Appendix C. – Clay lining of feedlot pens, pads and drainage system

Preamble

Runoff from the feedlot pad contains organic and mineralised manure constituents that could pose a significant ecological hazard if they were released, uncontrolled, into the environment.

If a groundwater assessment indicates a high potential for contamination of underground water resources because of leaching of nutrients through permeable, underlying soil or rock strata, an impermeable barrier will be needed between the contaminant and the groundwater. This is required if the permeability of underlying soil/rock strata exceeds 0.1mm/day (3.5 cm/year).

This impermeable barrier is generally created using a liner made of compacted clay or other suitable compactable soil materials. Where these materials are not available, a synthetic liner (polymembrane) may be used. Synthetic liners tend to be expensive, require specialist installation and are hard to protect from damage by cattle and cleaning equipment. Clay liners tend to be the most common form employed in feedlot construction, and the following section outlines the characteristics of suitable clay lining material.

Design standard

- Clay liners should have a maximum permeability of 1 x 10^{-9} m/s (0.1mm/day) for distilled water with 1 m of pressure head.
- Clay liners must be of sufficient depth so that the integrity of the structure is maintained throughout the general working of the feedlot.

Clay liners

Clay liners are commonly used in industry for a range of contaminants including liquid effluent.

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. Also, some soil types, because of their physical and chemical properties, are impermeable *in-situ*, but fail to meet the design standard when measured in the laboratory.

For these reasons, rather than relying on permeability standards, this section provides guidance on specifications for materials and construction methods to be used for clay lining.

The specifications in Table C.1 provide 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.

Table C.1 Specifications for clay liner materials

Soil characteristic	Acceptability criterion	Test method
Percentage fines	More than 25% passing 75 µm sieve	AS 1289 3.6
	More than 15% passing 2 µm sieve	
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

Areas to be clay lined within the controlled drainage area include:

- effluent catch drain
- sedimentation system
- holding ponds
- manure stockpile and composting pad
- any area where contaminants are stored or handled.

Because of the formation of a low permeability soil-manure interface layer, clay lining is not generally required on the feedlot pen and yard areas.

Trafficability of clay lined materials

The liner should be trafficable for cattle and equipment. To ensure that the integrity of the liner is maintained, the depth of the liner should be sufficient to ensure that equipment does not damage it during harvesting of manure. The minimum depth recommended for the clay liner is 300 mm after compaction. Periodic repair of the liner will be necessary due to the wear and tear associated with cattle traffic and normal cleaning operations.

The mechanical strength of liners can be tested using the Californian Bearing Ratio (CBR) test, which was developed for measuring the load-bearing capacity of soils used for building roads. The test is performed by measuring the pressure required to penetrate a soil sample with a plunger of standard area in both the saturated and dry conditions at a specified compaction. The minimum standard for CBR wet and dry is 20%.

Particular attention should be applied to the load-bearing capability of areas where cleaning or harvesting of dry waste is undertaken, including:

- feedlot pens
- effluent catch drain
- sedimentation system
- manure stockpile and composting pad.

Construction

All areas to be clay lined should be cleared and grubbed, stripped of top soil and prepared to the required levels and gradients by cutting and filling. The surface of the excavated area should also be tined before the clay material is placed to produce a satisfactory bonding surface.

The clay lining material should be placed in layers of 150 mm (±50 mm). Each layer should be tined, wetted to ±2% of optimum moisture content (AS 1289 5.1.1) and compacted to the required compaction (relative to the maximum dry density, AS 1289 5.4.2) that is needed to achieve the required permeability of 1mm/day.

APPENDIX E
STANDARD SPECIFICATION

CATTLE FEEDLOTS

QUEENSLAND GOVERNMENT

DPI QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

CLAY LINING OF DRAINS, SEDIMENTATION SYSTEMS, HOLDING PONDS AND MANURE STOCKPILE AREAS

Alan Skerman, Senior Environmental Engineer, Intensive Livestock Environmental Management Services

INTRODUCTION

This standard specification is intended to provide guidance and technical direction to licensees, contractors, consultants and project managers involved in the construction of cattle feedlots at sites where groundwater impact assessments have indicated a high potential for contamination of underground and/or surface water resources, because of leaching of nutrients through permeable, underlying soil or rock strata. It outlines this Department's recommended practices for the clay lining of drains, sedimentation systems, holding ponds and manure stockpile areas and provides a set of enforceable, quantitative standards to ensure that consistency is achieved throughout the industry.

This specification is based on established engineering principles and operational experience gained by the industry over several years. However, it may be revised from time to time as new methods are developed and/or as experience dictates. Proposals involving alternative materials and/or construction methods may be submitted to the administering authority for consideration.

1. PERMEABILITY STANDARD

If a groundwater impact assessment indicates a high potential for contamination of underground and/or surface water resources, because of the leaching of nutrients through permeable, underlying soil/rock strata, clay lining of the feedlot complex should be undertaken in accordance with this specification. For the purpose of this specification, it is considered that there is a significant risk of nutrient leaching if the permeability of underlying soil/rock strata exceeds 0.1 mm/day (37 mm/year).

Because in-situ and laboratory measurement of permeability is difficult and relatively inaccurate, rather than relying on permeability standards, this document provides proven standards for materials and methods used for clay lining. By applying these standards, the required permeability should be achieved consistently.

2. AREAS TO BE CLAY LINED

Unless the underlying soil type and geology changes significantly across the feedlot site, each of the following areas of the feedlot complex should be clay lined:

- internal catch drain(s),
- sedimentation system(s),
- holding pond(s) and
- manure stockpile area(s)

Because of the formation of a low permeability soil–manure interface layer, clay lining is not generally required on the pen and yard areas, unless directed by the administering authority.

3. CLAY LINING SURFACE PREPARATION

All surfaces to be clay lined shall be cleared and grubbed, stripped of topsoil and prepared to the required levels and gradients by cutting and filling, as required. This will involve over-excavation (excavation below the design level indicated on the plans) to accommodate the required thickness of clay lining while ensuring that the final design gradients, levels and dimensions are achieved, in accordance with the plans approved by the administering authority.

To produce a satisfactory bonding surface for the placement of subsequent layers, the following operations should be carried out on all areas to be clay lined:

(i) scarifying or ripping with a tined implement, to a minimum depth of 150 mm,
(ii) watering to produce the correct moisture content, as specified in Clause 6,
(iii) compaction in accordance with Clause 7.

4. CLAY LINING MATERIAL

Soils shall be considered suitable for use as clay lining materials, subject to compliance with the following requirements:

The material shall be classified as either CL, CI, CH, SC or GC in accordance with the soil classification system described in Appendix A of AS 1726. Furthermore, it shall conform with the following particle size distribution and plasticity limits:

(i) Particle Size Distribution:

AS Metric Sieve Size (mm)	**Percentage Passing** (by dry weight)
75	100
19	70 – 100
2.36	40 – 100
0.075	25 – 90

(ii) Plasticity Limits on fines fraction, passing 0.425 mm sieve:

Liquid Limit W_L	30 – 60 %
Plasticity Index I_p	> 10 %

Note for explanatory purposes: *The material classification symbols CL, CI, CH, SC* and *GC represent clays having low, intermediate and high plasticity, clayey sands and clayey gravels respectively.*

If materials complying with the above plasticity limits are not readily available, clays having liquid limits between 60% and 80% may be used as lining material, provided that the clay lining layer is covered with a layer of compacted gravel (or other approved material), having a minimum thickness of 100 mm, to prevent the clay lining from drying out and cracking.

Topsoil, soils incorporating tree roots or organic matter and any other material which does not compact properly, must not be placed in any of the areas to be clay lined. Wherever non-dispersive materials are available, they are to be used in preference to materials shown to be dispersive using the Emerson test, as described in Method 8.1 of AS 1289.

5. MATERIAL SUITABILITY AND IDENTIFICATION

The visual identification methods described in AS 1726 may be used by suitably qualified and experienced persons, for classifying soils in the field. However, if there is doubt about the suitability of the material, the administering authority may direct the licensee to arrange for laboratory testing, in accordance with the appropriate sections of AS 1289. All such laboratory testing must be carried out by a soils laboratory, accredited by the National Association of Testing Authorities (NATA).

6. CLAY LINING THICKNESS

The minimum required thickness of clay lining depends on the maximum head of effluent in contact with the clay lining and the duration of that contact. The following table outlines minimum lining thicknesses (after compaction), for the different areas of the feedlot, for two maximum head conditions.

Area of Feedlot	**Maximum Head Over Clay Lining** (m)	**Minimum Clay Lining Thickness** (mm)
Internal Catch Drains Sedimentation Systems Holding Ponds Manure Stockpile Areas	< 2 m	300
Sedimentation Systems Holding Ponds	> 2 m	450

7. PLACEMENT OF MATERIAL

Clay lining material complying with Clause 4, shall be placed at the correct moisture content as defined in Clause 8, on surfaces prepared in accordance with Clause 3, in progressive, uniform, horizontal layers, not exceeding 200 mm in thickness, prior to compaction.

8. CORRECT MOISTURE CONTENT

Prior to compaction, all material used for lining purposes shall be conditioned to have a moisture content within the range of two (2) percent wet to two (2) percent dry of the optimum moisture content required to produce the maximum dry density when compacted in accordance with Method 5.1.1 of AS 1289.

Note for explanatory purposes: *This moisture content is consistent with the requirements for compaction using a sheepsfoot roller to produce maximum impermeability. As a guide, the required moisture content is as wet as can be rolled without clogging a sheepsfoot roller. A preliminary assessment of the required moisture content can be made by rolling a sample of the material between the hands. If it can be rolled to pencil thickness without breaking, it should be satisfactory.*

9. COMPACTION

Each layer of material placed in accordance with Clause 7, shall be compacted to produce **either** a field dry density of at least 95% of the standard maximum laboratory dry density determined in accordance with Method 5.4.1 of AS 1289, **or alternatively**, a Hilf density ratio of at least 95% when tested in accordance with Method 5.7.1 of AS 1289.

Note for explanatory purposes: *This degree of compaction may generally be achieved by rolling each layer of material, placed at the correct moisture content, with at least eight (8) passes of a sheepsfoot roller of the configuration described in Clause 10 below. As a guide, compaction will generally be sufficient when there is a clearance of 100 mm between the drum of the roller and the compacted material.*

10. SHEEPSFOOT ROLLER

The following specifications describe a sheepsfoot roller which is suitable for fulfilling the compaction requirements described in Clause 9:

(i) The diameter of the drum(s) shall be not less than 1m.

(ii) The length of each drum(s) shall be approximately 1.2 times the drum diameter.

(iii) The feet shall extend approximately 175mm radially from the drum and be of the taper-foot type, with a cross-sectional area close to the outer end of not less than 3200mm^2 and not more than 4500mm^2.

(iv) The number of feet shall be such that their total area close to the outer ends shall be between 5% and approximately 8% of the area of the cylinder which would enclose all the feet, *i.e.* a cylinder having a diameter equal to the diameter of the drum plus twice the length of each foot.

(v) The weight of the roller ballasted, shall be such that the bearing pressure thus obtained shall be not less than 1750 kilopascals, in accordance with the following formula:

$$\text{Bearing Pressure (kPa)} = \frac{\text{Mass (kg)} \times 9.81 \times 1000}{\text{Area of contact of one row of feet (mm}^2\text{)}}$$

Rollers of other types and configurations may be used provided that the required compaction is achieved in accordance with Clause 9.

11. TEST FOR ADEQUATE COMPACTION

The administering authority may direct the licensee to arrange for compaction testing, in accordance with the methods referred to in Clause 9 of this specification, to be carried out on appropriate sections of the works area. Compaction testing is to be performed by suitably qualified and experienced personnel, employed by a soils laboratory accredited by the National Association of Testing Authorities (NATA) for the specified testing method.

Failure of the test results to comply with the compaction requirements described in Clause 9 will result in the licensee being prohibited from stocking the feedlot until appropriate remedial measures are implemented, as directed by the administering authority.

12. EXEMPTION FROM CLAY LINING REQUIREMENTS

The administering authority may exempt a licensee from the requirement to clay line cattle feedlot facilities if the licensee can submit certified test results confirming that the permeability of soils underlying nominated areas of the feedlot does not exceed 0.1 mm/day.

Permeability testing is to be carried in accordance with the methods specified in either Part 6 of BS 1377 (Triaxial Permeability) or Section F7.1 of AS 1289. The test results shall be submitted to the administering authority, following certification by a National Association of Testing Authorities (NATA) accredited soils laboratory.

13. FINAL TRIMMING

Following the completion of compaction, final trimming of all clay lined areas shall be carried out to produce a smooth, uniform surface, in accordance with the design gradients, levels and dimensions shown on the plans, as previously approved by the administering authority.

14. SYNTHETIC LINERS

A licensee may submit to the administering authority, alternate material and installation specifications relating to the use of synthetic lining materials, in lieu of clay lining. Approval of synthetic lining proposals will be subject to assessment by the administering authority.

15. INDEMNITY

The Department of Primary Industries and Officers of that Department shall not be responsible for any costs incurred by either the licensee or his/her contractor, in carrying out any works, as directed by the administering authority, for the purpose of rectifying design and/or construction faults or omissions.

Appendix B.

Groundwater bore logs and Hydrogeological Report

Australian Groundwater Technologies

WELL DISCHARGE TEST ANALYSIS MACKERODE STATION

Prepared for

Princess Royal Station

AGT Report No: 2008/16

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LIST OF FIGURES & TABLES

1. BACKGROUND

The proprietors of Princess Royal Station are seeking development application to construct a beef cattle and lamb feedlot on Mackerode Station, on section 214, Hundred of Ayers. It is proposed to water the feedlot from groundwater, and to that end two wells (wells P.N. 129800 and P.N. 129293) have been established near the proposed feedlot (figure 1).

Based on the original Development Application (June 2007), total annual consumption has been estimated at 78.5 ML for the feedlot. Surface storage capacity of 500,000 litres will be provided to meet peak 2 day water requirement of between 460,000 – 480,000 litres. Assuming 100% stocking for 12 months, and based on an average daily consumption of 33.8 L/d and 3 L/d for cattle and sheep, respectively, an average supply of 7.5 L/s is required for 8 hr pumping periods per 24 hrs. The yields of the two wells were reported as being 5 L/s and 3 L/s for wells PN 129800 and 129293, respectively, presumably based on airlift test during well development after drilling.

Concerns have been expressed about the impact of this extraction on the groundwater resources of the Booborowie Valley groundwater system and on nearby adjoining existing users- this was exacerbated by the lack of information on the capacity of each well.

The proponents of the feedlot subsequently undertook a well discharge testing program on the higher yielding of the two wells (well Permit Number 129800). The results and analysis of this test are presented in this report.

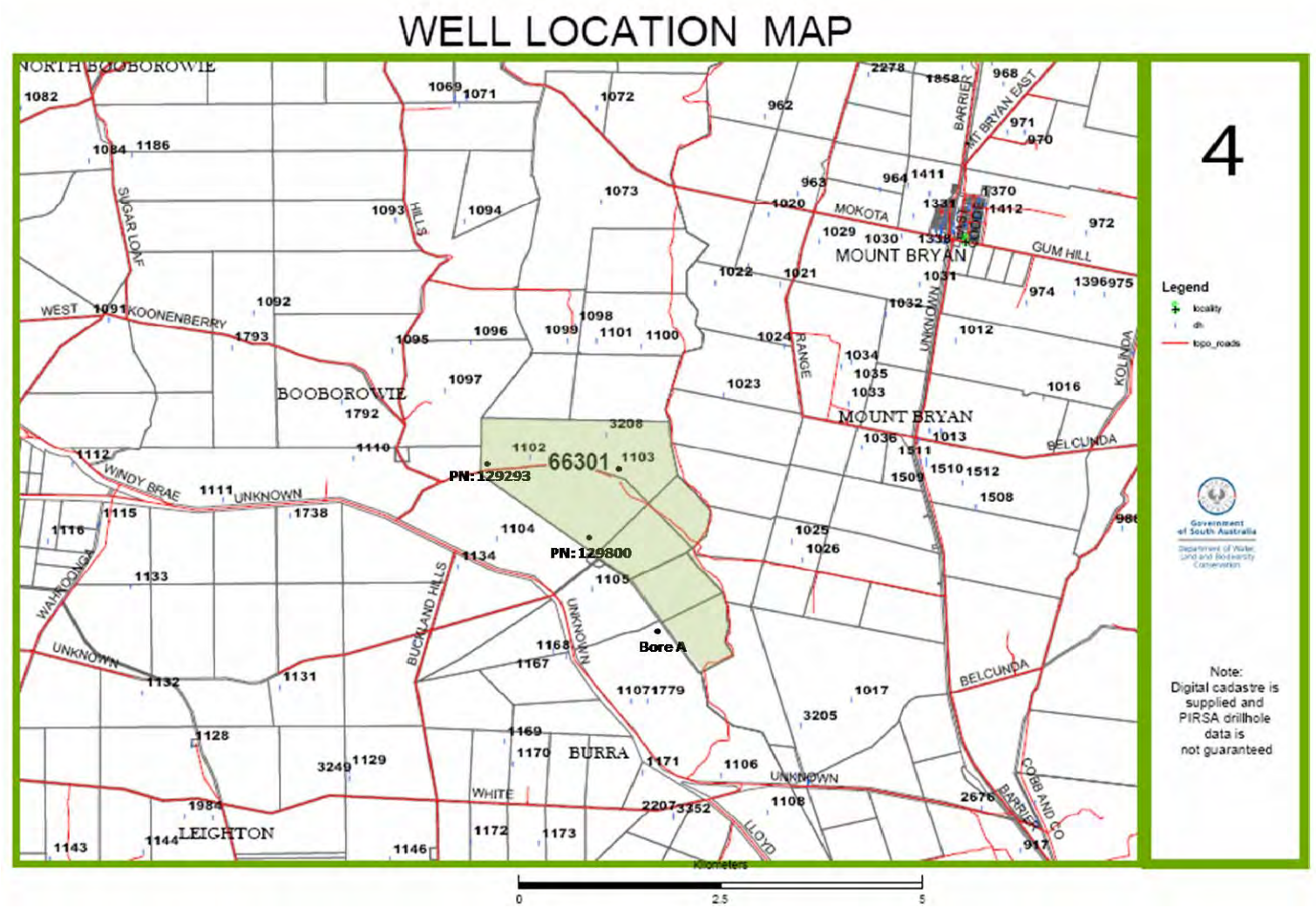


Figure 1 Mackerode Station Well Location

2. DRILLING RESULTS

The drilling results as documented in the driller's reports are summarized below:

Table 1 Drilling Summary

	PN 129293	**PN 129800**
Lithology	0-8m: clay and shale 8-25m: weathered siltstone 25-114m: firm grey sitstone	0-6m: clay and shale 6-15m: soft brown sandstone 15-61m: grey brown siltstone
Water cuts (yield)	99-100m (2.25 L/s) 107-108m (0.75 L/s)	29-33m (2 L/s), 50-51m (3L/s)
Casing	150mm PVC 0-34m	150mm PVC 0-26m
Salinity	1,700mg/L	2,300mg/L
Airlifted yield	3 L/s	5 L/s

3. DISCHARGE TESTING RESULTS

Discharge testing on the production well (PN129800) was carried out by staff from the Department of Water, Land and Biodiversity Conservation (DWLBC). Testing consisted of a 3 stage step test of 5 hrs duration followed after overnight recovery by a 24hr constant discharge test. The step discharge test is used to derive the well yield-drawdown relationship whilst the constant discharge test provides more regional information on the aquifer properties.

During pumping, the conductivity of the water (which is a measure of salinity) was continuously monitored with an in line probe.

Drawdown and conductivity field data are tabulated in appendix 1.

3.1 Step Discharge Test Results

Pumping for the step test began at 1050hrs and ceased at 1550hrs on the 26/3/08.

The step test was carried out in 3 steps of 100 minutes each at rates of 2.5 L/s, 5 L/s and 7.5 L/s, respectively.

The step test results are used to determine the relationship between well drawdown, discharge rate and duration of pumping, in the form of the following equation:

$s = aQ + bQ \log t + cQ^2$

Where, s is drawdown in metres

Q is the discharge rate in m^3/min

t is pumping duration in minutes

a and c are constants related to the well efficiency

b is the aquifer loss component of the drawdown

The plot of drawdown data versus the logarithm of time is shown in figure 2. Also shown in figure 2 are the plots for steps 2 and 3 corrected for the antecedent pumping conditions ie it shows the expected drawdown if each step had been started from zero drawdown conditions.

From step 1 and corrected steps 2 and 3 drawdown data, the following well drawdown equation was determined:

$s = 2Q + 6Q\log t + 9Q^2$

The results for steps 2 and 3 however show that the rate of drawdown is not constant (ie does not fit on a straight line), suggesting the presence of boundary conditions –ie the flow of water to the well is not radial but is linear along a fracture, suggesting that the bedrock aquifer is not densely fractured and the water bearing fractures are not connected

This equation, which assumes radial flow condition, is therefore only valid for pumping times up to approximately 100 minutes, after which time the drawdown values can be extrapolated using an analytical equation for linear flow conditions (refer section 3.2).

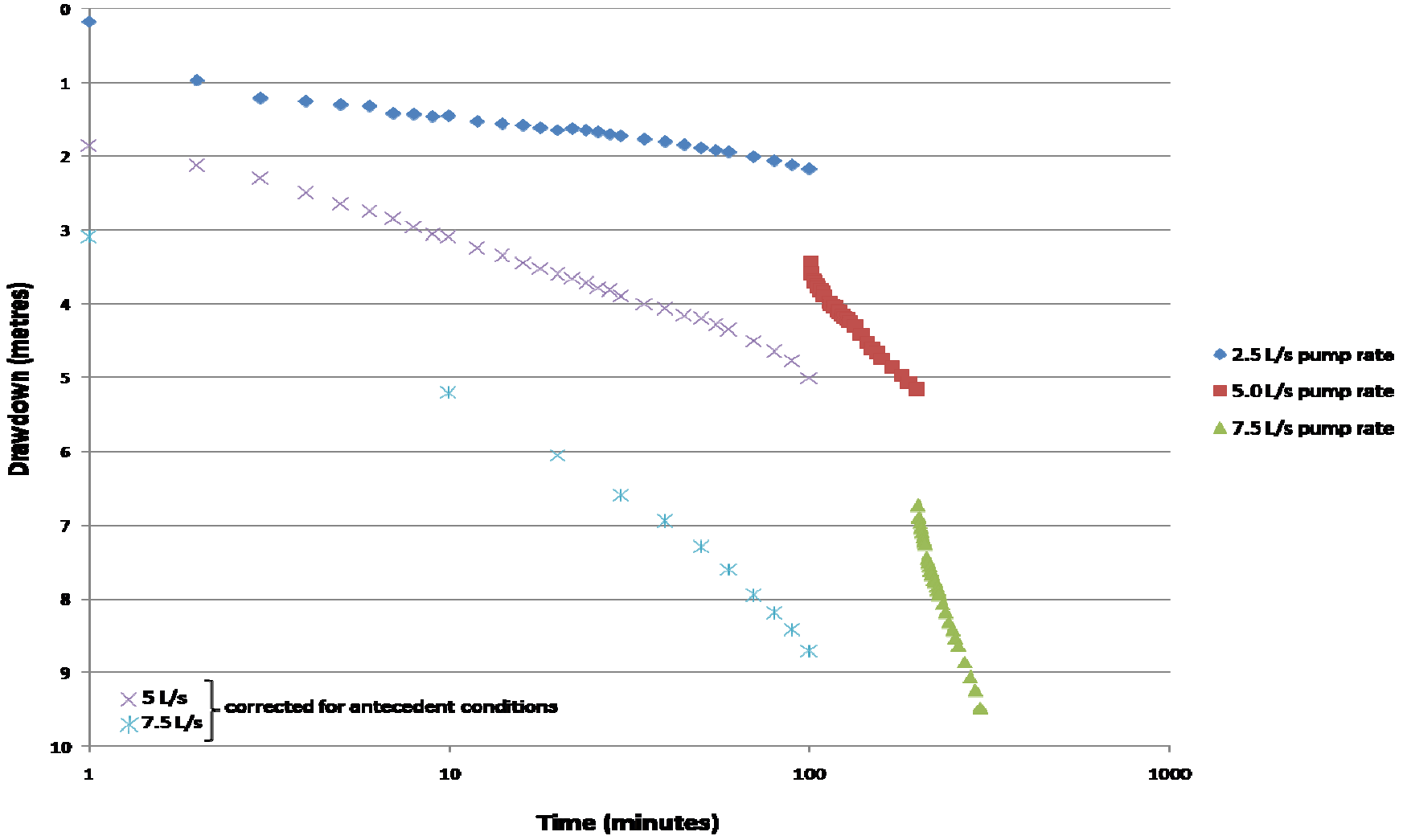


Figure 2 Step Test Data and Corrected Data (well 129800)

3.2 Constant Discharge Test Results

The constant discharge test commenced at 0940hrs on 27/3/08 and ceased at 0940hrs on the 28/3/08.

At the start of the pumping, the Standing Water Level (SWL, also known as Static Water Level) was still 0.35m below the SWL measured at the start of the step discharge test- ie the water level had not yet fully recovered between the stop of the discharge test at 1550 hrs on the 26.03.08 and 0940hrs on the 27.03.08, suggesting possible dewatering. This was taken into account when plotting the data.

Drawdown responses were measured in the pumping well P.N 129800 and also in wells P.N 129293, 1103 and Bore A (figure 1). Pumping was commenced at a discharge rate of 6.5 L/s, but this was reduced to 5 L/s after 1,100 minutes of pumping to ensure that the well did not "fork" towards the end of the 24 hr pumping period.

On cessation of pumping, the recovery in the pumping well and the 3 observation wells were monitored for 24hrs.

The plots of drawdown and residual drawdown for the pumping well are shown in figure 3.

The drawdown response is typical of linear flow conditions, or strip or long narrow aquifer, ie the rate of drawdown increases with time. The residual drawdown plot is affected by the reduction in pumping rate towards the end of the test, reducing the recovery water level starting point by some 3+m. This suggests that the residual drawdown plot would have intersected the t/t =1 line at s >0m, suggesting that there has been some dewatering.

For a strip or long narrow aquifer, the plot of drawdown versus √time should typically be linear.

Accordingly the drawdown during the constant discharge test was plotted against √time until the 1100 minute pumping period (when the discharge rate was reduced to 5l/s). Figure 4 shows a reasonable fit to a straight line response,

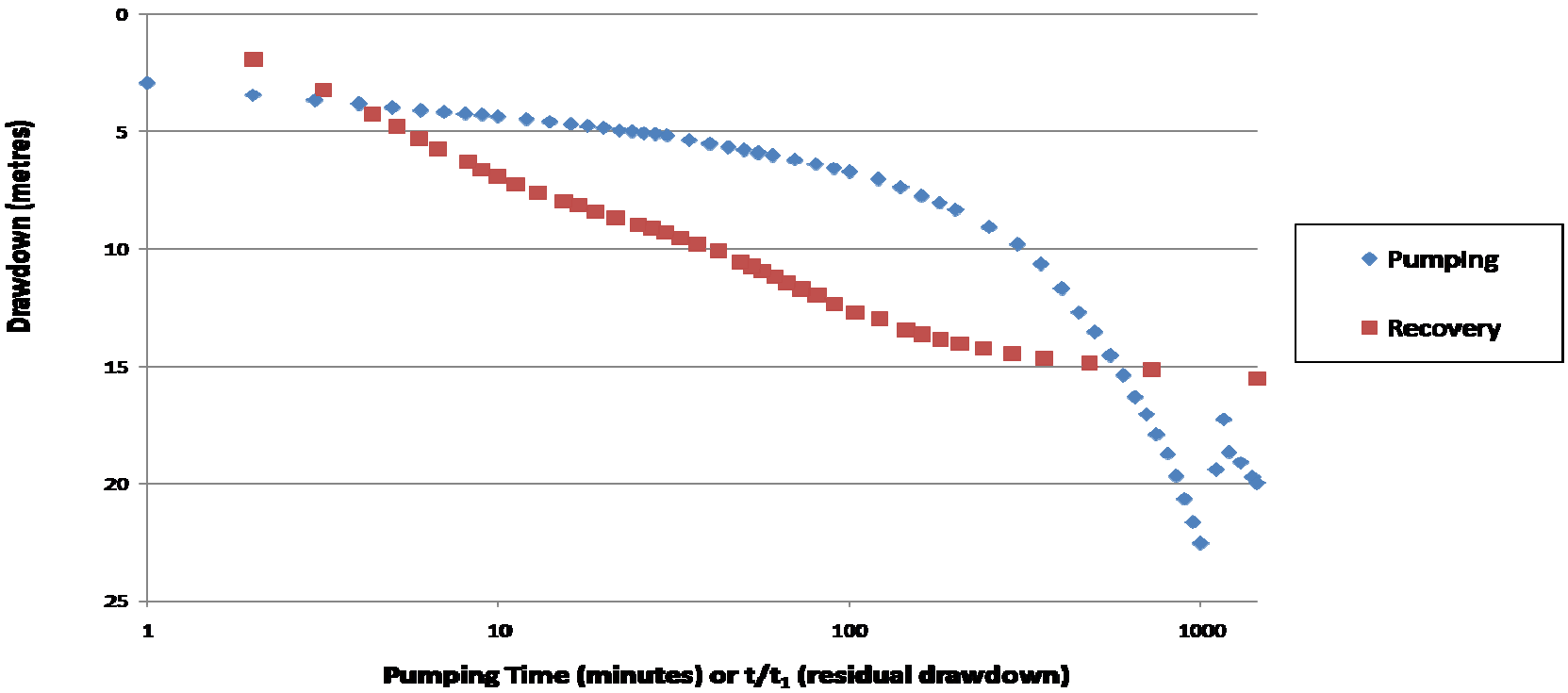


Figure 3 Constant Discharge Test, Drawdown and Residual Drawdown (well 129800)

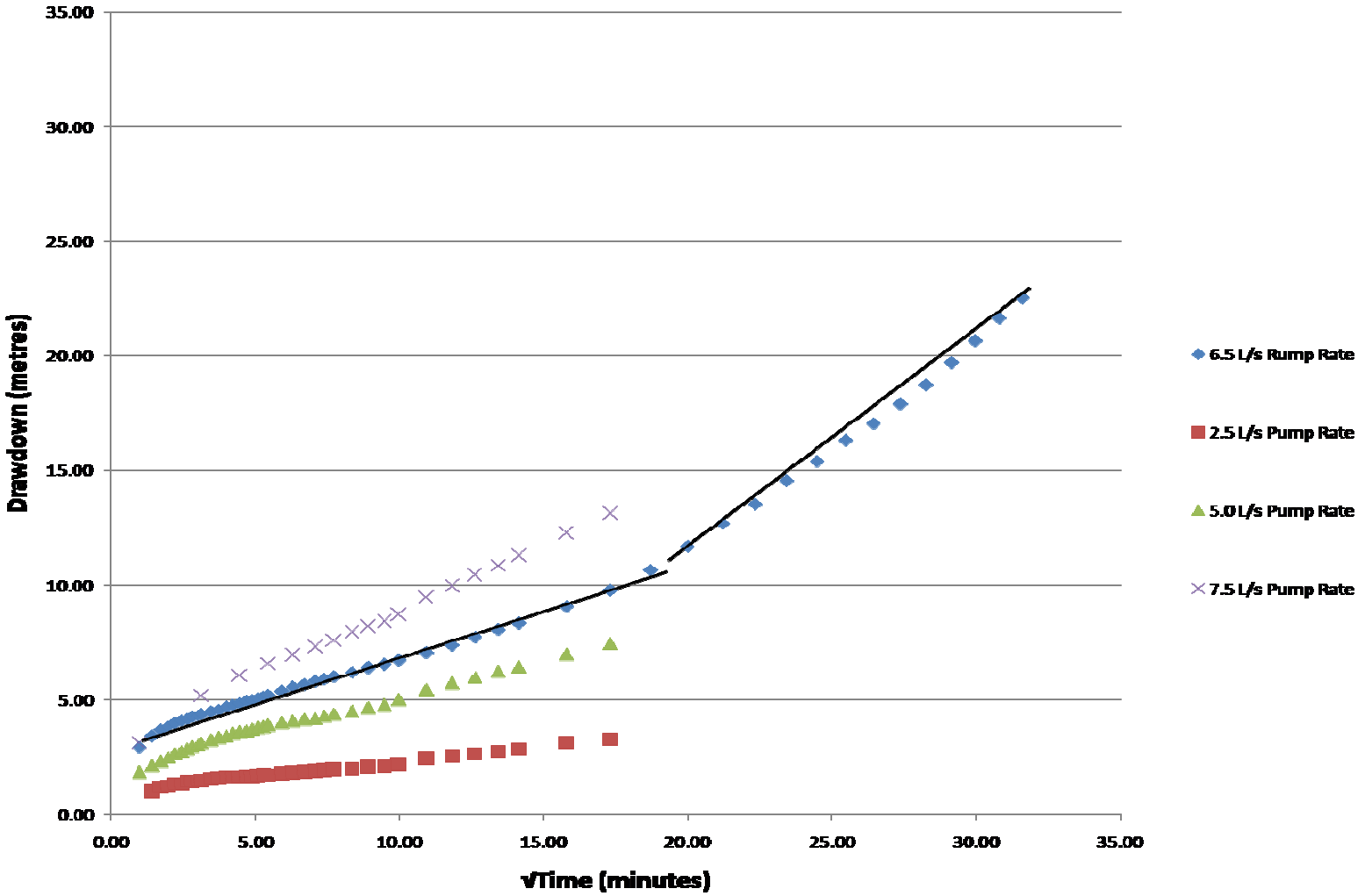


Figure 4 Drawdown vs √Time for Step Test and Constant Discharge Test (well 129800)

