assigned to each threatened species identified in the Protected Matters Search and BDBSA database searches. This rating, 'Highly Likely', 'Likely', 'Possible' and 'Unlikely' takes the following criteria into consideration:

- date of the most recent record (taking into consideration the date of the last surveys conducted in the area);
- proximity of the records (distance to the project area);
- landscape location of the records, vegetation remnancy and vegetation type of the record location (taking into consideration the landscape, remnancy and vegetation type of the project area, with higher likelihood assigned to species that were found in similar locations/condition/vegetation associations); and
- knowledge of the species habitat preferences, causes of its decline, and local population trends.

A summary of the likelihood criteria is shown below in Table 2.

Likelihood category	Criteria
Unlikely	No BDBSA records despite survey effort considered adequate, or No BDBSA records and survey effort is considered not adequate, and no suitable habitat is known to occur in the area, or No BDBSA records and survey effort is not considered adequate, and no suitable is known to occur in the area, and species of similar habitat needs have no records either.
Possible	No BDBSA records, survey effort is considered not adequate, suitable habitat does occur (or isn't known if it does occur) and species of similar habitat needs have been recorded in the area, or BDBSA records within the last 40 years, and the area is not largely intact, or BDBSA records in the last 10 years, the species does not have highly specific needs, and habitat is largely intact.

ecology

Likelihood category	Criteria
Likely	BDBSA records in the last 10 years, the species does not have highly specific habitat needs and the habitat is largely intact, or BDBSA records in the last 10 years, the species does have highly specific habitat needs and these needs occur in the area.
Highly likely	BDBSA records in the last 10 years, the species does not have highly specific needs, and the habitat is largely intact.

4.2 Background information

Existing information relevant to the project was reviewed, including:

- Aerial imagery.
- Spatial datasets: DEWNR biological survey sites, vegetation cover, protected areas, NVIS floristic mapping, Transport SA roadside vegetation survey.
- DoEE website for Species Profiles and Threats (SPRATs), recovery plans, conservation advices and policy statements for nationally listed species and ecological communities;
- Web-based literature, journal articles and other published information on bird migration patterns and bird collision risk associated with wind turbines (cited in the text where used).
- Reports and plans.

This information was used to provide a representation of:

- Native vegetation cover within the project area and immediate surrounds;
- previous survey effort in the area;
- vegetation associations present (including associations of significance);
- flora and fauna species (including species of national, state or local conservation significance) known or likely to occur in the area;
- potential ecological constraints and opportunities for the project; and
- key threatening processes (e.g. weeds, pest animals) that may require specific management.

Species nomenclature in this report follow that used in the DEWNR taxonomic lists (last updated February 2017).



4.3 Field survey

The project area was surveyed on 6th - 10th April 2017 by EBS staff Andrew Sinel and Paul Drummond.

4.3.1 Vegetation associations and condition

The vegetation associations and vegetation condition were mapped across the project site. A flora species list was compiled for each of the associations with a focus on threatened species. Declared weeds, listed under the Natural Resources Management Act 2004, were recorded where observed. Data was recorded to the required standards under the Native Vegetation Act 1991.

Each vegetation community where clearance was proposed was traversed on foot to record individual species, known as a ramble survey. Each vegetation community was assigned an SEB condition rating. The SEB condition scores are based on assessment criteria for the condition of vegetation communities in Table 3.



Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
	0:1	<10%	No overstorey stratum remaining.	Complete destruction of indigenous understorey* (by grazing &/or introduced plants).	Vegetation structure no longer intact (e.g. removal of one or more vegetation strata). Scope for regeneration, but not to a state approaching good	Where proposed clearance is considered to be minor and of limited biodiversity impact, e.g. lopping of overhanging limbs only or minor clearance of shrubs in areas otherwise considered as highly disturbed.
Very Poor	1:1	10-19%	Scattered trees in poor health and/or representing an immature stand.	condition without intensive management. Dominated by very aggressive weeds. Partial		Where proposed clearance is
	2:1	20-29%	Scattered trees either immature in good health or mature in poor/moderate health. Alternatively, the dominant overstorey stratum is largely intact and is an immature stand (or regrowth), and is generally in poor health.	Almost complete destruction of indigenous understorey* (by grazing &/or introduced plants) - reduced to scattered clumps and individual plants.	area). Evidence of heavy grazing (tracks, browse lines, species changes, complete depletion of soil surface crust).	introduced species, the area of native vegetation is largely reduced to scattered trees, indigenous understorey reduced to scattered clumps and individual plants.
Poor	3:1	30-39%	Dominant overstorey stratum is largely intact and is a moderately healthy mature stand.	Heavy loss of native plant species (by	Vegetation structure substantially altered (e.g. one or more vegetation strata depleted). Retains basic vegetation structure or the ability to regenerate it. Very obvious	Where the proposed clearance is of mostly intact
	4:1	40-49%	Dominant overstorey stratum is largely intact and is a healthy mature stand with high wildlife habitat value (e.g. hollows).	grazing &/or introduced plants). The understorey* consists predominately of alien species, although a small number of natives persist.	signs of long-term or severe disturbance. Weed dominated with some very aggressive weeds. Partial clearing (10 – 50% of area). Evidence of moderate grazing (tracks, browse lines, soil surface crust extensively broken).	overstorey vegetation but there is still considerable weed infestation amongst the understorey flora.

Table 3. Assessment criteria for the condition of vegetation communities



Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)	
Moderate	5:1	50-59%	Dominant overstorey stratum is largely intact – any condition+	Moderate loss of native understorey diversity. Weed-free areas small. Substantial invasion of aliens resulting in significant competition, but native understorey* persists; for example, may be a low proportion of native species and a high native cover, or a high proportion of native species and low native cover.	Vegetation structure altered (e.g. one or more vegetation strata depleted). Most seed sources available to regenerate original structure. Obvious signs of disturbance (e.g. tracks, bare ground). Minor clearing (<10% of area). Considerable weed infestation with some aggressive	Where the proposed clearance is of mostly intact overstorey vegetation with moderate but not severe weed infestation amongst the understorey flora. Clearance is not seriously at variance with the Principles.	
	6:1	60-69%	Dominant overstorey stratum is largely intact – any condition+	Moderate but not severe weed infestation amongst the understorey flora.	weeds. Evidence of some grazing (tracks, soil surface crust patchy).		
Good	7:1	70-79%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre- European vegetation.	Vegetation structure intact (e.g. all strata intact). Disturbance minor, only affecting individual	Where the proposed clearance is of mostly intact overstorey and understorey vegetation, weed infestation is moderate to low, but the original vegetation is still dominant. Clearance is assessed by the NVC to be at variance with the Principles.	
	8:1	80-89%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre- European vegetation.	species. Only non-aggressive weeds present. Some litter build-up.		
Excellent	9:1	Original vegetation is still dominant and intact. Over individuals in good conditi represent a mature stand.		Diverse vegetation with very little weed infestation.Understorey largely	All strata intact and botanical composition close to original.	Where the proposed clearance is of diverse	
	10:1	> 89%	Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand, with high habitat value (e.g. hollows).	species diversity. Very little or no sign of alien vegetation in the understorey*; resembles probable pre-European condition.	Little or no signs of disturbance. Little or no weed infestation. Soil surface crust intact. Substantial litter cover.	weed infestation. Clearance is assessed by the NVC to be seriously at variance with the Principles.	



4.4 Fauna survey

A specific fauna survey was not undertaken during this assessment however opportunistic sightings of fauna species with a particular focus on avian species were recorded. This was to act as a guide to the level of habitat being utilised by species onsite as well as for transient species visiting temporarily. Observations were also made on the quality of the habitat for fauna species within the project area (e.g. presence of hollows, Malleefowl mounds, fallen logs, leaf litter, wetlands, dense shrubby refuge etc). The entire proposed water pipeline was traversed with a corridor of 40m assessed. Additional targeted fauna surveys for Malleefowl, Australasian Bittern, Regent Parrot and Red-lored Whistler will be undertaken separately to support an EPBC Referral associated with the project.

4.5 Limitations

Biological Database of SA (BDBSA) flora and fauna records were limited to a 20 km buffer around the survey area. The reliability of the BDBSA data ranges from 100 m to over 100 km. Fauna species, can traverse distances in excess of 20 km. Hence the BDBSA records provided may not adequately highlight all threatened flora and fauna species that may occur in the area.

The findings and conclusions expressed by EBS Ecology are based solely upon information in existence at the time of the assessment. Field data collected during the survey combined with database records and background research is considered to provide an adequately detailed assessment of the flora and fauna that occur and are likely to occur within the project area.

At the time the survey was undertaken, not all plant species may have been visibly present or have distinguishing features (e.g. native grass seed) to enable positive identification. Consequently, it is likely that all species were not identified to species level. It should be noted however, that the number of species absent from the species list is expected to be low and data collected is considered adequate to make a reasonable assessment of potential impacts of the proposed works on flora and fauna.



5 RESULTS

5.1 Desktop assessment

5.1.1 Matters of national environmental significance

The EPBC Protected Matters Search identified 19 threatened species, nine migratory species, two nationally threatened ecological communities and one wetland of international significance protected under the EPBC Act that may be relevant to the project area (DoEE 2017b). These are summarised in Table 4 and the relevant matters of national environmental significance further discussed below.

Search area (20 km buffer)	Matters of National Environment Significance under the EPBC Act 1999	Identified within the search area
	World Heritage Properties	None
	National Heritage Properties	None
	Wetlands of International Significance	3
	Great Barrier Reef Marine Park	None
10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	Commonwealth Marine Areas	None
	Threatened Ecological Communities	2
	Threatened Species	19
Renmark	Migratory Species	9
	Commonwealth Lands	6
Molarook Berri	Commonwealth Heritage Places	2
River	Listed Marine Species	14
	Whales and other Cetaceans	None
	Critical Habitats	1
Loxton	Commonwealth Reserves	None
	State and Territory Reserves	14
0 25	Regional Forest Agreements	None
Kms	Invasive Species	33
	Nationally Important Wetlands	5



5.1.2 Threatened ecological communities

Two Threatened Ecological Communities were identified in the Protected Matters Search, of which River Murray and associated wetlands, floodplains and groundwater systems (from the junction with the Darling River to the sea) is known to occur. The Buloke Woodlands of the Riverina and Murray-Darling Depressions Bioregions TEC, was also identified as likely to occur within the project area however it was not recorded during the survey by EBS.



The River Murray – Darling to Sea ecological community is listed as Approval Disallowed under the EPBC Act; it occurs within the Murray-Darling Basins and extends from the junction of the Murray and Darling rivers near Wentworth in NSW to the mouth of the Murray, near Goolwa in SA. It incorporates the entire South Australian component of the River Murray and its floodplain, as well as associated tributaries.

The pumping station section of the project area impacts on a small section of this ecological community however the requirement is very low being limited to extraction pipes and pump infrastructure.

Buloke Woodlands of the Riverina and Murray-Darling Depressions Bioregions is listed as endangered under the EPBC Act. The nominated woodland's component communities are generally characterised as woodland or open woodland with a well-developed ground stratum that is usually grassy, but also includes many subshrubs and herbs; some component communities have understoreys that are predominantly shrubby or herbaceous (Thackway and Cresswell 1995). Most component communities lack a well-developed tall shrub layer. Buloke is common to all component communities, but slender cypress-pine and grey box may be structurally dominant in some. Native grasses often include wallaby grasses, Danthonia spp., and spear grasses, *Austrostipa* spp (Thackway and Cresswell 1995). The woodlands have been extensively cleared in the past, and the remnants that survive face ongoing major threats from incremental clearance, grazing by rabbits and stock, invasion by exotic plants, weedicide application and fertiliser drift. The community is poorly represented in conservation reserves throughout its range.

5.1.3 Threatened flora species

Two EPBC listed flora species were identified in the EPBC Protected Matters Report as potentially occurring or having potential habitat occurring within the vicinity of the project area (Table 5). None of these species have been detected or are likely to occur within the project area.

Scientific name	Common name	Conserv statu	rvation Likelihood of occurrence with			
		Aus SA project are		project area		
Caladenia tensa	Greencomb Spider-orchid, Rigid Spider-orchid	EN		Unlikely		
Swainsona pyrophila	Yellow Swainson-pea	VU	R	Unlikely		

Table 5. Threatened flora species identified by EPBC Protected Matters Search Tool as possibly occurring within the project area.

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare.

5.1.4 Threatened fauna

Twelve EPBC listed fauna species were identified in the EPBC Protected Matters Report as potentially occurring or having habitat potentially occurring within the vicinity of the project area (Table 6). This includes eleven bird and one mammal species.

Four out of the eleven bird species were determined as likely to occur within the project area, based on preferred habitat and previous records within close proximity to the project area. The potential impact on these species are described within the discussion section of this report.



		Conservation status	Likelihood of			
Scientific name	Common name	Aus	SA	occurrence within project area		
Birds						
Botaurus pociloptilus	Australasian Bittern	EN	V	Likely		
Calidris ferruginea	Curlew Sandpiper	CE, Mi (W), Ma		Likely		
Grantiella picta	Painted Honeyeater	VU, Ma	V	Unlikely		
Leipoa ocellata	Malleefowl	VU	V	Likely		
Manorina melanotis	Black-eared Miner	EN	E	Likely		
Numenius madagascariensis	Eastern Curlew	CE, Mi (W), Ma	V	Unlikely		
Pachycephala rufogularis	Red-lored Whistler	VU	R	Likely		
Pedionomus torquatus	Plains-wanderer	CE	E	Unlikely		
Pezoporus occidentalis	Night Parrot	EN	E	Unlikely		
Polytelis anthopeplus monarchoides	Regent Parrot (eastern)	EN	V	Likely		
Rostratula australis	Australian Painted Snipe	EN	V	Unlikely		
Mammals						
Nyctophilus corbeni	Corben's Long-eared Bat	VU	V	Unlikely		
Fish						
Craterocephalus fluviatilis	Murray Hardyhead	EN	-	Likely		
Galaxias rostratus	Flathead Galaxias,	CE	-	Likely		
Maccullochella peelii	Murray Cod	VU	-	Likely		
Macquaria australasica	Macquarie Perch	EN	E	Likely		
Frogs						
Litoria raniformis	Southern Bell Frog	VU	V	Likely		

 Table 6. Threatened fauna species identified by EPBC Protected Matters Search Tool as possibly occurring within the project area.

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. Mi: Migratory. Ma: Marine.

5.1.5 Migratory and marine species

Fourteen bird species listed as migratory and/or marine under the EPBC Act were identified in the EPBC Protected Matters Report as potentially occurring or having habitat potentially occurring within the vicinity of the project area (Table 7). None of the 14 species were recorded during the March 2017 survey. The Fork-tailed Swift, Great Egret, Cattle Egret and Rainbow Bee-eater could possibly occur as occasional visitors to the project area.

Table 7. Migratory and marine bird species identified by EPBC Protected Matters Search Tool as possibly utilising or flying over the project area.

