DEVELOPMENT APPLICATION FORM

APP 1580

PLEASE USE BLOCK LETTERS

FOR OFFICE USE

Development No:

Previous Development No:

Assessment No:

RECEIVED
21 OCT 2016
DAC

COUNCIL: REGIONAL COUNCIL OF GOYDER

APPLICANT: ILIRA PTY LTD & SIHERO PTY LTD

Postal Address: PO BOX 160, BURRA, SOUTH AUSTRALIA, 5417

Owner: ILIRA PTY LTD & SIHERO PTY LTD

Postal Address: PO BOX 160, BURRA, SOUTH AUSTRALIA, 5417

BUILDER:

Postal Address:

Licence No:

CONTACT PERSON FOR FURTHER INFORMATION

Name: MR. SIMON ROWE

Telephone: (08) 88922421 [work] 0428822232 [Ah]

Fax: (08) 88923066 [work] [Ah]

EXISTING USE: BEEF CATTLE FEEDLOT/ BROADACRE CROPPING

☐ Complying	Application forwarded to DA
☐ Non Complying	Commission/Council on
☐ Notification Cat 2	/ /
☐ Notification Cat 3	Decision:
☐ Referrals/Concurrences	Type:
☐ DA Commission	Date: / /

	Decision required	Fees	Receipt No	Date
Planning:				
Building:				
Land Division:				
Additional:				
Development Approval				

DESCRIPTION OF PROPOSED DEVELOPMENT: AN EXPANSION OF THE EXISTING BEEF CATTLE FEEDLOT

LOCATION OF PROPOSED DEVELOPMENT:

House No: Lot No: B27 Street: HILLS ROAD Town/Suburb: BOOBOROWIE

Section No [full/part] D2033 Hundred: AYRES Volume: CT5475 Folio: 736

Section No [full/part] Hundred: Volume: Folio:

LAND DIVISION:

Site Area [m²] 24.8 Reserve Area [m²] No of existing allotments

Number of additional allotments [excluding road and reserve]: Lease: **YES** ☐ **NO** ☑

BUILDING RULES CLASSIFICATION SOUGHT: Present classification:

If Class 5,6,78 or 9 classification is sought, state the proposed number of employees: Male: Female:

If Class 9a classification is sought, state the number o persons for whom accommodation is provided:

If Class 9b classification is sought, state the proposed number of occupants of the various spaces at the premises:

DOES EITHER SCHEDULE 21 OR 22 OF THE DEVELOPMENT REGULATIONS 2008 APPLY? **YES** ☐ **NO** ☐

HAS THE CONSTRUCTION INDUSTRY TRAINING FUND ACT 2008 LEVY BEEN PAID? **YES** ☑ **NO** ☐

DEVELOPMENT COST [do not include any fit-out costs]: $ 6,146,000.00

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the Development Regulations 2008.

SIGNATURE: S.Rowe Dated: 18 / 10 / 16

Simon Rowe

DEVELOPMENT REGULATIONS 2008
Form of Declaration
(Schedule 5 clause 2A)

To:

From:

Date of Application: 10 / 11 / 16

Location of Proposed Development: ....MACKEROME – 1578 HECTARDS

House No: ..... Lot No: .... Street: ....Hills Road..Town/Suburb..Boobaroowie

Section No (full/part) D4033..Hundred: ..AYERS

Volume: CT..5475 Folio: .....236.....

Nature of Proposed Development:

I .....Simon.....Rowe.....being the applicant/ **a person acting on behalf of the applicant (delete the inapplicable statement) for the development described above declare that the proposed development will involve the construction of a building which would, if constructed in accordance with the plans submitted, not be contrary to the regulations prescribed for the purposes of section 86 of the *Electricity Act 1996*. I make this declaration under clause 2A(1) of Schedule 5 of the *Development Regulations 2008*.**

Date: 10 / 11 / 16

Signed: .....SRowe.....

Note 1
This declaration is only relevant to those development applications seeking authorisation for a form of development that involves the construction of a building (there is a definition of 'building' contained in section 4(1) of the *Development Act 1993*), other than where the development is limited to –

a) an internal alteration of a building; or
b) an alteration to the walls of a building but not so as to alter the shape of the building.

Note 2
The requirements of section 86 of the *Electricity Act 1996* do not apply in relation to:

a) a fence that is less than 2.0 m in height; or
b) a service line installed specifically to supply electricity to the building or structure by the operator of the transmission or distribution network from which the electricity is being supplied.

Note 3
Section 86 of the *Electricity Act 1996* refers to the erection of buildings in proximity to powerlines. The regulations under this Act prescribe minimum safe clearance distances that must be complied with.

Note 4
The majority of applications will not have any powerline issues, as normal residential setbacks often cause the building to comply with the prescribed powerline clearance distances. Buildings/renovations located far away from powerlines, for example towards the back of properties, will usually also comply.

Particular care needs to be taken where high voltage powerlines exist; where the development:

- is on a major road;
- commercial/industrial in nature; or
- built to the property boundary.

Note 5
Information brochures 'Powerline Clearance Declaration Guide' and 'Building Safely Near Powerlines' have been prepared by the Technical Regulator to assist applicants and other interested persons. Copies of these brochures are available from council and the Office of the Technical Regulator. The brochures and other relevant information can also be found at www.technicalregulator.sa.gov.au

Note 6
In cases where applicants have obtained a written approval from the Technical Regulator to build the development specified above in its current form within the prescribed clearance distances, the applicant is able to sign the form.

Government of South Australia
Department of Planning, Transport and Infrastructure

Product	Register Search
Date/Time	16/08/2016 12:08PM
Customer Reference	
Order ID	20160816005935
Cost	$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 5475 Folio 736

REAL PROPERTY ACT, 1886
South Australia

Parent Title(s)	CT 4218/641
Dealing(s) Creating Title	CONVERTED TITLE
Title Issued	26/11/1997
Edition	3
Edition Issued	17/09/2014

Estate Type

FEE SIMPLE

Registered Proprietor

ILIRA PTY. LTD. (ACN: 008 202 864)
OF PO BOX 160 BURRA SA 5417
1 / 2 SHARE

SIHERO PTY. LTD. (ACN: 060 572 269)
OF PO BOX 160 BURRA SA 5417
1 / 2 SHARE

Description of Land

BLOCKS 27 AND 28 DEPOSITED PLAN 2033
IN THE AREA NAMED BOOBOROWIE
HUNDRED OF AYERS

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO THE ETSA CORPORATION (T 5133868)

Schedule of Dealings

Dealing Number	Description
10958857	CAVEAT BY AGL POWER GENERATION (HALLETT HILL) PTY. LTD.
12190028	MORTGAGE TO NATIONAL AUSTRALIA BANK LTD.

Notations

Dealings Affecting Title

NIL

Priority Notices

NIL

Notations on Plan

NIL

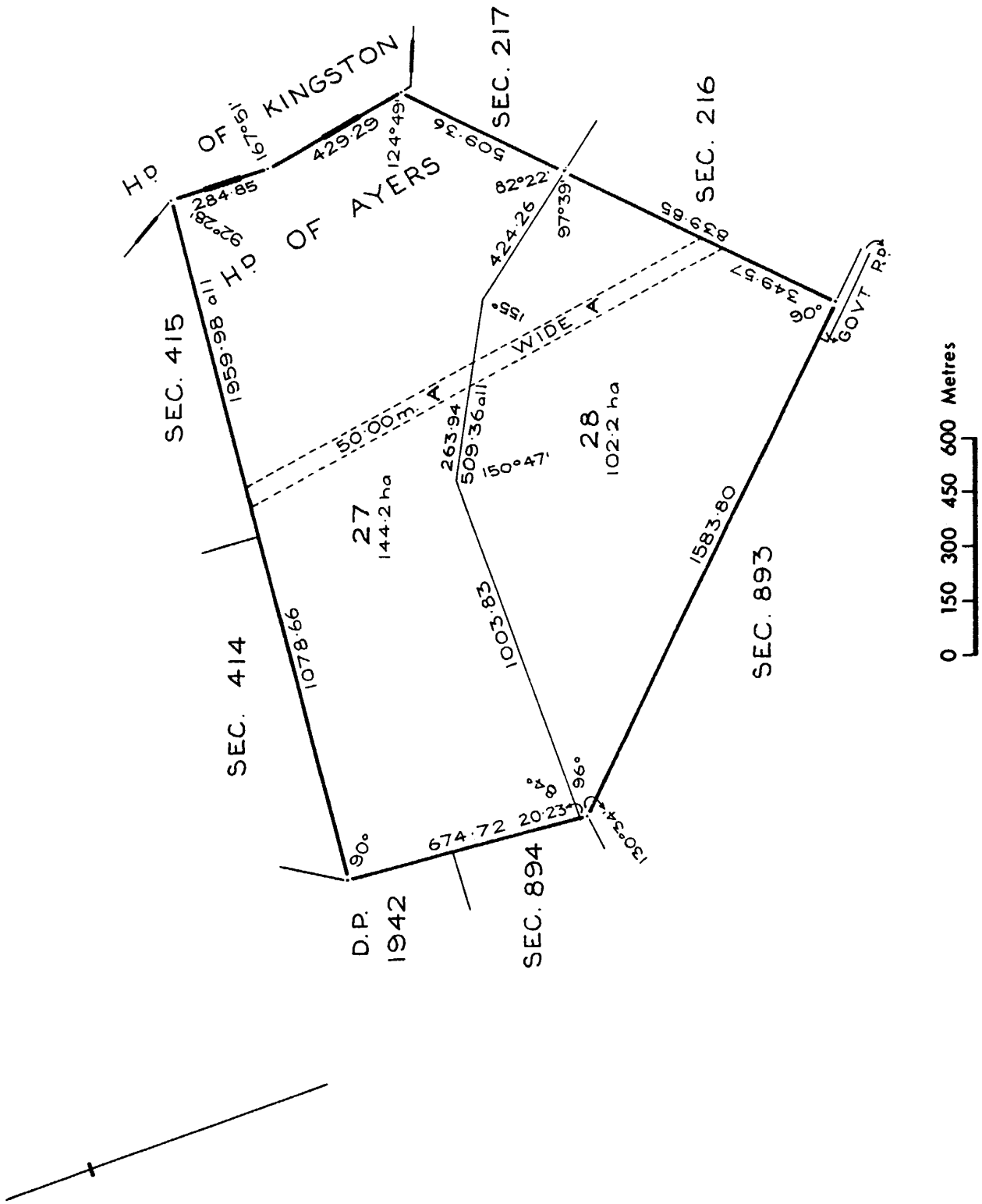
Registrar-General's Notes

APPROVED FILED PLAN FOR LEASE PURPOSES FX57631

Administrative Interests

NIL

* Denotes the dealing has been re-lodged.



REAL PROPERTY ACT, 1886
South Australia

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.

Certificate of Title - Volume 5469 Folio 103

Parent Title(s) CT 4211/291

Creating Dealing(s) CONVERTED TITLE

Title Issued 10/11/1997 **Edition** 3 **Edition Issued** 17/09/2014

Estate Type

FEE SIMPLE

Registered Proprietor

ILIRA PTY. LTD. (ACN: 008 202 864)
OF PO BOX 160 BURRA SA 5417
1 / 2 SHARE

SIHERO PTY. LTD. (ACN: 060 572 269)
OF PO BOX 160 BURRA SA 5417
1 / 2 SHARE

Description of Land

SECTION 894
HUNDRED OF AYERS
IN THE AREA NAMED BOOBOROWIE

Easements

NIL

Schedule of Dealings

Dealing Number	Description
10958857	CAVEAT BY AGL POWER GENERATION (HALLETT HILL) PTY. LTD.
12190028	MORTGAGE TO NATIONAL AUSTRALIA BANK LTD.

Notations

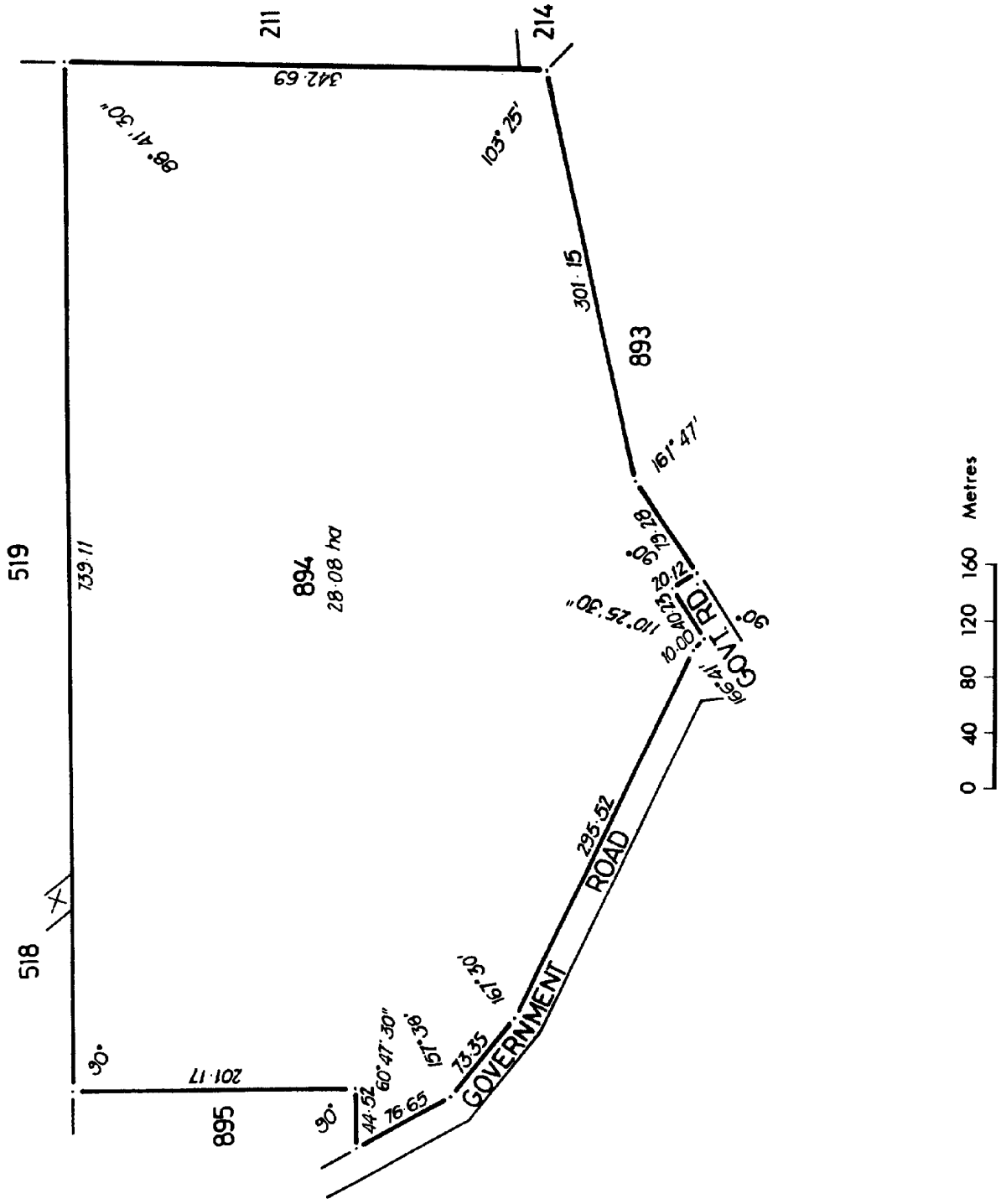
Dealings Affecting Title NIL

Priority Notices NIL

Notations on Plan NIL

Registrar-General's Notes NIL

Administrative Interests NIL



ostwald BROS

powerful partnerships

Development Application
Beef Cattle Feedlot Expansion
Princess Royal Station
Hills Road, Burra, SA

DOCUMENT STATUS RECORD

Prepared for:	Ilira Pty Ltd ATF Bob Rowe Class Trust and Sihero Pty Ltd ATF Simon Rowe Class Trust - trading as Princess Royal Station (ABN - 65 050 531 556).
Document Title:	Development Application – Proposed Beef Cattle Feedlot Expansion, Princess Royal Station, Hills Road, Burra, SA
Project No:	RU050500
Document File Name:	RU050500 Feedlot Planning Application V01R02

Version No	Date	Description	Prepared	Signature	Approved	Signature
V01R01	23/06/2016	Draft for client review	Rod Davis		Brendan Ostwald	
V01R02	29/07/2016	Submission to Council	Rod Davis		Brendan Ostwald	

Notes	Recipient	Copies
	Regional Council of Goyder	4

Citation:

Ostwald Bros Pty Ltd, 2016, Development Application – Proposed Beef Cattle Feedlot Expansion, Princess Royal Station, Hills Road, Burra, SA, Project No: RU050500 V01R02, Dalby, QLD.

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1. List of Abbreviations

AHD	Australian Height Datum
ARI	Average Recurrence Interval
AS	Australian Standard
AUSVETPLAN	Australian Veterinary Emergency Plan
BoM	Bureau of Meteorology
DA	Development Application
DEWNR	Department of Environment, Water and Natural Resources
EC	Electrical Conductivity
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA Act	Environmental Protection Act 1993
EPA	SA Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPL	Environment Protection Licence
GHG	Greenhouse Gases
H:V	Horizontal Units in proportion to Vertical Units
INP	Industrial Noise Policy
IPM	Integrated Pest Management
RCG	Regional Council of Goyder
LGA	Local Government Area
Ltd	Limited
MLA	Meat and Livestock Australia
NES	National Environmental Significance
NFAS	National Feedlot Accreditation Scheme
NVC Act	Native Vegetation Conservation Act 1997
OH&S	Occupational Health and Safety
Pty	Proprietary
QDPI	Queensland Department of Primary Industries
SA	South Australia
SCU	Standard Cattle Unit

2. Glossary of Terms

Aerobic	Associated with the presence of free oxygen.
Ambient	Surrounding environment.
Anaerobic	A condition in which no free oxygen nitrates are present.
Aquifer	Geological formation, group of formations, or part of a formulation capable of transmitting and yielding significant quantities of water.
AHD	The standard reference level used to express the relative elevation of various features. A height given in metres AHD is essentially the height above sea level.
Biodiversity	First coined in 1988 as a contraction of biological diversity; traditionally referring to species richness and species abundance. Biodiversity has been defined subsequently as encompassing biological variety at genetic, species and ecosystem scales (DASETT 1992). The maintenance of biodiversity, at all levels, is acknowledged internationally as a high conservation priority, and is protected by the International Convention on Biological Diversity 1992.
Bunds	An earthwork or wall to contain and control spillages, normally associated with tank farms, fuelling and chemical storage facilities.
Catchment	The area in which water collects to form the supply of a river stream or drainage area.
Contaminants	Polluting substances.
Contaminated Runoff	Any stormwater runoff that is generated from within the controlled drainage area of the complex.
Controlled Drainage Area	A dedicated catchment surrounding those parts of the feedlot complex from which stormwater runoff would constitute an environmental hazard if allowed to flow uncontrolled into the surrounding environment.
dB(A)	The most common measurement of environmental noise – measured using a simple sound level meter having an Aweighting filter to simulate the subjective response of the human ear.
Diversity	The abundance in numbers of species in a given location.
Ecosystem	An interdependent system of interacting plants, animals and other organisms together with the non-living (physical and chemical) components of their surroundings.
Effluent	Effluent means: wastewater from collection or treatment systems involving intensive livestock, being wastewater that is conveyed from the place of generation by means of a pipe, canal or other conventional method used in irrigation;
Electrical Conductivity	A measure of the conduction of electricity through water or a water extract (1 part soil to 5 parts water) of soil. Used to determine the soluble salts content.
Emission	The release of constituents into the atmosphere (e.g. gas, steam or noise).
Endangered species	Those plants and animal species likely to become extinct unless action is taken to remove or control the factors that threaten their survival.
Environment	The physical, biological, cultural, economic and social characteristics of an area, region or site.
Environmental management	That part of the overall management system which includes organisational structure, planning activities, responsibilities, procedures, processes and resources for developing, implementing, achieving,

	reviewing and maintaining environmental policy.
Environment Protection Licence	A licence to undertake a prescribed activity listed under the Environmental Protection Act 1993. In the case of a beef cattle feedlot, the licence would be issued by EPA.
Feed Bunk	An open-trough in which the feed ration is placed and cattle eat from.
Feed Road	Road used to access feed bunk.
Feedlot Class	There are four feedlot classes defined within the EPA Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (DPIR 2006): Class One: This represents the highest standard of design, operation, maintenance, pad management and cleaning frequency. All year round operation. Class Two: This is the generally accepted standard for a well-designed, constructed and maintained feedlot, which has a high standard of operation. Removed from impact locations. This is the reference standard for all classes. Class Three: Well-designed, well-constructed and operated with higher standards than Class Four for pad preparation and maintenance and pen cleaning. Well removed from impact locations. Class Four: Generally a small feedlot in an isolated situation with basic management and development standards, well separated from any residential situations and having fewer than 1000 head of cattle.
Geotechnical	Relating to the form, arrangement and structure of the geology.
Greenhouse Gas	Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs).
Groundwater	Subsurface water contained within the saturated zone.
Habitat	The particular local environment occupied by an organism.
Hydrogeology	The study of subsurface water in its geological context.
Hydrology	Surface water and groundwater and their interaction with earth materials.
Impervious	A material that does not allow another substance to pass through or penetrate it.
Infiltration	The process of surface water soaking into the soil.
Integrated Pest Management	An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of chemical control agents.
Liquid Waste	Stormwater run-off from the controlled drainage area. Also referred to as effluent. Liquid waste is high in nutrients because it has been in contact with manure, and has the potential to pollute surface water and groundwater. Liquid waste is valued as a source of nutrients for fertilising crops.
Manure	Manure is the solid waste produced by cattle. Manure is the faeces and urine excreted by the cattle.
Mitigation	Reduce the severity of impact.
National Feedlot Accreditation Scheme	An independently audited quality assurance scheme to develop a Quality System for beef feedlots that impacts positively on product quality and acceptability and for which the lot feeders maintain responsibility.
Native vegetation	Species of vegetation being either trees (including any sapling, shrub or

	scrub), understorey plants, groundcover (being any herbaceous vegetation) that existed before European settlement.
Ostwald Bros	A Resources and Infrastructure Services Group incorporating Contracting, Mining Services, Construction Materials, Facilities and Accommodation, Transport and Bulk Haulage, and Rural Enterprise (Ostwald Rural Operations).
Particulates	These include any solid material suspended in the atmosphere.
Pathogen	An organism capable of eliciting disease symptoms in another organism.
Permeability	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid.
PM_{10}	Particulate matter less than 10µm in size, the respirable fraction.
Proponent	The entity making a formal application for consent of the proposed development. In the case of this DA, Ilira Pty Ltd ATF Bob Rowe Class Trust and Sihero Pty Ltd ATF Simon Rowe Class Trust - trading as Princess Royal Station (ABN - 65 050 531 556).
Rating Background Level (RBL)	The RBL (L90) is defined as the overall single figure background level representing each assessment period (i.e. day/evening/night).
Recycling	The return of waste materials to the production system so that the need for raw materials is reduced.
Rehabilitation	The process of restoring the land in a given area to some degree of its natural state, after some process (industry, natural disasters, etc.) has resulted in its damage.
Revegetation	The process of re-establishing a vegetative cover.
Salinity	The concentration of water soluble salts, mainly sodium, calcium and magnesium, which may be chlorides, sulphates or carbonates. Measured as conductivity in dS/m, or as dissolved solids in mg/L.
Sorption	General term for the interaction (binding or association) of a solute ion or molecule with a solid.
Sound Power Level	The amount of acoustic energy (per second) emitted by a noise source. Sound Power Level is expressed in decibels (dB) and cannot be directly measured.
Sound Pressure Level (SPL)	The “Noise Level”, in decibels (dB), heard by our ears and/or measured with a sound level meter. The sound pressure level generally decreases with increasing distance from a source. Noise levels are often written as dB(A) rather than dB. The “A-weighting” is a correction applied to the measured noise signal to account for the ear’s ability to hear sound differently at different frequencies.
Solid Waste	Organic wastes produced within the feedlot including solids excreted by the cattle, solids that have settled from the stormwater runoff in the sedimentation basin, spilt feed and mortalities. Manure is the predominant solid waste generated. Solid waste is valued as a source of nutrients for fertilising crops.
SCU	A Standard Cattle Unit is equivalent to an animal with a liveweight of 600kg.
Statutory authority	An authority set up as a requirement of legislation.
Sustainable use	Use of an organism, ecosystem or their renewable resource at a rate within its capacity for renewal.
Terrestrial	Of or pertaining to the land as distinct from the water.
Threatened species	Animals and plants that are in danger of extinction or may now be

	considered extinct, but have been seen in the wild in the last 50 years.
Visibility	Measure of extent to which particular components of a project may be visible from surrounding areas.
Visual absorption capacity	An estimation of the capacity of the landscape to visually absorb a project without creating a significant change in visual character or producing a reduction in scenic quality.
Vulnerable species	A species which population is decreasing because of threatening processes, or its population has been seriously depleted and its protection is not secured, or its population, while abundant, is at risk because of threatening processes, or its population is low or localised or depends on limited habitat that is at risk because of threatening processes.
Wastewater	Water which is collected and transported to a treatment area. Wastewater normally includes water from both domestic and industrial use.

3. Executive Summary

Background

Princess Royal Station (PRS) is a regional, diversified and integrated family business, based in the mid-north district of South Australia near Burra.

The business has and continues to grow and now has a wide geographical reach with activities based in the mid-north and Flinders Ranges regions. The business continues to strengthen the economic and social base of these regions and is now one of the largest employers in the mid-north district.

Central to the business' operations is the intensive finishing of beef cattle. High-performance Angus cattle are fed scientifically formulated rations in a SA EPA licensed 4,409 SCU (6,090 head) feedlot on 'Mackerode' Station, near Burra. The feedlot is known as Princess Royal.

The existing feedlot was constructed and is operated at a Class One (1) standard, which is the highest level of construction and operation for beef cattle feedlots in South Australia.

The proprietors of PRS, wish to expand their existing Princess Royal feedlot on 'Mackerode' Station from 4,409 SCU (6,090 head) to 13,492 SCU (16,642 head) of cattle-on-feed, thereby increasing annual throughput from 22,000 head to some 58,400 head per annum.

The primary objective of the proposed development is to consistently supply market or customer requirements with grain-fed beef in terms of quality and quantity to compete with the US product on a global market, with a particular focus on the EU market.

The proposed development site is approximately 150 km north of Adelaide, some 15 km north-west of the township of Burra, some 7.5 km east of the township of Booborowie and approximately 5 km south-west of Mount Bryan in South Australia.

Road access to the proposed development is from Hills Road, a council controlled road. Hills Road intersects with the Goyder Highway about 1 km south-west of the proposed development. The principal traffic travel route shall be Hills Road onto the Goyder Highway.

Proposed Development Description

The proposed development is an expansion of the existing beef cattle feedlot located on the subject property. The proposed development shall be operated as a Class 1 beef cattle feedlot only with no sheep being fed. The stocking density of beef cattle is 12.9 m^2 per animal or 15 m^2/SCU based on average weight of cattle at turnoff.

The proposed development would occupy a footprint of approximately 24.8 ha and includes the following components in a functional configuration in two separate controlled drainage areas:

- Water Supply/ Storage and Reticulation – A reliable and uninterrupted supply of clean water of the required volume to sustain feedlot operations is required.
- Pens - Fenced areas are required for housing production cattle (production pens). Cattle arriving to or being dispatched from the proposed development (induction/dispatch pens),

and sick cattle (hospital pens) shall be accommodated in existing infrastructure within the existing feedlot.

- Access and Internal roads - Access to the site and the layout of internal road systems are critical to the efficient and safe functioning of the proposed development.
- Controlled drainage area - Stormwater runoff from areas such as production pens has a high organic matter and therefore a high pollution potential. This runoff is controlled within a system that collects and conveys this runoff to a sedimentation basin and storage lagoon prior to environmentally sustainable utilisation.
- Drainage system - The controlled drainage area contains a system including catch drains, sedimentation system and storage lagoon for conveying stormwater, allow entrained sediment to 'settle out' and capture and storage of the stormwater from the controlled drainage area until it can be sustainably utilised.
- Solid and liquid waste management areas – Solids wastes such as manure and mortalities shall be temporarily stockpiled and processed within the existing solid waste storage area prior to utilisation on the subject property or on other properties in the region owned by the proponent. Liquid wastes shall be stored in storage lagoon(s) pending application to the liquid waste utilisation area or until evaporated.
- Solid and liquid waste utilisation areas – Solid wastes generated are applied to an on-site utilisation area. Any solid wastes not utilised on the subject property are removed off-site. When available, liquid wastes are applied to land via irrigation within the waste utilisation area.

Other required components such as livestock handling, feed processing, administrative/maintenance and solid waste utilisation areas shall be met by existing infrastructure and facilities within the existing feedlot.

Construction

The construction phase shall commence after development consent and any other relevant permits are obtained and detailed design and component specifications have been completed.

The construction of the proposed development would consist of the following activities:

- Area setout
- Implementation of erosion and sediment control measures
- Construction of new site entrance and access road
- Clearance of vegetation in the development complex area
- Cut and fill bulk earthworks to design levels for pens, drainage system, sedimentation basin(s) and storage lagoon(s)
- Construction of pen infrastructure such as feed bunks, aprons, water troughs, fencing and shade structures
- Construction of roads

Operation

The proposed development has been designed to accommodate about 10,552 head (9,083 SCU) of beef cattle at a stocking density of 15 m^2/SCU.

The majority of cattle would be steers of *Bos taurus or Bos taurus cross* genotypes. Breed composition is expected to change with time as market signals develop.

The proximity of the proposed development to the premier beef cattle grazing districts of South Australia leaves it well positioned for livestock procurement. Most cattle shall be bred on properties owned and operated by the proponent. It is also expected that cattle would be sourced locally as far as possible from areas within close proximity to the proposed development.

Cattle would be transported to the proposed development at about the entry weight of the target market. The cattle would be fed a ration specific to that market type until they reach the exit weight of the respective market when they would be transported from the site to an abattoir for processing.

Typically, cattle would enter the feedlot at around 9 to 12 months of age and an average of some 300-340 kg liveweight. The cattle would be fed for approximately 80 to 115 days to achieve an average exit liveweight of about 420 to 512 kg.

Rations are prepared on-site in a dedicated facility, with associated commodity storage, handling and ration delivery infrastructure.

The ration contains grain, roughage (fibre), and minerals. Roughage is essential in the diet to enable normal rumen activity, and shall be provided by silage, hay or straw commodities. Commercial mineral/vitamin premixes may be added to the ration to achieve satisfactory growth rates.

The majority of grain and hay/straw for the proposed development would be transported from the northern cereal growing areas within close proximity to the proposed development. About 6% of the annual grain requirement (~2,000t) is produced on the property 'Mackerode' within the liquid and/or solid waste utilisation areas depending on seasonal conditions.

About 45% of the annual silage requirements (3,000t) would be produced on the property 'Mackerode' Station within the liquid and solid waste utilisation areas. The remaining silage requirements shall be produced on other cropping properties owned by the proponent or related entities within close proximity to the proposed development.

The proposed development would be designed, constructed and maintained as a Class One standard, the highest standards of design, construction and management.

Environmental Issues and assessment of Impacts

Air Quality

Odour

Odour emissions generated from the proposed development are expected to be the primary impact to air quality as a result of the proposed development. The highest potential for odour generation is in winter.

The nearest township is Mount Bryan to the north-east with a population of about 138 and the nearest rural residence is located some 2,715 m to the south-east. Analysis of available wind indicated that over the peak odour production period, the wind direction will be from the west meaning that potential odour impacts on Mount Bryan will be minimal.

The proposed development has been sited to provide adequate separation distances between the odour and dust generating sources and sensitive receivers.

It is concluded that sufficient separation exists between the proposed development and sensitive receptors to limit any adverse impacts and unreasonable interference with the amenity of neighbours as a result of odour.

Dust

The proposed development site is located in a rural area. Air quality in the local area would be considered to be of good quality and is unlikely to be influenced by dust emissions from current agricultural activities such as dryland cropping and beef cattle grazing.

The introduction of a development such as a beef cattle feedlot in areas previously bereft of intensive livestock facilities would have the potential to reduce local air quality from dust emissions.

Dust emissions from the proposed development are unlikely to cause impacts unless receptors are located nearby. The distance emissions generally disperse from the source depend on topographic and climatic factors.

Subsequently, as the separation distance is suitable to mitigate against odour impacts, dust impacts are also not expected by default.

Soils

An assessment of the soils within the vicinity of the proposed development site was undertaken. Soils can be described as hard setting sandy loam to clay loam overlaying red clay. These soils have low plasticity and low shrinkage potential.

Based on recommended suitability criteria from National and SA feedlot guidelines, these soils have engineering properties that are well suited to the construction and operation of a beef cattle feedlot.

It is concluded that provided appropriate design and construction measures are implemented, the in-situ soils within the proposed development complex area are suitable for the design and construction of the relevant infrastructure, such as roads, pen foundations, water retaining structures (drains, sedimentation basin(s), storage lagoon(s)).

Water

Groundwater

Activities associated with the construction and operation of the proposed development has the potential to generate impacts to groundwater.

Various mitigation measures have been adopted in the design and siting of the proposed development to prevent or minimise adverse impacts to groundwater. Various mitigation measures shall be implemented to prevent or minimise adverse impacts to groundwater during construction and operation of the proposed development such as:

- Areas within the controlled drainage area where the permeability of underlying soil/rock strata exceeds the design permeability, a clay lining to prevent soil leachate movement shall be engineered to the design permeability by mixing and compacting on-site material.

- Solid waste stockpiles established within controlled drainage area to prevent contaminated leachate into groundwater resources.

- Clean water runoff external to the controlled drainage area shall be diverted away from the controlled drainage area.

- Waste utilisation areas are sited and designed to enable the sustainable use of liquid waste and any solid waste that is utilised on-site.

- Development and implementation of emergency and contingency plans to manage spills or other emergencies on site, such as pipe breakages, effluent storage overflows, pump failures etc.

- An impermeable barrier will be constructed between the contaminant (i.e. drains, sedimentation basin(s) and lagoon(s) areas) and underlying strata using a liner made of compacted clay or other suitable compactable soil materials. The clay liner shall have a maximum permeability of 1×10^{-9} m/s (0.1mm/day) for distilled water with 1 m of pressure head

Due to the design, siting and mitigation measures proposed and depth and strata characteristics to groundwater (clay/siltstones), no adverse impacts to groundwater quality are predicted as a result of the proposed development.

Surface water

Activities associated with the construction and operation of the proposed development has the potential to generate impacts to surface waters.

Various mitigation measures have been adopted in the design and siting of the proposed development to prevent or minimise adverse impacts to surface waters. Various mitigation measures shall be implemented to prevent or minimise adverse impacts to surface waters during construction and operation of the proposed development such as:

- The proposed development is sited above the height of a 100 year average recurrence interval (Q_{100}) flood level.
- Site selection considered the natural attributes and general suitability of the site for draining and capturing runoff from the proposed development.
- A controlled drainage area designed to an acceptable hydrological standard that prevents unauthorised discharges of runoff from areas such as pens, which have high organic matter and therefore a high pollution potential.
- Waste utilisation areas are designed to enable the sustainable use of liquid waste and any solid waste that is utilised on-site.
- Any facilities to store hazardous materials (e.g. fuel) are designed to meet relevant guidelines and Australian Standards for the storage of hazardous and dangerous goods and spill management.
- A storage lagoon is designed to store runoff from the controlled drainage area without spilling or overtopping at an unacceptable frequency.

Due to the design, siting and mitigation measures proposed, no adverse impacts to surface water quantity or quality are predicted as a result of the proposed development.

Biodiversity

The proposed development shall have no direct impacts on native vegetation and habitat as the proposed development site is currently cultivated cropping land and devoid of vegetation. No clearing of this vegetation is required and buffers from liquid and solid waste utilisation have been allowed to property boundaries and any existing native vegetation.

Land Capability for Waste Utilisation

The proposed development would produce solid and liquid waste during its operation.

The characteristics of the soils in the proposed waste utilisation areas are well suited for waste application as they are suitable for cropping, have moderate to high water holding capacity, not prone to waterlogging within the root zone and can withstand cultivation without incurring significant erosion

The proposed development and associated waste utilisation areas have been sited and designed to minimise any adverse impacts to groundwater and surface waters. Various mitigation measures include riparian buffers and sustainable utilisation of applied nutrients.

The characteristics of the soils in the proposed waste utilisation areas are well suited for waste application as they are suitable for cropping, have moderate to high water holding capacity, not prone to waterlogging within the root zone and can withstand cultivation without incurring significant erosion. Further, the subject property has been a cropping property for some time. This suggests that the soils are suitable for application of liquid and solid waste.

The proposed development has some 885 ha of land available for the utilisation of liquid and solid waste. Based on the estimated solid waste generation, some 50%-75% is able to be utilised on-site. The remaining solid waste shall be transported off-site for utilisation on adjoining properties owned by the proponent.

The proposed development incorporates on-site utilisation of liquid waste from the storage lagoon(s) to land via irrigation.

A sustainable liquid waste irrigation management system will achieve a balance between the use of liquid waste for irrigation with the nutrient requirements of the crop while protecting the environment from potential pollution. Additionally, the amenity of the surrounding environment and meeting the needs on a social and ecological level are important considerations in sustainability.

The assessment investigated the soil characteristics and concluded that the soil is capable of absorbing the level of nutrients contained within the liquid waste. The assessment also confirmed the area available for waste utilisation (885 ha) is adequate to sustainably irrigate the liquid waste.

Overall, the assessment concluded that there is sufficient land available with characteristics suitable for the sustainable application of all the liquid and a proportion of solid waste.

Noise and Vibration

Activities associated with the construction and operation of the proposed development has the potential to generate noise impacts. Traffic noise on the Goyder Highway would also be generated from the traffic movements associated with the operational phase.

However, there are very few residential (sensitive) receptors in close vicinity of the noise sources of the proposed development. The closest residential receptor is located approximately 2,715 m away from the proposed development.

Subsequently, due to the large separation distances, the topography and landform between the proposed development and sensitive receptors and lack of certain vibration generating activities (blasting, jack-hammering, piling), it is predicted that no sensitive receptor shall be potentially impacted by vibration as a result of the construction and/or operation of the proposed development.

No adverse noise impacts are expected at sensitive receptors during the noisiest construction activities, which are bulk earthworks. Further, the activities generating these noise impacts would be temporary in nature and predicted noise levels from these activities meet the EPA construction noise criteria.

Operational activities involve noise generating equipment such as feed storage and processing equipment (electric motors, conveyors, roller mills) and mobile plant (feed trucks, tractors, front-end loaders etc.) on-site. Due to the significant distance to the nearest sensitive receptor and as the operational activities of the proposed development are consistent with the activities of the existing agricultural activities of the surrounding area, the noise generated from the proposed development is not expected to create a significant impact on the surrounding environment.

Visual Amenity

The landscape surrounding the subject property on which the development is proposed is characterised by undulating, low, moderate and high areas of relief, with moderate to high ranges.

There are few receivers surrounding the proposed development, with the closest residential receivers located some 2,715 m from the proposed development. Further, the site where the development is proposed is some 1,000 m from the property boundary adjoining the local access road – Hills Road. This setback area contains stands of vegetation and screens the proposed development from road users.

The views of the proposed development from these viewpoints were assessed by taking into account the visual absorption capacity of the proposed development and the types of views experienced from these viewpoints. The type of view took into account the type of viewer, the nature of the view and also the distance to the proposed development.

As a result, the viewpoint assessment indicated that there was expected to be no visual impact from the proposed development.

The assessment deemed that the nature of the proposed development would be consistent with the existing agricultural activities in the surrounding area although on a larger scale. It is considered that the proposed development would assimilate into the local landscape due to the nature of the development and the high visual absorption capacity of the surrounding landscape.

Overall, it is expected that the proposed development would not create any visual impacts to receivers in the surrounding area.

Pest Animal and Weeds

Pest animals and weeds are a constant risk for the primary producers, as they can have a serious impact on agricultural production and market access.

Pest animals can be defined as native or introduced, wild or feral, non-human species of animal that is currently troublesome locally, or over a wide area, to one or more persons, either by being a health hazard, a general nuisance, or by destroying food, fibre, or natural resources.

An integrated approach to weed and pest animal management shall be implemented based around the important elements of weed hygiene, operational hygiene, prevention of infestations, arresting weed outbreaks using effective reporting and physical or chemical control procedures, documenting weed and pest animal infestations and auditing management programs.

In summary, the proposed development is not expected to impact the surrounding environment in particular the soils, waterways and loss of biodiversity from the introduction and/or spread of pest animals and/or weeds provided the proposed mitigation measures are implemented.

Hazards and Risk

There are potential risks to human health and safety, potential risks to animal health and potential risks to the biophysical environment associated with the construction and operation of the proposed development.

The main human risk is the potential for contracting a zoonootic disease (such as Q-fever and Leptospirosis) which may be acquired by workers coming into contact with airborne particles created from tissue, waste and dust from infected animals.

The existing feedlots safe work management system (SWMS) manages the risks for employees such as general safety for working with machinery and cattle, including methods of managing the potential to acquire a zoonootic disease at the proposed development.

The proposed development also has the potential to impact upon the health of the animals through injury, infections and/or heat stress created from the climatic conditions. Mismanagement of the proposed development would also adversely impact upon the welfare of the animals and thus their productivity.

The existing feedlot is accredited by AUS-MEAT through the National Feedlot Accreditation Scheme (NFAS) (Princess Royal Station – SA556025). The proposed development shall become NFAS accredited once operational.

The biophysical environment would also be potentially impacted by the proposed development, in particular odour, liquid and solid wastes. However, various management and mitigation measures have been proposed to minimise adverse impacts to these biophysical elements.

In summary, the proposed development is not expected to create significant hazards or risks to humans, animals or the biophysical environment provided the management and mitigation measures proposed are implemented.

4. Introduction

Princess Royal Station (PRS) is a regional, diversified and integrated family business, based in the mid-north district of South Australia near the township of Burra.

The business was established in 2000 by the Rowe family, the late Robert, an original co-founder of T&R Pastoral Company (now Thomas Foods International) and son Simon, both pioneers in the South Australian beef industry.

The business has and continues to grow and now has a wide geographical reach with activities based in the mid-north and Flinders Ranges regions. The business continues to strengthen the economic and social base of these regions and is now one of the mid-norths largest employers.

The business has an agricultural focus centred around beef cattle breeding, backgrounding, intensive finishing (cattle and sheep), cereal cropping, and associated support services such as livestock and general freight, trading cattle and artificial insemination services. Tree crops (carob) and viticulture also form a small but important part of the business.

Central to the business' operations is the intensive finishing of beef cattle. High-performance Angus cattle are fed scientifically formulated rations in a SA EPA licensed 4,409 SCU (6,090 head) feedlot on "Mackerode" Station, near Burra in the mid-north district of South Australia. The feedlot is known as Princess Royal. The feedlot is located within the Regional Council of Goyder area on land formally described as Lot D2033 B28, Hundred of Ayers. The feedlot was constructed in 2007 and is used to finish up to 6,090 head of cattle in open pens, at any one time when fully stocked and is operated all year round.

The existing feedlot was constructed and is operated at a Class 1 standard, which is the highest level of construction and operation recognised in the Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006).

The proprietors of PRS, wish to expand their existing Princess Royal feedlot on "Mackerode" Station from 4,409 SCU (6,090 head) to 13,492 SCU (16,642 head) of cattle-on-feed, thereby increasing annual throughput from 22,000 head to some 58,400 head.

The site has a southerly aspect and is located within the Northern and Yorke Natural Resource Management region. The watercourses arising in the area adjacent to the proposed feedlot expansion site drain towards the Booborowie Valley.

The existing feedlot is accredited by AUS-MEAT through the National Feedlot Accreditation Scheme (NFAS) (Princess Royal Station – SA556025). The objectives of this quality assurance scheme are to meet modern environmental, animal welfare, veterinary, feed and chemical usage standards.

The existing feedlot is currently audited annually by NFAS auditors for compliance with NFAS standards, and for compliance with South Australian legislation, which includes planning and environmental legislation.

The proponents are members of the Australian Lot Feeders Association. The proponents bring considerable experience and skill to the proposed development, and are aware of industry standards, environmental management, and their environmental responsibilities.

The existing feedlot is licensed by the Environment Protection Authority in South Australia, and meets all conditions of approval and licensing. The Environment Authorisation Licence for the existing 4,409 SCU (6,090 head) feedlot is EPA33182. The existing Development Approval is Development Application 422/0068/07.

The main environmental issues associated with beef cattle feedlots are air quality, water quality, as well as lesser issues such as noise and traffic. To date Princess Royal Station has not had any formal complaints from neighbours regarding the operation and management of the existing feedlot.

The proposed development has been sited and designed to minimise the negative impacts on the natural values of the surrounding environment and minimise impacts to community amenity. The proposed development will be managed in accordance with the existing Operations and Governance manual which acts as the feedlot's National Feedlot Accreditation Scheme Quality Assurance Manual.

This report provides information on the proposed design and standards of construction and management of the proposed development to support an application for approval for the development. All aspects of this report have been prepared in accordance with the National Guidelines for Beef Cattle Feedlots in Australia (MLA 2012b) and the Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 20066).

4.1 Development Overview

The proposed development is an expansion of an existing beef cattle feedlot. A beef cattle feedlot is an intensive livestock production system in which beef cattle are finished on a grain-based ration in a confined land area with watering and feeding facilities. The proposed development shall include the following components:

- controlled drainage area incorporating
  - production pens including feed bunk, water trough and associated infrastructure (fences/aprons etc.)
  - cattle lanes and pen catch drains
  - sedimentation basin
  - liquid waste storage lagoon
  - feed roads

The existing development has developed infrastructure including:

- solid waste storage/processing area
- silage storage area
- vehicle washing facility
- induction and hospital pens and associated infrastructure (crush/veterinary facility)

- feed storage and feed preparation area (e.g. grain silos/liquid supplement tanks, hay pad)
- feed processing infrastructure
- maintenance workshop
- liquid and solid waste utilisation area

The proposed development shall utilise the aforementioned existing infrastructure.

It is expected that the construction of the feedlot expansion will require an average daily workforce of around 10-12 personnel (up to 25 full time equivalent (FTE) during peak construction) with an operational workforce of some 20 FTE staff.

4.2 Proponent Details

The proponent for the proposed development is outlined in Table 1.

Table 1 – Proponent details

Entity:	Ilira Pty Ltd ATF Bob Rowe Class Trust and Sihero Pty Ltd ATF Simon Rowe Class Trust - trading as Princess Royal Station (ABN - 65 050 531 556)
Physical Address:	Government Road, BOOBOWRIE, SA 5417
Postal Address:	PO Box 160, BURRA, SA 5417
Contact Person:	Mr Simon Rowe
Contact Details - Phone	08 8892 2421
- Facsimile	08 8892 3066
- Mobile	0428 822 232 (Simon Rowe)

4.3 Site Information

4.3.1 Location

The proposed development site is approximately 150 km north of Adelaide, some 15 km north-west of the township of Burra, some 7.5 km east of the township of Booborowie and approximately 5 km south-west of Mount Bryan in South Australia. Figure 1 is a locality plan highlighting the proposed development site in relation to the townships of Booborowie, Mount Bryan and Burra.