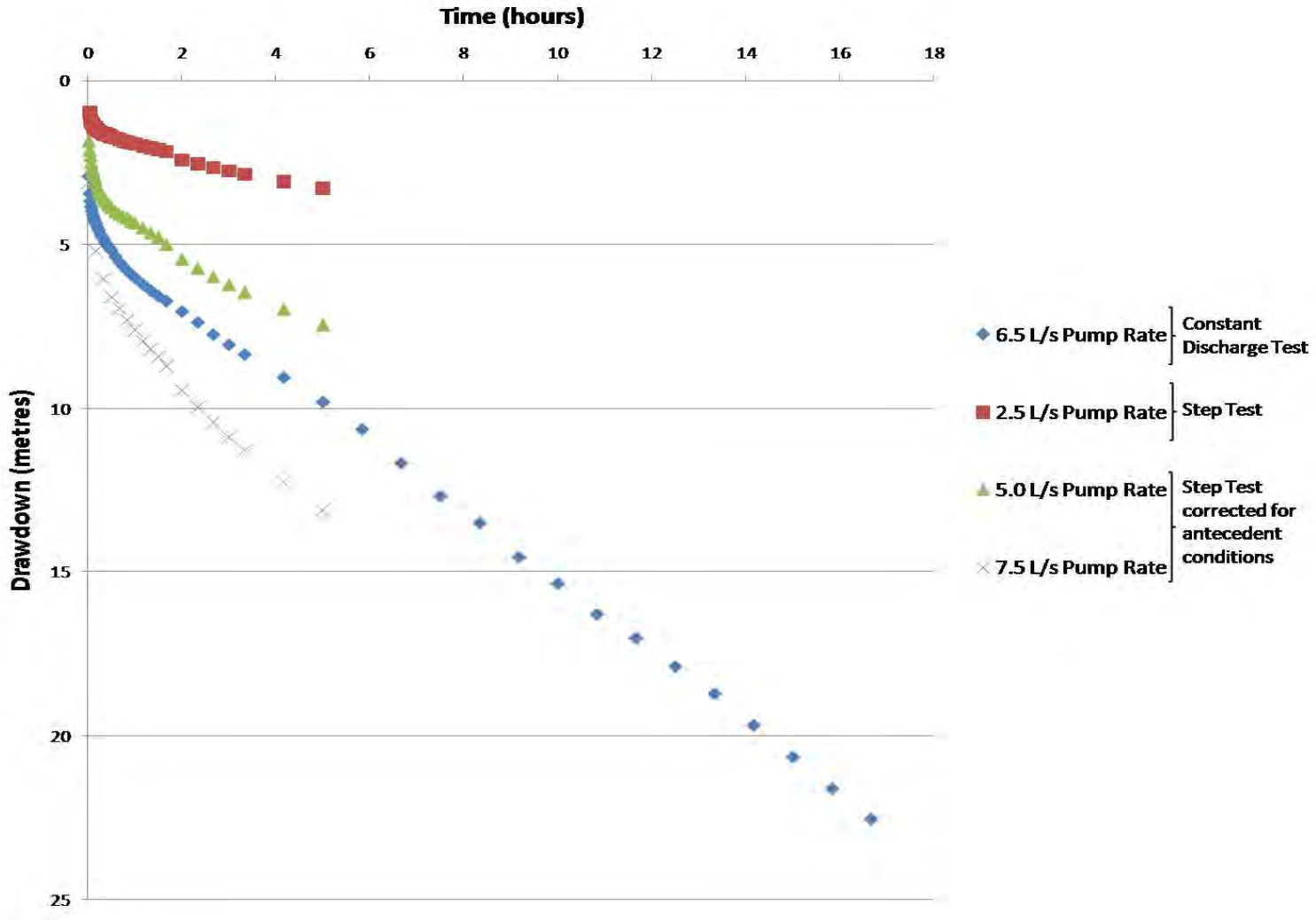


Figure 5 Drawdown vs Time for Various Discharge Rates (well 129800)

with a change in slope observed at √t = ~18 minutes (or ~300 minutes after the start of pumping). The straight line response confirms that the fractured rock aquifer behaves as a long narrow aquifer, whilst the change in slope indicates that the water level has dropped below the first water cut in the well after about 300 minutes of pumping, resulting in an increase rate of drawdown after that time.

The observed drawdowns and inferred trend lines (taking into account the change in slope were then used to plot drawdowns for various pumping rates and pumping durations (refer section 3.3, figure 5)

As previously indicated, three existing wells were used as monitoring wells during the constant discharge test (figure 1). The distance of each observation well from the pumping well is as follows:

P.N. 12293: approximately 1.5 km to the NW.

6630-1103: approximately 1 km to the N.

Well A: approximately 1.5 km to the SE.

Figure 6 shows that the water levels in the 3 observation wells have not been affected by the pumping. Both this observation and the apparent dewatering suggest that the aquifer system is compartmentalized.

Conductivity (mS) of the water pumped from the production well during the constant discharge test is shown in Figure 7. It can be seen that the conductivity is essentially stable at approximately 3,700 µS (2,150 mg/L).

3.3 Recommended pumping rate for well P.N 129800

The drillers report shows that water cuts were intersected between 29 to 33m and 50 to 51m below ground. The main water cut is between 50-51m, and it is therefore important that the pump depth is not greater than 49m below ground. With a SWL of some 25m, measured at the end of summer, the available maximum drawdown in the well is some 24m.

Plots of drawdowns for various pumping rates and pumping durations are shown in figure 5. This suggests that the well could be pumped at 7.5 L/s for some 8 hrs, or 6.5 L/s for some 18 hours. However, the step discharge test

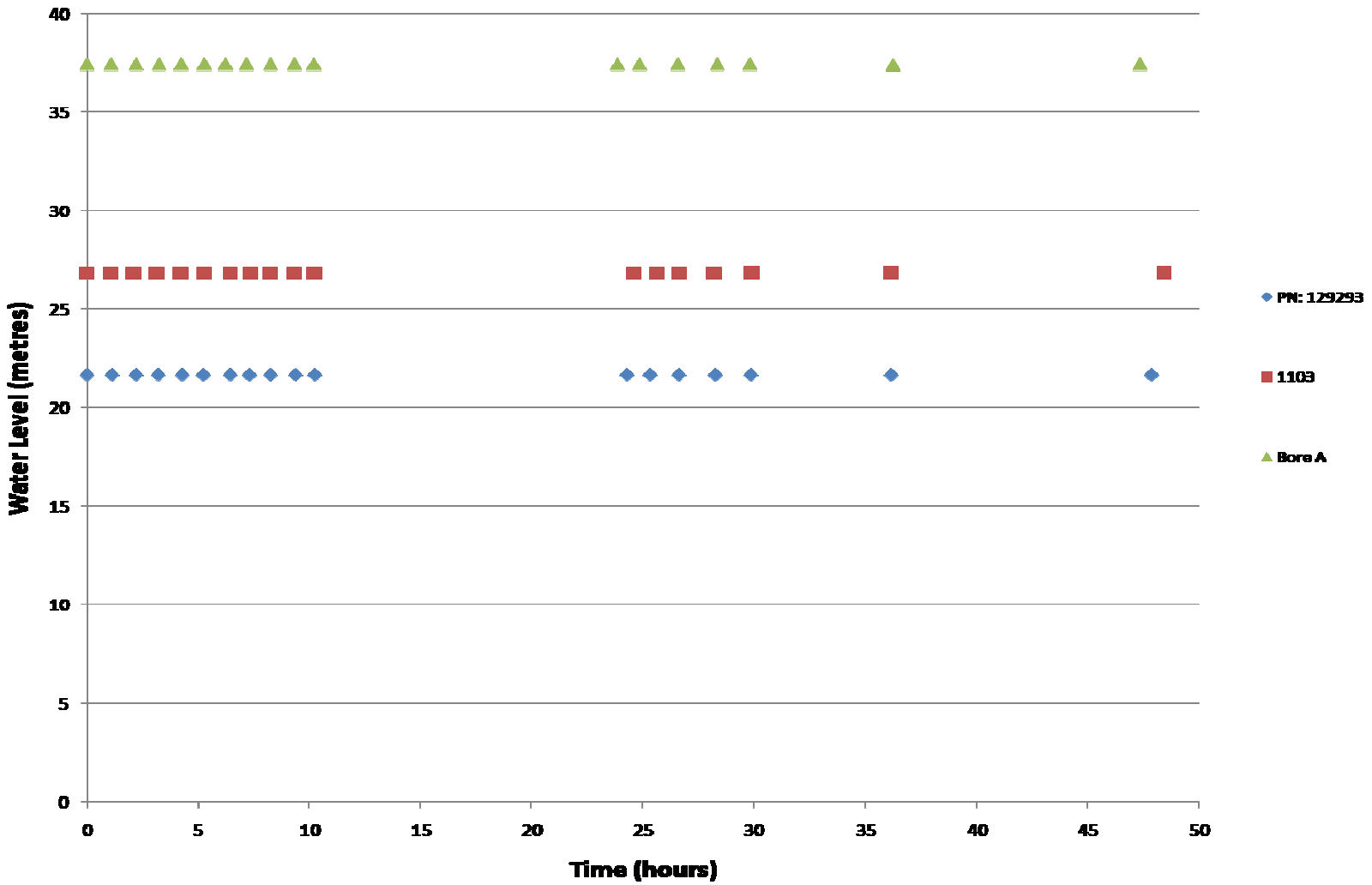


Figure 6 Water Levels of Observation Wells During Constant Discharge Test

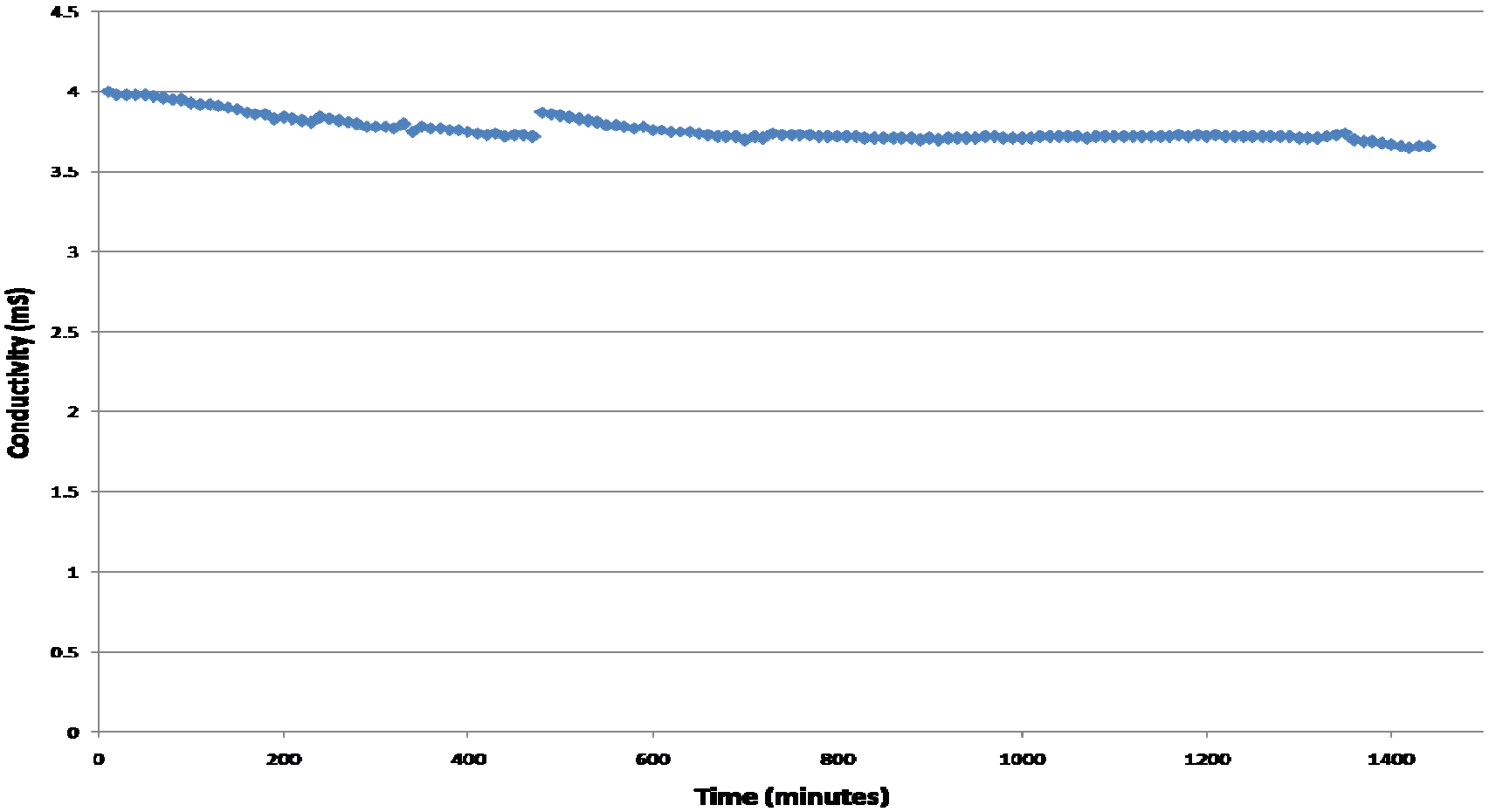


Figure 7 Conductivity vs Time for Constant Drawdown Test (well 129800)

showed that after pumping at an average of some 5 L/s for 5hrs, there was still some 0.35 m of residual drawdown after some 18 hrs of "rest". Similarly during the constant discharge test, after pumping for 24 hrs at an average of 6 L/s (allowing for the fact that the rate was reduced from 6.5 L/s to 5 L/s for the last 7 hrs of the test), the residual drawdown was still 2.3m after 24 hrs of "rest". Therefore if pumping cycles are repeated before full recovery is achieved, there will be a cumulative drawdown effect which will be additional to the drawdown produced when the well is pumping.

In the long term, well yield will depend on the frequency and size of recharge events. This cannot be determined from a pumping test, and but can be estimated by monitoring the water level response due to known extraction over many years. However, the estimated 1-2 year yield has been found to be a good indication of long-term sustained yield. This has been calculated below, based on the additional assumption that the well will be pumped 8 hrs a day for 365 days.

One year yield

The drawdown can be given approximately by the following equation:

$s = s^1 + s^2$,

where s is the estimated maximum drawdown

s^1 = drawdown for 364 days at the average rate Q/3,

s^2 = drawdown for 8 hrs at 2Q/3

For Q = 2.5 L/s, the 1 year drawdown was estimated at some 40m, using the drawdown equation for radial flow to approximately determine the drawdown for the first 100 minutes of pumping at 0.8 and 1.6 L/s, and thereafter extrapolate the drawdown based on the √t relationship. This suggests that the long term yield from this well is of the order of 1.5-2.5 L/s for 8 hr per day pumping cycles.

<u>However, this does not take into consideration any minor primary porosity from the bedrock matrix due to possible presence of micro-fractures.</u> The significance of the matrix yield can only be determined by undertaking a constant discharge test of at least 72 hrs duration, taking care that to minimize the risk of recirculation during the test. Alternatively, by carefully monitoring the water level of the well at the start of each pumping cycle when the feedlot operation is established- the risk being that the long term yield may prove to be inadequate to sustain the operation of the feed lot once established. A staged development in this case would therefore be prudent.

4. IMPACT ON GROUNDWATER RESOURCES

As documented by Water Search Pty Ltd (letter report dated 06 September 2007), the area is underlain by calcareous shales overlying sandstones and siltstones. Groundwater occurs in fractures/joints within the formation and yields of wells completed in this type of formation are dependent on the intensity of fracturing, their interconnection and openness.

The driller's reports for the 2 wells indicate that the water bearing fractures were intersected in siltstone.

As previously indicated, some concerns have been raised in relation to the impact of the proposed development on adjoining existing users and on the groundwater resources of the Booborowie Valley Groundwater Basin.

4.1 Impact on adjoining existing users

The limited available well data derived from the DWLBC drillhole data base from immediately surrounding wells (figure 1) are tabulated below:

Table 2 Data of Surrounding Wells

Well ID	Depth	SWL	Yield	Salinity
1102	85m	35m	0.08 L/s	2240mg/L
1103	36m	17m	-	2675mg/L
1104	51m	28m	-	2372mg/L
1105	-	-	-	2613mg/L
3208	64m	24m	0.40L/s	-

The status of the above wells is not known.

As previously indicated, water levels were also measured in wells PN 129293, 6630-1103 and well A (figure 1) during the constant discharge test on well PN 129800

As shown in figure 6, these did not respond during the test, supporting Water Search opinion that pumping from the two new wells should not have any adverse impact on any existing groundwater users locally. This is not to say it

will not have any impact in the long term, but given the likely compartmentalised nature of the system and the general tightness of the bed rock (ie generally very low yielding wells), it is unlikely to have a long term significant impact.

4.2 Impact on the Booborowie Valley

The link between the fractured rock aquifer to the east of the Booborowie Valley has been documented (Cobb and Smith 1977). There has not been any significant hydrogeological investigative work since that time, however a more recent review of the monitoring data from the area (Magarey and Deane 2005) concludes that "the water resources of Booborowie area are at least close to, if not at, the sustainable limits of use".

The groundwater budget derived from the 1977 investigations shows that the subsurface inflow into the valley fill sediments from the adjacent bedrock is of the order of 50 ML/year, which is about 10% of the total subsurface inflow. This inflow of 50 ML/year is effected over an estimated 14km flow width.

It must be stressed that these estimates are order of magnitude estimates only, given the complexity of the valley sediments/bed rock interface and the lack of data on the hydraulic characteristics of the wide range of rock types and the connectivity between the two aquifer systems.

The proposed development is located some 6 km to the east of the southern tip of the Booborowie Valley, and groundwater flow is generally westerly towards the valley.

Given a flow width of 2-4km (compared to some 14km for the whole valley length) and the likely compartmentalised nature of the aquifer at the site, the inflow from that area towards the valley flow is therefore expected to be minimal.

Whilst it is accepted that significant additional development along the eastern flank of the Booborowie Valley will have some impact on its water balance, albeit small, any impact from the proposed development per se is not expected to be measurable.

Given the hydrogeological complexity of fractured rock systems and the lack of aquifer properties, the use of numerical modelling techniques to predict the impact of any additional development in the bedrock aquifer on the Booborowie Valley basin, may not provide reliable results- at least unless it is supported by extensive hydrogeological investigations which is difficult to justify given the size of the resource.

5. CONCLUSIONS AND RECOMMENDATIONS

- The discharge test undertaken on well PN 129800 indicate that the flow is linear.
- Water levels in surrounding wells that were monitored during the 24 hr discharge test (1.5 km NW, 1 km N, 1.5 km SE) did not respond to the pumping.
- Whilst pumping from the compartmentalised/discreet fracture system is expected to have minimal impact on existing users and on the in flow to the Booborowie Valley basin, the converse is that the long term sustainable yield from well PN 129800 may be significantly less than the tested short term yield.
- Whilst the short term yield of the tested well PN 129800 can be as high as 5-6 L/s for 8hr pumping cycles, the long term yield for a pumping regime of 8hrs per 24 hrs will possibly be less than 2 L/s – unless there is some flow contribution from any primary porosity from the bedrock matrix.
- The significance of the matrix yield can only be determined by undertaking a constant discharge test of at least 72 hrs duration, taking care to minimize the risk of recirculation during the test. Alternatively, by carefully monitoring the water level of the well at the start of each pumping cycle when the feedlot operation is established- the risk being that the long term yield may prove to be inadequate to sustain the operation of the feedlot once established. A staged development, with appropriate monitoring of groundwater extraction and water levels, is therefore prudent.

6. REFERENCES

Cobb, M.A., and Smith, P.C., (1977). *Underground Water in the Booborowie Valley.* Report Book N0: 77/22. Department of Mines, South Australia

Magarey, P. and Deane, D., (2005).*Booborowie Valley Groundwater Monitoring Status Report 2005.* DWLBC Report 2005/31.

APPENDIX 1

STEP TEST DATA

Princess Royal Station
Step Test
Production Well

Well Permit No.: 129800
Pumping commenced on 26/3/08 at 10:50am
Pumping ceased on 26/3/08 at 15:50pm
Pump Depth = 46m
Static Water Level = 25.93m below measurement point
Measurement point = 1.1m A.G.L.
Test performed by D.Harrison

Time (min)	Drawdown (m)	Pump Rate (L/s)	
1	0.170	2.5	Pump Started
2	0.970		
3	1.210		
4	1.255		
5	1.300		
6	1.320		
7	1.420		
8	1.430		
9	1.460		
10	1.445	2.5	
12	1.520		
14	1.560		
16	1.585		
18	1.610		
20	1.640		
22	1.620		
24	1.640		
26	1.670		
28	1.700		
30	1.720	2.5	
35	1.760		
40	1.800		
45	1.845		
50	1.880		
55	1.915		
60	1.945		
70	2.000		
80	2.060		

90	2.115		
100	2.170	2.5	Rate Changed to 5L/s
101	3.450	5	
102	3.590		
103	3.670		
104	3.710		
105	3.740		
106	3.770		
107	3.800		
108	3.820		
109	3.850		
110	3.890	5	
112			
114	3.980		
116	4.010		
118	4.045		
120	4.085		
122	4.115		
124	4.150		
126	4.185		
128	4.210		
130	4.245	5	
135	4.310		
140	4.415		
145	4.525		
150	4.600		
155	4.670		
160	4.740		
170	4.850		
180	4.970		
190	5.070		
200	5.160	5	Rate Changed to 7.5L/s
201	6.730	7.5	
202	6.890		
203	6.960		
204	7.015		
205	7.045		
206	7.100		
207	7.150		
208	7.185		
209	7.220		
210	7.255	7.5	

212	7.450		
214	7.505		
216	7.560		
218	7.620		
220	7.670		
222	7.730		
224	7.770		
226	7.830		
228	7.885		
230	7.940	7.5	
235	8.065		
240	8.185		
245	8.310		
250	8.420		
255	8.525		
260	8.635		
270	8.855		
280	9.050		
290	9.240		
300	9.475	7.5	Pump Stopped

PRINCESS
ROYAL
STATION
STEP TEST

Date	Time	DO	EC	pH	mV	Temp	Remarks
26-Mar	10:50						Start of Test
26-Mar	11:00	0.0%S	2.39mS	7.25pH	96.mV	18.6oC	
26-Mar	11:10	0.1%S	2.40mS	7.22pH	100.mV	18.8oC	
26-Mar	11:20	-0.1%S	2.39mS	7.22pH	101.mV	18.7oC	
26-Mar	11:30	1.8%S	2.39mS	7.23pH	102.mV	19.2oC	
26-Mar	11:40	0.3%S	2.40mS	7.24pH	104.mV	19.1oC	
26-Mar	11:50	1.1%S	2.39mS	7.24pH	103.mV	19.0oC	
26-Mar	12:00	1.9%S	2.39mS	7.25pH	105.mV	18.8oC	
26-Mar	12:10	2.5%S	2.39mS	7.25pH	105.mV	19.0oC	
26-Mar	12:20	1.9%S	2.39mS	7.25pH	105.mV	19.2oC	
26-Mar	12:30	1.8%S	2.40mS	7.25pH	106.mV	19.1oC	
26-Mar	12:40	1.8%S	2.39mS	7.24pH	102.mV	18.8oC	
26-Mar	12:50	1.7%S	2.39mS	7.25pH	103.mV	18.9oC	
26-Mar	13:00	5.1%S	2.39mS	7.24pH	102.mV	18.8oC	
26-Mar	13:10	8.9%S	2.39mS	7.26pH	100.mV	18.7oC	
26-Mar	13:20	6.6%S	2.39mS	7.28pH	102.mV	18.6oC	
26-Mar	13:30	2.6%S	2.39mS	7.29pH	103.mV	18.9oC	
26-Mar	13:40	1.8%S	2.40mS	7.29pH	104.mV	18.7oC	
26-Mar	13:50	3.4%S	2.39mS	7.29pH	104.mV	18.6oC	
26-Mar	14:00	1.8%S	2.39mS	7.29pH	106.mV	18.7oC	
26-Mar	14:10	39.9%S	2.39mS	7.28pH	107.mV	18.8oC	
26-Mar	14:20	16.3%S	2.39mS	7.29pH	107.mV	18.8oC	
26-Mar	14:30	26.6%S	2.39mS	7.29pH	108.mV	18.8oC	
26-Mar	14:40	26.4%S	2.39mS	7.28pH	109.mV	18.7oC	
26-Mar	14:50	26.6%S	2.39mS	7.29pH	111.mV	18.7oC	
26-Mar	15:00	26.0%S	2.39mS	7.28pH	111.mV	18.7oC	
26-Mar	15:10	25.5%S	2.39mS	7.27pH	110.mV	18.7oC	
26-Mar	15:20	26.4%S	2.39mS	7.27pH	110.mV	18.8oC	
26-Mar	15:30	24.9%S	2.39mS	7.28pH	112.mV	18.8oC	
26-Mar	15:40	37.6%S	2.82mS	7.30pH	109.mV	18.7oC	
26-Mar	15:50	5.7%S	2.82mS	7.30pH	110.mV	18.8oC	End of Test

Princess Royal Station
24 Hour Constant Discharge Test at 6.5 L/s
Production
Well

Well Permit No.: 129800
Pumping Commenced on 27/3/08 at
09:40am
Pumping Ceased on 28/3/08 at 9:40am
Pump Test = 46 m
Static Water Level = 26.28m below measurement point
Measurement Point = 1.1m above ground
level
Test Performed by D. Harrison & D. Bryant

The following drawdown calculations have used
the static water level of 25.93m from the previous step test data.

Time (min)	Drawdown (m)	Pump Rate (L/s)
0	0.00	6.5
1	3.26	
2	3.79	
3	4.02	
4	4.19	
5	4.31	
6	4.42	
7	4.50	
8	4.59	
9	4.64	
10	4.70	6.5
12	4.82	
14	4.91	
16	5.03	
18	5.11	
20	5.18	
22	5.29	
24	5.34	
26	5.41	
28	5.47	

30	5.53	6.5	
35	5.71		
40	5.88		
45	6.01		
50	6.14		
55	6.25		
60	6.36		
70	6.56		
80	6.75		
90	6.92		
100	7.07	6.5	
120	7.39		
140	7.72		
160	8.09		
180	8.41		
200	8.70		
250	9.40		
300	10.15		
350	10.99		
400	12.05		
450	13.05		
500	13.88	6.5	
550	14.92		
600	15.72		
650	16.66		
700	17.38		
750	18.25		
800	19.08		
850	20.04		
900	21.01		
950	21.97		
1000	22.90	6.5	Flow rate reduced to 4 L/s
1100	19.74	4	at 1080mins
1160	17.60		
1200	19.01	5	Flow rate increased to 5L/s
1300	19.44		at 1160mins
1400	20.05		
1440	20.31	5	Pump Stopped
1441	15.87		Recovery
1442	15.52		
1443	15.24		
1444	15.01		

1445	14.83	
1446	14.61	
1447	14.43	
1448	14.23	
1449	14.01	
1450	13.80	
1452	13.36	
1454	13.04	
1456	12.67	
1458	12.35	
1460	12.10	
1462	11.83	
1464	11.57	
1466	11.34	
1468	11.10	
1470	10.90	
1475	10.47	
1480	10.16	
1485	9.89	
1490	9.68	
1495	9.50	
1500	9.32	
1510	9.02	
1520	8.75	
1530	8.50	
1540	8.30	
1560	7.93	
1580	7.59	
1600	7.25	
1620	6.95	
1640	6.67	
1690	6.08	
1730	5.68	
1790	5.16	
1870	4.64	Pump removed at 1820 mins
2106	3.61	New Measurement Point=
2855	2.29	0.33m A.G.L.