		Conservation status Aus SA		Likelihood of	
Scientific name	Common name			occurrence within project area	
Apus pacificus	Fork-tailed Swift	Mi (Ma), Ma		Possible	
Ardea alba	Great Egret	Ма		Possible	



		Conservatio	Likelihood of		
Scientific name	Common name Aus		SA	occurrence within project area	
Ardea ibis	Cattle Egret	Ма		Possible	
Calidris ferruginea	Curlew Sandpiper	CE, Mi (W), Ma		Unlikely	
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Mi (W), Ma	R	Unlikely	
Haliaeetus leucogaster	White-bellied Sea-Eagle	Ма	E	Unlikely	
Merops ornatus	Rainbow Bee-eater	Ма		Possible	
Motacilla cinerea	Grey Wagtail	Mi (T), Ma		Unlikely	
Motacilla flava	Yellow Wagtail	Mi (T), Ma		Unlikely	
Myiagra cyanoleuca	Satin Flycatcher	Mi (T), Ma	E	Unlikely	
Numenius madagascariensis	Eastern Curlew	CE, Mi (W), Ma	V	Unlikely	
Pandion haliaetus	Osprey	Mi (W), Ma	E	Unlikely	
Rostratula benghalensis (sensu lato)	Painted Snipe	EN, Ma	V	Unlikely	
Tringa nebularia	Common Greenshank	Mi (W), Ma		Unlikely	

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. Mi: Migratory. Ma: Marine.

5.1.6 Nationally important wetlands

The EPBC Protected Matters Report identified two nationally important wetlands as potentially occurring within a 20 km radius of the project area. The Banrock Station Wetland Complex, Riverland and The Coorong, and Lakes Alexandrina and Albert Wetland were identified. The Banrock Station Wetland Complex lies on the floodplain adjacent to the River Murray, opposite the township of Overland Corner, 26km North West of Berri. Banrock Station Wetland Complex is situated approximately 29km north west of the project area; the proposed development will have no impact on the Banrock Station Wetland Complex. Riverland Ramsar site is adjacent to the River Murray between Renmark and the Victorian and New South Wales borders. The wetlands are part of the large Murray-Darling Basis and consist of a variety of wetland types including channels, billabongs, floodplains and swamps. The Coorong, Lakes Alexandrina and Albert Wetland is located 100-150 km downstream from the project area. This wetland incorporates 23 different types of wetlands ranging from freshwater to hypersaline, dense vegetation to open water and temporary to permanently inundated land. This nationally important wetland has been recorded as potentially occurring due to the project area's relation to the River Murray. The scope of development in this area is very limited by way of a pumping and water transfer point from the river to the project site and therefore interaction with this community is very low.

5.1.7 Commonwealth lands

The summary of the EPBC Protected Matters Report listed six Commonwealth Lands as potentially occurring within the project area. These were Australian Postal Corporation, Calperum Station, Defence



Service Homes Corporation, Minister of Transport, Berri Training Deport and one unnamed. None of these Commonwealth Lands listed are relevant to the project area.

5.1.8 Critical habitats

Critical habitat for the Black-eared Miner (*Manorina melanotos*) has been listed within 20km of the project area and identified as Gluepot Reserve, Taylorville Station and Calperum Station (excluding the area of Calperum Station south and east of the Main Wentworth Road). A single record of the Black-eared Miner was listed within the Atlas of Living Australia from 1992 which was found within Cooltong Conservation Park. Another record from 1964 was listed from south of Berri. No observations of this species were made during the March 2017 survey and no suitable habitat mapped within the project area due to the level of degradation and fragmentation occurring within the project site boundary.

5.2 Nationally significant fauna species profiles

5.2.1 Malleefowl

A survey specifically targeted at identifying species presence was undertaken as part of the site assessment with a 40m corridor walked in order to identify potential occurrences. This included searches for Malleefowl mounds, nesting habitat and actual individuals.

Commonwealth Status

The Malleefowl (Leipoa ocellata) is listed as Vulnerable under the EPBC Act.

Description

A large (55-61 cm), predominantly grey, ground-dwelling fowl (Pizzey and Knight 2007).

Distribution

The distribution of the Malleefowl extends over much of the southern half of Australia, within the semi-arid zone (Pizzey and Knight 2007). The species has suffered a large decline in distribution, particularly within the arid zone and at the periphery of its former range (Benshemesh, 2007). Since 1981, the range of the Malleefowl has reduced by 22% in Victoria and New South Wales, 26% in South Australia and 28% in Western Australia (Benshemesh, 2007). The species is extinct within the Northern Territory, and was last sighted in 1965 (Benshemesh, 2007).

Ecology

The Malleefowl is a species of megapode, a group of mound-building bird species that use the heat generated from the decomposition of organic matter to incubate their eggs. Chicks emerge from the nests un-aided, and receive no parental care. Like other species of fowl, chicks are small, however, are able to run, feed and fly within a day of hatching (Benshemesh, 2007).

Malleefowl occur within mallee; coastal heath; acacia, paperbark and sheoak scrub; and eucalypt woodland (Pizzey and Knight, 2007; Parsons and Gosper, 2011). Habitat suitability is largely determined by time since last fire, with Malleefowl preferring areas which have not been burnt in 40 years. After 40 years, the structure of vegetation offers better protection from predators and increased stores of large



seeds are present within the soil seed-bank (Priddle and Wheeler, 1999). Therefore, inappropriate fire regimes are a primary threat to the Malleefowl (Priddle and Wheeler, 1999).

Malleefowl occur in their highest densities within habitat located within productive, fertile scrub (Benshemesh, 2007). Areas of productive habitat have been extensively cleared for cropping and pastoralism in southern Australia, and therefore populations are likely to occur within scrub that is less fertile than the surrounding cleared landscape.

The fragmentation of habitat associated with vegetation clearance exacerbates the threat of foxes and fire. Predation by foxes is a major cause of mortality in Malleefowl at all life stages. Foxes are known to consume eggs, however, mortality is greatest within recently fledged chicks, though remains severe within sub-adult and adult birds (Benshemesh, 2007). In addition to this, the smaller patches of scrub caused by fragmentation, may be completely engulfed by fire, which could cause the local extinction of a population if re-colonisation is not achievable (Priddle and Wheeler, 1999).

Grazing by stock and alien species, such as goats and rabbits, reduces the quality of habitat for Malleefowl. Grazers reduce the availability of food resources, due to their significant overlap in diet with Malleefowl, and also cause the thinning of dense and continuous vegetation cover, which may increase the exposure of Malleefowl to predators, such as foxes (Priddle and Wheeler, 1999). These factors have caused the density of Malleefowl to be supressed as the intensity of grazing increases (Benshemesh, 2007).

Potential Impact

Malleefowl are known to occur within Cooltong Conservation Park (CP), where there are 40 known mounds (DEWNR 2012). The Malleefowl monitoring report 2012 found that no mounds were active in Cooltong CP during the 2011/12 breeding season, however one mound was active in 2010/2011 (DEWNR 2012). The vast majority of records of individuals occurred in the centre of the park, however, they have been sighted in the south (ALA 2017). A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.2 Regent Parrot (Polytelis anthopeplus monarchoides)

Commonwealth Status

The Eastern Regent Parrot (*Polytelis anthopeplus monarchoides*) is listed as Vulnerable under the EPBC Act.

Description

The Regent Parrot is a medium sized (38-41 cm), sexually dimorphic parrot (Pizzey and Knight, 2007). Males predominantly golden-yellow, while females are greener. Males have red on the lower wing, which is less pronounced in females. Both sexes have salmon coloured beaks (Pizzey and Knight, 2007).

Distribution

The Eastern Regent Parrot is distributed in the interior of semi-arid south eastern Australia, primarily along the River Murray and within expanses of Mallee (Garnett et al. 2011). Within this distribution, there are three distinct breeding populations (Baker-Gabb and Hurley, 2011):

• Wimmera drainage system, Victoria;



- Lower River Murray, from Swan Reach, South Australia to north-western Victoria; and
- The mid Murray River in Victoria and NSW, between Red Cliffs (south-east of Mildura) and Piangil, including the lower Murrumbidgee and Wakool Rivers in NSW.

Ecology

The current population for the Eastern Regent Parrot is estimated to be 1500 breeding pairs, 400 of which occur in South Australia (Garnett et al. 2011). The number of breeding birds have declined throughout their range. This is particularly pronounced in South Australia, upstream of lock 3, where the number of breeding pairs declined by 66% from 1991 to 2010 (Garnett et al. 2011).

The Regent Parrot breeds from August to December, within hollows of River Red Gums (*Eucalyptus camaldulensis*) on the River Murray floodplain and Wimmera drainage system (Pizzey and Knight 2007; Baker-Gabb and Hurley, 2011; Garnett et al. 2011). The breeding range of the Regent Parrot is limited by the presence of large tracts of mallee woodland within 20 km (usually <10 km) of nest sites (Baker-Gabb and Hurley, 2011). Males forage within mallee woodland and return two to three times a day to regurgitate food to the hen, who broods the eggs and young chicks (Baker-Gabb and Hurley, 2011).

The non-breeding habitat of Regent Parrots are not well understood, with movements varying between individuals. Some individuals use similar habitat to that of the breeding season, roosting in Red Gums and feeding within mallee close to the River Murray (Baker-Gabb and Hurley, 2011). Other individuals will flock within large expanses of mallee, up to 100 km from the river, such as Murray Sunset National Park, Victoria and Gluepot Reserve, South Australia (Baker-Gabb and Hurley, 2011).

The main threats to the Regent Parrot are (Garnett et al. 2011):

- Loss of mallee (foraging habitat) within 20 km of breeding sites;
- Loss of tree lines or remnant vegetation used as flight corridors;
- Loss and degradation of floodplain habitat, including River Red Gum nesting trees, through direct clearance, salinisation and water logging;
- Deliberate killing to reduce agricultural damage; and
- Competition for nest hollows, primarily with the Little Corella (*Cacatua sanguinea*) and Yellow Rosella (*Platycercus elegans*) but also the Rock Dove (*Columba livia*), Starling (*Sturnus vulgaris*), and Honey Bee (*Apis mellifera*).

Potential Impact

While there is only one record of a Regent Parrot within the extent of the map in Figure 1, there are numerous records around the Barmera, Berri and Cooltong townships, and therefore are (assumed) locally present at the current time.

Regent Parrot nest surveys from Swan Reach to the South Australian border were performed in 2003 and repeated in 2010. This survey recorded two nests from Renmark to Lyrup sector in 2003, but no nests in 2010 (Smith, 2011). No nests were recorded from Lyrup to Lock 4 in 2003 and 2010, respectively. As such, the project area is not expected to constitute important breeding habitat for the species (Smith 2011).



However, mallee within the project area is within 20 km of large breeding colonies in the Cobdogla to Lock 3 sector, and therefore could be foraging habitat for breeding birds (Smith 2011).

The project may have some impact on the foraging behaviour and movement of Regent Parrots, due to the creation of 2050 ha of almond crops and 385 ha of vines, the fruits from which Regent Parrots consume. Regent Parrots regularly feed within almond crops, including during the breeding season, in large numbers. Despite the richer caloric content of almonds in comparison to native food resources, native foods are still their primary food resource (CSU, 2013). In addition to the creation of a new food resource, Regent Parrots are known to utilise almond crops as movement corridors. Regent Parrots are reluctant to move over open land due to risk of predation, and therefore, the cover offered by almond trees may facilitate movements between breeding and feeding sites (CSU, 2013).

There are concerns in regards to the creation of a new food resource. There have been reports of Regent Parrots being shot in almond orchards adjacent to declining colonies in South Australia (Smith 2011), and this is considered to be one of the primary threats to the species in the region (Hedger, pers. comm.).

The creation of a food resource may inflate numbers of Regent Parrots beyond the carrying capacity of food resources offered by native vegetation. This may pose problems in the future if almond orchards are to be removed. For example, the proposed removal of non-profitable large scale pine forests in south west Western Australia will have a significant impact on the endangered Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (Stock et al. 2013). A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.3 Australasian Bittern (Botaurus poiciloptilus)

Commonwealth Status

The Australasian Bittern (Botaurus poiciloptilus) is listed as Endangered under the EPBC Act.

Description

A large heron-like, wading bird, that is patterned plumage varying from light to dark brown (Pizzey and Knight, 2007).

Distribution

The Australasian Bittern is distributed throughout the Murray Darling Basin; the east coast of Australia, south of the south east Queensland; and in south-west Western Australia and Tasmania (Pizzey and Knight 2007). The closest record of an Australasian Bittern to the project area occurred in the north of the Murray River National Park in 2010 (ALA, 2017).

Ecology

The population estimate of the number of adult birds in 2009-2010 was 247-796 individuals (Garnett et al. 2010). The population of Australasian Bitterns has suffered a significant decline, with the rate of population decline estimated to be 20-30% over two generations (11 years) (Garnett et al. 2010).

The Australasian Bitterns occurs within permanent and seasonal wetlands with tall, dense vegetation, such as sedges, rushes and reeds. Wetlands or flooded areas with large expanses of sedges and rushes, such as Marsh Club Rush (*Bolboschoenus caldwellii*), and species with a similar structure, such as rice (*Oryza*)



sativa), are the preferred habitat for Australasian Bitterns rather than tall reeds (Pers Obs; Andrew Silcocks, pers. comm.).

Australasian Bitterns forage in the shallows of wetlands, where water is <0.3 m deep (TSSC, 2010). Within the shallows, the Australasian Bittern will opportunistically forage on range of food items, including frogs, fish, yabbies, insects, lizards and reptiles (NSW Scientific Committee, 2009).

Australasian Bitterns are highly mobile. The four individuals tracked as part of the Bitterns in Rice project all recorded movements in excess of 200 km, with the further movement occurring from the NSW Riverina to south-eastern South Australia (Bitterns in Rice Project, 2015).

The key threats to the Australasian Bittern are (TSSC, 2010):

- Loss of habitat, caused by the drainage of wetlands and swamps for agriculture and development; and
- Altered hydrological regimes caused by over-extraction, which has led to reduced flow and flooding events, salinisation and subsequent degradation of wetlands and floodplains.

Potential impact

The Australasian Bittern is unlikely to be impacted by the proposed development, as the intake pipe connects to the channel of the River Murray, which is not suitable habitat for the species. Wetlands, which are the preferred habitat of the species, are located approximately 500 m from the intake pipe. The wetlands will not be impacted directly, however, could be in-directly through localised water quality issues associated with construction. If Australasian Bitterns were to occur within these wetlands, it would be expected that their presence would be irregular and short-term. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.4 Red-lored whistler (Pachycephala rufogularis)

Commonwealth Status

The Red-lored Whistler (Pachycephala rufogularis) is listed as Vulnerable under the EPBC Act.

Description

The Red-lored Whistler is a small (19-22 cm) passerine with an orange-buff coloured throat and lores. The underparts of the males are also orange-buff, however are pale brown in the female. Both sexes have a grey head and chest band, and grey to olive coloured wings and tail feathers (Pizzey and Knight 2007).

Distribution

The distribution of the Red-lored Whistler extends from Eyre Peninsula, South Australia to central western New South Wales. However, the Eyre Peninsula population has not been observed following fire in 2005. Overall, their distribution is patchy, with populations restricted to areas of suitable habitat (DELWP 2016).

Ecology

In 2011, the population of the Red-lored Whistler was estimated to be 2,000 individuals, distributed over six populations, with the largest sub-population comprised of up to 1,000 individuals (Garnett *et al.* 2011).



A decade earlier, the population estimate was 10,000 individuals, distributed over eight sub-populations (DELWP 2016). The significant decline in population from 2000 to 2011 was due to landscape-scale fires and drought. The population has further declined since 2011, with landscape scale fires in Billiatt Conservation Park and Ngarkat Conservation Park, which significantly reduced their population in western South Australia (DELWP 2016).