Road access to the proposed development is from Hills Road, a council controlled road. Hills Road intersects with the Goyder Highway about 1 km south-west of the proposed development. The principal traffic travel route shall be Hills Road onto the Goyder Highway.

4.3.2 Real Property Description

The proposed development shall be located on one parcel of land within an aggregation of land parcels collectively known as 'Mackerode' Station. The real property description of 'Mackerode' Station is provided in Table 2 and comprises a total of about 1578 ha. The proposed development infrastructure including production pens, controlled drainage areas, sedimentation basin(s), storage lagoon(s) and associated infrastructure shall be located on Parcel ID D2033 B 28 as shown in Table 2. Waste utilisation areas shall be on adjoining land parcels which comprise the property 'Mackerode' Station.

The proposed development is located in the Regional Council of Goyder. Figure 2 is a cadastral plan highlighting the parcels of land that comprise the subject property on which the development is proposed. The subject property is approximately 1578 ha in area and is currently used for cereal cropping, extensive beef and sheep grazing and intensive beef cattle feeding.

Table 2 – Real property description

Property Name	Plan Type and Number	Parcel Type and Number	Title Type and Volume	Folio	Area Ha	Hundred
'Mackerode'	D2033	B27	CT5475	736	144.2	Ayers
'Mackerode'	D2033	B28	CT5475	736	102.2	Ayers
'Mackerode'	D79570	QP2	CT6055	756	6.4	Ayers
'Mackerode'	D79570	QP3	CT6055	756	207.0	Ayers
'Mackerode'	D79570	QP4	CT6055	756	42.5	Ayers
'Mackerode'	H200700	SE61	CT5839	748	32.4	Kingston
'Mackerode'	H200700	SE62	CT5839	748	37.2	Kingston
'Mackerode'	H216521	AL308	CT5638	50	67.4	Kingston
'Mackerode'	H216521	AL309	CT5638	50	71.4	Kingston
'Mackerode'	H216521	AL310	CT5638	50	32.3	Kingston
'Mackerode'	H216521	AL311	CT5638	50	32.7	Kingston
'Mackerode'	H216521	AL312	CT5638	50	47.3	Kingston
'Mackerode'	H216787	AL119	CT5649	487	254.1	Kingston & Kooringa
'Mackerode'	H216787	AL120	CT5649	487	52.6	Kingston & Kooringa
'Mackerode'	H218385	AL102	CT5845	539	39.7	Kingston & Kooringa
'Mackerode'	H230100	SE216	CT5475	737	47.1	Ayers
'Mackerode'	H230100	SE217	CT6055	757	30.8	Ayers
'Mackerode'	H230100	SE218	CT5475	737	43.7	Ayers
'Mackerode'	H230100	SE894	CT5469	103	28.1	Ayers
'Mackerode'	H200700	SE151	CT5813	820	87.8	Kingston
'Mackerode'	H200700	SE283	CT5709	509	67.6	Kingston
'Mackerode'	H200700	SE284	CT5709	508	40.1	Kingston
'Mackerode'	H200700	SE285	CT5534	3	27.1	Kingston
'Mackerode'	F11137	AL8	CT5488	704	36.3	Kingston & Kooringa
Total Area					1,578	

4.3.3 Ownership

The details of the ownership of the subject land on which the development is proposed is provided in Table 3.

Table 3 – Subject land ownership

Entity	Ilira Pty Ltd ATF Bob Rowe Class Trust and Sihero Pty Ltd ATF Simon Rowe Class Trust - trading as Princess Royal Station (ABN - 65 050 531 556)
ACN:	060 572 269 (Sihero Pty Ltd) 008 202 864 (Ilira Pty Ltd)
Physical Address:	633 Koonoona Road, BURRA, SA 5417
Postal Address:	PO Box 160, BURRA, SA 5417
Contact:	Mr Simon Rowe
Contact Details - Phone	08 8892 2421
- Facsimile	08 8892 3066
- Mobile	0428 822 232 (Simon Rowe)

The existing feedlot development is managed by Chris Drew. Chris is responsible for the everyday activities of the feedlot and his contact details are provided in Table 4.

Table 4 – Feedlot manager details

Entity	Princes Royal Station Feedlot
Physical Address:	Hills Road, BURRA, SA 5417
Postal Address:	PO Box 160, BURRA, SA 5417
Contact:	Mr Chris Drew
Contact Details - Phone	08 8892 2421
- Facsimile	08 8892 3066
- Mobile	0427 797 927 (Chris Drew)
- Email	chris@princessroyal.com.au

NOTES:
1. IMAGE DOWNLOADED FROM GOVERNMENT OF SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (SA NatureMaps) May 2016 AND ACCURACY IS LIMITED.

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Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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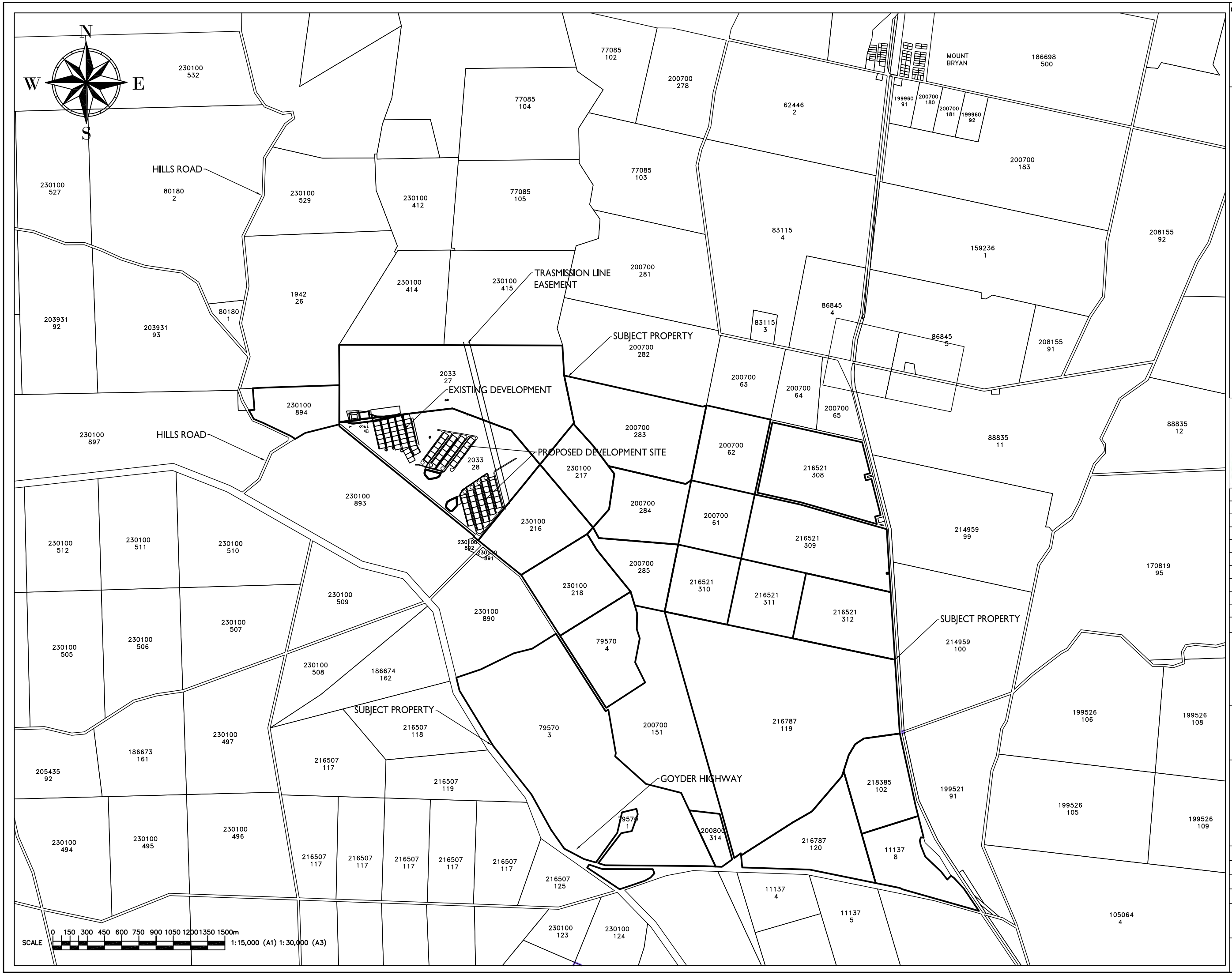
Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
LOCALITY PLAN

Scales	1= 40,000 (A1) 1= 80,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-LOC-01	A



NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
CADASTRAL PLAN

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	

Drawing No.	Issue
RU050500-PRS-CAD-02	A

4.3.4 History

The area has a long and rich agricultural history. Pastoralists and their shepherds settled around the Burra district as early as the 1840s. Burra is the earliest mining and industrial town to be established in Australia, copper having been discovered in 1845 and mined from that year. None of the farmers had large properties and all had to struggle to make a living from the red-brown earth just inside Goyder's Line. Much of their time was taken up with fencing, dam sinking and wood cutting to clear the land for farming and for firewood for the Burra mine, and water carting from the nearby springs.

'Mackerode' Station has always been associated with sheep grazing and wheat farming having been settled in the early 1880's and operated as a Lincoln and Merino stud.

The subject property has been exclusively used for beef cattle production, dryland cropping (wheat, canola, barley, oaten silage) since the 1990's. A carob orchard has also been established on a section of the property. Depending on seasonal conditions, sheep fattening is also undertaken.

4.3.5 Current Land Use

Current land use of the subject property incorporates a mixture of dryland cereal cropping (wheat, barley, oats), intensive beef production, extensive beef cattle and sheep grazing, grazing of modified pastures, irrigated cereals for silage, oil seeds (canola) and a small area of irrigated carobs.

The subject property on which the development is proposed currently supports infrastructure for intensive beef production in the form of an existing feedlot development and other infrastructure such as cattle handling yards, property residences, machinery/storage sheds and grain silos. The existing feedlot development is illustrated in Photograph 1.

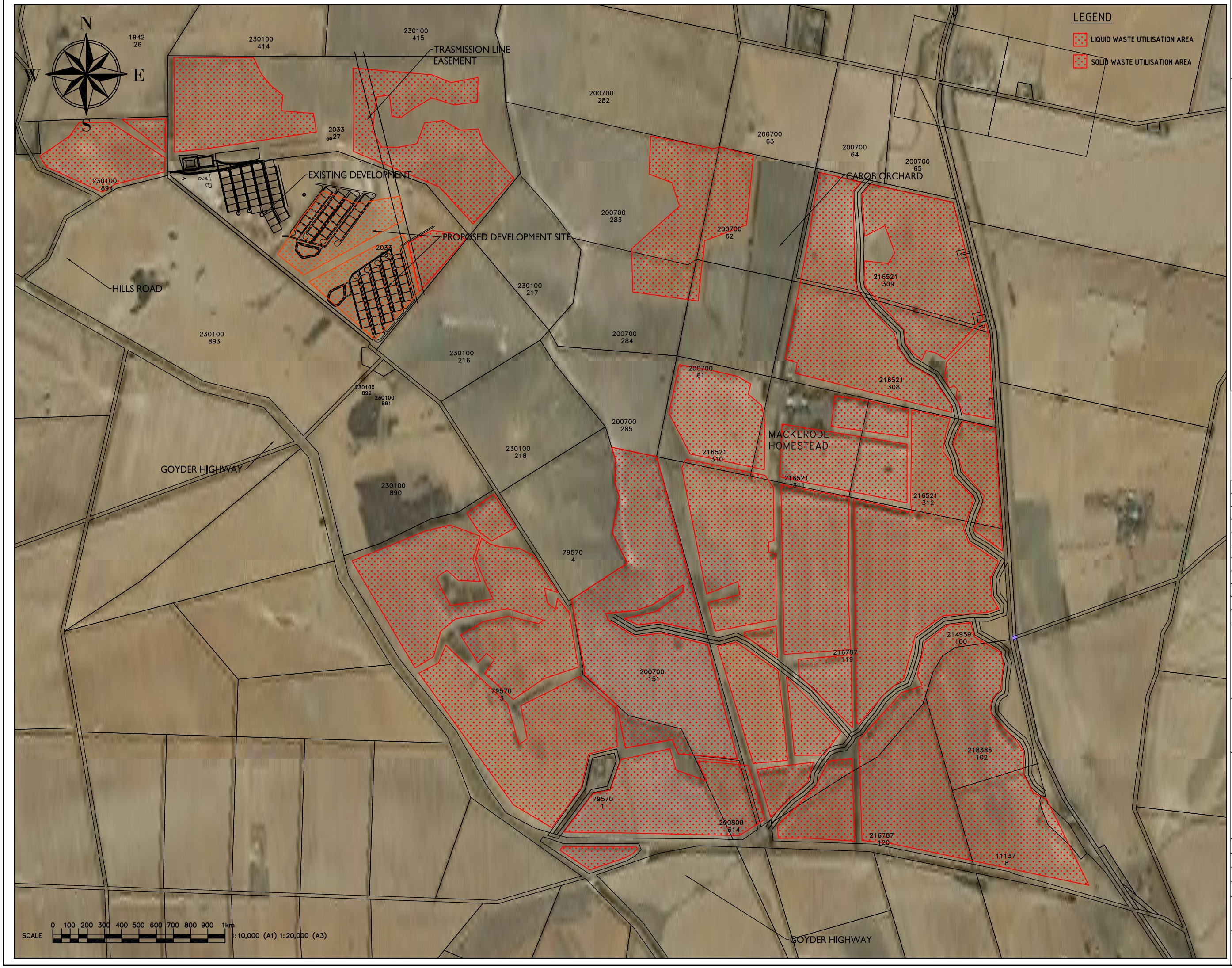
The site on which the development infrastructure is proposed is cleared of all native vegetation and comprises open grazing land on improved pasture as shown in Photograph 2.

Photograph 4 illustrates a typical dryland cropping area on the subject property. Figure 3 outlines the existing cropping area on the subject property.

Photograph 1 – Existing feedlot development

Photograph 2 – Proposed development site

Photograph 3 – Existing dryland cropping area



NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. AERIAL IMAGE GOOGLE™ EARTH ON THE 10TH APRIL 2016
3. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
EXISTING CROPPING AREA

Scales	1= 10,000 (A1) 1= 20,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	

Drawing No.	Issue
RU050500-PRS-ECA-03	A

4.3.6 Existing Services and Infrastructure

The subject property on which the development is proposed currently has existing service infrastructure in the form of electricity (generated on-site by diesel powered generators) and communications. Existing water supply is from groundwater sources.

The proposed development would not require connection to overhead electricity supply as the electricity demand of facilities such as the office, weighbridge, feed storage and processing, water pumping, lighting and ancillary services etc. shall be met by existing diesel powered generators.

Extensions to existing communications services to the office and ancillary buildings would not be required. Potable water supply would be from rainwater and supplemented from bore water supply as required.

Photograph 4 – Subject property existing infrastructure

5. Description of Existing Environment

5.1 Climate

5.1.1 Rainfall, Temperature and Evaporation

The climate of the area is typically Mediterranean (warm and temperate), characterised by higher winter rainfall than in summer and hot summers and cool winters.

Climatic data were obtained using the Bureau of Meteorology (BoM) climate data from the closest meteorological record stations to the proposed development for the relevant parameters. Table 5 shows the weather data obtained from the various sources.

Rainfall was obtained from Mount Bryan Post Office (Station number 021034) located some 5 km north east of the proposed development in the township of Mount Bryan. The area has an average annual rainfall of about 443 mm with the heaviest falls usually occurring in June, July and August. The lowest rainfall totals are in January, February and March.

The monthly rainfall averages and probabilities recorded from the Mount Byron Post Office are provided in Figure 4 and Figure 5 respectively.

In order to obtain site-specific data daily time series climate data at the proposed development site was acquired from SILO (DSITISA, 2016). The Queensland Department of Science, Information Technology, Innovation and the Arts - Science Delivery (DSITIA) supplied climate data over the last 100 years. Daily data for the proposed development site is summarised in Table 5. Table 5 shows that the mean annual rainfall for the proposed development site is about 456 mm/year with an annual average pan evaporation of 1700 mm.

The mean rainfall for a 1 in 20 year annual rainfall (mm) recurrence is shown in Table 5. The 1 in 20 year recurrence annual rainfall is equivalent to 635 mm.

Other relevant weather data was obtained from the BoM weather station located at Clare Post Office (Station number 021014), approximately 35 km south west of the proposed development site and SILO (DSITISA, 2016).

Summer in Mount Bryan is between December and February and maximum daily temperatures average between 27.7 and 29.8°C with overnight minimums averaging between 11.5 and 13.5°C.

Winter is between June and August and maximum daily temperatures average between 12.5 and 14.0°C with overnight minimums averaging between 3.1 and 3.9°C. Winter days in Mount Bryan are moderately cold but can be chilly if windy, dropping to around 12.5 °C. Mount Bryan (932 m), the highest point in the Mount Lofty Ranges, is high enough to have the occasional snow cover.

Table 5 – Climatic data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
***SILO (Site)**													
Mean Rainfall (mm)	20	23	17	28	48	52	56	59	51	45	29	27	456
1 in 20yr Rainfall (mm)	17	75	3.4	45	65	11	30	63	163	74	55	35	635
Pan Evap (mm)	265	221	187	110	65	42	46	69	102	151	198	243	1700
Av. Max Temp (^{0}C)	29.8	29.6	26.3	21.3	16.7	13.3	12.5	14.0	17.1	20.7	24.8	27.7	21.2
Av. Min Temp (^{0}C)	13.2	13.5	11.0	8.0	5.6	3.9	3.1	3.5	4.8	6.8	9.3	11.5	7.9
****BoM (Mt Bryan)**													
Mean Rainfall (mm)	19.8	22.2	17.6	27.2	44.9	51.6	54.5	57.7	50.8	41.4	29.0	26.3	443
Median Rainfall (mm)	10.8	11.1	13	21.3	41	48.7	53.4	56.6	48	35.3	23.8	17.8	436
Lowest Rainfall (mm)	0	0	0	0	0.8	3	9.1	3.4	7.6	0	0	0	207
Highest Rainfall (mm)	131	123	109	104	144	116	125	150	156	153	95	124	762
*****BoM (Clare Post Office)**													
Mean Max Temp (^{0}C)	29.7	29.3	26.9	21.8	17.3	14.1	13.2	14.5	17.5	21.0	24.6	27.5	21.4
Mean Min Temp (^{0}C)	13.4	13.5	11.5	8.2	5.7	3.9	3.1	3.6	5.0	7.2	9.6	11.7	8.0
Mean 9am Relative Humidity (%)	46	53	56	69	80	85	84	79	69	60	52	48	65
Mean 3pm Relative Humidity (%)	31	34	35	46	56	64	64	58	50	43	36	33	46

*SILO Data (Department of Science, Information Technology, Innovation and the Arts - Science Delivery, 2016)
** Bureau of Meteorology (BoM, 2016a) Site number 21034 MOUNT BRYAN, 1895 to DATE; Latitude (deg S): -33.56; Longitude (deg E): 138.90; State: SA
*** Bureau of Meteorology (BoM, 2016a) Site number 021014 CLARE 1862 to 1994; Latitude (deg S): -33.84; Longitude (deg E): 138.61; State: SA

Intensity-Frequency-Duration (IFD) design rainfalls for the proposed development site were obtained from the Bureau of Meteorology (BoM, 2016b). The IFD design rainfalls are shown in Table 6. From Table 6, the 1-in-20 year, 24 hour storm event is equal to 3.15 mm per hour or 75.6 mm over a 24-hour period.

From Table 6, the 1-in-100 year, 1 hour storm event is equal to 34.9 mm per hour.

Table 6 – Intensity-Frequency-Duration design rainfalls

Duration	Average Recurrence Interval						
	1 YEAR	2 YEARS	5 YEARS	10 YEARS	YEARS 20	50 YEARS	100 YEARS
5Mins	40.3	53.5	73.9	87.1	105	129	149
6Mins	37.5	49.8	68.7	80.9	97.1	120	138
10Mins	30.3	40	54.6	64	76.3	93.6	108
20Mins	21.5	28.3	37.8	43.8	51.8	62.8	71.6
30Mins	17.2	22.5	29.7	34.3	40.3	48.6	55.2
1Hr	11.4	14.8	19.3	22.1	25.8	30.9	34.9
2Hrs	7.27	9.44	12.3	14	16.4	19.6	22.1
3Hrs	5.56	7.22	9.41	10.8	12.6	15	17
6Hrs	3.5	4.56	5.97	6.85	8.02	9.63	10.9
12Hrs	2.2	2.88	3.78	4.34	5.09	6.12	6.93
24Hrs	1.37	1.79	2.35	2.69	3.15	3.79	4.28
48Hrs	0.83	1.08	1.41	1.61	1.87	2.24	2.53
72Hrs	0.601	0.78	1.01	1.16	1.35	1.61	1.82

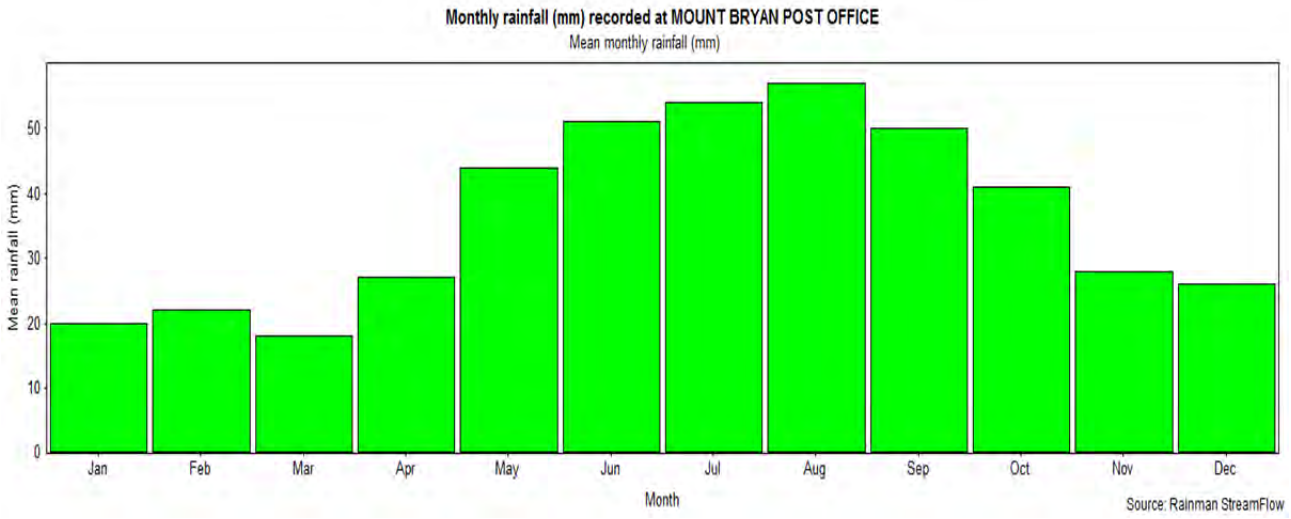

Figure 4 – Monthly rainfall average (Mount Bryan Post Office)

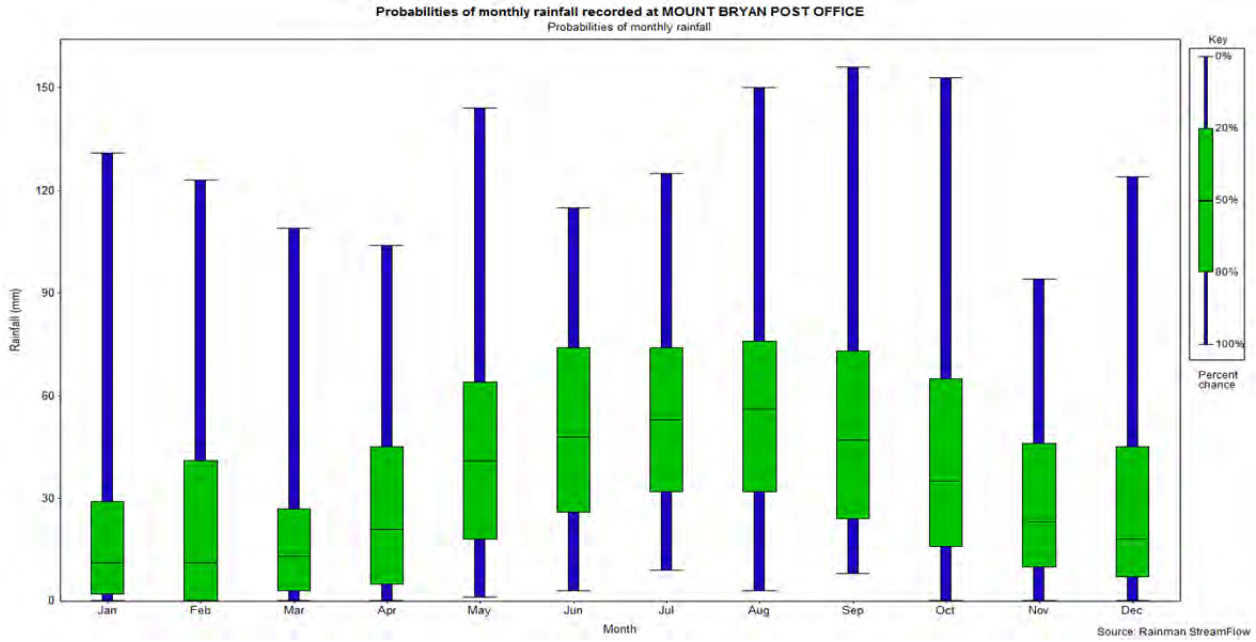

Figure 5 – Monthly rainfall probabilities (Mount Bryan Post Office)

5.1.2 Wind Direction and Frequency

The Bureau of Meteorology Clare High School Meteorological Station is the closest station to the proposed development site located some 35 km to the southwest in the township of Clare (SA). Wind direction and frequency data from the Clare High School station based on observations recorded at 9 am and 3 pm are presented in Table 7. The observations were recorded between 2 April 1994 and 30 September 2010.

The wind direction, frequency and intensity at the site are influenced by several factors including the local terrain and land use. On a relatively small scale, winds would be largely affected by the local topography. At larger scales, winds are affected by synoptic scale winds, which are modified by sea breezes near the coast in the daytime in summer (also to a certain extent in the winter) and also by a complex pattern of regional drainage flows that develop overnight.

Figure 6 and Figure 7 shows 9 am and 3 pm wind roses respectively for the Clare High School meteorological station. The prevailing wind as recorded at 9 am blows from the east. During the year, the 9 am observations are dominated by winds from the east with westerly winds predominating in winter. The prevailing wind as recorded at 3 pm blows from the west. During the year, the 3 pm observations are dominated by winds from the west and southwest direction.

Table 7 – Wind data (Clare High School)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Mean 9am Wind Speed (km/hr)	13.8	11.8	10.5	11.0	8.9	9.4	9.7	11.2	14.2	14.9	13.7	14.1	11.9
Wind Direction (9am)	E	E	E	E	E	NW	W	W	N	N	E	E	E
% of Total Observations	42%	45%	40%	28%	23%	17%	17%	17%	19%	20%	26%	30%	23%
Mean 3pm Wind Speed (km/hr)	16.5	15.8	15.2	14.6	14.0	15.0	15.9	16.5	17.4	16.9	16.3	17.0	15.9
Wind Direction (3pm)	SW	SW	SW	W	W	W	W	W	W	W	SW	SW	W
% of Total Observations	27%	23%	23%	21%	22%	22%	23%	26%	28%	22%	25%	29%	21%

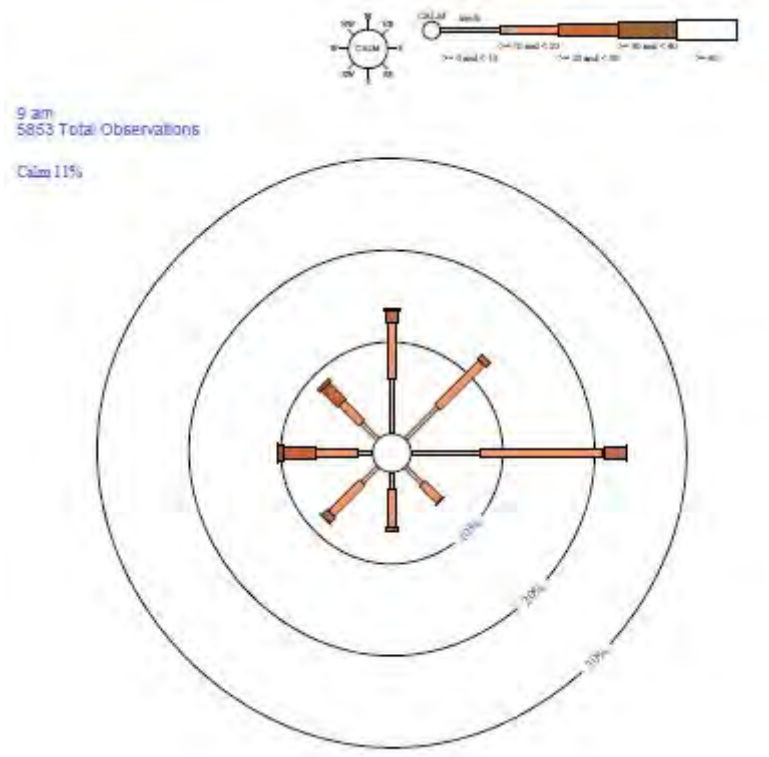

Figure 6 – 9am wind rose (Clare High School)

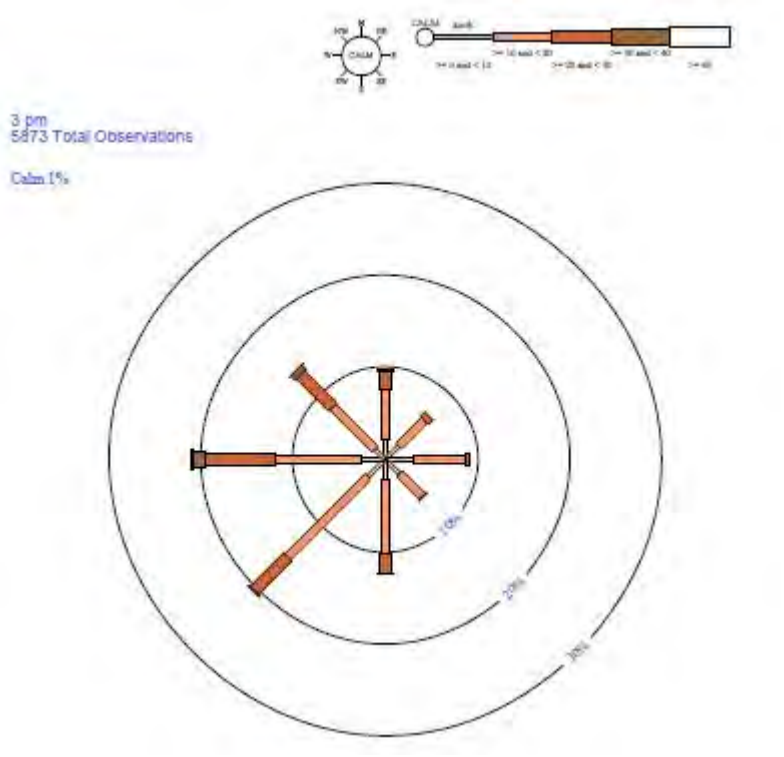

Figure 7 – 3pm wind rose (Clare High School)

5.2 Separation Distances

The proposed development shall be sited and designed to prevent or minimise adverse impacts on the amenity of the surrounding community.

The proposed development is relation to existing residential development, rural-residential development, rural residences and other sensitive land uses is shown on Figure 8.

The closest sensitive receptor is a rural residence approximately 2715 m from the existing feedlot to the north east. The Development Plan for the District of Goyder states that “intensive animal keeping” should not be located on land within “500 meters of a dwelling (except for a dwelling directly associated with the intensive animal keeping facility)”. There are no dwellings within 500 m of the proposed development. The Goyder Development Plan also requires a separation distance of 2,000 m from a defined and zoned township, settlement or urban area. The closest settlement is Mount Bryan, about 5 km from the proposed development site.

5.3 Site Access

Access to the proposed development would be via the existing dedicated safe and convenient site access to the existing feedlot. Figure 9 shows the access road to the existing feedlot development.

Access is gained from the Goyder Highway via Hills Road. The Goyder Highway (State route B64), locally known as Flagstaff Road, is an east-west link through the Mid North region of South Australia connecting Spencer Gulf to the Riverland. It is part of the most direct road route from Port

Augusta to much of Victoria and southern New South Wales. There are no B-double restrictions on the section of the Goyder highway closest to the proposed development.

5.4 Topography

The topography of the subject property on which the development is proposed comprises low undulating hills and rises grading to the various watercourse channels. The ridges and spurs of the Hallet Hill Range fringing the eastern boundary of the subject property (average elevation 650 metres AHD) are the main physical features of the surrounding area.

The ranges are aligned predominately in a north-south orientation, while the spurs generally run from the ridgeline down to the west. The broad valleys to the west of the range are approximately 540 metres AHD and are characterised by broad shallow flat-bottomed valleys between prominent north-south ranges/ridgelines with general slopes in the order of 4-5 %.

The proposed development is sited in a gently sloping valley area to the east of the existing feedlot. The proposed development site is dissected by an unnamed drainage line that runs north-east to south-west through the area as shown on Figure 9.

The western controlled drainage area (CDA 1) of the development grades south to the unnamed drainage line and the eastern controlled drainage area (CDA 2) grades west to the unnamed drainage line.

NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. IMAGE SOURCED FROM LAND SERVICES GROUP – GOVERNMENT OF SOUTH AUSTRALIA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE MAY 2016
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Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
SENSITIVE RECEPTORS

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-SP-08	A

NOTES:
1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. IMAGE SOURCED FROM GOOGLE EARTH™ MAY 2016
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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
SITE AERIAL PLAN

Scales	1= 2,750 (A1) 1= 5,500 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-SA-09	A

5.5 Biodiversity (Flora and Fauna)

Flora and fauna on the subject property were assessed using the South Australian Department of Environment, Water and Natural Resources (DEWNR) NatureMaps (version 3.0) online mapping (DEWNR, 2016a). The flora and fauna across the proposed development site are shown in Figure 10.

Since European settlement, large areas of native vegetation have been cleared for agriculture, housing, infrastructure, mining and other varied uses. While extensive areas of native vegetation remain in the State's arid zones, the loss is most apparent in agricultural regions, which retain only 25% of the original native vegetation.

While large-scale clearance of native vegetation has ceased in South Australia, the decline of remnant native vegetation has continued. The South Australian Government is committed to reversing the decline in the extent and quality of the State's native vegetation and to a reduction in the rate of native vegetation clearance.

Legislation is in place to protect native vegetation in South Australia via the Native Vegetation Act 1991 (the Act) and the Native Vegetation Regulations 2003 (the Regulations). The Act aims to minimise clearance and to offer opportunities to enhance and reinstate native vegetation across the State.

Subsequently, relevant approvals are required for any development that proposes clearing of native vegetation.

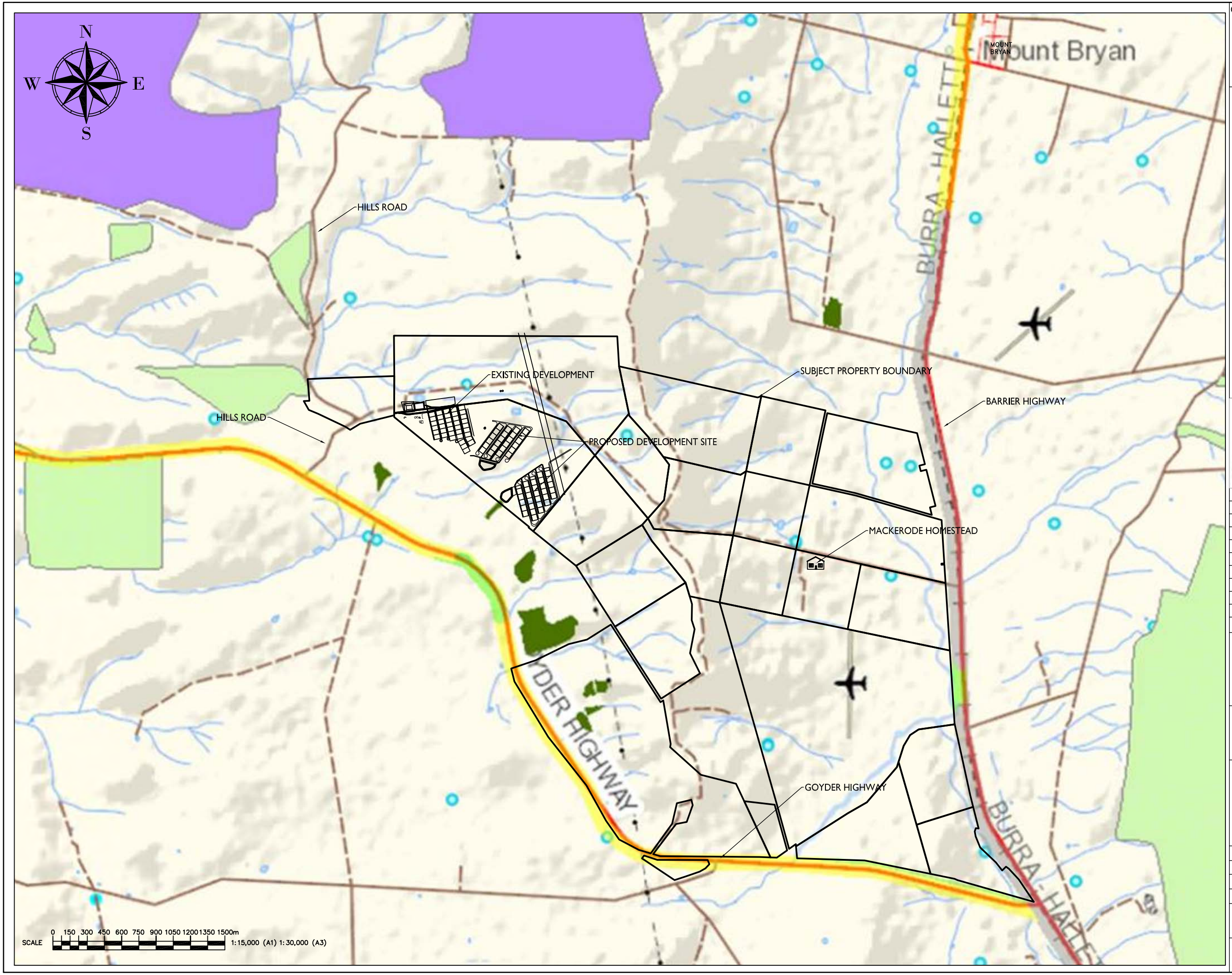
The majority of the subject property on which the development is proposed has been previously cleared, primarily for sheep and cattle grazing and cropping purposes. The impact of this action is that the remnant vegetation communities are now largely confined to small areas fringing draining lines and clusters of paddock trees, with consequential habitat fragmentation effects on the indigenous biota.

Locally native vegetation (Gilja, Inland Southern Blue Gum, Red Mallee, Grey Mulga etc) has been established along property boundaries and around the existing feedlot as a shelterbelt to provide protection of crops, livestock, reduction of soil erosion, salinity control and biodiversity improvements as shown in Photograph 5.

A search of the DEWNR' NatureMaps online database identified that there are no state or nationally rated flora or fauna or protected areas mapped on the proposed development site.

Photograph 5 – Shelter belt around existing feedlot

Photograph 6 – Existing vegetation on proposed development site



NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. IMAGED SOURCED FROM LAND SERVICES GROUP – GOVERNMENT OF SOUTH AUSTRALIA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE.
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PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title

BIODIVERSITY (FLORA AND FAUNA) PLAN

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-FF-10	Issue	A

The status of mapped vegetation on the subject property was assessed using the South Australian Department of Environment, Water and Natural Resources (DEWNR) NatureMaps (version 3.0). This included South Australian vegetation, planted vegetation cover, native vegetation cover, pre-European vegetation and roadside vegetation. It should however be noted that remnant native vegetation mapping is only available for approximately 50% of South Australia. The absence of mapped vegetation across the site may reflect a data gap in available mapping and may not necessarily reflect the vegetation of the area. The resulting NatureMaps map of the subject property is shown in Figure 10. As shown in Figure 10, there is no vegetation currently mapped within the subject property.

A review of available aerial imagery indicates that vegetation shelterbelts occur along the southern and north-western boundaries of the proposed development site. A vegetation shelterbelt also occurs between the existing feedlot and proposed development. The vegetation buffers are approximately 20 m wide and include predominantly local providence overstorey vegetation as shown in Photograph 5.

The proposed development site has been extensively cleared and comprises groundcover to facilitate the current agricultural land use of the site as shown in Photograph 6.

5.6 Water Resources

The state legislation and policy that forms the framework for water planning in South Australia are:

- Natural Resources Management Act 2004 and associated regulations
- South Australian Strategic Plan
- State Natural Resources Management Plan.

The Natural Resources Management Act 2004 is an act to promote sustainable and integrated management of the State's natural resources; to make provision for the protection of the State's natural resources.

In response to water usage issues, certain areas within the state may be prescribed in order to control future water extraction processes. The prescription may be either area based or watercourse based (or in some area both).

5.6.1 Groundwater

Groundwater is the largest source of fresh water in South Australia. Therefore, it is important to understand the groundwater systems in order to manage risks to water quality and supply. Groundwater is stored in geological formations below the earth’s surface. The type of geological formation determines the quantity of water that can be extracted.

The subject property lies outside of a Prescribed Water Resources Area (PWRA). The Booborowie Valley groundwater system lies some 5 km to the east in the Booborowie Valley. The Booborowie Valley groundwater system is an alluvium filled valley, which provides limited but important sources of groundwater to landowners in the region.

A search for all registered groundwater bores within a 2.5 km radius of the centroid of the existing feedlot was undertaken via the WaterConnect groundwater database (DEWNR, 2016b) and the South Australian Department of Environment, Water and Natural Resources (DEWNR) NatureMaps (version 3.0) online mapping (DEWNR, 2016a).

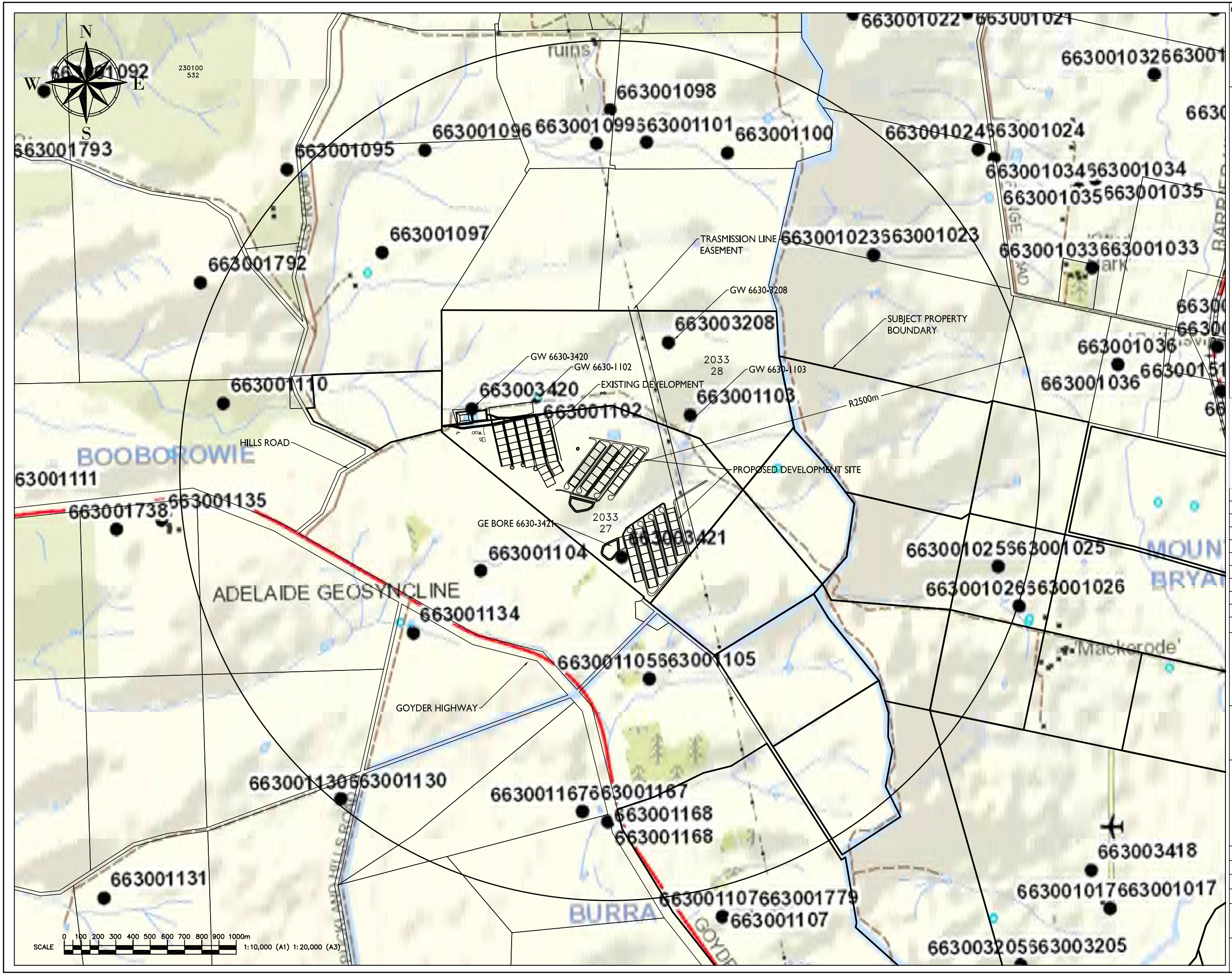
The groundwater bores within the search radius are shown in Figure 11. Bore log data including casing details, standing water levels (by date), flow rate (by date) and water analysis recorded at each bore was also obtained and is provided in Appendix B.

There are 22 registered groundwater bores that occur within 2.5 km of the existing feedlot. There are four (4) registered bores that occur within the land parcels on which the existing development and proposed development are located (Figure 11). Registered bore 6630-3420 is located towards the western boundary of parcel D2033 B27, immediately north-west of the existing feedlot. Registered bore 6630-3421 is located adjacent to the drainage line between the proposed development's CDA1 and CDA 2 to the east of the existing feedlot.

Groundwater of the area is associated with the fractured rocks of the Adelaide Geosyncline basin. Registered bore 6630-3421 had a standing water level of 24.7 m below ground level. The electrical conductivity (EC) of the groundwater at this bore is 4,240 µS/cm which is above the concentration deemed safe for human consumption (830 µS/cm) but below the salinity threshold for water used to irrigate crops including wheat (5000 µS/cm) and barley (6000 µS/cm) (Agriculture Victoria, 2008). The EC at this bore and groundwater of surrounding registered bores is below the maximum concentration for reasonable growth rates of beef cattle (6,700 µS/cm).

The Regional Council of Goyder's Development Plan has no requirement for minimum separation distances between 'intensive animal keeping' and bores or wells used for domestic or stockwater purposes.

Mitigation measures shall be implemented in the construction and operation of the proposed development. These measures are outlined in Section 10.3.



NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. GROUNDWATER BORE LOCATION INFORMATION SOURCED FROM SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) (NatureMaps) MAY 2016 AND ACCURACY IS LIMITED.
3. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
GROUNDWATER BORE PLAN

Scales	1= 10,000 (A1) 1= 20,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-GW-11	A

5.6.2 Surface water

Surface water is found on the surface of land, such as in a stream, river, lake or wetland. Surface water is replenished by rain and when groundwater seeps to the surface. It is lost through evaporation, seepage into the ground, use by plants and animals, runoff into the ocean and use by humans for living, agriculture and industry.

The region's surface water systems are mainly seasonal, flowing in response to rainfall events. The subject property lies outside of a Prescribed Water Resources Area (PWRA).

The subject property, including the existing feedlot and proposed development, occur within the Broughton River basin in the Broughton River catchment. Land immediately east and south-east of the subject property occurs within the Lower Murray River basin in the Burra Creek catchment.

Surface water drainage in the vicinity of the proposed development site was assessed using the South Australian Department of Environment, Water and Natural Resources (DEWNR) NatureMaps (version 3.0) online mapping (DEWNR, 2016a). The surface water drainage in the vicinity of the proposed development is shown in Figure 12.

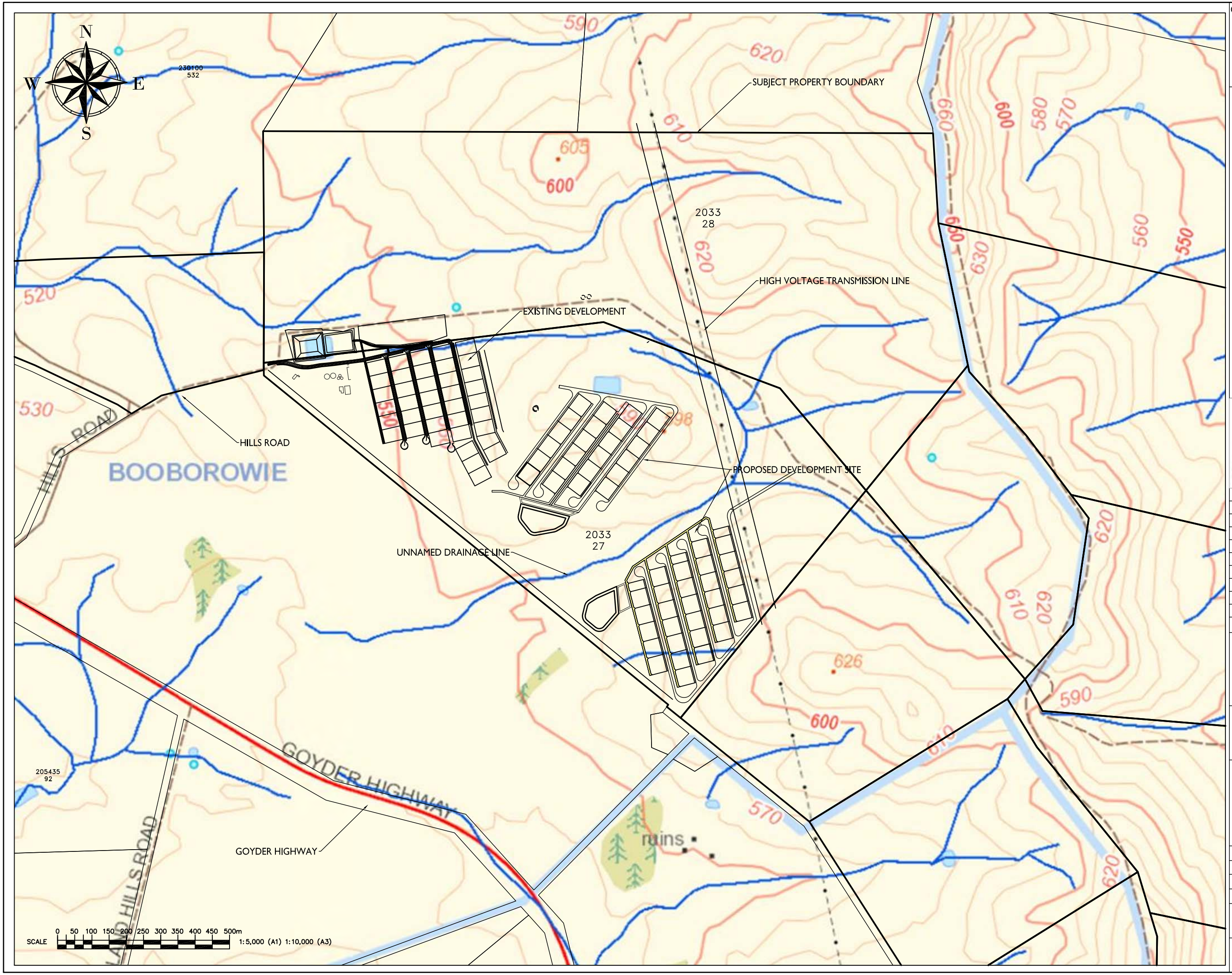
Surface water drainage in the vicinity of the proposed development site consists of an unnamed ephemeral drainage line, which flows in a southerly direction through the subject property. A number of small ephemeral drainage lines drain the surrounding hills. Drainage lines flow towards Booborowie Creek located approximately 10 km south-west of the subject property. Booborowie Creek drains to the Broughton River located approximately 20 km north-west of the subject property. Most defined drainage lines do not reach the valley bottom, and any surface flow quickly infiltrates into the porous sediments when runoff does occur.

South Australia uses the Strahler stream classification system where waterways are given an 'order' according to the number of additional tributaries associated with each waterway (Strahler, 1952). This system provides a measure of system complexity. The Strahler stream ordering process begins at the top of a catchment with headwater ('new') flow paths being assigned the number 1. Where two flow paths of order 1 join, the section downstream of the junction is referred to as a second order stream. Where two second order streams join, the waterway downstream of the junction is referred to as a third order stream, and so on. The unnamed drainage line that bisects the proposed development site is mapped as a 3rd order stream (Figure 12).

The Regional Council of Goyder's Development Plan states that intensive animal operations and their various components (i.e. holding yards, temporary feeding areas, moving lanes and similar) should not be located on land within 200 m of a major watercourse (third order or higher stream) and within 100 m of any other watercourse. Operations should also not be located on land within the 1 in 100 year average return interval flood event area on any watercourse.

The Development Plan also outlines the requirement for a strip of land at least 20 m wide (measured from the top of existing banks on each side of a watercourse) that is:

- Kept free of development, including structures, formal roadways or access ways for machinery or any other activity causing soil compaction or significant modification of the natural surface of the land; and
- Revegetated with indigenous vegetation.



NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. SURFACE WATER INFORMATION SOURCED FROM SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) (NatureMaps) MAY 2016 AND ACCURACY IS LIMITED.
3. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
SURFACE WATER PLAN

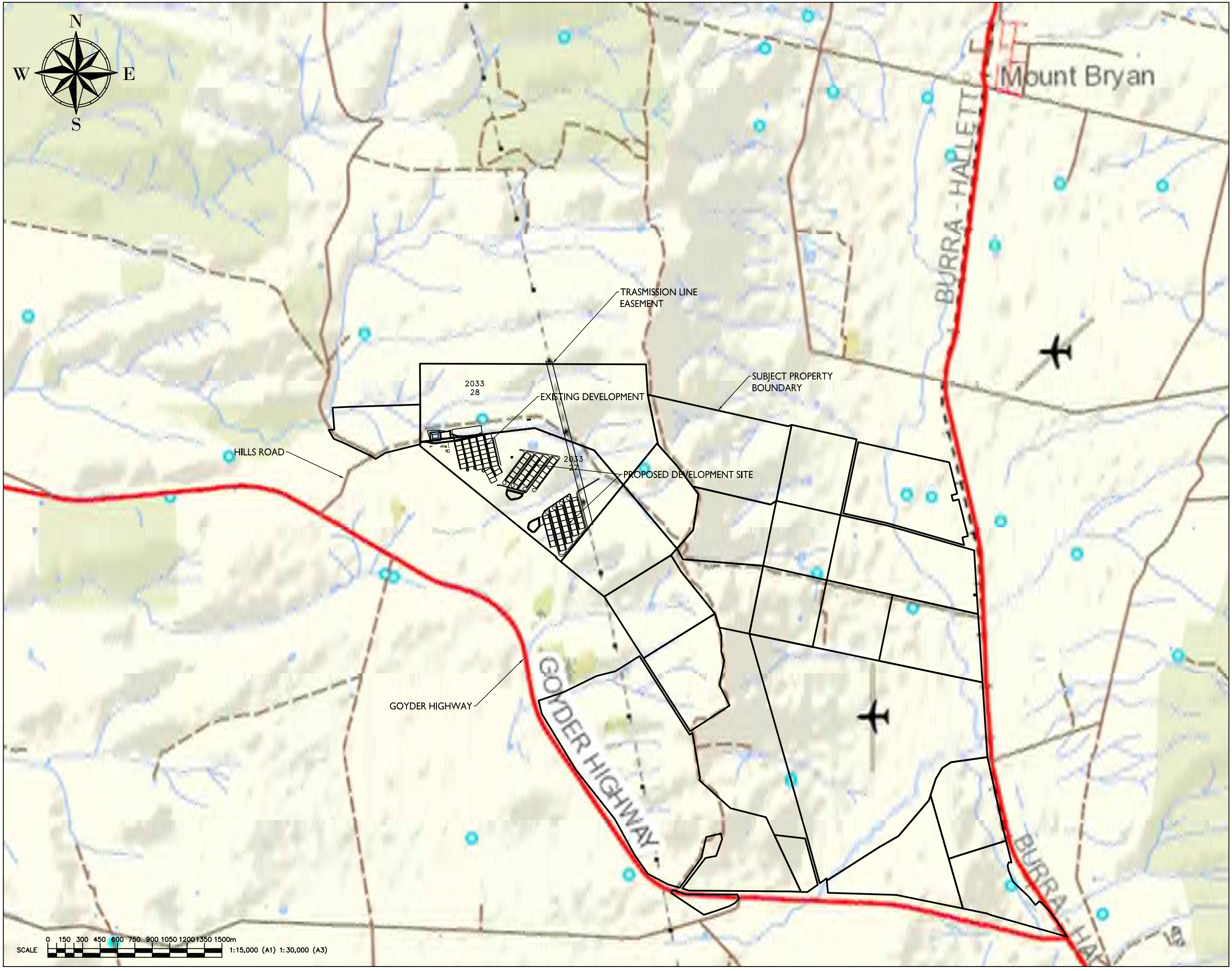
Scales	1= 5,000 (A1) 1= 10,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-SW-12	Issue	A

5.7 Wetlands

Wetlands are one of South Australia's most important natural assets. The 'Wetlands Strategy for South Australia' provides a framework for the sustainable use of South Australia's wetland ecosystems.

A series of wetland inventories have been completed at regional scale in South Australia. The wetland inventory of the northern agricultural districts has been completed by Seaman (2002). The extent of wetlands on the subject property was assessed using the South Australian Department of Environment, Water and Natural Resources (DEWNR) NatureMaps (version 3.0) (DEWNR, 2016a). The resulting NatureMaps wetlands overlay of the subject property is shown in Figure 13.

As shown in Figure 13, there are no wetlands of national importance, water protection areas, watershed protection zones or southeast seasonal herbaceous wetlands mapped within or surrounding the subject property.



NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. WETLANDS LOCATION INFORMATION SOURCED FROM SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) (NatureMaps) MAY 2016 AND ACCURACY IS LIMITED.
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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
WETLANDS PLAN

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-WL-13	A

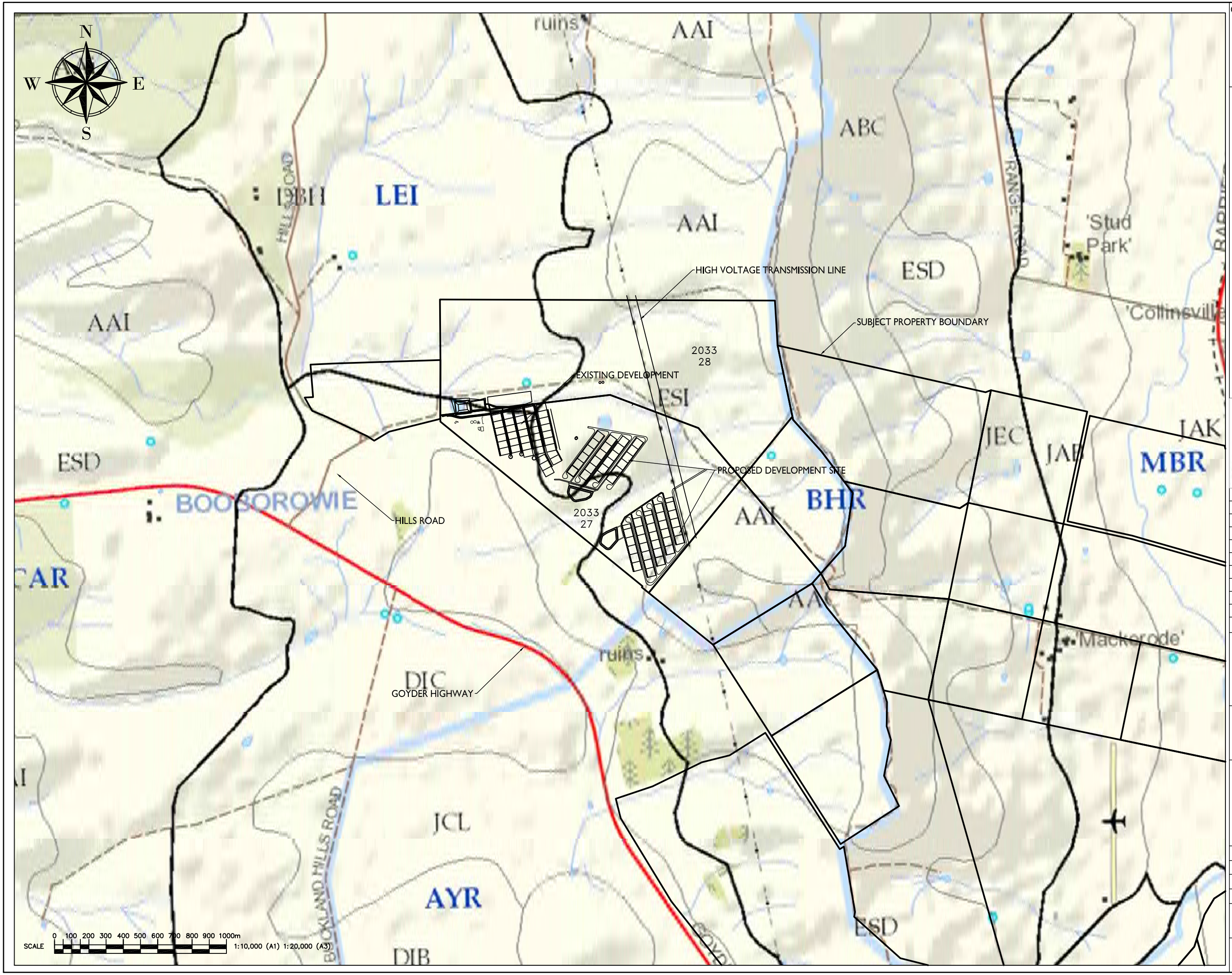
5.8 Soils

The South Australian Governments' 'State Land & Soil Mapping Program' has developed a hierarchy and framework of landscape and biophysical mapping units across the whole of non-arid South Australia.

Soils of the subject property were assessed using the South Australian Department of Environment, Water and Natural Resources (DEWNR) NatureMaps (version 3.0) online mapping (DEWNR, 2016a). The soil landscape units across the proposed development site are shown in Figure 14.

Two soil landscape units occur across the proposed development site (Figure 14). The Ayres (AYR) land system that occupies the southern portion of the proposed development site comprises flats and low rises with soils that generally include deep sandy loams over red clay sub-soils (Hall et al., 2008). These soils are often attributed with poor surface soil structure (hard setting) that increases run-off and erosion.

Soils of the Bald Hill Range (BHR) land system that occupies the remainder of the proposed development site are generally described as hard sandy loam over red clay on rock (Hall et al., 2008). These soils have moderately high water erosion potential and a negligible susceptibility to flooding.



NOTES:

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2. SOILS LOCATION INFORMATION SOURCED FROM SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) (NatureMaps) MAY 2016 AND ACCURACY IS LIMITED.
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PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title

SOIL LANDSCAPE UNITS PLAN

Scales	1= 10,000 (A1) 1= 20,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	

Drawing No.	Issue
RU050500-PRS-SLU-14	A

5.8.1 Soil Description

Soils in the area are a hard setting sandy loam to clay loam overlaying red clay representative of the AYR soil landscape unit described by Hall et al. (2008). The landform is undulating to steep arable and grazing areas as shown in Photograph 2. A typical soil profile is shown in Figure 15.

Soil Description:

Depth (cm)	*Description*
0-15	Dark reddish brown hard massive fine sandy loam. Abrupt to:
15-55	Dark reddish brown very hard medium heavy clay with strong very coarse prismatic, breaking to angular blocky, structure. Clear to:
55-95	Red hard highly calcareous medium clay with strong coarse angular blocky structure, 10-20% fine carbonate segregations and 2-10% ironstone nodules (2-6 mm). Gradual to:
95-125	Red, with grey and yellow inclusions of decomposed siltstone, very hard medium clay, moderate coarse subangular blocky structure and 2-10% fine carbonate segregations.

Figure 15 – Typical soil profile description (Hall et al., 2008)

A geotechnical assessment that focused on the investigation and determination of the subsurface conditions and potential risks that may exist within the site of the existing development was undertaken in 2007. The geotechnical assessment was undertaken to determine the suitability of the site for the proposed development complex and to enable the design and construction of the relevant infrastructure, such as roads, pen foundations, water retaining structures (drains, sedimentation basin, holding dams), building footings, compacted earthworks, feed storage and processing areas, excavations etc. in the detailed design phase. The geotechnical assessment report is provided in Appendix D.

As the proposed development site has similar soils to the existing feedlot site, these data are considered representative of the proposed development site. As shown in Table 8, the soils of the proposed development site are suitable for the development of feedlot infrastructure.

An assessment of the capability of the land on which solid and liquid waste utilisation is proposed was also undertaken. This assessment is provided in Section 10.7.

Table 8 – Soil description at selected locations

Location	Soil Description
Production pens	Sandy loam to clay loam overlaying red clay. Sub-soil specifications suit development of pen floors from subsoil material (AS James – Bear, Geotechnical Consultants and Laboratory, Kapunda SA - Appendix D).
Roadway and cattle laneway	Sandy loam to clay loam overlaying red clay.
Sedimentation basin(s)	Sandy loam to clay loam overlaying red clay. Sub-soil specifications suit effluent pond sealer (AS James – Bear, Geotechnical Consultants and Laboratory, Kapunda SA - Appendix D).
Storage lagoon(s)	Sandy loam to clay loam overlaying red clay. Sub-soil specifications suit effluent pond sealer. (AS James – Bear, Geotechnical Consultants and Laboratory, Kapunda SA - Appendix D).
Solid and liquid waste utilisation	Sandy loam to clay loam overlaying red clay.
Mass mortality disposal area	Sandy loam to clay loam overlaying red clay. Sub-soil specifications suitable for burial of mass mortalities. (AS James – Bear, Geotechnical Consultants and Laboratory, Kapunda SA - Appendix D).

6. Development Objectives and Development Demand

6.1 Development Objectives

The primary objective of the proposed development is to consistently supply market or customer requirements with grain-fed beef in terms of quality and quantity to compete with the US product on a global market, with a particular focus on the Asian market.

The proponent has considerable experience in the lot feeding industry providing an integrated production and processing system for grain-fed beef. As a result, the proposed development has a number of objectives which are listed below and are focussed on providing sustainable environmental, social and economic outcomes.

- To produce consistent quality grain-fed beef for the domestic and export market using best practice and sustainable animal welfare, environment, food safety and product integrity management systems
- To provide dedicated feeding programs for cattle to meet specific market requirements
- To provide a source of employment in the local area
- To enhance the proponents operations by finishing their own cattle using a grain-based ration
- To provide a local market for feeder cattle as the development would aim to source feeder cattle from local producers
- To provide a local market for feed commodities (grain/hay/silage etc.) as the development would aim to source a major proportion of these commodities from local producers
- To implement procedures, practices and processes that ensure compliance with the relevant industry standards and legislative, policy and planning requirements
- To sustainably utilise solid and liquid wastes.

6.2 Development Demand

The productivity of Australian beef production has significantly improved over time. The Australian grain fed cattle industry was the primary driver for this change. The main reasons why the cattle feedlot industry has grown over the last 30 years are:

1. Because it fulfills the market need to supply a consistent quantity and quality of beef throughout the year (regardless of seasons and climatic variation)
2. Because of the increasing consumer demand for grain fed beef.

Specifically, Australia's variable climate means that pastures are insufficient during seasonal dry periods or drought and finishing cattle on grain enables beef to have a more consistent eating quality. The emergence of markets such as Japan and Korea has also greatly assisted industry growth whilst the exclusion of US beef into world markets due to BSE concerns has ensured that this growth has been sustained.

Currently, cattle numbers in Australian feedlots are at near record levels. Importantly, despite high feeder cattle prices, strong demand for Australian beef overseas continues to encourage lot feeders to maintain cattle numbers on feed. Industry research has shown that demand for beef from world markets has grown consistently over recent years and demand is considered to be in excess of supply.

The proposed development is aimed at providing products to well established world markets in particular the EU. Other markets, such as the various Asian beef markets have indicated that high quality beef products are increasing in demand due to previous quality related problems involving Bovine Spongiform Encephalopathy (BSE or Mad Cow Disease).

As stated in Section 6.1, a key objective of the proposed development is to provide a consistent quality product. The proposed development would implement the highest standards of design, construction and management to ensure that the development produces safe, wholesome, consistent-quality beef. As a result, it is envisaged that the operation of the proposed development would be able to provide consistent quality beef to satisfy the demand requirements of world markets in particular the EU beef market.

7. Development Description

7.1 Existing Development

The subject property has an EPA licence for cattle feedlots comprising a maximum of 4,409 SCU (6,090 head) of beef cattle and 464 SCU (3,000 head) of sheep. The existing feedlot is operated as a Class 1 beef cattle feedlot only with no sheep being fed. The stocking density of beef cattle is 10.5 m^2 per animal or 14.5 m^2/SCU based on average weight of cattle at turnoff.

The existing development occupies a footprint of approximately 23.8 ha and includes the following components in a functional configuration:

- Water Supply/ Storage and Reticulation – A reliable and uninterrupted supply of clean water of the required volume to sustain feedlot operations.
- Pens - Fenced areas for housing production cattle (production pens), cattle arriving to or being dispatched from the feedlot (induction/dispatch pens), and sick cattle (hospital pens).
- Livestock handling – Infrastructure and facilities for the arrival, processing and dispatch of cattle and stabling for horses.
- Feed processing and commodity storage - Feed rations are prepared on-site in a dedicated facility, with associated commodity storage, handling and ration delivery infrastructure.
- Access and Internal roads - Access to the site and the layout of internal road systems are critical to the efficient and safe functioning of the feedlot.
- Administrative/Maintenance Infrastructure - Facilities are required for conducting management, maintenance and administrative functions at the feedlot. This includes office, machinery workshop, weighbridge and associated facilities for example.
- Controlled drainage area - Stormwater runoff from areas such as pens, livestock handling, silage pits has a high organic matter and therefore a high pollution potential. This runoff is

controlled within a system that collects and conveys this runoff to a sedimentation basin and storage lagoon prior to environmentally sustainable utilisation.

- Drainage system - The controlled drainage area contains a system including catch drains, sedimentation system and storage lagoon for conveying stormwater, allow entrained sediment to 'settle out' and capture and storage of the stormwater from the controlled drainage area until it can be sustainably utilised.
- Solid and liquid waste management areas – Solids wastes such as manure and mortalities are temporarily stockpiled and processed within the solid waste storage area prior to utilisation on surrounding cropping land or removed off the subject property and utilised on other land owned by the proponent in the region. Liquid wastes are stored in the storage lagoon pending evaporation or application to the liquid waste utilisation area.

7.2 Proposed Development Outline

The proposed development is an expansion of the existing beef cattle feedlot located on the subject property. The proposed development would include the following components in a functional configuration:

- Water Supply/ Storage and Reticulation – A reliable and uninterrupted supply of clean water of the required volume to sustain feedlot operations is required. The proposed development shall utilise the existing feedlots on-site water storage to overcome differences in supply and demand and to also provide an emergency storage for temporary supply failures.

- Pens - Fenced areas are required for housing production cattle (production pens). Cattle arriving to or being dispatched from the proposed development (induction/dispatch pens), and sick cattle (hospital pens) shall be accommodated in existing infrastructure within the existing feedlot.

- Access and Internal roads - Access to the site and the layout of internal road systems are critical to the efficient and safe functioning of the proposed development.

- Controlled drainage area - Stormwater runoff from areas such as production pens has a high organic matter and therefore a high pollution potential. This runoff is controlled within a system that collects and conveys this runoff to a sedimentation basin and storage lagoon prior to environmentally sustainable utilisation.

- Drainage system - The controlled drainage area contains a system including catch drains, sedimentation system and storage lagoon for conveying stormwater, allow entrained sediment to 'settle out' and capture and storage of the stormwater from the controlled drainage area until it can be sustainably utilised.

- Solid and liquid waste management areas – Solids wastes such as manure and mortalities shall be temporarily stockpiled and processed within the existing solid waste storage area prior to utilisation on the subject property or on other properties in the region owned by the proponent. Liquid wastes shall be stored in a storage lagoon(s) pending application to the liquid waste utilisation area or until evaporated.

- Solid and liquid waste utilisation areas – Solid wastes generated are applied to an on-site utilisation area. Any solid wastes not utilised on the subject property are removed off-site.

When available, liquid wastes are applied to land via irrigation within a dedicated liquid waste utilisation area.

Other required components such as livestock handling, feed processing, administrative/maintenance and solid waste utilisation areas shall be met by existing infrastructure and facilities.

Further description of the various elements is provided in Section 7.5.

The proposed development shall be designed, constructed and managed as a Class One (1) feedlot. A Class One (1) feedlot has highest standard of design, operation, maintenance, pad management and cleaning frequency. A Class One (1) feedlot is defined in Section 7.3.

7.3 Design Philosophy

The design philosophy of the proposed development has been informed by a deep understanding of the intrinsic purpose, the environmental context and the drivers of performance of a beef cattle feedlot. This holistic approach enables ecologically and economically sustainability to be integrated into the design, construction and management (when approved) of the development.

The design, construction and management of the proposed development is consistent with relevant legislation, environmental standards, codes of practice and guidelines as outlined in Section 8 and Section 9.

As beef cattle feedlots vary considerably in their size, animal density, design and operational standards, classes have been developed that define appropriate standards of siting, design, construction and management. The Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) outlines objectives for proposed feedlots to meet with four feedlot classes defined. There are four feedlot classes defined with standards becoming progressively more stringent moving from Class Four (4) to Class One (1). The four feedlot classes defined are:

Class One (1): This represents the highest standard of design, operation, maintenance, pad management and cleaning frequency.

Class Two (2): This is the generally accepted standard for a well-designed, constructed and maintained feedlot, which has a high standard of operation. This is the reference standard for all classes.

Class Three (3): Basic design, construction and operation standards with higher standards than Class Four for pen floor construction. Well removed from impact locations.

Class Four (4): Generally a small feedlot in an isolated situation with basic management and development standards, well separated from any residential situations and having fewer than 1000 head of cattle.

The proposed development would be designed, constructed and maintained as a Class One (1) standard, the highest standards of design, construction and management.

7.4 Capacity

The proposed development has been designed to accommodate a total of about 10,552 head of beef cattle at a stocking density of 12.9 m^2/head (9,083 SCU at 15 m^2/SCU). The proposed development comprises two separate controlled drainage area designated CDA 1 and CDA 2 as outlined in Section 7.5.9. CDA 1 has been designed to accommodate about 4,647 head (4,000 SCU) of beef cattle at a stocking density of 12.9 m^2/head (15 m^2/SCU). CDA 2 has been designed to accommodate about 5,905 (5,083 SCU) head of beef cattle at a stocking density of 12.9 m^2/head (15 m^2/SCU).

The term 'Standard Cattle Units' (SCU) is used in some states to describe the stocking capacity of a beef cattle feedlot in accordance with the weight of cattle turned off from the facility, rather than the number of head. A standard cattle unit is an animal of 600 kg liveweight, at the time of exit (turnoff) from the feedlot (Department of Primary Industries and Resources (SA), 2006). This term enables the stocking capacity of beef cattle feedlots to be expressed in line with the weight of cattle turned off from the facility, rather than the number of head. This concept is based on the understanding that manure production increases with cattle liveweight.

Each animal can be converted to a SCU equivalent based on their metabolic liveweight and the following formula:

SCU Scaling Factor = $(\text{Animal Liveweight}/600)^{0.75}$

Table 9 – Standard Cattle Unit conversion factor

Average Liveweight (kg)	SCU Scaling factor
350	0.68
400	0.74
450	0.81
500	0.87
550	0.94
600	1.00
650	1.06
700	1.12
750	1.18

Based on the estimated market types in the proposed development (Section 7.8.1), the proposed development can accommodate about 10,552 head (9,083 SCU) of beef cattle at a stocking density of 12.9 m^2/head (15 m^2/SCU).

7.5 Layout, Design and Specification

The proposed development layout and configuration is shown in Figure 16. The site layout was designed to:

- maximise operational efficiency
- maximise cattle performance

- minimise environmental impact
- minimise waste
- maximise worker health and safety
- maximise cattle welfare
- minimise capital and operational costs.

A detailed description of the various functional elements of the proposed development is outlined below.

NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. IMAGE SOURCED FROM GOOGLE EARTH™ MAY 2016
3. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

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Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
PROPOSED DEVELOPMENT LAYOUT

Scales	1= 2,750 (A1) 1= 5,500 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-DL-16	A

7.5.1 Water Supply/Storage & Reticulation

The proposed development depends on the supply of water of sufficient quantity, quality and reliability.

The proposed development will be watered from groundwater. Two bores being Registered No 663003420 and Registered No 663003421 were drilled in 2007 to provide water for the existing development. These bore holes have been drilled to 114 and 62 m respectively, and standing water level is about 21.5 and 24.7 m. Flow rates are 11,000 and 18,000 litres per hour. The TDS of the water is 1845 and 2300 mg/l with an EC of 3320 and 4240 mg/l for registered bores No 663003420 and No 663003421 respectively and is excellent for stock consumption.

Over 90% of the water used is for cattle to drink; it is also used for feed processing, cleaning yards, machinery, other general practices around the development, and in staff amenities. Water is also lost through evaporation and seepage from open storages.

The quantity of water consumed by feedlot cattle is mostly dependent on the environmental temperature and humidity, drinking water temperature and salt content, diet composition (nature of food and dry matter content), feed intake, size of the animal, breed, rate and composition of gain, frequency of watering and individual variation between animals (Davis & Watts, 2006).

Winchester and Morris (1956) provide data collected in a laboratory context relating water intake per day to ambient temperature, dry matter intake and breed. They show that water intake, and therefore metabolic demand, is relatively constant until about 30°C, above which intake increases rapidly due to increased evaporative (cooling) demand.

Watts et al. (1994) undertook a statistical analysis of their data and found the following relationships between water intake and temperature.

$WI = DMI \times (3.413 + 0.01592\ e^{0.17596T})$ - Equation 1 **(*Bos taurus*)**

The estimated drinking water requirements were calculated using the above equation and shown in Table 10. As shown in Table 10, the estimated total drinking water requirements are approximately 137 ML/year or equivalent to about 13 ML/1000 head-on-feed/year.

Table 10 – Estimated drinking water consumption (Watts et al., 1994)

Month	Average Temp ^{0}C	Water Consumption L/Head/Day	Monthly Consumption kL/month
January	21.5	39.92	12929
February	21.55	39.98	11695
March	18.65	37.25	12062
April	14.65	35.17	11021
May	11.15	34.23	11085
June	8.6	33.83	10603
July	7.8	33.74	10927
August	8.75	33.85	10963
September	10.95	34.19	10716
October	13.75	34.87	11292
November	17.05	36.24	11356
December	19.6	37.99	12304
Total			136953
Total (ML/year)			136.9

Davis et al. (2009) measured total water usage data from seven Australian feedlots between 2007 and 2009. The total water usage ranged from 14.5 to 20.5 ML/1000 head-on-feed. These data includes drinking water, feed processing, cattle washing (where this practice is undertaken), administration and direct sundry uses such as trough cleaning, dust control, vehicle and facility cleaning and indirect sundry 'uses' such as evaporation. The lower consumptive value was measured at a feedlot located in a similar climatic pattern to the proposed development.

Hence, the proposed development of 10,552 head will require in the order of 137 ML of water depending on the level of drinking water consumption and occupancy level. Allowing an additional 10% for other uses such as feed processing, administration and direct sundry uses such as trough cleaning, vehicle and facility cleaning and indirect sundry 'uses' such as evaporation some 152 ML of water shall be required for the proposed development.

Water shall be sourced from groundwater.

The proposed development shall utilise the existing feedlots on-site water storage to overcome differences in supply and demand and to also provide an emergency storage for temporary supply failures.

Water shall be reticulated to the relevant areas of the proposed development using an underground polyethylene pipe network. The reticulation system shall be designed to supply water throughout the pens during peak demand periods.

7.5.2 Pens

Pens are required for holding production cattle (production pens). Cattle arriving to or being dispatched from the proposed development (induction/dispatch pens), and sick cattle (hospital pens) shall be accommodated in facilities within the existing feedlot. Apart from pen slope and pen floor permeability, there are no specific design requirements for pen layout and design.

The dimensions of production pens depend on the capacity of the pen, stocking density and the amount of feed bunk required.

7.5.2.1 Stocking Density

Stocking density has a significant influence on the environmental performance of a feedlot since it partly determines the average moisture content of the pen surface. Every day, beef cattle add moisture to the pen surface by depositing manure (faeces and urine).

The National Feedlot Code of Practice recommends a maximum stocking density of 25 m^2 per Standard Cattle Unit (SCU). Stocking densities higher than 20 m^2 per SCU can lead to increased pen dust loads, and require higher capacity for sedimentation and storage lagoons.

A stocking density of 12.9 m^2/head (15 m^2/SCU) has been chosen for production pens.

This stocking density achieves a balance between a pen surface that is, on average, too dry and one that is too wet for the local climate and cattle size.

7.5.2.2 Feed Bunk

As the feed ration shall generally be processed on-site and fed-out more than once a day an open feed bunk (troughs) system shall be used. Further, all types of rations, including those moist or containing large amounts of coarsely chopped fibre, can be fed in troughs.

An open feed bunk shall be located on the outside, along the entire length of the fence at the higher end of the pen with frontage to the feed road. An illustration of an open feed bunk installed at the existing feedlot complex is shown in Photograph 7.

Typically, the length of bunk space required per head ranges from 200 mm to 300 mm. A bunk space of 240 mm per head was selected as a shorter feed bunk space may restrict the opportunity of shy feeders to feed, particularly at the commencement of the feeding period.

Each feed bunk will have a 3.0 m wide concrete apron that extends into the pen (see Figure 17 and Photograph 8). A concrete apron prevents wearing of the pen surface within this high-use area. The apron will slope away from the bunk to facilitate drainage. The concrete apron shall be constructed to withstand the loading of cleaning equipment.

Photograph 7 – Existing feedlot – Typical feed bunk and feed alley

Photograph 8 – Existing feedlot – Feed bunk apron

7.5.2.3 Pen Capacity

The capacity of production pens is sized to match multiples of deck sizes of livestock transport vehicles. A double-deck semi-trailer would carry about thirty-four (34) 300 kg cattle per deck giving a total load of 68 head. A B-double load would be approximately ninety six (96) 340 kg cattle. The proposed development will be designed with a range of pen sizes in multiples of 96 head.

7.5.2.4 Pen Area

The combination of selected design parameters translate into pen areas ranging from some 1,244 m^2 to 2,488 m^2. The nominal bunk length (width) of a pen will range from 25 m to 50 m. The depth of each pen will be some 50 m depending on final pen layout and cattle lane/drain design. Figure 17 shows the layout of a typical feedlot pen.

7.5.2.5 Pen Orientation

The orientation of the pens has been chosen based on consideration of the topography of the site to minimise bulk earthworks and to accommodate shade structures in the event that shade is installed in the future.

Rows of pens running north-south (with shade structures orientated north-south) with the shade material oriented in an east-west direction maximises the amount of shade and provides optimal drying of the pen floor.

Subsequently, the proposed development has been designed with rows of pens running northeast-southwest (CDA 1) and north-west to south-east (CDA 2) as shown in Figure 16.

7.5.2.6 Pen Configuration

The proposed development shall have a sawtooth pen configuration. The sawtooth configuration has the feed alley servicing a single row of pens falling away from the road to the cattle lane/catch drain. The sawtooth layout is the only cost effective layouts for steeper sites (>2%) where the pen slope matches the natural slope.

At the centre of CDA 1 the sawtooth layout is mirrored to effectively form a single row of back-to-back pens. The back-to-back design has two parallel rows of pens separated and serviced by a common feed road. The back-to-back configuration has a central feed alley servicing pens on both sides of the roadway. The feed road shall be located on the higher side or at the ‘front’ of the pens. Both rows of pens drain away from the feed alley to a cattle lane/catch drain towards the ‘back’ of the pens, where each row shares a common cattle lane/catch drain, with another row of pens.

A combination of sawtooth and back-to-back configuration was selected as this layout is best suited to the site with its relatively high natural gradient (i.e. 4-5%) and undulating topography.

Each sawtooth row of pens shall be serviced by a combined cattle lane/catch drain. The back-to-back pens shall be serviced by a combined cattle/lane drain or separate cattle lane and drain as shown in Figure 17.

7.5.2.7 Pen Slope

Pen slope is the fall of the pen surface perpendicular to the feed bunk. A pen also has down-slope as a consequence of the lateral catch drain slope. Hence, where there is a combined pen and drain slope across the site, the maximum pen slope is not perpendicular to the feed bunk. The magnitude of this slope and its angle from perpendicular to the bunk will depend on the relative magnitude of each of the pen and drain slopes.

A pen slope of between 2.5% and 6% will ensure quick drainage of rainfall, but without runoff scouring excessive amounts of manure from the pen surface.

The pens shall be designed with a pen slope in the order of 4% which falls to lateral catch drains with a slope in the order of 1.0%, depending on final design. The pens slope from west to east or east to west depending on location.

The relative levels of the pens shall be designed to provide an approximate balance of cut and fill earthworks on the site.

Figure 17 shows the layout of a typical feedlot pen.

7.5.2.8 Water Trough

Prefabricated concrete water troughs will be installed along the dividing fence lines between two pens. A typical water trough installed at the end of a row at the existing feedlot is shown in Photograph 9. The troughs will be situated towards the drain-end of the pens. This will allow dirty water released during trough cleaning or as a result of spills to be directed out of the pen and into the catch drains by underground pipes. This will prevent the pen floors from being wetted during trough cleaning.

Concrete aprons at least 3.0 m wide will be constructed around all water troughs (see Figure 17). The aprons will be reinforced to withstand the loading of pen cleaning equipment.

Photograph 9 – Existing feedlot – Typical water trough (end pen)

7.5.2.9 Shade

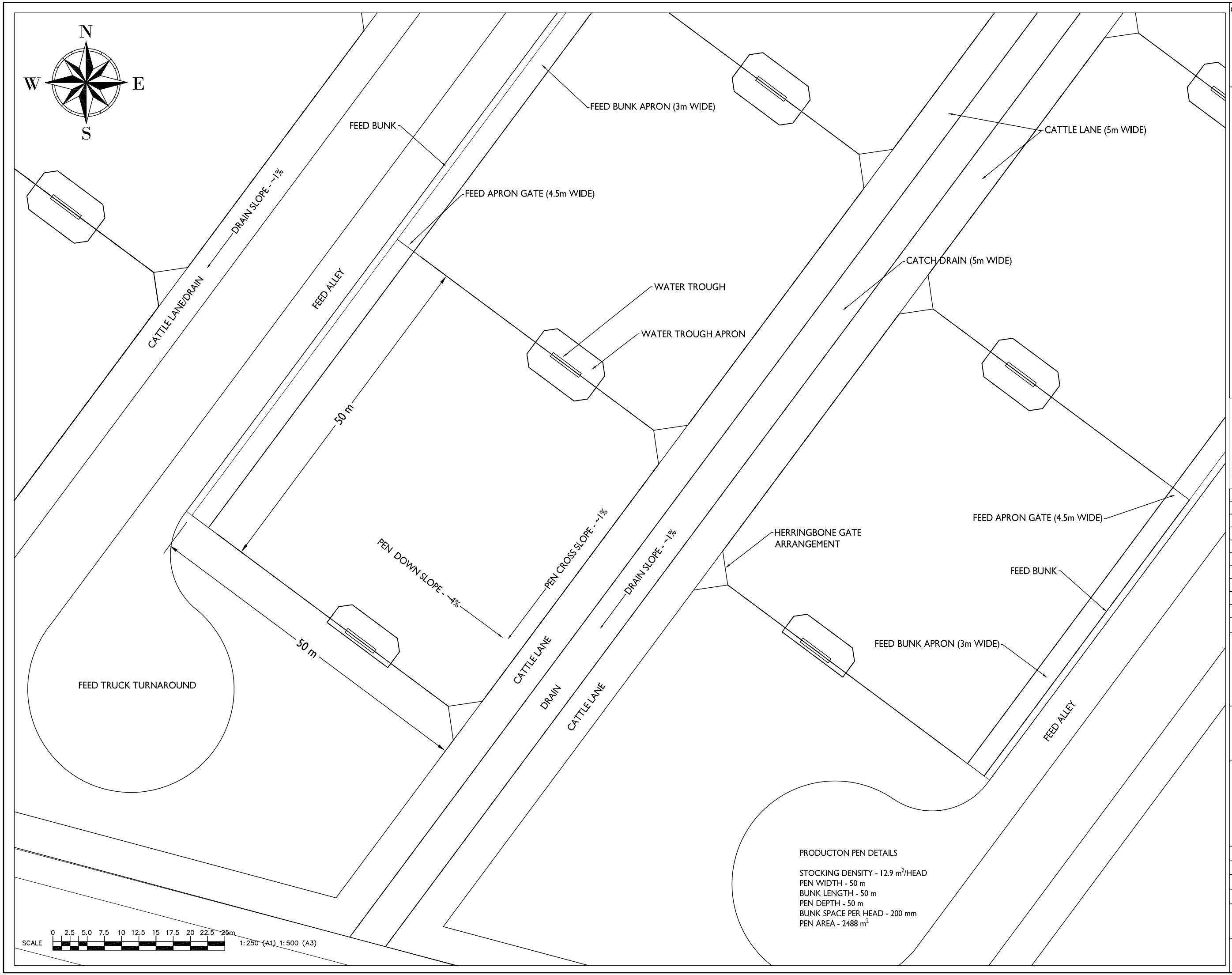
Whilst, beef cattle have a remarkable ability to cope with environmental stress, a combination of high temperature and humidity, with high levels of solar radiation and minimal air movement, can exceed the animal's ability to dissipate body heat. Therefore, excessive heat load (EHL) in feedlot cattle during summer months can result in significant production losses, animal welfare problems and, under extreme conditions, the death of cattle.

Subsequently, shade structures may be installed as one strategy to reduce the impact of heat load conditions on the cattle and this has been provisioned for in the design.

The pen layout orientation in a north-south direction considers the orientation of shade structures such that the pattern of the shade underneath maximises drying of the pen surface, and the local climate and prevailing winds that assist in ventilation and cooling.

The shade structures may be erected towards the centre of the pens so that cattle can follow the shaded area as it moves across the pen during the day. The structures shall be clear span with minimal obstructions (few or no support posts in pens) in the pen to allow easy cleaning and less risk of animal injury.

The type and nature of support structures and shade material has not be selected and designed at this stage. However, it is anticipated that the support structures shall be steel with either shade cloth and/or iron as shade material.



Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
TYPICAL PEN LAYOUT

Scales	1= 250 (A1) 1= 500 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	

Drawing No.	Issue
RU050500-PRS-PL-17	A

7.5.3 Livestock handling

Livestock handling facilities are located at the western side of the existing feedlot. These facilities have sufficient capacity to accommodate the livestock handling requirements of the expanded development.

7.5.4 Feed processing and commodity storage

The beef cattle in the proposed development require a nutritionally and scientifically formulated grain-based diet to meet production targets.

The proportions of the commodities used in the formulated ration will depend on the desired level of cattle performance, the nutrient content of the individual feed commodity, the quantity of the feed commodity available, the current price of each commodity and the desired beef carcase conformation.

Rations for the existing feedlot are prepared on-site in a facility, with associated commodity storage, handling and ration delivery infrastructure.

On-site feed preparation and commodity storage requires an integrated system of components and processes. The basic components in an on-site feed preparation facility include:

- grain storage and handling
- grain processing
- other commodity storage and management
- silage storage and management
- hay/straw storage and management
- storage and handling of liquid ingredients and supplements
- ration mixing and delivery systems.

The integrated components include storage structures (silos, sheds), handling equipment (augers, conveyors), grain processing and ration mixing and delivery operations.

The existing feedlot's feed preparation facility is located at the western side of the existing feedlot. Photograph 10 illustrates the grain processing infrastructure constructed at the existing feedlot. The grain processing facility shall be upgraded to increase the grain processing throughput to the capacity required for the expanded feedlot. A higher capacity roller mill and wetting silo shall be installed.

Photograph 11 illustrates the dry commodity and liquid ingredients storage infrastructure constructed at the existing feedlot.

Photograph 10 – Feed processing infrastructure

Photograph 11 – Commodity storage

7.5.5 Access and Internal Roads

Access and the layout of internal road systems are critical to the efficient and safe functioning of the proposed development.

The site entrance to the existing feedlot shall be used to access the proposed development. The existing site entrance shall provide efficient, functional and safe access. The site entrance to the existing feedlot is shown on Figure 9.

All incoming and outgoing vehicles shall travel past the administration office where a truck weighbridge is located. This provides security and control over site entry as well as improved inventory control.

Feed delivery roads shall be established between each row of pens in the back-to-back configuration or along the top of each row of pens in the sawtooth configuration. These roads would be approximately 6 m wide to enable vehicles to deliver feed to the feed bunks of the pens. The feed roads shall be constructed to:

- slope away from the feed bunk with a cross fall of approximately 2% towards the centre to ensure adequate drainage away from the feed bunk. The road will be constructed to also act as a clean water diversion bank to exclude clean water from the controlled drainage area
- produce a smooth finish to minimise wear and tear on feed trucks and reduce feed spillage
- withstand high traffic volumes and wheel loadings
- provide reliable all-weather access to the feed bunks.

A fit-for-purpose internal road system shall be established with adequate road width, turning radii, drainage, all-weather surface, adequate sight distance through intersections, curves and crests to provide good traffic flow around the site.

7.5.6 Administrative/Maintenance Infrastructure

A beef cattle feedlot requires facilities for conducting management, maintenance and administrative functions. This includes administration office, machinery workshop, weighbridge and associated facilities for example.