PRINCESS ROYAL STATION
C.D.
TEST

Date	Time	DO	EC	pH	mV	Temp	Remarks
27-Mar	9:40						Start of Test
27-Mar	9:50	-3.3%S	4.00mS	7.37pH	111.mV	18.3oC	
27-Mar	10:00	-2.9%S	3.98mS	7.32pH	111.mV	18.8oC	
27-Mar	10:10	-2.9%S	3.98mS	7.29pH	112.mV	18.8oC	
27-Mar	10:20	-2.6%S	3.98mS	7.26pH	105.mV	18.8oC	
27-Mar	10:30	38.3%S	3.98mS	7.25pH	104.mV	18.7oC	
27-Mar	10:40	39.4%S	3.97mS	7.24pH	107.mV	18.8oC	
27-Mar	10:50	3.4%S	3.96mS	7.23pH	101.mV	18.8oC	
27-Mar	11:00	35.6%S	3.95mS	7.23pH	108.mV	18.8oC	
27-Mar	11:10	-0.1%S	3.95mS	7.22pH	106.mV	18.8oC	
27-Mar	11:20	1.4%S	3.93mS	7.22pH	104.mV	18.8oC	
27-Mar	11:30	40.8%S	3.92mS	7.21pH	107.mV	18.9oC	
27-Mar	11:40	41.6%S	3.92mS	7.21pH	108.mV	18.6oC	
27-Mar	11:50	15.6%S	3.91mS	7.21pH	108.mV	18.9oC	
27-Mar	12:00	12.9%S	3.90mS	7.21pH	109.mV	18.6oC	
27-Mar	12:10	42.6%S	3.89mS	7.21pH	106.mV	18.9oC	
27-Mar	12:20	40.9%S	3.87mS	7.21pH	106.mV	18.8oC	
27-Mar	12:30	10.9%S	3.86mS	7.21pH	108.mV	18.7oC	
27-Mar	12:40	16.6%S	3.86mS	7.21pH	101.mV	18.8oC	
27-Mar	12:50	8.1%S	3.83mS	7.21pH	105.mV	18.8oC	
27-Mar	13:00	5.1%S	3.84mS	7.21pH	105.mV	18.6oC	
27-Mar	13:10	30.6%S	3.83mS	7.21pH	111.mV	18.7oC	
27-Mar	13:20	28.4%S	3.82mS	7.21pH	102.mV	18.9oC	
27-Mar	13:30	28.6%S	3.81mS	7.21pH	106.mV	18.8oC	
27-Mar	13:40	37.9%S	3.84mS	7.21pH	101.mV	18.7oC	
27-Mar	13:50	39.6%S	3.83mS	7.21pH	105.mV	18.7oC	
27-Mar	14:00	2.4%S	3.82mS	7.21pH	104.mV	18.8oC	
27-Mar	14:10	25.5%S	3.81mS	7.21pH	106.mV	18.7oC	
27-Mar	14:20	35.8%S	3.80mS	7.21pH	108.mV	18.6oC	
27-Mar	14:30	26.9%S	3.78mS	7.21pH	112.mV	18.7oC	
27-Mar	14:40	41.1%S	3.78mS	7.21pH	106.mV	18.7oC	
27-Mar	14:50	42.2%S	3.78mS	7.21pH	107.mV	18.7oC	
27-Mar	15:00	43.3%S	3.77mS	7.21pH	109.mV	18.6oC	
27-Mar	15:10	2.1%S	3.80mS	7.22pH	110.mV	18.6oC	
27-Mar	15:20	2.6%S	3.75mS	7.22pH	110.mV	18.6oC	
27-Mar	15:30	0.1%S	3.78mS	7.22pH	108.mV	18.6oC	
27-Mar	15:40	9.7%S	3.77mS	7.22pH	109.mV	18.6oC	
27-Mar	15:50	6.3%S	3.77mS	7.22pH	106.mV	18.6oC	
27-Mar	16:00	13.4%S	3.76mS	7.22pH	107.mV	18.6oC	
27-Mar	16:10	13.1%S	3.76mS	7.22pH	116.mV	18.6oC	
27-Mar	16:20	16.6%S	3.75mS	7.22pH	107.mV	18.6oC	
27-Mar	16:30	36.9%S	3.74mS	7.22pH	108.mV	18.6oC	
27-Mar	16:40	20.9%S	3.73mS	7.22pH	113.mV	18.6oC	
27-Mar	16:50	16.4%S	3.74mS	7.22pH	113.mV	18.6oC	
27-Mar	17:00	30.9%S	3.72mS	7.23pH	106.mV	18.6oC	

27-Mar	17:10	17.0%S	3.73mS	7.23pH	104.mV	18.6oC
27-Mar	17:20	15.9%S	3.73mS	7.23pH	112.mV	18.6oC
27-Mar	17:30	4.9%S	3.72mS	7.23pH	113.mV	18.6oC
27-Mar	17:40	5.1%S	3.87mS	7.23pH	108.mV	18.6oC
27-Mar	17:50	4.6%S	3.86mS	7.23pH	111.mV	18.6oC
27-Mar	18:00	4.9%S	3.85mS	7.24pH	107.mV	18.6oC
27-Mar	18:10	4.2%S	3.84mS	7.23pH	106.mV	18.6oC
27-Mar	18:20	4.2%S	3.83mS	7.24pH	111.mV	18.6oC
27-Mar	18:30	4.4%S	3.82mS	7.24pH	111.mV	18.6oC
27-Mar	18:40	4.1%S	3.81mS	7.24pH	108.mV	18.6oC
27-Mar	18:50	4.0%S	3.79mS	7.24pH	106.mV	18.6oC
27-Mar	19:00	3.7%S	3.79mS	7.24pH	109.mV	18.6oC
27-Mar	19:10	3.8%S	3.78mS	7.25pH	110.mV	18.6oC
27-Mar	19:20	4.0%S	3.77mS	7.25pH	110.mV	18.6oC
27-Mar	19:30	0.4%S	3.78mS	7.25pH	110.mV	18.6oC
27-Mar	19:40	-0.4%S	3.76mS	7.25pH	108.mV	18.6oC
27-Mar	19:50	-0.1%S	3.76mS	7.26pH	109.mV	18.6oC
27-Mar	20:00	0.0%S	3.75mS	7.26pH	112.mV	18.6oC
27-Mar	20:10	1.7%S	3.75mS	7.27pH	102.mV	18.6oC
27-Mar	20:20	1.6%S	3.75mS	7.28pH	105.mV	18.6oC
27-Mar	20:30	0.0%S	3.74mS	7.29pH	109.mV	18.6oC
27-Mar	20:40	-0.2%S	3.73mS	7.29pH	102.mV	18.6oC
27-Mar	20:50	-0.3%S	3.72mS	7.29pH	107.mV	18.6oC
27-Mar	21:00	-0.3%S	3.72mS	7.30pH	107.mV	18.6oC
27-Mar	21:10	1.9%S	3.72mS	7.29pH	110.mV	18.6oC
27-Mar	21:20	2.4%S	3.70mS	7.29pH	110.mV	18.6oC
27-Mar	21:30	-1.9%S	3.72mS	7.30pH	100.mV	18.7oC
27-Mar	21:40	-1.9%S	3.71mS	7.30pH	102.mV	18.7oC
27-Mar	21:50	2.5%S	3.74mS	7.31pH	107.mV	18.5oC
27-Mar	22:00	2.2%S	3.73mS	7.30pH	109.mV	18.4oC
27-Mar	22:10	2.1%S	3.73mS	7.31pH	105.mV	18.4oC
27-Mar	22:20	2.0%S	3.73mS	7.32pH	110.mV	18.3oC
27-Mar	22:30	2.1%S	3.73mS	7.33pH	103.mV	18.3oC
27-Mar	22:40	-0.3%S	3.72mS	7.33pH	109.mV	18.2oC
27-Mar	22:50	2.1%S	3.72mS	7.33pH	110.mV	18.2oC
27-Mar	23:00	-1.2%S	3.72mS	7.34pH	105.mV	18.2oC
27-Mar	23:10	-1.2%S	3.72mS	7.35pH	106.mV	18.2oC
27-Mar	23:20	-0.5%S	3.72mS	7.35pH	101.mV	17.5oC
27-Mar	23:30	1.7%S	3.71mS	7.38pH	109.mV	17.1oC
27-Mar	23:40	2.3%S	3.71mS	7.41pH	100.mV	17.0oC
27-Mar	23:50	2.2%S	3.71mS	7.41pH	97.mV	16.9oC
28-Mar	0:00	-0.9%S	3.71mS	7.42pH	109.mV	16.7oC
28-Mar	0:10	1.7%S	3.71mS	7.40pH	108.mV	16.5oC
28-Mar	0:20	1.6%S	3.71mS	7.39pH	113.mV	16.3oC
28-Mar	0:30	1.6%S	3.70mS	7.40pH	109.mV	16.1oC
28-Mar	0:40	1.8%S	3.71mS	7.40pH	108.mV	16.1oC
28-Mar	0:50	1.8%S	3.70mS	7.39pH	117.mV	16.2oC
28-Mar	1:00	1.9%S	3.71mS	7.41pH	108.mV	16.1oC
28-Mar	1:10	1.8%S	3.71mS	7.40pH	119.mV	15.5oC
28-Mar	1:20	2.0%S	3.71mS	7.39pH	118.mV	14.9oC
28-Mar	1:30	2.0%S	3.71mS	7.41pH	110.mV	14.3oC

28-Mar	1:40	1.8%S	3.72mS	7.41pH	124.mV	13.9oC	
28-Mar	1:50	1.9%S	3.72mS	7.42pH	114.mV	13.5oC	
28-Mar	2:00	1.9%S	3.71mS	7.43pH	121.mV	13.2oC	
28-Mar	2:10	2.0%S	3.71mS	7.43pH	107.mV	12.9oC	
28-Mar	2:20	1.9%S	3.71mS	7.44pH	121.mV	12.6oC	
28-Mar	2:30	1.8%S	3.71mS	7.45pH	109.mV	12.3oC	
28-Mar	2:40	1.8%S	3.72mS	7.46pH	116.mV	12.1oC	
28-Mar	2:50	1.8%S	3.72mS	7.47pH	100.mV	11.8oC	
28-Mar	3:00	-1.7%S	3.72mS	7.51pH	94.mV	11.5oC	
28-Mar	3:10	-2.0%S	3.72mS	7.53pH	104.mV	11.2oC	
28-Mar	3:20	-2.1%S	3.72mS	7.59pH	87.mV	10.9oC	
28-Mar	3:30	-2.0%S	3.71mS	7.67pH	86.mV	10.7oC	
28-Mar	3:40	-2.0%S	3.72mS	7.73pH	53.mV	10.4oC	
28-Mar	3:50	-2.2%S	3.72mS	7.76pH	78.mV	10.1oC	
28-Mar	4:00	-2.4%S	3.72mS	7.78pH	72.mV	9.9oC	
28-Mar	4:10	-2.3%S	3.72mS	7.89pH	56.mV	9.6oC	
28-Mar	4:20	-2.2%S	3.72mS	7.91pH	54.mV	9.4oC	
28-Mar	4:30	-2.3%S	3.72mS	7.94pH	56.mV	9.1oC	
28-Mar	4:40	-2.3%S	3.72mS	8.02pH	22.mV	8.9oC	
28-Mar	4:50	-2.3%S	3.72mS	8.05pH	25.mV	8.7oC	
28-Mar	5:00	-2.3%S	3.72mS	8.09pH	34.mV	8.4oC	
28-Mar	5:10	-2.3%S	3.73mS	7.77pH	68.mV	8.2oC	
28-Mar	5:20	-2.2%S	3.72mS	7.83pH	67.mV	8.1oC	
28-Mar	5:30	-2.3%S	3.73mS	8.14pH	20.mV	7.9oC	
28-Mar	5:40	-2.3%S	3.72mS	8.21pH	11.mV	7.8oC	
28-Mar	5:50	-2.1%S	3.73mS	8.21pH	33.mV	7.6oC	
28-Mar	6:00	-2.1%S	3.72mS	8.25pH	40.mV	7.4oC	
28-Mar	6:10	-2.0%S	3.72mS	8.24pH	38.mV	7.3oC	
28-Mar	6:20	1.9%S	3.72mS	8.36pH	44.mV	7.1oC	
28-Mar	6:30	1.7%S	3.72mS	8.45pH	46.mV	7.0oC	
28-Mar	6:40	1.8%S	3.72mS	8.48pH	72.mV	6.8oC	
28-Mar	6:50	1.8%S	3.72mS	8.64pH	47.mV	6.6oC	
28-Mar	7:00	1.5%S	3.72mS	8.58pH	77.mV	6.5oC	
28-Mar	7:10	1.8%S	3.72mS	8.61pH	85.mV	6.4oC	
28-Mar	7:20	1.6%S	3.71mS	8.48pH	113.mV	6.3oC	
28-Mar	7:30	1.5%S	3.71mS	8.36pH	116.mV	6.2oC	
28-Mar	7:40	1.5%S	3.71mS	8.41pH	124.mV	6.2oC	
28-Mar	7:50	1.1%S	3.72mS	8.47pH	129.mV	6.5oC	
28-Mar	8:00	-2.0%S	3.73mS	8.52pH	107.mV	6.9oC	
28-Mar	8:10	-2.4%S	3.74mS	8.03pH	132.mV	7.7oC	
28-Mar	8:20	0.0%S	3.70mS	7.55pH	117.mV	18.7oC	
28-Mar	8:30	2.3%S	3.69mS	7.47pH	111.mV	18.8oC	
28-Mar	8:40	2.8%S	3.69mS	7.39pH	113.mV	18.8oC	
28-Mar	8:50	2.9%S	3.68mS	7.33pH	112.mV	18.8oC	
28-Mar	9:00	3.2%S	3.67mS	7.29pH	110.mV	18.9oC	
28-Mar	9:10	3.4%S	3.66mS	7.27pH	111.mV	18.9oC	
28-Mar	9:20	3.5%S	3.65mS	7.25pH	110.mV	18.9oC	
28-Mar	9:30	4.0%S	3.66mS	7.24pH	111.mV	19.0oC	
28-Mar	9:40	3.7%S	3.66mS	7.23pH	111.mV	18.8oC	End of Test

Princess Royal Station
24 Hour Constant Discharge Test at 6.5L/s
Observation Wells

Western well
Well Permit Number = 129293
Static Water Level = 21.67m below measurement
point at 08:53am
Measurement Point = 0.31m above ground level

Date	Time	Time minutes	Time hours	Water Level (m)
27/03/2008	8:53	0	0	21.67
	9:59	66	1	21.67
	11:04	131	2	21.67
	12:04	191	3	21.67
	13:10	257	4	21.67
	14:07	314	5	21.67
	15:18	385	6	21.67
	16:12	439	7	21.67
	17:08	495	8	21.68
	18:15	562	9	21.68
	19:07	614	10	21.67
28/03/2008	9:10	1457	24	21.67
	10:12	1519	25	21.67
	11:30	1597	27	21.67
	13:10	1697	28	21.67
	14:45	1792	30	21.67
	21:02	2169	36	21.66
29/03/2008	8:46	2873	48	21.665

Northern well
Well Permit Number =
Static Water Level = 26.84m below measurement
point at 08:45am
Measurement Point = 0.28m above ground level

Date	Time	Time minutes	Time hours	Water Level (m)
27/03/2008	8:45	0	0	26.84
	9:50	65	1	26.84
	10:52	127	2	26.84
	11:55	190	3	26.84

	13:00	255	4	26.84
	14:00	315	5	26.84
	15:10	385	6	26.84
	16:05	440	7	26.835
	17:00	495	8	26.84
	18:05	560	9	26.84
	19:00	615	10	26.84
28/03/2008	9:20	1475	25	26.84
	10:22	1537	26	26.84
	11:22	1597	27	26.83
	13:00	1695	28	26.83
	14:40	1795	30	26.82
	20:53	2168	36	26.815
29/03/2008	9:10	2905	48	26.805

Eastern Well

Well Permit Number =

Static Water Level = 37.43 below measurement point at 09:09am

Measurement Point = 0.22m above ground level

Date	Time	Time minutes	Time hours	Water Level (m)
27/03/2008	9:09	0	0	37.43
	10:14	65	1	37.43
	11:20	131	2	37.43
	12:22	193	3	37.43
	13:23	254	4	37.43
	14:25	316	5	37.43
	15:22	373	6	37.43
	16:20	431	7	37.43
	17:23	494	8	37.43
	18:30	561	9	37.43
	19:22	613	10	37.43
28/03/2008	9:00	1431	24	37.43
	10:00	1491	25	37.43
	11:45	1596	27	37.43
	13:30	1701	28	37.43
	15:00	1791	30	37.42
	21:24	2175	36	37.41
29/03/2008	8:31	2842	47	37.415

DHNO	Unit_No	Unit_Number	Obs_No	drillhole_class	Aquifer	Orig_drilled_depth	Orig_drilled_date	max_drill_depth	max_drill_date	late_open_depth	late_open_date	late_permit_no	cased_to	case_min_diam	purpose	latest_status	latest_status_date	swl	rswl	water_level_date	TDS	EC	salinity_date	pH	pH_date	yield	yield_date	mga_easting	mga_northing	hundred	plan	parcel	Title	map_250k	map_100k	map_50k	map_10k	map_2_5k	map_1k	water_info	salinity	water_chemistry	geophys_log	drill_log	lith_log
65639	6630-1023	663001023		WW				36.58	17/01/1968	36.58	7/03/1968		6.1	152	DOMSTK	OPR		15.24	548.63	17/03/1968	2545	4563	7/03/1968	6.5	7/03/1968	1.26	17/01/1968	301977.91	6283405.43	KINGSTON	H200700	S281	CT 5976 576	SI5405	6630	1	7	f	5	Y	Y	N	N	N	N
65711	6630-1095	663001095		WW	Nnt			30.48	5/10/1973	30.48	5/10/1973			152														298530.98	6283891.4	AYERS	H230100	S521	CT 5352 110	SI5405	6630	1	7	g	1	N	N	N	N	N	N
65712	6630-1096	663001096		WW	Nnt			33.53	29/09/1973	33.53	29/09/1973		30.48	102				10.66	531.31	29/09/1973	2372	4255	3/10/1973	7	3/10/1973			299340	6284010.41	AYERS	D1942	B26	CT 5548 750	SI5405	6630	1	7	g	2	Y	Y	N	N	N	N
65713	6630-1097	663001097		WW				32	29/09/1973	32	29/09/1973		19.81	152				10.67	532.2	29/09/1973	2309	4145	29/09/1973	6.5	29/09/1973			299090.98	6283406.41	AYERS	D1942	B26	CT 5548 750	SI5405	6630	1	7	g	5	Y	Y	N	N	N	N
65714	6630-1098	663001098		WP				2	2/10/1973	2	2/10/1973			SOK							213	387	10/10/1973	6	10/10/1973			300426.91	6284246.4	AYERS	H230100	S412	CT 5337 476	SI5405	6630	1	7	f	1	N	Y	N	N	N	N
65715	6630-1099	663001099		WW					21/10/1973		21/10/1973			102							2067	3715	10/10/1973	7	10/10/1973			300348	6284052.37	AYERS	H230100	S412	CT 5337 476	SI5405	6630	1	7	g	3	N	Y	N	N	N	N
65716	6630-1100	663001100		WW	Nya			36.8	2/10/1973	36.8	2/10/1973			152				18.3	585.77	2/10/1973	1664	3000	2/10/1973	7	2/10/1973			301122.98	6283999.43	AYERS	H230100	S413	CT 5976 576	SI5405	6630	1	7	f	1	Y	Y	N	N	N	N
65717	6630-1101	663001101		WP				1	2/10/1973	1	2/10/1973							0.8	579.65	2/10/1973	154	280	10/10/1973	6	10/10/1973			300643.97	6284054.41	AYERS	H230100	S413	CT 5976 576	SI5405	6630	1	7	f	1	Y	Y	N	N	N	N
65718	6630-1102	663001102		WW				85	31/03/1988		31/03/1988	20970						35	523.11	26/04/1988	2239	4020	2/10/1973	7	2/10/1973	0.08	31/03/1988	299995.97	6282567.43	AYERS	D2033	B27	CT 5469 103	SI5405	6630	1	7	k	3	Y	Y	N	N	N	N
65719	6630-1103	663001103		WW	Nya			36.58	2/10/1973	36.58	2/10/1973			102				17.3	564.16	2/10/1973	2675	4790	2/10/1973	7	2/10/1973			300901.96	6282460.43	AYERS	D2033	B27	CT 5469 103	SI5405	6630	1	7	l	1	Y	Y	N	N	N	N
65720	6630-1104	663001104		WW				51	21/09/1973	51	21/09/1973			102				28	515.3	21/09/1973	2372	4255	2/10/1973	7.5	2/10/1973			299673.98	6281544.41	AYERS	H230100	S893	CT 5470 237	SI5405	6630	1	7	k	5	Y	Y	N	N	N	N
65721	6630-1105	663001105		WW	Nya									152							2613	4680	2/10/1973	6.5	2/10/1973			300669.98	6280917.42	AYERS	H230100	S890	CT 5470 237	SI5405	6630	1	7	p	1	N	Y	N	N	N	N
65726	6630-1110	663001110		WP										IRR							2185	3925	8/08/1957					298154.93	6282524.36	AYERS	H230100	S897	CT 5553 646	SI5405	6630	1	7	k	1	N	Y	N	N	N	N
65746	6630-1130	663001130		WW				30.48	26/09/1973	30.48	26/09/1973		15.24	152														298853.97	6280205.4	AYERS	H230100	S497	CT 5442 674	SI5405	6630	1	7	q	6	N	N	N	N	N	N
65750	6630-1134	663001134		WW	Nnt			36.58	22/09/1973	36.58	22/09/1973										2795	5000	22/09/1973	7	22/09/1973			299276.99	6281181.41	AYERS	H230100	S509	CT 5460 983	SI5405	6630	1	7	q	2	N	Y	N	N	N	N
65751	6630-1135	663001135		WW	Nnt			36.37	22/09/1973	36.37	22/09/1973		9	152	ABD			29	492.35	22/09/1973	2848	5092	2/10/1973	7	2/10/1973			297790.98	6281836.35	AYERS	H230100	S511	CT 5460 983	SI5405	6630	1	7	j	4	Y	Y	N	N	N	N
65783	6630-1167	663001167		WW				30.48	26/09/1973	30.48	26/09/1973		6.1	152							1130	2045	2/10/1973	7	2/10/1973			300273.94	6280138.42	AYERS	F186674	A162	CT 5442 674	SI5405	6630	1	7	q	4	N	Y	N	N	N	N
65784	6630-1168	663001168		WW				13.6	6/10/1973	13.6	6/10/1973				ABD													300421.95	6280079.37	AYERS	F216507	A118	CT 5442 674	SI5405	6630	1	14	b	3	N	N	N	N	N	N
66408	6630-1792	663001792		WW	Nnt	58.4	10/05/1988	58.4	10/05/1988	0	10/05/1988	20945			BKF		10/05/1988											298021.98	6283229.44	AYERS	F203931	A93	CT 5379 975	SI5405	6630	1	7	h	4	N	N	N	N	Y	N
196699	6630-3208	663003208		WW	Nya	64	16/01/2003	64	16/01/2003	64	16/01/2003	60468	64	127	STK			24	586.24	16/01/2003						0.4	16/01/2003	300772.68	6282886.67	AYERS	D2033	B27	CT 5469 103	SI5405	6630	1	7	l	1	Y	N	N	N	Y	N
240361	6630-3420	663003420		WW		114	2/04/2007	114	2/04/2007	114	2/04/2007	129293	34	150				21.5	518.45	2/04/2007	1845	3320	2/04/2007			3	2/04/2007	2996220.38	6282495.07	AYERS	D2033	B27	CT 5469 103	SI5405	6630	1	7	k	2	Y	Y	N	N	Y	N
240362	6630-3421	663003421		WW	Nya	62	29/04/2007	62	29/04/2007	62	29/04/2007	129800	26	150				24.7	535.33	29/04/2007	2364	4240	28/03/2008			5	29/04/2007	300501.98	6281628.29	AYERS	D2033	B28	CT 5469 103	SI5405	6630	1	7	l	6	Y	Y	N	N	Y	N

DHNO	Unit_Number	Aquifer	Easting	Northing	Zone	Unit_No	Obs_No	obs_date	swl	rswl	pressure	temperature	dry_ind	anom_ind	pump_ind	measured_during	data_source	Comments
65639	663001023		301977.9	6283405	54	6630-1023		17/03/1968	15.24	548.63				N	N	U	DEWNR	
65712	663001096	Nnt	299340	6284010	54	6630-1096		29/09/1973	10.66	531.31				N	N	U	DEWNR	
65713	663001097		299091	6283406	54	6630-1097		29/09/1973	10.67	532.2				N	N	U	DEWNR	
65716	663001100	Nya	301123	6283999	54	6630-1100		2/10/1973	18.3	585.77				N	N	U	DEWNR	
65717	663001101		300644	6284054	54	6630-1101		2/10/1973	0.8	579.65				N	N	U	DEWNR	
65718	663001102		299996	6282567	54	6630-1102		26/04/1988	35	523.11				N	N	U	DEWNR	
65719	663001103	Nya	300902	6282460	54	6630-1103		2/10/1973	17.3	564.16				N	N	U	DEWNR	
65720	663001104		299674	6281544	54	6630-1104		21/09/1973	28	515.3				N	N	U	DEWNR	
65751	663001135	Nnt	297791	6281836	54	6630-1135		22/09/1973	29	492.35				N	N	U	DEWNR	
196699	663003208	Nya	300772.7	6282887	54	6630-3208		16/01/2003	24	586.24				N	N	D	DEWNR	
240361	663003420		299620.4	6282495	54	6630-3420		2/04/2007	21.5	518.45				N	N	D	DEWNR	
240362	663003421	Nya	300502	6281628	54	6630-3421		29/04/2007	24.7	535.33				N	N	D	DEWNR	

DHNO	Unit_No	Obs_No	log_date	logger_name	depth_from	depth_to	lith_code	description
66408	6630-1792		10/05/1988	THOMAS I C	0	3	TPSL	
66408	6630-1792		10/05/1988	THOMAS I C	3	13	SHLE	Yellow shale
66408	6630-1792		10/05/1988	THOMAS I C	13	58.4	ROCK	Blue rock
196699	6630-3208		16/01/2003	THOMAS D D	0	1	TPSL	dirt
196699	6630-3208		16/01/2003	THOMAS D D	1	23	SHLE	yellow shale
196699	6630-3208		16/01/2003	THOMAS D D	23	48	ROCK	blue rock
196699	6630-3208		16/01/2003	THOMAS D D	48	49	ROCK	broken blue rock
196699	6630-3208		16/01/2003	THOMAS D D	49	64	ROCK	blue rock
240361	6630-3420		2/04/2007	MAYNARD S R	0	8	CLYU	CLAY and shale
240361	6630-3420		2/04/2007	MAYNARD S R	8	25	SLST	Weathered SILTSTONE
240361	6630-3420		2/04/2007	MAYNARD S R	25	114	SLST	Firm grey SILTSTONE
240362	6630-3421		29/04/2007	MAYNARD S R	0	6	CLYU	CLAYand shale
240362	6630-3421		29/04/2007	MAYNARD S R	6	15	SDST	Soft brown SANDSTONE
240362	6630-3421		29/04/2007	MAYNARD S R	15	61	SLST	Grey-brown SILTSTONE

DHNO	Aquifer	Unit_No	Unit_Number	Obs_No	Collected_date	Collected_time	TDS	EC	pH	Sample_type	Anomalous_ind	Test_Place	extract_method	Measured_during	data_source	Easting	Northing	Zone
65639		6630-1023	663001023		23/01/1968		2530	4536	6.7	S	N			D	DEWNR	301977.9	6283405	54
65639		6630-1023	663001023		7/03/1968		2545	4563	6.5	S	N		PUMP	F	DEWNR	301977.9	6283405	54
65712	Nnt	6630-1096	663001096		3/10/1973		2372	4255	7	S	N		WMLL	F	DEWNR	299340	6284010	54
65713		6630-1097	663001097		29/09/1973		2309	4145	6.5	S	N			F	DEWNR	299091	6283406	54
65714		6630-1098	663001098		10/10/1973		213	387	6	S	N			U	DEWNR	300426.9	6284246	54
65715		6630-1099	663001099		10/10/1973		2067	3715	7	S	N		WMLL	F	DEWNR	300348	6284052	54
65716	Nya	6630-1100	663001100		2/10/1973		1664	3000	7	S	N			F	DEWNR	301123	6283999	54
65717		6630-1101	663001101		10/10/1973		154	280	6	S	N			U	DEWNR	300644	6284054	54
65718		6630-1102	663001102		2/10/1973		2239	4020	7	S	N			U	DEWNR	299996	6282567	54
65719	Nya	6630-1103	663001103		2/10/1973		2675	4790	7	S	N		WMLL	F	DEWNR	300902	6282460	54
65720		6630-1104	663001104		2/10/1973		2372	4255	7.5	S	N		WMLL	F	DEWNR	299674	6281544	54
65721	Nya	6630-1105	663001105		2/10/1973		2613	4680	6.5	S	N		WMLL	F	DEWNR	300670	6280917	54
65726		6630-1110	663001110		8/08/1957		2185	3925		S	N			U	DEWNR	298154.9	6282524	54
65750	Nnt	6630-1134	663001134		22/09/1973		2795	5000	7	S	N		WMLL	F	DEWNR	299277	6281181	54
65751	Nnt	6630-1135	663001135		2/10/1973		2848	5092	7	S	N		WMLL	F	DEWNR	297791	6281836	54
65783		6630-1167	663001167		2/10/1973		1130	2045	7	S	N		PUMP	F	DEWNR	300273.9	6280138	54
240362	Nya	6630-3421	663003421		25/03/2008	14:40	2415	4330		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		25/03/2008	15:50	2358	4230		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		25/03/2008	17:00	2364	4240		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		26/03/2008	11:00	2347	4210		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		26/03/2008	12:30	2358	4230		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		26/03/2008	14:10	2358	4230		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		26/03/2008	15:50	2358	4230		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	9:50	2352	4220		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	11:20	2347	4210		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	13:00	2364	4240		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	14:40	2352	4220		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	16:20	2358	4230		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	18:00	2380	4270		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	19:40	2386	4280		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	21:20	2397	4300		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		27/03/2008	23:00	2404	4310		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		28/03/2008	1:30	2409	4320		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		28/03/2008	4:00	2375	4260		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		28/03/2008	7:20	2375	4260		S	N	GL	PUMP	M	DEWNR	300502	6281628	54
240362	Nya	6630-3421	663003421		28/03/2008	9:40	2364	4240		S	N	GL	PUMP	M	DEWNR	300502	6281628	54

DHNO	Unit_No	Obs_No	completion_date	total_depth	final_depth	current_depth	permit_no	Bkf_ind	case_from	case_to	case_min	case_material	pcem	pcem_fror	pcem_to	pz_from	pz_to	pz_min_diame	pz_type	pz_material	pz_aperture	drill_from	drill_to	drill_diam	drill_meth	well_dev_	well_dev_dur	Comments
65639	6630-1023		17/01/1968	36.58				N	0	6.1	152		N			6.1	36.58		UKN									
65639	6630-1023		7/03/1968			36.58		N					N															
65711	6630-1095		5/10/1973	30.48	30.48	30.48		N			152		N															
65712	6630-1096		29/09/1973	33.53	33.53	33.53		N	0	30.48	102		N			30.48	33.53		UKN									
65713	6630-1097		29/09/1973	32	32	32		N	0	19.81	152		N			19.81	32		UKN									
65714	6630-1098		2/10/1973			2		N					N															
65715	6630-1099		21/10/1973					N			102		N															
65716	6630-1100		2/10/1973	36.8	36.8	36.8		N			152		N															
65717	6630-1101		2/10/1973			1		N					N															
65718	6630-1102		31/03/1988	85			20970	N					N			0	85		OH			55	85	130	ROT			
65719	6630-1103		2/10/1973	36.58	36.58	36.58		N			102		N															
65720	6630-1104		21/09/1973	51	51	51		N			102		N															
65721	6630-1105							N			152		N															
65746	6630-1130		26/09/1973	30.48	30.48	30.48		N	0	15.24	152		N			15.24	30.48		UKN									
65750	6630-1134		22/09/1973			36.58		N					N															
65751	6630-1135		22/09/1973	36.37	36.37	36.37		N	0	9	152		N			9	36.37		UKN									
65783	6630-1167		26/09/1973	30.48	30.48	30.48		N	0	6.1	152		N			6.1	30.48		UKN									
65784	6630-1168		6/10/1973	13.6	13.6	13.6		N					N															
66408	6630-1792		10/05/1988	58.4	0		20945	Y					N									0	58.4	180	RTA			
196699	6630-3208		16/01/2003	64	64	64	60468	N	0	64	127	PVC	N			47	64	127	SC	PVC	3.2	0	64	165	RTA	AIRL	2	New well
240361	6630-3420		2/04/2007	114	114	114	129293	N	0	34	150	PVC	N			34	114		OH			0	114	165	RTA			Water sup
240362	6630-3421		29/04/2007	62	62	62	129800	N	0	26	150	PVC	N			26	61		OH			0	61	165	ACR+RTA			Water sup

Appendix C.