The Red-lored Whistler has specialised habitat requirements, with suitable habitat restricted to the occurrence of spinifex (*Triodia* spp.) within mallee. The height of mallee within which they occur is low (2-5 m) and features a patchy shrub layer (DELWP, 2016). On occasion, the species may also be recorded within tall mallee (>5 m), eucalypt woodland and banksia scrub (DELWP, 2016).

Time since last fire, like other threatened mallee birds, greatly influences the suitability of habitat. Redlored Whistlers may recolonise habitat five years following fire, however, predominantly use mallee woodland and mallee heath, that were burnt 21-40 and 10-24 years ago, respectively (DELWP, 2016). This may align with the growth of *Triodia*, which reaches a plateau in size after approximately 20 years (Burrows *et al.* 2006).

In addition to broad scale fire, grazing also threatens the Red-lored Whistler, through habitat degradation, with their absence noted from areas within 6 km of water points, which concentrate stock and exacerbate grazing intensity (DELWP, 2016).

Potential Impact

Regionally, important habitat for the species is predominantly located within Gluepot Reserve and west of Taylorville Station (ALA, 2017). However, potential habitat for the Red-lored Whistler would be cleared by the proposed development. Vegetation Associations 2 and 6 are considered to be potential habitat, especially where located on the southern border of Cooltong Conservation Park. There were three records of the species in 2002, which have spatial uncertainty that overlap with Cooltong Conservation Park, indicating their potential presence (ALA, 2017). The species may be present within the project area during autumn-winter, when the species regularly disperse outside their normal range (Pizzey and Knight, 2007). A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.5 Murray Hardyhead (Craterocephalus fluviatilis)

Commonwealth Status

The Murray Hardyhead (Craterocephalus fluviatilis) is listed as Vulnerable under the EPBC Act.

Description

A small, silvery fish, that is streamlined and measures up to 75 mm in length (Lintermans, 2007).

Distribution

The Murray Hardyhead is distributed in the lower and mid River Murray system. The species has suffered a significant decline in range, with the loss of up to 15 populations (Backhouse *et al.* 2008). Outside of South Australia, three populations are extant, and are located near Mildura and Swan Hill (Suitor, 2009). In South Australia, the species exists as two genetically distinct populations, one in the Lower Lakes region



and the other in the Riverland. The Riverland population is distributed at Berri and Disher Creek Saline Water Disposal Basins (Suitor, 2009).

Ecology

The Murray Hardyhead primarily occurs in slow-moving water habitats, such as lakes, wetlands, backwaters and billabongs, however has also been recorded within the river channel, albeit rarely, and of few or single fish (Backhouse *et al.* 2008). Within these habitats, the Murray Hardyhead is often cited as favouring waters with elevated salinity, where it is more common than within fresh water. The species has been caught in water varying between 500 and 48,000 μ S/cm⁻¹ (Sea water is approx. 50,000 μ S/cm⁻¹) (Backhouse *et al.* 2008). It is unknown whether the species has a physical preference for saline water, or whether they are most prevalent in these habitats due to increased predators or competition with other species, especially the Un-specked Hardyhead (*Craterocephalus fulvus*) (Suitor, 2009).

Murray Hardyheads occur in shallow (<1 m deep) open waters, where submerged macrophytes are present. The submerged macrophytes often associated with Murray Hardyhead are *Ruppia spp.*, *Ceratophyllum spp.*, and *Vallisneria spp.* (Pers Obs; Suitor, 2009). Littoral vegetation is also important, such as *Typha spp.*, *Juncus spp.*, and *Eleocharis spp.* (Pers Obs; Suitor, 2009).

The main threats to the Murray Hardyhead as described in Lintermans (2007) are:

- Increased salinisation;
- Habitat degradation;
- Altered flow regimes; and
- Alien species

Potential Impact

There is a distinct genetic unit of the Murray Hardyhead located within 10 km of the proposed intake location. However, Murray Hardyhead are unlikely to be impacted as they are rarely present within the river channel, favouring slow-water habitats with higher salinities (Suitor, 2009). A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.6 Flathead Galaxias (Galaxias rostratus)

Commonwealth Status

The Flathead Galaxias (Galaxias rostratus) is listed as Critically Endangered under the EPBC Act.

Description

The Flathead Galaxias is an elongated freshwater fish that rarely exceeds 100 mm in length, however may reach a maximum size of 146 mm. The species has small pectoral fins and is coloured olive-green on its back and sides, and grey on its belly (Lintermans, 2007).

Distribution

The Flathead Galaxias is distributed in the Lachlan, Murrumbidgee and Murray River catchments in New South Wales, and the Mitta Mitta, Kiewa, Ovens, Loddon, Goulburn and Murray River catchments in



Victoria (TSSC, 2016). The presence of the species in South Australia is comprised of one record collected in 1872 near Murray Bridge (ALA, 2017).

Ecology

The Flathead Galaxias occurs is a pelagic, schooling species that occurs within billabongs, lakes, swamps and rivers, where still or slow flowing water is available (Lintermans, 2007). The species is adapted for still water environments, ventilating their gills in the oxygenated surface layer of water.

Like other small fish species in the region, they are spring and summer breeders, cued to commence breeding as water temperatures surpass 10.5°C.

The main threats to the Flathead Galaxias according to Lintermans (2007) are:

- River regulation (cold water pollution and altered flow regimes);
- Alien fish species (predators and habitat degraders);
- Potential competition with the Climbing Galaxias (*Galaxias brevipinnis*), which was introduced to parts of its range due to the Snowy Mountain Scheme.

Potential Impact

The Flathead Galaxias has not been recorded in South Australia for nearly 150 years, and therefore will not be impacted by the proposed development. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.7 Murray Cod (Maccullochella peelii)

Commonwealth Status

The Murray Cod (Maccullochella peelii) is listed as Vulnerable under the EPBC Act.

Description

The Murray Cod is Australia's largest freshwater fish, with the largest individual weight 113.6 kg and measuring 1800 mm in length. The age of this individual was estimated to be 74-114 years old (NMCRT 2010). The species has a large mouth, cream to white belly and green mottled pattern on the body and head (Lintermans, 2007).

Distribution

The distribution of the Murray Cod extends widely across the Murray-Darling Basin, with the exception of some the upper tributaries (Lintermans, 2007; DSE, 2010). In South Australia, the species occurs in the Lower Lakes and River Murray to the border with New South Wales and Victoria (Lintermans, 2007).

Ecology

The Murray Cod was formerly widespread and abundant throughout its range, however now has a patchy distribution throughout its historic range, and its abundance is estimated to have declined by 30% in the past 50 years (Lintermans, 2007; NMCRT 2010).

Within South Australia, the Murray Cod primarily inhabits the River Murray channel, however will also utilise larger tributaries and anabranches. These habitats typically have slow flowing, turbid water and may offer



structurally complex cover, such as large rocks, snags, undercut banks and over-hanging vegetation (NMCRT 2010). The Murray Cod uses the cover from these features as it sits and waits to predate upon fish, crayfish and frogs (Lintermans, 2007).

The Murray Cod makes movements up to 120 km upstream to spawn, when river levels are high in spring (Lintermans, 2007). Sexual maturity is reached at four years of age, and eggs are deposited on hard surfaces such as logs and rocks (Lintermans, 2007). Males protect the clutch of eggs until they hatch 5 to 13 days later (Lintermans, 2007). While the Murray Cod does not require flooding to stimulate spawning, which occurs when water temperatures exceed 15°C, flooding is strongly associated with recruitment success (NMCRT 2010).

The threats to the Murray Cod include over-fishing, river regulation, and alien species. Over-fishing from commercial fisheries caused the early decline in the species (prior to 1930), however recreational fishers interstate are currently impacting on the population structure of the species within sections of the River Murray (NMCRT 2010). The size limit for Murray Cod is 50 cm, which does not allow fish to reach sexual maturity and breed. In South Australia, the Murray Cod is protected at all times (PIRSA, 2016).

River regulation has adversely impacted the Murray Cod through:

- A reduction in the frequency and scale of flooding, which has reduced successful recruitment (NMCRT, 2010).
- Barriers to the movement of pre and post spawning mature individuals, which could cause the isolation of populations. In addition to this, drifting larvae would be limited in their dispersal, and may settle near the slow flowing water of locks and weirs, which may not offer suitable resources for successful recruitment in to the population (NMCRT, 2010).
- Water quality issues, in particularly the release of water that has: excessively raised or lowered temperatures, depleted oxygen, high nutrient loads, and contaminants. The release of such water can result in fish kills (NMCRT, 2010).
- Further habitat degradation has occurred through the de-snagging of the River Murray channel to aid navigation, water flow and to reduce damage to infrastructure during flooding (Koehn 2004).

The impact of alien species on the Murray Cod are largely masked by other confounding processes as over-fishing and river regulation. However, it is considered that the impact of alien species would be substantial, with the Murray Cod being adversely impacted through predation, competition, habitat alteration and the spread of disease and parasites (Koehn, 2004; NMCRT, 2010). Whilst, the impact of alien species is largely confounded, there is a negative correlation between the populations of Murray Cod and those of the Common Carp and Redfin (Koehn, 2004; NMCRT, 2010). The Common Carp negatively impacts the Murray Cod by degrading its habitat and causing water quality issues, whilst the Redfin predates and competes with young Murray Cod (Koehn, 2004; NMCRT, 2010).

Potential Impact

The Murray Cod may be impacted by the proposed development. The Intake pipe will be laid above ground and with minimal impact to river bank stability. Potential sediment and deposition of material will be managed during construction to minimise impacts. In addition to this, there could be uptake of Murray Cod embryos and larvae in the pump, as they would fit through the 10 mm steel mesh. A reduction in mesh



size to 5mm may reduce the potential loss of embryos and larvae through this impact with free drifting embryos typically ranging between 7.2 and 11mm in length (Humphries, 2005) however the overall losses are expected to be minimal and localised. Murray cod larvae are well developed upon hatching and have the capacity to both feed and move immediately (Todd, et al. 2005). A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.



5.2.8 Macquarie Perch (Macquaria australasica)

Commonwealth Status

The Macquarie Perch (Macquaria australasica) is listed as Endangered under the EPBC Act.

Description

A large (max length 465 mm) deep-bodied (max weight 3.5 kg), laterally compressed fish, with rounded fins and large eyes. The body colour is typically black-grey but can be mottled, especially in juvenile fish (Lintermans, 2007).

Distribution

The population of Macquarie Perch located within the Murray Darling Basin, are distributed in the upper reaches of drainage systems in southern New South Wales, the Australian Capital Territory and northern Victoria (Lintermans, 2007; TSSC 2013). There is one record pre-1980 in South Australia in the River Murray near Caldwell (Lintermans, 2007).

Ecology

The Macquarie Perch has suffered a large decline in the area of occupancy, and is now present as small, geographically isolated populations within its range (TSSC, 2013).

The habitat of the Macquarie Perch is largely associated with flowing water and the availability of small complex rock piles, which they use as cover (Gilligan *et al.* 2010). The species remains within home sites during the day and becomes active at dusk and remains so through the night (Lintermans, 2007). During this period, the Macquarie Perch forages on shrimps and small benthic aquatic insect larvae, particularly mayflies, caddisflies and midges (Lintermans, 2007).

The Macquarie Perch spawns from October to December, when water temperatures remain between 15-17°C for 10 consecutive days. Spawning occurs at sites at the downstream end of pools, with the released eggs becoming lodged amongst gravel and cobble in riffles (Lintermans, 2007).

The Macquarie Perch suffered a large historic decline due to their unsustainable catch by commercial and recreational fishers. The current threats to their population are (Lintermans, 2007; TSSC, 2013):

- Increased human activity-induced sedimentation;
- Competition and predation from introduced fish species;
- Barriers to movement, i.e. dams and weirs;
- Epizootic Haematopoietic Necrosis Virus;
- Cold water pollution from water releases;
- Water quality pollution; and
- Illegal and incidental capture by recreational fishers.


Potential Impact

The Macquarie Perch is unlikely to be impacted by the proposed development as its presence in South Australia is limited to one record prior to 1980 (Lintermans, 1980). Therefore, no important populations exist within the state. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.9 Silver Perch (Bidyanus bidyanuys)

Commonwealth Status

The Silver Perch (Bidyanus bidyanus) is listed as Critically Endangered under the EPBC Act.

Description

The Silver Perch is a large, deep-bodied, laterally compressed fish species.

Distribution

The Silver Perch is widely distributed over the Murray Daring Basin. The species has not contracted in distribution like other fish species in the MDB, however, their population has suffered a significant decline. However, the species is considered to be patchily abundant in the mid River Murray.

Ecology

The Silver Perch predominantly occur within lowland rivers, however may also occur in upland river during the summer months. The species inhabits both slow and fast flowing rivers, with clear to turbid water (Lintermans, 2007; TSSC, 2013). Anecdotally, the species is considered to prefer habitat featuring fast flowing water with rapids or races (TSSC, 2013). The habitat requirements are thought to be similar to those of the Murray Cod, and therefore, undercut banks, and the presence of cover in the form of rocks and snags may be important (Lintermans, 2007).

The diet of the Silver Perch is varied, with the species consuming zooplankton, aquatic insects, molluscs, small crustaceans and worms as well as algae. The relative contribution of algae to their diet is considered to vary considerably between habitats, based on the available food resources (TSSC, 2013).

Breeding Silver Perch make long distance movements, up to 570 km, during the summer breeding season (TSSC, 2013). The movements are thought to allow for the drifting of eggs and larvae to be offset, to ensure their colonisation within areas of suitable habitat (TSSC, 2013). Spawning is stimulated by a combination of flooding and relatively high water temperatures, reported to be 17-23°C (Lintermans, 2007; TSSC, 2013). The eggs of Silver Perch are semi-pelagic, only settling in the absence of a current. Juvenile fish move upstream in spring, which allow for the re-colonisation or re-population of habitat (TSSC, 2013).

The Silver Perch is primarily threatened by river regulation, particularly in South Australia, where the short distances between locks and weirs do not allow for the migratory movements of breeding and juvenile fish, and would impede the drifting of eggs and larvae (TSSC, 2013). In addition to this, river regulation has significantly reduce the frequency and extent of flooding, which is require to stimulate Silver Perch to breed (TSSC, 2013). The lack of flooding also increases the threat of black water events, as the mass of organic matter on the floodplain increases due to the reduction in flood events (TSSC, 2013).



Habitat degradation also threatens the Silver Perch. The habitat of the species has been degraded through the removal of snags and the loss of aquatic macrophytes attributed to river regulation and the destructive foraging behaviour of the Common Carp (TSSC, 2013).

In addition to the Common Carp, other alien fish species are potential threats for the Silver Perch due to predation, competition and dispersing disease. Potential specific threats to the Silver Perch are (TSSC, 2013):

- Predation of small sized individuals by Redfin Perch;
- Dietary competition of juvenile fish with juvenile Common Carp;
- Fish nipping of larval and juvenile fish by the Eastern Gambusia; and
- Transportation of diseases which may threaten Silver Perch by introduced fish species.

Potential Impact

The Silver Perch may be impacted by the proposed development. The intake pipe will be laid above ground and with minimal impact to river bank stability. Potential sediment and deposition of material will be managed during construction to minimise impacts. There could be uptake of Silver Perch eggs and larvae in the pump, as they would fit through the 10 mm steel mesh. However, these impacts are expected to be minimal and localised. A reduction to a 5mm mesh size as advised for mitigation of Murray Cod larval loos would significantly mitigate the effects of this risk. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.10 Growling Grass Frog (Litoria raniformis)

Commonwealth Status

The Growling Grass Frog (Litoria raniformis) is listed as Vulnerable under the EPBC Act.