The existing feedlot has facilities and infrastructure developed for management, maintenance and administrative functions. These are located on the western side of the feedlot complex as shown in Figure 9. The administration office includes employee amenities such as a dining area, drinking water, toilets, hand-washing facilities, first aid station and car parking and meets minimum workplace health and safety standards.

These facilities have sufficient capacity to accommodate the requirements of the proposed development.

7.5.7 Washdown Facilities

7.5.7.1 Cattle

Reducing the manure, dirt and dags on the hides of cattle being presented for slaughter lowers the risk of meat contamination when the hide is removed after slaughter. Subsequently, the majority meat processors require that the hides of cattle are visibly clean before slaughter. Dags are accumulated balls of manure and soil that adhere to the coat or hair of cattle, and are most prevalent on the brisket, underbelly, tail and sides (ribs, flank).

A cattle washing system may be integrated into the dispatch facility or within an adjacent facility to facilitate washing of cattle before dispatch for slaughter. The cattle wash facility shall treat and recycle water from the storage lagoon.

A washing system typically involves soaking followed by high-pressure washing. During soaking, cattle are exposed to low pressure sprays in a soaking yard to soften dags, mud and dirt, and to wash loose manure and dirt out of the coat. Cattle are then subjected to a period of high pressure washing which may be manual hosing with high pressure hoses or an automatic system or a combination of both.

The cattle wash shall be located within the controlled drainage area of the existing feedlot and the wastewater directed towards the sedimentation basin and storage lagoon of the existing feedlot as shown in Figure 16.

7.5.7.2 Vehicle

Vehicle and machinery hygiene is important for biosecurity, maintaining operational efficiency, maintaining aesthetic appearance and facilitating mechanical servicing.

The existing feedlot has a vehicle washing facility for cleaning the various types of vehicles, mobile plant and machinery as required. These include front-end loaders, skid steers or bobcats, feed trucks, manure cartage and spreader trucks, tractors and tillage equipment, and livestock transport vehicles.

The vehicle washdown facility is located within the controlled drainage area of the existing feedlot with the wastewater directed towards the sedimentation basin and storage lagoon as shown in Figure 16. This facility has sufficient capacity to accommodate the requirements of the proposed development.

7.5.8 Lighting

Lighting is desired mainly for the convenience of the operator, for inspecting feed processing, handling cattle and administrative activities. Security and predator control are other advantages.

Whilst, the existing development requires illumination of a number of elements within the complex, for example:

- Lighting around the cattle handling facilities (receivals/dispatch/processing) to allow for night loading and unloading of cattle.
- Internal and external lighting within the administrative/maintenance infrastructure for general illumination and safety for night activities.
- Lighting within the feed storage and processing for illumination for feed preparation activities undertaken outside of daylight hours.

No lighting is required around the production pen area or the drainage systems. Subsequently, the proposed development shall not require outdoor lighting.

In the event outdoor lighting is required, it will comply with Australian Standard AS1158.1.1 (1997 – Road Lighting) and AS4282 (1997 – Control of the Obtrusive Effects of Outdoor Lighting).

7.5.9 Controlled drainage area

Stormwater runoff from areas such as pens, livestock handling, solid waste storage and processing area and silage storage area has a high organic matter and therefore a high pollution potential. This runoff is controlled within a system that collects and conveys this runoff to a sedimentation basin and storage lagoon prior to environmentally acceptable utilisation.

The proposed development shall have two discrete controlled drainage areas. The controlled drainage areas are referred to as CDA 1 and CDA 2. Each controlled drainage area shall include the following elements:

- production pens
- cattle lanes
- feed lanes or alleys
- run-off catch drains
- sedimentation system
- storage lagoon.

The controlled drainage area is divided into three main sub-component areas, each of which has different runoff characteristics. These areas are:

- pen area – areas containing cattle and covered with manure e.g. production pens.
- hard catchment – areas with a high runoff yield including feed roads, cattle lanes, catch/main drains, sedimentation basin etc.
- soft catchment – areas with a low runoff yield such as grassed and other vegetated areas within the controlled drainage area.

Figure 18 and Figure 19 show the controlled drainage area plan for the proposed development. The location of each controlled drainage area along with their respective pen, hard and soft areas is shown on Figure 18 and Figure 19.

Table 11 summaries the areas of the sub-catchments shown in Figure 18 and Figure 19. The sub-component catchment areas are needed to calculate the design volumes for the sedimentation basin and storage lagoon (see Sections 7.5.10.1 and 7.5.10.2) for each controlled drainage area respectively. Varying runoff coefficients are applied to the different sub-catchments depending on surface characteristics as outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006).

Table 11 – Controlled Drainage Area catchment details

Sub-Component Catchment	CDA 1 Area Ha	CDA 2 Area Ha	Runoff Coefficient
Pens – production	6.00	7.63	0.8
Hard – feed roads, cattle lanes / drains, sedimentation basin	2.46	2.73	0.8
Soft – grassed areas	1.75	2.43	0.4
Storage Lagoon – inside crest surface area	0.88	0.91	1.0
Total	11.09	13.7	-

NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
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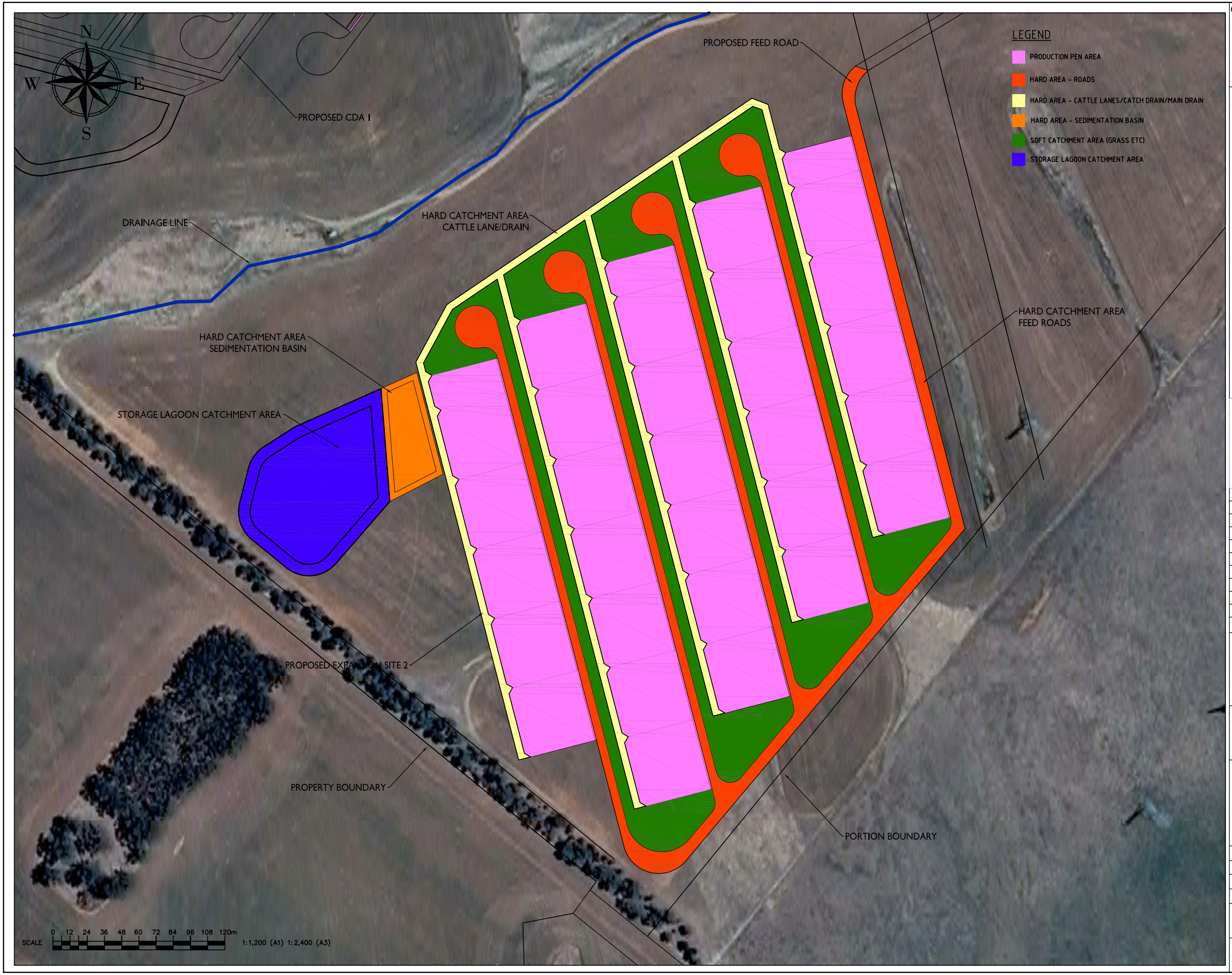
Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
PROPOSED CONTROLLED DRAINAGE AREA 1 PLAN

Scales	1= 1,000 (A1) 1= 2,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-CD1-18	A



NOTES:

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
PROPOSED CONTROLLED DRAINAGE AREA 2 PLAN

Scales	1= 1,200 (A1) 1= 2,400 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No. RU050500		Bldg No	
Drawing No. RU050500-PRS-CD2-19		Issue	A

7.5.10 Drainage system

Each controlled drainage area contains a system including catch drains, sedimentation system and storage lagoon for conveying stormwater, allow entrained sediment to 'settle out' and capture and storage of the stormwater from the controlled drainage area respectively.

Uncontaminated upslope runoff shall be diverted away from each controlled drainage area in order to minimise the quantity of contaminated runoff requiring treatment. An earthen diversion bank shall be constructed upslope of each controlled drainage area (northern end of the proposed development) as the extraneous drainage exclusion system to divert clean stormwater into the existing drainage line (Figure 18 and Figure 19). There is a vegetative buffer approximately 100 m wide between each controlled drainage area and the closest drainage line being an unnamed watercourse. This buffer distance will offer very good environmental protection.

The diversion bank(s) design specifications include:

- carry peak flow rates resulting from a design storm event with an average recurrence interval of 20 years at non-scouring velocities
- provide embankment batters of 1V:2H or greater
- provide embankment freeboard of 0.5 m above the peak flow height.

Stormwater runoff from each controlled drainage area shall initially drain into a collection drain system, discharging into a sedimentation system and, finally, through to the storage lagoon.

Catch drains are located along the bottom of each row of pens. Catch drains flow into a main drain that flows into the sedimentation basin. Drains shall be designed to produce velocities sufficient to transport manure without the solids settling, but not sufficient to produce scouring and erosion.

Catch drains shall also be used as cattle lanes and access for pen cleaning equipment to each pen. Therefore, catch drains shall be topped with a durable all-weather surface to permit access by cleaning equipment.

The specifications outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) shall be used to design the catch drains. The catch drains design specifications include:

- carry peak flow rates resulting from a design storm event with an average recurrence interval of 20 years at non-scouring velocities, using a runoff coefficient of 0.8.
- provide embankment batters of 1V:2H or greater
- Design storm is a site specific rainfall event with a 20 year recurrence interval which has a duration equal to the catchment's time of concentration

The main drain directs stormwater runoff into a sedimentation basin. The aim of the sedimentation basin is to allow the entrained manure and other solids to 'settle' from the stormwater runoff before it enters the storage lagoon.

7.5.10.1 Sedimentation System

The sedimentation basins are typically wide, shallow storages, having a maximum water ponding depth less than 1 m. They are designed to drain completely (down to bed level) following a runoff event. Solids are deposited in relatively thin layers over a large area, facilitating rapid drying after the basin has drained of liquid material. The dried solids are then removed at the earliest possible opportunity and stockpiled in the solid waste storage area.

The specifications outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) were used to design each sedimentation basin. The sedimentation basin design specifications include:

- cater for the peak flow rate from a design storm having an average recurrence interval of 1 in 20 years with a duration equal to the time of concentration of the feedlot controlled drainage area; using runoff coefficients of 0.8 from production pens, roadways and other hard standing areas and 0.4 for grassed areas within the controlled drainage area
- have a top water level of ≤1.2 m
- provide embankment freeboard of 0.9 m above the top water level
- provide embankment batters of 1V:2H or greater
- achieve effluent flow velocities of 0.005 m/s or less which are sufficient to enable the settlement of at least 50% of entrained solids.

The sedimentation basin shall have a control outlet designed to temporarily retain stormwater within the sedimentation system. The control outlet regulates the discharge from the sedimentation system into the storage lagoon allowing the stormwater to drain freely from the entire depth of the settled sediment down to the bed of the basin and safely discharges flows in excess of the design flow. The horizontal slatted weir control outlet at the existing feedlot sedimentation basin is shown in Photograph 12.

Photograph 12 – Sedimentation basin horizontal slatted weir control outlet

The methodology outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) was used to calculate the required sedimentation basin volume.

The formula for determining the required volume of the sedimentation basin that will service each controlled drainage area is:

$V = Q_p \times (L/W) \times (\lambda/v)$ ..... Equation 1

Where:

V = sedimentation system volume (m^3)
Q_p = peak inflow for a design storm with an average recurrence interval of 20 years and duration equal to the time of concentration of the catchment (m^3/s)
L/W = length to width ratio, where l is the length in direction of flow
λ = a scaling factor (2.5 for a basin)
v = flow velocity (m/s), <0.005 m/s

The methodology outlined in the National Feedlot Guidelines (MLA, 2012a) was used to determine Qp for the above relationship.

Table 12 summarises the input parameters used to determine the minimum required volume of the sedimentation basin.

Table 12 – Sedimentation basin design details

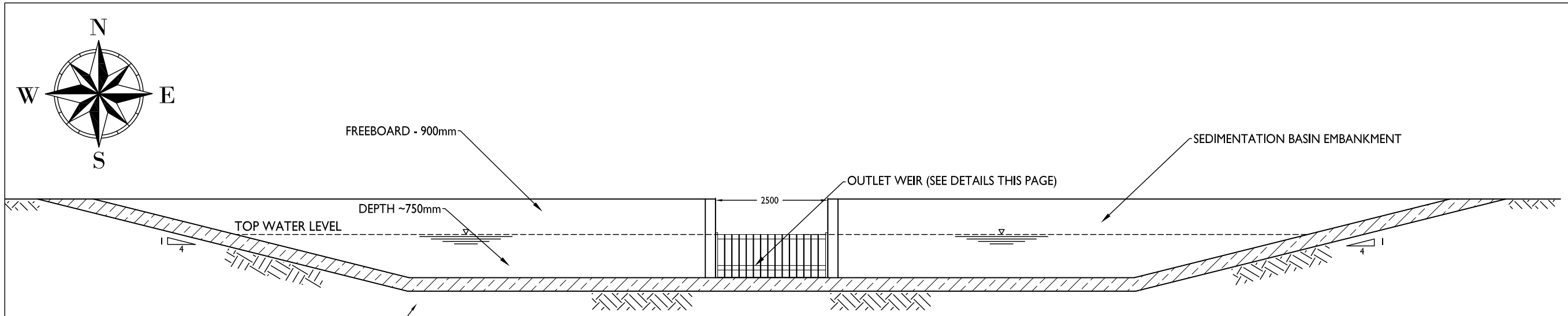
Parameter	Units		SA Guidelines	
			CDA 1	CDA 2
Time of concentration	hours	T_c	0.19	0.30
Time of concentration	minutes	T_c	11.5	17.7
Rainfall Intensity	mm/hr	$I_{tc,20}$	70.7	55.7
Peak flow rate	m^3/s	Q_p	1.47	1.16
Lambda		λ	2.5	2.5
Length:Breadth ratio at TWL		L/W	~8	~2.4
Design flow velocity	m/s	v	0.005	0.005
Required volume	m^3	V	1,833	1,444
Volume proposed (minimum)	m^3	V	1,875	1,450

There are several acceptable methods for determining the time of concentration of a small catchment. The time of concentration (Tc) is the time taken for rain that has fallen in the farthermost part of a catchment to flow to the discharge point. Thus after Tc, the whole of the catchment is contributing to the discharge and the peak flow (Q) will only occur after this time. The methodology outlined in the National Feedlot Guidelines (MLA, 2012a) was used to determine the time of concentration of each catchment.

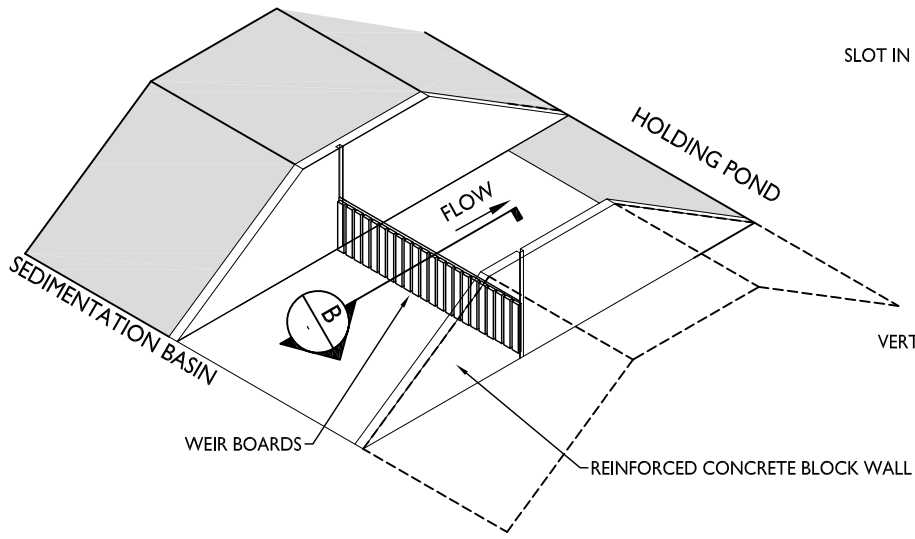
The rainfall intensity was selected from Intensity-Frequency-Duration (IFD) design rainfalls for the site for an average recurrence interval of 20 years and duration equal to the time of concentration of the catchment. The IFD design rainfalls for the site were obtained from the Bureau of Meteorology (BOM, 2016) and are shown in Table 6 in Section 5.1.1.

The minimum calculated volume for CDA 1 and CDA 2 is 1,833 m^3 and 1,444 m^3 respectively calculated by the method outlined in the SA Feedlot guidelines. The sedimentation design volume for CDA 1 and CDA 2 shall be a minimum of 1,875 m^3 and 1,450 m^3 respectively. The geometry of each sedimentation basin shall be shaped with existing topography to minimise land reshaping and earthworks.

Figure 18 shows the location of the sedimentation basin in relation to the production pens for CDA 1. Figure 19 shows the location of the sedimentation basin in relation to the production pens for CDA 2. Figure 20 shows a typical cross section of the sedimentation basin and outlet weir.



A/18 TYPICAL SECTION THROUGH SEDIMENTATION BASIN EMBANKMENT



TYPICAL CONTROL WEIR
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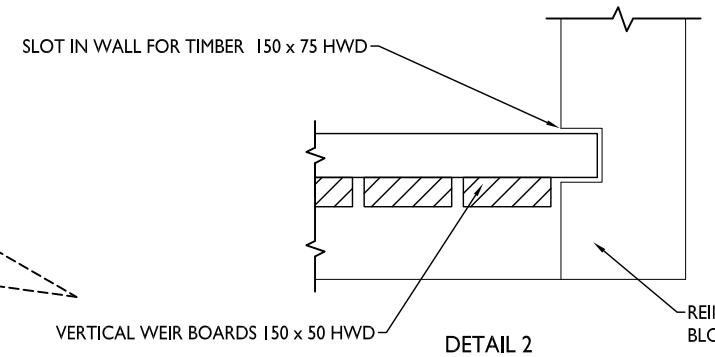
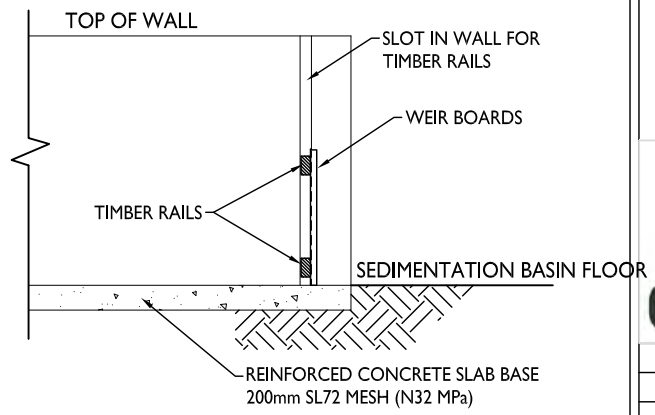
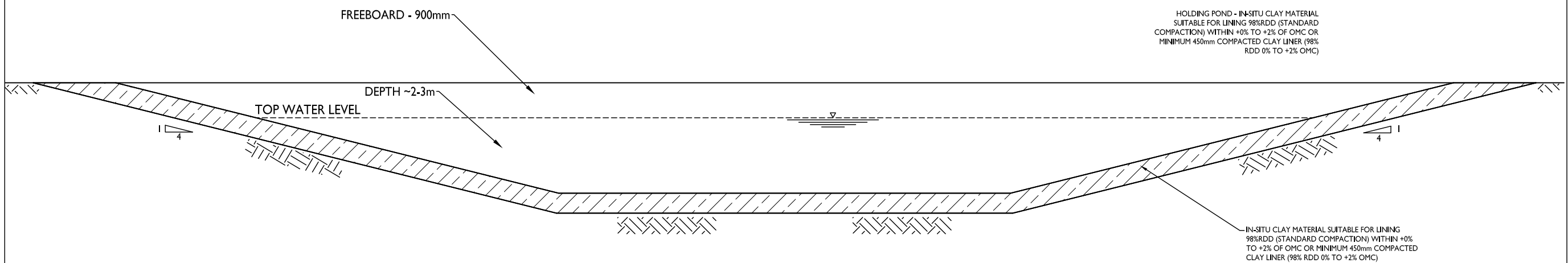


DETAIL 2
PLAN VIEW



B/- TYPICAL SECTION THROUGH CONTROL STRUCTURE



SCALE 0 27.5 55 82.5 110 137.5 165 192.5 220 247.5 275m
1:50 (A1) 1:100 (A3)

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
SEDIMENTATION BASIN AND OUTLET WEIR TYPICAL SECTIONS

Scales	1= 50 (A1) 1= 100 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No. RU050500		Bldg No	
Drawing No. RU050500-PRS-SBW-20		Issue	A

7.5.10.2 Storage Lagoon

A storage lagoon shall be located at the lower end of each controlled drainage area, immediately below the sedimentation basin. The storage lagoon shall be designed to temporarily store stormwater runoff (liquid waste) from winter rainfall so that lagoon overtopping events are prevented and / or limited to an acceptable frequency. Liquid waste will be stored in the storage lagoon pending application to the liquid waste utilisation area or lost through evaporation.

The criteria outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) was used to calculate the required storage lagoon volume and design parameters.

The Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) states that storage lagoons should:

- be of sufficient capacity to accommodate the runoff from May to October inclusive with an average recurrence interval of 20 years
- provide embankment freeboard of 900 mm above the top water level
- provide embankment batters of 1V:3H or greater and embankment width of at least 5 m for safe machinery access during construction and cleanout
- incorporate a spillway to cater for the peak flow rate from a design storm having an average recurrence interval of 1 in 50 years at non-scouring velocity.

The methodology outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) was used to calculate the required storage lagoon volume for each controlled drainage area.

The formula for determining the required volume of the storage lagoon that will service each controlled drainage area is:

$Q = [(Rp \times Ap) + (Rb \times Ab) + ((D - E) \times Al)] \times 10 \times SF$ ..... Equation 2

where Q = Volume (kilolitres)

Rp = May to October inclusive runoff from the pens, with a recurrence interval of 20 years or greater (mm)
Ap = Area of pens (ha)
Rb = May to October inclusive runoff from rest of CDA, with a recurrence interval of 20 years or greater (mm)
Ab = Area of rest of CDA (ha)
D = May to October inclusive rainfall with a recurrence interval of 20 years or greater (mm)
E = Average May to October inclusive lagoon evaporation (mm)
Al = Surface area of the lagoon (ha)
SF = Safety Factor - usually 1.25

Runoff (May to October = 0.5 x (May to October rainfall - 200) inclusive) (mm) (relationship derived from research data)

May to October rainfall = numerically equivalent to mean rainfall for a 1 in 20 year annual rainfall (mm) recurrence.

The May to October rainfall for a 1 in 20 year annual rainfall (mm) recurrence for the proposed development site is provided in Table 5.

Table 13 – Storage Lagoon Design

Parameter	Units	CDA 1	CDA 2
Pen area	m^2	60,000	76,250
Hard area	m^2	24,560	27,330
Soft area	m^2	17,480	24,295
Lagoon area	m^2	8,815	9,050
May-Oct Rainfall	mm	406	406
Safety Factor		1.25	1.25
Required lagoon volume	kL	12,650	15,880
Proposed lagoon volume	kL	12,750	16,000
Proposed lagoon volume	ML	12.75	16.00

The storage lagoon shall have a bywash capable of discharging the peak flow from the controlled drainage area from a 50-year ARI design storm.

A minimum freeboard of at least 900 mm shall be provided between the crest of the discharge weir and the crest of the storage lagoon embankment.

The storage lagoon for CDA 1 and CDA 2 have a minimum design maximum operating level (bywash) volume of 12.75 ML and 16 ML respectively as shown in Table 13.

7.5.11 Solid and liquid waste management system

The disposal of solid waste and liquid waste is a major consideration in the siting, structure and management of a beef cattle feedlot. The proposed development shall produce significant amounts of solid and liquid wastes as outlined below.

7.5.11.1 Solid Wastes

7.5.11.2 Manure

Manure is the solid waste produced by cattle. Manure is the faeces and urine excreted by the cattle. Since manure includes both faeces and urine, freshly excreted manure has a moisture content of around 90%. However, it usually dries quickly once deposited on the pen surface.

Excreted manure consists of:

- total solids (TS) – the dry matter content of the manure made up of volatile and fixed solid components
- volatile solids (VS) – the organic fraction of TS

- fixed solids (FS) or ash – the inorganic fraction of TS
- moisture – determined from the weight of the material less TS.

Manure also includes those solids that have settled from the stormwater runoff in the sedimentation basin and which are removed after drying. Manure is the major solid waste for management.

7.5.11.3 Waste Feed

Typically, in well managed feedlots, very low levels of feed commodities or rations are wasted through spillage or spoilage. However, feed rations in feed bunks may become wet and unpalatable in rainy weather and cattle may go off their feed. Under these circumstances the ration is spoiled and removed from the bunk and deposited within the pen or taken directly to the solid waste storage and processing area.

7.5.11.4 Mortalities

The mortality rate in beef cattle feedlots is generally low and constant (less than 1%). The mortality rate in the existing feedlot is about 0.9% and 0.95% for domestic and mid fed cattle respectively.

Carcases are removed from the pens following the daily pen inspection.

Composting is currently the method used for disposal of carcases as composting yields a product for utilisation and is ecological sustainable when compared to other methods of disposal such as burial and incineration.

It is proposed to compost carcases from the proposed development in the existing feedlots solid waste storage and processing area (Figure 9). Most Australian feedlots use composting for managing mortalities (MLA, 2012b).

Whilst, carcases of the expected small numbers of mortalities shall be composted, a contingency plan to manage the disposal of large numbers of unexpected mortalities shall be developed in accordance with relevant guidelines and form part of the proposed developments quality assurance and NFAS standards. Section 7.8.14 outlines the process for the emergency disposal of mass mortalities.

7.5.11.5 Solid Waste Storage

A solid waste storage area is needed to temporarily store manure after it has been removed from pens. Stockpiling allows pens to be cleaned out as frequently as required, even when spreading machinery is not available, when agricultural land is not ready for the application of manure or when it may not be possible to directly remove it from the site.

The stockpiled manure will commence to decompose anaerobically. The stockpiled manure may be actively composted to accelerate the decomposition process and enhance its value. Anaerobic bacteria break down the organic matter, reducing the total dry weight of the manure. The nitrogen content is reduced by its conversion to gaseous forms that are released to the atmosphere during the decomposition process, making it less valuable as an organic fertiliser. The concentration of other less volatile and less soluble nutrients such as phosphorus, increase in the stockpile as the volume of manure decreases. The anaerobic decomposition process generates considerable heat.

Temperatures up to 54°C are commonly experienced. The heat generated in well-managed stockpiles may be sufficient to sterilise any weed seeds and a significant proportion of potentially harmful pathogens contained in the manure.

The handling properties of the manure is also enhanced by stockpiling as clumps of manure are broken up and reduced in size.

The composting of mortalities shall be undertaken within the solid waste storage and processing area.

The storage, processing and/or composting of solid wastes shall be undertaken within the existing feedlots solid waste storage and processing area. This area is a suitably designed and constructed area within the controlled drainage area of the existing feedlot. The design criteria include:

- Impervious base
- Good drainage
- Provision of sufficient area.

The solid waste storage and processing area of the existing feedlot was constructed using the specifications similar to those outlined in Section 7.7.1.15.

Figure 9 shows the location of the solid waste storage and processing area on the existing development. The solid waste storage area has a floor slope of 1-3% to ensure drainage to the sedimentation basin. The existing solid waste storage and processing area encompasses an area of some 18,500 m^2 (1.85 ha).

From Section 7.8.4.1, BEEFBAL (QPIF, 2004) estimates some 3,735 t of manure (dry matter) harvested from the pens per year. Based on a scraped manure moisture content of 49%, this translates into some 7,625 t of wet scraped manure per year.

The area required for solid waste storage was based on the estimated volume of solid waste produced from BEEFBAL (QPIF, 2004) and assuming each solid waste windrow is triangular shaped, with 1 vertical to 4 horizontal batters (1V:4H) and no higher than 4.5 m and a bulk density of solid waste of about 0.6 t/m^3.

With the assumed windrow dimensions some 8,200 m^2 of pad area is required to store and process manure and allowing additional space for carcass composting and solid waste processing equipment, screening etc, the solid waste shall be able to be accommodated in the existing solid waste storage and processing area of some 18,500 m^2 (1.85 ha).

As shown in Table 27, it is expected that approximately 3,735 tonnes of solid waste on a dry matter basis would be scraped from the production pens each year during the operation of the proposed development. This translates into some 2,905 t of dry matter available for utilisation after stockpiling

7.5.11.1 Liquid Waste

Stormwater run-off from the controlled drainage area is described as ‘effluent’. Because it has been in contact with manure, the effluent is high in nutrients and has the potential to pollute surface water

and groundwater. Effluent shall be collected, temporarily held in the sedimentation basin and then stored in the storage lagoon until it can be used as outlined in Section 7.5.10.

7.5.11.2 Waste Utilisation Area

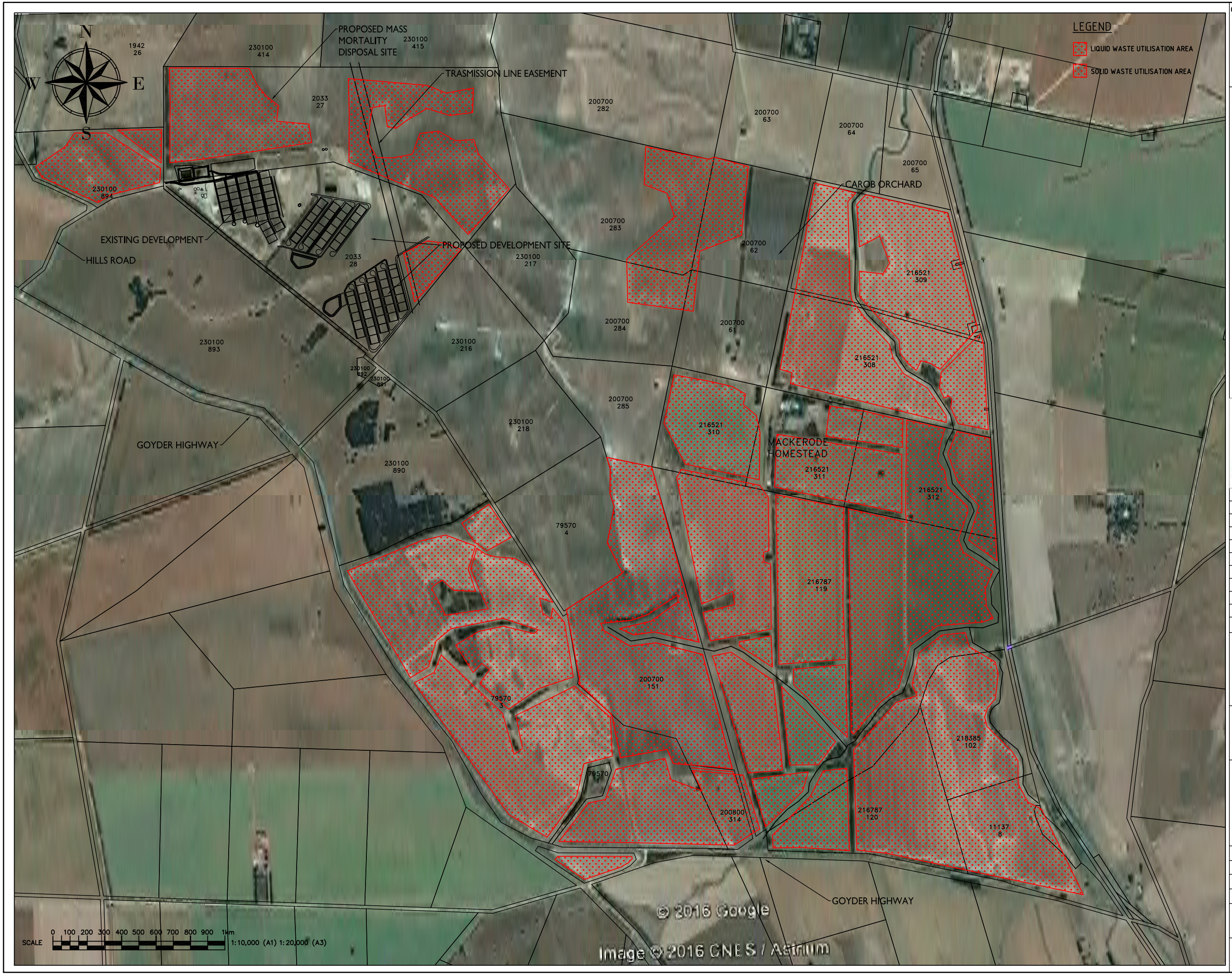
Liquid and solid waste is valued as a source of nutrients for fertilising crops and therefore, shall be applied to land where it can be sustainably utilised by crops and soil. Land is required for the long term application of water, nutrients, salts and organic loads in the liquid and solid wastes. The soils of these areas shall be productive however, less productive soils may be used, but lower productivity means lower application rates and more land area is required.

The solid and liquid waste utilisation areas have been selected and sized to be ecologically sustainable to prevent environmental harm, especially to soils, groundwater and surface water.

The liquid waste utilisation system is a full utilisation system. In this system, the liquid waste is fully used (thereby no discharges to surface waters), with the area required for irrigation determined by calculating the limiting land area using a nutrient balance.

The amount of water, nutrients and organic matter for optimum sustainable production of the cropping system is a function of the crop, the agronomic system employed, and site-specific factors such as climate, topography and soil type. Subsequently, the application rates depend on factors such as the liquid and/or solid waste chemical characteristics, soil physical and chemical characteristics, type of crop and climate.

The methodology for sizing the liquid and solid waste utilisation area is provided in Section 10.7. Figure 21 shows that approximately 885 ha of land is available on the subject property for liquid and solid waste utilisation. The land area required for liquid and solid waste application was determined by calculating the limiting land area using a nutrient balance.



NOTES:

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
LIQUID AND SOLID WASTE UTILISATION AREA

Scales	1= 10,000 (A1) 1= 20,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-WUA-21	Issue	A

7.6 Separation Distances

The proposed development shall minimise adverse impacts on the amenity of the surrounding community and environmental impacts such as water quality degradation, dust and odours. This will be achieved by appropriate siting, design and management practices and suitable separation between the proposed development and impact areas.

The proposed development in relation to existing residential development, rural-residential development, rural residences and other sensitive land uses is shown on Figure 8.

7.6.1 Fixed Separation Distances

The Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) outline recommended separation distances between the boundary of the proposed development and various relevant features.

The proposed separation distances between the boundary of the proposed development and each of the relevant features as shown in Table 14. These buffer distances are based on recommended separation distances in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) and site-specific risk assessment. Figure 22 illustrates the proposed separation distances between the boundary of the proposed development and each of the relevant features shown in Table 14.

Table 14 – Proposed fixed separation distances

Feature	Separation distance m
Public road - except as below	200
Public road - unsealed with less than 50 vehicles per day excluding feedlot traffic	50
Major watercourse	200
Other watercourse as defined by a blue line on a 1:50000 current SA Government topographical map	100
Property boundary	20

NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. MAGE SOURCED FROM GOOGLE EARTH™ MAY 2016
3. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

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Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
FIXED SEPARATION DISTANCES PLAN

Scales	1= 2,750 (A1) 1= 5,500 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-FSD-22	Issue	A

7.6.2 Variable Separation distances

Section 10 demonstrates that the proposed development has the capability for sustained compliance with relevant dust, noise and odour, does not detract from visual amenity, away from incompatible land uses and does not impact on road safety and traffic levels.

This assessment identifies required separation distances from the proposed development to the closest sensitive receptors. Required separation distances were calculated to prevent impacts of odour, dust and noise on neighbours and the closest urban centre.

According to the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006), the S-Factor method can be used to determine minimum separation distances required between various types of receptors and a beef cattle feedlot development. The S-Factor method provides a conservative estimate as to the required separation distance.

The S-Factor equation is:

$D = \sqrt{N} \times S$ ..... Equation 3

where:

D = Separation distance in metres between the closest points of the feedlot, including the pens, manure storage areas, effluent system and loading or unloading facilities and the most sensitive receptor or impact location.

N = Maximum number of standard cattle units (SCUs) at any one time. A Standard Cattle Unit is defined as a beast of 600 kilograms live weight as outlined in Section 7.4.

S = composite S factor, where

$S = s1 \times s2 \times s3 \times s4 \times s5$,

where:

s1 = design and management factor,

s2 = receptor type factor,

s3 = topography or terrain factor,

s4 = vegetation factor,

s5 = wind direction factor,

7.6.2.1 Composite Site Factor - S

The value of S to apply in equation 3 depends on site specific information pertaining to the proposed stocking density, population centres or homes and intervening terrain factors. The factors s1, s2, s3, and s4 were determined from Tables 4, 5, 6 and 7 respectively from the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006).

The separation distances were based on a development capacity of 13,492 SCU which includes both the proposed expansion capacity (9,083 SCU) and the existing feedlot capacity (4,409 SCU).

The available and required separation distance between the closest sensitive receptors and the proposed development are shown in Table 15.

Table 15 – SA Feedlot Guidelines separation distances (Department of Primary Industries and Resources (SA), 2006)

Receptor Number	Direction	Receptor Type, s2	Night time drainage, s3	Surface roughness, s4	s1	s2	s3	s4	Separation Distances (m)		Comment
									Required	Available	
1 (Mt Bryan)	NE	Towns > 100 persons	High relief > 10% from site or significant hills and valleys between cattle feedlot and receptor	Significant hills and valleys	77.3	1.2	0.7	0.7	5,131	**4,880**	Insufficient
2	NE	Rural farm residence	High relief > 10% from site or significant hills and valleys between cattle feedlot and receptor	Significant hills and valleys	77.3	0.3	0.7	0.7	1,283	**2,715**	Sufficient
3	SE	Rural farm residence	Flat	Few trees, long grass, crops	77.3	0.3	1.0	1.0	2,695	**2,780**	Sufficient
4	S	Rural farm residence	Flat	Few trees, long grass, crops	77.3	0.3	1.0	1.0	2,695	**3,120**	Sufficient
5	SW	Rural farm residence	Flat	Few trees, long grass, crops	77.3	0.3	1.0	1.0	2,695	**3,860**	Sufficient
6	W	Rural farm residence	Flat	Few trees, long grass, crops	77.3	0.3	1.0	1.0	2,695	**2,785**	Sufficient
7 (Booborowie)	W	Towns > 100 persons		Undulating hills	77.3	1.2	0.7	0.9	7,017	**7,525**	Sufficient
8 (Burra)	SE	Towns > 100 persons	Low relief at > 2 % from site	Significant hills and valleys	77.3	1.2	1.2	0.7	8,796	**11,000**	Sufficient

Table 16 – National Feedlot Guidelines separation distances (MLA, 2012b)

Receptor Number	Direction	Receptor Type, S2	Terrain, S3	Vegetation Cover, S4	S1	S2	S3	S4	S5*	Separation Distances (m)		Comment
										Required	Available	
1 (Mt Bryan)	NE	Medium Town > 125-500 persons	High relief terrain	Crops only (no effective tree cover)	52	1.1	0.7	1.0	1.0	4,650	**4,880**	Sufficient
2	NE	Rural farm residence	High relief terrain	Crops only (no effective tree cover)	52	0.3	0.7	1.0	1.0	1,268	**2,715**	Sufficient
3	SE	Rural farm residence	Undulating low relief terrain	Crops only (no effective tree cover)	52	0.3	0.9	1.0	1.0	1,630	**2,780**	Sufficient
4	S	Rural farm residence	Undulating low relief terrain	Crops only (no effective tree cover)	52	0.3	0.9	1.0	1.0	1,630	**3,120**	Sufficient
5	SW	Rural farm residence	Undulating low relief terrain	Crops only (no effective tree cover)	52	0.3	0.9	1.0	1.0	1,630	**3,860**	Sufficient
6	W	Rural farm residence	Undulating low relief terrain	Crops only (no effective tree cover)	52	0.3	0.9	1.0	1.0	1,630	**2,785**	Sufficient
7 (Booborowie)	W	Medium Town > 125-500 persons	High relief terrain	Crops only (no effective tree cover)	52	1.1	0.7	1.0	1.0	4,650	**7,525**	Sufficient
8 (Burra)	SE	Medium Town > 500-2000 persons	Undulating low relief terrain	Crops only (no effective tree cover)	52	1.2	0.9	1.0	1.0	6,523	**11,000**	Sufficient

*Normal wind direction

NOTES:

1. CADASTRAL INFORMATION SOURCED FROM MAPLAND – SOUTH AUSTRALIA DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES (DEWNR) MAY 2016 AND ACCURACY IS LIMITED.
2. IMAGED SOURCED FROM LAND SERVICES GROUP – GOVERNMENT OF SOUTH AUSTRALIA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE.
3. OTHER FEATURES MAY HAVE BEEN DIGITISED FROM PLANS OR AERIAL PHOTOGRAPHS AND ACCURACY IS LIMITED

Date	Issue	Amendment	Init	App
31/05/16	A	ISSUE FOR REVIEW	RJD	BJO

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Project

PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title

VARIABLE SEPARATION DISTANCE PLAN

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	31/05/2016
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-VSD-23	Issue	A

7.7 Construction

The construction phase shall commence after development consent and any other relevant permits are obtained and detailed design and component specifications have been completed.

Operational requirements, funding limitations and other considerations may dictate that construction of the proposed development may be undertaken in a staged manner. Each stage shall be tailored to match operational requirements and required market levels, with the basic philosophy being able to ensure that maximum use is made of existing infrastructure in subsequent development stages.

7.7.1 Construction Process

The process of constructing the proposed development involves a number of steps. A brief outline of these steps is provided in the following sections.

7.7.1.1 Area Set-out

The proposed development layout must be transferred from design to on-ground at the site with precision and detail. The approach shall include the traditional method of pegging the physical position as well as using GPS-guided machinery.

GPS-guided (machine control) plant provides independent operation and less survey pegging resulting in significant cost benefits, improved accuracy, easy design updates, the inclusion of unplanned works and increased safety. All construction machinery can be equipped with machine-control.

7.7.1.2 Clearing and Grubbing

Clearing is carried out in advance of any earthwork operations on areas affected by earthworks or other areas to be cleared as designated on the approved design layouts.

The proposed development site is predominantly devoid of vegetation, however a few isolated paddock trees are to be removed.

If required, the area to be cleared is that required by site works, including the area occupied by the pens, feed roads, drains, sedimentation basin and storage lagoon plus appropriate clearance of some 5 m beyond tops of cuts and toes of embankments.

The absolute minimum area for construction of site works shall only be cleared. Before clearing commences, the limits of clearing shall be marked by pegs placed at 25 m intervals around the area to be cleared.

Clearing consists of the removal of vegetation both living and dead, all man-made structures, all rubbish and other materials are unsuitable for use in the works except where such trees, vegetation,

structures etc. are designated for preservation. Any vegetation or man-made structures to remain shall be appropriately marked.

Trees that shall be preserved shall be protected during site works by the erection of barricades, generally at a distance of 4 m from the trunk of the tree,

The material to be cleared shall include, but not be limited to, trees, stumps (parts above ground), logs, bushes, undergrowth, grasses, large rocks and fences.

Grubbing consists of the removal of vegetation, the bases of stumps, roots and other obstructions to a depth not less than 300 mm below the natural surface or 1.5 m below the finished surface level whichever is the lower in areas where bulk earthworks will be required unless otherwise specified in the earthworks specifications.

Holes remaining after trees and stumps have been grubbed shall be backfilled with sound material to prevent the infiltration and ponding of water. The backfilling material shall be compacted to at least the relative density of the material existing in the adjacent ground.

The cleared vegetation may be chipped and mulched and stockpiled for subsequent use in landscaping or for use at other locations as appropriate.

7.7.1.3 Bulk Earthworks

Bulk earthworks create the foundations of the engineering works on the site such as pens, runoff and drainage control, drains, feed roads, sedimentation basin and storage lagoon.

The standard of the bulk earthworks will have a profound effect on protection of the environment and the ongoing maintenance costs of the proposed development.

7.7.1.4 Blasting

Due to the material strata, no blasting is expected to be required during the construction of the proposed development.

7.7.1.5 Topsoil Stripping

Topsoil is surface soil which is normally high in organic material and contaminated by residual grass seed and grass roots and reasonably free from subsoil, refuse, clay lumps and large stones.

Topsoil is unsuitable for use in bulk earthworks due to the high organic matter and contamination by other materials (e.g. rocks and timber).

Topsoil can only be removed once clearing and grubbing and disposal of materials have been completed and sediment and erosion control measures have been implemented on that section of the works.

Topsoil shall be stripped to a minimum depth of around 100 mm with the stripped material to be stockpiled in areas outside of the area to be covered by the works for subsequent spreading on areas marked for revegetation upon completion of construction.

Topsoil shall be placed in layers not exceeding 200 mm to a maximum height of 2.5 m and a maximum batter slope of 1V:2H.

To minimise erosion, stockpile batters shall be track rolled or stabilised by other acceptable means. Temporary erosion and sedimentation control measures to protect the stockpiles may be installed dependent on time of construction.

7.7.1.6 Material Suitability

The suitability of material for construction is assessed on the basis of its geotechnical qualities. Soil testing, during site investigations, determines the nature of the material on the proposed development site.

Soils may need to be mixed or engineered to produce a material that meets the foundation, sub-base or lining specifications. The parameters of interest include permeability (for protecting groundwater) and strength (for trafficability).

Even though soil investigations may indicate that materials are suitable for construction, unsuitable materials may still be encountered below the designed level of excavations. Unsuitable material shall be excavated and disposed of as directed to spoil or as fill in areas in which it would be deemed suitable.