Department of Environment and Heritage (DEH) EPBC Online Database Search Results

Australian Government
Department of the Environment

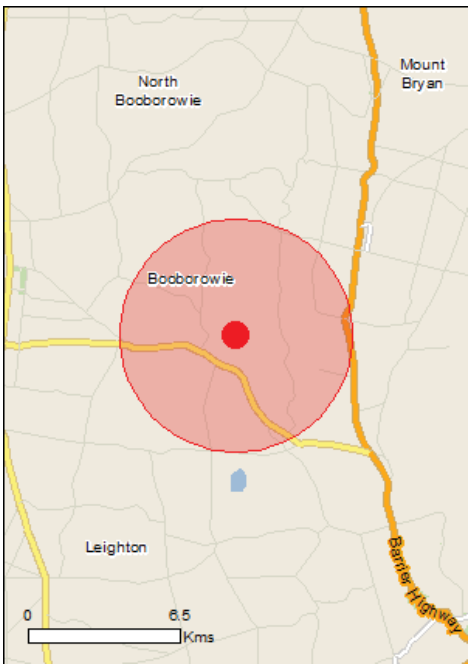
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

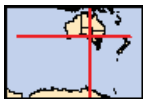
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 18/05/16 13:54:11



Coordinates
Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	17
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	28
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
The coorong, and lakes alexandrina and albert wetland	150 - 200km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Iron-grass Natural Temperate Grassland of South Australia	Critically Endangered	Community likely to occur within area
Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		
Galaxias rostratus Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Plants		
Acacia glandulicarpa Hairy-pod Wattle [8838]	Vulnerable	Species or species habitat may occur within area
Acacia menzelii Menzel's Wattle [9218]	Vulnerable	Species or species habitat may occur within area
Caladenia gladiolata Bayonet Spider-orchid, Clubbed Spider-orchid [8079]	Endangered	Species or species habitat may occur within area
Caladenia macroclavia Large-club Spider-orchid [55012]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia tensa Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area
Caladenia woolcockiorum Woolcock's Spider-orchid [55023]	Vulnerable	Species or species habitat may occur within area
Caladenia xantholeuca White Rabbits, Flinders Ranges White Caladenia [55025]	Endangered	Species or species habitat may occur within area
Dodonaea procumbens Trailing Hop-bush [12149]	Vulnerable	Species or species habitat likely to occur within area
Olearia pannosa subsp. pannosa Silver Daisy-bush [12348]	Vulnerable	Species or species habitat likely to occur within area
Prasophyllum pallidum Pale Leek-orchid [20351]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Aprasia pseudopulchella Flinders Ranges Worm-lizard [1666]	Vulnerable	Species or species habitat likely to occur within area
Tiliqua adelaidensis Pygmy Blue-tongue Lizard, Adelaide Blue-tongue Lizard [1270]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Alauda arvensis		
Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula		
Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.58041 138.84486

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix D.

Geotechnical Report

A.S. JAMES - BEAR PTY. LTD
ABN: 84 089 254 491
GEOTECHNICAL ENGINEERING

7 Carrington Street
Kapunda SA 5373
Tel: (08) 8566 2399
Fax: (08) 8566 2344
Email asjbear@capri.net.au
Website: www.asjamesbear.net.au

22nd June 2007

Princess Royal Station
PO BOX 160
Burra SA 5417

Re: Proposed Pond Liner Material

As requested by Mr. Trevor Clark (PIRSA) on the 23rd May 2007, a laboratory permeability test was carried out on a sample of red brown/mottled grey clay sampled from a depth of 1500mm as supplied by Mr. Trevor Clark on behalf of Princess Royal Station.

Material was prepared close to Optimum Moisture Content on the 5th June 2007 before pressing/compacting into a testing tube. Water was added and the water level marked. Twenty-four hours later the water level had dropped 6mm but no water had transmitted through the clay plug. The test was performed for a total of 17 days, dropping a further 4mm during that time, with no water transmitting through.

Therefore the material has taken up the drop in water level and would therefore meet permeability requirements for pond liners.

Please do not hesitate to ring the undersigned, should you have any further questions.

Yours faithfully

Shawn Klix
Senior Geotechnician
Field and Laboratory Services Manager

A.S. James-Bear Pty. Ltd.
7 CARRINGTON STREET
KAPUNDA SA 5373

Phone: 08 8566 2399
Fax: 08 8566 2344

MATERIAL TEST REPORT

Report Number: C07-9796

CLIENT/JOB DETAILS

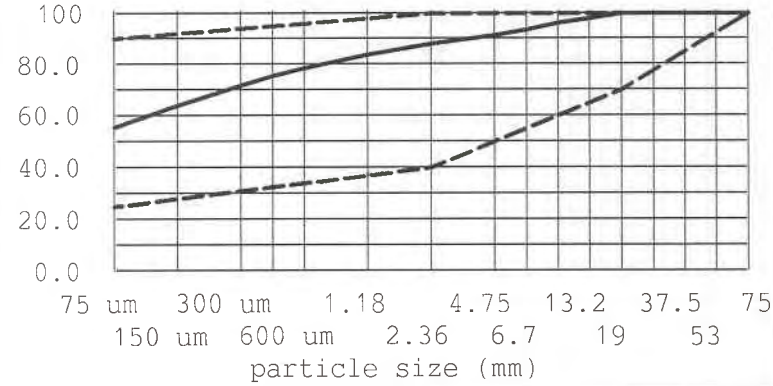
Client	PRINCESS ROYAL STATION
Job/Project	Q.A.TESTING ON PROPOSED CLAY LINER MATERIAL
Section	N/A
Order No	N/A

SAMPLE DETAILS

Sample No. 07-9796

Material	CLAY		
Source	INSITU		
Site	N/A		
Location	SAMPLE 2 - DEPTH: 1500mm		
Ref. Lab Number	4017001/2		
Date Sampled	23-05-2007	Pavement Layer	N/A
Lot No.	N/A	Sampling Method	CLIENT SUPPLIED
		Preparation Method	AS1289.1

PARTICLE SIZE DISTRIBUTION AS1289.3.6.1



mm	% Passing	
75.0	100	100
53.0	100	
37.5	100	
26.5	100	
19.0	100	70-100
13.2	98	
9.5	96	
6.7	93	
4.75	91	
2.36	88	40-100
1.18	84	
0.600	78	
0.425	76	
0.300	72	
0.150	64	
0.075	56	25-90

OTHER PROPERTIES	Method	Results	Limits
Liquid Limit	AS1289.3.1.2	54 %	30-60
Plastic Limit	AS1289.3.2.1	15 %	
Plasticity Index	AS1289.3.3.1	39 %	>10
Linear Shrinkage	AS1289.3.4.1	13.0 %	
PI times 0.425mm Sieve		2944.9	

Form: [CO5STANDARD-AJSA]

REMARKS: CLASSIFICATION AS 1726 CH
SAMPLE DESC: CLAY, red brown/mottled grey

APPROVED SIGNATORY .....
Doug Bear
Date Issued: 30-05-2007

PI = LI

PSD = Purple

A.S. JAMES-BEAR PTY LTD
Geotechnical Engineering
7 Carrington Street, Kapunda SA

GRADING WORKSHEET AS 1289 3.6.1 METHOD

SAMPLE No:	07-9796	CLIENT:	Princess Royal Station		
COPY:		PROJECT:	QA Testing		
SAMP DATE:	23/5/2007	SAMPLED BY:	Client		
PRODUCT:	CLAY	LOCATION:	Sample 2	LOT No:	NA
SPEC:		LOC DETAILS:	Depth 1500mm		
		CLIENT REF.:	4017001/2		
PREP:		ORDER No.:		PAVEMENT LAYER:	Liner

USE WEIGHTS		SIEVE 1	1	SIEVE2	2	TEST METHOD:		AS 1289 3.6.1	
OVEN:	2	BAL 1	2	BAL 1	2	COARSE	26.5	INTER	4.75

COARSE

Total Mass	758
125	
106	
75	
53	
37.5	
26.5	
TOTAL COARSE	

SPLIT SAMPLE	Y / (N)
PAST LAST COARSE	758

INTERMEDIATE

DRY MASS			758
WASH DRY MASS			308
19		*1200	—
13.2		*900	13.1
9.5		*600	12.3
6.7		*500	18.2
4.75		*400	13.7
TOTAL INTERMEDIATE			
PASS LAST INTERMEDIATE			250.7

FINE

SUBSAMPLE MASS			250.9
2.36		*150	21.4
1.18		*100	29.0
0.6		*75	34.7
0.425		*60	18.9
0.3		*50	24.1
0.15		*40	51.3
0.075		*25	55.9
		PAN	15.6
		TOTAL FINE	250.9

TIN NUMBER	S14
WET SAMPLE MASS	951.4
DRY SAMPLE MASS	850.3
TIN MASS	180.3
MOISTURE MC(w)	15.1

NOTE: * Maximum Allowable Mass (gms), All sieves are in (mm), All Masses are in grams

TESTED BY :	DATE: 25/5/07	CHECKED BY: E.R.	DATE: 30.5.07

RURAL SOLUTIONS SA

LABORATORY TESTS REQUIRED ON SOIL/CLAY SAMPLE

For PRINCESS ROYAL STATION
PO Box 160
BURRA SA 5417.

LABORATORY INVOICE TO

Client (see at left) ☑
Rural Solutions SA ☐

PURPOSE:- TEST FOR SUITABILITY AS

☑ EFFLUENT POND LINING
☑ FEEDLOT PEN FLOOR CLAY LINING MATERIAL

Please report

1. **Soil classification**
2. **Particle size distribution**
3. **Plasticity limits**

SAMPLE ID 1500 mm.

(4) LABORATORY PERMEAMETER TEST.

Specifications

The soil will be considered suitable for use as clay lining or pen sub base material if it meets the following specifications:

A - Suitable 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.

It also must conform with the following particle size distribution and plasticity limits:

B (i) Particle Size Distribution:

AS Metric Sieve Size (mm)	Percentage Passing (by dry weight)
75	100
19	70 – 100
2.36	40 – 100
0.75	25 – 90

(ii) Plasticity Limits on fines fraction, passing 0.425 mm sieve:

Liquid Limit W_L	30 – 60 %
Plasticity Index I_P	> 10 %

For pond lining material only:-

If the clay sample meets the above specifications, and in the opinion of the laboratory has a good chance of meeting permeability specifications of 1 x 10^{-9} m/sec, retain the sample pending requirement for the following tests by the EPA.

Additional tests on clay samples for pond lining meeting above specifications (when required by EPA):-

1. **Maximum Dry Density**
2. **Optimum Moisture Content**
3. **Permeability at 95% maximum dry density – or percentage maximum dry density at which permeability meets standard of 1 x 10^{-9} m/sec**
4. **Pinhole dispersion test**

Fax results to:-

Trevor Clark
Feedlot Services; Rural Solutions SA
PO Box 822 Clare SA 5453
Phone 08 8842 6226
Fax 08 8842 3775
Mobile 0438 423 900
Email clark.trevor@saugov.sa.gov.au

PLEASE REFER ANY QUESTIONS ON TESTING OF THIS MATERIAL TO T. CLARK

A.S. JAMES-BEAR P.L. Geotechnical Engineering 7 Carrington Street,Kapunda SA 5373	JOB: Princess Royal Station QA	JOB No. 4017001/2 DATE: 23/5/07

ATTERBERG LIMITS
LABORATORY WORKSHEET

DEPTH OF TEST :	1500mm		TYPE 1= 1 POINT 4= 4 POINT :		1
SAMPLE No :	2		1		
SAMPLE DESCRIPTION :	CLAY – Red brown mottled grey				
BALANCE : 4	OVEN : 2	LL MACH.: SAC300J4	G. TOOL: S3005/	OPERATOR : SK	
CONDITION OF SAMPLE :	OVEN DRY	SIEVING METHOD :	DRY	BOWL No : —	
MIXING: TIME: 1400	DATE: 25/5/07	CURING TIME :	48+ hrs		

	LIQUID LIMIT			
TIN No.	60			
TIN & WET SOIL gms.	31.14			
TIN & DRY SOIL gms.	27.42			
TIN gms.	20.50			
MOISTURE LOSS gms				
DRY SOIL gms.				
MOISTURE CONTENT				
No. OF BLOWS	26			

BLOWS	FACTOR
15	0.95
16-17	0.96
18-19	0.97
20-21	0.98
22-23	0.99
24-26	1.00
27-28	1.01
29-31	1.02
32-35	1.03

PLASTIC LIMIT	
A285	D
32.36	49.20
31.10	47.75
22.78	38.11
AVG. %	

LINEAR SHINKAGE		
MOULD No.		AC
INITIAL LENGTH mm		250
TOP LENGTH mm		218
BOTTOM LENGTH mm		218
LS	%	
CRACKS	YES	NO
CURLING	YES	NO

RESULTS	
LIQUID LIMIT	%
PLASTIC LIMIT	%
PLASTICITY INDEX	%
LINEAR SHRINKAGE	%

EACH USE CHECK ENTER"OK"or"U/S"	GROOVING TOOL	L.L.MACHINE
	OK	OK

TEST METHODS	AS1289.1 3.1.2, 3.2.1, 3.3.1, 3.4.1, 2.1.1	TESTED BY : SK	DATE: 28/5/07
ASJB FORM: WF008, REV 7 DATE 21/5/2007 SAVED AS WORKSHEET FORM\A'BERGPI.W		CHECKED BY :	DATE:

A.S. JAMES - BEAR PTY. LTD
ABN: 84 089 254 491
GEOTECHNICAL ENGINEERING

7 Carrington Street
Kapunda SA 5373
Tel: (08) 8566 2399
Fax: (08) 8566 2344
Email asjbear@capri.net.au
Website: www.asjamesbear.net.au

22nd June 2007

Princess Royal Station
PO BOX 160
Burra SA 5417

Re: Proposed Pond Liner Material

As requested by Mr. Trevor Clark (PIRSA) on the 23rd May 2007, a laboratory permeability test was carried out on a sample of clayey red brown sand sampled from a depth of 600mm as supplied by Mr. Trevor Clark on behalf of Princess Royal Station.

Material was prepared close to Optimum Moisture Content on the 1st June 2007 before pressing/compacting into a testing tube. Water was added and the water level marked. Twenty-four hours later the water level had dropped 3mm but no water had transmitted through the clay plug. The test was performed for a total of 21 days, dropping a further 2mm during that time, with no water transmitting through.

Therefore the material has taken up the drop in water level and would therefore meet permeability requirements for pond liners.

Please do not hesitate to ring the undersigned, should you have any further questions.

Yours faithfully

Shawn Klix
Senior Geotechnician
Field and Laboratory Services Manager

A.S. James-Bear Pty. Ltd.
7 CARRINGTON STREET
KAPUNDA SA 5373
Phone: 08 8566 2399
Fax: 08 8566 2344

MATERIAL TEST REPORT

Report Number: C07-9795

CLIENT/JOB DETAILS

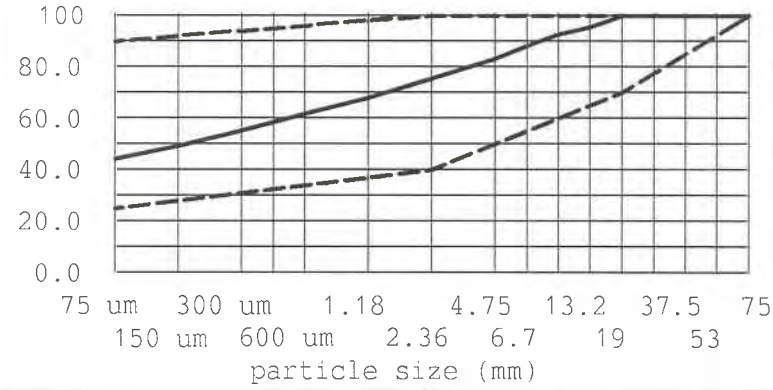
Client	PRINCESS ROYAL STATION
Job/Project	Q.A.TESTING ON PROPOSED CLAY LINER MATERIAL
Section	N/A
Order No	N/A

SAMPLE DETAILS

Sample No. 07-9795

Material	CLAY		
Source	INSITU		
Site	N/A		
Location	SAMPLE 1 - DEPTH: 600mm		
Ref. Lab Number	4017001/1		
Date Sampled	23-05-2007	Pavement Layer	N/A
Lot No.	N/A	Sampling Method	CLIENT SUPPLIED
		Preparation Method	AS1289.1

PARTICLE SIZE DISTRIBUTION AS1289.3.6.1



mm	% Passing	
75.0	100	100
53.0	100	
37.5	100	
26.5	100	
19.0	100	70-100
13.2	95	
9.5	93	
6.7	88	
4.75	83	
2.36	75	40-100
1.18	68	
0.600	62	
0.425	58	
0.300	55	
0.150	49	
0.075	44	25-90

OTHER PROPERTIES	Method	Results	Limits
Liquid Limit	AS1289.3.1.2	68 %	30-60
Plastic Limit	AS1289.3.2.1	21 %	
Plasticity Index	AS1289.3.3.1	47 %	>10
Linear Shrinkage	AS1289.3.4.1	15.5 %	
PI times 0.425mm Sieve		2746.6	

Form: [C05STANDARD-AJSA]

REMARKS: CLASSIFICATION AS1726 SC
SAMPLE DESC: SAND, clayey, red brown

NATA

This laboratory is accredited by the National Association of Testing Authorities, Australia. The Test(s) reported have been performed in accordance with its terms of accreditation. No: 12730

APPROVED SIGNATORY .....
Doug Bear
Date Issued: 30-05-2007

PSD = Lime Tommo = PI

A.S. JAMES-BEAR PTY LTD
Geotechnical Engineering
7 Carrington Street, Kapunda SA

GRADING WORKSHEET AS 1289 3.6.1 METHOD

SAMPLE No:	07-9795	CLIENT:	Princess Royal Station		
COPY:		PROJECT:	QA Testing		
SAMP DATE:	23/5/2007	SAMPLED BY:	Client		
PRODUCT:	CLAY	LOCATION:	Sample 1	LOT No:	NA
SPEC:		LOC DETAILS:	Depth 600mm		
		CLIENT REF.:	4017001/1		
PREP:		ORDER No.:		PAVEMENT LAYER:	Liner

USE WEIGHTS		SIEVE 1	1	SIEVE2	2	TEST METHOD:		AS 1289 3.6.1	
OVEN:	2	BAL 1	2	BAL 1	2	COARSE	26.5	INTER	4.75

COARSE

Total Mass	630
125	
106	
75	
53	
37.5	
26.5	
TOTAL COARSE	

SPLIT SAMPLE	Y / (N)
PAST LAST COARSE	630

INTERMEDIATE

DRY MASS			630
WASH DRY MASS			300
19		*1200	—
13.2		*900	24.3
9.5		*600	14.4
6.7		*500	23.9
4.75		*400	26.9
TOTAL INTERMEDIATE			
PASS LAST INTERMEDIATE			212

FINE

SUBSAMPLE MASS			212
2.36		*150	41.5
1.18		*100	39.1
0.6		*75	33.2
0.425		*60	18.2
0.3		*50	17.3
0.15		*40	31.9
0.075		*25	26.2
PAN			4.4
TOTAL FINE			211.8

TIN NUMBER	S67
WET SAMPLE MASS	893.6
DRY SAMPLE MASS	783.8
TIN MASS	180.9
MOISTURE MC(w)	18.2

NOTE: * Maximum Allowable Mass (gms), All sieves are in (mm), All Masses are in grams

TESTED BY :	DATE: 25/5/07	CHECKED BY: E.R.	DATE: 30.5.07

PSD = Lime Tommo = PI

A.S. JAMES-BEAR PTY LTD
Geotechnical Engineering
7 Carrington Street, Kapunda SA

GRADING WORKSHEET AS 1289 3.6.1 METHOD

SAMPLE No:	07-9795	CLIENT:	Princess Royal Station		
COPY:		PROJECT:	QA Testing		
SAMP DATE:	23/5/2007	SAMPLED BY:	Client		
PRODUCT:	CLAY	LOCATION:	Sample 1	LOT No:	NA
SPEC:		LOC DETAILS:	Depth 600mm		
		CLIENT REF.:	4017001/1		
PREP:		ORDER No.:		PAVEMENT LAYER:	Liner

USE WEIGHTS		SIEVE 1	1	SIEVE2	2	TEST METHOD:		AS 1289 3.6.1	
OVEN:	2	BAL 1	2	BAL 1	2	COARSE	26.5	INTER	4.75

COARSE

Total Mass	630
125	
106	
75	
53	
37.5	
26.5	
TOTAL COARSE	

SPLIT SAMPLE	Y / (N)
PAST LAST COARSE	630

INTERMEDIATE

DRY MASS			630
WASH DRY MASS			300
19		*1200	—
13.2		*900	24.3
9.5		*600	14.4
6.7		*500	23.9
4.75		*400	26.9
TOTAL INTERMEDIATE			
PASS LAST INTERMEDIATE			212

FINE

SUBSAMPLE MASS			212
2.36		*150	41.5
1.18		*100	39.1
0.6		*75	33.2
0.425		*60	18.2
0.3		*50	17.3
0.15		*40	31.9
0.075		*25	26.2
PAN			4.4
TOTAL FINE			211.8

TIN NUMBER	S67
WET SAMPLE MASS	893.6
DRY SAMPLE MASS	783.8
TIN MASS	180.9
MOISTURE MC(w)	18.2

NOTE: * Maximum Allowable Mass (gms), All sieves are in (mm), All Masses are in grams

TESTED BY :	DATE: 25/5/07	CHECKED BY: E.R.	DATE: 30.5.07

RURAL SOLUTIONS SA

LABORATORY TESTS REQUIRED ON SOIL/CLAY SAMPLE

For PRINCESS ROYAL STATION
PO BOX 160
BORRA SA 5417

LABORATORY INVOICE TO

Client (see at left) ☑
Rural Solutions SA ☐

PURPOSE:- TEST FOR SUITABILITY AS

EFFLUENT POND LINING ☑
FEEDLOT PEN FLOOR CLAY LINING MATERIAL ☑

Please report

SAMPLE ID – 600mm.

1. Soil classification
2. Particle size distribution
3. Plasticity limits
4. LABORATORY PERMEAMETER TEST

Specifications

The soil will be considered suitable for use as clay lining or pen sub base material if it meets the following specifications:

A - Suitable 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.

It also must conform with the following particle size distribution and plasticity limits:

B (i) Particle Size Distribution:

AS Metric Sieve Size (mm)	Percentage Passing (by dry weight)
75	100
19	70 – 100
2.36	40 – 100
0.75	25 – 90

(ii) Plasticity Limits on fines fraction, passing 0.425 mm sieve:

Liquid Limit W_L	30 – 60 %
Plasticity Index I_P	> 10 %

For pond lining material only:-

If the clay sample meets the above specifications, and in the opinion of the laboratory has a good chance of meeting permeability specifications of 1 x 10^{-9} m/sec, retain the sample pending requirement for the following tests by the EPA.

Additional tests on clay samples for pond lining meeting above specifications (when required by EPA):-

1. **Maximum Dry Density**
2. **Optimum Moisture Content**
3. **Permeability at 95% maximum dry density – or percentage maximum dry density at which permeability meets standard of 1 x 10^{-9} m/sec**
4. **Pinhole dispersion test**

Fax results to:-

Trevor Clark
Feedlot Services; Rural Solutions SA
PO Box 822 Clare SA 5453
Phone 08 8842 6226
Fax 08 8842 3775
Mobile 0438 423 900
Email clark.trevor@saugov.sa.gov.au

PLEASE REFER ANY QUESTIONS ON TESTING OF THIS MATERIAL TO T. CLARK

A.S. JAMES-BEAR P.L. Geotechnical Engineering 7 Carrington Street,Kapunda SA 5373	JOB: Princess Royal Station QA Testing	JOB No. 4017001/1 DATE: 23/5/07

ATTERBERG LIMITS
LABORATORY WORKSHEET

DEPTH OF TEST :	600mm		TYPE 1= 1 POINT 4= 4 POINT :		1
SAMPLE No :	1		1		
SAMPLE DESCRIPTION :	CLAY - Red Brown				
BALANCE : 4	OVEN : 2	LL MACH.: 5300J4	G. TOOL: 5300S1	OPERATOR : SK	
CONDITION OF SAMPLE :	OVEN DRY	SIEVING METHOD :	DRY	BOWL No :	
MIXING: TIME: 1400	DATE: 25/5/07		CURING TIME :	48 hrs +	

	LIQUID LIMIT				BLOWS	FACTOR	PLASTIC LIMIT	
TIN No.	160				15	0.95	K	L
TIN & WET SOIL gms.	33.56				16-17	0.96	51.31	48.63
TIN & DRY SOIL gms.	28.96				18-19	0.97	49.46	46.76
TIN gms.	22.13				20-21	0.98	40.63	37.54
MOISTURE LOSS gms					22-23	0.99		
DRY SOIL gms.					24-26	1.00		
MOISTURE CONTENT					27-28	1.01		
No. OF BLOWS	26				29-31	1.02	AVG. %	
					32-35	1.03		

LINEAR SHINKAGE		
MOULD No.		101
INITIAL LENGTH mm		249
TOP LENGTH mm		211
BOTTOM LENGTH mm		211
LS	%	
CRACKS	YES	NO
CURLING	YES	NO

RESULTS	
LIQUID LIMIT	%
PLASTIC LIMIT	%
PLASTICITY INDEX	%
LINEAR SHRINKAGE	%

EACH USE CHECK ENTER"OK"or"U/S"	GROOVING TOOL	L.L.MACHINE
	OK	OK

TEST METHODS	AS1289.1 3.1.2, 3.2.1, 3.3.1, 3.4.1, 2.1.1	TESTED BY : SK	DATE: 28/5/07
ASJB FORM: WF008, REV 7 DATE 21/5/2007 SAVED AS WORKSHEET FORM\A'BERGPI.W		CHECKED BY : E.R.	DATE: 30.5.07

Neldner, Simon (DPTI)

From: Rebecca Rowe <becrowe@princessroyal.com.au>
Sent: Thursday, 17 November 2016 3:26 PM
To: Neldner, Simon (DPTI)
Cc: Simon Rowe
Subject: Information Request - Princess Royal Station
Attachments: RU0505O Princess Royal Station Information Request DA 422_E003_16.pdf; PRS Feedlot DA Electricity Declaration Form - Complete.pdf; Netpro Typical Cattle Feedlot Protective Canopy.pdf; Princess Royal Current Handling Yard Design[1].pdf

Good afternoon Simon,

Please find the attached information request responses, the Proway design for the current cattle handling facility as well as the complete electricity declaration form. I have also attached a typical Netpro design for the checkerboard style pen shade that Simon mentioned earlier today.

We hope that our meeting and tour of our feedlot facilities was informative and effective in clearing up any queries you may have had. If you do however have any further questions for us, or need any further information, please do not hesitate to contact us.

Thank you,
Bec Rowe
becrowe@princessroyal.com.au
M: 040 0097 919

PRINCESS ROYAL STATION

Princess Royal Station

P: (08) 88 922 421 F: (08) 88 923 066 A: Box 160 Burra SA 5417
E:admin@princessroyal.com.au ABN: 65 050 531 556
www.princessroyal.com.au

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RURAL OPERATIONS

zero harm
OUR COMMITMENT

Simon Neldner
Team Leader – Development Assessment
Development Assessment
Investment Management | Development Division
Department of Planning, Transport and Infrastructure

Dear Simon,

RE: Response to DA 422/E003/16 - Further information request (Email 9th November 2016)

Provision of an engineered site works and drainage plan for the development site. This plan would also detail existing and proposed site levels (on that portion of the land to be developed) and the extent of bulk earthworks required to enable the construction of the proposed CDA1 + CDA2 production pens and associated infrastructure.

For the approvals process a concept design of the proposed development has been prepared in sufficient detail to provide a construction cost estimate. An estimate has been provided of the extent of bulk earthworks required.

A detailed design of the proposed development shall be undertaken after development consent is given to allow bill of quantities to be confirmed and tender documentation prepared for construction contractors.

Clarification on the location of all bores / wells that will supply water for stock / construction etc. for the current and expanded operations etc.

The existing bores on the subject property are shown in Figure 11 of the development report.

GW 6630-3420 – No 1 bore – This bore is used in the existing feedlot. This bore will also be used for the proposed development.
GW 6630-3421 – No 2 bore – This bore is used in the existing feedlot. This bore will also be used for the proposed development.

GW 6630-1102 – This bore is decommissioned

There are two bores shown on Lot 28 Plan D2033 being:
GW 6630-1103 – This bore is not currently in use (reserve) and may be used for the proposed development.
GW 6630-3208 – This bore is not currently in use (reserve) and may be used for the proposed development.

Further, there are two additional bores shown on Figure 11 of the development report that could also be used as a backup for the proposed development. These are:

Bores 663001025663001025 & 663001026663001026 on Lot 61 Plan H200700.

Dalby office
T 1300 678 925
F 07 4669 9450
Lot 6 Winton St Dalby Q 4405
Mail P.O. Box 279 Dalby Q 4405

Texas office
T 1300 678 925
F 07 4669 9450
"Eldorado" Texas-Yelarbon Rd
Texas Q 4385

E ostwald@ostwaldbros.com.au
www.ostwaldbros.com.au
Ostwald Rural Trust
ABN 28 853 186 014

More detailed plan of the existing operations / storage cattle handling infrastructure (western edge of complex) and location of chemical storage area. I also have a query here, that with the significant increase in cattle numbers / through-put, how the existing feed storage arrangements can meet increased demand (or are the current facilities under-utilised or simply be managed more intensively?)

Currently, all operations requiring chemical usage with the exception of animal treatments are undertaken by contractors. No chemicals for these operations are stored on-site. All veterinary chemicals (vaccines/medicines etc) are stored according to relevant legislation in the cattle handling facility.

The existing feedlot's feed storage and preparation facility is located on the western side of the existing feedlot. This facility shall have a minor upgrade and shall be managed more intensively to provide sufficient capacity required for the proposed development.

The grain processing facility shall be upgraded to increase the grain processing throughput to the capacity required for the expanded feedlot. The existing roller mill will be removed and replaced with a higher capacity roller mill (48 x 24 inch). A wetting silo for pre-treatment of grain shall be installed upstream of the roller mill.

The cattle handling facility currently servicing the existing feedlot shall be used for the proposed development. The existing facility shall be managed more intensively (frequent).

Traffic analysis – can Table 31 be revised to separate current traffic movements from proposed traffic movements (and at each stage of the expanded development).

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 existing development are summarised in Table 1.0. These data are based on the actual incoming and outgoing numbers of cattle and feed commodities per year.

Table 1 – Estimated traffic movements (Existing Development)

Activity	Vehicle Type	Movements per year	Movements per week
Incoming cattle	B-Double	167	3
Outgoing cattle	B-Double	300	6
Incoming feed commodities	Semi-trailer/B-Double	525	10
Employees	Light vehicles	8008*	154

*based on estimated staffing level of 22FTE

Estimated traffic movements (inbound and outbound) associated with each stage of the proposed development are summarised in Table 2.0. These data are based on the estimated market type composition and the estimated ration composition respectively and would be additional to the traffic movements associated with the existing development.

Table 2 – Estimated traffic movements (Proposed Development)

Activity	Vehicle Type	Movements per year		Movements per week	
		CDA 1	CDA 2	CDA 1	CDA 2
Incoming cattle	B-Double	167	213	3	4
Outgoing cattle	B-Double	219	279	4	6
Incoming feed commodities	Semi-trailer/B-Double	540	685	10	14
Employees	Light vehicles	2548*	1820**	49	35

*based on estimated staffing level of 7 FTE.
**based on estimated staffing level of 5 FTE.

Clarification of the type of shade structures proposed for the feedlot areas. No details have been provided on these structures.

Currently, shade facilities are not installed in the existing development with a number of other management strategies implemented to manage excessive heat load in cattle.

Strategies adopted in the existing development for management of excessive heat load shall be relied upon for management of excessive heat load in the proposed development.

Notwithstanding the use of existing management strategies, shade has been provisioned for in the design of the proposed development (through orientation of pens), in the event that shade is adopted in the future as a management strategy for excessive heat load.

Subsequently, shade facilities shall not be provided when the proposed development is constructed. The addition of shade shall be based on a number of considerations including animal welfare and financial resources.

A cost estimate of a typical beef cattle feedlot shade arrangement has been obtained in the event that shade is to be implemented in the future. The cost estimate was based on a 'NETPRO' design with flat canopy structure and structural HDPE knitted net in use in southern QLD beef cattle feedlots.

A typical 'NETPRO' design is provided.

Clarification on whether any additional landscape buffers are proposed for the expanded development (amenity / dust mitigation etc.).

No additional landscape buffers are proposed. The existing tree race along the southern edge of the subject property and adjoining the southern edge of the proposed CDA 1 and CDA 2 provides substantial mitigation of views to the proposed development from local roads and sensitive receptors. The separation distances from the proposed development to sensitive receptors provides mitigation of odour and dust impacts.

I have also attached a new fee advice – a separate advice will be forwarded for any advertising fee required for Category 3 notification.

Received by Princess Royal

I'd also appreciate the attached electricity act declaration form be completed.