Description

The Growling Grass Frog, also commonly known as the Southern Bell Frog is a large (100 mm nose to urostyle) frog that varies from dull olive to bright green in colour, and is marked by golden-bronze blotches (Clemann and Gillespie, 2012).

Distribution

The distribution of the Growling Grass Frog extends from the Mount Lofty Ranges, South Australia, south to southern Tasmania and north to the New South Wales Riverina. Within South Australia, they occur in three broad areas (Clemann and Gillespie, 2012):

- Mount Lofty Ranges dams (possible originated from captive frogs);
- River Murray wetlands and Lower Lakes; and
- South East wetlands.

Within their South Australian distribution they are most abundant within the south east and Riverland, and considered to be rare elsewhere (Pers Obs; Mason, 2015; ALA, 2017).



Ecology

The Growling Grass Frog was formerly one of the most common frog species in south-eastern Australia. However, since the 1970s the species have suffered a significant decline in abundance and distribution, and is now present throughout much of its range in small, fragmented populations (Pyke, 2000; Clemann and Gillespie, 2012).

The ecology of the Growling Grass Frog is markedly different between populations that are associated with the River Murray and those occurring within areas outside of its influence. Populations associated with the River Murray are stimulated to breed following the flooding of ephemeral wetlands in spring or summer (Clemann and Gillespie, 2012). Due to the dynamic hydrology of the River Murray system, the period of metamorphosis is two months, significantly shorter than the population not associated with the River Murray (Clemann and Gillespie, 2012).

During periods of low flow and drought the Growling Grass Frog is restricted to refugia, however, disperses across the landscape during breeding events associated with flooding (Wassens *et al.* 2008). The species is highly dispersive, and may be capable of moving 1 km in a night (Clemann and Gillespie, 2012). Movement of individuals between sites during flooding facilitates the exchange of genetics between populations, and is considered important in safeguarding populations (Clemann and Gillespie, 2012).

The habitat utilised by Growling Grass Frogs in the Riverland is comprised of permanent and ephemeral waterbodies flanked by River Red Gums, Lignum (*Muehlenbeckia florulenta*) and Cumbungi (*Typha spp.*), and floodplains dominated by Black Box (*Eucalyptus largiflorens*), Lignum and chenopods (Clemann and Gillespie, 2012). In addition to this, the Growling Grass Frog favours sites with significant cover offered by emergent vegetation, and slow-flowing or still water (Pyke, 2000).

The Growling Grass Frog has suffered extensive habitat loss through the drainage of wetlands and reclaimed flood irrigated pasture (Clemann and Gillespie, 2012). This is particularly evident in the southeast of South Australia and the lower River Murray.

The hydrological management of the River Murray has adversely impacted the Growling Grass Frog. The frequency and extent of flooding events has significantly declined (DEWNR, 2016), which directly impacts the frequency and magnitude of Growling Grass Frog breeding events (Pyke, 2000). In addition to this, wetlands are maintained at pool level, which limits wetland productivity and width of littoral vegetation, which the species inhabits (DEWNR, 2016).

Alien species, both terrestrial and aquatic threatened the Growling Grass Frog (Clemann and Gillespie, 2012). Domestic stock degrade the habitat of the Growling Grass Frog, through grazing littoral and terrestrial vegetation, plugging and compaction of soil, and pollution of water (Clemann and Gillespie, 2012). These impacts reduce the quality of refugia, breeding and dispersal habitat of the species. The aquatic habitat of the Growling Grass Frog is also adversely impacted by alien species. The Common Carp (*Cyprinus carpio*) largely prevents and establishment and growth of submerged aquatic plants through their direct consumption and the stirring of wetland sediments, which limits the penetration of light through the water column required for growth (Nieoczym and Kloskowski, 2014). In addition to this, the alien predatory fish species may consume frogs, tadpoles and eggs (Clemann and Gillespie, 2012). Of particular concern is the Eastern Gambusia (*Gambusia holbrookii*) (Pyke, 2000), which has been implicated in the decline of closely related Green and Gold Bell Frog (*Litoria aurea*) (Clemann and Gillespie, 2012). Foxes



and cats also consume frogs, and are likely to opportunistically consume Growling Grass Frogs (Pyke, 2000).

Chytrid fungus threatens frogs worldwide, and has been recorded in the Southern Bell Frog (Pyke, 2000). The fungus is thought to impair the function of the function of the skin and result in electrolyte depletion and osmotic imbalance (DSEWPC, 2013). This fungus predominates in wet, cool areas, and therefore may not be of significant concern for the populations in the Riverland, especially given their basking nature.

Potential Impact

The Growling Grass Frog inhabits wetlands and floodplains, and therefore, as the intake pipe is to be located on the side of the river with steep topography, neither of these habitats are to be directly affected. Wetlands are located approximately 500 m from the intake pipe. The wetlands will not be impacted directly, however, could be in-directly through localised water quality issues associated with construction. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.



5.2.11 Black-eared Miner (Manorina melanotis)

Commonwealth Status

The Black-eared Miner (Manorina melanotis) is listed as endangered under the EPBC Act.

Description

The Black-eared Miner is a large, predominantly grey honeyeater (25 cm), with a yellow eye ring and beak, and a black face. The grey breast softs to a pale cream on the underparts (Pizzey and Knight, 2007).

Distribution

The distribution of the Black-eared Miner extends throughout the mallee region of north-west Victoria, south-west New South Wales and the Murray Mallee in South Australia (Pizzey and Knight, 2007). There has been a substantial decline in the range of the species, with the species no longer present within New South Wales and only two colonies persist in Victoria at Murray Sunset National Park. As such, the species has suffered a severe decline in population over the past decade (Garnett *et al.* 2011). The vast majority of the population (>95% of colonies) occur within Bookmark Biosphere Reserve, South Australia (Garnett *et al.* 2011).

To help safeguard the Black-eared Miner, translocations have been performed supplement and re-colonise populations of the species. Five colonies, totalling approximately 100 birds were translocated to Murray-Sunset National Park, Bronzewing Flora and Fauna Reserve, Scotia Sanctuary and Tarawi Nature Reserve in western NSW (Garnett et al. 2011).

Ecology

The Black-eared Miner, like other threatened mallee species, has specific habitat requirements. The species inhabits shallow-sand mallee and chenopod mallee within its current area of occurrence. These habitats have an overstorey dominated by multi-stemmed eucalypt species and an understorey comprised of *Triodia* and chenopods. Within these habitats, time since last fire greatly influences the suitability of habitat. The Black-eared Miner has a preference for the described mallee habitats which have not been burnt for at least 40 years, however, may forage within younger (5-10 years), as well as recently burnt mallee (Baker-Gabb 2003; Hedger pers. comm).

The breeding behaviour of the Black-eared Miner is specialised, with up to 13, predominantly male, helpers providing assistance for a single breeding pair (TSSC, 2016).

The diet of the Black-eared Miner consists of invertebrates, particularly psyllids and the sugary secretion they form called lerp, as well as nectar (TSSC, 2016). The foraging range of the species is dependent on the breeding season, with short movements of up to 0.8 km while breeding, and greater distances outside the breeding season (TSSC, 2016).

The Black-eared Miner has been threatened by extensive habitat clearance and fragmentation, however the current threats to the species are fire and hybridisation with the Yellow-throated Miner (*Manorina flavigula*) (Garnett *et al.* 2011). Fire, like other threatened mallee bird species, can render habitat unsuitable for up to 40 years (Garnett *et al.* 2011). Mallee is highly flammable, and fires within this habitat are often at a landscape scale. Such landscape scale fires have cause significant declines in the population of Black-eared Miners (Baker-Gabb, 2003).



Fragmentation of mallee caused by vegetation clearance, has allowed for Yellow-throated Miners to spread in to mallee remnants that otherwise would have been unsuitable for the species (Baker-Gab, 2003). The Yellow-throated Miner is closely related to the Black-eared Miner, and the two species readily hybridise (Baker-Gab, 2003). Hybridisation occurs in all Black-eared Miner populations, and is particularly prominent within colonies present within smaller reserves (Baker-Gab, 2003). As such, the species is threatened by the genetics of the Black-eared Miner being diluted by the Yellow-throated Miner.

Potential Impact

The Black-eared Miner may be impacted by the proposed project through the clearance of Mallee habitat on the southern border of Cooltong Conservation Park. The species has been recorded within Cooltong Conservation Park, which is a component on the Bookmark Biosphere Reserve (ALA 2017). However, since 2010, the area of occupancy of the Black-eared Miner in the Bookmark Biosphere Reserve has contracted, and is now present in the west of Calperum Station, Taylorville Station, with the majority of the population in Gluepot Reserve (ALA, 2017). In addition to this, there have been no historic records of the species within the proposed project area (ALA, 2017). As such, the proposed clearance of Mallee on the southern border of Cooltong Conservation Park, would only be expected to adversely impact the species if the population within Bookmark Biosphere Reserve were to recover and expand in distribution. Given the on-going presence of Malleefowl within Cooltong Conservation Park (DEWNR, 2012; ALA, 2017), another species with similar habitat requirements, it would be assumed that suitable habitat is still present in the centre of park for Black-eared Miners. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

5.2.12 Curlew Sandpiper (Calidris ferruginea)

Commonwealth Status

The Curlew Sandpiper is listed as Critically Endangered, Migratory and Marine under the EPBC Act, and is subject to the bilateral migratory bird agreements with Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA), under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (TSSC, 2015).

Description

The Curlew Sandpiper (*Calidris ferruginea*) is a small (20 – 22 cm) species of migratory shorebird. The species is characterised by its thin down-curved black bill. In non-breeding plumage, the species has a white front, rump and eye-brow, while the remainder of the bird is a uniform grey-brown colour (Pizzey and Knight, 2007). While the species is a non-breeding migrant to Australia, some individuals may be present in their breeding plumage, on arrival from, or on departure to, their breeding grounds. In breeding plumage, individuals are a deep rosy chestnut, however retain their white-rump (Pizzey and Knight, 2007).

Distribution

The breeding range of the Curlew Sandpiper extends across the Arctic Tundra in Siberia. The species distribution extends over multiple flyways with individuals spending their non-breeding season in Africa, Asia and Australia. Individuals that spend their non-breeding season in Australia operate on the East-Asian Australasian Flyway (TSSC, 2015).



Approximately 13% of the global population of Curlew Sandpipers occur on the East-Asian Australasian Flyway. Key flyway staging areas are located across south-east Asia and northern China on the shores of the Yellow Sea (Bamford, *et al.* 2008). The majority of the EAA Flyway population (115,000 of 172,750 individuals) spend their non-breeding season in Australia. Curlew Sandpipers arrive in Australia from September and depart for northern migration between the months of March and May.

Within Australia, Curlew Sandpipers occur primarily around the coasts, however may be present inland following rainfall events (Queensland Wader Study Group 2010). The Curlew Sandpiper has been recorded in all states during the non-breeding season as well as the breeding season, when some birds forego their opportunity to breed and remain in Australia (TSCC 2015). Sites supporting more than 1% of the individuals within the EAA Flyway are concentrated within the south-east, south-west and north-west of the country (Bamford *et al.* 2008).

Within South Australia, Curlew Sandpipers predominantly occur within coastal and subcoastal habitats east of Streaky Bay, Eyre Peninsula. The species may also occur inland (TSSC, 2015). The Coorong and Lake George are sites of international importance in South Australia, as they support >1% of the total population in the EAA Flyway (Bamford *et al.* 2008). Inland South Australia is of limited importance to the species, with few, and on occasion hundreds, of Curlew Sandpipers passing through the north east from late August to early December (TSSC, 2015).

Ecology

The population of Curlew Sandpipers has suffered a population decline in excess of 50% in the past 20 years (Garnett *et al.* 2011). In South Australia, the population decline has been particularly severe, with a decline of 79% in the Coorong from the 1980s to 2004 (Wainwright and Christie, 2008), and a decline of 71% in the Gulf of St Vincent from 1981 to 2004 (Close, 2008).

The vast majority of Curlew Sandpipers in Australia are present within coastal and subcoastal habitats. The habitats within which they are present from fresh to hypersaline, and include: intertidal mudflats, saltworks, sewage farms, wetlands, lakes, swamps and lagoons (Pizzey and Knight, 2007). Although irregularly present inland, Curlew Sandpipers have been observed at ephemeral and permanent lakes, dams, waterholes, bore drains, and floodwaters (TSSC, 2015). Within all of these habitats, Curlew Sandpipers are typically present foraging in microhabitats of exposed mud or shallow water, within sheltered areas. Roosting typically occurs above the water line on spits, islets, islands or areas which offer an open view to observer predators.

The Curlew Sandpiper forages within the sediment within exposed mud or shallow water habitats. The Curlew Sandpiper typically feeds within water of 1-3 cm, however, may forage as deep at 6 cm (TSSC, 2015). Curlew Sandpipers probe the sediment with their long down-curved bill, primarily feeding upon invertebrates, such as larvae, polychaetes, molluscs, crustaceans and seeds (Puttick, 2010; TSSC, 2015).

Curlew Sandpipers typically feed within flocks, varying from a few individuals to hundreds (Pers. Obs.). In addition to this, the species is often present within mixed species foraging groups with other migratory shorebird species, such as the Sharp-tailed Sandpiper (*Calidris acuminata*) and Red-necked Stint (*Calidris ruficollis*) (TSSC, 2015).



High quality feeding habitat in Australia is of utmost importance in the conservation of Curlew Sandpipers. Individuals gain 40% of their body weight in Australia, a fat resource that provides fuel for their migration to their breeding grounds (Zwarts *et al.* 1990). It is assumed that individuals which reach their breeding grounds with good body condition have higher recruitment than individuals in sub-par condition.

Breeding takes place in the Arctic Tundra, Siberia (Garnett *et al.* 2011), where the melting permafrost caused by an Arctic summer leads to extensive warm, shallow pools across the region, providing ideal conditions for mosquitos to breed. The mosquito larvae provides an abundant food resource for brooding chicks.

The Curlew Sandpiper reach sexual maturity at two years of age, with first year birds typically foregoing their northward migration and staying in Australia. Nesting occurs in June and July, with a typical clutch consisting of four eggs (TSSC, 2015).

The cause of population decline is believed to be reduced adult survival (rather than reduced recruitment) attributed to the degradation and loss of staging grounds in East Asia (Garnett *et al.* 2011). The staging grounds are threatened by environmental pollution, reduced river flows, human disturbance and reclamation for tidal power plants and barrages, industrial use and urban expansion (Garnett *et al.* 2011). The reclamation and development of Bohai Bay, where up to 30% of the population stages within a 20 km stretch of mudflat, is of particular concern for the conservation of the species (Rogers *et al.* 2010).

In Australia, Curlew Sandpipers are threatened by human disturbance, habitat loss and degradation, changes to water regime and invasive plants (TSSC, 2015; Garnett *et al.* 2011). These threats are also considered to be significant, as they have been associated with significant declines in the populations of resident shorebirds species and have increased the proportion of time that migratory shorebird species spend foraging (>80%) in order to gain sufficient body condition for their migration to breeding grounds (Paton and Bailey, 2014).