Material excavated and suitable for placement in the pen foundation or clay lining shall be subject to the suitability requirements outlined in the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) and/or National Feedlot Guidelines (MLA, 2012b).

7.7.1.7 Excavation and Fill

All excavations and filling shall be carried out to produce a smooth, uniform surface in accordance with the design grades, levels and dimensions of the proposed engineering works.

Material for filling shall be obtained from the excavations within the site, supplemented by borrow material (e.g. sedimentation basin, storage lagoon) if necessary.

The fill material shall be free of tree stumps and roots and be capable of being compacted in accordance with the earthworks specification. In general, fill materials will be well-graded suitable material such as soil or gravel. A well graded soil is a soil that contains particles of a wide range of sizes and has a good representation of all sizes.

Fill materials shall be generally placed in layers with a minimum thickness of 200 mm before compaction and uniformly compacted to the design (dry density at optimum moisture content) specification before the next layer is applied. Typically, compaction shall achieve at least 95% of the standard maximum laboratory dry density determined in accordance with AS1289 (Skerman, 2000).

The Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) state that clay lining material should be placed in layers not exceeding 200 mm prior to compaction. Each layer should be tined, wetted to ±2% of optimum moisture content and compacted to at least 95% of the Maximum Dry Density to achieve the required permeability of 1 mm/ day. The minimum depth recommended for the clay liner is 300 mm after compaction.

The finished surface of the clay liner or pen surface shall be durable and trafficable for cattle and equipment.

7.7.1.8 Pen Infrastructure

After completion of the bulk earthworks, the feed bunks, water troughs, fences, gates and cattle lanes shall be installed.

The feed bunks for each row are constructed in-situ as a continuously formed concrete section. The feed bunk shall be constructed using a horizontal slip-form machine. The concrete is laid down, vibrated, worked, and settled in place while the form itself slowly moves ahead. The feed bunk is placed over a compacted gravel base with a minimum thickness of 100 mm. Concrete aprons along the feed bunk and extending some 3 m into the pen will be constructed in-situ (Figure 17, Photograph 7 and Photograph 8) using slip formwork and suitably reinforced to withstand the loading of pen cleaning equipment.

Pre-fabricated concrete water troughs shall be placed at the required location along the dividing fence between each pen (Figure 17 and Photograph 9) and protected by dedicated steel framework. Concrete aprons will be constructed in-situ around all water troughs (Photograph 9) using formwork and suitably reinforced to withstand the loading of pen cleaning equipment.

The fences shall be constructed from steel posts with steel top, belly rail and bottom rail to provide the required strength. Wire cables will be strung along the fence between the top rail and belly rail and under the belly rail to securely contain the cattle and facilitate under-fence cleaning. Typical production pen fencing at the existing feedlot is shown in Photograph 13.

Photograph 13 – Existing feedlot – Typical production pen fencing

Steel gates shall be installed at the rear of pens for movement of stock and pen cleaning equipment and across the feed bunk apron at the top of each dividing fence between pens to facilitate cleaning of aprons and movement of pen riders between pens. The typical production pen gate arrangement at the existing feedlot is shown in Photograph 14. Gates will be constructed on-site from either steel pipe or rectangular hollow section.

Photograph 14 – Existing feedlot – Typical production pen gates

Water reticulation pipelines shall be installed in-ground to maintain the water at a relatively constant temperature year round and to prevent wet sports in the pens respectively. Water pipeline material shall be HDPE, polyethylene or PVC depending on the location within the development.

The overflow from each water trough shall be directed to the catch drain at the bottom of the pen with underground pipes. This system is referred to as a sewered system, and minimises wet spots within the pen due to trough cleaning and/or overflows. The wastewater pipeline material shall be PVC. The typical trough outflow system at the existing feedlot is shown in Photograph 15.

Photograph 15 – Existing feedlot – Typical water trough drainage

7.7.1.9 Roads

The design and construction of road surfaces are important for their long-term performance. Roads are complex engineering structures upon which feed delivery and reliable access to the proposed development depend.

Typically, the complete road surface shall include a compacted gravel base of a minimum of 200 mm and a strong and stable underlying subgrade. The subgrade is the prepared surface (foundation) on which the road surface is constructed, and provides support to the road surface. The subgrade for the feed roads is the layer of soil (cut or fill) prepared during bulk earthworks.

Access and feed roads shall be designed and constructed with careful consideration given to correct shape of the cross section.

For feed roads, the design objective is to keep water drained away from the roadway. In the back-to-back pen layout, the feed road cross-section includes no cross fall towards the centre and a longitudinal fall along the length of the road.

In the sawtooth pen layout, the feed road cross-section includes cross fall towards the outer edge and a longitudinal fall along the length of the road.

For feed roads, outside of the production pen rows, the design objective is to keep water drained away from the roadway. In these locations, the road cross section has three components – a crowned driving surface, a shoulder area that slopes away from the edge of the driving surface and a drain to remove the water away from the road.

Typically, the feed road surfaces shall be unbound natural material such as gravel without surface sealing as shown in Photograph 7.

7.7.1.10 Buildings and structures

The proposed development shall not include buildings and structures for feed storage and processing, maintenance, administrative and livestock handling functions for example.

The existing feedlot's office, machinery workshop, weighbridge, grain silos, feed processing equipment, commodity storage and associated facilities shall be used.

7.7.1.11 Drainage System

Runoff from the pen area contains organic and mineralised manure constituents that could pose a significant impact to soil and water resources if they were released, uncontrolled, into the environment.

A low-permeability barrier shall be needed on those areas within the controlled area where the permeability of underlying soil/rock strata exceeds 0.1 mm/day (3.5 cm/year). This barrier shall be created by using a liner made of compacted clay (clay liner).

For a given soil, permeability is related to soil particle composition, moisture content and level of compaction; and there are limits to the permeability that can be achieved at any level of compaction. In-situ and laboratory measurement of permeability is difficult, and relatively inaccurate (MLA, 2012b).

For these reasons, most feedlot design guidelines provide guidance on specifications for materials and construction methods to be used for clay lining rather than relying on permeability standards. However, the Guidelines for Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) do not outline material specifications.

Subsequently, guidance on material specification for clay liner material has been taken from the National Feedlot Guidelines (MLA, 2012b). Table 17 and Appendix A outline the characteristics of suitable clay lining material and provides guidance on the selection of the correct materials for use

in the liner. Soils may need to be mixed or engineered to produce a material that meets the specifications.

Because of the formation of a low permeability soil-manure interface layer, clay lining is not generally required on the production pen area (MLA, 2012b).

Table 17 – Specifications for clay liner materials (MLA, 2012b)

Soil characteristic	Acceptability criterion	Test method
Percentage fines	More than 25% passing a 75 μm sieve More than 15% passing a 2 μm sieve	AS 1289 3.6
Liquid Limit	Less than 70	AS 1289 3.1.2
Plasticity Index	More than 15	AS 1289 3.3.1
Emerson Class	Number 5 to 6	AS 1289 3.8.1

7.7.1.12 Drains

Catch drains are located along bottom of each row of pens. Catch drains within CDA 1 flow directly into the sedimentation basin. Catch drains within CDA 2 flow into a main drain that flows into the sedimentation basin. The catch drains and main drains convey stormwater runoff to the sedimentation basin. Catch drains and main drains shall be constructed by clearing vegetation and undertaking bulk earthworks as outlined in Sections 7.7.1.2 and 7.7.1.3 to achieve the design geometry.

To mitigate the potential for contamination of underground water resources because of leaching of contaminants through permeable, underlying soil, a low-permeability barrier shall be constructed on the floor of the drains.

Hence, the base of catch and main drains shall be underlain by a minimum of either 300 mm clay or other suitable soil, able to provide a design permeability of no greater than 1 x 10^{-9} m/s (~ 0.1 mm/day) (Department of Primary Industries and Resources (SA), 2006).

The specification for clay lining is provided in Appendix A.

7.7.1.13 Sedimentation Basin

A sedimentation basin shall be constructed downslope of the production pen area in each controlled drainage area. Each sedimentation basin shall be constructed by clearing vegetation and undertaking bulk earthworks as outlined in Sections 7.7.1.2 and 7.7.1.3 to achieve the design geometry. The minimum nominal working volume of each sedimentation basin is provided in Section 7.5.10.1.

The general method of protecting groundwater is to ensure that a low-permeability barrier exists between the stored wastewater and any underlying groundwater resources. Hence, the base and embankment of each sedimentation basin shall be underlain by a minimum of either 300 mm clay or other suitable soil, able to provide a design permeability of no greater than 1 x 10^{-9} m/s (~ 0.1 mm/day) (Department of Primary Industries and Resources (SA), 2006).

Embankment slopes shall be stabilised as soon as possible after construction to minimise erosion.

7.7.1.14 Storage Lagoon

A storage lagoon shall be constructed downslope of the sedimentation basin as shown on Figure 18 and Figure 19. Each storage lagoon shall be constructed by clearing vegetation and undertaking bulk earthworks as outlined in Sections 7.7.1.2 and 7.7.1.3 to achieve the design geometry. The minimum nominal working volume of each storage lagoon is provided in Section 7.5.10.2.

The general method of protecting groundwater is to ensure that a low-permeability barrier exists between the stored effluent and any underlying groundwater resources. For lagoons with depths greater than 2 metres the lagoon base and embankment shall be underlain by a minimum of either 600 mm clay (or other suitable soil), able to provide a design permeability of no greater than 1×10^{-9} m/s (~ 0.1 mm/d) (Department of Primary Industries and Resources (SA), 2006).

Earthen embankment slopes and bywash returns shall be stabilised as soon as possible after construction to minimise erosion.

Excavation of the storage lagoon(s) would be performed to a depth of some 2-3 m below natural surface to achieve the minimum design volume.

7.7.1.15 Solid Waste Storage Area

Solid wastes contain organic and mineralised manure constituents that could have adverse impacts on the environment if they were released uncontrolled from the site. Therefore, the storage of solid wastes shall take place on the solid waste storage area (manure stockpile/carcass composing) that is within the controlled-drainage area of the existing feedlot.

Runoff external to the solid waste storage area is diverted away from the solid waste storage area by the provision of diversion banks upslope of the area that exclude upslope runoff from entering the area.

Any groundwater resources underlying the solid waste storage area are protected by a low-permeability barrier on the base of the area.

7.7.2 Hours of Construction

The construction of the proposed development shall occur within the hours specified by the Regional Council of Goyder decision notice.

Due to the rural location, the suggested hours would be between 6 am and 6 pm for Monday to Friday and between 7 am and 5 pm on Saturdays and Sundays with no construction activities undertaken on Public Holidays.

However, there are some situations, where construction work may need to be undertaken outside of these hours, including for example:

- the delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours.

7.7.3 Staging and timing

The proposed development would involve the phased construction of the development in line with the market demand for lot-fed beef. Operational requirements, funding limitations and other considerations shall dictate the development of each stage.

Commencement of construction of the proposed development would depend on a range of factors including market demand and approval timeframes.

It is proposed to develop the proposal in two stages as outlined in Table 18. It is noted that the time periods outlined in Table 18 are indicative and do not represent a commitment to undertake the development.

A brief description of each major works item within each development stage, as well as likely triggers for each item, is provided in Table 18.

Table 18 – Proposed development staging

Stage	Development	Trigger	Timing
1	Construction of CDA 1	Development Approval	Short Term (0 – 2 years)
2	Construction of CDA 2	Growth in markets – increased beef production	Short Term (2 – 5 years)

The proposed works for each stage would comprise the following elements:

- Vegetation clearing and bulk earthworks
- Drainage system, sedimentation basin and storage lagoon
- Production pens infrastructure such as feed bunks, aprons, water troughs and fences.

7.7.4 Construction Period

Each stage of the proposed development is estimated to take approximately 5-6 months depending on weather conditions to construct after receiving development consent from the Regional Council of Goyder and an environment protection licence from the EPA (SA).

7.7.5 Construction Materials

Various materials are required for the construction of the proposed development. These include:

- Concrete aggregates and products - cement, sand, gravel etc.
- Steel – fencing, reinforcing mesh etc.

All materials with the exception of those able to be legally sourced from the proposed development area such as gravel for road/pen surfacing shall be imported onto the site.

7.7.6 Traffic and Access Arrangements

The proposed development would be accessed from the Goyder Highway onto Hills Road. Direct access into the proposed development site would be off Hills Road. The dedicated safe and convenient access from Hills Road for the existing development shall be used for access during the construction period and for access to the development once operational. Table 19 summarises the number of traffic movements expected during construction of the proposed development.

Table 19 – Construction Phase - Expected traffic movements

Activity	Vehicle Type	No of Units	Movements		
				per day	per week
Earthworks / Road Construction / Drainage	Bulldozer (CAT D6/D8)	1	2	-	-
	Open bowl scraper (CAT 637)	4	8	-	-
	Elevating scraper (CAT 623)	2	4	-	-
	Excavator (CAT 325)	1	2	-	-
	Graders (CAT 140M)	2	4	-	-
	Water truck (13,000L)	2	4	-	-
	Roller – compactor 825H	1	2	-	-
	Roller – smooth drum C56	2	4	-	-
	Backhoe (CAT 580)	1	2	-	-
	Bobcat trencher (CAT T9B)	1	2	-	-
	Fuel/service truck - medium rigid	1	2	-	-
	Fuel supply – B-Double	1	-	-	1
	Concrete batch plant	1	2	-	-
	Bunk forming machine	1	2	-	-
	Concrete agitator trucks	3	6	-	-
	Service vehicles	1	2	-	-
	Material supply (B-Double) (Cement)	1	-	1	4*
	Material supply (semi-trailer) (Steel)	-	-	1	-
	Fuel Storage (Transtank TN68)	1	2	-	-
Employees	Light Vehicles (Landcruiser/Hilux)	12	-	24	

*For duration of concrete works period being a period of some 4 weeks.

7.7.7 Security and Lighting

Access control to the proposed development site will be maintained at the access off Hills Road.

The proposed development shall be fenced with standard cattle-proof fencing for livestock control.

Construction activities shall only be conducted during daylight hours. Hence, no illumination lighting will be required.

7.7.8 Vehicles and Equipment

The typical construction vehicles and equipment required for the construction of the proposed development are shown in Table 20. The make and model of vehicles and equipment is based on the current Ostwald Bros fleet composition and subject to change depending on the contractor engaged.

Material would be excavated by self-loading scrapers and then moved to feed pens and roads. Compactors, rollers, water carts and graders would be involved to achieve the required compaction.

Table 20 – Construction vehicles and equipment

Activity	Vehicles / Equipment
Vegetation clearing	Bulldozer (CAT D6/D8)
Bulk Earthworks – cut/fill	Open bowl scraper (CAT 637)
Topsoil stripping / trimming	Elevating scraper (CAT 623)
Drains / trimming embankments	Excavator (CAT 325)
Trimming/ subgrade placement	Graders (CAT 140M)
Soil moisture conditioning	Articulated Vehicle - CAT740 (32t)
Dust suppression	Medium Vehicle – Rigid (16t)
Fill compaction	Roller – Compactor 825H
Subgrade compaction	Roller – Smooth Drum C56
Road aggregate placement	Medium Vehicle – Rigid 12t
Services / material placement	Backhoe (CAT 580)
Water reticulation lines	Bobcat trencher (CAT T9B)
Fuel Distribution	Medium Vehicle – Rigid 10t
Equipment servicing/repairs	Medium Vehicle – Rigid 10t
Fencing structures	Truck mounted pipe cutting and welding equipment
Post holes	Bobcat hole borer (CAT T9B)
Concrete manufacture - feed bunks / aprons	Concrete Batch Plant
Concrete placement	Concrete agitator trucks 6 wheel – Rigid 12t
Feed bunk construction	Bunk forming machine
Equipment delivery	Heavy Vehicle - Semi-trailer low loader
Material delivery – cement/steel etc.	Heavy Vehicle - Semi-trailer / B-Double
Fuel Delivery	Heavy Vehicle - B-Double
Personnel	Light vehicle

7.7.9 Workforce requirements

At this stage it is anticipated that construction of the proposed development shall involve an average construction workforce of some 10-12 FTE personnel, with some 25 FTE at peak construction. As far as possible, the construction workforce shall be recruited locally and accommodated in existing dwellings.

7.7.10 Hazardous Chemical Storage

All hazardous chemicals required to be stored on-site during construction shall be kept in designated bunded areas or stored in transportable bunded vessels. This includes fuels (diesel, petrol), lubricants (oils, grease) and chemicals (concrete plasticisers) etc.

7.8 Operation

7.8.1 Cattle Management

The proposed development is designed to accommodate some 10,552 head of cattle (9,083 SCU) at the design stocking density. The majority of cattle would be steers of *Bos taurus* genotypes. Breed composition may change with time as market signals develop.

The proximity of the proposed development to the premier beef cattle grazing districts of South Australia leaves it well positioned for livestock procurement. Most cattle shall be bred on properties owned and operated by the proponent. It is also expected that cattle would be sourced locally as far as possible from areas within close proximity to the proposed development.

The wide range of beef markets (i.e. domestic, export – Korea, Japan etc.) available to the feedlot industry means that there is a broad spectrum of market specifications for cattle. Each market may require different specifications for delivery of each of its products. Factors determining market specifications include a wide range of carcase and eating quality criteria including liveweight, fat score, marbling and age. Subsequently, it is expected that the proposed development shall have cattle targeted to a range of market types on feed at any point in time. This is also a risk minimisation strategy to provide flexibility for market conditions, such as cattle and commodity availability, buying and selling price of cattle, buying price of commodities and consumer demands.

The estimated market type composition of the proposed development is shown in Table 21. The market composition is based on expected target markets, market growth and opportunities and feeding of predominantly *Bos taurus* all straightbred high-performance black angus steers sourced from the proponents black angus herd. However, the composition may change seasonally and from year to year depending on the previously mentioned factors.

Cattle would be transported to the proposed development at about the entry weight of the target market. The cattle would be fed a ration specific to that market type until they reach the exit weight of the respective market when they would be transported from the site to an abattoir for processing.

Typically, cattle would enter the feedlot at around 9 to 12 months of age and an average of some 300-340 kg liveweight. The cattle would be fed for approximately 80 to 115 days to achieve an average exit liveweight of about 420 to 512 kg.

While cattle numbers will vary with market demands and seasonal conditions, it is expected that cattle will be fed predominantly for the domestic market. In order to estimate cattle numbers, feed and traffic movements, the market type composition from the existing feedlot have been used. These data are provided in Table 21.

The average occupancy rate and an average mortality rate at the existing feedlot have been assumed for the proposed development as shown in Table 21.

The number of cattle entering and exiting the proposed development per year is examined in Section 7.8.1.1. The number of days on feed will determine how long each animal is fed in the facility. In turn, the market into which the cattle will be sold determines the number of days the cattle are on feed and live weight of the animals. Assumptions have been made to estimate these cattle numbers, these may change depending on market demands.

Table 21 – Estimated market type composition

Parameter	Units	Market type	
		Domestic	Mid Fed
Percent in lot	%	20	80
Days on feed	Days	80	115
Entry weight	kg	300	340
Exit weight	kg	420	512.5
SCU Scale Factor	-	0.77	0.89
Net gain (kg)	kg	120	172.5
Dressing percent	%	52	54
Dressed carcase wt (HSCW)	kg	218	276
Average daily gain	kg gain/head/day	1.6	1.5
Dry matter intake	kg DM/head/day	9	10
Feed conversion efficiency	kg DM/kg gain	5.6	6.7
Mortality rate (No in/No Out)	%	0.9	0.95

Upon arrival at the feedlot, all cattle shall be counted to ensure that the number, breed and sex of cattle unloaded, balances with accompanying documentation. The cattle are inspected for signs of stress and general health and held in holding yards prior to induction. Any cattle with health problems are drafted-off and treated accordingly. All details of arrival cattle are recorded in the feedlot herd management system.

Within 2-3 days of arrival at the feedlot, each animal is inducted whereby the necessary health treatments (e.g. 7 in 1, vitamins, parasite treatments etc.) and identification (e.g. ear-tags etc.) are applied and cattle weighed.

After induction, cattle are allocated to a production pen ensuring that appropriate stocking densities are maintained and pen allocation details are recorded in the feedlot herd management system.

All sick or injured cattle are carefully removed from the pens and taken to the hospital facility for treatment according to veterinary advice. If necessary, they are retained in the hospital pens. Once treated cattle recover, they are returned to an appropriate production pen.

Low-stress handling techniques shall be employed to minimise stress, bruising and hide damage. Excessive noise and movement of cattle within the feeding period is avoided along with handling of cattle during adverse weather conditions (e.g. very hot and humid weather).

Cattle shall be provided with an adequate supply of feed and water.

After approximately the required days on feed, cattle are individually weighed and drafted according to weight. Cattle in each drafting group are designated a dispatch date.

On the dispatch date, cattle are loaded onto the livestock transport vehicle at a suitable density, the vehicle weighed-out over the weigh bridge and the weight of cattle recorded. The cattle shall are then transported to a processing facility.

Cattle are transported in a manner that protects their welfare, which maximises meat quality and which considers climatic conditions. Transport operators would adhere to the Australian Standards and Guidelines for the Welfare of Animals — Land Transport of Livestock (AHA, 2012).

7.8.1.1 Incoming/Outgoing Cattle Numbers

The number of cattle turned off from the proposed development is dependent on the following factors:

- intake weight
- days on feed
- average daily gain
- required turnoff weight
- occupancy levels
- mortality rates.

The specifications for each market type are outlined in Table 21. Based on these data the estimated additional number of incoming and outgoing cattle from the proposed development is shown in Table 22. Total cattle throughput would be approximately 36,000 head of cattle annually with an occupancy level of 99%.

Table 22 – Estimated cattle turned off

Market type	Units	Domestic	Mid Fed	Total
Days on feed	Days	80	115	-
Entry weight	kg	300	340	-
Exit weight	kg	420	512.5	-
Dressing percent	%	52	54	-
Mortality rate (No in/No Out)	%	0.9	0.95	-
Percent in lot	%	20.0	80.0	-
Incoming cattle	No per year	10,720	25,700	36,420
Outgoing cattle	No per year	10,625	25,450	36,075
Outgoing liveweight of cattle	Tonnes/year	4,460	13,040	17,500

7.8.2 Feed Management

Rations are prepared on-site in a dedicated facility, with associated commodity storage, handling and ration delivery infrastructure.

The ration contains grain, roughage (fibre), and minerals. Roughage is essential in the diet to enable normal rumen activity, and shall be provided by silage, hay or straw commodities. Commercial mineral/vitamin premixes may be added to the ration. These may contain calcium, urea, sulphur, salt and various trace minerals and vitamins (or just the trace minerals and vitamins) required for achieving satisfactory growth rates.

Dry and wet feed commodities may include dry grains, processed grains, high-moisture grains, roughages and by-products from feed or food processing operations, fermented feeds, liquid feeds and wet or dry vitamin or mineral supplements.

Bulk feed commodities that are typically by-products from the food or feed industry shall also be used depending on cost and availability. Examples include hulls and meals from oilseed extraction, distillers grains from beverage or fuel ethanol production, brans, grain germs, and chaff from various grain milling operations, fermented sugars, starches, and bran from sweetener production, as well as pulps from sweetener or juice production.

Various industrial food wastes such as potato wastes, snack food waste (corn and potato chips), fruit and vegetable cannery waste and bakery wastes (e.g. bread) may also be used in the feed ration depending on cost and availability.

The proximity of the proposed development to South Australia's mid-north grain producing region leaves it well positioned for grain and commodities procurement.

The majority of grain and hay/straw for the proposed development would be transported from the northern cereal growing areas within close proximity to the proposed development. About 6% of the annual grain requirement (~2000t) is produced on the subject property within the liquid and/or solid waste utilisation areas depending on seasonal conditions.

About 45% of the annual silage requirements (3000t) would be produced on the subject property within the liquid and solid waste utilisation areas.

By-products from the food or feed industry may be used depending on cost and availability.

Each market type is fed a different ration. A typical ration composition for each market type is outlined in Table 23. The percentage of each commodity within a ration is dependent on commodity availability and the buying price and therefore the composition often changes seasonally and from year to year.

Table 23 – Typical ration composition

Parameter	Type	Units	Market Type	
			Domestic	Mid-Fed
Grain	Summer	%	-	-
	Winter	%	72	70
Protein	Cottonseed/canola meal	%	1.5	1.0
Roughage	Straw/Hay	%	5	5
	Silage	%	15	15
Liquids	Molasses	%	5	5
	Vegetable Oil	%	0	2
Supplements	Finisher	%	1.5	2

The approximate annual amount of feed commodities required for the proposed development are listed in Table 24.

Table 24 – Estimated annual commodity requirements

Parameter	Type	Units	Market Type		
			Domestic	Mid-Fed	Total
Grain	Winter (Wheat)	tonnes/year	3,630	12,420	16,050
	Winter (Barley)	tonnes/year	3,630	12,420	16,050
Protein	Cottonseed	tonnes/year	350	590	940
Roughage	Straw/Hay	tonnes/year	560	1,975	2,535
	Silage	tonnes/year	1,475	5,710	7,185
Liquids	Molasses	tonnes/year	490	1,900	2,390
	Vegetable Oil			750	750
Supplements	Starter/Finisher	tonnes/year	300	910	1,210
Total		tonnes/year	10,435	36,675	47,110

All grain would be processed on-site through the existing dedicated facility. The existing facility consists of storage silos to store grain, a grain movement system and a grain processing (tempering) system. The facility is sized to enable the processing of the annual requirements for grain at full capacity of the proposed development. There are no plans to steam flake feed grains.

Hay would be processed on-site by use of a tub-grinder or similar equipment. Silage storage pits would also be established in vicinity of the feed processing and storage area as shown on Figure 16, to minimise the distance and time to travel to and from the storage pits to the commodity shed.

The processed feeds and commodities would be stored in storage bays within the commodity shed where they are loaded into tractor-drawn mixer wagon by front-end loader. The wagons have on-board mixing equipment. The ration would then be dispensed into the feed bunks directly from the tractor-drawn mixer wagon.

7.8.3 Water Management

Water is a vital resource for the proposed development and is also a significant expense. Most of the water used is for cattle to drink; it is also used for grain processing, cleaning yards, machinery washdown, other general practices around the feedlot, and in amenities for people working on the feedlot.

Water is also lost through evaporation and seepage from open storages.

The proposed development's water supply, storage and reticulation shall be managed to:

- meet the total annual water requirement of the proposed development
- provide an unrestricted, reliable supply of water to livestock at all times of the year
- provide water that is clean, fresh and free from contamination for livestock
- meet the peak water intake requirement for the cattle, especially during the summer period
- minimise losses and maximise water use efficiency
- ensure that the quality of the water (which includes temperature, salinity and impurities) does not affect cattle performance or welfare
- provide water that is clean, fresh and free from contamination for people.

7.8.3.1 Quantity

As outlined in Section 7.5.1, the proposed development of 10,552 head will require in the order of 137 ML of water depending on the level of drinking water consumption and occupancy level. Allowing an additional 10% for other uses such as feed processing, administration and direct sundry uses such as trough cleaning, vehicle and facility cleaning and indirect sundry 'uses' such as evaporation some 152 ML of water shall be required for the proposed development. This equates to about 14.4 ML/1000 head-on-feed/year.

The estimated water requirement is similar to that measured by Davis et al. (2010b) for a feedlot that experienced similar climate and breed of cattle.

The subject property has groundwater resources as outlined in Section 10.3 and 10.4. A proportion of these shall be used as a source of water for the proposed development.

Subsequently, as there is a secure and adequate water supply available to meet construction needs and predicted operational needs, no adverse impact is predicted as a consequence of meeting the proposed development water needs.

If an extreme drought event were to occur which placed pressure on availability there is a fall back capacity for the proponents to transport water to site for construction needs or to reduce livestock numbers during operation.

Stormwater from roof structures is also captured for incidental use, such as potable drinking water and landscaping.

7.8.4 Solid Waste

7.8.4.1 Quantity

7.8.4.1.1. Putrescible

As discussed in Section 7.5.11.1, the proposed development shall generate solid waste comprising manure, composted mortalities and split feed.

Various studies have assessed the estimation of manure output from lot-fed beef cattle with typical levels in the order of 1 tonne DM/head/year.

Predictive models such as BEEFBAL can be used to estimate waste characteristics from a feedlot (QPIF 2004). BEEFBAL is a Microsoft Excel® worksheet model. BEEFBAL was designed initially as a nutrient budgeting tool for beef cattle feedlot operations, but has been modified to include the Dry Matter Digestibility Approximation of Manure Production (DMDAMP) model for predicting the organic component of waste composition and quantification. The dry matter digestibility (DMD) approximation of manure production (DMDAMP) predicts the amount of TS, VS and FS (or ash) excreted by animals using DMD (van Sliedregt et al., 2000). The model requires data on herd numbers, feed ingredients and quantity fed. The digestibility of each feed ingredient is used to predict the TS, VS and FS (or ash) excreted by an animal using mass balance principles.

The volatile solids in the excreted manure decompose rapidly on the pen surface. Davis et al. (2010) measured a reduction in VS by:

- 60–70% after 20 days
- 70% after 35 days
- 75% after 80–100 days.

Davis et al. (2010) measured the VS/TS ratio of harvested manure (at pen cleaning) to range between 0.60–0.68, with an average of averages 0.64. It is proposed that pen cleaning will occur at intervals not exceeding 10 weeks. Subsequently, some 70% of the VS is lost on the pen before manure is harvested, corresponding to about a 56% reduction in TS.

The amount of nitrogen, phosphorus and potassium excreted in manure varies depending on the diet, feed intake, class of cattle and other factors. Fresh manure typically contains 5.0–8.5% nitrogen (N), 0.16% phosphorus (P) and 3.6% potassium (K).

The typical composition of aged beef feedlot manure and compost is shown in Table 25.

Table 25 – Typical characteristics of cattle feedlot manure (McGahan and Tucker et al., 2003)

Parameter		Units	Average	Range
Total Nitrogen	TN	%	2.18	1 – 3
Ammonium Nitrogen	NH_4^+ - N	%	0.038	0.036 – 0.169
Total Phosphorous	Total P	%	0.8	0.4 – 1.3
Potassium	K	%	2.3	1.5 – 4.0
Sodium	Na	%	0.6	0.3 – 1.3
Chloride	Cl	%	1.35	0.7 – 2.3
Acidity/Alkalinity	pH		6.85	5.5 – 8.6
Electrical Conductivity	EC	dS/m	12.36	3.9 – 22
Sodium Absorption Ratio	SAR		5.9	0.8 – 18.8

Solid waste samples are taken from the existing feedlots solid waste stockpiles on a regular basis and analysed for a range of parameters. This process is undertaken to ensure that the appropriate level of nutrients contained in the solid waste are sustainably applied to the solid waste utilisation area. These data are shown in Table 26.

Table 26 – Measured solid waste characteristics

Parameter		Units	Sample 1	Sample 2
Total Nitrogen	TN	%	1.3	1.5
Total Phosphorous	Total P	%	0.5	0.5
Potassium	K	%	1.4	1.6
Acidity/Alkalinity	pH		7.9	7.2
Electrical Conductivity	EC	dS/m	3.6	5.4

BEEFBAL was used to estimate the weight and nutrient content for solid waste from the proposed development. Input data for BEEFBAL was taken from Table 21 and Table 23 for herd data, quantity fed and feed ingredients respectively. The estimated solid waste generated from the proposed development is shown in Table 27.

Table 27 – Estimated solid waste generated

Parameter	Units	Mass	
		t/day	t/year
Fresh Manure Excreted	Dry Mass	20	7,450
	Wet Mass @85%MC	136	49,730
Scraped from Pad	Dry Mass*	-	3,735
Removed from Stockpile	Dry Mass**	-	2,905
	Wet Mass @35%MC	-	4,470

***50% dry matter loss on the pad**

**** 20% dry matter loss in the stockpile**

As shown in Table 27, it is expected that approximately 3,735 t of solid waste on a dry matter basis would be scraped from the production pens each year during the operation of the proposed

development. This translates into some 2,905 t of dry matter available for utilisation after stockpiling.

7.8.4.1.1. Non-putrescible

The operation of the proposed development shall generate negligible quantities of non-putrescible solid waste. Non-putrescible solid waste shall include paper, cardboard etc. from office/administrative and shall be placed into skip bins for collection by a waste contractor and transported to a recycling facility.

Other types of non-putrescible solid waste such as metal, polyethylene materials (fence post offcuts, rails, water pipeline) etc. shall be stored on-site and used in repairs/maintenance of infrastructure.

7.8.4.2 Management

Regular cleaning and maintenance in and around the development complex, in accordance with Class One (1) specifications minimises odour emissions and reduce the risk of any amenity impacts on neighbouring sensitive receptors. Regular cleaning:

- reduces manure build up within the pens
- reduces odours emanating from the proposed development
- eliminates wet spots in the pens (production/induction/hospital), which reduces fly breeding areas and also reduces odour.

7.8.4.2.1. Pen Cleaning and Maintenance

Pen cleaning refers to the removal of built up manure from the pens and drains. Small amounts of spoilt feed thrown into the pen during bunk cleaning, is also removed with manure during pen cleaning. Pen cleaning and maintenance is not viewed as a cost, but as a method of minimising potential impacts to the environment and the potential to return income to the proposed development by the sale or sustainable utilisation of the manure harvested from the pens.

The pens shall be regularly cleaned to minimise the depth of manure on the pen surface. Subsequently, pen cleaning becomes a major on-going part of operational management. Regular pen cleaning is necessary to:

- promote free pen drainage
- optimise cattle performance and welfare
- reduce dags on cattle
- provide a safe work environment for staff
- maintain low odour levels
- minimise dust
- minimise pen maintenance costs.

Free drainage of pens is essential in optimising conditions for animals and staff (particularly pen riders), preventing odour nuisance and minimising pen maintenance costs.

Ideally, pen cleaning shall occur when the manure is moist but not wet since moist manure is more easily scraped from the surface. However, regular cleaning may occur even when conditions are not ideal.

Typically, as manure is deposited on the pen surface it dries and is compacted by the action of the cattle hooves. It is typically laid down in layers. In some cases the lowest layer may be an "interface layer" – a compacted mixture of manure and pen surface material (clay/gravel). The interface layer has a low permeability and offers additional production against nutrient leaching through the pen surface (Lott et al., 1994).

However, experience has shown that the winter climate in southern Australia is not suited to the development and maintenance of a manure/soil interface layer.

Subsequently, it is not proposed, to either establish or maintain this layer. Pens will be cleaned back to the compacted clay layer which by virtue of its construction and compaction by animal hooves will remain impervious.

The Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) outlines the maximum intervals for pen cleaning and operational activities for the various feedlot classes. The proposed development shall be designed, constructed and managed in accordance with Class One (1) standards and with a stocking density of 12.9 m^2/head (15 m^2/SCU), the pen cleaning and maintenance schedule shall be in accordance with the intervals outlined in Table 28. Class One (1) represents the highest level of management standards.

The machinery to be used for pen and drain cleaning and maintenance activities includes:

- skid steer loader – under fence cleaning and removal of solids from around feed and water troughs
- front-end loader to remove manure out of the pens/drains and stockpile area
- rigid and articulated tip trucks for removing manure from the pens to the solid waste stockpile / carcass composting area, loading manure and compost for transport to the utilisation areas
- front-end loader for mixing and aerating the manure windrows and carcass compost.

7.8.4.2.2. Under-fence cleaning

The removal of manure from under fence lines is important for two reasons. Accumulated manure acts as a fly breeding area and a trap that prevents run-off leaving the pen. Removal of accumulated manure under fence lines shall be undertaken at the same time as pen cleaning.

Table 28 summarises the proposed under-fence cleaning interval for the proposed development.

7.8.4.2.3. Pen Maintenance

General pen maintenance activities shall be conducted after each pen cleaning event and the manure from the pens and under fence lines has been removed. General pen maintenance activities include:

- Depressions/potholes within the pen are filled and compacted
- Elimination of wet spots in the pen surface
- Removal of split feed residues from around feed bunks.

Attention shall be given to the area behind the feed bunk apron, as that area tends to become worn and hollowed out and, if not maintained, retains water, remains boggy and quickly becomes worn.

Table 28 summarises the proposed pen maintenance interval for the proposed development.

7.8.4.2.4. Drain Cleaning

To work effectively, drains need to be maintained. Poorly maintained drains such as when vegetation is allowed to grow in them or if manure builds up, restricts the flow of stormwater allowing, manure in the runoff from pens to be deposited in the drains rather than flowing to the sedimentation basin.

Manure in drains tends to stay wet, thus creating an odour problem and also is difficult to remove.

When practical, drains shall be cleaned after each rainfall event. Cleaning includes removal of manure and vegetation.

Table 28 summarises the proposed drain cleaning interval for the proposed development.

Table 28 – Schedule for pen and drain cleaning and maintenance

Activity	Frequency and / or Action
Removal of spilt feed /feed residues	Weekly
Elimination of wet patches in pens	Weekly
Repairs to potholes in pens	Weekly
Clean water troughs	Weekly
Under fence cleaning	Monthly (or after manure obstructs pen drainage)
Pen cleaning	At intervals not exceeding 10 weeks
Pen surface checks	After runoff events and repaired as required
Diversion banks and drains	After runoff events and repaired as required

7.8.4.2.5. Manure Stockpile / Processing

The manure collected from the pens shall be temporarily stored in the solid waste storage area of the existing feedlot as shown in Figure 9 so that pen cleaning can regularly occur even though it may not be possible to continually spread the manure or remove it from the site. The solid waste storage area is within the controlled drainage area of the existing feedlot, and therefore, runoff from the storage area is prevented from flowing uncontrolled into the natural environment.

The process of manure stockpiling and passive composting reduces the bulk and the moisture content of the manure. It also improves the handling properties of the manure by breaking up

lumps. The solid waste storage area is also used to store composting mortalities until the compost is cured.

Typically, manure removed from the pens, drains and sedimentation basin will be laid out in windrows with the long axes perpendicular to the area contours to ensure free drainage.

The stockpiled manure will decompose anaerobically. Anaerobic bacteria break down the organic matter, reducing the total dry weight of the manure. The nitrogen content is reduced by its conversion to gaseous forms that are released to the atmosphere during the decomposition process. The concentration of other less volatile and less soluble nutrients such as phosphorus, increase in the stockpile as the volume of manure decreases. The anaerobic decomposition process generates considerable heat. Temperatures up to 54°C are commonly experienced. The heat generated in well-managed stockpiles may be sufficient to sterilise any weed seeds and a significant proportion of potentially harmful pathogens contained in the manure.

To accelerate the decomposition process, further aeration of the windrows is achieved by regularly turning the windrows using excavator /loader or similar equipment. Aerobically composting allows the manure to be stored or spread with little odour or fly breeding potential and eliminates most of the weed seeds and pathogens within the manure. Actively composting the manure stockpiles reduces moisture content, odour and makes the manure more friable for spreading. This process also breaks down very large particles including slabs of dry feedlot manure prior to spreading.

Manure from the stockpile area would be removed when possible and favourable weather conditions permitting immediately after harvest of winter crops and placed directly onto the available waste utilisation area, as shown in Figure 21. This operation continues until all manure in the stockpile is utilised.

7.8.4.2.5.1. Carcass Composting

The average mortality rate in Australian feedlots is around 0.9% expressed as a percentage of cattle throughput. Losses tend to be higher in cattle sourced from saleyards and lower for backgrounded cattle. Most mortalities occur relatively early in the feeding period.

Based on an average mortality rate in the existing feedlot of between 0.9%-0.95%, the expected number of mortalities per year is approximately 342 animals (approximately 139 t of carcasses).

Carcasses are removed from the pens on a daily basis and taken to the hospital area for post-mortem or directly to the manure stockpile/processing area. Typically, carcasses shall be lifted and carried using a front-end loader rather than being dragged away, which could result in the discharge of blood and other body fluids.

The majority of carcass mass is moisture and will evaporate, significantly reducing the mass remaining after composting. The mass of carcasses is considered negligible when compared to the mass and nutrient content of manure that will be handled. Carcasses will be composted in separate windrows to the bulk manure windrows.

The construction and management of a carcass compost windrow shall generally comprise the following:

- A bed of at least 300 mm of the material being used as the carbon source (e.g. sawdust or straw) is placed on the base of the composting storage area. This bed of material absorbs leachate from the carcasses.
- A carcass is placed on the straw or sawdust bed and covered with at least 500 mm of manure on all sides.
- The carcass windrow shall be no more than two levels of carcasses high. The second level of carcasses shall be placed on top of 50 mm of manure covering the first level of carcasses and covered with at least 500 mm of manure.
- The top of the windrow shall be shaped to an apex to shed rainfall.
- The windrow shall be periodically checked and any exposed carcasses recovered. The carcasses must be covered to facilitate the composting process by adding a carbon source, and to control odours and in deterring vermin from disturbing the windrow.
- The carcasses are allowed to decompose for around 4 weeks before turning. Typically, a front-end loader shall be used for turning carcass compost.
- Active composting may last for up to 4-8 months. The windrow shall be turned every 2-3 months.
- After active composting the composted windrow is left to mature for at least 3-4 months.
- The carcass composting area shall be monitored for scavenging animals.

Since effective aerobic composting of carcasses is a low odour process, the carcass composting area is not expected to be a significant odour source.

7.8.4.2.5.2. Sedimentation Basin

The sedimentation basin(s) have been designed to separate larger solids in the stormwater runoff from the liquid component. Solids shall settle in the basin while the liquid drains into the storage lagoon.

Over time, solids build up in the sedimentation basin and, if not removed, will begin to flow into the storage lagoon. Each sedimentation basin shall be checked for efficacy after each runoff event.

Where practical, each sedimentation basin shall be allowed to dry out prior to removal of sediment.

Typically, sediment shall be removed using a front-end loader or similar equipment.

Each sedimentation basin incorporates an outlet control structure (semipermeable weir), which permits the percolation of liquid from the settling basin into the storage lagoon. The outlet control structure may clog up. If left clogged, the sedimentation basin will quickly fill with sediment that remains wet and creates odour. For this reason, the outlet control structure shall be maintained on a regular basis.

Maintenance of the outlet control structure involves removing, cleaning and then replacing timber slats to ensure the gaps are free of obstructions.

7.8.4.3 Utilisation

Land has been identified on the subject property as being suitable for application of solid wastes as shown in Figure 21 along with the proposed buffers to sensitive sites (e.g. watercourses, vegetation communities, drainage lines and property boundaries. The amount of land available for solid waste utilisation is approximately 885 ha.

Utilisation of solid wastes will substitute a percentage of the synthetic fertilisers that would otherwise be trucked-in for use in the cropping program on the subject property. Various crops or pasture shall be grown on the waste utilisation area. Crops will be harvested for hay, silage and / or grain to use as feed commodities in the proposed development.

Utilisation of solid wastes would involve the following principles:

- Solid wastes applied only to the nominated waste utilisation areas
- Annual application rates would be based on annual soil tests and would not exceed nutrient recommendations for a particular crop, soil type or yield goal
- Application of solid wastes would occur after harvest but before initial land preparation begins for planting
- A minimum 20 m buffer zone would be maintained between the application area and drainage lines
- A minimum 20 m buffer zone would be maintained between the application area and property boundaries
- Neighbouring landholders are not subjected to odour and dust nuisance because of poorly timed and managed solid waste application practices.

Typically, solid waste shall be applied using a tractor-drawn manure spreader. The type of tractor-drawn manure spreader currently used to spread solid waste at the existing feedlot is shown in Photograph 16.

Photograph 16 – Typical tractor-drawn manure spreader

7.8.5 Liquid Waste

7.8.5.1 Quantity

The volume of liquid waste generated from the operation of the proposed development is dependent on the runoff from the controlled drainage area and thus is dependent on climatic factors such as rainfall and evaporation and pen surface conditions (manure depth).

BEEFBAL was used to estimate the volume of runoff generated from the proposed development. BEEFBAL (QPIF, 2004) was originally developed as a tool to provide an estimate of quantity and composition of beef cattle feedlot waste (both liquid and solid fractions) based on a mass balance approach.

Based on the catchment areas for the controlled drainage areas outlined in Table 11 and the average annual rainfall and evaporation from the area (Table 5), the proposed development may generate about 28.4 ML of liquid waste per year on average. However, over the past 5 years the existing development has generated little liquid waste for disposal due to the below average rainfall and use of liquid waste for dust suppression.

7.8.5.1 Characteristics

Liquid waste from beef cattle feedlots is a rather concentrated wastewater with high levels of nitrogen and phosphorus and considerable colour. The concentrations of both inorganic and organic nutrients are high. Salinity (EC) can also be quite high.

Table 29 shows the typical composition of beef cattle feedlot liquid waste based on data from Tucker et al. (2011). These data were collected from holding ponds and evaporation ponds at various feedlots.

Table 29 – Typical liquid waste characteristics (Tucker et al., 2011)

Parameter	Units	Avg.	Min.	Max.
DON	mg/L	63.3	0.8	3,090
Total Kjeldahl nitrogen	mg/L	134	2.0	3,100
Ammonia nitrogen	mg/L	41.0	0.1	670
Nitrate nitrogen	mg/L	1.2	0.1	78.7
Nitrate	mg/L			
Total phosphorus	mg/L	61	0.2	440
Orthophosphate-P	mg/L	17.7	1.5	133
K^+	mg/L	665	1.2	9,100
Ca^{2+}	mg/L	110	8.0	597
Cl^-	mg/L	716	8.0	12,800
Mg^{2+}	mg/L	80	2.4	805
Na^+	mg/L	180	9.8	6700
SO_4^{2-}	mg/L	45.2	2.0	378
Total dissolved solids	mg/L	4,330	1,000	18,600
pH	-	7.8	6.8	9.6
EC	mS/cm	6.3	0.1	37.8
SAR	-	3.1	1	65.7
COD	mg O_2/L	1,950	450	4 680
Apparent Colour	mg/L Pt-Co	13,400	1,980	30,100
True Colour	mg/L Pt-Co	2,500	820	5,600
Turbidity	NTU	1,100	98	2,860

For the purposes of mass balance calculations, the nutrient composition of the liquid waste has been assumed to be 720 mg/l of Nitrogen and 120 mg/l of Phosphorus and 1,400 mg/L of Potassium.

7.8.5.2 Storage Lagoon

The storage lagoon has been designed to store stormwater runoff prior to application to land or until evaporated. The following general maintenance practices shall be implemented:

- Embankments shall be checked for evidence or indications that erosion has or will take place, for leaks etc.
- All fences shall be maintained in satisfactory condition and livestock proof.
- All inlet and outlet pipework, structures and pumps shall be checked regularly to ensure adequate functioning, e.g. flow rates, leaks.
- Tree and shrubs on the embankments shall be removed to ensure the integrity of the embankments are maintained and prevent drying out of the embankment core.
- Grass cover shall be established and regularly mowed to prevent erosion of embankment slopes and a resting site for flies or habitat for other vermin.

Despite the pre-treatment of settling the suspended solids, the stormwater runoff may still contain a proportion of suspended solids entering the storage lagoon. Subsequently, after a number of years the storage lagoon will need to be desludged.