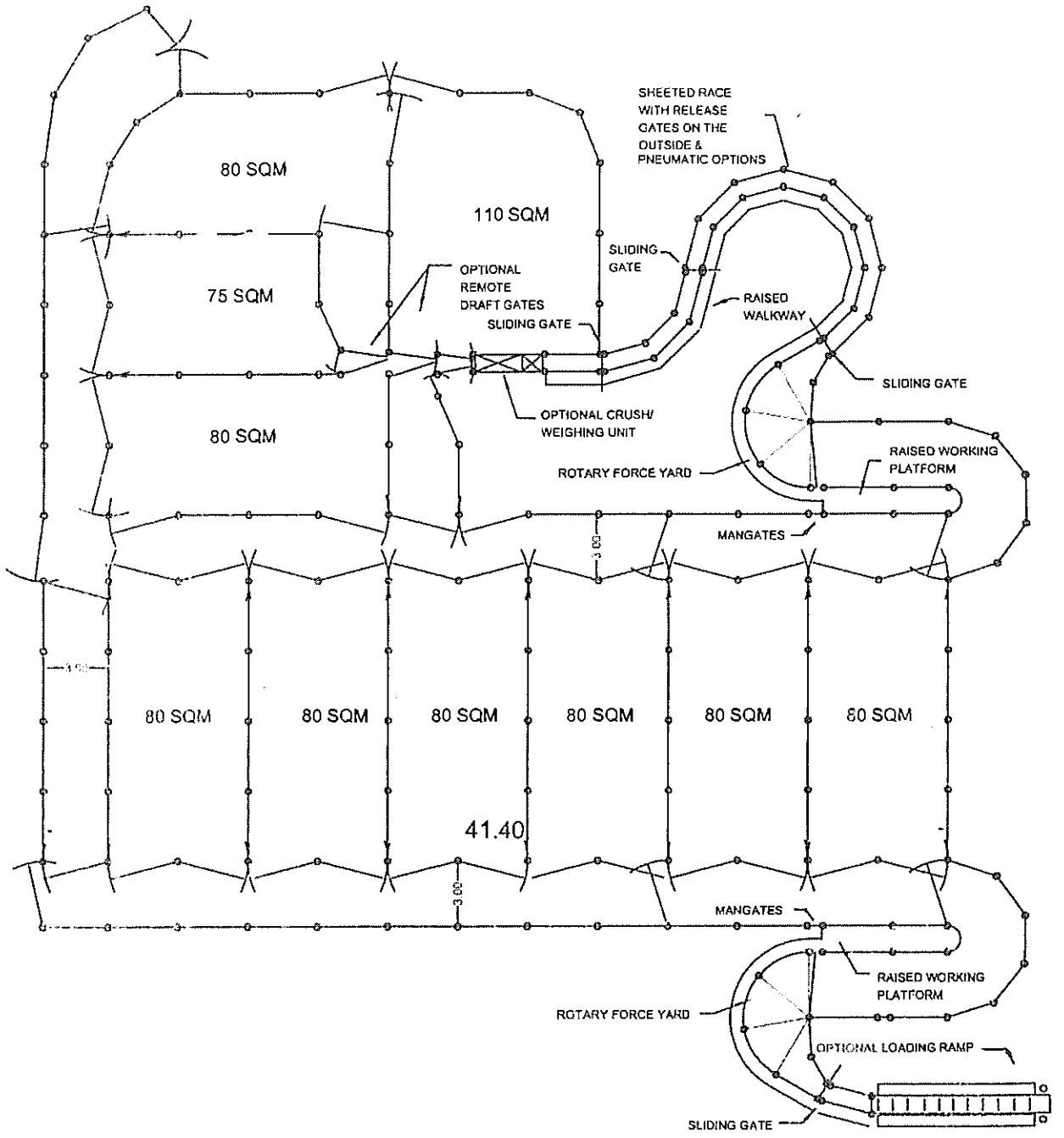
Electricity Act declaration form attached.

Yours Sincerely

R.J. Davis

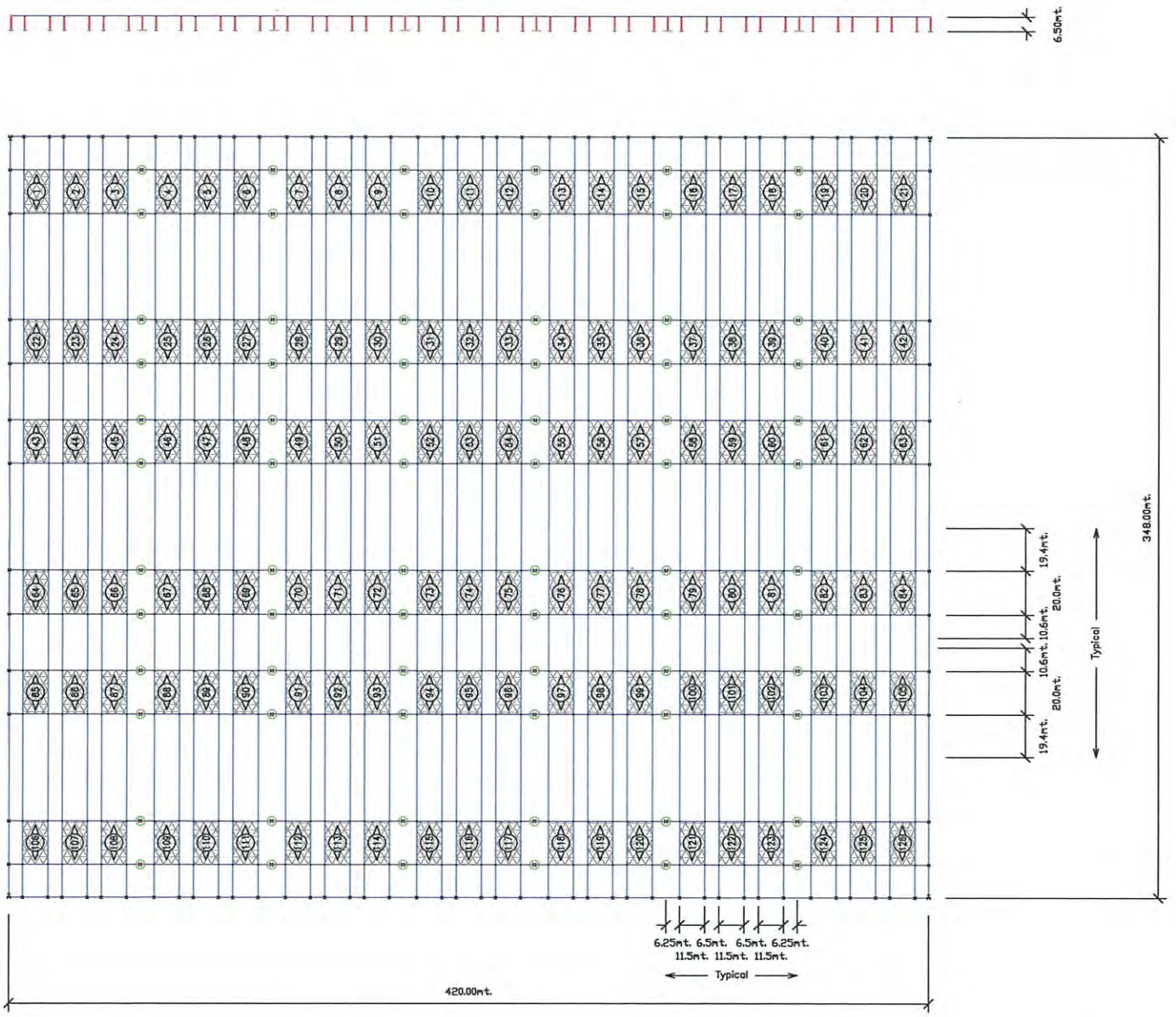
Rod Davis
Group Manager, Environment
Ostwald Bros Group Entities

PFL 1460



LEGEND

NORTH POINT		EXISTING/ OTHERS FENCELINE	
GATE		CONCRETE SLAB	
TROUGH		OVE HEAD BRA NG	
HAZELDEAN GATE CATCH	HAZ	CRUSH	
LOCK OPEN HAZELDEAN GATE CA	LOCK	TREE	
ACCESS GATE	AG	SLIDING GATE	
PRATTLEY FENCE LINE		MANGATE	



LEGEND:

- Universal Beam
- Universal Beam Double
- 12mm Cable - Galv.
- T-Connector - 12mm
- Roof Cloth Run Number 70% Cattle Shade

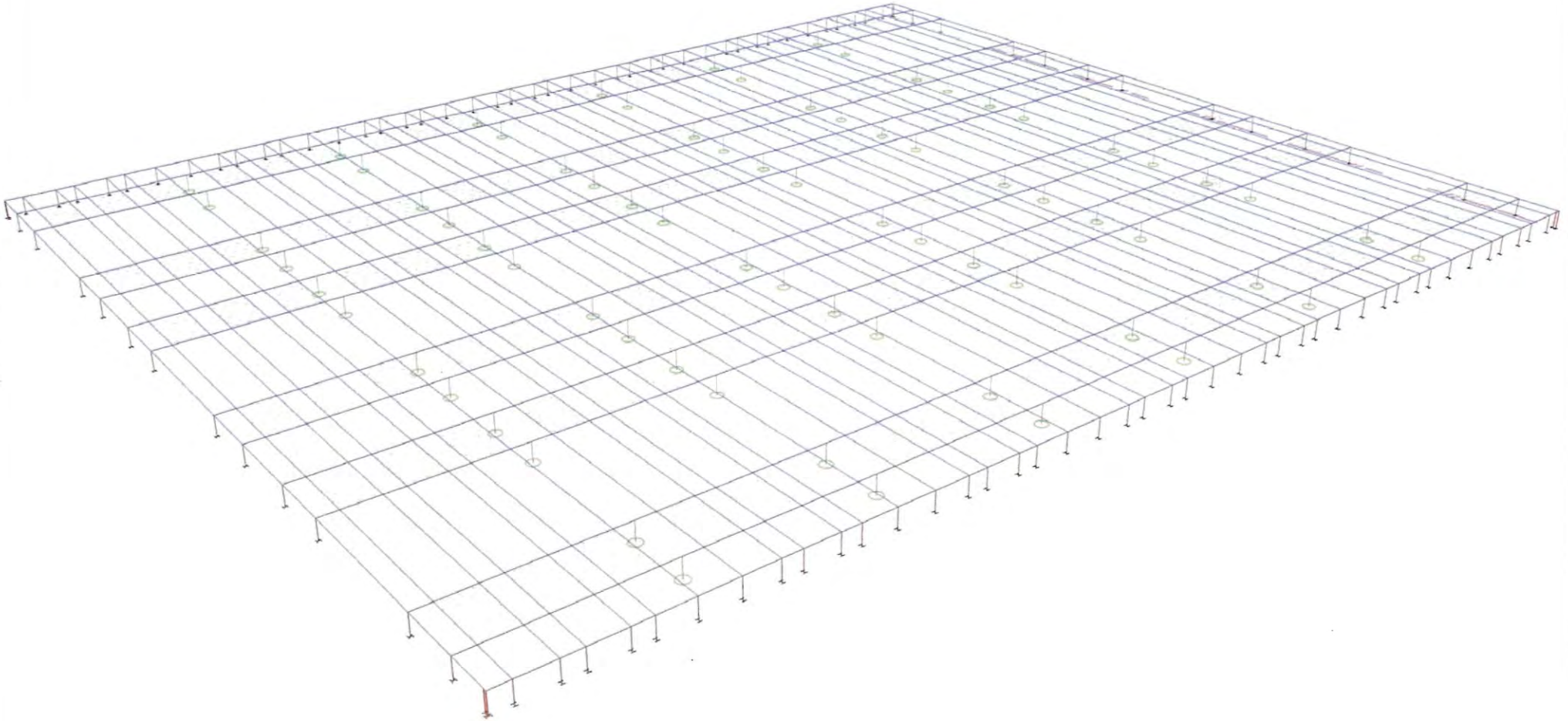
TYPICAL PROTECTIVE CANOPY DESIGN - BEEF CATTLE FEEDLOT

PLAN & ELEVATION

NetPro Pty. Ltd. – A.C.N 054 642 036 – Lot 1 Sullivan Drive, Stanthorpe, 4380
P.O. Box 337, Stanthorpe Qld. 4380 – Phone: (07) 4681 6666 Fax: (07) 4681 6600

NetPro PROTECTIVE CANOPIES

FILE NAME			PLAN NO.	REVISION
7367_OstwaldBros_CShade_R0.0			7367	0.0
SHEET SIZE	SHEET OF	DRAWN BY	DATE	
A3	01 2	RMH	29/04/2016	



TYPICAL PROTECTIVE CANOPY DESIGN - BEEF CATTLE FEEDLOT

PERSPECTIVE

NetPro Pty. Ltd. – A.C.N 054 642 036 – Lot 1 Sullivan Drive, Stanthorpe, 4380
P.O. Box 337, Stanthorpe Qld. 4380 – Phone (07) 4681 6666 Fax: (07) 4681 6600

NetPro PROTECTIVE CANOPIES

FILE NAME			PLAN NO.	REVISION
7367_OstwaldBros_CShade_R0.0			7367	0.0
SHEET SIZE	SHEET OF	DRAWN BY	DATE	
A3	02 2	RMH	29/04/2016	

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

To:

From:

Date of Application: 10 / 11 / 16

Location of Proposed Development: 'MACKEROME' – 1578 HECTARES

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

Section No (full/part) D2033 ..Hundred: AYRES

Volume: CT 5475 Folio: ..... 736 .....

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.

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DPTI Information Request – DA 422_E003_16
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:	DPTI Information Request DA 422_E003_16 – Proposed Beef Cattle Feedlot Expansion, Princess Royal Station, Hills Road, Burra, SA
Project No:	RU05050O
Document File Name:	RU05050O 422_E003_16 PRS Feedlot Information Request V01R02

Version No	Date	Description	Prepared	Signature	Approved	Signature
V01R01	28/03/2017	Draft for client review	Rod Davis	R.J. Davis	Brendan Ostwald	
V01R02	31/03/2017	Submission to DPTI	Rod Davis	R.J. Davis	Brendan Ostwald	

Notes	Recipient	Copies
	Department of Planning ,Transport and Infrastructure	1

Citation: Ostwald Bros Pty Ltd, 2017, DPTI Information Request DA 422_E003_16 – Proposed Beef Cattle Feedlot Expansion, Princess Royal Station, Hills Road, Burra, SA, Project No: RU05050O V01R02, Dalby, QLD.

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1. 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.

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 feedlot on 'Mackerode' Station, near Burra. The feedlot is known as Princess Royal.

The proprietors of PRS, have lodged a development application (422/E003/16) to expand their existing Princess Royal feedlot on 'Mackerode' Station from 4,409 SCU to 13,492 SCU of cattle-on-feed, thereby increasing annual throughput from 22,000 head to some 58,400 head per annum depending on market type.

The Development Assessment Commission (DAC) has been appointed as the relevant planning authority for the development proposal.

Ostwald Bros continues act on behalf Ilira Pty Ltd ATF Bob Rowe Class Trust and Sihero Pty Ltd ATF Simon Rowe Class Trust, the applicant for the abovementioned development application.

This report and the attached supporting documents comprise a response to all of the items outlined in the requests for information issued by the Environment Protection Authority dated 30th November 2016 (EPA Reference: 33942) and the Department of Planning, Transport and Infrastructure dated 16th December 2016 by email from Simon Neldner.

Each item raised in the request for information correspondence is outlined in the following sections followed by the corresponding response.

2. Response to Information Requested

Four additional parcels of land have been acquired by the proponent since the development application was lodged in October 2016. These additional parcels shall be utilised for waste disposal. No infrastructure shall be placed on these parcels.

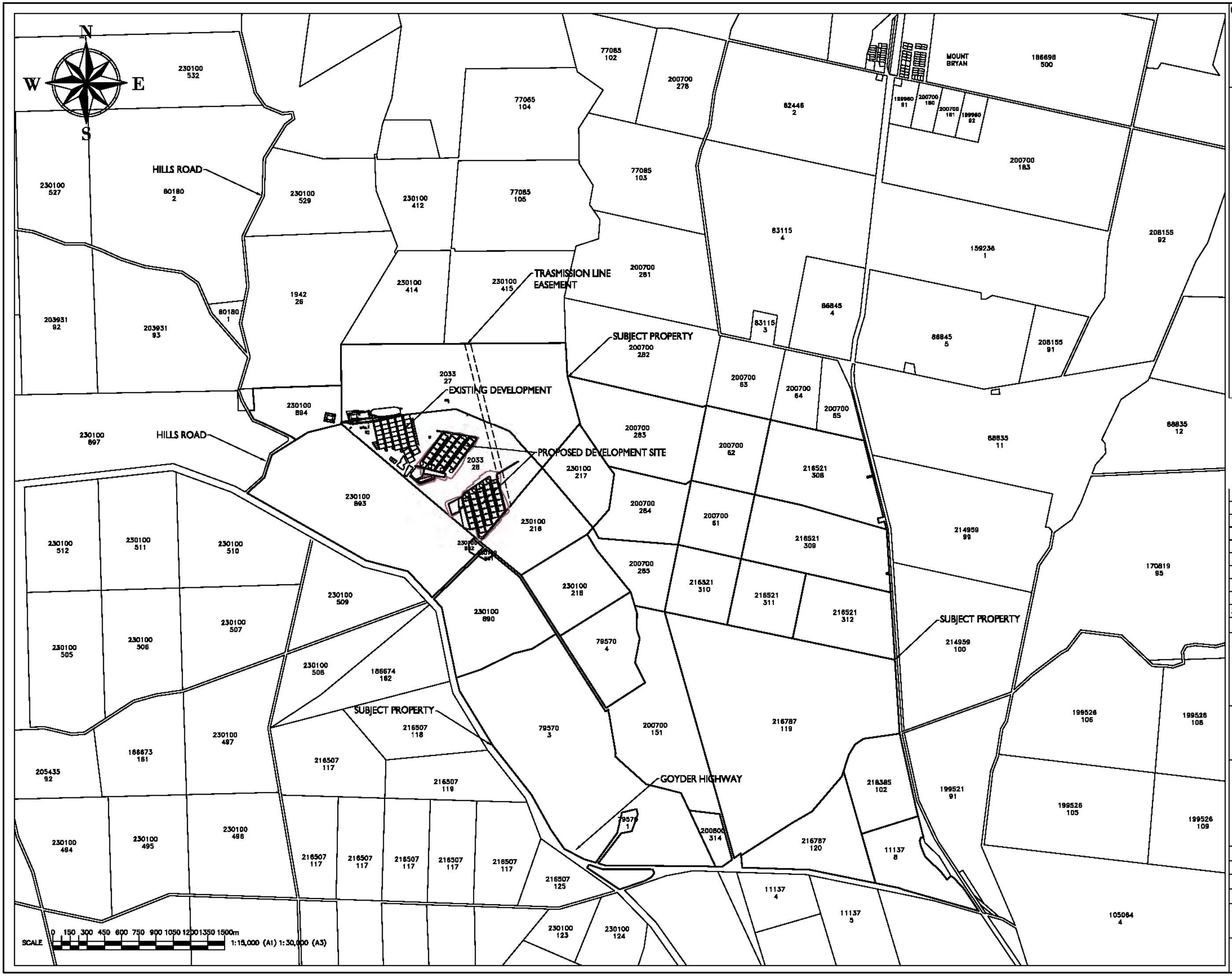
The proponent wishes to include these parcels in the Development Application 422_E003_16. The additional parcels are provided in Table 1.

An updated cadastral plan is provided in Figure 1.

Table 1 – Real property description

Property Name	Plan Type and Number	Parcel Type and Number	Title Type and Volume	Folio	Area Ha	Hundred
Portions included initial DA						
'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
Additional portions to be included						
'Mackerode'	H230100	SE890	CT5470	237	68.7	Ayers
'Mackerode'	H230100	SE891	CR5764	826	0.6	Ayers
'Mackerode'	H230100	SE892	CR5764	827	0.86	Ayers
'Mackerode'	H230100	SE893	CT5532	42	143.8	Ayers
Total Area					1,792	

** Location of proposed additional wastewater lagoon – existing development



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

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Date	Issue	Amendment	Int	App
24/03/17	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATIDN – DA422-E003-16 – REQUEST FOR INFORMATION

Drawing Title
CADASTRAL PLAN

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	24/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-IR-CAD-01	Issue	A

2.1 EPA Reference - 33947

2.2 Odour

The sources of odour proposed by this DA are the cattle feedlots, the wastewater lagoons and the solid waste storage/composting area.

1. **Confirm which solid waste disposal to land category is proposed and the associated recommended separation distances to waste disposal areas (having regard to page 34 and Table 9 on page 35 of the Guidelines for the establishment and operation of cattle feedlots in South Australia, second edition (2006)**

With reference to the solid and liquid waste disposal to land categories outlined on page 34 of the Guidelines for the establishment and operation of cattle feedlots in South Australia, second edition (2006), the proposed methods of solid and liquid waste disposal are included in Category B, Category C and Category D. Subsequently, as more than one category of disposal to land is used, Category D method which requires the greatest separation distance has been used to determine the separation distance from various receivers.

Disposal method B

- Solids that have been completely composted – The manure stored in the stockpile is aged and not actively aerobically composted. Subsequently, the solid waste does not meet the definition of compost as defined in the EPA's Compost Guideline (2013).
- effluent having a solids content of not more than 1%

Disposal method C

- Mechanical spreaders in combination with "ploughing-in" type equipment. Typically, the solid waste is spread and may remain on the surface for 1-2 weeks prior to sowing of crops.
- downward effluent discharge nozzles.
- discharged material is not projected to a height of more than 2 metres above ground level

Disposal method D

- All effluents that are discharged or projected to a height in excess of 2 metres above ground level.
- Liquid effluent in which water remains visible on the soil surface for periods in excess of one hour.
- Separated solids or sludge (except fully composted solids) that remain on the soil surface for more than 24 hours (i.e. Are not immediately ploughed in). Typically, the settled solids from the sedimentation basin and sludge removed from the wastewater lagoon is transferred to the solid waste stockpile and carcass compost area where it is combined with solid waste from the pens, then aged prior to spreading. The solid waste may remain on the surface for 1-2 weeks prior to sowing of crops.

Table 2 – Separation distances surrounding waste disposal areas

	Disposal Method D	Compliant	Reference
Large towns >2000 persons	2000	Yes	Figure 2
Towns >100 persons	1500	Yes	Figure 2
Small towns >20 persons	1000	Yes	Figure 2
Rural farm residence not owned by feedlot	500	Yes	Figure 2
Public area (minimum value)	200	Yes	Figure 2
Public road – except as below	200	Yes	Figure 2
Public road – unsealed with less than 50 vehicles per day excluding feedlot traffic	50	Yes	Figure 2
Major watercourse	200	Yes	Figure 2
Other watercourses as defined by a blue line on a 1:50000 current SA Government topographical map	100	Yes	Figure 2
Property Boundary	20	Yes	Figure 2

Land has been identified on the subject property as being suitable for application of solid wastes as shown in Figure 2 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 550 ha.

The rationale for the use of solid waste on the dryland farming 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.

The remainder of solid waste generated from the proposed development would be transported off-site for utilisation. For clarity, all solid waste generated by the proposed development shall be stored, processed and stockpiled in the dedicated solid waste storage and processing area within controlled drainage areas. This applies to solid waste that is destined for both on-site and off-site utilisation.

The solid waste removed off-site is intended to be used as a soil conditioner and organic fertiliser from cropping operations on other farming properties in the Mid North District owned by the proponent. The proponent has over 60,000 acres of land across the following properties:

- Ayers Park
- Belcunda
- Caroona Station
- Curburra
- Kercolo
- Mt. Bryan
- Mullaby
- Newikie
- Princess Royal Station
- Polville
- Razorback
- Stud Park

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

Date	Issue	Amendment	Init.	App
24/03/17	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION – DA422-E003-16 - REQUEST FOR INFORMATION

Drawing Title
SEPARATION DISTANCES TO LIQUID AND SOLID WASTE UTILISATION AREAS

Scales	1= 10,000 (A1) 1= 20,000 (A3)		
Drawn	RJD	Date	24/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-WUA-02	A

2. **Provide a map showing the distance between sensitive receivers and:**
    a. **Wastewater lagoons, and**
    b. **Solid waste storage/composting areas/s.**

The separation distance between sensitive receivers and wastewater lagoons and solid waste storage and carcass composting areas is shown in Figure 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. 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

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Date	Issue	Amendment	Init.	App
24/03/17	A	ISSUE FOR REVIEW	RJD	BJO

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Web: www.ostwaldbros.com.au

Project
PRINCESS ROYAL STATION – DA422-E003-16 – REQUEST FOR INFORMATION

Drawing Title
SEPARATION DISTANCE TO SENSITIVE RECEIVERS FROM WASTEWATER LAGOONS AND SOLID WASTE STORAGE AND CARCASS COMPOSTING AREAS

Scales	1= 15,000 (A1) 1= 30,000 (A3)		
Drawn	RJD	Date	24/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-IR-SD-03	Issue	A

2.3 Sedimentation basins and storage lagoons

3. **Complete and submit the risk assessment matrix contained at Appendix 1 of the EPA's Wastewater Lagoon Construction Guidelines (2014) to determine the appropriate construction and liner category for the proposed wastewater lagoons.**

The risk assessment matrix contained at Appendix 1 of the EPA's Wastewater Lagoon construction guidelines (2014) was used to determine the appropriate construction and type of liner required for the proposed wastewater lagoons.

The EPA uses a risk-based approach when determining the construction and type of liner required for a particular lagoon proposal by considering groundwater, wastewater characteristics and nature of the wastewater lagoon.

By considering the site-specific environs including groundwater, wastewater characteristics and nature of the wastewater lagoon, the risk assessment matrix results in a risk rating of **39** for the proposed wastewater lagoons in the development as shown in Figure 4.

A risk assessment matrix rating of **39**, is placed in the range (25-44) for a **Category 2** liner. The Table of Suggested Construction and Lining Categories (SCL) shown in Appendix 2 of the EPA's Wastewater Lagoon Construction Guidelines (2014) outlines the preferred level of risk management for a Category 2 liner.

The Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006) state that wastewater lagoons should be lined with an impervious material, e.g. compacted clay and/or synthetic membrane to prevent seepage. All compacted clay linings should have a minimum compacted thickness of 600 mm. Subsequently, the wastewater lagoon shall have a clay lining with a minimum compacted thickness of 600 mm.

SA A risk assessment matrix rating of **39**, is placed in the range (25-44) for a **Category 2** liner. The Table of Suggested Construction and Lining Categories (SCL) shown in Appendix 2 of the EPA's Wastewater Lagoon Construction Guidelines (2014) outlines the preferred level of risk management for a Category 2 liner.

APPENDIX 1 RISK ASSESSMENT MATRIX

Instructions: Select one category under each criteria by clicking 'Y' in the blue column opposite the category. Additional explanati
Appendix 3A.

SITE: Princess Royal Feedlot - Proposed Expansion - CDA 1 - Wastewater Lagoon

		Points	Yes/No	Score	Notes/Comments
1	**Groundwater occurrence**				
1a	none	0			
1b	confined	0.2	Y	0.2	The groundwater in the area is confined. Refer groundwater assessment report (Appendix B of the DA report)
1c	semi-confined	2			
1d	unconfined (covered)	6			
1e	unconfined	10			
2	**Aquifer type**				
2a	Clay or crystalline rock	0.25			The area is underlain by calcareous shales overlying sandstones and siltstones. Refer to bore logs and groundwater assessment report (Appendix B of the DA report)
2b	Silt, fractured rock or limestone	3.75	Y	3.75	
2c	Sand,gravel or Fill	10			
3	**Minimum distance of groundwater from base of lagoon liner**				
3a	greater than 50m	0			The typical depth to groundwater in the vicinty of the proposed wastewater lagoons is in the order of 25-30m. With a typical holding pond depth of 3-4m - The minimum distance from the base of the lagoon liner is > 20m. Refer to bore logs and groundwater assessment report (Appendix B of the DA report)
3b	>20m to 50 m	0.1	Y	0.1	
3c	>10m to 20 m	1			
3d	>5m to10 m	2			
3e	>2m to 5 m	6			
3f	2 m or less	10			
4	**Groundwater usage**				
4a	Not Likely	0.5			Groundwater is the principal source of water of the proposed development. Refer Section 7.5.1 of the DA report
4b	Possible	2.5			
4c	Current	10	Y	10	
5	**Groundwater salinity**				
5a	>10 000 mg/L	0			Groundwater is the principal source of water of the proposed development. Refer Section 7.5.1 of the DA report
5b	>5000 to10000 mg/L	0.2			
5c	>1500 to 5000 mg/L	3	Y	3	
5d	1500 mg/L or less	10			
6	**Nominal capacity of lagoon (excluding freeboard)**				
6a	Small (5ML or less)	0.2			The nominal capacity of the wastewater lagoons is >10ML but less than 30ML for CDA 1. Refer Section 2.8.1.
6b	Medium (>5ML to 10ML)	1.2			
6c	Large (>10ML to 30 ML)	4.8	Y	4.8	
6d	Very Large (>30ML)	10			
7	**Max lagoon water depth**				
7a	1m or less (evaporative)	0.2			The nominal design depth of the wastewater lagoon for CDA 1 is >3m but less than 6m. Refer Section 2.8.1
7b	>1m to 3m (aerobic/facultative)	1.2			
7c	>3m to 6m (anaerobic)	4.8	Y	4.8	
7d	deeper than 6m	10			
8	**Nature of wastewater (see Appendix 3A for definitions)**				
8a	contaminated stormwater	0.2			The wastewater to be stored in the lagoons is stormwater runoff from the pen area pens and solid waste storage and processing aea which is high is organic matter. Refer Section 7.5.9 of the DA report
8b	treated wastewater	0.8			
8c	composting/landfill	4.2			
8d	organic/nutrient	4.2	Y	4.2	
8e	reactive	6.4			
8f	hazardous	10			

Rating		38.6
Preliminary category		2
A. Is the lagoon located within 100m of a watercourse?	N	2
B. Is there potential groundwater that may intersect the base of lagoon liner?	N	2

RECOMMENDED CATEGORY 2

EPA USE ONLY

FOR ASSESSOR:

Suggested Category and reasons:

ASSESSOR *(name and signature)* **:**

PEER REVIEWER *(name and signature* **):**

Category supported : _____ Date: _____

APPENDIX 1 RISK ASSESSMENT MATRIX

Instructions: Select one category under each criteria by clicking 'Y' in the blue column opposite the category. Additional explanati
Appendix 3A.