Potential Impact

The Curlew Sandpiper is unlikely to be impacted by the proposed development, as the intake pipe connects the channel of the River Murray, which is not suitable habitat for the species. In addition to this, records of the Curlew Sandpiper in the Riverland are limited, with the only local record at the Berri sewage ponds rather than River Murray wetlands (ALA, 2017). While the Curlew Sandpiper may inhabit wetlands, those present within 500 m of the intake pipe appear heavily vegetated and therefore unlikely to support habitat for the species. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.



5.3 Matters of state environmental significance

5.3.1 State threatened flora species

The BDBSA search for all flora records within 20km highlighted the presence of two nationally threatened species and 33 at state level (Table 8). Most these are associated with the river corridor meaning that the anticipated impact as part of the project is expected to be low. Nationally listed species determined most likely to be potentially impacted as part of the project are discussed below.

Species	Common	AUS	SA	Most recent record	Likelihood
Lepidium monoplocoides	Winged Peppercress	EN	E*	2/10/1915	Unlikely
Lepidium hyssopifolia	Small Peppercress	EN		11/02/2010	Possible
Acacia lineata	Streaked Wattle		R	2/10/1984	Unlikely
Callistemon brachyandrus	Prickly Bottlebrush		R	1/03/1916	Unlikely
Callitriche sonderi	Matted Water Starwort		R	20/04/1957	Unlikely
Calocephalus sonderi	Pale Beauty-heads		R	24/11/2011	Likely
Calotis scapigera	Tufted Burr-daisy		R	19/01/2012	Likely
Corynotheca licrota	Sand Lily		R	13/12/2011	Likely
Cyperus flaccidus	Flaccid Flat-sedge		R	18/01/1994	Possible
Cyperus nervulosus	Cyperus		R	20/01/1994	Possible
Duma horrida ssp. horrida	Spiny Lignum		R	7/05/2015	Possible
Elatine gratioloides	Waterwort		R	16/05/2006	Possible
Eragrostis infecunda	Barren Cane-grass		R	10/11/1986	Possible
Eragrostis lacunaria	Purple Love-grass		R	20/01/1994	Possible
Eremophila polyclada	Twiggy Emubush		R	17/11/1955	Unlikely
Exocarpos strictus	Pale-fruit Cherry		R	31/01/2007	Possible
Goodenia heteromera	Spreading Goodenia		R	11/01/2012	Likely
Gratiola pedunculata	Stalked Brooklime		R	18/01/1994	Possible
Gratiola pubescens	Glandular Brooklime		R	1/03/1993	Possible
Gratiola pumilo	Dwarf Brooklime		R	Unknown	Possible
Hakea tephrosperma	Hooked Needlewood		R	15/08/1995	Possible
Lachnagrostis robusta	Tall Blown-grass		R	17/02/1947	Unlikely
Lawrencia berthae	Showy Lawrencia		R	2/12/1913	Unlikely
Maireana pentagona	Slender Fissure-plant		R	11/01/2012	Likely
Maireana rohrlachii	Rohrlach's Bluebush		R	5/11/1994	Possible
Myoporum parvifolium	Creeping Boobialla		R	8/05/2015	Possible
Myriophyllum papillosum	Robust Milfoil		R	19/11/2003	Possible
Nymphoides crenata	Wavy Marshwort		R	1/12/1913	Unlikely
Orobanche cernua var. australiana	Australian Broomrape		R	8/09/1974	Unlikely
Osteocarpum acropterum var.	Wingless Bonefruit		R	25/11/2009	Likely
Picris squarrosa	Squat Picris		R	7/12/2011	Possible

Table 8. Threatened flora species records highlighted as part of BDBSA search (20km buffer).

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. Mi: Migratory. Ma: Marine





Figure 3. Threatened flora species records highlighted as part of BDBSA search (map extent).

5.3.2 State threatened fauna species

The BDBSA search highlighted 14 nationally threatened fauna species and 55 state listed fauna species as being previously recorded within 20 km of the project site (Table 9). These were mostly recorded within the river corridor and in the adjacent conservation park areas.

Species	Common	AUS	SA	Most recent record	Likelihood			
Miniopterus orianae bassanii	Large Bent-winged Bat	CR	E	1961	Unlikely			
Bidyanus bidyanus	Silver Perch	CR		2013	Likely			
Calidris ferruginea	Curlew Sandpiper	CR		2001	Likely			
Botaurus poiciloptilus	Australasian Bittern	EN	V	2010	Likely			
Rostratula australis	Australian Painted-snipe	EN	V	2001	01 Possible			
Dasyurus maculatus	Spotted-tailed Quoll (Tiger Quoll)	EN	E	1958	Unlikely			
Manorina flavigula melanotis	Black-eared Miner	EN	E	2002 Likely				
Craterocephalus fluviatilis	Murray Hardyhead	EN		2007	Likely			
Leipoa ocellata	Malleefowl	VU	V	2007	Likely			
Litoria raniformis	Southern Bell Frog	VU	V	2011	Likely			
Polytelis anthopeplus monarchoides	Regent Parrot (Eastern ssp)	VU	V	2014	Likely			
Pachycephala rufogularis	Red-lored Whistler	VU	R	2002	Likely			
Ardeotis australis	Australian Bustard		V	1965	Possible			
Chelodina expansa	Broad-shelled Tortoise		V	2003	Possible			
Cladorhynchus leucocephalus	Banded Stilt		V	2011	Likely			
Coturnix ypsilophora	Brown Quail		V	2015	Likely			
Emydura macquarii	Macquarie Tortoise		V	2003	Possible			
Grus rubicunda	Brolga		V	2010	Likely			
Stictonetta naevosa	Freckled Duck		V	2015	Likely			
Cinclosoma castanotum	Chestnut-backed Quail thrush		R	2015	Likely			
Melanodryas cucullata	Hooded Robin		R	2015	Likely			
Petroica boodang	Scarlet Robin		R	1998	Possible			
Actitis hypoleucos	Common Sandpiper		R	2003	Possible			
Amytornis striatus	Striated Grasswren		R	2007	Possible			
Anas rhynchotis	Australasian Shoveler		R	2015	Likely			
Anhinga novaehollandiae	Australasian Darter		R	2016	Likely			
Ardea ibis	Cattle Egret		R	2000	Possible			
Ardea intermedia	Intermediate Egret		R	2015	Likely			
Biziura lobata	Musk Duck		R	2011	Likely			
Burhinus grallarius	Bush Stone curlew		R	2006	Likely			
Cacatua leadbeateri	Major Mitchell's Cockatoo		R	2002	Possible			
Calamanthus (Hylacola) cautus	Shy Heath wren		R	2002	Possible			
Calidris melanotos	Pectoral Sandpiper		R	2010	Likely			
Climacteris affinis	White-browed Treecreeper		R	2010	Likely			
Coracina papuensis	White-bellied Cuckoo shrike		R	2004	Possible			
Corcorax melanorhamphos White-winged Chough			R	2015	Likely			

Table 9. Threatened fauna species records highlighted as part of BDBSA search (20km buffer).



Species	Common	AUS	SA	Most recent record	Likelihood
Egretta garzetta	Little Egret		R	2014	Likely
Entomyzon cyanotis	Blue-faced Honeyeater		R	2015	Likely
Falco hypoleucos	Grey Falcon		R	1970	Possible
Falco peregrinus	Peregrine Falcon		R	2015	Likely
Gallinago hardwickii	Latham's Snipe		R	1976	Possible
Morelia spilota	Carpet Python		R	2012	Likely
Myiagra inquieta	Restless Flycatcher		R	2015	Likely
Neophema elegans	Elegant Parrot		R	2007	Possible
Neophema splendida	Scarlet-chested Parrot		R	1970	Possible
Oriolus sagittatus	Olive-backed Oriole		R	2001	Possible
Oxyura australis	Blue-billed Duck		R	2009	Likely
Pachycephala inornata	Gilbert's Whistler		R	2014	Likely
Philemon citreogularis	Little Friarbird		R	2015	Likely
Plectorhyncha lanceolata	Striped Honeyeater		R	2015	Likely
Plegadis falcinellus	Glossy Ibis		R	2011	Likely
Pluvialis fulva	Pacific Golden Plover		R	2001	Possible
Podiceps cristatus	Great Crested Grebe		R	2011	Likely
Porzana tabuensis	Spotless Crake		R	2010	Possible
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat		R	1969	Possible
Trichosurus vulpecula	Common Brushtail Possum		R	2006	Possible
Tringa glareola	Wood Sandpiper		R	2001	Possible
Varanus varius	Lace Monitor		R	2004	Possible
Vermicella annulata	Common Bandy Bandy		R	1983	Possible
Anseranas semipalmata	Magpie Goose		E	2007	Likely
Haliaeetus leucogaster	White-bellied Sea-Eagle		E	2015	Possible
Ixobrychus dubius	Australian Little Bittern (Black- backed Bittern)		E	2005	Possible
Ornithorhynchus anatinus	Platypus		E	1975	Unlikely
Pandion haliaetus	Osprey		E	1991	Possible

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. Mi: Migratory. Ma: Marine





Figure 4. Threatened fauna species records highlighted as part of BDBSA search (map extent).



5.4 Field survey

5.4.1 Vegetation associations and condition

Seven broad indigenous vegetation associations were observed within the project area in addition to extensive pastoral and cropping areas which were not described as part of this assessment (Table 10). Four of the vegetation associations occur within 300m of the river corridor with two of these being woodland associations.

One nationally threatened ecological community occurs along the river corridor and falls within the project footprint, River Murray and associated wetlands, floodplains and groundwater systems, from the junction with the Darling River to the sea. This is a very short section which would encompass the pump station infrastructure.

Significant Environmental Benefit (SEB) condition ratios in patches ranged from 2:1 to 8:1 with the poorest areas located near the Sturt Highway and immediately south of the proposed water storage dam where high understorey annual exotic species cover was high (see section 4.3.1). Most intact remnant patches were in moderate condition with degradation from stock grazing activity. Best condition areas of vegetation occurred adjacent to the southern boundary of the Cooltong CP which had low weed density and intact stratums.

A summary and description of the dominant species and structures associated with each indigenous association is provided below. Vegetation associations are mapped in Figure 5 below.

Assoc #	Description	Condition range	Area (Ha)	% of area surveyed
1	Dodonaea viscosa ssp. angustissimus (Sticky Hop Bush) Senna artemisioides ssp. (Senna) Low Open Shrubland	3:1	25.17	0.76
2	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.13	0.004
3	Eucalyptus largiflorens (Black Box) Woodland	6:1	17.27	0.52
4	Eucalyptus camaldulensis (River Red Gum) Woodland	6:1	0.04	0.002
5	Maireana pyramidata (Black Bluebush) Shrubland	2:1	4.19	0.12
6	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.13	0.004
7	<i>Myoporum platycarpum</i> (False Sandalwood) Low Open Woodland over <i>Aristida holathera</i> (Wire Grass)	2:1	25.53	0.77
8	Pasture / Cropping Exotic grassland	0:1	3,227	97.8
		Total	3,300	100%

 Table 10. Vegetation associations recorded within project area boundary summary





Figure 5. Vegetation associations and scattered trees within project area. (Unshaded areas represent Shrub land and or Cropping land).



Vegetation association 1: *Dodonaea viscosa* ssp. *angustissimus* (Sticky Hop Bush) *Senna artemisioides* ssp. (Senna) Low Open Shrubland



Figure 6. Dodonaea / Senna shrubland on old quarry area adjacent to River

Overstorey and mid storey	Dodonaea viscosa ssp. angustissimus, Acacia oswaldii, Acacia ligulata, Exocarpos aphyllus, Senna petiolaris				
Understorey	 Common native species included: Salsola australis (Buckbush) Rhagodia spinescens (Berry Saltbush) Olearia pimeleoides (Pimelea Daisy-bush) Austrostipa elegantissima (Feather Spear Grass) Ajuga australis (Austral Bugle) Maireana pyramidata (Black Bluebush) 				
Exotic species	Common weed species included: Asphodelus fistulosus (Onion Weed) Carthamus lanatus (Star Thistle) Vulpia myuros (Rats tail fescue) 				
Conservation significant species	No conservation significant species recorded				
Vegetation condition	Poor (2:1 – 4:1)				
Habitat value	Low to moderate due to high cover of exotic annual grass species.				
Species richness	18				





Vegetation association 2: Eucalyptus socialis (Red Mallee) Mixed Mallee

Figure 7. Eucalyptus socialis Mixed Mallee

Overstorey and mid storey	Eucalyptus socialis, Alectryon oleifolius, Eucalyptus gracilis, Myoporum platycarpum, Pittosporum angustifolium, Acacia nyssophylla				
Understorey	 Common native species included: <i>Rhagodia spinescens</i> (Berry Saltbush) <i>Olearia muelleri</i> (Mueller's Daisy-bush) <i>Austrostipa elegantissima</i> (Feather Spear Grass) <i>Beyeria opaca</i> (Turpentine) <i>Maireana pentatropis</i> (Bluebush) <i>Atriplex stipitata</i> (Bitter Saltbush) <i>Grevillea huegelii</i> (Comb Grevillea) 				
Exotic species	Common weed species included: • Avena barbata (Bearded Oat) • Asphodelus fistulosus (Onion Weed) • Carthamus lanatus (Star Thistle) • Salvia verbenaca (Wild Sage) • Carrichtera annua (Wards Weed)				
Conservation significant species	No conservation significant species recorded				
Vegetation condition	Very Good (8:1)				
Habitat value	Low to moderate due to high cover of exotic annual grass species.				
Species richness	45				





Vegetation association 3: Eucalyptus largiflorens (Black Box) Woodland

Figure 8. Eucalyptus largiflorens Woodland on River Murray Floodplain area adjacent to pump station

Overstorey and midstorey	Eucalyptus largiflorens
Understorey	 Common native species included: Enchylaena tomentosa (Ruby Saltbush) Atriplex rhagodioides (River Saltbush) Olearia pimeleoides (Pimelea Daisy-bush) Rhagodia spinescens (Berry Saltbush)
Exotic species	Common weed species included: Asphodelus fistulosus (Onion Weed) Carthamus lanatus (Star Thistle) Vulpia myuros (Rats tail fescue
Conservation significant species	No conservation significant species recorded
Vegetation condition	Moderate (5:1)
Habitat value	Low to moderate due to high cover of exotic annual grass species.
Species richness	14





Vegetation association 4: Eucalyptus camaldulensis (River Red Gum) Woodland

Figure 9. Eucalyptus camaldulensis (River Red Gum) in river corridor

Overstorey and midstorey	Eucalyptus camaldulensis, Acacia stenophylla, Duma florulenta			
Understorey	Common native species included: • Rhagodia spinescens • Cyperus gymnocaulos • Maireana brevifolia • Salsola australis (Buckbush)			
Exotic species	Common weed species included: • Asphodelus fistulosus (Onion Weed) • Carthamus lanatus (Star Thistle) • Salvia verbenaca (Wild Sage) • Euphorbia terracina (False Caper)			
Conservation significant species	No conservation significant species recorded			
Vegetation condition	Moderate (5:1)			
Habitat value	High habitat value in proximity to river with numerous hollows.			
Species richness	19			





Vegetation association 5: Maireana pyramidata (Black Bluebush) Shrubland

Figure 10. Patch of *Maireana pyramidata* Shrubland surrounded by intact Mallee adjacent to the Sturt Highway.