The storage lagoon shall be desludged when it is apparent that sludge level in the storage lagoon is causing loss of detention in the storage lagoon and degeneration of the effectiveness of treatment. Therefore the following maintenance practices shall be implemented:

- Sludge levels shall be measured annually
- Sludge levels shall never exceed more than 2/3rds of the storage lagoon capacity
- Clay lining of the storage lagoon shall be checked after each desludging to ensure its structure and integrity has not been damaged or compromised. Any damage to lining will need to be repaired before wastewater is reintroduced into the storage lagoon.

7.8.5.3 Utilisation

Land has been identified on the subject property as being suitable for application of liquid wastes as shown in Figure 21 along with the proposed buffers to sensitive areas (e.g. watercourses, vegetation communities, drainage lines and property boundaries). Irrigation of liquid waste shall be undertaken within the same area as solid waste utilisation. In those years where liquid waste is applied, solid waste would not be applied to that area.

Utilisation of liquid waste will substitute a percentage of the synthetic fertilisers that would otherwise be trucked-in for use in the existing cropping program on the subject property. Various crops shall be grown on the liquid waste utilisation area with these crops will be harvested hay, silage and / or grain to use as feed commodities in the proposed development.

Utilisation of liquid wastes would involve the following principles:

- Liquid wastes applied only to the nominated liquid waste utilisation areas

- Annual application rates would be based on annual soil tests and would not exceed nutrient recommendations for a particular crop, soil type or yield goal
- Application of liquid wastes would occur prior to planting of crops with timing and application rates based on soil moisture deficit levels
- A minimum 50 m buffer zone would be maintained between the application area and drainage lines and public areas
- A minimum 20 m buffer zone would be maintained between the application area and property boundaries
- Neighbouring landholders are not subjected to odour and aerosol nuisance because of poorly timed and managed liquid waste application practices
- The application method adopted ensures that no ponding occurs on the soil surface or runoff occurs from the utilisation areas to drainage lines or watercourses
- The irrigation system used has a high uniformity of application and the overall management is of a high standard.

Typically, liquid waste which remains in late autumn will be removed from the storage lagoon(s) and spread on cropping land before planting of winter crops. The liquid will be spread using a contractor and slurry spreading tanker.

7.8.6 Hours of Operation

The proposed development would operate for 12 hours each day from 6 am to 6 pm and be operational 7 days per week. Staff would be on-site 24 hours a day, 7 days a week.

Some heavy vehicle movements are likely to occur outside normal operating hours (e.g. in summer, it is desirable to transport cattle either at night or in the early hours of the morning for animal welfare reasons). The proposed development will require the flexibility to allow strategic heavy vehicle movements outside of the normal operating hours.

7.8.7 Vehicles and Equipment

The anticipated vehicles and equipment required during operation of the proposed development are shown in Table 30. The make and model of vehicles and equipment is based on vehicles currently in use at the existing development and are subject to change.

Table 30 – Typical vehicles and equipment

Activity	Vehicles / Equipment
Livestock transport	Heavy vehicle - B-Double
Incoming feed commodities	Semi-trailer/B-Double
Solid waste processing/removal off-site	Front-end loader/Truck and Super Dog (38t)
Pen Cleaning	Bobcat / 4wd tractor / front-end loader /excavator
Feed Processing/Ration Delivery	Front-end loader/Body truck 12t
Dust Suppression	Medium vehicle – Rigid (12t)
Personnel	Light vehicle

7.8.8 Operational workforce requirements

When fully developed, the proposed development would provide employment for approximately 20 full time equivalent (FTE) personnel. The proposed development would employ full time and part time staff. This includes administrative, livestock handling, feed storage, preparation and delivery, machinery maintenance, waste management and general farm staff.

Personnel shall be sourced from the local area. The staff shall be trained to uphold strong guidelines in meat quality, animal health and welfare and environment.

7.8.9 Traffic and Access Arrangements

All traffic would access the proposed development from Hills Road via the access route to the existing feedlot. The existing access route is a dedicated safe and convenient access from Hills Road.

The proposed route for all heavy vehicles associated with the operation of the development would be the Goyder Highway to Hills Road.

Estimated traffic movements (inbound and outbound) associated with the proposed development are summarised in Table 31. These data are based on the estimated market type composition as shown in Table 22 and the estimated ration composition as shown in Table 23 respectively.

Table 31 – Estimated traffic movements

Activity	Vehicle Type	Movements	
		per year	per week
Incoming cattle	B-Double	380	7
Outgoing cattle	B-Double	498	10
Incoming feed commodities	Semi-trailer/B-Double	1225	24
Employees	Light vehicles	6240**	120

**based on estimated staffing level of 20FTE.

7.8.10 Hazardous Chemical Storage

To minimise the risk of environmental harm from liquid spills and leaks, all hazardous chemicals required to be stored on-site shall have a spill containment system appropriate for the nature and pollution risk of that liquid in accordance with relevant guidelines and Australian Standards. Liquids that may be stored during the operation of the proposed development include:

- agricultural chemicals – herbicides, pesticides etc.
- cleaning agents
- detergents and their byproducts
- engine coolant

- oil, grease, lubricants
- diesel, petrol fuels
- solvents.

All spill containment systems shall be routinely inspected to ensure maintenance of their integrity. A routine inspection and maintenance program shall be tailored to suit the specific installation.

7.8.11 Fire Management Strategy

A fire is an emergency that causes the greatest concern for personnel. A fire management strategy shall be developed for fire developing from a range of sources. These include bushfires (e.g. planned controlled burning that escapes the original burn zone, embers from a cigarette or unattended campfire, lightning strikes, or deliberate arson) and fires originating from the proposed development such as from flammable chemical storage, machinery use, electrical faults, maintenance activities or feed storage and processing where hay, and/or grain dust is present etc.

There will be a graded road around the development complex (outside the controlled drainage area) that will act as a firebreak and also provide access for fire-fighting vehicles.

All flammable chemicals stored on-site shall be kept in designated bunded areas or stored in transportable bunded vessels. This includes machinery chemical, fuel and water treatment products.

The chemical register shall include details of dangerous goods stored, or used in quantities, which could conceivably be a subject of concern in an emergency and which may have the potential to act as a pollutant causing environmental harm under certain circumstances.

The Country Fire Service will be contacted in the event of a fire. Staff will fight the fire, if it is reasonably safe to do so. The following on-site infrastructure/equipment shall be utilised for fire-fighting purposes as required:

- On-site water storages - tanks and turkey's nest
- Smoke or thermal detection in the administration office and grain processing facility
- Control panels in the administration office, grain processing control room and pumps
- Fire hydrants attached to storage tanks
- Portable fire extinguishers, located around the site for various classes of fire (audited by CHUBB)
- A water truck (used for dust suppression)
- Bulldozer
- Excavator
- Front-end loader
- Grader

If any fire cannot be controlled or attempts for control too dangerous, all staff would be evacuated to a safe area and the livestock let out of the pens into the surrounding paddocks.

7.8.12 Lighting

All outdoor lighting shall me managed in accordance with AS4282 (1997 – Control of the Obtrusive Effects of Outdoor Lighting).

7.8.13 Vermin and Disease Control Measures

Vermin such as flies, rodents (rats/mice), pest birds may become a problem at the proposed development during operation, irritating stock and workers and carrying infectious diseases.

The major nuisance flies in beef cattle feedlots are house flies, stable flies, bush flies and blowflies. House and stable flies breed in non-compacted solid wastes often under fence lines, in drains and in the sedimentation basin. Blowflies breed in animal carcasses. Bush flies rarely breed in beef cattle feedlots but can fly in from external breeding sites.

Rodents, such as mice and rats may become a problem at the proposed development during operation by consuming and contaminating stored/processed feed, cause structural damage such as undermining feed bunk aprons, chewing holes in silage covers, cabling etc. and carry infectious diseases including leptospirosis etc.

Pest birds such as ducks or parrots may become a problem at the development complex during operation by consuming and contaminating the livestock feed, cause structural damage such as chewing communication cabling etc.

Vermin can be difficult to control when populations have become established. Hence, an Integrated Pest Management (IPM) program that incorporates good hygiene, physical methods, biological agents and the focused use of insecticides to prevent and reduce vermin populations shall be implemented, rather than relying on insecticidal control methods alone or control of a large infestation.

The management practices adopted to minimise vermin populations shall include:

- Good hygiene practices are implemented at feed storage and preparation areas and feed bunks such as cleaning up and disposing of spoilt/spilled grains and commodities and rations.
- Ensuring grassed areas are kept short by regular mowing and trimming to reduce fly habitat.
- Ensuring weeds are controlled by physical or chemical means.
- Regular inspection of the proposed development for signs of vermin infestation and pressure levels.
- Timely implementation of appropriate control methods.

7.8.14 Emergency Animal Disease and Mass Mortality Contingency Plans

Emergency animal disease outbreak and / or mass mortality contingency plans will be developed as part of the environmental management plan (if development consent is granted). A suitable site for mass burial of mortalities has been identified on the subject property as shown in Figure 21.

The burial pits shall be established in low permeability soils (red clay) on a site well removed from surface waters, drainage lines, gullies, groundwater bores and the proposed development. The soils in this location are low permeability, thus lining of the pits with clay is unlikely to be required. If lining is required, then the pits shall be lined with at least 600 mm of clay.

The pit shall be located so that all water runoff is directed away from the pit. Use of exclusion bunds or trenches may be required. Pits shall be deep but relatively narrow, and excavated using an excavator.

The carcass of each animal shall be opened at the time of placing in the pit and the carcass immediately covered by at least 500 mm of soil to reduce odour and exclude flies and vermin.

Each pit shall be progressively filled with carcasses until sufficient pit capacity remains for the pit to be sealed with clay and compacted to a minimum depth of 1 m.

Soil shall be mounded over the top, and replenished should the pit subside to below ground level.

The site where mass mortalities are buried shall be recorded for future reference.

Where the mortalities are suspected to be caused by an emergency/infectious disease AUSVETPLAN procedures shall be implemented and disposal managed under the AUSVETPLAN. In this case, advice shall be sought from Department of Primary Industries and Regions South Australia (PIRSA) and/or the Environment Protection Authority.

7.8.15 Environmental Management and Monitoring

As outlined in Section 11, an Environment Management Plan (EMP) for the proposed development shall be developed. The purpose of the EMP is to document a framework for environmental management by outlining how the proposed development will impact on the relevant environmental factors and how those impacts may be mitigated and managed so as to be environmentally acceptable.

The Environment Management Plan shall detail the methods and procedures which will be used to achieve the planned environmental targets and objectives.

Environmental monitoring, including using sustainability indicators to interpret results, shall be used to assess the effectiveness of strategies chosen to minimise environmental harm and allows adjustment of management practices to prevent those impacts from reaching unacceptable levels.

The key environmental parameters to be monitored would include but not limited to:

- Solid and liquid waste management systems e.g. efficacy of collection and storage systems, utilisation performance measures
- Climatic variables that influence solid and liquid waste storage and utilisation systems or odour nuisance e.g. rainfall, evaporation, wind speed, wind direction
- Groundwater quality
- Social impacts e.g. Odour, dust and noise complaints.

7.8.15.1 Social Impacts

7.8.15.2 Community Liaison

Open communication between the neighbours and regulators from the inception of the development application through construction and operation can help to identify social impact issues, and identify and address these issues to minimise the impact of the development (when approved) on neighbours. Once operational, community liaison practices may include:

- informing neighbours in advance of any unusual events/problems/emergency practices that may cause an unavoidable increase in odour, dust or noise, including practices to mitigate the issue and the expected duration of the issue
- participation and cooperation in dispute resolution
- gathering relevant evidence, and identifying and implementing strategies to remedy the issue
- informing the complainant of the outcome of any investigations and any actions taken to avoid future associated issues, and seeking feedback to ascertain if the issue has been resolved.

7.8.15.3 Handling complaints

The number of complaints received is one measure of the impact of the development (when approved) on community amenity. While this measure is imperfect, it helps to identify when sensitive receptors perceive that the development is unreasonably affecting their enjoyment of life and property. Many community amenity impacts are closely related to weather conditions, so daily weather data can assist in assessing the validity of complaints.

Details of any complaints received, results of investigations, and corrective actions taken shall be recorded in a ‘complaints register’.

To date the existing development has not had any complaints formal or informal from an environmental perspective.

7.9 Animal Welfare Statement

The proponents will manage the proposed development to ensure a very high standard of animal welfare and health. The operation and practices for the proposed development will comply with following legislation, guidelines and standards:

- Animal Welfare Act 1985 (South Australia)
- Animal Welfare Regulations 2012 (South Australia)
- Model Code of Practice for the Welfare of Animals: Cattle (SCARM, 2004)
- Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock (Animal Health Australia (AHA) 2012)
- NFAS Rules & Standards (April 2011) (AUS-MEAT, 2011).
- Animal welfare guidelines for animals in poor condition (Sheep and Cattle) 2012 (Primary industries and Regions, 2012).

8. Relevant Statutory Planning

The development application for the proposed development will be assessed in accordance with the framework established by the Development Act 1993 and its' associated Development Regulations 2008.

The Development Act is the core legislation enacted by the South Australian Parliament to establish the planning and development system framework and many of the processes required to be followed within that framework (including processes for assessing development applications). The Regulations provide more details about the framework and are updated from time to time by the Governor (on the advice of the Minister for Planning).

As part of the assessment, a number of local and State planning instruments and policies are required to be addressed, together with relevant Commonwealth and SA legislation. This section provides an outline of the planning framework and assesses the proposed development in the context of that framework. It describes how the proposed development will address and / or comply with local planning policies; and state and federal legislation.

8.1 Local Planning Matters

8.1.1 Regional Council of Goyder Development Plan 2012

The primary development plan applying to the proposed development is the Regional Council of Goyder Development Plan 2012.

8.1.1.1 Land Use Definition

Use of land for a beef cattle feedlot according to the Regional Council of Goyder Development Plan 2012 is defined as an "***intensive animal keeping***". The definition of intensive animal keeping pursuant to Schedule 1 to the Development Regulations 2008 is:

- "the keeping or husbandry of animals in a broiler shed, chicken hatchery, feedlot, kennel, piggery, poultry battery or other like circumstances, but does not include horse keeping"

8.1.1.2 General Provisions

The general objectives of the Regional Council of Goyder Development Plan 2012 for Animal Keeping are:

1. Animals not kept at a density beyond the carrying capacity of the land or water.
2. Animal keeping development sited and designed to avoid adverse effects on surrounding development.
3. Intensive animal keeping protected from encroachment by incompatible development.

The principles of development control for animal keeping are:

1. Animal keeping and associated activities should not create adverse impacts on the environment or the amenity of the locality.
2. Storage facilities for manure, used litter and other wastes should be designed and sited:
   (a) to be vermin proof
   (b) with an impervious base
   (c) to ensure that all clean rainfall runoff is excluded from the storage area
   (d) outside the 1 in 100 year average return interval flood event area.

The general principles of development control for intensive animal keeping are:

9. Intensive animal keeping operations and their various components, including holding yards, temporary feeding areas, movement lanes and similar, should not be located on land within any of the following areas:

   a. 800 metres of a public water supply reservoir
   b. the 1 in 100 year average return interval flood event area of any watercourse
   c. 200 metres of a major watercourse (third order or higher stream)
   d. 100 metres of any other watercourse
   e. 2000 metres of a defined and zoned township, settlement or urban area
   f. 500 metres of a dwelling (except for a dwelling directly associated with the intensive animal keeping facility.

10. Intensive animal keeping operations should include on site storage and treatment facilities for manure, used litter and other wastes and appropriate disposal of wastes.

11. Intensive animal keeping operations should include a drainage system to direct surface runoff from uncovered areas to appropriately designed wastewater lagoons.

12. Intensive animal keeping facilities and associated wastewater lagoons and liquid/solid waste disposal areas should be designed, managed and sited to avoid adverse impacts on other land uses

8.1.1.3 Zoning

Under the Regional Council of Goyder Development Plan 2012, the proposed development is located in the Primary Production zone as shown in Figure 24. Intensive animal keeping are permissible with consent in the Primary Production zone. The Development Plan states that the objectives of this zone are:

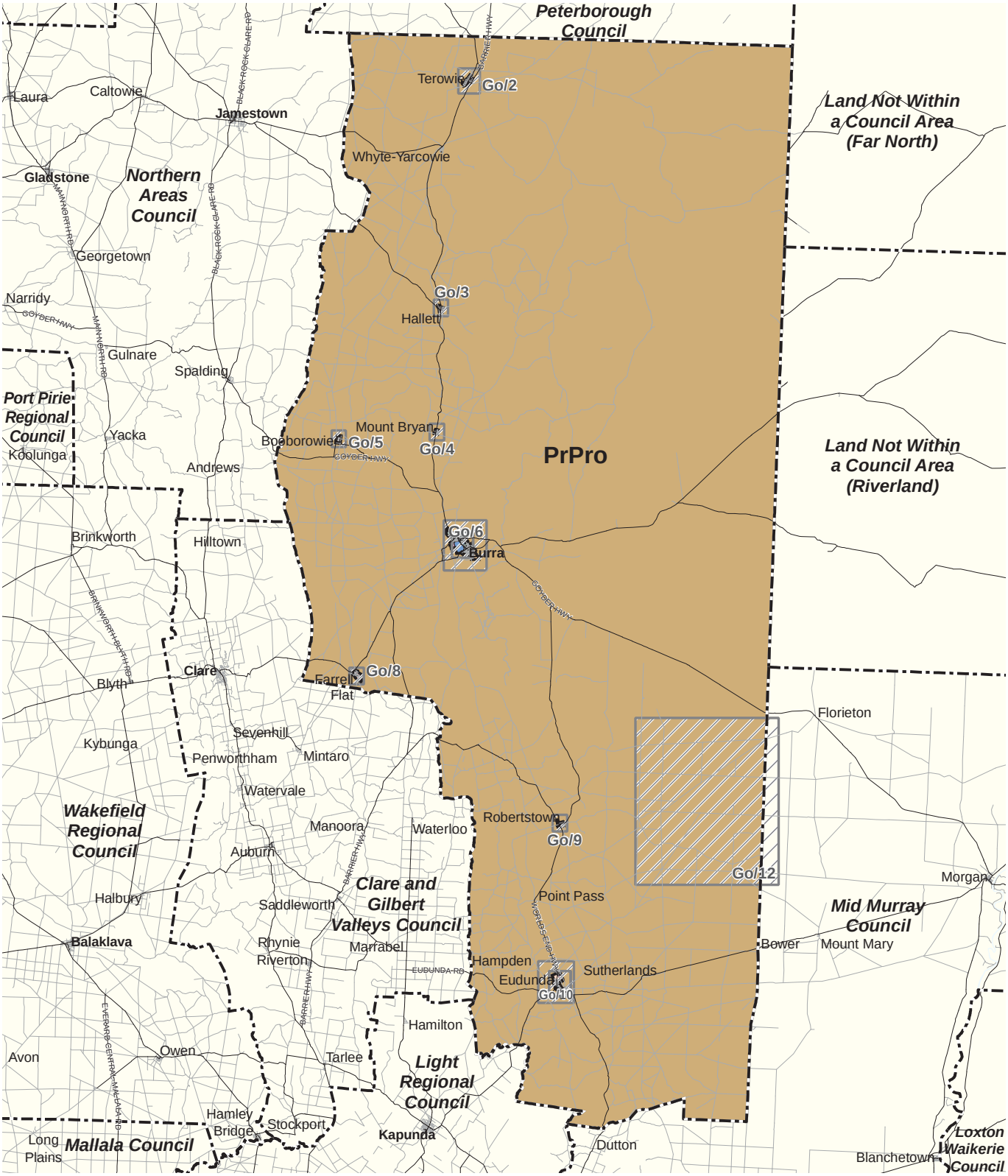
1. Economically productive, efficient and environmentally sustainable primary production.
2. Allotments of a size and configuration that promote the efficient use of land for primary production.
3. Protection of primary production from encroachment by incompatible land uses and protection of scenic qualities of rural landscapes.
4. Accommodation of wind farms and ancillary development.
5. Development that contributes to the desired character of the zone.

The proposed development would result in economically productive, efficient and environmentally sustainable use of agricultural land on the subject property.

An assessment of land capability, including soil types, water resources, vegetation and other physical attributes indicates that the land is suitable for the proposed development. Further, the proposed development provides diversification of primary industry enterprises and systems appropriate for the area.

The proposed development has been assessed in terms of its potential environmental impacts and management and mitigation measures recommended to mitigate potential adverse impacts to an acceptable level.

The proposed development is consistent with the objectives of the Primary Production zone.



See enlargement map for accurate representation.

Zone Map Go/1

Zones

- PrPro — Primary Production
- Zone Boundary
- Development Plan Boundary

GOYDER COUNCIL

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8.2 State Planning Matters

8.2.1 Development Act 1993

The Development Act 1993 and its associated Development Regulations 2008 provide the framework for development planning in SA and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment, and provide opportunity for public involvement.

The objectives of Development Act 1993 are:

The object of this Act is to provide for proper, orderly and efficient planning and development in the State and, for that purpose:

(a) to establish objectives and principles of planning and development; and
(b) to establish a system of strategic planning governing development; and
(c) to provide for the creation of Development Plans—
  (i) to enhance the proper conservation, use, development and management of land and buildings; and
  (ii) to facilitate sustainable development and the protection of the environment; and
  (iia) to encourage the management of the natural and constructed environment in an ecologically sustainable manner; and
  (iii) to advance the social and economic interests and goals of the community; and
(d) to establish and enforce cost-effective technical requirements, compatible with the public interest, to which building development must conform; and
(e) to provide for appropriate public participation in the planning process and the assessment of development proposals; and
(ea) to promote or support initiatives to improve housing choice and access to affordable housing within the community; and
(f) to enhance the amenity of buildings and provide for the safety and health of people who use buildings; and
(g) to facilitate -
  (i) the adoption and efficient application of national uniform building standards; and
  (ii) national uniform accreditation of buildings products, construction methods, building designs, building components and building systems.

8.3 State Legislation

8.3.1 Environment Protection Act 1993

The *Environment Protection Act 1993* provides the regulatory framework to protect South Australia's environment, including land, air and water.

The *Environment Protection Act 1993* is the key piece of environment protection legislation administered by the EPA in South Australia. It provides the regulatory framework to protect South Australia's environment, including land, air and water.

The objects of the Environment Protection Act are:

(a) to promote the following principles (principles of ecologically sustainable development):
(i) that the use, development and protection of the environment should be managed in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical wellbeing and for their health and safety while—
(A) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and
(B) safeguarding the life-supporting capacity of air, water, land and ecosystems; and
(C) avoiding, remedying or mitigating any adverse effects of activities on the environment;
(ii) that proper weight should be given to both long and short term economic, environmental, social and equity considerations in deciding all matters relating to environmental protection, restoration and enhancement; and
(b) to ensure that all reasonable and practicable measures are taken to protect, restore and enhance the quality of the environment having regard to the principles of ecologically sustainable development, and—
(i) to prevent, reduce, minimise and, where practicable, eliminate harm to the environment—
(A) by programmes to encourage and assist action by industry, public authorities and the community aimed at pollution prevention, clean production and technologies, reduction, reuse and recycling of material and natural resources, and waste minimisation; and
(B) by regulating, in an integrated, systematic and cost-effective manner—
• activities, products, substances and services that, through pollution or production of waste, cause environmental harm; and
• the generation, storage, transportation, treatment and disposal of waste; and
(i) to establish processes for carrying out assessments of known or suspected site contamination and, if appropriate, remediation of the sites; and
(ii) to co-ordinate activities, policies and programmes necessary to prevent, reduce, minimise or eliminate environmental harm and ensure effective environmental protection, restoration and enhancement; and
(iii) to facilitate the adoption and implementation of environment protection measures agreed on by the State under intergovernmental arrangements for greater uniformity and effectiveness in
environment protection; and
(iv) to apply a precautionary approach to the assessment of risk of environmental harm and ensure that all aspects of environmental quality affected by pollution and waste (including ecosystem sustainability and valued environmental attributes) are considered in decisions relating to the environment; and

(v) to require persons engaged in polluting activities to progressively make environmental improvements (including reduction of pollution and waste at source) as such improvements become practicable through technological and economic developments; and

(vi) to allocate the costs of environment protection and restoration equitably and in a manner that encourages responsible use of, and reduced harm to, the environment with polluters bearing an appropriate share of the costs that arise from their activities, products, substances and services; and

(vii) to provide for monitoring and reporting on environmental quality on a regular basis to ensure compliance with statutory requirements and the maintenance of a record of trends in environmental quality; and

(viii) to provide for reporting on the state of the environment on a periodic basis; and

(ix) to promote—

(A) industry and community education and involvement in decisions about the protection, restoration and enhancement of the environment; and

(B) disclosure of, and public access to, information about significant environmental incidents and hazards.

(2) The Minister, the Authority and all other administering agencies and persons involved in the administration of this Act must have regard to, and seek to further, the objects of this Act.

8.3.2 Water Resources Act 1997

Management of water resources in South Australia relies on a range of legislation, initiatives and cooperative arrangements with the Commonwealth and other state governments. The key pieces of legislation for the management of water in SA are the *Water Resources Act 1997*, *Water Industry Act 2012*.

The object of the *Water Resources Act 1997* is the sustainable and integrated management of the state's water resources.

The *Water Resources Act 1997* recognises the need to sustainably manage the State's water resources to provide security for all water users, now and into the future allocate. Important water resources in South Australia are protected and managed by being 'prescribed' under the Act.

For each prescribed water resource, a Water Allocation Plan is developed to meet the needs of the environment and the community.

The proposed development is not located within a prescribed water resources area.

The watercourses and groundwater in the vicinity of the proposed development will be protected through appropriate design and management practices, including controlled drainage area, low permeability pen and drainage system construction, and sustainable solid and liquid waste management as outlined in Section 7.5.9, Section 7.5 and Section 10.7 respectively.

8.4 Commonwealth Matters

8.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as matters of national environmental significance (NES). Approval from the Commonwealth is in addition to any approvals under NSW legislation.

The objectives of the EPBC Act are to:

- provide for the protection of the environment, especially matters of national environmental significance;
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources;
- conserve Australian biodiversity;
- provide a streamlined national environmental assessment and approvals process;
- enhance the protection and management of important natural and cultural places
- control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife
- to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity;
- to promote the use of indigenous people's knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.

Approval under the EPBC Act is triggered by a proposal which has the potential to have a significant impact on a matter of NES or by a proposal which has the potential to have a significant impact on the environment which involves the Commonwealth. The EPBC Act lists nine matters of NES which must be addressed when assessing the impact of a proposal.

The nine matters of NES are:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act also identifies approval requirements involving Commonwealth land and activities undertaken by Commonwealth agencies.

The proposed development does not involve Commonwealth land and is not an activity proposed by a Commonwealth agency, and therefore, the relevance of the EPBC Act relates to matters of NES.

Under Section 68 of the EPBC Act, a proposal must be referred to the Commonwealth Minister for Environment and Heritage if the applicant believes an approval under the EPBC Act is required.

The Commonwealth Minister for the Environment and Heritage would subsequently decide whether the proposal requires approval under the EPBC Act.

An assessment of the proposed development in relation to the listed matters of NES is provided below. A search of the Department of Environment and Heritage (DEH) EPBC Online Database was also undertaken within a 5 km radius of the proposed development, the results of which are included in Appendix C.

8.4.1.1 World Heritage properties

There are no declared world heritage properties in proximity to the proposed development, or that would potentially be affected by the proposed development.

8.4.1.2 National Heritage Places

There are no declared national heritage properties in proximity to the proposed development, or that would potentially be affected by the proposed development.

8.4.1.3 Wetlands of International Importance (Ramsar wetlands)

There are no Wetlands of International Importance in proximity to the proposed development, or that would potentially be affected by the proposed development.

8.4.1.4 Nationally threatened species and ecological communities

The database search identified two Commonwealth-listed threatened ecological communities and 17 Commonwealth-listed threatened species that may occur within proximity to the proposed development. The biodiversity assessment undertaken (Section 10.6) has confirmed that there are no threatened species or endangered communities on the subject property on which the development is proposed which are likely to be significantly affected by the proposed development.

8.4.1.5 Migratory species

The database search identified ten migratory species that may occur within proximity to the proposed development site. The biodiversity assessment undertaken (Section 10.6) identified that the proposed development is not expected to impact significantly on the habitat for these species.

8.4.1.1 Commonwealth marine areas

There are no Commonwealth marine areas in proximity to the proposed development, or that would potentially be affected by the proposed development.

8.4.1.2 The Great Barrier Reef Marine Park (GBRMP)

The proposed development is not located in the Great Barrier Marine Park or in an area that drains into the GBMR. Therefore, the GBRMP would not be affected by the proposed development.

8.4.1.3 Nuclear actions

The proposed development would not involve a nuclear action, as defined under the EPBC Act 1999.

8.4.1.4 a water resource, in relation to coal seam gas development and large coal mining development.

The proposed development is not a coal seam gas or large coal mining development.

8.4.1.5 Actions prescribed by the regulations

The proposed development would not involve actions as prescribed by the *EPBC Regulations 2000*.

The proposed development is not expected to impact on matters of NES, and as a consequence the EPBC Act is not triggered and referral to, and approval from, the Commonwealth Minister for Environment and Heritage is not required.

9. Relevant Guidelines

The Australian beef cattle lot feeding industry and various states including South Australia have prepared codes of practice, guidelines and reference manuals to be used as a resource for guiding the siting, design and preventing adverse impacts on the environment for beef cattle developments.

It should be emphasised that these guidelines, code of practice and reference manuals do not override or replace federal, state or local government legislation, regulation, plans or policies.

The aim of these reference documents is to ensure that those planning to construct a beef cattle feedlot, or operate one, comply with all relevant regulatory requirements.

Ostwald Bros has extensive experience in the preparation of planning applications, layouts and designs for cattle feedlots. The following guidelines have been used to plan and design the proposed development and provide best practice methods for siting, design, operation and management (in the event development consent is granted) of the proposed development.

9.1.1 State Guidelines

The following state documents have been used as a resource when preparing this development application. These guidelines provide a broad framework of generally acceptable principles for establishing and operating feedlots within South Australia.

Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition (Department of Primary Industries and Resources (SA) (PIRSA), 2006). The guidelines contains information on the establishment and operation of feedlots in South Australia including the starting a feedlot, feedlot operation, financial aspects and technical issues.

9.1.2 National Guidelines

The Australian beef cattle lot feeding industry considers that the protection of the environment is essential for ecologically and economically sustainable agricultural production. To this end the industry has been pro-active developing and adopting appropriate guidelines and codes of practice for best practice siting, design, construction and operation for beef cattle feedlots. The following documents have been used as a resource when preparing this development application. These documents provide a framework of acceptable principles for the establishment and operation of feedlots in Australia.

The National Guidelines for Beef Cattle Feedlots in Australia (MLA, 2012a) contains information on the establishment and operation of feedlots including the major design components of a feedlot, key site selection parameters, development application and approval process, and feedlot construction.

The National Beef Cattle Feedlot Environmental Code of Practice (MLA, 2012b) addresses the environmentally relevant aspects of the site, design, construction and operation of a beef cattle feedlot. It defines a series of outcomes that should prevent or minimise adverse impacts on environmental values.

The Beef Cattle Feedlots: Design and Construction (MLA, 2016a) handbook provides a reference document that outlines current best practice design and construction of feedlot facilities including site selection and layout, site infrastructure, site earthworks, cattle handling, shade structures, pen design and layout, feed storage, preparation and delivery, water supply and usage, cattle washing, runoff control and storage, feedlot construction.

The Beef Cattle Feedlots: Waste Management and Utilisation (MLA, 2016b) handbook provides a reference document that outlines current best practice for waste management and utilisation including types of wastes, waste storage and processing and utilisation.

10. Environmental Issues and Assessment of Impacts

10.1 Air Quality

10.1.1 Introduction

This section discusses the potential impacts on air quality and the emissions of greenhouse gases (GHG) associated with the proposed development; including mitigation measures when practicable.

The main emissions of concern are odour and dust, and to a lesser extent GHG emissions associated with the livestock, vehicles, feed processing operations.

The main impacts on air quality in regards to the proposed development include:

- odours from the surface of pens and liquid waste storage
- impacts of dust from operations associated with construction and operation such as bulk earthworks, movement of cattle within the pens, vehicle movement etc.
- vehicle exhaust emissions
- livestock and manure GHG emissions.

Potential impacts to air associated with the proposed development are expected to be minimal based on the implementation of a number of mitigation measures, the location of the proposed development and the absence of nearby residential facilities will limit any adverse impacts.

Odour is considered the key potential air quality impact of the proposed development and therefore an odour assessment in accordance with the *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition* (Department of Primary Industries and Resources (SA) (PIRSA), 2006) was undertaken.

There are limited potential sources of particulate emissions from the existing environment as the environment is considered undisturbed. Existing particulate emissions include primarily vehicle emissions from local traffic, smoke from bushfires and wind-blown dust.

This section includes a summary of this assessment as well as addressing other relevant matters relating to air quality such as dust and greenhouse gases.

10.1.2 Existing Environment

10.1.2.1 Sensitive Receptors

The proposed development is located in the mid-north region, which is a sparsely populated area of Northern South Australia. The nearest communities to the proposed development are the townships of Mount Bryan, Booborowie and Burra which are 5 km north-east, 7.5 km north-west and 11 km south-east respectively.

The nearest potentially affected sensitive receptors have been identified from examination of aerial imagery (Google Earth™) and a site inspection and are shown in Figure 23.

Figure 23 and Table 15 shows that the closest sensitive receptor is a rural residence located some 2,715 km to the north-east of the proposed development.

10.1.2.2 Existing Emission Sources

The air quality assessment should account for cumulative impacts associated with existing emission sources as well as currently approved developments linked to the receiving environment.

There are no existing emission sources nor any currently approved developments (other than the existing feedlot) linked to the receiving environment in the locality of the proposed development. Subsequently, there are no cumulative effects of the proposed development with any existing development or emission source.

10.1.3 Air quality impacts

10.1.3.1 Odour

The Australian feedlot industry expanded significantly about 25 years ago and is currently experiencing further expansion. Many aspects of the siting, design, construction, management and monitoring of Australian feedlots have improved substantially in the past 25 years. Overall, these factors have led to a significant improvement in environmental performance. The improvements include:

- Significant investment in research into environmental aspects of feedlots, including recent odour studies (Atenzi et al., 2014, Nicholas et al., 2014, Omerod et al., 2014).
- The introduction of best practice guidelines to provide industry with tools to design and manage feedlots, including environmental aspects such as pen and manure management (MLA, 2012a, 2012b).
- The adoption of National Feedlot Guidelines and Code of Practice by industry and regulators (MLA, 2012a, 2012b).
- The adoption of the National Feedlot Accreditation Scheme (NFAS) (AUS-MEAT, 2011).
- Major improvements in feedlot nutrition, feed management and feed processing that have minimised manure production.

Odour is considered the key potential air quality impact of the proposed development and is important from a community amenity perspective. Various design and management measures can be implemented to minimise the generation of odour but it is not possible to completely eliminate this nuisance source.

The accepted solution to limit any adverse impacts and unreasonable interference with the amenity of neighbours is to provide an adequate buffer between the nuisance source and the sensitive receptor. Experience with cattle feedlots is that, if the buffer distance is adequate for odour, then dust and noise nuisance is unlikely to occur.

For an intensive beef cattle feedlot development, there are two possible approaches to determining the appropriate buffer distance between the facility and sensitive receptors. These approaches are either:

1. A conservative assessment using a simple formula
2. A detailed assessment using odour dispersion modelling.

This two-level approach is recognised in both the National Feedlot Guidelines (MLA 2012b) and *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition* (Department of Primary Industries and Resources (SA) (PIRSA), 2006) for odour assessment. The simple formula approach is sufficient to broadly identify whether the proposed development site is suitable or if further assessment of odour impact is necessary or worthwhile. In South Australia, this is described as a Level 1 assessment and is completed using the S-Factor formula.

10.1.3.2 Odour objectives

The objective of the assessment was to determine the potential odour impact from the proposed development in accordance with:

- *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition* (Department of Primary Industries and Resources (SA) (PIRSA), 2006).

10.1.3.3 Odour generation processes

Simplistically, odour at a beef cattle feedlot is generated when organic matter breaks down anaerobically in the presence of water. The predominant organic matter generated is solid waste including manure, animal carcasses and spilt feed. Water generally comes from rainfall but can also come from the water reticulation system via leaks, overflows, cleaning of water troughs and the moisture added to the pen surface via manure (faeces and urine).

Subsequently, the pen area, solid waste storage area, sedimentation basin and storage lagoon are the principle sources of odour at the proposed development.

Australian research (Atenzi et al., 2014, Nicholas et al., 2014, Omerod et al., 2014), has shown that very little odour is emitted from dry pens or any other dry organic material. However, when the pen manure is wetted due to rainfall or spilt water, the odour emission rate can increase 100 fold. This means that even small wet patches in pens can contribute large amounts of odour.

10.1.3.4 Odour control processes

The basic principles of odour control at beef cattle feedlots are to:

- Minimise the amount of organic matter available for decomposition
- Minimise the amount of water that mixes with organic matter
- Maximise the rate of drying of wet organic matter.

10.1.3.5 Assessment Methodology

The assessment has been performed in line with the *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition* (Department of Primary Industries and Resources (SA) (PIRSA), 2006). The assessment included:

- Determination of the separation distance between the proposed development and the nearest receptor using the S-Factor method.

This approach is also recognised in the National Feedlot Guidelines (MLA 2012b) for odour assessment. The simple formula approach is sufficient to broadly identify whether the proposed development site is suitable or if further assessment of odour impact is necessary or worthwhile. Subsequently, an assessment has also been undertaken in line with *The National Guidelines for Beef Cattle Feedlots in Australia (3rd Edition*) (MLA, 2012b) – which is the most recently published beef cattle feedlot guideline.

10.1.3.6 Dust

The proposed development is located in a rural area. Air quality in the local area would be considered to be of good quality and is unlikely to be influenced by dust emissions from current agricultural activities (dryland cropping, beef cattle grazing etc).

The introduction of a development such as a beef cattle feedlot in areas previously bereft of intensive livestock facilities would have the potential to reduce local air quality from dust emissions.

Dust emissions from the proposed development are unlikely to cause impacts unless receptors are located nearby. The distance emissions generally disperse from the source depend on topographic and climatic factors.

Typically, for beef cattle feedlot developments, if the separation distance is suitable to mitigate against odour impacts, dust impacts are also not expected.

10.1.3.7 Greenhouse Gases

Greenhouse gases (GHGs) are a natural part of the atmosphere, they act to absorb and re-emit infrared radiation from the sun, trapping heat and warming the Earth's atmosphere, a process similar to that occurring in a greenhouse. However, human activities are increasing the concentrations of these heat-absorbing gases, which allows the atmosphere to warm up, resulting in global warming thus the name Greenhouse Gas. The most significant greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_x) and various forms of fluorocarbons.

Methane is a colourless, odourless gas released into the atmosphere from many human-related activities and natural sources such as wetlands, oceans, freshwater, fossil-fuel production, livestock, landfills, and is the main constituent of natural gas. Methane is the second most abundant

greenhouse gas (GHG) after carbon dioxide (CO_2), accounting for about 14 per cent of global emissions (Global Methane Initiative, 2011).

Global warming potential (GWP) indicates the amount of heat trapped per mass of gas and the time the gas remains in the atmosphere. It is expressed relative to carbon dioxide which has a GWP of 1. GWP is used to convert the impact of different greenhouse gases into a single metric, carbon dioxide-equivalent (CO_2-e). Methane is more efficient at trapping heat than carbon dioxide and therefore has a current GWP of 25 (Lines-Kelly, 2014).

The digestive processes of ruminants (cattle, sheep, camels, deer etc.), rice cultivation, animal manures, biomass burning, and waste decomposition in landfills are some of the major sources of agricultural methane emissions.

Nitrous oxide is also produced from urine deposited by livestock on soils and from manure and liquid waste during storage and treatment (Eckard, et al., 2010). Of the dietary nitrogen consumed by ruminants, less than 30% is utilised for production, with the majority (over 70%) being excreted.

Agriculture generated about 15% of Australia's total direct greenhouse gas (GHG) emissions in 2010 (DCCEE 2012) with beef cattle including feedlot cattle contributing the largest proportion of these emissions at around 7%.

Hence, the introduction of a development such as a beef cattle feedlot has the potential to impact on local area GHG emissions.

10.1.3.8 Assessment of Impacts

Potential air quality impacts from the project have been assessed by:

- identifying the nearest sensitive receptors describing existing air quality and defining the prevailing wind direction
- reviewing legislative requirements and ambient air quality goals
- identifying mitigation measures to assist with the management of the potential air quality impacts from the proposed development.

10.1.4 Air Quality Assessment

10.1.4.1 Odour

The separation distance between the proposed development and the nearest receptor using the S-Factor method outlined in Section 9.3 of the *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition* (Department of Primary Industries and Resources (SA) (PIRSA), 2006) was undertaken.

Receptors within 10 km of the proposed development site were identified from aerial imagery (Google Earth™) as shown in Figure 8.

The composite site factor (S) is related to the stocking density, receptor type, terrain, vegetation and wind frequency factors.

- Stocking factor (s1): Same for all receptor types. Class One (1) feedlot and stocking density of 15 m^2/SCU.
- Receptor factor (s2): Receptor types chosen for the assessment included "Rural farm residence", "Towns with >100 persons".
- Topography factor (s3): "High Relief" and "Low Relief" chosen for receptor types.
- Landscape factor (s4): "Undulating Hills" and "Significant Hills and Valleys" used for receptor types.

Table 15 shows that the existing separation distances exceed the minimum separation calculated by the *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia 2nd Edition* (Department of Primary Industries and Resources (SA) (PIRSA), 2006) with the exception of Receptor 1 (Mount Bryan).

The separation distance between the proposed development and the nearest receptor using the S-Factor method outlined in Appendix B of *The National Guidelines for Beef Cattle Feedlots in Australia (3rd Edition*) (MLA, 2012b) was undertaken. This method follows the same S-factor method as the SA Guidelines. However, the composite S-values are slightly more refined.

Table 16 shows that the existing separation distances exceed the minimum separation calculated by *The National Guidelines for Beef Cattle Feedlots in Australia (3rd Edition*) (MLA, 2012b).

As shown in Table 15 and Table 16, the proposed development shows compliance at all receptors with the exception of Mount Bryan based on a s2 factor of Towns >100 persons (1.2). However, if a more appropriate s2 factor for the size of Mount Bryan with a population of 138 (medium town >100-500 persons) as outlined in the National Beef Cattle guidelines is used then the proposed development is compliant.

Further, an analysis of available wind indicated that over the peak odour production period, the wind direction will be from the west meaning that potential odour impacts on Mount Bryan will be minimal.

Subsequently, a more in depth assessment (dispersion modelling based approach) has not been undertaken.

10.1.4.2 Dust

Potential impacts to air quality from dust emissions were considered at a local level based on the type of infrastructure proposed, construction techniques to be employed, temporal duration of construction, operational occurrences of dust and the spatial extent of the individual sensitive receptors.

During construction of the proposed development there is potential for impacts to air quality caused by the generation of dust during bulk earthworks involved in creating the design surface, access roads, infrastructure areas etc. Dust emissions will be influenced by the moisture content and particle size of the materials being moved.

Once operational there is also potential for dust generation, particularly during prolonged dry periods. Dust arises from:

- movement of cattle within the pens. Dust problems are likely to develop when the water evaporated from the pen surface exceeds the water added by rainfall and manure.
- feed storage and processing
- movement of vehicles around the development complex in particular, trucks delivering ration to the cattle
- storage and processing of solid wastes
- land application of solid wastes.

Less obvious is the time of day when dust is generated. Observations of beef cattle feedlots in the United States and Australia have found that increased dust levels develop during the late afternoon and dusk when temperatures drop and cattle become more active (Skerman, 2000). When temperatures drop, cattle that have been resting during the heat of the day become active and apart from feeding and drinking, younger cattle tend to become playful. This creates considerable dust that 'hangs' in the cool still evening air. However, it is considered that the potential for dust can be minimised by the implementation of measures outlined in Section 10.1.5.

Dispersion conditions (separation from sensitive receptors) adequate for managing off-site odour impacts are usually also adequate for managing off-site dust impacts (DECC, 2013). Subsequently, due to separation from sensitive receptors combined with the mitigation and management measures proposed, dust is not expected to impact on air quality of the local area.

10.1.4.3 Greenhouse Gases

Beef cattle produce methane (CH_4) as a by-product of their anaerobic digestive process (enteric fermentation) as the rumen breaks down cellulose in grasses and other forages to obtain energy and nutrients for growth. Most of the methane (enteric methane) that accumulates in the rumen is expelled via the mouth through belching and breathing. About 2% of total emission is also produced in the intestine and emitted through the rectum as flatulence.

Methane emissions from beef cattle have been estimated at about 200g per head per day (Charmley et al., 2011). Subsequently, the longer an animal takes to get to market and the more often a cow does not get bred, then that animal is producing methane with very little beef being marketed in return (Charmley et al., 2008). This so called methane intensity, is markedly higher for extensive grazing systems than cattle raised in more intensive grain-based feedlot production systems.

Cattle manure contains in the order of 16 to 24 kg nitrogen per tonne. Nitrogen can occur as organic nitrogen, ammonium and nitrate with a range of transformations possible after deposition to land (Wiedemann et al., 2013).

Energy is fundamental to the proposed development. Indirect sources arise mainly from the transport of cattle in and out of the development, commodity delivery and solid waste removal. Energy is used directly in the construction of the proposed development – through plant and equipment fuel usage and in the operation of the proposed development for the production of beef – feed processing, feed delivery, water supply, office etc.

In GHG terms, grain finishing beef cattle has a number of key differences from grass finishing; GHG emissions from enteric methane are lower (Dong et al., 2006) while emissions from manure management may be higher (Department of the Environment 2015) though to date the Australian inventory has not based estimates of manure emissions on Australian research.

GHG emissions from the proposed development can be broken into three sources; direct methane emissions to the atmosphere (enteric methane) from the livestock themselves, methane and nitrous oxide emissions resulting from the breakdown of organic matter during solid/liquid waste storage, treatment and handling and utilisation and those resulting from the use of fossil fuels for energy usage.

Potential impacts to air quality from GHG emissions were considered based on the type of infrastructure proposed, construction techniques and machinery to be utilised and management techniques to be employed.

GHG emissions from the proposed development are unlikely to cause impacts due to productivity improvements over extensively grazed systems and the mitigation and management measures proposed.

10.1.5 Mitigation and Management Measures

As discussed in 10.1.3.8, a number of air quality impacts were identified. The implementation of the following management and mitigation measures would minimise potential odour sources and the identified impacts to air quality as a result of the proposed development.

10.1.5.1 Odour

10.1.5.2 Design and Siting

The implementation of the following management and mitigation measures would minimise identified potential odour impacts to air quality as a result of the proposed development:

- Provision of adequate separation distances between the proposed development and sensitive receptors as shown in Figure 23
- The pens are designed with adequate slope to maximise drainage and encourage rapid drying of the pen surface after rainfall
- Sedimentation basin designed to maximise the removal of solids and drain free of water after a runoff event
- Design and siting of water troughs so that excess water released during trough cleaning or from a broken float valve does not enter the pen area, thus minimising wet areas in pens
- The catch and main drains designed with adequate and uniform slope to maximise drainage and encourage rapid drying after rainfall
- Provision of vegetative screen around proposed development as a wind break and vegetative filter.