SITE: Princess Royal Feedlot - Proposed Expansion - CDA 2 - Wastewater Lagoon

		Points	Yes/No	Score	Notes/Comments
1	**Groundwater occurrence**				
1a	none	0			
1b	confined	0.2	Y	0.2	The groundwater in the area is confined. Refer groundwater assessment report (Appendix B of the DA report)
1c	semi-confined	2			
1d	unconfined (covered)	6			
1e	unconfined	10			
2	**Aquifer type**				
2a	Clay or crystalline rock	0.25			The area is underlain by calcareous shales overlying sandstones and siltstones. Refer to bore logs and groundwater assessment report (Appendix B of the DA report)
2b	Silt, fractured rock or limestone	3.75	Y	3.75	
2c	Sand,gravel or Fill	10			
3	**Minimum distance of groundwater from base of lagoon liner**				
3a	greater than 50m	0			The typical depth to groundwater in the vicinty of the proposed wastewater lagoons is in the order of 25-30m. With a typical holding pond depth of 3-4m - The minimum distance from the base of the lagoon liner is > 20m. Refer to bore logs and groundwater assessment report (Appendix B of the DA report)
3b	>20m to 50 m	0.1	Y	0.1	
3c	>10m to 20 m	1			
3d	>5m to10 m	2			
3e	>2m to 5 m	6			
3f	2 m or less	10			
4	**Groundwater usage**				
4a	Not Likely	0.5			Groundwater is the principal source of water of the proposed development. Refer Section 7.5.1 of the DA report
4b	Possible	2.5			
4c	Current	10	Y	10	
5	**Groundwater salinity**				
5a	>10 000 mg/L	0			Groundwater is the principal source of water of the proposed development. Refer Section 7.5.1 of the DA report
5b	>5000 to10000 mg/L	0.2			
5c	>1500 to 5000 mg/L	3	Y	3	
5d	1500 mg/L or less	10			
6	**Nominal capacity of lagoon (excluding freeboard)**				
6a	Small (5ML or less)	0.2			The nominal capacity of the wastewater lagoons is >10ML but less than 30ML for CDA 1. Refer Section 2.8.1.
6b	Medium (>5ML to 10ML)	1.2			
6c	Large (>10ML to 30 ML)	4.8	Y	4.8	
6d	Very Large (>30ML)	10			
7	**Max lagoon water depth**				
7a	1m or less (evaporative)	0.2			The nominal design depth of the wastewater lagoon for CDA 1 is >3m but less than 6m. Refer Section 2.8.1
7b	>1m to 3m (aerobic/facultative)	1.2			
7c	>3m to 6m (anaerobic)	4.8	Y	4.8	
7d	deeper than 6m	10			
8	**Nature of wastewater (see Appendix 3A for definitions)**				
8a	contaminated stormwater	0.2			The wastewater to be stored in the lagoons is stormwater runoff from the pen area pens and solid waste storage and processing aea which is high is organic matter. Refer Section 7.5.9 of the DA report
8b	treated wastewater	0.8			
8c	composting/landfill	4.2			
8d	organic/nutrient	4.2	Y	4.2	
8e	reactive	6.4			
8f	hazardous	10			

Rating		38.6
Preliminary category		2
A. Is the lagoon located within 100m of a watercourse?	N	2
B. Is there potential groundwater that may intersect the base of lagoon liner?	N	2

RECOMMENDED CATEGORY 2

EPA USE ONLY

FOR ASSESSOR:

Suggested Category and reasons:

ASSESSOR *(name and signature)* **:**

PEER REVIEWER *(name and signature* **):**

Category supported : _____ Date: _____

4. **Provide construction details of proposed wastewater lagoons having regard to the completed risk assessment matrix and the wastewater lagoon construction guidelines (2014).**

Having regard to the completed risk assessment matrix, the wastewater lagoon construction guidelines (EPA, 2014) and the Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia (Department of Primary Industries and Resources (SA), 2006), the proposed wastewater lagoons shall be constructed with clay and lined with a minimum of 600mm of compacted clay that achieves a design permeability of 1×10^{-9} m/s in accordance with the construction details for a Category 2 liner as outlined in Section 2.3.1.

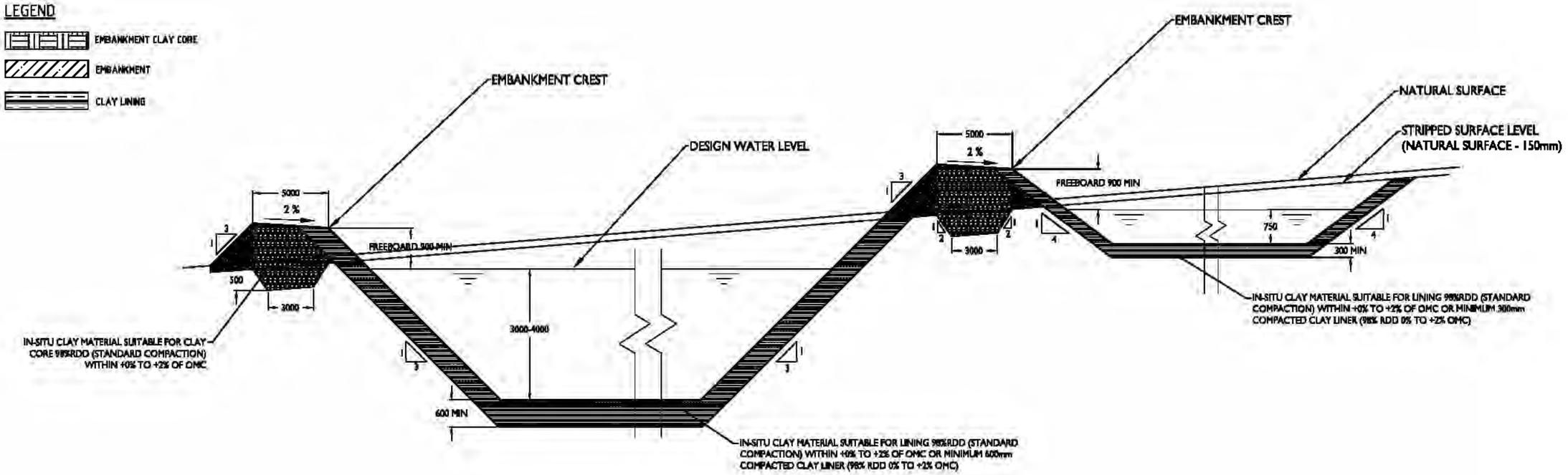
Figure 6 illustrates a typical cross-section through the wastewater lagoon and Figure 7 outlines the specifications for construction of the wastewater lagoons.

2.3.1 Construction details Category 2 liner

The construction and liner details of a Category 2 liner are provided in Appendix A.

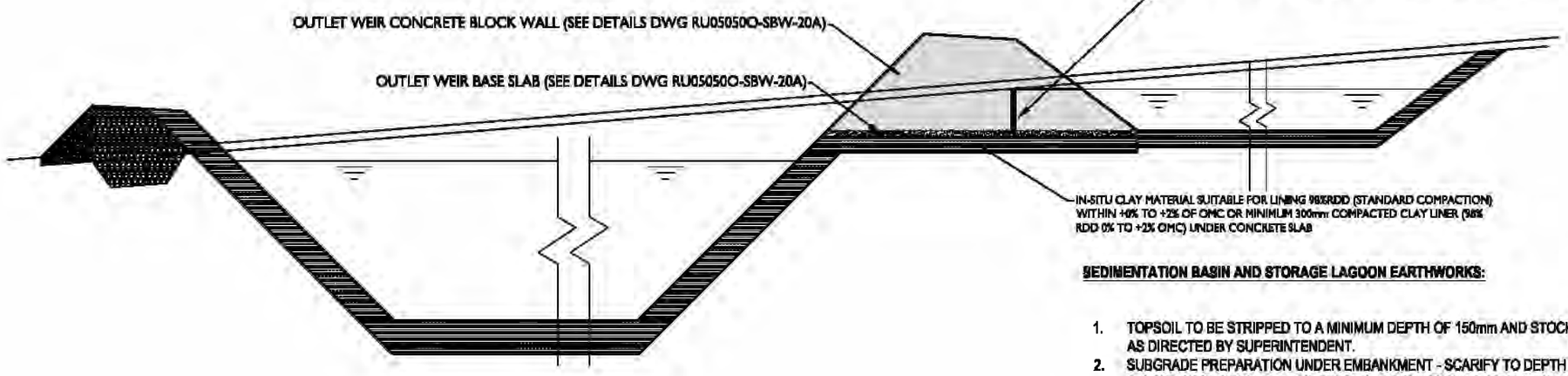
LEGEND

- EMBANKMENT CLAY CORE
- EMBANKMENT
- CLAY LINING



A/18 TYPICAL SECTION THROUGH SEDIMENTATION BASIN AND WASTEWATER LAGOON

SCALE 1: 150 (H) 1:50 (V)



B/18 TYPICAL SECTION THROUGH SEDIMENTATION BASIN OUTLET WEIR AND WASTEWATER LAGOON

SCALE 1: 150 (H) 1:50 (V)

CLAY LINING NOTES:

1. MATERIAL SUITABLE FOR CLAY LINING:
   - 1.1. CLASSIFIED AS CL, CL, CH, SC OR GC IN ACCORDANCE WITH AS1726.
   - 1.2. PERCENTAGE FINES - MORE THAN 25% PASSING 75um
     MORE THAN 25% PASSING 2um
   - 1.3. PLASTICITY INDEX > 10%
   - 1.4. LIQUID LIMIT - 30-60%
2. PERMEABILITY < 1 X 10^{-9} m/s.

SCALE 0 1.5 3.0 4.5 6 7.5 9.0 10.5 12 13.5 15m
1:150 (A1) 1:300 (A3)

SEDIMENTATION BASIN AND STORAGE LAGOON EARTHWORKS:

1. TOPSOIL TO BE STRIPPED TO A MINIMUM DEPTH OF 150mm AND STOCKPILED ONSITE AS DIRECTED BY SUPERINTENDENT.
2. SUBGRADE PREPARATION UNDER EMBANKMENT - SCARIFY TO DEPTH OF 150mm BELOW STRIPPING LEVEL AND MOISTURE CONDITION BEFORE BEING RECOMPACTED TO THE REQUIREMENTS AS SHOWN ON THE DRAWINGS.
3. REMOVE ANY UNSUITABLE MATERIAL AT SUBGRADE LEVEL AND REPLACEMENT WITH SELECTED FILL MATERIAL (IF REQUIRED)
4. EMBANKMENT AND CLAY CORE TO BE CONSTRUCTED FROM SUITABLE MATERIAL EXCAVATED FROM SEDIMENTATION BASIN /STORAGE LAGOON FROM BELOW 500mm NATURAL SURFACE.
5. MOISTURE CONTENT OF SELECTED CLAY CORE AND CUTOFF TRENCH WILL BE IN THE RANGE OF +2% - 0% WET OF OPTIMUM MOISTURE CONTENT (OMC) AND COMPACTED TO ACHIEVE A FIELD DRY DENSITY NOT LESS THAN 98% OF THE STANDARD LABORATORY MAXIMUM DRY DENSITY DETERMINED IN ACCORDANCE WITH AS1289.5.3.1
6. EACH LAYER OF THE OUTER EMBANKMENT WILL BE COMPACTED TO PRODUCE A FIELD DRY DENSITY OF AT LEAST 98% OF THE STANDARD LABORATORY MAXIMUM DRY DENSITY DETERMINED IN ACCORDANCE WITH AS1289.5.3.1 AND HAVE A MOISTURE CONTENT OF ±2% OF OMC.
7. CUTOFF TRENCH TO EXTEND THROUGH UPPER LAYERS OF UNDERLYING IMPERMEABLE CLAYEY MATERIAL (KEYED IN 500mm MINIMUM).
8. 150mm OF TOPSOIL TO BE SPREAD ON EXTERNAL EMBANKMENTS AND CREST UPON COMPLETION OF BULK EARTHWORKS.
9. THE FREQUENCY OF MATERIAL TESTING SHALL BE AS OUTLINED ON DRAWING No RU050500-PRS-IR-CNA-07.

Date	Issue	Amendment	Init	App
11/01/17	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION – DA422-E003-16 – REQUEST FOR INFORMATION

Drawing Title
SEDIMENTATION BASIN – WASTEWATER LAGOON TYPICAL SECTION

Scales	1= 150 (A1) 1= 300 (A3)		
Drawn	RJD	Date	11/01/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-IR-WLXS-06	A

GENERAL NOTES:

1. THE CONTRACTOR SHALL MAKE HIMSELF FAMILIAR WITH THE SA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE (DPTI) CONDITIONS OF CONSENT REGARDING CONSTRUCTION / OPERATION OF THE PROPOSED WORKS AND SHALL COMPLY WITH THESE CONDITIONS.
2. LEVELS AND GRADIENTS AT JUNCTIONS TO EXISTING WORKS AS SHOWN ARE INDICATIVE AND SHALL VARY AS REQUIRED TO ACHIEVE A SATISFACTORY TRANSITION.
3. THE CONTRACTOR SHALL OBTAIN THE LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY EXCAVATION.
4. THE CONTRACTOR SHALL COORDINATE THE WORKS WITH THE RELEVANT AUTHORITIES AND SHALL BE RESPONSIBLE FOR REINSTATING ANY EXISTING SERVICES WHICH BECOME UNCOVERED OR DAMAGED DURING THE CONSTRUCTION PERIOD.
5. ANY ALTERATIONS REQUIRED TO EXISTING SERVICES TO BE CARRIED OUT AS DIRECTED BY THE SUPERINTENDENT.
6. ALL DESIGN LEVELS SHOWN ON DRAWINGS ARE FINISHED SURFACE LEVELS.
7. ALL LEVELS ARE SHOWN IN METRES TO AHD.
8. BENCHMARKS - REFER MOSEL STEED DRAWING C0951E12.2
9. ALL CONSTRUCTION SHALL COMPLY WITH THE RELEVANT STANDARD SPECIFICATIONS, DRAWINGS AND BY-LAWS OF THE RELEVANT AUTHORITIES AND RELEVANT AUSTRALIAN STANDARDS. THIS INCLUDES, BUT IS NOT LIMITED TO, REGIONAL COUNCIL OF GOYDER (RCG), SA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE AND TRANSPORT (DPTI), BUILDING CODE OF AUSTRALIA (BCA) AND SA ENVIRONMENT PROTECTION AUTHORITY (EPA).
10. EARTHWORKS SHALL BE COMPLETED IN ACCORDANCE WITH AS3798 (REFER ALSO TO BULK EARTHWORKS NOTES).
11. THE CONTRACTOR SHALL CHECK ALL INFORMATION AND DIMENSIONS SHOWN ON CONSTRUCTION DRAWINGS, ON SITE, PRIOR TO COMMENCEMENT OF WORKS.

SETOUT NOTES:

1. ALL SETOUT MUST RELATE TO PERMANENT ONSITE BENCHMARKS.
2. ALL SETOUT POINTS (UNLESS IDENTIFIED AS OFFSETS) REPRESENT FINISHED DESIGN SURFACES.
3. COMPACT THE REPLACEMENT MATERIAL IN ACCORDANCE WITH THE BULK EARTHWORKS NOTES.
4. EXCAVATED MATERIAL UNSUITABLE FOR REUSE SHALL BE DEPOSITED IN AN AREA NOMINATED BY THE SUPERINTENDENT.

PEN, DRAIN AND ROADWAY NOTES:

1. CLEAR ALL PROPOSED PEN, DRAIN AND ROADWAY AREAS AND REMOVE VEGETATION AND TOPSOIL IN ACCORDANCE WITH BULK EARTHWORKS NOTES.
2. THE CONTRACTOR SHALL MAKE HIMSELF FAMILIAR WITH THE SA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE (DPTI) AND SA ENVIRONMENT PROTECTION AUTHORITY (EPA) CONDITIONS OF CONSENT REGARDING CONSTRUCTION / OPERATION OF THE PROPOSED WORKS AND SHALL COMPLY WITH THESE CONDITIONS.
3. LEVELS AND GRADIENTS AT JUNCTIONS TO EXISTING WORKS AS SHOWN ARE INDICATIVE AND SHALL VARY AS REQUIRED TO ACHIEVE A SATISFACTORY TRANSITION.
4. THE CONTRACTOR SHALL OBTAIN THE LOCATIONS OF ALL EXISTING SERVICES PRIOR TO ANY EXCAVATION.
5. THE CONTRACTOR SHALL COORDINATE THE WORKS WITH THE RELEVANT AUTHORITIES AND SHALL BE RESPONSIBLE FOR REINSTATING ANY EXISTING SERVICES WHICH BECOME UNCOVERED OR DAMAGED DURING THE CONSTRUCTION PERIOD.
6. ANY ALTERATIONS REQUIRED TO EXISTING SERVICES TO BE CARRIED OUT AS DIRECTED BY THE SUPERINTENDENT.
7. ALL DESIGN LEVELS SHOWN ON DRAWINGS ARE FINISHED SURFACE LEVELS.
8. ALL LEVELS ARE SHOWN IN METRES TO AHD.
9. BENCHMARKS - REFER GENERAL NOTES.
10. ALL CONSTRUCTION SHALL COMPLY WITH THE RELEVANT STANDARD SPECIFICATIONS, DRAWINGS AND BY-LAWS OF THE RELEVANT AUTHORITIES AND RELEVANT AUSTRALIAN STANDARDS. THIS INCLUDES, BUT IS NOT LIMITED TO, REGIONAL COUNCIL OF GOYDER (RCG), SA DEPARTMENT OF PLANNING, TRANSPORT AND INFRASTRUCTURE (DPTI), BUILDING CODE OF AUSTRALIA (BCA) AND SA ENVIRONMENT PROTECTION AUTHORITY (SA).
11. EARTHWORKS SHALL BE COMPLETED IN ACCORDANCE WITH AS3798 (REFER ALSO TO BULK EARTHWORKS NOTES).
12. THE CONTRACTOR SHALL CHECK ALL INFORMATION AND DIMENSIONS SHOWN ON THESE DRAWINGS, ON SITE, PRIOR TO COMMENCEMENT OF WORKS.

EROSION AND SEDIMENT CONTROL NOTES:

1. DIVERSION DRAINS AND SEDIMENT PONDS, AS NECESSARY, SHALL BE INSTALLED ONSITE PRIOR TO COMMENCEMENT OF ANY WORKS.
2. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AFTER EACH RUNOFF PRODUCING RAINFALL EVENT.

BULK EARTHWORKS NOTES:

1. REMOVE ALL TOPSOIL, VEGETATION AND DELETERIOUS MATERIAL.
2. THE TOP 100mm (TOPSOIL) FROM EXISTING SURFACE OVER PROPOSED SITE TO BE STRIPPED AND STOCKPILED IN ACCORDANCE WITH THE DRAWINGS AND AS DIRECTED BY THE SUPERINTENDENT.
3. TOPSOIL SUITABLE FOR REUSE IS TO BE STOCKPILED ONSITE IN A LOCATION AGREED TO BY THE SUPERINTENDENT.
4. OTHER MATERIAL SUITABLE FOR REUSE (e.g CLAY etc) IS TO BE STOCKPILED ONSITE IN A LOCATION AS DIRECTED BY THE SUPERINTENDENT.
5. THE CONTRACTOR SHALL REMOVE MATERIAL WHICH IS UNSUITABLE FOR COMPACTION AND REPLACE WITH SUITABLE MATERIAL FOUND ONSITE.
6. COMPACT THE REPLACEMENT MATERIAL TO 98% RDD (STANDARD COMPACTION) WITHIN ±2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1.
7. SUBGRADE TO BE RIPPED TO A DEPTH OF 150mm, MOISTURE ADDED AS REQUIRED AND COMPACTED TO 98% RDD (STANDARD COMPACTION) WITHIN ±2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1.
5. FILL MATERIAL TO BE PLACED IN MAXIMUM 150mm LAYERS, MOISTURE ADDED AS REQUIRED AND COMPACTED TO 98% RDD (STANDARD COMPACTION) WITHIN ±2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1.
6. EXCAVATED MATERIAL UNSUITABLE FOR REUSE SHALL BE DEPOSITED IN THE STOCKPILE AREA NOMINATED BY THE SUPERINTENDENT.
7. ALL EARTHWORKS VOLUMES ARE SOLID AND DO NOT ALLOW FOR COMPACTION, BULKING OR LOSSES.
8. ALL EARTHWORKS ARE DESIGNED TO STRIPPED SURFACE (UNLESS OTHERWISE NOTED). STRIPPED SURFACE IS 50mm LOWER THAN THE SURVEYED NATURAL SURFACE AND IS REPRESENTED ON ALL DRAWINGS ASSUMING A TOPSOIL STRIP OF 100mm. NATURAL SURFACE IS NOT SHOWN IN THESE DRAWINGS WITH RESPECT TO DESIGN SURFACES (UNLESS OTHERWISE NOTED).
9. THE CONTRACTOR SHALL COMPLY WITH SA DEPARTMENT PLANNING, TRANSPORT AND INFRASTRUCTURE (DPTI) CONDITIONS OF CONSENT REGARDING EARTHWORKS. THE CONTRACTOR SHALL ENSURE THAT THE PROPOSED EARTHWORKS WILL NOT CAUSE EROSION OR SEDIMENT DEPOSITS WITHIN OR ADJACENT TO THE SITE.
10. TOPSOIL TO BE SPREAD ON BATTERS TO RAISE LEVEL TO PEN SURFACE AS REQUIRED.

PEN AND ROADWAY SUBGRADE AND PAVEMENT NOTES:

1. REMOVE ALL TOPSOIL, VEGETATION AND DELETERIOUS MATERIAL IN ACCORDANCE WITH BULK EARTHWORKS NOTES.
2. PROOF ROLL SUBGRADE TO DETECT ANY SOFT SPOTS. SOFT SPOTS SHALL BE REMOVED AND BACKFILLED WITH APPROVED SUBGRADE MATERIAL.
3. FILL TO BE PLACED IN MAXIMUM 150mm LAYERS, MOISTURE ADDED AS REQUIRED AND COMPACTED TO 98% RDD (STANDARD COMPACTION) WITHIN ±2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1.
4. BULK EARTHWORKS FOR PENS AND CATCH DRAINS IS TO FINISH 200mm BELOW THE FINISHED SURFACE LEVELS.
5. BULK EARTHWORKS FOR FEED ROADS IS TO FINISH 300mm BELOW THE FINISHED SURFACE LEVELS .
6. GRAVEL PAVEMENT COURSES TO BE PLACED AT OPTIMUM MOISTURE CONTENT AND COMPACTED TO 98% RDD STANDARD COMPACTION IN ACCORDANCE WITH AS1289.5.1.1.
7. ALL PROPOSED PEN AND DRAIN AREAS TO BE FINISHED WITH 300mm COMPACTED THICKNESS OF SELECT CLAY AND CLAY/GRAVEL MATERIAL SUPPLIED FROM SITE WON MATERIAL.
8. ALL PROPOSED ROADWAY AREAS TO BE FINISHED WITH 300mm COMPACTED THICKNESS OF SELECT GRAVEL MATERIAL SUPPLIED FROM SITE WON MATERIAL.
9. PENS, DRAINS AND ROADWAYS ARE TO BE EXCAVATED / FILLED AND TRIMMED AS REQUIRED TO ACHIEVE A CONSTANT GRADIENT AS DEFINED BY THE PROPOSED FINISHED SURFACE LEVELS SHOWN ON DRAWINGS AND THE RELEVANT SECTIONS / DETAILS.
10. EXISTING ROADWAYS ARE TO BE BUILTUP / TRIMMED AS REQUIRED TO ACHIEVE A SATISFACTORY TRANSITION BETWEEN EXISTING FEEDLOT INFRASTRUCTURE AREAS (e.g. PRODUCTION PEN/CATTLE HANDLING/WEIGHBRIDGE/FEEDMILL) AND NEW WORK.
11. GEOTECHNICAL TESTING HAS NOT BEEN CARRIED OUT ONSITE TO DATE AND SHOULD BE UNDERTAKEN PRIOR TO COMMENCEMENT OF WORKS.

SOLID WASTE STORAGE AREA EARTHWORKS:

1. REMOVE ALL TOPSOIL, VEGETATION AND DELETERIOUS MATERIAL IN ACCORDANCE WITH BULK EARTHWORKS NOTES.
2. SUBGRADE PREPARATION IN ACCORDANCE WITH THE BULK EARTHWORK NOTES.
3. IN-SITU CLAY MATERIAL SUITABLE FOR LINING 98% RDD (STANDARD COMPACTION) WITHIN 0% TO +2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1 OR MINIMUM 300mm COMPACTED CLAY LINER (98% RDD 0% TO +2% OMC) ON BED.

CATTLE LANES (NOT ADJOINING PENS) NOTES:

1. REMOVE ALL TOPSOIL, VEGETATION AND DELETERIOUS MATERIAL IN ACCORDANCE WITH BULK EARTHWORKS NOTES.
2. PROOF ROLL SUBGRADE TO DETECT ANY SOFT SPOTS. SOFT SPOTS SHALL BE REMOVED AND BACKFILLED WITH APPROVED SUBGRADE MATERIAL.
3. FILL TO BE PLACED IN MAXIMUM 150mm LAYERS, MOISTURE ADDED AS REQUIRED AND COMPACTED TO 98% RDD (STANDARD COMPACTION) WITHIN ±2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1.
4. ALL PROPOSED CATTLE LANES (NOT ADJOINING PENS OR THAT ARE ALSO DRAINS) TO BE FINISHED WITH 200mm COMPACTED THICKNESS OF SELECT CLAY/GRAVEL MATERIAL SUPPLIED FROM SITE WON MATERIAL.
5. GRAVEL PAVEMENT COURSES TO BE PLACED AT OPTIMUM MOISTURE CONTENT AND COMPACTED TO 98% RDD STANDARD COMPACTION IN ACCORDANCE WITH AS1289.5.1.1.
6. ALL CATTLE LANES ARE TO BE EXCAVATED / FILLED AND TRIMMED AS REQUIRED TO ACHIEVE A CONSTANT GRADIENT AS DEFINED BY THE NATURAL SURFACE AND TIE IN TO CATTLE LANES ADJOINING PENS.

SEDIMENTATION BASIN AND STORAGE LAGOON EARTHWORKS:

1. THE TOP 100mm FROM THE EXISTING SURFACE OVER PROPOSED SEDIMENTATION / STORAGE LAGOON TO BE STRIPPED AND STOCKPILED ONSITE AND REUSED AS COVER FOR EMBANKMENTS AS DIRECTED BY SUPERINTENDENT.
2. THE CONTRACTOR SHALL REMOVE MATERIAL WHICH IS UNSUITABLE FOR COMPACTION AND REPLACE WITH SUITABLE MATERIAL FOUND ONSITE.
3. COMPACT THE REPLACEMENT MATERIAL IN ACCORDANCE WITH THE BULK EARTHWORKS NOTES.
4. SUBGRADE PREPARATION IN ACCORDANCE WITH THE BULK EARTHWORK NOTES.
5. SEDIMENTATION BASIN IN-SITU CLAY MATERIAL SUITABLE FOR LINING 98% RDD (STANDARD COMPACTION) WITHIN 0% TO +2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1 OR MINIMUM 300mm COMPACTED CLAY LINER (98% RDD 0% TO +2% OMC) ON EMBANKMENTS AND BED.
8. STORAGE LAGOON IN-SITU CLAY MATERIAL SUITABLE FOR LINING 98% RDD (STANDARD COMPACTION) WITHIN 0% TO +2% OF OPTIMUM MOISTURE CONTENT (OMC) IN ACCORDANCE WITH AS1289.5.1.1 OR MINIMUM 450mm COMPACTED CLAY LINER (98% RDD 0% TO +2% OMC) ON EMBANKMENTS AND BED

CLAY LINING NOTES:

1. MATERIAL SUITABLE FOR CLAY LINING:
   - 1.1. CLASSIFIED AS CL, CL, CH, SC OR GC IN ACCORDANCE WITH AS1726.
   - 1.2. PERCENTAGE FINES - MORE THAN 25% PASSING 75um
     MORE THAN 25% PASSING 2um
   - 1.3. PLASTICITY INDEX > 10%
   - 1.4. LIQUID LIMIT - 30-60%
2. PERMEABILITY < 1 X 10^{-9} m/s.

SAMPLING OF MATERIAL:

1. EARTHWORKS, SELECTED BACKFILL AND SELECTED FILL SHALL BE TESTED IN ACCORDANCE WITH THE FOLLOWING AUSTRALIAN STANDARDS:
   - 1.1. AS1289.1.1-2001 — PREPARATION OF DISTURBED SOIL SAMPLES FOR TESTING
   - 1.2. AS1289.2.1.1-2005 — DETERMINATION OF MOISTURE CONTENT OS SOIL - OVEN DRYING METHOD (STANDARD METHOD)
   - 1.3. AS1289.3.4.1-2008 — DETERMINATION OF LINEAR SHRINKAGE OF A SOIL
   - 1.4. AS1289.3.6.1-2009 — PARTICLE SIZE DISTRIBUTION (STANDARD METHOD)
   - 1.5. AS1289.5.1.1-2003 — DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATION (STANDARD COMPACTION)
   - 1.6. AS1289.5.3.1-2004 — FIELD DENSITY- SAND REPLACEMENT METHOD
   - 1.7. AS1289.5.4.1-2007 — COMPACTION CONTROL TEST - DETERMINATION OF DRY DENSITY RATIO
   - 1.8. AS1289.6.1.1-2014 — DETERMINATION OF CBR - STANDARD METHOD FOR REMOULDED SPECIMEN
   - 1.9. AS1289.7.1.1-2003 — SHRINKAGE INDEX OF A SOIL - SHRINK-SWELL INDEX
2. THE FREQUENCY OF TESTING SHALL BE:
   - 2.1. DETERMINATION OF THE DRY DENSITY RATIO
     - 2.1.1. SUBGRADE: ONE TEST PER 10,000 m^2 OF COMPACTED MATERIAL, WITH A MINIMUM OF TEN TESTS.
     - 2.1.2. PEN SELECTED BACKFILL AND SELECTED FILL: ONE TEST PER 7,500 m^3 OF COMPACTED MATERIAL, WITH A MINIMUM OF TEN TESTS.
     - 2.1.3. CLAY CORE/CUT-OFF TRENCH: ONE TEST PER 150m^3, WITH A MINIMUM OF SEVEN TESTS.
     - 2.1.4. STORAGE LAGOON EMBANKMENT FILL: ONE TEST PER 2,500 m^3, WITH A MINIMUM OF SEVEN TESTS.
     - 2.1.5. GRAVEL PAVEMENT: ONE TEST PER 1,000 m^3 WITH A MINIMUM OF TEN TESTS.
     - 2.1.6. CLAY LINING: ONE TEST PER 2,500 m^3, WITH A MINIMUM OF SEVEN TESTS.

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Chng	Issue	Amendment	Init	App
24/03/17	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS RDYAL STATION - DA422-E003-16 - REQUEST FOR INFORMATION

Drawing Title
NOTES AND DETAILS GENERAL / BULK EARTHWORK / PEN, DRAINS, ROADS/ SEDIMENTATION BASIN/ STORAGE LAGOON

Scales	AS SHOWN		
Drawn	RJD	Date	24/03/2017
Approved	BJO	Designed	RJD
Datum	NA	Zone	NA
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-IR-CNA-07	Issue	A

5. **Clarify whether wastewater irrigation would occur on the subject site. If so, demonstrate that irrigation would occur having regard to the EPA's Wastewater irrigation management plan guidelines (2009)**.

The Mediterranean climate of the region results in winter dominant annual rainfall of about 456 mm/year and an annual average evaporation 1700 mm. Subsequently, the site has a rainfall deficit of about 1244 mm/year.

Irrigated cropping is currently not undertaken on the subject site as it is not possible to reliably grow crops and improved pastures due to the lack of available irrigation water. It is expected that no irrigation of effluent will be undertaken on the subject site with the expanded development.

Therefore the effluent, the majority of which is derived from the winter rainfall, needs to be stored until it can be utilised safely.

In a below-average rainfall year all the stormwater runoff generated from the existing feedlot is used for dust suppression (access roads, feed roads), construction water (pen repairs and maintenance) and landscaping (tree races, grassed areas) during summer months. The existing wastewater lagoon is dry for pro-longed periods.

In an average rainfall year all the stormwater runoff generated from the existing feedlot is utilised by dust suppression (access roads, feed roads), construction water (pen repairs and maintenance) and landscaping (tree races, grassed areas) during summer months with any remaining effluent evaporated.

The expanded development includes the construction of new feed roads. Subsequently, all the stormwater runoff generated from the expanded development is expected to be utilised through dust suppression (feed roads), construction water (pen repairs and maintenance) during summer months with any remaining effluent evaporated. Effluent may also be treated and recycled through the cattle wash facility as soaking water and/or yard washing water.

2.4 Manure and mortality composting

6. **Advise how many tonnes of compost (i.e. the total of manure and carcasses would be produced each year.**

The proposed development shall generate solid waste comprising manure scraped from pens, composted mortalities, waste feed (spillage and spoilage), settled solids from the sedimentation basins and sludge from the wastewater lagoons. Manure scraped from pens is the largest of the solid wastes generated.

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. McGahan and Tucker (2003) report typical excretion rates 1-1.2 t DM/head/year.