Overstorey and mid storey	Maireana pyramidata,
Understorey	Common native species included: • Salsola australis (Buckbush) • Sclerolaena uniflora () • Enchylaena tomentosa (Ruby saltbush) • Austrostipa sp. (Spear Grass)
Exotic species	Common weed species included: Carthamus lanatus (Star Thistle) Carrichtera annua (Wards Weed)
Conservation significant species	No conservation significant species recorded
Vegetation condition	Very Poor (2:1)
Habitat value	Low to moderate due to high cover of exotic annual grass species.
Species richness	8



Vegetation association 6: *Eucalyptus cyanophylla* (Blue-leaved Mallee) / *Eucalyptus socialis* (Red Mallee) / *Senna artemisioides* ssp. (Senna) / *Dodonaea viscosa* (Sticky Hop Bush) Mixed Mallee over *Triodia irritans* (Spinifex)



Figure 11. Mallee vegetation structure on deeper sand rises.

Overstorey and midstorey	Eucalyptus cyanophylla, E. socialis, E. gracilis, Callitris gracilis, Melaleuca lanceolata, Duboisia hopwoodii.				
Understorey	Common native species included: • Triodia irritans (Spinifex) • Podolepis capillaris (Cooper Wire Daisy) • Acacia spinescens (Spiny Wattle) • Acacia hakeoides (Hakea Wattle) • Lomandra leucocephala () • Eremophila subfloccosa (Woolly Emu-bush) • Dampiera rosmarinifolia (Rosemary Dampiera)				
Exotic species	Common weed species included: Carthamus lanatus (Star Thistle) Salvia verbenaca (Wild Sage) 				
Conservation significant species	No conservation significant species recorded				
Vegetation condition	Very good (8:1)				
Habitat value	Low to moderate due to high cover of exotic annual grass species.				
Species richness	35				



Vegetation association 7: Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)



Figure 12. Degraded dunes on Monash property with emergent *Myoporum platycarpum*.

Overstorey and midstorey	Myoporum platycarpum (False Sandalwood)
Understorey	Common native species included: • Aristida behriana (Wire Grass)
Exotic species	Common weed species included: Salvia verbenaca (Wild Sage)
Conservation significant species	No conservation significant species recorded
Vegetation condition	Very Poor (1:1)
Habitat value	Low to moderate due to high cover of exotic annual grass species.
Species richness	8



5.4.2 Flora species distribution and richness

A total of ninety-one flora species were observed within the project area (Table 11). These were represented by a full range of lifeforms including grasses, herbs, shrubs and trees with high structural diversity recorded within most habitats.

No threatened flora species at national or state level were observed despite traversing the entire alignment of the pipeline easement on foot with a corridor of 40 m assessed. This was a focus of this assessment with the proposed alignment running along the southern boundary of Cooltong Conservation Park which has several threatened species records. The extent of the works is not expected to reduce the extent of existing habitat significantly and will be located at the fringes of intact areas which has a low likelihood of providing nesting habitat to this species.

In some patches, the understorey was highly modified with loss of perennial plants and annual weeds and this was often correlated with the level of grazing disturbance from cattle which disturb the microbiotic soil crust. Microbiotic crusts are assemblages of non-vascular plants (mosses, liverworts, algae, lichens, fungi, bacteria and cyanobacteria) which form intimate associations with surface soils. Unlike physical soil crusts, microbiotic crusts stabilize the soil against water and wind erosion, increasing landscape stability, particularly in areas of low vascular plant cover (Eldridge and Greene 1994).

Other areas have appeared to be previously disturbed either through rolling or altered fire regimes which have reduced the aged trees which would appear in natural mallee communities and as a result have reduced hollow abundance and a dense cover of smaller multi stemmed trees than an undisturbed area. The proposed infrastructure has sought to be located in these previously disturbed or cleared areas as far as practicable to minimise potential impacts.

The alignment where the infrastructure utilises a previously used pipeline easement has a largely natural vegetation stratum present however a large trench and spoil heap has remained and as such disturbs the natural movement of resources through the landscape.



Exotic	Scientific Name	Common Name	AUS	SA	1	2	3	4	5	6	7
	Acacia calamifolia	Wallowa								\checkmark	
	Acacia havilandiorum	Needle Wattle								\checkmark	
	Acacia ligulata	Umbrella Bush			\checkmark	\checkmark					
	Acacia nyssophylla	Spine Bush				\checkmark					
	Acacia oswaldii	Umbrella Wattle			\checkmark	\checkmark					
	Acacia sclerophylla var. sclerophylla	Hard-leaf Wattle				\checkmark					
	Acacia spinescens	Spiny Wattle				\checkmark				\checkmark	
	Acacia stenophylla	River Cooba						\checkmark			
	Ajuga australis	Australian Bugle			\checkmark						
	Aristida holathera var. holathera	Tall Kerosene Grass									\checkmark
*	Asphodelus fistulosus	Onion Weed			\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
	Atriplex rhagodioides	River Saltbush					\checkmark				
	Atriplex semibaccata	Berry Saltbush					\checkmark	\checkmark			
	Atriplex stipitata	Bitter Saltbush				\checkmark					
	Austrostipa elegantissima	Feather Spear-grass			\checkmark						
	Austrostipa sp.	Spear-grass			\checkmark	\checkmark			\checkmark		
*	Avena barbata	Bearded Oat						\checkmark			
	Beyeria opaca	Dark Turpentine Bush				\checkmark				\checkmark	
*	Brassica tournefortii	Wild Turnip								\checkmark	
	Callitris gracilis	Southern Cypress Pine				\checkmark				\checkmark	
	Calotis cymbacantha	Showy Burr-daisy								\checkmark	
	Calotis sp.	Burr-daisy								\checkmark	
	Carpobrotus modestus	Inland Pigface								\checkmark	
*	Carrichtera annua	Ward's Weed				\checkmark			\checkmark		\checkmark
*	Carthamus lanatus	Saffron Thistle			\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
	Chenopodium curvispicatum	Cottony Goosefoot				\checkmark					
	Chenopodium desertorum ssp.	Desert Goosefoot				\checkmark				\checkmark	
	Chrysocephalum apiculatum	Common Everlasting								\checkmark	
*	Citrullus sp.	Wild Melon						\checkmark			
	Cyperus gymnocaulos	Spiny Flat-sedge						\checkmark			
	Dampiera rosmarinifolia	Rosemary Dampiera								\checkmark	
	Dianella revoluta var. divaricata	Broad-leaf Flax-lily				~				\checkmark	
	Dicrastylis verticillata	Dicrastylis								\checkmark	

Table 11. Flora species observations within individual vegetation associations within the project site.



Exotic	Scientific Name	Common Name	AUS	SA	1	2	3	4	5	6	7
	Dodonaea viscosa ssp. spatulata	Sticky Hop-bush			✓			✓			✓
	Duboisia hopwoodii	Pituri									
	Duma florulenta	Lignum					✓	\checkmark			
	Enchylaena tomentosa var.	Ruby Saltbush				\checkmark	√	\checkmark	\checkmark		
	Enneapogon cylindricus	Jointed Bottle-washers						\checkmark			
	Eremophila scoparia	Broom Emubush				\checkmark					
	Eremophila sp.	Emubush/Turkey-bush								\checkmark	
	Eremophila subfloccosa ssp.	Woolly Emubush								\checkmark	
	Eucalyptus camaldulensis ssp. camaldulensis	River Red Gum						~			
	Eucalyptus gracilis	Yorrell				✓					
	Eucalyptus largiflorens	River Box					\checkmark				
	Eucalyptus socialis ssp.	Red Mallee				\checkmark					
	Euphorbia tannensis ssp. eremophila	Desert Spurge						\checkmark			
	Eutaxia microphylla	Common Eutaxia				\checkmark				\checkmark	
	Exocarpos aphyllus	Leafless Cherry			\checkmark	\checkmark					
	Goodenia willisiana	Silver Goodenia								\checkmark	
	Grevillea huegelii	Comb Grevillea				\checkmark					
	Grevillea stenobotrya	Rattle-pod Grevillea								\checkmark	
	Halgania cyanea	Rough Blue-flower				\checkmark				\checkmark	
	Hypolaena fastigiata	Tassel Rope-rush								\checkmark	
*	Lactuca sp.	Lettuce						\checkmark			
	Leucopogon sp.	Beard-heath								\checkmark	
	Lomandra leucocephala ssp. robusta	Woolly Mat-rush				\checkmark				\checkmark	
	Maireana brevifolia	Short-leaf Bluebush					✓				
	Maireana pentatropis	Erect Mallee Bluebush				✓					
	Maireana pyramidata	Black Bluebush			\checkmark			✓			
	Maireana radiata	Radiate Bluebush				✓					
	Melaleuca lanceolata	Dryland Tea-tree								✓	
	Myoporum platycarpum ssp.	False Sandalwood				✓					\checkmark
	Nicotiana sp.	Tobacco								\checkmark	
	Olearia muelleri	Mueller's Daisy-bush				✓					
	Olearia pimeleoides	Pimelea Daisy-bush			\checkmark	✓	✓				
	Pimelea micrantha	Silky Riceflower			\checkmark	\checkmark					
	Pittosporum angustifolium	Native Apricot				\checkmark					



Exotic	Scientific Name	Common Name	AUS	SA	1	2	3	4	5	6	7
	Podolepis capillaris	Wiry Podolepis								√	
	Prostanthera sp.	Mintbush								\checkmark	
*	Psilocaulon granulicaule	Match-head Plant								✓	
	Ptilotus nobilis ssp.	Yellow Heads				✓				✓	
	Rhagodia spinescens	Spiny Saltbush			\checkmark	\checkmark	\checkmark		✓		
	Rhagodia ulicina	Intricate Saltbush				✓					
	Salsola australis	Buckbush			\checkmark	✓	✓	✓	✓		\checkmark
*	Salvia verbenaca var.	Wild Sage									\checkmark
*	Schinus molle	Pepper-tree						✓			
	Sclerolaena obliquicuspis	Oblique-spined Bindyi				✓				\checkmark	
	Sclerolaena parviflora	Small-flower Bindyi				✓				\checkmark	
	Sclerolaena uniflora	Small-spine Bindyi			\checkmark	✓	✓	✓	✓		
	Senna artemisioides ssp. artemisioides x ssp. coriacea	Desert Senna			\checkmark	~					
	Senna artemisioides ssp. filifolia	Fine-leaf Desert Senna				\checkmark					
	Senna artemisioides ssp. petiolaris	Senna			\checkmark						
	Senna artemisioides ssp. X coriacea	Broad-leaf Desert Senna				\checkmark				\checkmark	
*	Sisymbrium sp.	Wild Mustard				\checkmark	\checkmark	\checkmark			
	Triodia sp.	Spinifex								\checkmark	
	Vittadinia sp.	New Holland Daisy								✓	
*	Vulpia myuros	Fescue			\checkmark	✓	\checkmark				
	Westringia rigida	Stiff Westringia								\checkmark	
	Zygophyllum apiculatum	Pointed Twinleaf				✓					
	Zygophyllum eremaeum					\checkmark					



5.4.3 Exotic flora species

Twelve exotic species were recorded for the entire project site which would be considered low for these types of environments due to the number of fragmented patches subject to fringe effects in most cases (Table 12). None of these species are declared under the *Natural Resources Management Act 2004. Asphodelus fistulosus* (Onion Weed) and *Carthamus lanatus* (Star Thistle) were the most widespread species being recorded within 6 associations each respectively. Other commonly occurring species were *Carrichtera annua* (Wards Weed), *Vulpia myuros* (Fecue) and *Sysimbrium* (London Rocket).

Species	Common	Declared
Asphodelus fistulosus	Onion Weed	
Avena barbata	Bearded Oat	
Brassica tournefortii	Wild Turnip	
Carrichtera annua	Ward's Weed	
Carthamus lanatus	Saffron Thistle	
Citrullus sp.	Wild Melon	
Lactuca sp.	Lettuce	
Psilocaulon granulicaule	Match-head Plant	
Salvia verbenaca var.	Wild Sage	
Schinus molle	Pepper-tree	
Sisymbrium sp.	Wild Mustard	
Vulpia myuros f.	Fescue	

Table 12. E	xotic species	records for	the pro	oject site.
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5.4.4 Fauna

Fauna based surveys were largely based on opportunistic bird observations made during the April 2017 survey, which coincided with vegetation association mapped within the project area. This area surveyed for fauna covered from the southern boundary of the project site at the river's edge to the northern most boundary (Figure 13).

One mammal species was recorded within the project area, the European Rabbit (*Oryctolagus cuniculus*), which is an introduced pest species common in all states. Goats were seen on neighbouring properties with tracks passing through boundary fences in several locations. Several mammal tracks were observed during the survey; this included the Red Fox (*Vulpes vulpes*) and kangaroo tracks which were most likely to be the Western Grey Kangaroo (*Macropus fuliginosus melanops*).

One reptile species was recorded during the survey; the Mallee Dragon (*Ctenophorus fordi*) is a commonly found reptile in Mallee woodlands. A track mostly likely made by a Sand goanna (*Varanus gouldii*) was observed; these are common to South Australia.

A total of 46 bird species were recorded within the project area, 43 of which were commonly occurring and widespread (Table 13). Three of 46 species have a State rare conservation significance within South Australia:

• Chestnut Quail-thrush (Cinclosoma castanotus castanotus);



- Little Egret (Egretta garzetta); and
- Striped Honeyeater (Plectorhyncha lanceolata).

The Chestnut Quail-thrush was observed foraging in leaf litter in Mallee woodland with a flock of Whitebrowed Babbler (*Pomatostomus superciliosus*). The Little Egret was recorded on the edge of open cropping land and mallee woodland and the Striped Honeyeater was observed in River Red Gum (*Eucalyptus camaldulensis*) at the river's edge near the existing pumping station (Figure 13). These species are described in more detail, with regard to potential impact from the proposed development, under the discussion section.

Two of the 46 bird species recorded during the survey were introduced; these were the Common Starling (*Sturnus vulgaris*) and Barbary Dove (*Streptopelia risoria*).

All bird observations recorded within the project area during the field survey are listed below

Scientific Name	Common Name	Habitat Comment	EPBC Act	NPW Act	Exotic
Birds			1	1	1
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	River edge			
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	River edge			
Acanthiza nana	Yellow Thornbill	Mallee woodland			
Anthus australis	Australian Pipit	Cropping land			
Aphelocephala leucopsis	Southern Whiteface	Mallee woodland			
Aquila audax	Wedge-tailed Eagle	Flying over Cropping land			
Barnardius zonarius	Australian Ringneck	Mallee woodland			
Cheramoeca leucosterna	White-backed Swallow	River edge			
Cinclosoma castanotus castanotus	Chestnut Quail-thrush (eastern ssp)	Mallee woodland		R	
Colluricincla harmonica	Grey Shrike-thrush	Mallee woodland			
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Mallee woodland			
Corvus coronoides	Australian Raven	Across Site			
Cracticus nigrogularis	Pied Butcherbird	River edge			
Cracticus torquatus	Grey Butcherbird	Mallee woodland			
Dromaius novaehollandiae	Emu	Mallee woodland			
Egretta garzetta	Little Egret	Cropping land		R	
Eolophus roseicapilla	Galah	Mallee woodland			
Epthianura albifrons	White-fronted Chat	Cropping land			
Falco cenchroides	Nankeen Kestrel	Flying over Cropping land			
Gavicalis virescens	Singing Honeyeater	River edge			
Grallina cyanoleuca	Magpielark	Mallee woodland			
Gymnorhina tibicen	Australian Magpie	Across site			
Haliastur sphenurus	Whistling Kite	River edge			
Hirundo neoxena	Welcome Swallow	River edge			
Malurus lamberti	Variegated Fairy-wren	River edge			
Manorina flavigula	Yellow-throated Miner	Mallee woodland			
Microeca fascinans	Jacky Winter	Mallee woodland			
Northiella haematogaster	Bluebonnet	Mallee woodland			

Table 13. Fauna species observations during project area assessment.