10.1.5.3 Operation

The implementation of the following management and mitigation measures would minimise identified potential odour impacts to air quality as a result of the proposed development:

- Minimisation of wet areas in pens by fixing leaks from water troughs
- Utilising the best animal production genetics - Improved production traits such as growth rate and carcass weight will contribute significantly to reducing emissions intensity
- Maximise feed energy by eliminating parasites and nutrient deficiencies
- Generating and maintaining best practice management for solid and liquid waste storage, processing and utilisation
- Frequent removal of manure from the pens/drains and under-fences
- Elimination of wet areas within the pens
- Sedimentation basin control weir(s) maintained in operational order to ensure that complete drainage occurs
- Remove solids from the sedimentation basin(s) as soon as practical
- Dewatering of the storage lagoon(s) by irrigation to crops or pastures as soon as possible after rainfall
- Receiving, reporting and responding to any complaints in relation to air quality through the 24-hour community response line
- Ensure that all employees and contractors are given adequate training in environmental awareness, legal responsibilities, and air quality control methods.

10.1.5.4 Dust

As it is not practical to remove dust from the air, management and mitigation measures shall be directed towards preventing dust from being created as outlined in the following sections.

10.1.5.5 Design and Siting

The implementation of the following management and mitigation measures would minimise identified potential dust impacts to air quality as a result of the proposed development:

- Provision of adequate separation distances between the proposed development and sensitive receivers as shown in Figure 23
- Provision of vegetative screen around proposed development as a wind break and vegetative filter.

10.1.5.6 Construction

The implementation of the following management and mitigation measures shall minimise identified potential dust impacts to air quality as a result of the construction of the development:

- Vegetation clearing minimised to the extent necessary for construction of the proposed development and access tracks
- Dust suppression measures, such as watering exposed soil and ceasing dust generating activities during periods of high wind, shall be implemented
- As soon as practical at the completion of construction works any disturbed areas required to be revegetated shall be.

10.1.5.7 Operation

The implementation of the following management and mitigation measures shall minimise identified potential dust impacts to air quality as a result of the operation of the development:

- Adapting the cattle stocking density in pens to maintain manure on pen surface at 25-35% moisture content to minimise dust generation. For example, stocking density may change from lighter rates in winter to heavy rates in summer
- Setting and enforcing speed limits on internal road network
- Dust suppression measures, such as watering access and feed roads and solid waste stockpiles as required
- Any operations involving the movement of dusty materials such as hay processing, grain movement, solid waste turning and spreading shall be timed and managed where possible when materials are have adequate moisture content
- Ceasing dust generating activities such as hay processing, pen cleaning, solid waste stockpiling, screening, spreading during periods of high wind, shall be implemented
- Minimising the accumulation of manure in pens and cattle lanes by cleaning more frequently that Class One (1) requirements
- Application of solid wastes to land when wind conditions and dispersion conditions are favourable
- Receiving, reporting and responding to any complaints in relation to air quality through the 24-hour community response line
- Ensure that all employees and contractors are given adequate training in environmental awareness, legal responsibilities, and air quality control methods.

10.1.5.1 Greenhouse Gas Emissions

10.1.5.2 Design

The implementation of the following management and mitigation measures at the design stage of the proposed development shall minimise identified potential GHG impacts to air quality as a result of the proposed development:

- The pens designed with adequate slope to maximise drainage and encourage rapid drying of the pen surface after rainfall
- Sedimentation basin(s) designed to maximise the removal of solids and drain free of water after a runoff event
- Appropriately sized solid and liquid waste utilisation area for sustainable application of nutrients.

10.1.5.3 Construction

The implementation of the following management and mitigation measures shall minimise identified potential GHG impacts to air quality as a result of the construction of the development:

- Use of appropriately sized plant and equipment for respective processes to ensure machines are operating at peak efficiency and activities completed in a timely manner
- Routine service and maintenance of mobile equipment used to ensure efficient operation
- Review and further evaluation of all construction vehicles against current industry fuel efficiency benchmarks.

10.1.5.4 Operation

The implementation of the following management and mitigation measures shall minimise identified potential GHG impacts to air quality as a result of the operation of the development:

- Sourcing livestock from as close to the development as practical as well as on-site production to minimise fugitive emissions during transport
- Utilising the best animal production genetics - Improved production traits such as growth rate and carcass weight will contribute significantly to reducing emissions intensity
- Rations formulated to minimise enteric methane emissions
- Maximise feed energy by eliminating parasites and nutrient deficiencies
- Use of appropriately sized plant and equipment for respective processes
- Generating and maintaining best practice management for solid and liquid waste storage, processing and utilisation
- Frequent removal of manure from the pens/drains and under-fences
- Elimination of wet areas within the pens
- Sedimentation basin control weir(s) maintained in operational order to ensure that complete drainage occurs

- Remove solids from the sedimentation basin(s) as soon as practical
- Manure stockpiles are not turned to release emissions generated from the anaerobic decomposition process
- Dewatering of the storage lagoon(s) by irrigation to crops or pastures should occur as soon as possible after rainfall
- Utilisation of solid and liquid wastes on-site to minimise inorganic fertiliser requirements
- Matching fertiliser to plant nutrient requirements to maximise crop growth
- Sourcing feed commodities from as close to the development as practical as well as on-site production to minimise fugitive emissions during transport
- Incorporate energy and GHG awareness into training of managers and supervisors
- Routine service and maintenance of mobile equipment used on-site to ensure efficient operation
- Regular reviews and monitoring of GHG emissions and energy usage
- Ongoing research into cleaner technologies and energy minimisation practices, leading to implementation where practicable.

10.1.6 Conclusion

Odour emissions generated from the proposed development are expected to be the primary impact to air quality as a result of the proposed development.

The proposed development has been sited to provide adequate separation distances between the odour and dust generating sources and sensitive receivers as shown in Figure 23.

It is concluded that sufficient separation exists between the proposed development and sensitive receptors to limit any adverse impacts and unreasonable interference with the amenity of neighbours as a result of odour. Further, as the separation distance is suitable to mitigate against odour impacts, dust impacts are also not expected by default.

Other issues relating to air quality such as greenhouse gases are not expected to create significant air quality impacts to the local area.

10.2 Soils

10.2.1 Geotechnical Assessment

A geotechnical assessment that focused on the investigation and determination of the subsurface conditions and potential risks that may exist within the site of the existing development was undertaken in 2007. The geotechnical assessment was undertaken to determine the suitability of the site for the proposed development and to enable the design and construction of the relevant infrastructure, such as roads, pen foundations, water retaining structures (drains, sedimentation basin, storage lagoon), building footings, compacted earthworks, feed storage and processing areas, excavations etc. in the detailed design phase.

An assessment of the capability of the land on which solid and liquid waste utilisation is proposed was also undertaken. This assessment is provided in Section 10.7.

10.2.1.1 Methodology

The geotechnical assessment involved the following steps:

- Desktop review – prior to conducting fieldwork, discussions with relevant government stakeholders and the farm manager were undertaken, and collection and collation of land resource information covering the area. This allowed soil test pits to be targeted within representative areas of the various soil groups.
- Field work - a series of test pits were excavated at strategic locations across the existing development site to characterise the subsurface morphology. A strata log of each test pit was recorded. A selection of soil samples were taken from various horizons within the test pits. The fieldwork was undertaken in May 2007.
- Soil analysis – Soil samples that characterised the representative soil horizons were forwarded to a NATA accredited laboratory for testing for a range of engineering properties.

10.2.1.2 Subsurface Conditions

In general terms, the investigation confirmed the presence of suitable material for construction of the development. The suitability of material for construction was assessed on the basis of its geotechnical qualities. The geotechnical report is provided in Appendix D.

10.2.2 Assessment of Impacts

The proposed development has the potential to impact the environmental values of the soils, groundwater and surface water at or in the vicinity of the site through the release of contaminants commonly found in liquid and/or solid waste streams.

The in-situ soils may need to be mixed or engineered to produce a material that ensures that any significant risks to the environment, in particular groundwater are mitigated.

Contamination of groundwater has been shown to occur wherever three main components exist; a potential source of contamination, an underlying aquifer, and a pathway for transfer between the two. This pathway can be either indirectly through the soil or directly through man-made structures which intersect the water table, such as drain(s), sedimentation basin(s) and storage lagoon(s).

10.2.2.1 Engineering properties

The engineering characteristics of the in-situ soils determine the suitability of these materials for construction of the engineering works on the site. These include pens, runoff and drainage control, drains, roads, silage pits, buildings, sedimentation basin(s), storage lagoon(s) and foundations of buildings and structures that are to be erected such as site offices, grain storages, feed processing, commodity, workshop and cattle handling facilities.

Soil materials for construction purposes are available on-site or borrowed from near-by sites.

The key engineering properties include permeability (for protecting groundwater), strength (for trafficability) and shrink-swell potential (for cracks/foundation movement etc.).

The key engineering properties of representative in-situ soil samples were assessed by testing remoulded specimens in a laboratory with NATA accreditation for those tests undertaken. The geotechnical assessment identified no constraints with the engineering properties of the in-situ soils as discussed in the geotechnical report (Appendix D).

10.2.2.2 Classification and Particle Size Distribution

The pen floors will be developed from the clay sub-soil underlying the site. A sample of this material has been tested in the laboratories of AS James Bear Pty Ltd, Geotechnical Engineers at Kapunda for its suitability for this purpose. The material meets the standard described in the Reference Manual for the Establishment and Operation of Beef Cattle Feedlots in Queensland; Appendix F, Pen Foundation Preparation Requirements for Class 1 and 2 Cattle Feedlots. This appendix covers specifications for preparation and materials suitability.

Material is suitable for placement in the pen foundation, subject to compliance with the following requirements:

The material is classified as either CL, CI, CH, SC or GC in accordance with the soil classification system described in Appendix A of AS 1726.

The material sampled for pen foundation and clay lining material was classified as SC and CH respectively.

The particle size distribution for the tested samples is provided in Table 32.

Table 32 – Particle Size Distribution

AS Metric Sieve Size	Percentage Passing (by dry weight)		
mm	Standard Specification	Pen Foundation Material	Clay Lining Material
75	100	**100**	**100**
19	70 – 100	**100**	**100**
2.36	40 – 100	**75**	**88**
0.075	25 – 90	**44**	**56**

10.2.2.3 Soil Plasticity

The sandy clay soils encountered typically have low plasticity and low linear shrinkage. Therefore, these soils have low shrink/ swell capacity movements with variations in moisture content, reduces potential for shrinkage cracks.

The Plasticity Limits on fines fraction, passing 0.425 mm sieve is provided in Table 33. These tests indicate that the pen foundation material is an inorganic clay of high to very high plasticity, and is suitable for placement in the pen floor foundation and sedimentation basin and storage lagoon lining.

Table 33 – Soil plasticity

	Standard Specification	Pen Foundation Material	Clay Lining Material
Liquid Limit, LL	30 – 60 %	**68%**	**54%**
Plasticity Index, PI	> 10	**47**	**39**
Linear shrinkage, LS	-	**15.5%**	**13%**

10.2.2.4 Compaction and moisture content

Compaction of earthworks is not expected to be a significant constraint to the proposed development due to the implementation of appropriate specifications to earthwork design and procedures.

10.2.2.5 Soil Permeability

It is expected that due to the grading and classification of the in-situ soils, that the design permeability ($<1 \times 10^{-9}$m/s) shall be achieved on compaction at or close to the optimum moisture content.

A laboratory permeability test which was conducted on the material indicates it is impermeable and can exceed the permeability specifications for effluent management systems. The material test reports are provided in Appendix D.

10.2.2.6 Excavation

The excavation of in-situ soils is achievable using conventional earthmoving equipment such as excavators, backhoes and scrapers. Therefore, blasting shall not be required and excavation of material is not expected to be a significant constraint to the proposed development.

During the detailed design process, further geotechnical investigations would be undertaken as the precise location of each component of the proposed development shall be known along with the depth of cut and fill at the location. The additional geotechnical investigation would ensure that appropriate geotechnical design input is incorporated into the detailed design process.

10.2.3 Mitigation Measures

10.2.3.1 Engineering Properties

The implementation of the following management and mitigation measures shall mitigate identified potential issues associated with the engineering properties of the in-situ material during the construction and operation of the proposed development.

10.2.3.2 Unsuitable Material

Generally, all materials from excavated areas, shall be placed as fill. However, some material encountered in excavation may be unsuitable as fill, such as:

- vegetative materials
- clays or silts with a Liquid Limit exceeding 90 or Plasticity Index exceeding 60
- soft or saturated material which cannot be moisture conditioned to achieve the required compaction

- stripped topsoil
- large rocks.

10.2.3.3 General

- An appropriate earthworks specification shall be prepared for the bulk earthworks.
- The disturbance area of the proposed development area shall be cleared and all trees, roots, stumps, small rocks, artificial obstructions, etc. grubbed to a depth of 300 mm below the surface of the ground.
- The topsoil shall be removed from all borrow areas and water retaining embankment foundation areas and from all other areas, which are to be filled or excavated as outlined in the Earthworks specifications.
- If any rock or beds of gravel, sand or other pervious materials are exposed during excavation, then an additional 600 mm shall be excavated and replaced by covering the exposed rock or pervious material with at least 600 mm of impervious material thoroughly compacted to prevent seepage along the rock plane or through the pervious material.
- Topsoil is to be conserved for top dressing of embankments.
- Suitable material won from the borrow area shall be used to form the design grades. This material, at the correct moisture content, shall be placed in progressive layers of uniform loose thickness of not more than 200 mm before compaction, preferably by rolling.
- Filling shall be compacted to a field dry density of at least 98% maximum dry density as determined by AS 1289 5.1.1 (Standard Compaction). The material shall be compacted at a moisture content of within (+2% - 0%) of OMC as determined by AS 1289.5.1.1 (Standard Compaction).
- Field dry density tests, according to AS 1289.5.1.1 (Standards Australia, 2003), shall be undertaken to ensure that adequate compaction is being achieved.
- To ensure stability, fill batters shall be constructed:
    - at a slope no steeper than 2:5H:1V
    - no steeper that a slope of 3H:1V on the interior side of the water retaining embankment
- Suitably experienced on-site personnel to:
    - Inspect and approve stripped areas for the placement of fill
    - Confirmation that the earthworks construction techniques are in accordance with specification
    - Inspection of excavated areas for unsuitable fill material such as rocks, sand layers and bands.

10.2.4 Conclusion

A geotechnical assessment of the soils within the vicinity of the proposed development site was undertaken in 2007. The geotechnical assessment identified that the soils are low plasticity, sandy clay soils with low shrinkage potential.

Based on recommended suitability criteria from National and South Australia feedlot guidelines, these soils have engineering properties that are well suited to the construction and operation of a beef cattle feedlot.

It is concluded that that provided appropriate design and construction measures are implemented, the in-situ soils within the proposed development area are suitable for the design and construction of the relevant infrastructure, such as roads, pen foundations, water retaining structures (drains, sedimentation basin(s), storage lagoon(s)) etc.

10.3 Groundwater

10.3.1 Assessment of Impacts

10.3.1.1 Design and Siting

Inappropriate design, siting and operation of the proposed development above vulnerable groundwater resources or in salinity hazard areas may adversely impact on those resources unless suitable measures can be put in place to protect those resources.

10.3.1.2 Construction

Site preparation and construction activities would involve clearing of vegetation, cut and fill bulk earthworks to design levels, infrastructure construction etc.

Storage of fuels and lubricants has the potential to impact ground water if not stored and handled appropriately. There is considered to be minimal potential for contamination of ground water from fuel spills or leaking equipment during construction of the proposed development. However, measures shall be implemented to ensure fuels are stored appropriately and any accidental leaks or spills are minimised and managed.

10.3.1.3 Operation

The following activities associated with the operation of the proposed development have the potential to adversely impact on groundwater:

- Leachate of liquid wastes through the liner underlying the controlled drainage area as a result of integrity failure or exceedance of design criteria.
- Spills or leaks of hazardous chemicals or substances stored or used on-site such as fuels, chemicals etc.
- Inappropriate storage of solid wastes such as outside of the controlled drainage area.
- Inappropriate utilisation of solid and liquid wastes on-site such as high application rates and ponding of liquid waste.

10.3.2 Mitigation Measures

10.3.2.1 Design and Siting

The implementation of the following management and mitigation measures minimise identified impacts to groundwater as a result of the proposed development:

- Site selection considered the natural attributes and general suitability of the site with respect to soil characteristics (texture, depth, permeability), groundwater depth, and hydrogeological formation
- Geotechnical investigation conducted to determine those areas within the controlled drainage area where the permeability of underlying soil/rock strata exceeds the design permeability, thus requiring lining to prevent soil leachate movement
- The liner shall be capable of remaining effective when subject to the physical effects of livestock, machinery and water flow
- Runoff external to the controlled drainage area is diverted away from the controlled drainage area
- Solid and liquid waste utilisation areas are sited so that they do not pose an unacceptable risk to groundwater quality as a result of leaching
- Solid and liquid waste utilisation areas are designed to enable the sustainable use of liquid waste and any solid waste that is utilised on-site
- Facilities to store hazardous materials are designed to meet relevant guidelines and Australian Standards for the storage of hazardous and dangerous goods and spill management.

10.3.2.2 Construction

The implementation of the following management and mitigation measures minimise identified impacts to groundwater during construction of the proposed development:

- Erosion and sediment control measures implemented and maintained to minimise erosion and the release of sediment
- Construction of diversion banks to separate contaminated stormwater from clean water
- Where soil lining materials are used in areas subject to traffic (including pen surfaces and parts of the drainage system subject to mechanical cleaning), or in drains exposed to flow velocities that would otherwise cause scouring, then:
    - Sufficient depth of these materials is laid to prevent failure of the lining under the normal conditions
    - The liner is constructed to achieve the specified design permeability.
- Fuels and lubricants are stored in appropriately bunded areas
- Maintenance of vehicles and equipment to minimise leaks of oil or fuel
- Provision and implementation of procedures to manage spills on site.

10.3.2.3 Operation

The implementation of the following management and mitigation measures minimise identified impacts to groundwater during operation of the proposed development:

- Development and implementation of emergency and contingency plans detailing methods to manage spills or other emergencies on site, such as pipe breakages, storage lagoon overflows, pump failures etc.
- Groundwater extraction managed to ensure sustainable drawdown rates
- Solid waste storage established within the existing feedlot's controlled drainage area to prevent contaminated leachate into groundwater resources
- The land application of solid and liquid wastes is made at rates consistent with the ability of soils and crops grown in the on-site utilisation areas to sustainably utilise the applied nutrients, salts and organic matter, under the climatic conditions prevailing at the site
- Soil condition is monitored periodically and soil tests are used where there is potential for deterioration of soil condition
- Application rate of liquid waste is controlled to ensure that excessive ponding does not occur
- The liner of all elements of the controlled drainage area such as drains, sedimentation basin(s), flow control structures etc. is maintained to ensure the integrity and ongoing compliance with specified design criteria
- Liquid wastes shall be stored, treated and sustainably applied to land on-site by irrigation. Section 10.7 details the measures which would be used to manage and treat liquid wastes from the site.

10.3.3 Conclusion

Activities associated with the construction and operation of the proposed development have the potential to generate impacts to groundwater.

Various mitigation measures have been adopted in the design and siting of the proposed development to prevent or minimise adverse impacts to groundwater. Various mitigation measures shall be implemented to prevent or minimise adverse impacts to groundwater during construction and operation of the proposed development.

Due to the design, siting and mitigation measures proposed and depth and strata characteristics to groundwater (clay/siltstones), no adverse impacts to groundwater quality are predicted as a result of the proposed development.

Further, an impermeable barrier will be constructed between the contaminant and underlying strata using a liner made of compacted clay or other suitable compactable soil materials in areas such as drains, sedimentation basin(s) and storage lagoon(s). The clay liner shall have a maximum permeability of 1×10^{-9} m/s (0.1 mm/day) for distilled water with 1 m of pressure head (MLA, 2012).

10.4 Surface water

10.4.1 Assessment of Impacts

10.4.1.1 Design and Siting

Inappropriate design and siting of the proposed development may adversely impact surface waters external to the development site such as changes to hydrology including drainage patterns, surface runoff yield, flow regimes and groundwater.

10.4.1.2 Construction

Site preparation and construction activities would involve clearing of vegetation, cut and fill bulk earthworks to design levels, infrastructure construction etc. The soil exposed during these activities has the potential to erode during rainfall events, resulting in sediment transportation and impacts to surface waters.

Storage of fuels and lubricants has the potential to impact surface water if not stored and handled appropriately. There is considered to be minimal potential for contamination of surface water from fuel spills or leaking equipment during construction of the proposed development. However, measures shall be implemented to ensure fuels are stored appropriately and any accidental leaks or spills are minimised and managed.

The sedimentation basin(s) shall be constructed as part of the early works and utilised as a part of the erosion and sediment control plan. All stormwater runoff from the disturbed areas shall be directed to this point using diversion banks as required.

10.4.1.3 Operation

The following activities associated with the operation of the proposed development have the potential to adversely impact on surface waters:

- Uncontrolled release of liquid wastes from controlled drainage area as a result of overflows, integrity failure or exceedance of design criteria
- Spills or leaks of hazardous chemicals or substances stored or used on-site such as fuels, chemicals etc.
- Surface runoff from the inappropriate application of liquid wastes to land impacting water chemistry, clarity, nutrient and toxicants, for example
- Inappropriate storage of solid wastes such as outside of the controlled drainage area
- On-site utilisation of solid and liquid wastes.

10.4.2 Mitigation Measures

10.4.2.1 Design and Siting

The implementation of the following management and mitigation measures minimise identified impacts to surface water as a result of the proposed development:

- The proposed development is sited above the height of a 100 year average recurrence interval (Q_{100}) flood level
- Site selection considered the natural attributes and general suitability of the location for draining and capturing runoff from the proposed development
- A controlled drainage area designed to an acceptable hydrological standard that prevents unauthorised discharges of runoff from areas which have high organic matter and therefore a high pollution potential
- A vegetated buffer of 100m is provided between controlled drainage areas and drainage lines
- Runoff external to the controlled drainage area is diverted away from the controlled drainage area
- Solid and liquid waste utilisation areas are sited so that they do not pose an unacceptable risk to surface water quality as a result of stormwater runoff
- Solid and liquid waste utilisation areas are designed to enable the sustainable use of liquid waste and any solid waste that is utilised on-site
- Any facilities to store hazardous materials are designed to meet relevant guidelines and Australian Standards for the storage of hazardous and dangerous goods and spill management
- Elements of the controlled drainage area are designed to capture contaminated runoff from within those areas which have high organic matter and therefore a high pollution potential and safely divert it to a sedimentation system as discussed in Section 7.5.10
- The sedimentation system is designed to provide flow velocities less than 0.005 m/s, and discharge to a storage lagoon as discussed in Section 7.5.10.1
- Storage lagoon(s) are designed to store runoff from the controlled drainage area without spilling or overtopping at an unacceptable frequency as discussed in Section 7.5.10.2
- Appropriately designed outlet weirs and by-washes are used to discharge excess runoff during overtopping or spill events in the sedimentation system and storage lagoon.

10.4.2.2 Construction

The implementation of the following management and mitigation measures minimise identified impacts to surface water during construction of the proposed development:

- Erosion and sediment control measures implemented and maintained to minimise erosion and the release of sediment
- Construction of the sedimentation basin(s) during early works on the site in order to retain stormwater runoff on-site and minimise release of sediment off-site

- Construction of exclusion banks to separate contaminated stormwater from clean water and prevent contaminated runoff from entering surface water
- Fuels and lubricants are appropriately stored in bunded areas
- Maintenance of vehicles and equipment to minimise leaks of oil or fuel
- Provision and implementation of procedures to manage spills on site.

10.4.2.3 Operation

The implementation of the following management and mitigation measures minimise identified impacts to surface water during operation of the proposed development:

- Development and implementation of emergency and contingency plans within the EMP detailing methods to manage spills or other emergencies on site, such as pipe breakages, lagoon overflows, pump failures etc.
- Maintenance of buffer zones around drainage lines to prevent contamination of surface waters
- Solid waste to be stockpiled within a controlled drainage area to prevent contaminated runoff into clean water areas
- The land application of solid and liquid wastes is made at rates consistent with the ability of soils and crops grown in the on-site utilisation areas to sustainably utilise the applied nutrients, salts and organic matter, under the climatic conditions prevailing at the site
- Soil condition is monitored periodically and soil tests are used where there is potential for deterioration of soil condition
- Application rates of liquid waste is controlled to ensure that excessive runoff does not occur
- All elements of the controlled drainage area such as drains, sedimentation basin, storage lagoon, flow control structures etc. are cleaned and maintained to ensure their integrity and ongoing compliance with specified design criteria
- Liquid wastes shall be stored, treated and sustainably applied to land on-site by irrigation when available. Section 7.8.5 details the measures which would be used to manage liquid waste from the proposed development.
- Design discharge events from the storage lagoon shall be directed to a natural grassed discharge area. This grassed area shall filter and disperse the liquid waste whilst allowing some infiltration.

10.4.3 Conclusion

Activities associated with the construction and operation of the proposed development has the potential to generate impacts to surface waters.

Various mitigation measures have been adopted in the design and siting of the proposed development to prevent or minimise adverse impacts to surface waters. Various mitigation measures shall be implemented to prevent or minimise adverse impacts to surface waters during construction and operation of the proposed development.

Due to the design, siting and mitigation measures proposed, no adverse impacts to surface water quality are predicted as a result of the proposed development.

10.5 Flooding and Stormwater

10.5.1 Existing environment

10.5.1.1 Flooding

The climate, topography and location of the subject property in the upper slopes of the Booborowie Creek catchment, some 200m elevation above the Booborowie Creek results in no flooding of the subject property.

Subsequently, no flood studies have been completed within proximity to the subject property.

10.5.1.2 Stormwater

The subject property has stormwater catchment areas, which eventually discharge to natural drainage lines and eventually to Booborowie Creek or to land (infiltration/evaporation). There is no existing stormwater system due to the undeveloped nature of the proposed development site and its rural character.

Topography within the proposed development site is generally sloping to towards a central drainage line between the two controlled drainage areas. The drainage of the proposed development site is shown on Figure 12.

10.5.2 Assessment of Impacts

10.5.2.1 Flooding

Inappropriate design and siting of the proposed development may adversely impact flood prone land or on flood behaviour resulting in:

- detrimental increases in the potential flood affectation of other development or properties
- cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses
- risk to life
- unsustainable social and economic costs to the community.

As the proposed development is located at an elevation of some 200m above Booborowie Creek, the development is not located in flood prone area.

10.5.2.2 Stormwater

During the construction phase, construction activities will include stripping of topsoil and excavation to proposed design grade levels. The primary risk occurs when soils are exposed during earthworks. During this time, if adequate erosion and sediment control measures are not adopted suspended sediment and associated pollutants can be mobilised and transported into the downstream receiving environment. A series of erosion and water quality control structures and good site practices would be needed to minimise the potential for adverse impacts during construction.

Once the proposed development is operational, surface runoff quantities have the potential to increase due to the impervious surfaces and concentration of runoff. The main pollutants of concern will be those associated with livestock manure.

Build-up of pollutants from vehicles such as hydrocarbons and combustion derivatives, lubricating oil, rubber and heavy metals such as lead, zinc, copper, cadmium, chromium, and nickel on road surfaces is predicted to be negligible and are unlikely to disperse in rainfall events.

The stormwater runoff shall be retained in the controlled drainage system and sustainably utilised on-site. The controlled drainage and treatment system is outlined in Section 7.7.1.11 and 7.8.5 and the predicted stormwater runoff sustainably utilised on-site is outlined in Section 7.8.5.1.

The recommended mitigation measures for the management of stormwater during construction and operation are outlined in Section 10.5.3.

10.5.3 Mitigation Measures

10.5.3.1 Flooding

The implementation of the following management and mitigation measures minimise identified impacts from flooding or to flood behaviour and stormwater as a result of the proposed development:

- The proposed development is sited above the height of a 100 year average recurrence interval (Q_{100}) flood level
- Site selection considered the natural attributes and general suitability of the site for draining and capturing runoff from the proposed development
- Solid and liquid waste utilisation areas are sited so that they do not pose an unacceptable risk to surface water quality as a result of flood events
- Solid and liquid waste utilisation areas are designed to enable the sustainable use of liquid waste and any solid waste that is utilised on-site.

10.5.3.2 Stormwater

The implementation of the following management and mitigation measures minimise identified impacts from stormwater as a result of the proposed development:

- Separation of 'clean water' and 'dirty water' during construction and operation with diversion banks and/or other relevant control structures diverting 'clean water' from undisturbed areas around disturbed areas
- Implementation of erosion control techniques based upon effective use of construction practices, structural controls and vegetative measures. Erosion control measures would be temporary for the construction phase of the proposed development
- Require regular maintenance of erosion control measures
- The installation of appropriate sediment control measures to ensure that any eroded material is trapped and retained prior to leaving the construction site
- Require regular maintenance and cleaning of sediment control measures
- Controlled drainage area(s) designed to an acceptable hydrological standard that prevents unauthorised discharges of runoff from production pen areas which have high organic matter and therefore high pollution potential
- Runoff external to the controlled drainage area is diverted away from the controlled drainage area to existing natural drainage lines
- Elements of the controlled drainage area(s) are designed to capture contaminated runoff from within those areas which have high organic matter and therefore a high pollution potential and safely divert it to a sedimentation system as discussed in Section 7.5.10
- A sedimentation system is designed to provide flow velocities less than 0.005 m/s, and discharge to a storage lagoon as discussed in Section 7.5.10.1
- A storage lagoon designed to store runoff from the controlled drainage area without spilling or overtopping at an unacceptable frequency as discussed in Section 7.5.10.2
- Appropriately designed outlet weirs and by-washes are used to discharge excess runoff during overtopping or spill events in the sedimentation system and storage lagoon
- Vehicles are maintained to minimise leaks of hydrocarbons, lubricating oil etc.

10.6 Biodiversity (Flora and Fauna)

10.6.1 Introduction

The loss and modification of native vegetation and habitat can present serious risks to the persistence of native flora and fauna.

The proposed development shall have no direct impacts on native vegetation and habitat as the proposed development site is currently cultivated cropping land and devoid of vegetation. No clearing of this vegetation is required and buffers from liquid and solid waste utilisation have been allowed to property boundaries and any existing vegetation.

Subsequently, no biodiversity assessment has been undertaken.

10.6.2 Assessment of Impacts

10.6.2.1 Direct Impacts

The majority of the subject property on which the development is proposed has been previously cleared, primarily for cattle grazing and cultivation purposes and has been impacted to varying degrees by weed invasion and overgrazing by stock and feral species. The impact of this action is that the remnant vegetation communities are now largely confined to small areas fringing draining lines and isolated clusters of paddock trees, with consequential habitat fragmentation effects on the indigenous biota.

A consequence of the intensive land-use activities is that pasture grasses and to a lesser extent weeds have colonised much of the subject property.

The proposed development shall have no direct impacts on remaining riparian areas fringing drainage lines as no clearing of this vegetation is required and buffers from liquid and solid waste utilisation have been allowed.

The proposed development shall have no direct impacts on vegetation communities within grazing areas as these areas have already been significantly modified from their native state for cropping and grazing and isolated clusters of paddock trees shall not be removed.

10.6.2.2 Indirect Impacts

Indirect impacts may be experienced on areas outside of or adjacent to the proposed development site as a result of the construction and/or operation. Such impacts would largely operate on a short to medium timeframe and would be minimised where possible through management procedures.

A range of indirect impacts could occur as a result of the proposed development, these include:

- Increased spreading of pest plants
- Erosion or sedimentation in areas adjoining construction and operational activities

- Increased noise, dust and light from construction and operational activities.

10.6.3 Mitigation Measures

Impacts to biodiversity have been considered throughout the site selection and design process. Where possible, impacts to species and habitat of conservation significance have been avoided.

Management and mitigation measures would be implemented to minimise impacts on biodiversity during the construction and operation stages of the proposed development. These include:

- Clearing restricted to those areas required for development and firebreaks
- Methods and communication tools to monitor road strike and mortality of wildlife
- Any areas to be rehabilitated with species of local providence.

10.6.4 Conclusion

It is expected that, with the implementation of appropriate mitigation measures, the proposed development would not impact biodiversity.

10.7 Land Capability for Waste Utilisation

10.7.1 Introduction

The proposed development would produce solid and liquid waste during its operation and would require licensing approvals for utilisation of liquid and solid waste onto land. An Environment Protection Licence (EPL) would be required from the Environmental Protection Authority (EPA).

The characteristics of the waste utilisation areas and their location relative to residences, surface waters, and groundwater need to be known. Assessment of these characteristics will identify the constraints to solid and liquid waste utilisation and assist with adoption and implementation of mitigation measures. The key factors governing the suitability of a site for solid and liquid waste utilisation are:

- Topography
- Soil considerations
- Proximity of surface and groundwater
- Proximity of residences.

This section provides a review of the areas proposed for solid and liquid waste utilisation based on topography, soil, groundwater and surface water characteristics.

10.7.2 Existing Environment

10.7.2.1 Topography

The liquid and solid waste utilisation area comprises flat to gently undulating areas and is currently cultivated and cropped with winter cereals.

Due to the undulating nature of region and low volume of liquid waste available for utilisation, a fixed irrigation area and system is not proposed. Rather, when liquid waste is available for utilisation a slurry tanker will be used to distribute liquid waste onto the utilisation area.

10.7.2.2 Soil Characteristics

The characteristics of the soils in the proposed solid and liquid waste utilisation areas will impact on the suitability of the land for liquid and solid waste utilisation and level of management required.

As the liquid and solid waste from the proposed development shall be high in nutrients and possibly salts, it is important that the chemical properties of the soil are assessed to determine the management requirements for protecting against soil degradation which could result in:

- degraded soil structure
- restricted plant growth

- erosion
- salinity
- release of contaminants to surface or groundwaters.

10.7.2.3 Methodology

Assessment of the soil characteristics involved the following steps:

- Desktop review – prior to conducting fieldwork, discussions with relevant government stakeholders and the farm manager were undertaken, and collection and collation of land resource information covering the area. This allowed the soil groups on the subject property to be identified for follow-up subsurface assessment.
- Soil analysis – Soil samples from pre-determined depths were forwarded to a NATA accredited laboratory for testing for a range of soil properties.

A land suitability assessment that focused on the investigation and determination of the surface conditions and capability of the land on which solid and liquid waste utilisation was undertaken.

Broadly, the utilisation area can be divided into two soil groups as outlined in Section 5.8. Although the utilisation area has been divided into two groups, these boundaries are not exact and often transitions between soils occur rather than an abrupt change from one distinct soil type to another. The soil boundaries are shown on Figure 14.

10.7.2.4 Surface water and Groundwater

The proposed development is required to be sited, designed, constructed and operated to prevent or minimise adverse impacts on groundwater and surface waters external to the developments' controlled drainage area and external to solid and liquid waste utilisation areas (MLA, 2012a, Department of Primary Industries and Resources (SA), 2006).

Potential impacts on current and future groundwater users and downstream surface water users and resources need to be considered. These risks can be minimised by ensuring:

- careful selection of suitable sites for solid and liquid waste utilisation
- adequate buffer zone between solid and liquid utilisation area and drainage lines
- annual application rates would be based on annual soil tests and not exceed nutrient recommendations for a particular crop, soil type or target yield
- application of liquid wastes would occur prior to planting with timing and application rates based on soil moisture and nutrients levels
- the plant/soil mantle within and down-gradient of the liquid waste utilisation area is capable of immobilising any potential contaminants in the liquid waste.
- adequate buffer zone between solid and liquid waste utilisation areas and surface water and groundwater bores used as a domestic water source.

The proposed development and associated solid and liquid utilisation areas have been sited and designed to minimise any adverse impacts to groundwater and surface waters. Section 7.5 outlines

the siting and design considerations to minimise any adverse impacts to groundwater and surface waters. Further, Sections 10.3 and 10.4 outline the potential risks and mitigation measures proposed to minimise adverse impacts to groundwater and surface waters.

Review of strata log details for various groundwater bores on the subject property identifies the presence of one or more impervious geological strata such as compacted clay, cemented clay bands above the groundwater aquifer. These layers shall minimise deep percolation from reaching the aquifer.

10.7.2.5 Climate

Beef cattle feedlots can be located in a wide range of climates. However, climatic factors impact on a diverse range of issues. These include:

- heat and cold stress and animal welfare
- water requirements (drinking, cattle washing)
- animal productivity and feed conversion
- odour
- dust
- drainage
- waste management and utilisation.

The climate of the proposed development site is provided in Section 5.1. The climate of the area is typically Mediterranean (warm and temperate), characterised by higher winter rainfall than in summer and hot summers and cool winters. Table 5 shows that the mean annual rainfall for the proposed development site is about 456 mm/year with an annual average pan evaporation of 1700 mm.

10.7.3 Solid Waste Utilisation

The subject property has an existing cropping area incorporating about 885 ha as shown in Figure 21. This cropping area is available for liquid and solid waste utilisation. Due to the suitability of soil types on the subject property (Section 10.7.5) and the on-site generation of solid waste suitable for use as a soil conditioner and fertiliser, solid waste shall be utilised on the subject property. Composted solid waste shall be spread between spring and autumn after the harvest of the winter crops.

As shown in Table 27, it is expected that approximately 2,905 t of dry matter is available for utilisation after stockpiling. This equates to about 4,470 t of solid waste based on a moisture content of 35%.

Table 34 and Table 35 shows a nutrient balance that has been calculated for solid waste utilisation based on the available area for solid waste utilisation on the subject property and potential crop nutrient removal from winter oaten silage and barley harvested as grain. BEEFBAL (QPIF 2004) was used to estimate the volume of solid waste generated by the proposed development along with the nutrient composition of the solid waste.

The average nutrient composition of the stockpiled solid waste is shown in Table 26 and a nutrient composition of 1.4% N, 0.5% P and 1.5% K (dry matter basis) was assumed based on nutrient composition analyses from solid waste samples taken from the existing feedlot's solid waste stockpiles.

Table 34 – Solid waste nutrient balance (Oaten Silage)

	Units	Nitrogen	Phosphorus	Potassium
Stockpiled solid waste	kg DM/year	43,200	14,280	44,820
Available for crop uptake	kg DM/year	34,560*	14,280	44,820
Nutrients removed**	kg DM/ha/year	63	12	113
Minimum area required to utilise all the nutrients available	ha	550	1,190	396

*Assumed 20% N volatilisation during spreading and from soil surface.
**Assumed oaten silage yield 4.4 t DM/ha

As shown in Table 34, the limiting nutrient is phosphorus. The subject property's waste utilisation area of 885 ha, can sustainably utilise some 75% (10,710 kg based on phosphorus) of the generated solid waste with the remainder being transported off site for utilisation in those years when no liquid waste is applied and oaten silage is grown.

Table 35 – Solid waste nutrient balance (Barley - grain)

	Units	Nitrogen	Phosphorus	Potassium
Stockpiled solid waste	kg DM/year	43,200	14,280	44,820
Available for crop uptake	kg DM/year	34,560	14,280	44,820
Nutrients removed**	kg DM/ha/year	42	8	12
Minimum area required to utilise all the nutrients available	ha	822	1,785	3,735

*Assumed 20% N volatilisation during spreading and from soil surface.
**Assumed barley yield 2.5 t DM/ha

As shown in Table 35, the limiting nutrient is potassium, but as there is no recognised environmental impact from excess potassium, the next limiting nutrient is phosphorus. The subject property's waste utilisation area of 885 ha, can sustainably utilise some 50% (7,140 kg based on phosphorus) of the generated solid waste with the remainder being transported off site for utilisation in those years when no liquid waste is applied and cereal crops only are grown.

The rationale for the use of solid waste on the cropping area of the subject property is to provide the appropriate agronomic conditions for the growth of crops and/or improved pasture on this area. Prior to the addition of solid waste to the solid waste utilisation area, soil and manure analysis would be undertaken to establish baseline nutrient levels and the required amount of solid waste for the crops to be grown as is the current practice.

The remainder of solid waste generated from the proposed development would be stockpiled within the solid waste and processing area before being transported off-site to be used on other farming properties owned by the proponent.

10.7.4 Liquid Waste Utilisation

A sustainable liquid waste utilisation system will achieve a balance between the nutrients applied in the liquid waste with the nutrient requirements of the crop while protecting the environment from potential pollution in runoff and percolation.

Additionally, the amenity of the surrounding environment and meeting the needs on a social and ecological level are important considerations in sustainability.

There are a number of commercially available tools to assist with water and nutrient balance calculations such as WASTLOAD and MEDLI (Model for Effluent Disposal Using Land Irrigation (Gardner et al., 1996).

WASTLOAD, a spreadsheet model for calculating the sustainable spreading rates of solid and liquid wastes has been developed by PIRSA in 2006. MEDLI is a Windows® based computer model for designing and analysing effluent reuse systems for intensive rural industries, agri-industrial processors (e.g. abattoirs), sewage treatment plants and other effluent producers using land irrigation. MEDLI was developed jointly by the CRC for Waste Management and Pollution Control, the Queensland Department of Natural Resources and the Queensland Department of Primary Industries (Gardner et al., 1996).

As outlined in Section 7.8.5.1 it is expected that approximately 28.4 ML of liquid waste is available for utilisation. As outlined in Section 7.8.5.1, if the liquid waste has 720 mg/L of nitrogen, this equates to 100 mm of irrigation providing some 720 kg/ha/year of nitrogen. Most crops and pastures have a limit to the amount of nitrogen that can be taken up by plants, therefore, often the main issue is to manage the amount of nitrogen, not the amount of water.

For the purposes of mass balance calculations, the nutrient composition of the liquid waste has been assumed to be 720 mg/l of Nitrogen and 120 mg/l of Phosphorus and 1400 mg/L of Potassium.

Table 36 and Table 37 gives the annual balance of nutrients in the liquid waste for utilisation for two cropping scenarios – oaten silage and barley harvested as grain.

Table 36 – Liquid waste nutrient balance (Oaten Silage)

	Units	Nitrogen	Phosphorus	Potassium
Nutrients in liquid waste	kg /year	20,400	1,700	42,575
Available for crop uptake	kg/year	16,320*	1,700	42,575
Nutrients removed**	kg DM/ha/year	63	12	113
Minimum area required to utilise all the nutrients available	ha	259	141	375

*Assumed 20% N volatilisation during application and from soil surface.
**Assumed oaten silage yield 4.4 t DM/ha

The existing area available for waste utilisation is 885 ha (Section 7.5.11.2). Table 36 shows that the most limiting nutrient is potassium, but as there is no recognised environmental impact from excess potassium, the next limiting nutrient is nitrogen.

The behaviour of nitrogen in plant-soil systems is complex and includes additions and losses to the system as well as transformations of the forms of nitrogen. The capacity of an irrigation system to use nitrogen can be maintained and restored over time as the removal of nitrogen from liquid waste largely depends on biological processes. To calculate the nitrogen balance nitrogen inputs are compared with nitrogen losses.

The area required for complete nitrogen uptake is 259 ha when oaten silage is grown.

Table 37 – Liquid waste nutrient balance (Barley - grain)

	Units	Nitrogen	Phosphorus	Potassium
Nutrients in liquid waste	kg /year	20,400	1,700	42,575
Available for crop uptake	kg/year	16,320	1,700	42,575
Nutrients removed**	kg DM/ha/year	42	8	12
Minimum area required to utilise all the nutrients available	ha	388	212	3,548

*Assumed 20% N volatilisation during application and from soil surface.
** Assumed barley yield 2.5 t DM/ha

Table 37 shows that the most limiting nutrient is potassium with nitrogen being the next limiting nutrient. The area required for complete nitrogen uptake is 388 ha when cereal crops are grown.

Subsequently, in years when 28.4 ML of liquid waste is available for utilisation and based on the modelled nutrient concentrations up to 40% of the waste utilisation area may have liquid waste applied.

10.7.5 Soil Suitability Assessment

The soils of the liquid and solid waste utilisation areas were characterised and assessed as to the suitability for liquid and solid waste utilisation. A number of soil cores were excavated and representative samples from 0-10cm depths were taken and analysed for a suite of chemical parameters.

The chemical properties of the depths sampled are presented in Table 38.

Table 38 – Soil analysis results – Chemical parameters

Parameter	Units	S1	S2	S3
			Depth (cm)	
		0-10	0-10	0-10
pH ($CaCl_2$)		5.7	5.3	6.0
Conductivity	µS/cm	153	136	166
Total Nitrogen	mg/kg	75	-	-
Phosphorus – Colwell	mg/kg	45	54	153
Potassium	mg/kg	758	693	633
Organic Carbon	%	1.52	1.61	1.54
Sodium	mg/kg	120	46	69
Sulphur	mg/kg	35.5	25.9	7.6
Exchangeable Sodium	meq/100g	0.53	0.20	0.3
Exchangeable Potassium	meq/100g	0.60	0.17	0.13
Exchangeable Calcium	meq/100g	7.0	6.6	5.7
Exchangeable Magnesium	meq/100g	2.1	1.9	1.8
Boron	mg/kg	0.9	0.88	1.04
Copper	mg/kg	3.5	3.29	3.46
Zinc	mg/kg	2.06	2.12	3.52
Manganese	mg/kg	27.27	35.09	20.11
Iron	mg/kg	17.13	32.39	34.44

10.7.5.1 pH ($CaCl_2$)

The pH of the soils range from neutral to mildly alkaline (pH 5.3 to 6.0) in the surface (Hazelton and Murphy, 2007). These results are typical values expected for the type of soils encountered.

Soil pH in the range found at the soil monitoring sites is considered acceptable for pasture and crop growth and should not affect the availability of nutrients, toxic elements and chemical species to plant roots.

10.7.5.2 Total Nitrogen

Total nitrogen results from the soils sampled show a total N level of 75 mg/kg in the surface (0-10cm). This value is considered low (Hazelton and Murphy, 2007). High total N in the soil provides strong and stable structure and provides a plant nitrogen source after mineralisation by soil microbes.

10.7.5.3 Phosphorus

The surface (0-10cm) phosphorus concentrations range from 45 to 153 mg/kg. The surface phosphorus results are high and indicate that phosphorus levels are sufficient (Hazelton and Murphy, 2007).

10.7.5.4 Exchangeable Cations

The exchangeable calcium levels in the topsoil (10cm) are considered moderate (6.3-7.9 meq/kg) for these soils. Similarly, the exchangeable magnesium levels are considered moderate (1.6-

2.3 meq/kg). This suggests that the soils are not strongly leached and that plant growth would not be limited as a result.

The exchangeable sodium levels in the topsoil (10cm) are considered low to moderate (0.21-0.32 meq/kg).

Similarly, in the topsoil (10cm), the exchangeable potassium levels are considered high (1.19-1.53 meq/kg) in these soils.

10.7.5.5 Salinity

Salinity refers to the total dissolved salts in a liquid or in a soil solution. Salts are mostly added to the soil through soil formation, hydrologic processes and rainfall (DNR, 1997). However irrigation, especially with liquid waste can add significant quantities of salt to the soil. Electrical conductivity ($EC_{1:5}$) and chloride levels were examined in the results from the soil sampling in the solid waste utilisation areas to establish current salinity levels.