McGahan and Tucker (2003) recommend using a mass balance approach to estimate the quality and quantity of solid waste generated by beef cattle feedlots. One such method is the predictive model known as BEEFBAL (QPIF 2004). BEEFBAL can be used to estimate waste characteristics from a beef cattle feedlot. 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.

Feed digestibility improvements in beef cattle feedlots using secondary processing, such as steam flaking, have enhanced feed digestibility and potentially reduced manure production since the time of the McGahan and Tucker (2003) study.

BEEFBAL_V9.1_TI (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 volatile solids in the excreted manure quickly decomposes 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.

BEEFBAL was used to estimate the weight and nutrient content for solid waste from the proposed development. Input data for BEEFBAL was taken from herd data, quantity fed and feed ingredients respectively (Table 22, Table 23 and Table 24 of the Development Application – Proposed Beef Cattle Feedlot Expansion report). The estimated solid waste generated from the proposed development is shown in Table 3 and Table 6. The BEEFBAL inputs and outputs for the scenarios modelled are provided in Appendix A.

The mass-balance model estimates manure excretion on a daily basis based on feed intake. Subsequently, any ration that is spilt or spoilt as a result of environmental conditions (e.g. rainfall) and is not consumed by the animals (and subsequently ends up in the pen with manure) is accounted for in the daily intake in the mass balance calculations. Further, the mass of spilt or spoilt feed is expected to be negligible compared to the volume of manure generated.

Similarly, any settled solids and sludge that is generated in the sedimentation basin and wastewater lagoon originates from excreted manure. The mass-balance model allows partitioning of excreted manure into that remaining on the pad and that exported to the sedimentation basin / wastewater lagoon (and accumulating as sludge). The mass-balance modelling assumes that no manure is exported off the pad. Subsequently, settled solids and sludge that have accumulated in the

sedimentation basin and/or wastewater lagoon has already been accounted for in the manure excreted component of the mass-balance.

In reality, some sediment shall be suspended in the liquid effluent and settle as sludge in the wastewater lagoon.

Table 3 – Estimated solid waste generated CDA 1 (Manure)

Parameter	Units	Mass	
		t/day	t/year
Fresh manure excreted	Dry mass	8.9	3,290
	Wet mass @85%MC	59.6	21,930
Scraped from pad	Dry mass*	-	1,645
	Wet mass @50%MC	-	3,290
Removed from stockpile	Dry mass	-	1,645
	Wet mass @35%MC	-	2,531

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

Table 4 – Estimated solid waste generated CDA 2 (Manure)

Parameter	Units	Mass	
		t/day	t/year
Fresh manure excreted	Dry mass	11.4	4,180
	Wet mass @85%MC	75.7	27,870
Scraped from pad	Dry mass*	-	2,090
	Wet mass @50%MC	-	4,180
Removed from stockpile	Dry mass	-	2,090
	Wet mass @35%MC	-	3,216

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

BEEFBAL estimates the mass of mortalities and the dry matter of composted mortalities has been estimated based on an average carcass moisture content of 60% (Michell et al, 1989). Table 6 the estimated mass of mortalities generated in the proposed development.

Table 5 – Estimated solid waste generated CDA 1 (Mortalities)

Parameter	Units	Mass	
		t/day	t/year
Mortalities	Dry mass	0.10	25
	Wet mass @60%MC*	0.17	62
Removed from stockpile	Dry mass	-	25
	Wet mass @35%MC	-	38

*The fluid content, including water, comprise an average of 60% of the total body weight of a beef animal (Michell et al., 1989).

Table 6 – Estimated solid waste generated CDA 2 (Mortalities)

Parameter	Units	Mass	
		t/day	t/year
Mortalities	Dry mass	0.13	32
	Wet mass @60%MC*	0.22	79
Removed from stockpile	Dry mass	-	32
	Wet mass @35%MC	-	49

*The fluid content, including water, comprise an average of 60% of the total body weight of a beef animal (Michell et al., 1989).

The total estimated solid waste available for utilisation from the proposed development (9,083 SCU) is shown in Table 7.

Table 7 – Estimated solid waste available for utilisation

Parameter	Units	Source	
		Manure/Feed/Sludge	Mortalities
Dry Mass	t/year	3,735	57
Wet Mass @35%MC	t/year	5,746	87

7. **Demonstrate that the existing feedlot solid waste storage and processing area has adequate capacity to store and process the additional manure and mortalities that would be generated by the expanded feedlot.**

Stockpiling of solid wastes from the existing feedlot is undertaken in open windrows up to 3 m high rather than in large piles. The existing feedlot solid waste storage and processing area is approximately 240 m in length and 67 m wide, giving an area of about 16,000 m^2.

The existing feedlot solid waste storage and processing area does not have adequate capacity to store and process all the additional solid waste that would be generated by the expanded feedlot.

Subsequently, each controlled drainage area of the expanded development shall have a dedicated solid waste storage and processing area. The controlled drainage area of each development site has been amended to include this area. The sedimentation basin and storage lagoon capacity have been amended to reflect the additional hard area included in the controlled drainage area.

The storage, processing and/or composting of solid wastes shall be undertaken on a suitably designed and constructed area within CDA 1 and CDA 2 respectively. The main design criteria include:

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

The solid waste storage and carcass composting area shall be constructed using the specifications outlined in Figure 7. Figure 16 and Figure 17 shows the location of the solid waste storage and carcass composting area within CDA 1 and CDA 2 respectively.

The solid waste storage area shall have a floor slope of 1-3% to ensure drainage. The solid waste storage area was sized 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 2 horizontal batters (1V:2H) and no higher than 3 m and a bulk density of solid waste of about 0.6 t/m^3.

Based on a scraped manure moisture content of 50%, this translates into some 3,290t and 4,180 t of wet scraped manure per year from CDA 1 and CDA 2 respectively. With the assumed windrow dimensions some 7,000 m^2 and 9,000 m^2 of pad area is required to store and process harvested manure from CDA 1 and CDA 2 respectively. Allowing additional space for carcass composting and solid waste processing equipment, screening etc, the solid waste storage and carcass composting area shall encompass an area of some 8,000 m^2 (0.8 ha) for CDA 1 and 9,000 m^2 (0.9 ha) for CDA 2.

8. **Demonstrate that the existing feedlot solid waste storage and processing area is designed and constructed having regard to the EPA's Compost Guideline (2013).**

2.4.1 Siting of compost works

The existing feedlot solid waste storage and processing area is located in the north-west of the existing development. The area receives solid waste (manure, mortalities, spoilt feed etc) from the existing development.

The EPA recommends that the operation of composting facilities is avoided in the following locations:

- 1,000 m to land that is for sensitive use.
  - Sensitive use as defined in section 3(1) of the *Environment Protection Act 1993*, sensitive use means –
    a) use for residential purposes; or
    b) use for a pre-school within the meaning of the *Development Regulations 1993;* or
    c) use for a primary school; or
    d) use of a kind prescribed by regulation.

- Within the floodplain known as the '1956 River Murray Floodplain' or any floodplain subject to flooding that occurs, on average, more than one in every 100 years

- Within the Mount Lofty Ranges Water Protection Area and the South East Water Protection Area as declared under Part 8 of the EP Act

- Within 100 m of a bank of a major watercourse (eg Murray, Torrens and Onkaparinga Rivers), or within 500 m of a high-water mark.

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

ostwald BROS

Date	Issue	Amendment	Init	App
24/03/17	A	ISSUE FOR REVIEW	RJD	BJO

OSTWALD BROS PTY LTD

Phone: 1300 678 925
Fax: (07) 4669 9450
Email: info@ostwaldbros.com.au
Web: www.ostwaldbros.com.au

Project
PRINCESS ROYAL STATION – DA422-E003-16 – REQUEST FOR INFORMATION

Drawing Title
SOLID WASTE PROCESSING AREA – EXISTING DEVELOPMENT

Scales	1= 1,200 (A1) 1= 2,400 (A3)		
Drawn	RJD	Date	24/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

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

The existing feedlot solid waste storage and processing area is located over 1000 m from land that is for sensitive use. The closest sensitive use is a rural residence located some 2,785 m west of the existing feedlot solid waste storage and processing area as shown in Figure 3.

The existing feedlot solid waste storage and processing area is not located on a floodplain. The existing feedlot solid waste storage and processing area is sited in the upper catchment some 200m above the elevation of Booborowie Creek and therefore is not subject to flooding.

The existing feedlot solid waste storage and processing area is located at Mt Bryan over 90 km from the closest point of the '1956 River Murray Floodplain' at Morgan as shown in Figure 9.

The existing feedlot solid waste storage and processing area is not located within the Mount Lofty Ranges Water Protection Area and the South East Water Protection Area as declared under Part 8 of the EP Act as shown in Figure 10.

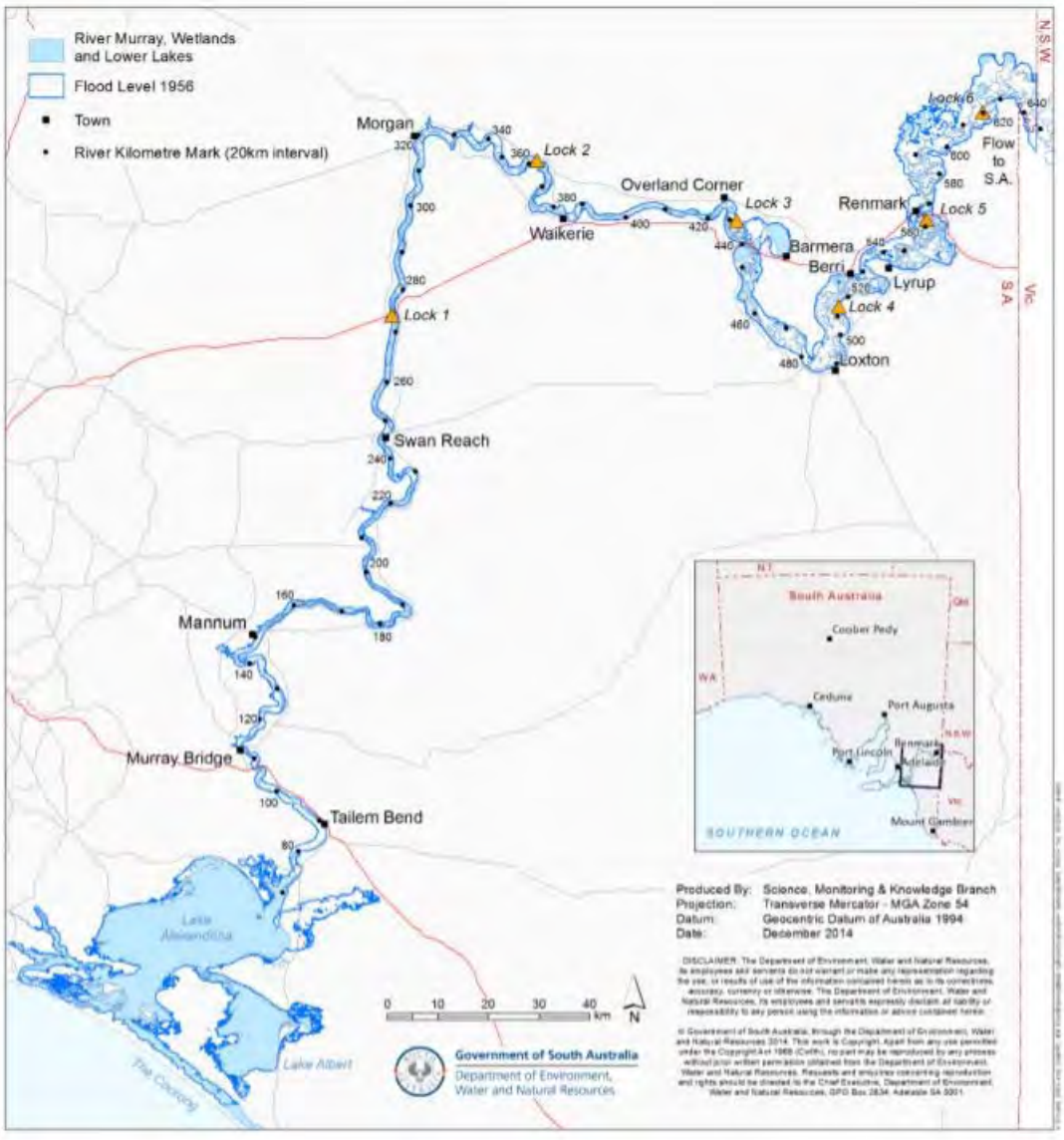
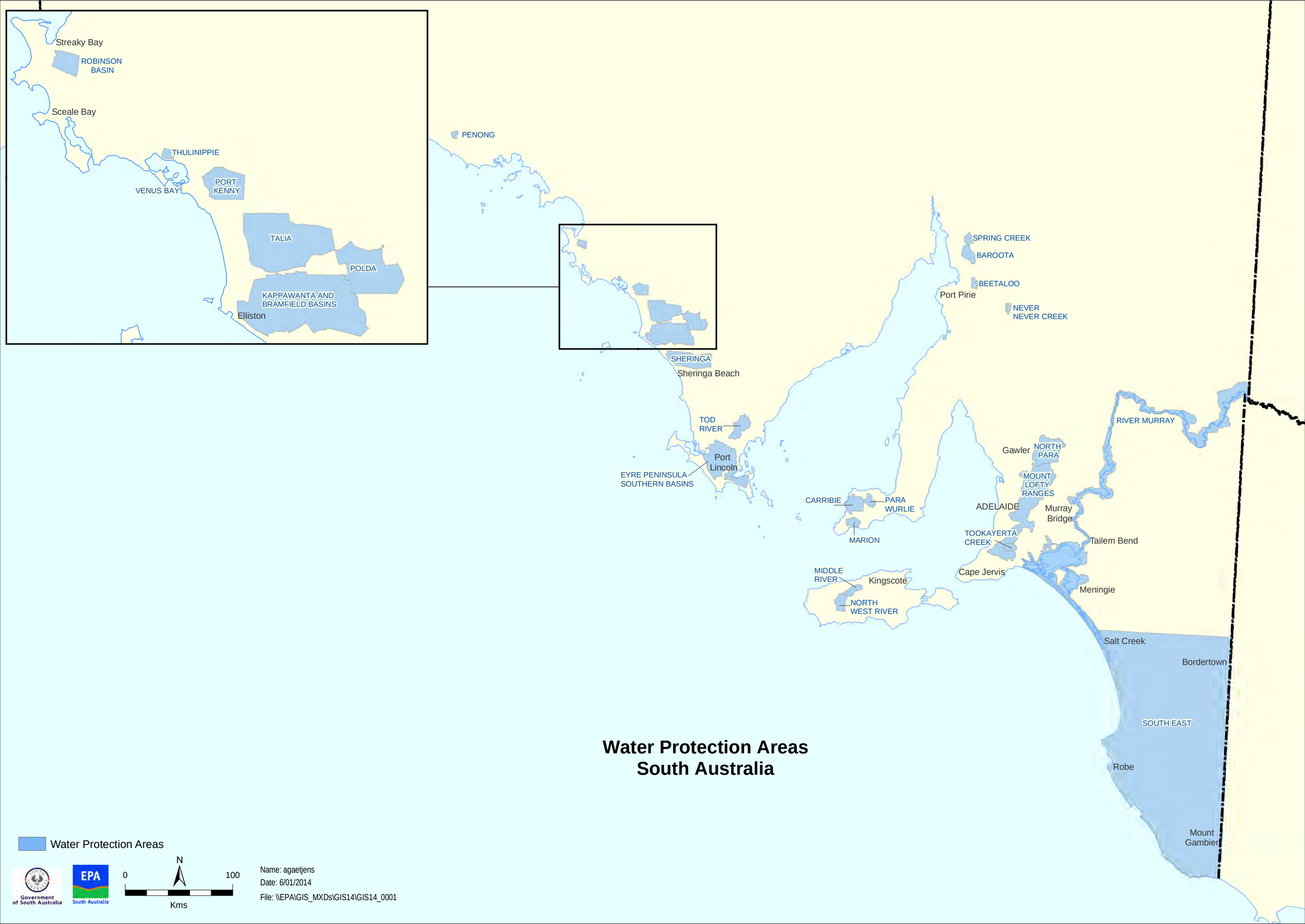


Figure 9 – '1956 River Murray Floodplain' (Bloss et al 2015)



Water Protection Areas
South Australia

The existing solid waste storage and processing area is located at Mt Bryan and not within 100 m of a bank of a major watercourse (e.g. Murray, Torrens and Onkaparinga Rivers), or within 500 m of a high-water mark as demonstrated in Figure 9 and Figure 10.

Subsequently, the existing solid waste storage and processing area satisfies the EPA's Compost Guideline (2013) for siting of compost works.

2.4.2 Design of composting facilities

The existing solid waste storage and processing area is located within a dedicated area within the controlled drainage area of the existing feedlot as shown in Figure 8. All solid waste is stockpiled in open windrows within this area. As composting of carcasses is undertaken using manure no additional feedstocks are required for composting.

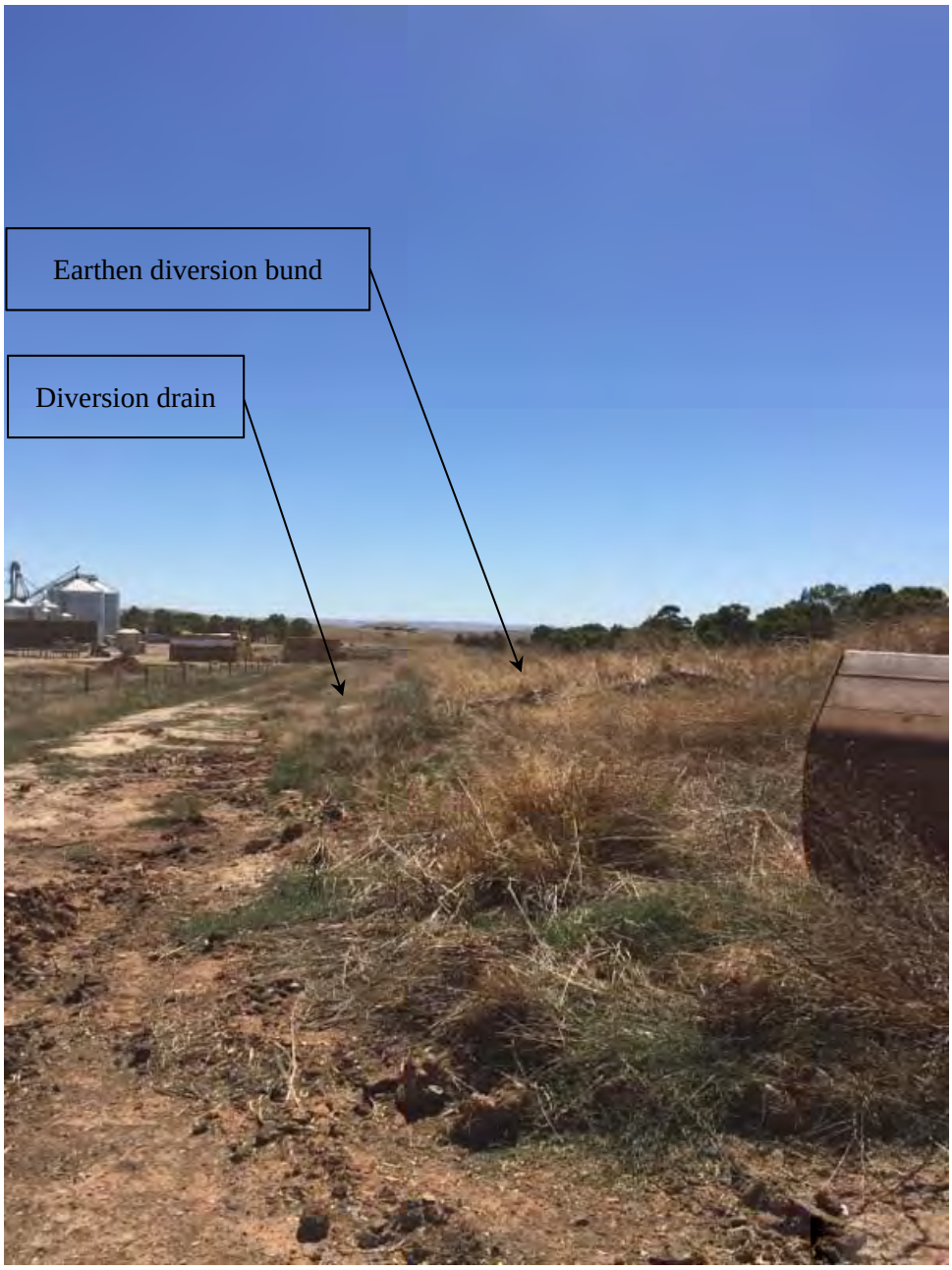
The existing solid waste storage and processing area has been constructed with a 4% downgrade that directs stormwater runoff and leachate from the area to the existing sedimentation basin and wastewater lagoon that services the existing development.

The existing solid waste storage and processing area has been constructed on a low permeability clay liner with a minimum thickness of 300 mm as recommended by Rural Solutions SA report dated 28th June 2007. The subsoil at the site of the existing solid waste storage and processing area is clay. Testing by the Geotechnical Laboratory of AS James Bear at Kapunda indicated that its suitability for a low permeability clay lining. The material met the standard described in the Reference Manual for the Establishment and Operation of Beef Cattle Feedlots in Queensland; Appendix E, Clay lining of drains, sedimentation systems, holding ponds and manure stockpile areas.

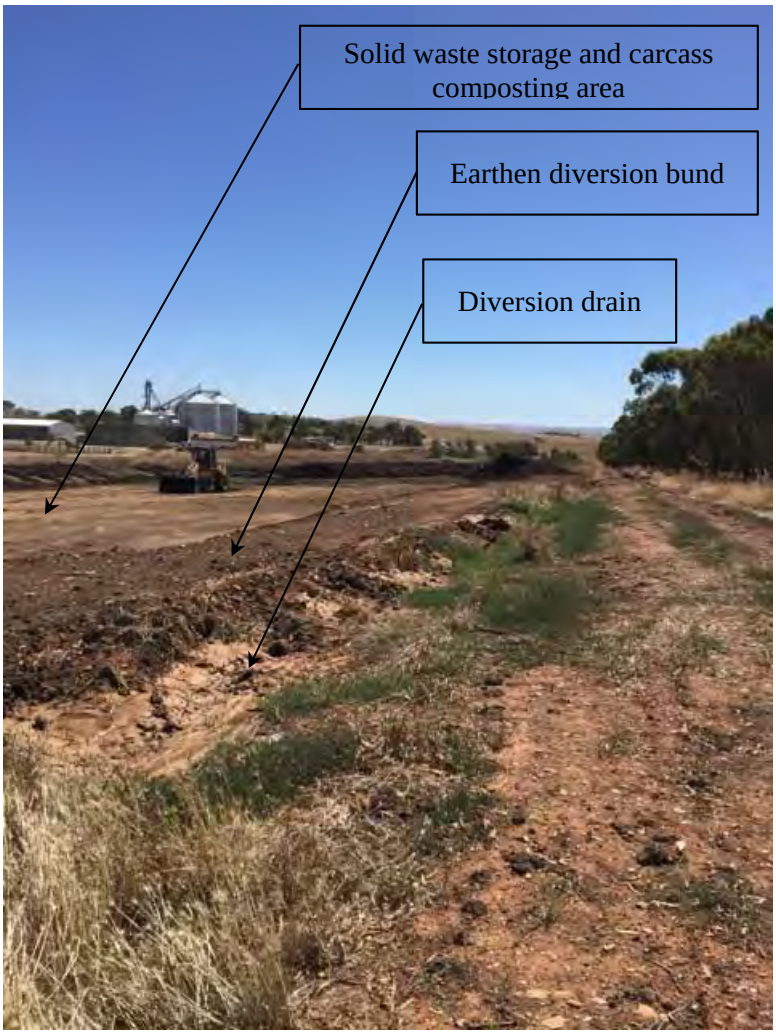
Clean stormwater is prevented from entering the existing solid waste storage and processing area by earthen diversion bunds on the northern, eastern and southern sides of area. An access road is constructed along the top of the earthen diversion bund on the eastern side of the area. The earthen diversion bund along the northern and southern sides is shown in Photograph 1 and Photograph 2 respectively.

Stormwater runoff and leachate from the solid waste storage and processing area is directed to the existing sedimentation basin and wastewater lagoon that services the existing development.

The sedimentation basin and wastewater lagoon have been sized to hold a 1:20 year high winter rainfall and 1 in 100 year 1 hour storm event (34.9 mm/hr) above the high winter rainfall storage level from the existing feedlot's controlled drainage area which includes the area on which the existing solid waste storage and processing is located.



Photograph 1 – Existing solid waste storage and processing area diversion bund (Southern wall)



Photograph 2 – Existing solid waste storage and processing area diversion bund (Northern wall)

Wallbridge & Gilbert (Consulting Engineers, Adelaide) conducted a practical completion inspection of the constructed development in August 2011 and confirmed that the civil works undertaken on-site are consistent with the design intent of the civil works drawings, the details contained in the Rural Solutions SA report dated 28th June 2007 and subsequent condition of the development approval.

A copy of the Wallbridge & Gilbert practical completion response is provided in Figure 11.

W&G
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adelaide@wgeng.com
www.wallbridgeandgilbert.com.au

5th August 2011

Job No: C090784

Princess Royal Station
PO Box 160
BURRA
South Australia 5417

Attention: Mr Graham Chandler

Dear Neil,

MACKERODE FEEDLOT
PRACTICAL COMPLETION INSPECTION

Further to my inspection undertaken on Tuesday 26th July 2011 in response to issues raised by Mr Tony Sliuzas of the EPA, I can confirm that the works carried out on site are consistent with the design intent of the civil works drawings, the details contained in the Rural Solutions SA report dated 28th June 2007 and the subsequent conditions of the DA conditions.

I note my telephone discussions with Mr Tony Sliuzas of the EPA in regard to the comments in his email dated 22nd June 2011. It is my understanding that the Tony's reference to the sand/gravel covering of the clay liner was more directed towards the pens, rather than the pond itself. As discussed on site, I appreciate that there are issues involved in the cleaning out of the ponds should they be covered with a separate liner. It is recommended that you monitor the performance of the ponds and make any repairs necessary to comply with the DA conditions.

Mosel Browne Surveyors have provided a copy of the as-built survey of the ponds and I can confirm that the volumes of the ponds are consistent with the Rural Solutions SA report.

Please contact the undersigned of this office should you wish to discuss any of these matters further.

Yours faithfully

Colin Hill
for
WALLBRIDGE & GILBERT

cc: Mr Michael Liebelt, Mosel Browne Surveyors 6 Graves St Kadina SA 5554
Mr Tony Sliuzas, EPA via email.

CH:cmk

090784lt001

ABN 90 743 056 456 ACN 052 528 926
W&G Engineers Pty Ltd trading as Wallbridge & Gilbert

Figure 11 – Existing development practical completion

2.5 Hazardous chemical storage

Reference: EPA's Bunding and spill management Guidelines (2012) (the Bunding Guidelines')

9. **With reference to the EPA's Bunding and spill management Guideline (2012), provide details to demonstrate that the proposed bund or spill containment system would appropriately contain hazardous chemicals and leaks.**

The range of hazardous substances that may be stored during the operation of the proposed development were outlined in the Section 7.8.10 of the Development Application. These included;

- agricultural chemicals – herbicides, pesticides, veterinary chemicals etc.
- cleaning agents
- detergents and their byproducts
- engine coolant
- oil, grease, lubricants
- diesel, petrol fuels
- solvents.

No agricultural herbicide chemicals shall be stored at the proposed development site. Herbicides are appropriately stored on another cropping property owned by the applicant in a chemical storage shed. In the event weeds need to be controlled at the proposed development, the required volume of mixed product shall be brought to the site by the cropping team and applied to the area to be treated.

A small volume of veterinary chemicals are stored on-site at the induction/hospital area in climate controlled receptacles. The quantity of veterinary chemicals stored on-site is less than 5L.

All hazardous materials proposed to be stored on-site are liquids and shall be stored above-ground. The quantities of hazardous chemicals shall be kept to a minimum, commensurate with their usage and shelf life. With the exception of diesel fuel, hazardous materials shall be stored in steel drums (205L) or HDPE containers (20L) located in a dedicated secured shipping container facility as shown in Photograph 3.

A shipping container dedicated for storage of small volumes of hazardous materials contained in drums storage is provided on-site and shown in Photograph 3. The shipping container has a floor area of 6m x 2.4m and a small lip (25mm) on the floor at the entrance. The shipping container is sealed on the floor and rear sides. In accordance with the EPA's Bunding and spill management guideline (2012), the bunded area is able to contain at least 25% of the total volume of the stored products as the material to be bunded is contained in drums and other small containers.

Diesel fuel shall be stored in a 15,000L above-ground steel tank. Diesel fuel is currently stored in a 15,000L above-ground steel tank with spill containment system as shown in Photograph 4. No additional diesel storage tanks are proposed for the expanded development.

Table 8 – Storage quantities

Substance	Maximum pack size	Quantity	Use	Storage Option
Agricultural chemicals	-	Nil	Weed control	Off-site
Cleaning agents/detergents	20L	20L	Plant & machinery maintenance	Shipping container
Engine coolant	20L	80L	Plant & machinery maintenance	Shipping container
Oil/grease/lubricants	205L	410L	Plant & machinery maintenance	Shipping container
Diesel	15,000L	15,000	Plant and machinery fuel	Bulk Tank
Petrol	205L	80L	Motorcycle fuel	Shipping Container
Solvents	20L	20L	Plant & machinery maintenance/repairs	Shipping container

As diesel fuel is a combustible liquid (AS1940) and poses a risk to the environment, the storage facility shall have a spill containment system appropriate for the nature and pollution risk of diesel in accordance with relevant guidelines and Australian Standards.

Subsequently, in accordance with EPA's Bunding and spill management guideline (2012), the net capacity of the bunded compound for the diesel storage facility should be at least 120% of the net capacity of the tank or 18,000L.

The existing diesel storage tank is located within a bund with floor and walls constructed of concrete. The bund has an internal floor area of 30.16 m^2 (8m (L) x 3.77m (W)). The bund wall is 600mm high. The capacity of the bund is 18,096 m^3 or 18,096L. Taking into consideration storage tank foundations, the bund has a capacity of 120% of the storage tank within the bund.

The bund floor and walls are constructed of reinforced concrete which is impervious to the contents of the diesel contained in the tank within the bund. The wall is 130 mm thick and provides sufficient strength and structural integrity to ensure that it is unlikely to burst or leak in ordinary use, and does not have a damp course.

Subsequently, the existing bund and spill containment systems would appropriately contain spills and leaks of hazardous substances contained on-site.

Photograph 3 – Hazardous material minor quantity storage

Photograph 4 – Diesel storage tank and bund

2.6 Temporary cattle storage paddock

10. **Provide details about the construction and use of the induction/hospital pen area including, but not limited to:**
    a. **Dimensions**
    b. **Cattle numbers and density**
    c. **Typical length of time cattle would be held in this area**
    d. **Construction of pen flooring**
    e. **Stormwater management, and**
    f. **How adverse impacts would be mitigated.**

The induction/hospital pen area comprises two separate areas within the controlled drainage area of the existing feedlot development.

2.6.1 Induction pen area

The induction pens are located on either side of the processing shed as shown on Figure 8.

There are seven induction pens. The dimension of each pen is provided in Table 9.

Table 9 – Induction/hospital pen dimensions

Pen No	Width	Depth	Area	Pen Density	Pen Type
	m	m	m^2	m^2/head	Induction
1	6-14.4	22.8	300	12.5	Induction
2	14.9	22.8	340	12.5	Induction
3	14.4	22.8	328	12.5	Induction
4	16.2	33.6	544	12.5	Induction
5	16.5	27.4	452	12.5	Induction
6	16.3	21.1	344	12.5	Induction
7	16.2	8.75-15.0	224	12.5	Induction
8	20	55	1100	12.5	Dispatch
9	20	55	1100	12.5	Dispatch
10	20	55	1100	12.5	Dispatch
11	20	55	1100	12.5	Dispatch
12	40	55	2200	12.5	Dispatch
13	40	55	2200	12.5	Dispatch
14	40	55	2200	12.5	Dispatch
15	40	55	2200	12.5	Dispatch
16	40	55	1100	20-25	Hospital

There is no set day for cattle to arrive at the existing development. Typically, cattle arrive in B-Double livestock transport with approximately 70-80 animals per vehicle depending on market type. Cattle are unloaded at the arrival/dispatch facility and placed in two or more induction pens to await processing.