Scientific Name	Common Name	Habitat Comment	EPBC Act	NPW Act	Exotic
Ocyphaps lophotes	Crested Pigeon	Across site			
Pachycephala rufiventris	Rufous Whistler	Mallee woodland			
Pardalotus punctatus	Spotted Pardalote	Mallee woodland			
Petrochelidon nigricans	Tree Martin	River edge			
Petroica goodenovii	Red-capped Robin	Mallee woodland			
Phalacrocorax varius	Australian Pied Cormorant	River edge			
Phaps chalcoptera	Common Bronzewing	Mallee woodland			
Platycercus elegans	Crimson Rosella	River edge			
Plectorhyncha lanceolata	Striped Honeyeater	River edge		R	
Pomatostomus superciliosus	White-browed Babbler	Mallee woodland			
Ptilotula ornata	Yellow-plumed Honeyeater	Mallee woodland			
Ptilotula penicillata	White-plumed Honeyeater	River edge			
Rhipidura leucophrys	Willie Wagtail	Across site			
Smicrornis brevirostris	Weebill	Mallee woodland			
Strepera versicolor	Grey Currawong	Mallee woodland			
Streptopelia risoria	Barbary Dove	River edge			*
Sturnus vulgaris	Common Starling	Cropping land			*
Threskiornis moluccus	Australian White Ibis	River edge			
Mammals					
Oryctolagus cuniculus	Rabbit (European Rabbit)	cropping land			*
Reptiles					
Ctenophorus fordi	Mallee Dragon	Mallee woodland			

*indicates an introduced species

SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: EN: Endangered V/VU: Vulnerable. R/RA: Rare. NT: Near threatened. LC: Least concern.





Figure 13. Threatened fauna observations.



The following bird species are discussed in more detail in relation to whether the proposed project may impact directly on the species, or on potential habitat for the species.

Chestnut Quail-thrush (Cinclosoma castanotus castanotus)

Cinclosoma castanotus is largely mallee-dependent Eucalyptus spp. and extends throughout the Great Victoria Desert (GVD) and into the central Australian ranges, chiefly on sandy substrates (Black and Walker 2006). It mainly occurs in low shrubs and undergrowth of mallee scrub, but also in Acacia shrubs, dry sclerophyll woodland, heath and native pine. This species is generally considered as patchy, sedentary and locally nomadic. It forages on the ground, often among spinifex clumps, on a wide range of invertebrates (including grasshoppers, bugs, caterpillars and ants), seeds of both native and introduced species and more rarely, fruits. This species was observed within mallee woodland in the project area (Figure 13). All efforts to microsite infrastructure including tracks outside of mallee woodland, should be considered in the first instance, which will assist with limiting the unlikely potential impact on this species. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

Little Egret (Egretta garzetta)

The Little Egret frequents tidal mudflats, mangroves, salt works and shallow margins of tidal estuaries and inland rivers and lakes (Emison et. al. 1987). They are found mainly in coastal and inland areas of northern, eastern and south-eastern Australia. It is common on the north, uncommon in the south, and only a winter visitor to Tasmania. The Little Egret is nomadic, depending on water levels in wetlands. They hunt in shallow water by shuffling a foot to stir up aquatic prey, and also chases small fish with its wings raised. Reclamation of tidal land may affect local breeding populations in mangroves. The Little Egrets long-term capacity to find suitable nest sites in Australia and their declining status have been highlighted as a concern (Baxter and Fairweather 1994). This species was observed within cropping land, most likely occurring as a fly over species from the River Murray situated south of the project area (Figure 13). It is considered unlikely that the proposed development will have an impact on this species due to existing infrastructure being similar to that proposed. A risk assessment of potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.

Striped Honeyeater (Plectorhyncha lanceolata)

The Striped Honeyeater is found in eastern Australia, mainly inland, from the Yorke Peninsula, South Australia to the coast of New South Wales, around Toukley, and north to Charters Towers, Queensland. It is listed as Rare under the NPW Act in South Australia, mainly because the western extreme of its range extends into eastern South Australia. The Striped Honeyeater inhabits a wide range of habitats including drier open forests, woodlands, mallee, mulga, heathlands along rivers, and mangroves. It is mainly arboreal, feeding in pairs or small flocks in dense foliage, at the lower levels of the canopy. As well as feeding on nectar, this species also uses many other food sources including insects, seeds and fruit. This species was observed near the river's edge, near the existing pumping station. It is considered unlikely that the proposed development will have an impact on this species due to the project infrastructure in this area being located in place of existing pumping infrastructure. It is unlikely therefore that any additional disturbance to this species will occur above that existing at the time of the survey. A risk assessment of



potential impacts within and adjacent to the project area and mitigation measures for construction and operation is provided in Section 6.



6 RISK ASSESSMENT

Specific management measures may be required during the construction and post construction phase and routine management required into the future to ensure the condition of the reserve areas adjoining the concept plan are not compromised.

Potential impacts assessed in relation to vegetation and fauna within and adjacent to the project area and considered through elements of the project from pre-construction through to establishment of the agribusiness. Based on existing knowledge of potential receptors, the preliminary risks are summarised below;

- Unlawful activities and legal non-compliance (spoil, spills, contamination)
- Invasion and spread of weeds and pest fauna species / pets
- Loss of habitat and feeding opportunities for common fauna species
- Loss of feeding and roosting habitat for nationally listed fauna species
- Loss of feeding opportunities for threatened fauna that may visit the site on an irregular basis
- Reduction in terrestrial fauna movement along existing corridors

Once all risks are identified, the consequence and likelihood of each individual risk was analysed using the risk assessment matrix. Table 14 and Table 15 present the ratings for consequence and likelihood respectively. These tables are guided by AS/NZS ISO 31000:2009.

Consequence level	Environment	Community
1	Low level impacts to ecological systems	Low level impacts to indigenous species within the site and no impact to surrounding areas of ecological significance
2	Minor impacts to ecological systems	Low to medium impacts on local indigenous flora and fauna species and no impact to surrounding environments of ecological significance
3	Moderate impacts to ecological systems	High impact to localised flora and fauna and knock on effects to surrounding environments of ecological significance
4	Significant (>20 years) impacts to ecological systems	Loss of all existing localised biodiversity and significant impacts to surrounding areas of ecological significance
5	Permanent impacts to ecological systems	Loss of all surrounding ecological functional attributes and permanent loss of regional biodiversity

Table 14. Ratings for the assessment of consequence levels.

Table 15. Ratings for the assessment of likelihood.

Likelihood	Environment
Almost certain	Is expected to occur
Likely	Occurs frequently in similar projects
Possible	Could occur under unusual circumstances.
Unlikely	Unlikely to occur within the next 20 years
Rare	Unlikely to occur ever



The overall risk category was determined by the risk matrix provided below in Table 16 which considers both the consequence and probability.

	CONSEQUENCE							
LIKELIHOOD	1	2	3	4	5			
Almost certain	High	High	Extreme	Extreme	Extreme			
Likely	Moderate	High	High	Extreme	Extreme			
Possible	Low	Moderate	High	Extreme	Extreme			
Unlikely	Low	Low	Moderate	High	Extreme			
Rare	Low	Low	Moderate	High	High			

Table 16. Risk assessment matrix.

Risk	Description	Potential effect on ecological system	Risk	Justification / Recommendation	Residual risk
Construction					
Disturbance to threatened migratory, marine and threatened fauna associated with River corridor	Construction of the pump station and associated infrastructure causes loss of nesting foraging or roosting habitat	EPBC listed species such as Australasian Bittern, Regent Parrot, Curlew Sandpiper, are displaced or lose habitat extent due to construction of pumping infrastructure	Low	The extent of the construction footprint and time to implement would appear to be very low impact event under any circumstance. Avoid construction during peak nesting periods. The area under consideration should be checked prior to construction to ensure no nests or specific habitat are disturbed with a particular emphasis on checks in the period from September to December however nesting for some species may occur outside these times.	Low
Entrapment of small mammals and reptiles	Open trenches during pipeline construction causes entrapment of small mammals and reptiles leading to death or predation from other species.	Reduction in indigenous species richness and abundance due to construction activities.	High	Provide exit ramps at intervals of not less than 250m, pre check prior to backfilling open trenches and removal of any species if required.	Low
Disturbance to nesting sites of Mallee Fowl	Works and construction of the pipeline along the Cooltong CP boundary reduce the potential for Mallee Fowls establishing nests on existing mounds near boundary	Reduction of nest success and movement of Mallee Fowl through remnant patches	Moderate	Given the low establishment of nests in the vicinity of the project area and the pipeline being buried, it is unlikely to cause any disturbance once construction is complete. No Mallee Fowl nests are known within a 40m buffer each side of proposed pipeline easement. Employ management strategies during construction to avoid peak nesting periods, primarily around spring from September to December.	Low
Disturbance to nationally listed threatened fauna species associated with construction of project	Primarily associated with areas adjacent to the Cooltong CP during construction for species such as Red-lored Whistler	Reduction of available feeding habitat and reduced corridor movement.	Low	Due to the extensive adjacent intact vegetation the level of displacement is expected to be extremely low and for a short time period. Avoid construction during peak nesting periods for species, primarily between September to December however if suitable conditions occur, nesting can happen throughout the year for some species. Avoid removal of trees prior to construction which have nests present.	Low

Table 17. Risk assessment summary.



Risk	Description	Potential effect on ecological system	Risk	Justification / Recommendation	Residual risk
Loss of nesting hollows	Trees with range of hollow entrance sizes lost from community due to clearance	Reduction of suitable nesting habitat	High	Keep any hollow bearing logs and replace into area post construction either within trees or as ground habitat.	Low
Weed invasion	Machinery and associated equipment brings weed seeds into new areas in soil attached to underbody, wheels etc.	Loss of biodiversity and displacement of indigenous species	Moderate	Follow weed hygiene strategies and implement Weed Management Plan as part of Construction environmental management plan (CEMP).	Low
Damage to intact vegetation communities	Off-site damage to intact vegetation outside of the clearance footprint due to vehicles turning etc.	Unnecessary loss of vegetation which is not off- set or approved under legislation	Low	Ensure implementation of project buffer zones and temporary fencing / bunting if required to ensure no unauthorised clearance/disturbance.	Low
Operation	·	·		·	
Reduction of Mallee Fowl Habitat as part of project	Decrease in patches due to low level clearance within project area	Reduced dispersal of Males and suitable nesting sites	Low	The likelihood of Mallee Fowl utilising existing patches within the project area is exceptionally low due to poor condition and grazing within project site vegetation communities. They are unlikely to disperse across the open cropping fields which surround patches. The level of clearance is minor considering the level of remnancy in the local area. There is some potential that increased fire security vigilance in the surrounding area will increase the quality or remnant vegetation within and surrounding the project area.	Low
Pest fauna species	Feral species such as Rats, Feral Cats and Foxes potentially increase due to additional food resources such as unharvested or fallen nuts and fruits providing increased pressure on indigenous fauna.	Loss of threatened species nesting success (Mallee Fowl) and reduction in number of individuals.	Moderate	Ensure appropriate rubbish management to deter feral animal species. Feral animals trapped/destroyed as an ongoing pest management strategy in association with the local NRM board authorised officer. Contribute and participate in region wide programs such as baiting.	Low
Vegetation fragmentation	Employing new pipeline easements increases edge effects and loss of biodiversity through weed invasion and	Loss of diversity due to soil disturbance and displacement by exotic species. Lower dispersal and	Moderate	Almost all pipeline easements are associated with existing fire breaks and previous pipeline locations. Fence pipeline easements where appropriate to reduce ongoing disturbance. Minimise access to	Low
Risk	Description	Potential effect on ecological system	Risk	Justification / Recommendation	Residual risk
--	---	--	----------	--	---------------
	increased disturbance from vehicle traffic and unauthorised off track disturbance	habitat utilisation for threatened species		pipeline easement. Ensure post construction remediation of the pipeline trench is returned to pre- existing soil grade and level to ensure no changes to hydrology. Existing fire breaks and fire protection vigilance has potential to increase habitat quality for fire susceptible species such as Red-lored Whistler.	
Pest control methods and crop protection	Routine pest control and crop protection impacts on species such as Regent Parrot	Increased loss of breeding pairs	Moderate	Ensure crop protection does not include specific indigenous species as targets or control methods do not provided risks to off-target species. Methods such as shooting are not acceptable measures due to inability to determine species in brief sighting periods. Implement management strategies as well as awareness and education to ensure protection of threatened species.	Low
Operation of pumping infrastructure	Noise and water movement caused by pumping infrastructure impacts on EPBC listed species. Pumping infrastructure would be set up under best practice methods including exclusion screens on water inlets and flow rates to ensure no entrapment	Reduction in species abundance and richness	Low	Species which will be impacted as part of this risk do not have key threats associated with this risk.	Low

7 MANAGEMENT STRATEGIES

The primary risk highlighted by the assessment is during construction of the project. To ensure the best outcomes in ensuring no impact to surrounding environments is through avoidance of impacts, either through elimination or substitution. This could be enacted in the following ways:

- Plans showing the location of the adjacent reserves should be highlighted and controls implemented to ensure no impact outside of the construction site. To be provided to site supervisors as well as displayed in areas such as lunch rooms and other high traffic areas.
- Protective fencing and environmental signage adjacent to the wetland and CP could be provided with a twenty-metre buffer from the canopy area of any remaining trees.
- An environmental induction for all persons involved in construction activities (including any subcontractors) before they commence work on site to enable acknowledgement of flora (inclusive of weeds, amenity and indigenous) and fauna on site should be conducted.
- Toolbox meetings attended by the Environmental Management Representative or similar role should occur at least once a fortnight to raise awareness of any on-site flora or fauna management issues.

7.1 Flora management

All vegetation adjacent to, or within construction sites that is to be retained, should be protected via the following:

- No stockpile material to be placed against trees, under the drip line of trees, or on native grasses, shrubs and groundcover plants. All stockpiled material to be placed on previously disturbed areas or set stockpiling sites highlighted prior to construction works.
- Where vegetation is to be retained adjacent to or within construction sites the following restrictions should apply:
 - No parking of vehicles to occur under the drip lines of trees;
 - No storage of equipment or material against trees, under the drip line of trees, or on native grasses, shrubs and groundcover plants should occur;
 - Movement of vehicles, machinery and construction equipment should be restricted to the existing road network or previously disturbed soil profiles only.

7.2 Fauna management

Any trees containing hollows, any which are resultant from felled logs or tree trunks should be retained as fauna habitat. These should be stored in an approved secure storage area until required and replaced into reserve areas. Removal of this habitat does not however mean that the area is free from fauna.

For general fauna management, the following principles should apply:



- Vegetation should be cleared as a staged approach to allow movement of animals to other areas;
- Nests with eggs should not be relocated. A new exclusion zone should be created and reported on, particularly nests with young chicks. These may not be disturbed until the chicks are able to fly.
- Open trenching has exit ramps or climbing aids when unattended.

Should any fauna be found injured on the site during the works, Fauna Rescue SA, the RSPCA or a veterinarian should be contacted to provide advice and treatment.

7.3 Weed management

Weed management should be completed prior to vegetation removal where practicable.