The current $EC_{1:5}$ levels in the soils indicate salinity is considered low (136-166 µS/m) for the surface soil. Crops that are moderately sensitive to salinity may be affected.

Annual monitoring of salinity shall identify any trends in soil salinity and potential accumulation of salts in the soils as a result of salts applied in the liquid and/or solid waste.

10.7.6 Irrigation System Components

10.7.6.1 Balancing (Wet Weather) Storage

Due to the variation in climate and weather patterns, there will be periods of wet weather when irrigation is not possible. Therefore, to prevent discharge of liquid waste from the site, during periods of wet weather the liquid waste shall be temporarily held in the storage lagoon(s) until conditions are suitable for irrigation.

As discussed in Section 7.5.10.2, the storage lagoon(s) have been sized such that an acceptable overtopping frequency is achieved.

10.7.6.2 Application Method

Application of liquid waste to land shall be via slurry tanker using a low pressure overhead spray system.

This type of system provides uniform application of the liquid waste and at a rate less than the permeability of the soil, suitability for the range of soil types on the subject property and crops to be grown and ease of management.

10.7.6.3 Wet-Weather Discharge

Wet-weather discharge from a site is defined as the discharge of liquid waste from the subject property boundary.

Whilst, the storage lagoons(s) has been designed with an acceptable overtopping frequency in accordance with relevant guidelines, wet-weather discharge may occur particularly during periods of wet weather with a recurrence interval of greater than 1 in 20 years.

Therefore, during wet weather if discharge from the storage lagoon(s) is necessary, it shall be engineered and managed to occur in a controlled and organised manner. Ideally, during wet weather, a steady discharge at a uniform depth shall be considered. Liquid waste will be treated and diluted as it passes through grassed areas to lower reaches of the subject property so that "clean" runoff leaves the site at the boundary.

10.7.6.4 Irrigation System Management

10.7.6.5 Scheduling

Irrigation scheduling of liquid waste is dependent on three main factors:

- the quality of the liquid waste and nutrient requirements
- the moisture content of the soil and the amount of water needed to water the root zone
- weather considerations – wind rainfall and temperature.

Irrigation would occur only on suitable, selected areas within the proposed liquid waste utilisation area in any year. Irrigation scheduling would be closely supervised by the Farm Manager. The irrigation schedule would be established to sustainably manage the application of liquid waste and the volume of the storage lagoon(s). Liquid waste would be applied primarily during the months of March-May prior to the planting of winter crops.

10.7.7 Mitigation Measures

Sustainable management of liquid and solid waste utilisation will involve measures which include the operation, monitoring, and reporting for the systems. Annual review of the performance of the irrigation management system from data collected on operation and environmental performance will assist with identifying areas of risk and potential improvements to the system. Elements of the measures are outlined below.

10.7.7.1 Monitoring

The most important aspect of meeting environmental requirements as well as satisfying licence conditions is monitoring of the liquid and solid waste utilisation system.

Monitoring of the liquid waste irrigation system can be broken down into operational and environmental performance.

10.7.7.2 Operational Monitoring

On the operational side, data needs to be collected to assist with day to day decisions regarding:

- irrigation scheduling
- system management during irrigation to prevent over watering

To keep track of operational activities as they occur, records shall be kept such as volume irrigated, crop type, mass harvested and removed, stocking rates where applicable.

10.7.7.3 Environmental Performance Monitoring

The systematic collection of data to quantify the levels of potential pollutants in the receiving environment shall be undertaken to monitor environmental performance. These data provide essential information regarding environmental performance and non-conformances trigger the review of management strategies to ensure that environmental objectives are met.

To ensure that remedial action can be taken early, a suite of sampling and records are recommended as outlined in Section 7.8.15. In summary, these include:

- volume of liquid waste stored and applied
- liquid waste quality monitoring
- soil monitoring
- groundwater monitoring
- climate – rainfall.

Monitoring would be undertaken in accordance with the requirements outlined in the EPL and using techniques outlined in EPA guidelines.

10.7.8 Conclusion

The proposed development shall generate substantial volumes of liquid and solid waste. Liquid waste would be collected in the controlled drainage area and drain into the sedimentation basin(s) and then into the storage lagoon(s). Solid waste shall be scraped from the pen surface and stockpiled in a dedicated storage area within the controlled drainage area of the existing feedlot.

The characteristics of the waste utilisation areas and their location relative to residences, surface waters, and groundwater have been assessed to identify the constraints to solid and liquid waste utilisation and assist with adopting and implementation of mitigation measures. The key factors governing the suitability of a site for solid and liquid waste utilisation are:

- Topography
- Soil considerations

- Proximity of surface and groundwater
- Proximity of residences.

It is concluded that topography of the utilisation areas are well-suited to the type of application methods proposed. The liquid waste utilisation area has well-graded, uniform slopes and liquid waste shall be applied with mobile slurry tanker. Therefore, there no issues associated with poor drainage and ponding are expected.

The characteristics of the soils in the proposed solid and liquid waste utilisation areas are well suited for waste application as they are suitable for cropping, have moderate to high water holding capacity, not prone to waterlogging within the root zone and can withstand cultivation without incurring significant erosion. Further, the subject property has been a cropping property for some time. This suggests that the soils are suitable for application of liquid and solid waste.

The proposed development and associated solid and liquid utilisation areas have been sited and designed to minimise any adverse impacts to groundwater and surface waters. Various mitigation measures include riparian buffers and sustainable utilisation of applied nutrients.

The proposed development has some 885 ha of land available for the utilisation of liquid and solid waste. Based on the estimated solid waste generation, some 50%-75% is able to be utilised on-site. The remaining solid waste shall be transported off-site for utilisation on adjoining properties on by the proponent.

The proposed development incorporates on-site utilisation of liquid waste from the storage lagoon(s) to land via irrigation.

A sustainable liquid waste irrigation management system will achieve a balance between the use of liquid waste for irrigation with the nutrient requirements of the crop while protecting the environment from potential pollution. Additionally, the amenity of the surrounding environment and meeting the needs on a social and ecological level are important considerations in sustainability.

The assessment investigated the soil characteristics and concluded that the soil is capable of absorbing the level of nutrients contained within the liquid waste. The assessment also confirmed the area available for waste utilisation (885 ha) is adequate to sustainably irrigate the liquid waste.

Overall, the assessment concluded that there is sufficient land available with characteristics suitable for the sustainable application of all the liquid and a proportion of solid waste.

10.8 Noise and Vibration

10.8.1 Introduction

This section discusses the potential impacts from noise and vibration associated with the proposed development; including mitigation measures when practicable.

The sources of noise emissions from the proposed development include:

- Plant and machinery used to construct the proposed development
- Feed storage and processing equipment (electric motors, conveyors, roller mills) and mobile plant (feed trucks, tractors, front-end loaders etc.) during operation of the proposed development.
- Livestock
- Livestock, feed commodity and solid waste transport vehicles both on-site and off-site.

Potential noise impacts are expected to be minimal based on the implementation of a number of mitigation measures, the location of the proposed development and the absence of nearby residential facilities will limit any adverse impacts.

The sources of vibration from the construction and operation of the proposed development include:

- Continuous construction activities such as bulk earthworks machinery, vibrating compactors
- Infrequent activities such as occasional dropping of heavy equipment, loading and unloading steel.
- Feed processing equipment such as the grain movement and milling system
- Livestock, feed commodity and solid waste transport vehicles.

No blasting, impact pile driving or jack hammers shall be used during the construction of the proposed development.

10.8.2 Assessment of Impacts

There is potential for impacts of noise on nearby residences and other sensitive land uses as a result of the construction and operation of the proposed development.

Due to the large separation distances from the proposed development and sensitive receptors (single rural residences being a minimum of some 3 km), the topography and landform and lack of certain vibration generating activities (blasting, jack-hammering, piling), it is predicted that no sensitive receptor shall be potentially impacted by vibration as a result of the construction and/or operation of the proposed development.

10.8.2.1 Construction

Each stage of the proposed development is estimated to take approximately 5-6 months depending on weather conditions to construct after receiving development consent from the Regional Council of Goyder and an environment protection licence from the EPA (SA). The primary equipment that may be used during the construction of the proposed development is shown in Table 39. Jack hammers, pile-drivers and blasting shall not be used during construction.

Table 39 – Main equipment used in construction

Type	Purpose
Bulldozer (large)	Vegetation clearing, topsoil clearing, bulk earthworks
Scraper	Bulk earthworks, sedimentation basin / storage lagoon construction
Excavator	Excavation of soil for pens, sedimentation basin (s), storage lagoon(s), drains
Grader	Finish grading, road base preparation, trimming roads
Trucks	Haulage of materials to site
Batch Plant	Concrete batching
Concrete Truck	Placement of concrete for feed bunks, aprons, structural foundations etc.

Table 40 outlines the range of equipment that may be used during the construction of the proposed development along with typical sound pressure levels. The sound pressure levels shown in Table 40 are generalised values of construction machinery and equipment that have either been reproduced from Department of Planning Transport and Infrastructure (SA) (2014) or Australian Standard 2436 (Australian Standards, 2010).

Table 40 – Typical sound power level from construction equipment (Department of Planning Transport and Infrastructure (SA), 2014)

Equipment	Source *	Sound Pressure Level dB(A) 7m		20m		50m		100m		200m	
		$L_{eq\ (15min)}$	L_{max}	$L_{eq\ (15min)}$	L_{max}	$L_{eq\ (15min)}$	L_{max}	$L_{eq\ (15min)}$	L_{max}	$L_{eq\ (15min)}$	L_{max}
Asphalt Truck/Sprayer	106	81	81	72	72	64	64	58	58	52	52
Backhoe	104	79	83	70	74	62	66	56	60	50	54
Batch Plant	116	91	90	82	81	74	73	68	67	62	61
Bobcat (skid-steer loader)		85		76		68		62		56	
Bulldozer (large)	108	92	95	83	86	75	78	69	72	63	66
Bulldozer (small)	106	90	93	81	84	73	76	67	70	61	64
Chainsaw (4-5hp)	110	89	92	80	83	72	75	66	69	60	63
Cherry picker		80		71		63		57		51	
Compactor	113	88		79		71		65		59	
Compressor (silenced)	101	76		67		59		53		67	
Concrete Truck	109	84	85	75	76	67	68	61	62	55	56
Concrete Vibrator	103	78	80	69	71	61	63	55	57	49	51
Delivery Truck	107	83	88	74	79	66	71	60	65	54	59
Dump Truck	117	83	90	74	81	66	73	60	67	54	61
Dump Truck (50t) - loaded	110	76	90	67	81	59	73	53	67	47	61
Dump Truck (50t) - unloaded	117	83	90	74	81	66	73	60	67	54	61
Tracked Excavator (5t)	100	77		68		60		54		48	
Tracked Excavator (45t)	107	83	90	74	81	66	73	60	67	54	61
Forklift	106	81		72		64		58		52	
Front-end loader	113	88	90	79	81	71	73	65	67	59	61
Generator	99	78	81	69	72	61	64	55	58	49	52
Grader	110	85	90	76	81	68	73	62	67	56	61
Hand tools (electric)	102	77		68							
Hand tools (pneumatic)	116	91		82							
Hand-held vibrating compactor		83		74		66		60		54	
Jackhammer	121	96		87		79		73		67	
Loader moving with full bucket	105	76		67	70	59		53		47	
Mobile Crane	104	88	91	79	82	71	74	65	68	59	62
Road Truck	107	83	88	74	79	66	71	60	65	54	59
Roller		82	88	73	79	65	71	59	65	53	59
Scraper	116	85	98	76	89	68	81	62	75	56	69
Tub Grinder & Mulcher (40-50hp)	116	91	95	82	86	74	78	68	72	62	66
Vibratory Roller	108	84	85	75	76	67	68	61	62	55	56
Water Cart	107	82	83	73	74	65	66	59	60	53	54
Welding Equipment	105	80	85	71	76	63	68	57	62	51	56

*A-weighted sound power levels - Typical mid-point

Due to the rural location, construction activities would be limited to between 6 am and 6 pm for Monday to Friday and between 7 am and 5 pm on Saturdays and Sundays with no construction activities undertaken on Public Holidays.

There are a number of residential receptors in the vicinity of the proposed development potentially impacted from construction noise. An indicative noise factor at these receptors for rural living taken from the *Environmental Noise Policy (2007)* is shown in Table 41.

During construction, it is expected that the use of bulldozers and scrapers would occur together. Subsequently, predicted noise levels at these receptors have been calculated from noise attenuation data for combined sources and are shown in Table 42.

Table 41 – Applicable noise criteria during construction

Maximum Construction Noise Levels	Recommended standard hours (7am-10pm)	Outside recommended standard hours (10pm-7am)
	dB(A)	dB(A)
Rural Living	47	40

Table 42 – Predicted sound power levels at nearby residential receptors

Receptor	Distance from closest edge of development	Nearest Activity A-weighted Sound Power Level at Source	Deduction from A-weighted Sound Power Level[1]	Predicted A-weighted Sound Power Level	Exceedance – Standard Hours
	m	db(A)	db(A)	db(A)	
R2	2,715	117	85	33	No
R3	2,780	117	85	33	No
R4	3,120	117	86	32	No
R5	3,860	117	89	29	No
R6	2,785	117	85	33	No

Notes: 1. Deduction from A-weighted Sound Power Level obtained from Figure B1 and Table D1 in AS2436-2010 – Guide to Noise Control on Construction, Maintenance and Demolition Sites.

The predicted construction noise levels presented in Table 42 show that no exceedance of the noise limit is expected at any receptor locations. All receptors in the vicinity of the proposed development are located a considerable distance from the proposed development site. As a result, there are expected to be minimal adverse noise impacts from construction activities on residential receptors.

10.8.2.2 Operation

Noise generated from the operation of the proposed development would be from the infrequent operation of machinery and equipment on the site and from animal noise.

The proposed development would operate between 6 am and 6 pm seven days per week, fifty two weeks a year. Activities including the receipt and dispatch of cattle, feeding, cleaning and maintenance would occur throughout the day. Pens would be periodically cleaned using a front-end loader and the manure placed into compost stockpiles.

Increased noise from cattle would generally occur during loading and unloading of cattle and any situations where cattle may be distressed. Stress impacts upon cattle growth, and would therefore be minimised to ensure cattle are healthy and well thereby ensuring optimum growth.

Table 43 below indicates the predicted noise levels during various operational activities associated with the proposed development.

Table 43 – Typical sound power level from operational equipment (Department of Planning Transport and Infrastructure (SA), 2014)

Type	Activity	Typical Sound Power Level (db(A))
Feed processing plant	Grain movement, processing	95
Truck (<20t)	Ration delivery, solid waste transport	107
Front-end loader	Ration preparation, pen cleaning, solid waste stockpiling/processing	105
Tractor	General activities	100
Water cart	Dust suppression	107
Trucks (>20t)	Incoming/outgoing cattle, feed commodities	107

Based on data from Table 43 and predicted A-weighted Sound Power Level at residential receptors (Table 42), noise generation from the operational activities of the proposed development at residential receptors does not exceed the background noise level measurement by more than 5dB(A) for intrusive noise for daytime, evening or night time periods.

Further, noise generation from the operational activities of the proposed development at residential receptors is not expected to exceed the acceptable noise levels for amenity criterion due to the considerable distance between the development site and receivers shown in Figure 23, the typical sound power levels of operational equipment (Table 43) and the relatively short periods of continuous activity.

10.8.2.3 Off-site Traffic

Increased traffic generation on Hills Road and the Goyder Highway would result in an associated increase in traffic noise. However, due to the numbers of existing traffic on these roads, the similarity of vehicles generated by the proposed development with those currently using these roads and the few sensitive receptors within close proximity to the roads, the potential increase in traffic noise is not expected to impact upon sensitive receptors. Subsequently, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB at sensitive receptor locations.

10.8.3 Mitigation Measures

As discussed in 10.8.2, noise generation from construction or operational activities of the proposed development at residential receptors is not expected to exceed the acceptable noise levels. However, the implementation of the following management and mitigation measures would further minimise the potential for noise as a result of the proposed development.

10.8.3.1 Construction

While the proposed construction activities have limited potential for impact on the local ambient noise environment, noise management strategies can be applied which would further reduce the potential for noise issues during the construction period. Mitigation measures shall be implemented

to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary. The mitigation measures shall include:

- Carrying out all noisy construction works during the standard daytime construction hours
- Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors
- Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors where possible
- Awareness training for staff and contractors in environmental noise issues
- Minimising the use of horn signals and consideration of alternative methods of communication
- Switching off any equipment not in use for extended periods during construction work
- Minimising heavy vehicles' entry to site and departure from site outside the nominated construction hours
- Consideration of the positioning of construction plant / processes
- All plant and equipment required would be well maintained and regularly serviced
- All plant and equipment would be installed with the appropriate noise attenuation apparatus
- Retrofitting reversing alarms that are quieter and display less annoying characteristics
- Maintaining a suitable complaint register. Should noise and/or vibration complaints be received, undertake noise and/or vibration monitoring at the locations concerned.

10.8.3.2 Operation

The implementation of the following management and mitigation measures would minimise identified potential noise impacts as a result of the proposed development:

- Low-stress cattle handling techniques employed to manage cattle to ensure they are handled quietly and efficiently
- Carrying out all noisy activities such as feed processing during the standard daytime operational hours
- Awareness training for staff and contractors in environmental noise issues
- Minimising the use of horn signals and consideration of alternative methods of communication
- Switching off any equipment not in use for extended periods
- Minimising heavy vehicles' entry to site and departure from site outside the nominated operational hours
- All plant and equipment required would be well maintained and regularly serviced
- All plant and equipment would be installed with the appropriate noise attenuation apparatus
- Retrofitting reversing alarms that are quieter and display less annoying characteristics
- Maintaining a suitable complaint register. Investigate all non-vexatious noise complaints.
- Selection of machines that are inherently free of or have low vibration
- Vibration-producing machinery shall be supported on stiff structural components, and be provided with efficient vibration isolation systems

- Maintenance of plant and equipment machinery – ensuring rotating parts are balanced, vibration isolators are functioning as intended etc.

10.8.4 Conclusion

Activities associated with the construction and operation of the proposed development has the potential to generate noise impacts. However, there are very few residential (sensitive) receptors in close vicinity of the noise sources of the proposed development. These residential receptor locations are shown in Figure 23, with the nearest residential receptor located approximately 2,715 m away from the proposed development.

Subsequently, due to the large separation distances, the topography and landform between the proposed development and sensitive receptors and lack of certain vibration generating activities (blasting, jack-hammering, piling), it is predicted that no sensitive receptor shall be potentially impacted by vibration as a result of the construction and/or operation of the proposed development.

No adverse noise impacts are expected at sensitive receptors during the noisiest construction activities, which are bulk earthworks. Further, the activities generating these noise impacts would be temporary in nature and predicted noise levels from these activities meet the SA EPA construction noise criteria.

Operational activities involve noise generating equipment such as feed storage and processing equipment (electric motors, conveyors, roller mills) and mobile plant (feed trucks, tractors, front-end loaders etc.) on-site. Due to the significant distance to the nearest sensitive receptor and as the operational activities of the proposed development are consistent with the activities of the existing agricultural activities of the surrounding area, the noise generated from the proposed development is not expected to create a significant impact on the surrounding environment.

10.9 Landscape and Visual Amenity

10.9.1 Visual Character of surrounding landscape

The landscape surrounding the subject property on which the development is proposed is characterised by undulating, low, moderate and high areas of relief, with moderate to high ranges.

The ridges and spurs of the Hallet Hill Range fringing the eastern boundary of the proposed development site (average elevation 650 metres AHD) are the main physical features of the surrounding area as shown in Photograph 17.

The ranges are aligned predominately in a north-south orientation, while the spurs generally run from the ridgeline down to the west. The broad valleys to the west of the range are approximately 540 metres AHD and are characterised by broad shallow flat-bottomed valleys between prominent north-south ranges/ridgelines with general slopes in the order of 4-5 % as shown in Photograph 18.

The native vegetation has been almost totally cleared with only small isolated pockets of mature trees remaining. Previous landholders have planted extensive avenues of trees for shelter belts along property boundaries with local province vegetation as shown Photograph 5.

Photograph 17 – Visual character of Hallet Hill Range

Photograph 18 – Visual character of undulating landscape to the south

10.9.2 Visual character of subject property

The topography of the proposed development site and the surrounding land is gently undulating with avenues of trees for shelter belts along property boundaries and internal fence lines with local province vegetation.

The proposed development site slopes north to south from approximately 585 m AHD to 555 m AHD at about 5%.

The proposed development site is currently cultivated cropping land with only a few paddock trees. Shelter belts containing mature trees line the site boundary as shown in Photograph 19.

Photograph 19 – Visual character of proposed development site

10.9.3 Visual receivers

The surrounding area to the proposed development comprises agricultural land with the main activity being cropping and beef cattle/sheep grazing. As shown in Figure 23, there are few residences located within 3 km of the proposed development site. A viewpoint assessment was undertaken to assess the impact that the proposed development may have on any potential visual receivers.

Each identified potential visual receiver was assessed with respect to:

- View type from the receiver (e.g. permanent or intermittent views)
- Distance from the receiver to the proposed development
- Sensitivity of the receiver (e.g. residences have a higher sensitivity than a road user).

A field inspection was undertaken to identify and assess potential viewpoints. If the viewpoint was deemed to be a visual receiver, it was then classified as high, medium or low. A brief analysis of potential viewpoints is illustrated in Table 44.

Table 44 – Sensitive receiver visual assessment

Identifier	Type of Viewer	Distance to development complex	Type of View	Sensitivity
R1	Towns > 100 persons	4,880	Not visible	N/A
R2	Rural Residence	2,715	Not visible	N/A
R3	Rural Residence	2,780	Not visible	N/A
R4	Rural Residence	3,120	Not visible	N/A
R5	Rural Residence	3,860	Not visible	N/A
R6	Rural Residence	2,785	Not visible	N/A
R7	Towns > 100 persons	725	Not visible	N/A
R8	Towns > 100 persons	11,000	Not visible	N/A
R9	Hills Road users	1,000	Obstructed	N/A
R10	Goyder Highway users	1,500	Obstructed	N/A

As indicated in Table 44, it was established that all of the closest residences do not have direct views to the proposed development and would not be visually impacted by the development.

Generally, there are three main factors contributing to the lack of a direct view of the proposed development. The primary factor is due to the topography and tree shelter belts between each receiver and the proposed development. The topography and vegetation obstructs the view of the majority of the potential surrounding viewpoints. Secondly, the considerable distance between the receiver and the proposed development minimises the probability of a sensitive view of the proposed development. Thirdly, the siting of the proposed development further east of the existing development some 1-1.5 km from Hills Road and the Goyder Highway.

Photograph 20 illustrates the view looking from Hills Road at the access to the subject property to the proposed development site. The undulating topography of the area ensures that no sensitive view of the proposed development can be obtained from Hills Road as shown in Photograph 20.

Photograph 21 illustrates the view looking from the Goyder Highway at the Hills Road intersection to the proposed development site. Due to the topography of the surrounding land and remaining vegetation, the proposed development would not be visible from the Goyder Highway.

Photograph 20 – View of proposed development site from Hills Road

Photograph 21 – View of proposed development site from Goyder Highway

10.9.4 Assessment of Impacts

10.9.4.1 Visual Absorption Capacity

Visual absorption capacity is the level of visual contrast of the proposed development to the context in which it is placed. The existing landscape consists of vegetated shelter belts along property boundaries and fencelines, as detailed in Section 5.5 and shown in Photograph 5 and Photograph 19. These vegetation communities are located between the Goyder Highway and the proposed development.

The proposed development site consists of open cultivated areas on gentle slopes surrounded by low hills and rises and undulating topography. These landscape characteristics are typical of the local area.

It is considered that the proposed development is consistent with the nature of the agribusiness undertaken in the local area. As such, the elements associated with the proposed development are generally consistent with infrastructure usually associated with these agricultural activities.

The siting of the proposed development further east of the existing development increases the distance between the larger elements (pens, storage lagoons etc.) of the development and receivers, which would enhance the absorption capacity of the existing viewshed.

It is considered that the amount of vegetation fringing fencelines and property boundaries surrounding the proposed development, the undulating topography and the distance between the receivers and the proposed development minimises the potential visual impact due to the visual absorption capacity of the existing environment.

10.9.4.2 Viewpoint Assessment

The potential visual impact of the proposed development would be a result of construction activities and the impact of the final built form on the environment.

As discussed in Section 10.9.3, there are relatively few sensitive visual receivers to the proposed development. An inspection of the site and surrounding area was undertaken to determine the sensitivity of nearby receivers to the proposed development.

The impact assessment verified the location of these receivers to the proposed development, as shown in Figure 23. The assessment took into account the nature of the landscape, topography, the distance between the receiver and the proposed development as well as the type of view experienced. The assessment concluded that due to the topography of the landscape and level and form of existing vegetation, no residential receivers would experience any level of visual impact as a result of the proposed development.

All of the selected viewpoints, as shown in Table 44, would experience no visual impact.

10.9.5 Mitigation Measures

As discussed in 10.9.4, the proposed development is not expected to impact on the visual amenity of sensitive receivers or the landscape character of the area due to the implementation of the following management and mitigation measures:

- Provision of adequate separation distances between the proposed development and sensitive receivers as shown in Figure 23.
- Existing vegetative shelter belts around proposed development as a wind break and vegetative filter.

10.9.6 Conclusion

There are few receivers surrounding the proposed development as indicated in Table 44, with the closest residential receivers located some 2,715 m from the proposed development. Further, the site where the development is proposed is some 1,000 m from the property boundary adjoining the local access road – Hills Road. This setback area contains stands of vegetation and screens the proposed development from road users.

The views of the proposed development from these viewpoints were assessed by taking into account the visual absorption capacity of the proposed development and the types of views experienced from these viewpoints. The type of view took into account the type of viewer, the nature of the view and also the distance to the proposed development.

As a result, the viewpoint assessment indicated that there was expected to be no visual impact from the proposed development.

The assessment deemed that the nature of the proposed development would be consistent with the existing agricultural activities in the surrounding area although on a larger scale. It is considered that the proposed development would assimilate into the local landscape due to the nature of the development and the high visual absorption capacity of the surrounding landscape.

Overall, it is expected that the proposed development would not create any visual impacts to receivers in the surrounding area.

10.10 Pest Animals and Weeds

10.10.1 Introduction

This section discusses the potential impacts from pest animals and weeds that have the potential to become established as a result of the proposed development; including mitigation measures when practicable.

Pest animals and weeds are a constant risk for the primary producers, as they can have a serious impact on agricultural production and market access.

Pest animals can be defined as native or introduced, wild or feral, non-human species of animal that is currently troublesome locally, or over a wide area, to one or more persons, either by being a health hazard, a general nuisance, or by destroying food, fibre, or natural resources.

In South Australia, established pest animals include foxes, rabbits and feral goats and their effect may be seen on public and private land across the state. Flies, rats and mice may also impact on the environment as well as on animal and human health and welfare.

The problems caused by pest animals vary but include; competing with native wildlife for food and habitat; preying on livestock and wildlife; grazing pressure on pastures, crops and native plant communities. They may also spread weeds, contribute to erosion, waterway degradation and become nuisances to human activities which may, in turn, be responsible for stress in rural communities. Human and animal diseases may also be introduced and spread through these animals.

Weeds are non-native plant species that are in the early stages of establishment and have the potential to become a significant threat to biodiversity if they are not managed. Weeds are often grouped in categories depending on their characteristics and impacts with many occurring in more than one category. Categories include:

- Noxious weeds
- Weeds of National Significance
- National Environmental Alert List Weeds
- Water weeds
- Native plants considered weeds
- Non-saleable weeds.

In South Australia, under the *Noxious Weeds Act 1993* all landholders in certain areas are required to control certain serious weeds. These are known as noxious weeds.

10.10.2 Assessment of Impacts

Whilst, the local area has been colonised by a range of pest animals such as foxes and weeds, the potential for the proliferation and spread of these weeds and pest animals or introduction and invasion of other weeds or pest animal species is an important consideration for the proposed development.

The construction of the proposed development requires the movement and transport of machinery, equipment and people to the site. Subsequently, these activities are potential vectors for the introduction of weeds if not effectively managed. The key activities to be managed include:

- Movement of people, vehicles and machinery
- Clearing vegetation
- Movement of soil and vegetation.

A risk of increased pest species populations exists from food waste introduced during construction activities. Subsequently, mitigation measures will predominately focus on reducing the amount and access to food waste by pest species.

The operation of the proposed development requires the movement and transport of livestock, feed commodities, and people to the site. Subsequently, these activities are potential vectors for the introduction of weeds if not effectively managed. The key activities to be managed include:

- Movement of livestock, feed commodities and vehicles
- Pen cleaning, drain and sedimentation basin cleaning
- Solid waste (manure, carcasses, spoilt feed, human waste) handling, storage, processing and movement
- Movement of solid wastes
- Feed storage and processing
- Ration delivery, spoilage and spillage.

Incoming livestock and grains and roughages can carry weed seeds from other areas. Weeds can be easily imported from different regions or states because livestock and fodder can travel significant distances by road within a 24-hour period.

10.10.3 Mitigation Measures

The implementation of the following management and mitigation measures shall minimise identified potential impacts from pest animals and weeds as a result of the operation of the development:

- A ‘mitigation hierarchy’ of first avoiding, then minimising and then mitigating the impact shall be adopted
- A weed survey will be undertaken prior to construction to identify the overall abundance and diversity of weed species across the proposed development site and adjacent land
- Earthmoving machinery shall be cleaned down prior to entering the proposed development site
- Earthmoving machinery shall be cleaned down on-site as soon as possible upon completion of works and leaving the proposed development site if advised by the Construction Manager or operators notice the presence of weeds in the construction area

- Timely control of initial weed populations around the proposed development, such as, along fence lines, drainage structures, in tree plantings etc. Weeds in these areas experience little competition and can produce large quantities of seed
- Control of weeds around the proposed development also reduces any potential fire hazard. Control shall be achieved by regular mowing or herbicide application. Knockdown or residual herbicides (or a combination of the two) shall be used depending on whether the weeds have emerged, the time of year and the weeds present
- Prior to importing livestock and /or feed commodities (grains, roughages) from known weed infestation areas (e.g. bathurst burr, calthrop), the weed status of materials and vehicles shall be determined from the supplier
- A pest management program shall be implemented to control pest animal species already present, using acceptable methods as well as identifying potential pest species, their likely distribution and methods to prevent their spread
- Pest animal species populations near the proposed development shall be monitored
- Established pest animals shall be controlled and their spread prevented
- Pest animal control programs shall use the most humane, target specific, cost effective and efficacious techniques available
- Mice and rat populations will be mitigated:
    - primarily through the solid waste management schedule outlined in Table 28 (i.e. minimise feed wastage and spillage to minimise likelihood of attracting vermin)
    - implementing a baiting program if the vermin population reaches a nuisance level.
- Fly breeding sites shall be mitigated using measures such as:
    - Integration of design features, such as pen foundation and slope to facilitate pen drying, wide feed bunk and water trough aprons and wide fence panels, to make cleaning aprons, under fences and drains that are known potential breeding sites easier or more effective
    - Several control methods such as biological, chemical and physical methods following integrated pest management (IPM) principles shall be used
    - Best practice sanitation methods such as solid waste management practices (pen cleaning, under-fence cleaning) and schedules as outlined in Table 28 to minimise fly breeding sites
    - Controlling weeds and keeping grass and other vegetation short, particularly around pens, drains, sedimentation systems and storage lagoons makes it more difficult for flies to find resting places and reduces the vegetation–manure interface, a preferred breeding substrate for stable flies
- Mortalities shall be removed from the pen area on a daily basis if required and taken to the manure stockpile area of the existing development for composting. Carcasses shall be covered with manure to prevent scavenging by pest animals.
- Human waste shall be managed appropriately and in accordance with any relevant statutory requirements.

10.11 Other Hazards and Risks

10.11.1 Human Health and Safety

Disease which is naturally transmissible from animals to people is classified as a zoonosis. More than 200 zoonoses have been identified involving all types of agents, bacteria, parasites, viruses, prions, fungi and others. Zoonoses are common and the diseases they cause can be serious.

Zoonotic diseases can spread through a variety of means such as working closely with livestock or by coming in contact with soil or water contaminated by animals. In Australia, the two most common and important zoonoses disesases are Q Fever and Leptospirosis.

Q Fever is primarily a risk to workers in the livestock, agriculture, veterinary and meat industries, and therefore has been considered as part of this assessment for the proposed development.

Q Fever is an infection resulting from the organism *Coxiella burnetii*, and was first identified in Australia in the 1930s and the infection became known as "Query" fever as the cause of the illness was then unknown. Q Fever is caused by a small bacterium-like organism that multiplies inside the cells of various organs of infected cattle.

Coxiella burnetti can also exist in a variety of domestic and wild animals without the animal displaying apparent signs of infection. In Australia, *Coxiella burnetti* is maintained in the wild by kangaroos, bandicoots and rodents. Domestic animals such as goats, cattle and sheep and their ticks also often carry the organism.

Humans are infected by breathing the organism in droplets or dust contaminated by the placenta, birth fluids, faeces or urine of infected diseases.

The *Coxiella burnetti* organism is very resilient and it has the ability to withstand harsh environmental conditions. It has been found to be resistant to heating, drying and sunlight and to survive for more than a year at 4°C in a dried state (O'Neill, 1997).

Leptospirosis is a contagious disease which infects both animals and humans. It is caused by bacteria called *Leptospira*. There are over 200 different strains of *Leptospira* found worldwide, with infections being most prominent in areas that have a hot and humid climate. Leptospirosis is considered an occupational hazard for many people who work outdoors or with cattle, for example farmers, veterinarians, abattoir workers, and therefore has been considered as part of this assessment for the proposed development.

In South Australia, there are two strains of *Leptospira* that are frequently identified in dairy and beef cattle:

- *Leptospira hardjobovis*
- *Leptospira pomona.*

Both the strains may also cause severe illness in humans.

Leptospira bacteria occurs most commonly in cattle (and pigs), rodents and wild animals. They colonise the kidneys of infected animals and, in females, they also colonise the reproductive tract.

Leptospirosis is also spread in contaminated water supplies, food, pastures and soil. Many infected animals do not display any illness. These apparently healthy carriers are the main source of infection for other cattle as well as for humans. The bacteria can live for a long time in surface fresh water, damp soil, vegetation and mud, but are very quickly killed on dry soil or by sunlight (Zelski, 2007).

The organism is present in the urine of infected animals and enters the human body through damaged (e.g. scratched and abraded) skin or through linings of the eyes, mouth or nose.

10.11.2 Animal Welfare and Disease management

10.11.2.1 Animal Health

The welfare of cattle is an important consideration to maximise cattle growth and productivity and thus profitability. The main potential risk to cattle health in a feedlot environment is disease as animals reside in close contact. The main causes of feedlot disease are:

- nutrition – deficiencies or excess
- infections
- injuries.

The illnesses and diseases which affect cattle, particularly in feedlots include:

1. Nutritionally-based diseases

    - Deficiency of energy – pregnancy toxaemia, ketosis, fatty liver, poor weight gain or weight loss
    - Excess of energy – acidosis, rumenitis, polioencephalomalacia, nutritional diarrhoea
    - Deficiency of minerals (calcium) – transport tetany
    - Deficiency of dietary fibre – indigestion, acidosis, feedlot bloat, inanition, liver abscesses, dietary diarrhoea
    - Excess of rough, unpalatable, indigestible fibre – impaction, poor weight gain and production.

2. Infectious diseases

    - Respiratory infections/ pneumonia – runny noses, fever, depression and rapid breathing.
    - Bovine Ephemeral Fever (3-day Sickness)
    - Foot rot and foot abscess
    - Pink Eye

- Diarrhoea (infectious)
- Ringworm.

3. Stress diseases

- Heat stress
- Transport stress.

10.11.3 Biophysical Environment

Risks to the biophysical environment would include the impacts of pests, odour, dust and solid and liquid waste utilisation on the receiving environment.

10.11.4 Assessment of Impacts

10.11.4.1 Human Health

Q Fever and Leptospirosis are debilitating diseases. These infections are important and continuing public health problems in rural areas. Workers employed at the proposed development are at risk of contracting leptospirosis during normal cattle handling activities.

Q Fever and Leptospirosis illness may last for weeks or months, forcing the affected person to take considerable time off work. Relapses are common, with a 'washed out' feeling which may persist for months. Leptospirosis infection can cause serious problems for pregnant women and can prove fatal to a human foetus.

Leptospirosis in humans is a notifiable disease in Australia.

10.11.4.2 Animal Health and Disease Management

The welfare of cattle is an important consideration to maximise cattle growth and productivity. Therefore the proposed development has been designed to the highest of animal welfare and disease management standards and would be operated to ensure that the health and wellbeing of cattle is maintained and the potential for disease and spread of disease minimised.

Cattle for the proposed development may be sourced from multiple sources (markets or properties) and hence are high risk for introduction and spread of disease. The main causes of disease in lot-fed cattle are:

- nutrition – deficiencies or excess
- infections
- injuries.

There are various health disorders routinely encountered in beef cattle feedlots. These can be broadly categorised as:

- Disease in special at-risk groups – new arrivals, fat cattle, late pregnancy/calving cows
- Disease caused by faulty feeding or feedstuffs – acidosis, impaction, indigestion, bloat
- Disease caused by faulty handling or faulty facilities – injuries, wounds, heat stress
- Disease caused by infectious agents – viruses, bacteria, internal or external parasites.

Heat stress is a significant animal welfare issue in beef cattle feedlots. Heat stress occurs when an animal cannot effectively control body heat and the body temperature rises to dangerous levels leading to reduced feed intake, poor production and, if not adequately controlled, death. There are a number of factors that can influence heat stress in feedlot cattle. These include:

- high humidity and air temperature over an extended period
- an accumulation of manure within the pen
- poor drainage and air circulation
- lack of effective shelter
- lack of options to reduce body temperature in the animal
- breed effect, with *Bos taurus* cattle recognised as more susceptible to heat stress.

Maintaining animal health and preventing disease in the proposed development is going to depend greatly on the experience of:

- stockmen – who have to be both skilled animal handlers and observers
- consulting veterinarian
- animal nutritionist.

10.11.4.3 Biophysical Environment

An assessment of odour and dust, and measures proposed to minimise these impacts have been considered and outlined in Section 10.1.

An assessment of solid and liquid waste management and measures proposed to mitigate these impacts have been considered and outlined in Sections 10.2 and 10.7.

An assessment of pest animals and weeds, and measures proposed to mitigate these impacts have been considered and are outlined Section 10.10.

Assessments of the impacts to surface water and groundwater along with measures proposed to mitigate these impacts have been considered and outlined Sections 10.3 and 10.4.

10.11.5 Mitigation Measures

The existing feedlot is accredited under the National Feedlot Accreditation Scheme (NFAS). Subsequently, welfare issues for the proposed development will be adequately covered in the feedlots' Quality Assurance manuals, which are given both off-site and field audits.

Further, the implementation of the following management and mitigation measures shall minimise identified potential impacts from hazards and risks as a result of the construction and operation of the proposed development:

- Maintaining animal health through biosecurity and animal health programs, including the use of vaccines, plays an important role in reducing the risk of zoonotic diseases.
- All personnel working with or handling animals shall take precautions to minimise the risk of infection from animal-borne diseases. Because different zoonotic diseases behave differently, avoiding specific infections requires an individual approach. The following practices shall be implemented to provide a high level of general protection.
    - Good personal hygiene practices such as washing hands after handling animals and before preparing or eating food or smoking cigarettes shall be implemented.
    - Hygienic food preparation: Food-borne diseases can be largely avoided through correct processing and hygienic food preparation.
    - Personnel shall be vaccinated for those zoonoses for which vaccinations are available, for example Q Fever.
    - Personal protective equipment such as gloves, boots and aprons or overalls shall be worn when handling animals. Cuts and scratches shall be covered with waterproof plasters.
    - Pest animals such as rats can carry zoonotic diseases and control programs will reduce the likelihood of transmission to people.
- Employees are trained to understand the mechanisms of disease introduction and spread, including via cattle, feedstuffs, people, vehicles, machinery and equipment, feral animals and wildlife, and solid and liquid waste.
- The existing feedlots preventive herd health plan outlines animal health prevention and treatment.
- Implementation of herd management systems that support rapid and accurate trace-back and trace-forward of livestock.
- Livestock are vaccinated against major preventable diseases.
- Early identification of animal health issues through daily monitoring, observation and assessment of livestock for a range of key behavioural indicators. Experienced stockmen are usually very good observers, and less experienced staff shall be trained in observation techniques.
- Accurate diagnosis of animal health issues backed by the local veterinarian.
- Separation of sick cattle into hospital/treatment pens for treatment and convalescing.
- Prudent use of antibiotics to manage infectious disease, reduce livestock pain and suffering, and to minimise losses due to disease.
- Destruction and disposal of infected and exposed susceptible animals.

- Development and implementation of a heat stress management plan to mitigate excessive heat stress events. The plan should include procedures and equipment for dealing with an excessive heat load event including:
  - regular removal of manure
  - diet changes to reduce metabolic heat produced during digestion
  - more frequent water changes to ensure cool, good quality water is available at all times
  - provision of shade and activation of additional cooling (irrigation) equipment
  - trigger points for when to activate the plan
  - for example during periods of prolonged high temperature and humidity, or forecasted extreme weather conditions.
- Sufficient capacity of water required to supply cattle is available on-site
- Sufficient capacity of feed required to supply cattle is available on-site
- Implementation of best practice solid and liquid waste management techniques including regular cleaning of pens, drains and sedimentation basin of manure and composting of mortalities
- Preparation of a contingency plan to manage the disposal of large numbers of mortalities.

Subsequently, due to the mitigation and management measures proposed, the proposed development is not expected to impact on human health.

10.12 Land Use

The proposed development shall be located in a rural area. The subject property on which the development is proposed is surrounded by other predominantly beef cattle/sheep grazing and dryland cropping landholdings. The majority of rural land to the east and south-east is owned by the proponent. The Hallet Hill Range lies adjacent to the eastern boundary of the proposed development site.

The subject property consists of some 1,578 ha across a number of parcels and is irregular in shape. Road access to the proposed development is from Hills Road, a council controlled road. Hills Road intersects with the Goyder Highway some 1.5 km south-west of the proposed development site.

The subject property on which the development is proposed has been historically used for dryland agriculture (cereals (wheat, barley, oats) and beef cattle and sheep grazing) and is located in a rural area which encourages agricultural uses.

10.12.1 Surrounding Land Use

The subject property on which the development is proposed is situated at the southern extent of the Hallet Hill Range on its western side. The surrounding land uses include:

- Rural
- Rural residences
- Infrastructure/services

10.12.1.1 Rural

Rural land uses dominate the surrounding area and include land used for beef cattle and sheep grazing and irrigated and dryland agriculture. The area is also scattered with infrastructure that supports these activities such as sheds, livestock handling facilities, shearing sheds and rural residences.

A wind farm known as Hallet Hill No 2 is located on the Hallet Hill Range to the east of the proposed development site. The wind farm provides power for the south eastern Australian electricity grid.

The surrounding land holdings are of similar size in area to the subject property on which the development is proposed.

10.12.1.2 Transport Infrastructure

The subject property on which the development is proposed is accessed from Hills Road, a local government road. Hills Road joins the Goyder Highway some 1 km to the south-west of the subject property.

10.12.1.3 Service Infrastructure

The subject property on which the development is proposed is not connected to the electricity network grid. Subsequently, electricity requirements for the existing feedlot development are generated on-site by diesel powered generators as shown in Photograph 4.

10.12.1.4 Proposed Land Use

The proposed development would continue, but intensify, the existing rural land uses of the surrounding area. The proposed development would utilise the administrative and infrastructure capacity such as office buildings and feed processing facilities of the existing feedlot to operate the development.

10.12.2 Assessment of Impacts

10.12.2.1 During Construction

The construction of the proposed development and elements such as access roads, production pens, sedimentation basin(s) and storage lagoon(s) is not expected to adversely impact surrounding land uses. There is the potential for dust and noise to be generated during construction. However, potential impacts to air quality and implementation of prescribed mitigation measures outlined in Section 10.1 shall ensure that sensitive receivers would not be adversely impacted from construction activities.

10.12.2.2 During Operation

The operation of the proposed development would substantially intensify the agricultural activities on the site, with some 10,552 head (9,083 SCU) of cattle to be located within the proposed development at full capacity. This is in addition to the existing feedlot which currently has a capacity of 6,090 head (4,409 SCU).

Operation of the proposed development would provide employment for some 20 full time equivalent personnel. Noise, odour and traffic have the potential to affect surrounding land users. Measures would be implemented to minimise noise and odour, and increases in traffic are not expected to significantly affect receivers adjoining Goyder Highway.

11. Environmental Management Plan

An Environmental Management Plan (EMP) is a procedural document which outlines the environmental goals of the proposed development, the safeguard measures to be implemented, the timing of the implementation in relation to the progress of the proposed development, responsibilities for implementation and management, and a review process.

The key objectives of the EMP include:

- Ensuring the works are carried out in accordance with appropriate environmental statutory requirements and relevant non-statutory policy as is detailed in this development application
- Operations and environmental protection measures shall be planned to minimise environmental risks and comply with specified environmental protection requirements
- Ensuring that works are carried out in accordance with the objectives and requirements presented in this development application
- Ensuring that works are carried out in such a way as to minimise the likelihood of adverse environmental impact occurring
- Ensuring that works are carried out in such a way as to manage the impact of the works on nearby sensitive receivers
- Implement environmental management principles and practices to conserve and protect environmental resources through, amongst approaches, the efficient use of energy and water, reduction in greenhouse gas emissions intensity, vermin and pest control, minimising waste and preventing pollution
- Communicate with our employees, local communities, contractors, suppliers, and other interested third parties to encourage an environmentally responsible culture
- Monitor the effectiveness of the environmental protection measures
- Response procedures which will initially contain, then remedy, any environmental incidents that may occur
- Identifying management responsibilities and reporting requirements to demonstrate compliance with the EMP
- Providing clear procedures for management of environmental incidents including corrective actions
- Improve environmental protection measures and revise the EMP promptly when deficiencies are identified.

The scope and content of the EMP will be a function of the proposed development's potential environmental impacts as outlined in this development application. The EMP, shall include, but not be limited to those elements identified and described in Table 45 and in accordance with the procedures documented in the Princess Royal Feedlot NFAS manual.

Table 45 – Typical EMP structure

Section	Description
Introduction	Background
	Purpose and Scope
	Objectives
Legislative and Other Requirements	Legal and Other Requirements
	Approvals, Permits and Licences
	Environmental Policy
Environmental Management Framework	Obligations, Roles , Responsibilities and Authority
	Certification and Approval
Environmental Aspects and Impacts	Objectives and Targets
Competence, Training and Awareness	Environmental Induction
	Training and Awareness
Consultation and Communication	Processes for external and internal communication in relation to the environmental aspects
Incident and Emergency Management	Incident Investigation, Reporting and Recording
	Environmental Emergency - Preparation and Response
Inspections, Monitoring and Auditing	Environmental Inspections
	Monitoring
	Auditing
	Reporting
	Non-conformances, Corrective, Preventative Actions
Review and Improvement	Review of environmental controls and procedures
Document Control and Records Management	Document Control
	Environmental Records

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Appendix A.

Foundation and clay lining of feedlot pens, pads and drainage system