Weeds can invade any area on which the soil or natural vegetation is disturbed. Disturbance will often facilitate invasion by reducing competition from other vegetation, increasing availability of light resources and concentrating moisture and nutrients. To prevent establishment or spread of weeds:

- Weed propagules or weed infested topsoil material should not be imported into the site through use of quarried and composted materials;
- Clean all earth moving machinery of soil and vegetation prior to entering and prior to leaving the site; and
- All declared pest plant and environmental weed species must be disposed of at a licensed waste depot or a suitable recycling facility in accordance with the AMLR NRM Board requirements.

The management would be undertaken dependent on the following factors:

- Species invasiveness (Legislative and compliance listings);
- Size of infestation; and
- Ease of control.

Options to control weeds within the project area are realistically restricted to involve the following:

- Physical removal: For small outbreaks, woody weeds, hard to control species and;
- Chemical application: Large outbreaks, too small in size to manually remove, requires systemic action (e.g. bulbous plants).

Any use of herbicides should be strictly in accordance with the product label. Where approved herbicides are required to be used to control weed species near water i.e. creeks, drainage depressions and



stormwater drains, specific riparian safe herbicides will be used only. All herbicides will only be used during suitable weather conditions.

7.4 Inspection and auditing

Inspection and auditing of flora and fauna management and mitigation measures should be included in regular inspections and compliance records retained.

Weekly inspections of the project area and project boundary fencing should be undertaken with typical records generated being:

- Environmental Inspection Forms;
- Results and outcomes of inspections, monitoring and auditing to be reported internally on a weekly basis.

Specific inspections of relevant elements of the construction phases to be undertaken where necessary in the event of potential harm to fauna and flora that is not part of regular inspections.



8 SIGNIFICANT ENVIRONMENTAL BENEFIT

8.1 Overview

In South Australia, native vegetation is protected by the Native Vegetation Act 1991 and (to June 30, 2017) the associated Native Vegetation Regulations 2003.

The Act establishes the Native Vegetation Council (NVC) – an independent body appointed by the Governor of South Australia. The NVC is responsible for making decisions about a wide range of matters concerning native vegetation in South Australia, including whether to approve native vegetation clearance via some of the Regulations.

Under the Native Vegetation Act 1991, approval to clear native vegetation is normally conditional upon the proponent providing a suitable Significant Environmental Benefit (SEB) to offset the clearance. The primary aim of the SEB is to achieve a net environmental gain, which contributes to improving the biodiversity values of the region, rather than simply off-setting the vegetation clearance. There is also a requirement for a Management Plan describing how the clearance will be conducted to minimise impacts and how the SEB offset will be managed into the future. The Management Plan must be endorsed by the NVC.

The landowner may achieve the SEB offset by works on the property (or such other property as approved by the NVC), such as managing existing remnant native vegetation, restoring degraded native vegetation or revegetating cleared areas. Alternatively, the proponent may make a payment to the NVC through the Native Vegetation Fund, with the funds enabling similar works elsewhere within the same region of the State.

8.2 Clearance requirements

8.2.1 Clearance of patches

A number of areas (patches) containing vegetation communities are proposed for clearance to facilitate the Monash REWARD project. Based on the area of the patch and the assigned SEB condition ratios, the offset requirements are displayed. The primary clearance is required for the project infrastructure that extracts water resources from the River Murray for use in irrigation and water storage system.

All areas of clearance are based on a 22m clearance buffer width along the pipeline easement and pump station area. The actual clearance may be smaller than this measure.

It is understood that an agreement may be reached in regards to exemptions along the southern boundary of the Cooltong CP in regards to a firebreak easement that would result in no SEB payable for that section however SEB offset requirements have been calculated for this area in the interim. The pipeline easement from the western boundary of the CP north to the south eastern boundary of the project site property has been deemed not requiring clearance based on existing fire breaks on both sides of the property boundaries.

A summary of each impact patch is provided in Table 18 to Table 24. Representative photos of each impact patch are provided in Appendix 3.





Figure 14. Impact area 1.





Figure 15. Impact area 2.





Figure 16. Impact area 3.





Figure 17. Impact area 4





Figure 18. Impact area 5.



Figure 19. Impact area 6





Figure 20. Impact area 7

Table 18. Impact area 1 clearance summary.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
1	Eucalyptus camaldulensis (River Red Gum) Woodland	6:1	0.01	0.04	Berri Barmera Council
2	Dodonaea viscosa ssp. angustissimus (Sticky Hop Bush) Senna artemisioides ssp. (Senna) Shrubland	4:1	0.18	0.71	Berri Barmera Council
3	Eucalyptus camaldulensis (River Red Gum) Woodland	6:1	0.06	0.39	Berri Barmera Council
4	Maireana pyramidata (Black Bluebush) Shrubland	6:1	0.04	0.23	Berri Barmera Council
5	Eucalyptus camaldulensis (River Red Gum) Woodland	6:1	0.18	1.10	Berri Barmera Council
6	Maireana pyramidata (Black Bluebush) Shrubland	2:1	0.05	0.09	Berri Barmera Council
7	Dodonaea viscosa ssp. angustissimus (Sticky Hop Bush) Senna artemisioides ssp. (Senna) Shrubland	3:1	0.15	0.45	Berri Barmera Council
8	Eucalyptus socialis (Red Mallee) Mixed Mallee	6:1	0.56	3.33	Berri Barmera Council

Table 19. Impact area 2 clearance summary including provisional exemption for implementation of 18m firebreak on southern boundary of Cooltong CP.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
9	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.080	0.643	Berri Barmera Council
10	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.197	1.576	Berri Barmera Council
11	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.186	1.486	Berri Barmera Council
12	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.094	0.748	Berri Barmera Council
13	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.095	0.756	Berri Barmera Council
14	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.131	1.045	Berri Barmera Council
15	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.084	0.675	Berri Barmera Council
16	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.007	0.060	Berri Barmera Council

Table 20. Impact area 3 clearance summary.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
17	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	2.65	21.26	Berri Barmera Council
18	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.72	5.76	Berri Barmera Council
19	Dodonaea viscosa ssp. angustissimus (Sticky Hop Bush) Senna artemisioides ssp. (Senna) Shrubland	2:1	24.75	49.51	Pastoral Unincorporated Area

Table 21. Impact area 4 clearance summary.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
20	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.080	0.643	Berri Barmera Council
21	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.197	1.576	Berri Barmera Council
22	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.186	1.486	Berri Barmera Council
23	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	8:1	0.094	0.748	Berri Barmera Council
24	Eucalyptus socialis (Red Mallee) Mixed Mallee	8:1	0.095	0.756	Berri Barmera Council



Table 22. Impact area 5 clearance summary.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
25	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	5:1	0.77	3.85	Pastoral Unincorporated Area
26	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	3:1	0.67	2.01	Pastoral Unincorporated Area
27	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	3:1	0.98	2.93	Pastoral Unincorporated Area
28	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	4:1	0.55	2.21	Pastoral Unincorporated Area

Table 23. Impact area 6 clearance summary.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
29	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	4:1	0.16	0.65	Pastoral Unincorporated Area
30	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	4:1	0.99	3.96	Pastoral Unincorporated Area
31	Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)	1:1	5.19	5.19	Pastoral Unincorporated Area
32	Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)	1:1	3.11	3.11	Pastoral Unincorporated Area
33	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	4:1	3.61	14.45	Pastoral Unincorporated Area
34	Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)	1:1	3.42	3.42	Pastoral Unincorporated Area
35	Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)	1:1	0.43	0.43	Pastoral Unincorporated Area
36	Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)	1:1	0.63	0.63	Pastoral Unincorporated Area
37	Myoporum platycarpum (False Sandalwood) Low Open Woodland over Aristida holathera (Wire Grass)	1:1	12.73	12.73	Pastoral Unincorporated Area

Table 24. Impact area 7 clearance summary.

Patch ID	Vegetation description	SEB	Area ha	Offset Ha	LGA
38	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	4:1	0.29	1.16	Berri Barmera Council
39	Eucalyptus cyanophylla (Blue-leaved Mallee) / Eucalyptus socialis (Red Mallee) / Senna artemisioides ssp. (Senna) / Dodonaea viscosa (Sticky Hop Bush) Mixed Mallee	3:1	1.72	5.15	Berri Barmera Council



Impact patch	Council valuation (\$)	Area ha	Offset Ha	Sum of SEB offset \$
1	10,095	1.30	6.99	70,538.95
2	10,095	0.87	6.99	70,558.80
2	20	24.76	49.52	990.33
3	10,095	3.38	27.03	272,896.12
4	10,095	1.48	4.43	44,733.28
5	20	2.97	10.99	219.82
6	20	30.30	44.59	891.84
7	10,095	2	6	63,615.24
	Total	67.06	156.54	524,444.38

Table 25. Areas cost summary.

Table 26. Overall clearance summary

Formula (Land Valu Area	(Land Value per ha x Required SEB in ha) + (Management Fee x Area cleared) = Payment into Native Vegetation Fund									
Where:										
Land value (Local Government Area values updated annually by Valuation SA)	Berri Barmera Council (\$10,095) and Pastoral unincorpora	ted area (\$20)								
Required SEB	156.54 Ha	524,444.38								
Management Fee	\$800 per ha (flat rate calculated by the NVC) x area cleared (67.06ha cleared area)	53,648.00								
	Total	578,092.38								



9 DISCUSSION

The level of remnancy of native vegetation in the project area and the broader region is high due to the adjacent Cooltong Conservation Park and reserves to the north of the project site. This lessens the impact of any clearance to a degree however the level of clearance that has occurred in the immediate area over the previous 30 years is high. The primary impact associated with the project from an ecological perspective is the fragmentation of the area south of the Cooltong Conservation Park. The level of fragmentation however is minimal due to the clearance having minimal impact in substantially modifying, destroying or isolating any areas of important habitat. Based on database searches and field survey undertaken onsite, the species utilising this habitat are likely to be largely unaffected with the extent of the project. All areas set aside for agri-development, solar and pumped hydro are at the current point already very highly degraded and very marginal given the current land use for cropping which poses risks associated with erosion due to the sandy nature of the soil profile.

Of the vegetation that remains within the project site boundary, the majority is considered to be in poor to moderate condition so opportunities exist for on ground offsets in the form of restoring areas, largely through the removal of grazing stock and goat control. Condition was based on the vegetation structure, quality of the understorey and level of weed invasion. They do not necessarily represent the value of the area as fauna habitat.

Most vegetation patches within the project area earmarked for clearance were small (< 5 ha) and isolated, i.e. lacking a physical connection with other vegetation patches. Small and isolated patches of remnant vegetation are very vulnerable to disturbance and degradation and many were already highly degraded due to the shelter provided by these patches for stock.

All remaining native vegetation within the project area, regardless of condition or patch size, is considered important to conserve. Given that the large part of the project site is already cleared, retention of any significant portions should be retained where possible and preferably, enhanced.

All areas of remnant mallee native vegetation and woodland vegetation were considered to be of high habitat value for native fauna species. Mixed Mallee is considered of very high value for many fauna groups, providing a range of roosting and nesting resources, protective shelter and food resources. Areas of native vegetation also provide resources for a wide variety of insects which in turn are significant food resources for vertebrate fauna species. Numerous small hollows were present in the mallee trees which are vital for bat roosting, bird shelter and nesting. The trees also provide shelter for mammals (e.g. kangaroos, echidna). The proposed limited site clearance requirements are not considered likely to substantially modify, destroy or isolate any areas of important habitat due to the significant connectivity and intactness of surrounding vegetation communities.

The nationally vulnerable Malleefowl (*Leipoa ocellata*) is identified as possibly occurring within the project area. This is based on BDBSA records 2 km east of the project area, less than 10 years ago. If the species was present, it would be limited to the larger, intact patches of vegetation. A survey specifically targeted at identification of Mallee Fowl mounds within the intact areas surrounding the pipeline easement were



undertaken on foot with a 20 metre buffer applied to each side of the easement. No mounds were observed as part of this survey.



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11 APPENDICES

11.1.1 Scattered trees

Eighteen individual trees were identified despite not requiring clearance. These were provisionally assessed to satisfy the requirements under the *Native Vegetation Act 1991* should they be required. Each tree was photographed (Appendix 2) and the location was recorded using a hand-held GPS unit. The following key attribute data were collected:

- Species;
- height (metres);
- canopy health (also known as percentage dieback);
- canopy spread (metres);
- proximity to other areas of intact native vegetation (>1 hectare);
- number and size of hollows (small = <5cm, medium = 5 -15cms, large = >15cms);
- density; and
- habitat potential for threatened fauna species.

The current NVC endorsed scoring system for scattered trees was utilised to determine the wildlife habitat value of individual trees to meet the requirements of Principles of Clearance 1(b) Wildlife Habitat. The data is then entered into the NVC's Point Scoring System (PSS) to calculate a wildlife habitat value for each tree and determine the Significant Environmental Benefit (SEB) contribution.



Tree	Species	Height (m)	Diameter (cm)	Radius (m)	Canopy area (m2)	Dieback (%)	Hollows (No)	Hollow points	Threatene d species points	Density	Proximity	Score	Area offset (ha)
1	Eucalyptus socialis	7	33	5	78.54	30	0	1	1	1	1	22.70	0.15
2	Eucalyptus socialis	7	25	5	78.54	15	0	1	1	1	1	26.69	0.18
3	Eucalyptus socialis	8	30	4	50.27	15	0	1	1	1	2	29.23	0.19
4	Eucalyptus oleosa	8	21	4	50.27	40	0	1	1	2	2	24.98	0.17
5	Eucalyptus socialis	7	18	4	50.27	40	0	1	1	2	2	24.98	0.17
6	Eucalyptus oleosa	7	20	3.5	38.48	90	0	1	1	1	2	12.07	0.08
7	Eucalyptus phenax	5	67	2.5	19.63	40	0	1	1	1	1	20.27	0.14
8	Eucalyptus gracilis	7	83	3.5	38.48	40	3 <50mm	2	1	1	1	29.98	0.20
9	Eucalyptus socialis	5	45	2.5	19.63	65	2 50- 150mm	3	1	1	1	25.65	0.17
10	Eucalyptus socialis	3.5	20	1.5	7.07	50	0	1	1	2	1	14.73	0.10
11	Eucalyptus socialis	4	19	2	12.57	65	0	1	1	2	1	12.07	0.08
12	Eucalyptus socialis	3	21	1.25	4.91	40	0	1	1	1	1	14.73	0.10
13	Eucalyptus socialis	3	33	2.5	19.63	40	0	1	1	1	1	14.73	0.10
14	Eucalyptus socialis	7	24	5	78.54	10	0	1	1	2	2	33.94	FALSE
15	Eucalyptus socialis	8	21	7	153.94	15	0	1	1	2	2	32.32	FALSE
16	Eucalyptus socialis	5	18	4	50.27	10	0	1	1	1	1	21.16	0.14
17	Eucalyptus socialis (Clump x 6)	5	19	10	314.16	10	0	1	1	3	3	31.53	FALSE

Appendix 1. Scattered tree scores recorded during project site assessment.





Appendix 2. Scattered tree representative photos











Tree 4 (Left) and tree 5 (Right)









































Appendix 3. Clearance representative photos

Southern boundary of Cooltong CP.



Degraded vegetation at location of proposed retention dam.





Looking north into degraded area.



Patch 27.




Narrow remnant strip patch 26.



Patch 40.





Patch 34.



Patch 21.





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