Cattle numbers inducted vary, but on-average around 1500 per month are inducted. Cattle are held for no more than 7 days in the induction pens. The livestock team processes cattle Monday to Friday and the processing facilities are located within the processing shed. The location of the processing shed is shown on Figure 8.

The induction process includes scanning each animals RFID tag, recording age and sex and two site identification tags are given to the animal. Any required vaccinations are given at this stage of the process. The animals are then sent to production pens for growing out.

2.6.2 Dispatch

The first row of 8 production pens (Pens 55 m x 40 m) closest to the processing shed (Pens 8-15) are dispatch pens. Cattle can be held in these pens for approximately 7 to 10 days prior to dispatch.

The location of the dispatch pens are shown on Figure 8.

Cattle dispatched from the existing development for processing vary, but on-average around 1500 per month exit the existing development. Typically, cattle will exit the feedlot Mondays and Tuesdays, but this may also vary.

2.6.3 Hospital pen

Early detection and treatment of ill and injured cattle is critical in optimising welfare and productivity and minimising mortalities. Hospital pens are used to treat and hold sick or injured cattle before they are returned to their production pen or exit from the feedlot.

The hospital pen is located on the end of a row of production pens as shown on Figure 8. The dimension of the hospital pen is provided in Table 9.

The number of cattle held in the hospital pen depends on the number of ill or injured animals. Sick or injured animals are stocked at a lower density in the hospital pen than in production pens. Typically, 50% more pen space is provided for sick cattle in the hospital pens approximately 20-25 m^2/SCU. Further, more feed bunk space is provided for sick cattle in the hospital pen approximately 450-600 mm of bunk space per head than in production pens (250mm/head).

The length of time cattle are held in the hospital pen varies and depends on their illness or injury, treatment program etc. Once animals have recovered from their illness they are returned to the production pens or sent to slaughter as salvage.

2.6.4 Construction of pen flooring and stormwater management

The induction/hospital pen area was constructed at the same time as the production pens, sedimentation basin and wastewater lagoon of the existing development during 2010.

Construction of the processing shed and induction pens commenced in January 201, followed by Pens 8-15 and then the rest of the pens followed.

The existing induction/hospital pen area is located within the controlled drainage area of the existing feedlot as shown on Figure 8. The runoff from the processing shed roof drains into sedimentation basin and wastewater lagoon. The existing induction/hospital pen area has been constructed with suitable crossfall that directs stormwater runoff and leachate from the area to the existing sedimentation basin and wastewater lagoon that services the existing development.

The existing induction/hospital pen area has been constructed on a low permeability clay liner with a minimum thickness of 300 mm as recommended by Rural Solutions SA report dated 28th June 2007. The subsoil at the site of the existing solid waste storage and processing area is clay. Testing by the Geotechnical Laboratory of AS James Bear at Kapunda indicated that its suitability for a low permeability clay lining (Refer Appendix D 422/E003/16 Development Report Ostwald Bros Pty Ltd, 2016). The material met the standard described in the Reference Manual for the Establishment and Operation of Beef Cattle Feedlots in Queensland; Appendix E, Clay lining of drains, sedimentation systems, holding ponds and manure stockpile areas (Skerman, 2000).

Wallbridge & Gilbert (Consulting Engineers, Adelaide) conducted a practical completion inspection of the constructed development in August 2011 and confirmed that the civil works undertaken on-site are consistent with the design intent of the civil works drawings, the details contained in the Rural Solutions SA report dated 28th June 2007 and subsequent condition of the development approval.

A copy of the Wallbridge & Gilbert practical completion response is provided in Figure 11.

2.6.5 Mitigation of adverse impacts

The implementation of the following management and mitigation measures minimise identified impacts to soils, surface water, groundwater and air quality.

- Runoff external to the controlled drainage area is diverted away from the controlled drainage area
- 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
- 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 pens are designed with adequate slope to maximise drainage and encourage rapid drying of the pen surface after rainfall
- The catch and main drains designed with adequate and uniform slope to maximise drainage and encourage rapid drying after rainfall

2.7 Construction of additional wastewater lagoon existing development

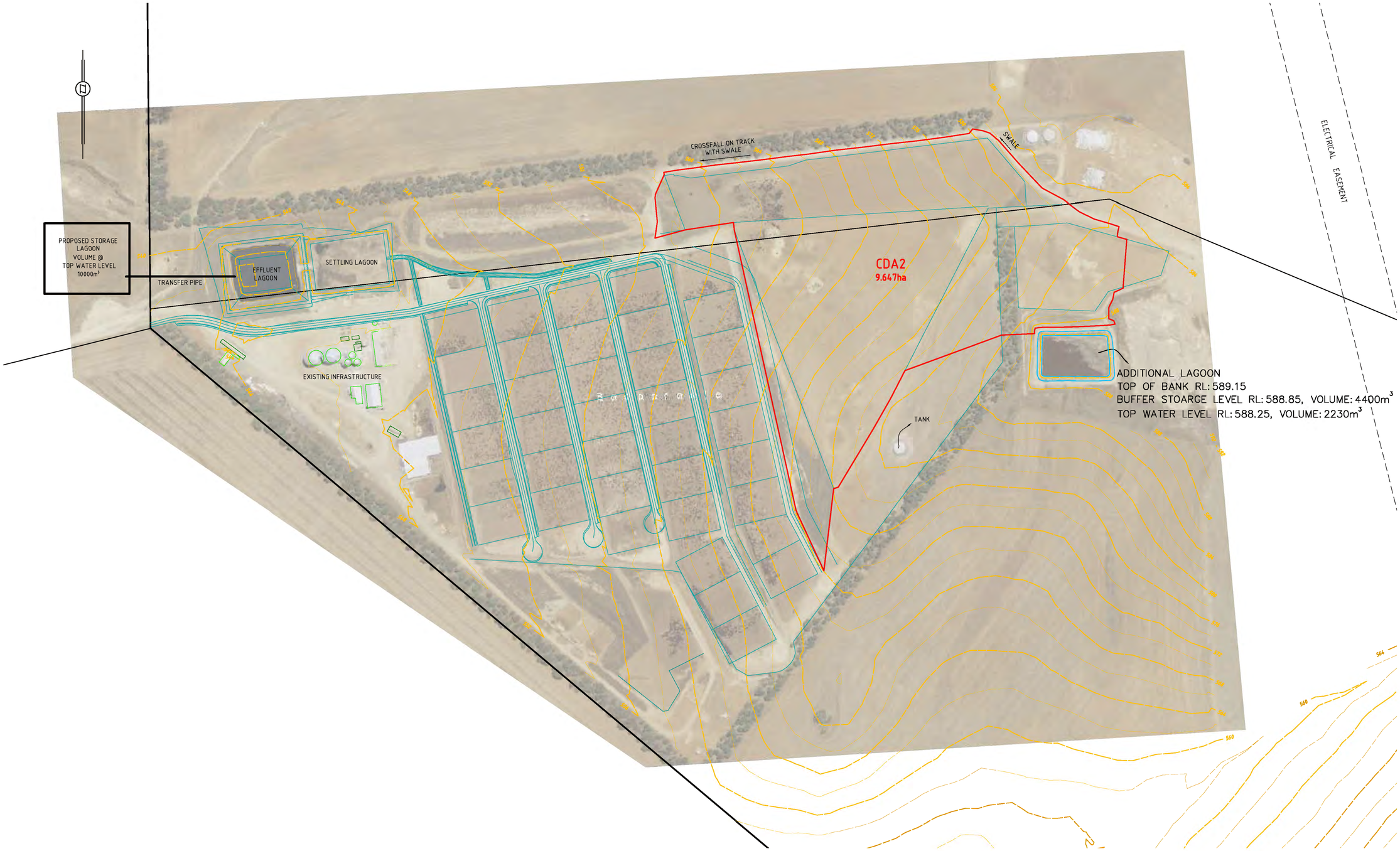
After a recent site visit, EPA requested the area to the north of the existing feedlot development in which cattle are temporarily held for backgrounding prior to entry into the feedlot be included in the controlled drainage area of the existing development. Subsequently, this requires revision of the original developments drainage calculations to ensure that the existing wastewater lagoon can adequately contain runoff from the expanded area.

Mosel Steed surveyed the extended catchment area and determined its area to be 9.647 ha. Figure 12 illustrates the extended catchment area.

Walbridge and Gilbert reviewed the revised catchment area and calculated the capacity of the sedimentation basin and existing wastewater storage lagoons to ensure that sufficient capacity to accommodate the runoff from May to October with an average reoccurrence interval of 20 years was available. An embankment freeboard of 900mm above the top water level was adopted in accordance with EPA guidelines. Based on the revised catchment area, the minimum capacity of the wastewater lagoon was calculated to be approximately 6,900kL (6.9ML).

Taking into consideration existing on-site wastewater storage there is a shortfall of approximately 4,670 kL (4.67ML) to meet capacity for the revised catchment area. Two options are proposed to cater for this shortfall depending on practicalities, construction timing and cost. Option 1 is to extend the southern embankment of the existing wastewater lagoon by some 12m to the south towards the access road. This is the preferred option and is shown on Figure 8. Alternatively a separate wastewater storage lagoon of approximately 10,000 m^3 could be constructed on the north-western corner of the site. This is the least preferred option.

The proposed separate wastewater storage lagoon (Options 2) is to be located on land described as Plan type 230100, Parcel SE894 and Title type CT5469 as shown on Figure 1 and Figure 12.



Mosel Steed
SURVEYING · LAND SOLUTIONS
Kadina 6 Graves Street SA 5554 08 8821 3544
info@moselsteed.com.au
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ACN 144 516 398
Norwood 08 8362 7900 | Murray Bridge 08 8532 5200 | Clare 08 8842 1228 | Kangaroo Island 08 8559 4283

REFERENCE: C09051E11.4 21/11/16 BAL

SCALE 0 40 80 120 160 200 METRES
ORIGINAL SHEET SIZE A1

COORDINATE DATUM: PLANE
HEIGHT DATUM: PSM6630/1094 RL521.117m AHD
CONTOUR INTERVAL: 2.0 metre
SURVEY DATE: 26/05/15 & 03/11/16
CLIENT: PRINCESS ROYAL STATION

LEGEND

- MAJOR CONTOUR
- MINOR CONTOUR
- EXISTING INFRASTRUCTURE DESIGN
- PROPOSED INFRASTRUCTURE
- EASEMENT
- FEEDLDT CATCHMENT BOUNDARY

REV	DATE	DESCRIPTION
11.4	21/11/16	PROPOSED LAGOON ADDED
11.3	17/11/16	VOLUME UPDATED
11.2	09/11/16	CATCHMENT AREA
11.1	08/11/16	CATCHMENT AREA
11.0	04/11/16	ORIGINAL ISSUE

ADDITIONS & AMENDMENTS

ADDITIONAL FEEDLOT CATCHMENT

BLOCKS 27 & 28
IN D 2033

BOOBOROWIE

2.7.1 Proposed construction details

The design geometry of the proposed additional wastewater storage lagoon is shown Figure 14 and Figure 15. This design may not be constructed if the existing storage lagoon can be practically extended.

The construction of the proposed additional wastewater storage lagoon or extension of existing storage lagoon will be the same as the storage lagoons on the current site, lined with a minimum thickness of 600 mm of compacted clay which has a hydraulic conductivity of $1x10^{-9}$ m/s or less to prevent seepage into groundwater. The subsoil at the site of the proposed wastewater storage lagoon is clay, CH classification, which was tested previously by the Geotechnical Laboratory of AS James Bear at Kapunda and meets the standards set out in Appendix 4A of EPA guidelines for lagoon construction.

In accordance with EPA guidelines and risk matrix, the proposed wastewater storage lagoon will meet the category 1 set out in Appendix 2 of the guidelines. To meet the permeability measures, the following procedures will be used by the construction contractors;

- All surfaces to be cleared and grubbed, stripped of topsoil and prepared to the required levels and gradients by cutting and filling. This will involve over excavation to accommodate the required thickness of clay lining while ensuring that the final design gradients, levels and dimensions are achieved.
- Clay lining is to be placed in progressive, uniform, horizontal layers, not exceeding 200 mm in thickness prior to compaction.
- Each layer will be compacted to produce a field dry density of at least 95% of the standard maximum laboratory dry density achieved through rolling.
- Following compaction, final trimming of all clay lined areas must be carried out to produce a smooth uniform surface.

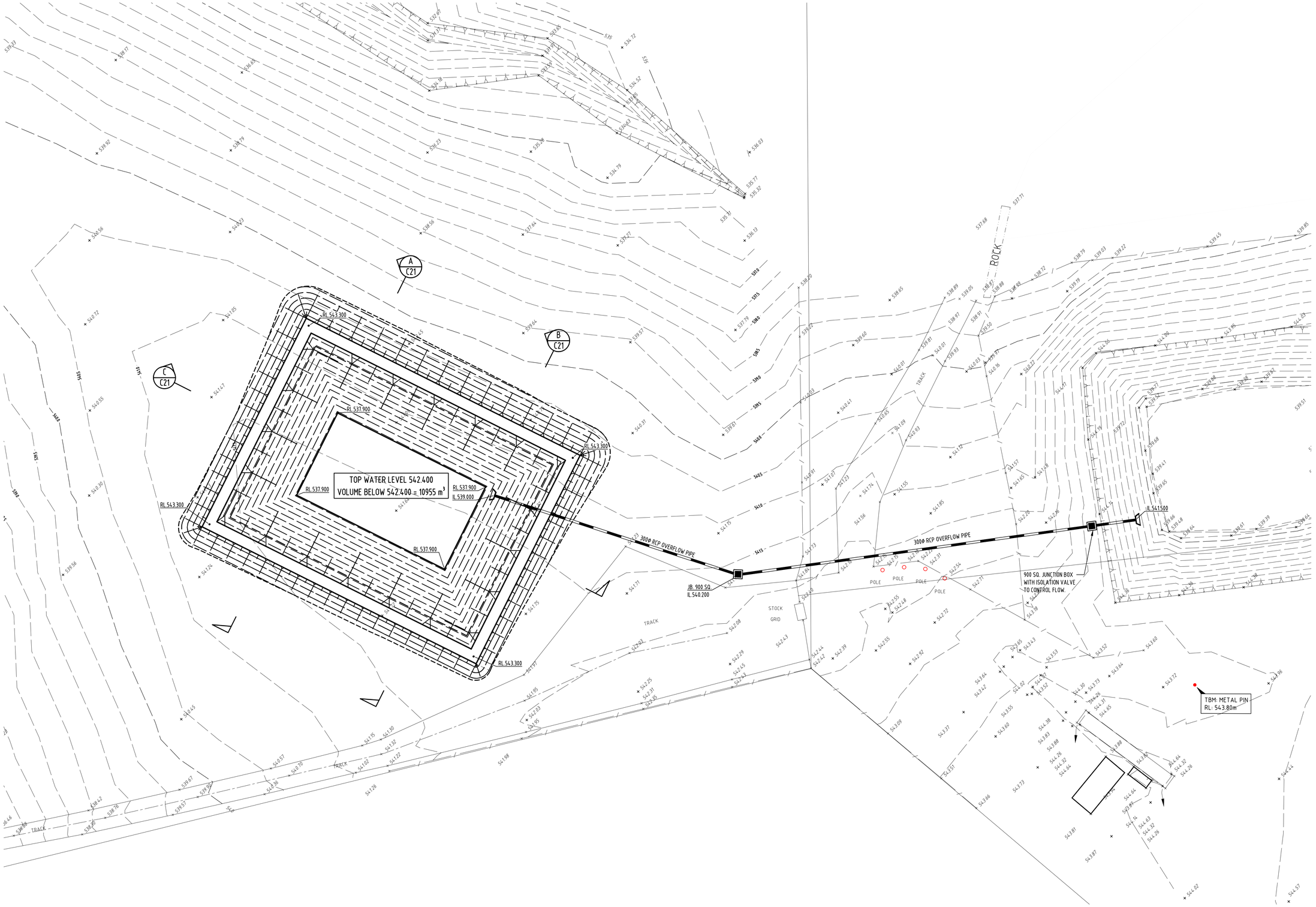
Wastewater captured in the storage lagoon will be evaporated or used for dust suppression around the development. Construction and quality control will be undertaken by S.C. Heinrich & Co. Pty. Ltd.

APPENDIX 1 RISK ASSESSME

Instructions: Select one category under each criteria by clicking 'Y' in the blue col
provided in Appendix 3A.

SITE: Princess Royal Feedlot, Hills Road, Booborowie, South Australi

		Points	Yes/No	Score
1	**Groundwater occurrence**			
1a	none	0	Y	0
1b	confined	0.2		
1c	semi-confined	2		
1d	unconfined (covered)	6		
1e	unconfined	10		
2	**Aquifer type**			
2a	Clay or crystalline rock	0.25	Y	0.25
2b	Silt, fractured rock or limestone	3.75		
2c	Sand,gravel or Fill	10		
3	**Minimum distance of groundwater from base of lagoon liner**			
3a	greater than 50m	0	Y	0
3b	>20m to 50 m	0.1		
3c	>10m to 20 m	1		
3d	>5m to10 m	2		
3e	>2m to 5 m	6		
3f	2 m or less	10		
4	**Groundwater usage**			
4a	Not Likely	0.5	Y	0.5
4b	Possible	2.5		
4c	Current	10		
5	**Groundwater salinity**			
5a	>10 000 mg/L	0		
5b	>5000 to10000 mg/L	0.2		
5c	>1500 to 5000 mg/L	3	Y	3
5d	1500 mg/L or less	10		
6	**Nominal capacity of lagoon (excluding freeboard)**			
6a	Small (5ML or less)	0.2		
6b	Medium (>5ML to 10ML)	1.2		
6c	Large (>10ML to 30 ML)	4.8	Y	4.8
6d	Very Large (>30ML)	10		
7	**Max lagoon water depth**			
7a	1m or less (evaporative)	0.2		
7b	>1m to 3m (aerobic/facultative)	1.2		
7c	>3m to 6m (anaerobic)	4.8	Y	4.8
7d	deeper than 6m	10		
8	**Nature of wastewater (see Appendix 3A for definitions)**			
8a	contaminated stormwater	0.2		
8b	treated wastewater	0.8		
8c	composting/landfill	4.2		
8d	organic/nutrient	4.2	Y	4.2
8e	reactive	6.4		
8f	hazardous	10		



LEGEND:

- EXISTING LEVELS
- EXISTING CONTOURS
- DESIGN LEVELS
- DESIGN CONTOURS
- STORMWATER PIPE - RCP
- JUNCTION BOX (JB.)

NOTES:

1. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH THE SPECIFICATION.
2. ALL R.C. STORMWATER PIPES ARE TO BE CLASS '2' WITH BEDDING TYPE 'HS2', U.N.O.
3. **ALL EXISTING SERVICES ARE TO BE LOCATED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORK.**
4. **CONTRACTOR TO CONFIRM INVERTS OF ALL EXISTING PIPES & SUMPS PRIOR TO CONNECTING & LAYING OF ALL NEW PIPEWORK.**

VOLUMES:

STRIPPING (150mm)	1100m³
CUT	6750m³
FILL	6000m³
NET (CUT)	750m³

When sheet printed full size, the scale bar is 100mm.

0 50 100mm

10 5 0 10 20
SCALE BAR (m)

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	DRAFT	ENG.	CHKD
A	15.03.17	PRELIMINARY ISSUE	MWRJ	CH	

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Consulting Engineers
60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
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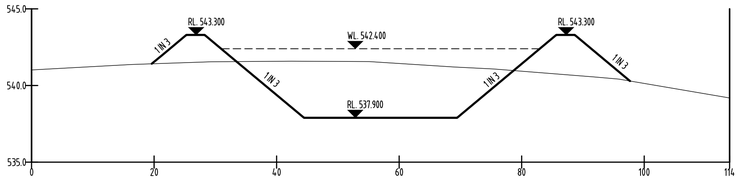
MACKERODE STATION
BURRA, SOUTH AUSTRALIA
EFFLUENT POND
SITE PLAN

A1

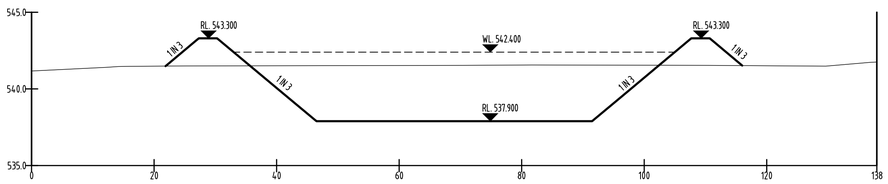
DRAWING NUMBER
Job Number C090784 Sheet No. C20 Rev. A

Design MWRJ Drawn MWRJ



SECTION A
SCALE 1500H 1200V C20

SECTION B
SCALE 1500H 1200V C20



SECTION C
SCALE 1500H 1200V C20

I:\2009\07\July\2009\C090784\C090784-C21.dwg, A, 15/3/2017 11:29 AM, mwrfs

When sheet printed full size, the scale bar is 100mm.

0 50 100mm

10 5 0 10 20
SCALE BAR (m)
HORIZONTAL

5 2.5 0 5 10
SCALE BAR (m)
VERTICAL

PRELIMINARY ISSUE
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REV.	DATE	DESCRIPTION	DRAFT	ENG.	CHKD
A	15.03.17	PRELIMINARY ISSUE	MWRJ	CH	

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MACKERODE STATION
BURRA, SOUTH AUSTRALIA
EFFLUENT POND
SECTIONS

A1

DRAWING NUMBER

Design	Drawn	Job Number	Sheet No.	Rev.
MWRJ	MWRJ	C090784	C21	A

2.8 Commissioner of Highways (Email correspondence Simon Neldner 16/12/16)

2.8.1 Further detail on traffic distributions

A traffic impact assessment has been produced by Wallbridge & Gilbert.

2.8.2 Requirement for further upgrades to the Goyder Highway / Hills Road junction (beyond that already required for DA 422/0064/07).

A traffic impact assessment, produced by Wallbridge & Gilbert has been prepared to address the following matters:

a) Assess the Goyder Highway / Hills Road junction against the relevant Austroads Guides and Australian Standards to identify the level of turn treatment required for the proposed junction to accommodate the movements associated with the development;

b) Detail the expected traffic volumes to be generated by the proposed development, including:

i) Daily volumes;

ii) Peak development volumes;
and (if different to the above);

iii) Development volumes during AM and PM peak times for Hills Road.

c) Assess and provide details (including diagrammatic representation) of the traffic distribution of traffic to/from the site;

d) Specify the largest vehicle anticipated on site and provide turn paths demonstrating that this vehicle can enter and exit in a forward direction.

The traffic impact statement is provided in Appendix A.

2.9 DPTI

2.9.1 Controlled Drainage Area

The information request has resulted in a design review of the proposed development design. As a result of the design review a solid waste storage area has now been incorporated into the controlled drainage area of each site.

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
- solid waste storage area
- 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, solid waste storage, sedimentation basin etc.
- soft catchment – areas with a low runoff yield such as grassed and other vegetated areas within the controlled drainage area.

Figure 16 and Figure 17 show the revised controlled drainage area plan for the proposed development including solid waste stockpile area. The location of each controlled drainage area along with their respective pen, hard and soft areas is shown on Figure 16 and Figure 17.
Table 10 summaries the areas of the sub-catchments shown in Figure 16 and Figure 17. The sub-component catchment areas are needed to calculate the design volumes for the sedimentation basin and storage lagoon (Table 11 and Table 12) 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 10 – 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, sed basin / solid waste	4.20	4.01	0.8
Soft – grassed areas	2.09	3.42	0.4
Storage Lagoon – inside crest surface area	0.62	0.94	1.0
Total	12.91	16.0	-

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

N
W E
S

PRODUCTION PENS - EXISTING DEVELOPMENT

PROPOSED CDA 1

TBM: META'. PIN RL: 591.32m

HARD CATCHMENT AREA FEED ROADS

PROPOSED FEED ROAD

HARD CATCHMENT AREA CATTLE LANE/DRAIN

WATER TANK

LEGEND

- PRODUCTION PEN AREA
- HARD AREA – ROADS
- HARD AREA – CATTLE LANES/CATCH DRAIN/MAIN DRAIN
- HARD AREA – SEDIMENTATION BASIN
- SOFT CATCHMENT AREA (GRASS ETC)
- STORAGE LAGOON CATCHMENT AREA

PEN AREA CATCHMENT

HARD CATCHMENT AREA SEDIMENTATION BASIN

STORAGE LAGOON CATCHMENT AREA

PROPOSED CDA 2

DRAINAGE LINE

PUMP SHED

SCALE 0 10 20 30 40 50 60 70 80 90 100m
1:1,000 (A1) 1:2,000 (A3)

Date	Issue	Amendment	Init.	App
23/03/17	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION – PROPOSED FEEDLOT EXPANSION

Drawing Title
PRDPOSED CDNTRDLLED DRAINAGE AREA 1 PLAN

Scales	1= 1,000 (A1) 1= 2,000 (A3)		
Drawn	RJD	Date	23/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-IR-CD1-18	Issue	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
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
23/03/17	A	ISSUE FOR REVIEW	RJD	BJO

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
PRDPOSED CDNTRDLLED DRAINAGE AREA 2 PLAN

Scales	1= 1,200 (A1) 1= 2,400 (A3)		
Drawn	RJD	Date	23/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-PRS-IR-CD2-17	Issue	A

Table 11 summarises the input parameters used to determine the minimum required volume of the sedimentation basin.

Table 11 – 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	1,998	1,575
Volume proposed (minimum)	m^3	V	2,000	1,600

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).

The minimum calculated volume for CDA 1 and CDA 2 is 1,998 m^3 and 1,575 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 2,000 m^3 and 1,600 m^3 respectively. The geometry of each sedimentation basin shall be shaped with existing topography to minimise land reshaping and earthworks.

Figure 16 shows the location of the sedimentation basin in relation to the production pens for CDA 1. Figure 17 shows the location of the sedimentation basin in relation to the production pens for CDA 2.

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 revised storage lagoon volume is provided in Table 12. The storage lagoon for CDA 1 and CDA 2 have a minimum design maximum operating level (bywash) volume of 14.70 ML and 18.5 ML respectively as shown in Table 12

Table 12 – Storage lagoon design

Parameter	Units	CDA 1	CDA 2
Pen area	m^2	60,000	76,250
Hard area	m^2	41,968	40,109
Soft area	m^2	20,870	34,221
Lagoon area	m^2	6,201	9,443
May-Oct Rainfall	mm	406	406
Safety Factor		1.25	1.25
Required lagoon volume	kL	14,650	18,400
Proposed lagoon volume	kL	14,700	18,500
Proposed lagoon volume	ML	14.70	18.50

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.

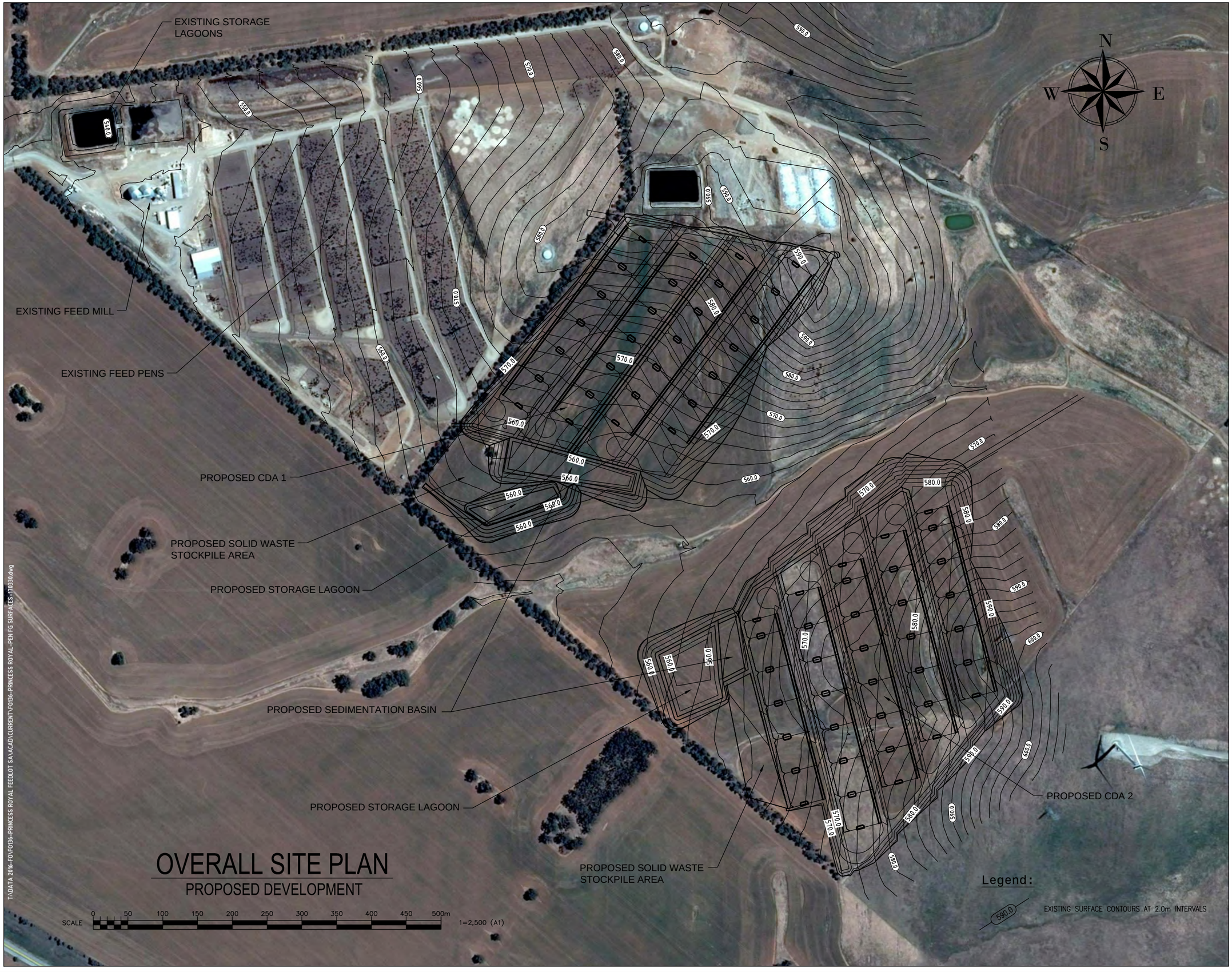
A minimum freeboard of at least 900 mm shall be provided between the crest of the discharge weir and the crest of the storage lagoon embankment.

2.9.2 Engineered Site Earthworks Plan

A detail survey of the proposed development site was conducted by a registered surveyor (SA) to obtain all relevant site information such as existing infrastructure, natural features and natural surface levels for contouring.

The survey data was reduced and a digital terrain model for volume calculations of the proposed design surface created.

Figure 19 provides the earthworks volumes for Controlled Drainage Area 1. Figure 20 provides the earthworks volumes for Controlled Drainage Area 1.



OVERALL SITE PLAN

PROPOSED DEVELOPMENT

Legend:

590.0 EXISTING SURFACE CONTOURS AT 2.0m INTERVALS

T:\DATA 2016-FO\FO136-PRINCESS ROYAL FEEDLOT SA\ACAD\CURRENT\FO136-PRINCESS ROYAL-PEN FG SURFACES-170330.dwg

NOTES:
1. IMAGE SOURCE FROM GOOGLE EARTH™ MAY 2016

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Date	Issue	Amendment	Init	App
30/03/17	A	ISSUE FOR REVIEW	P.G.	R.D.

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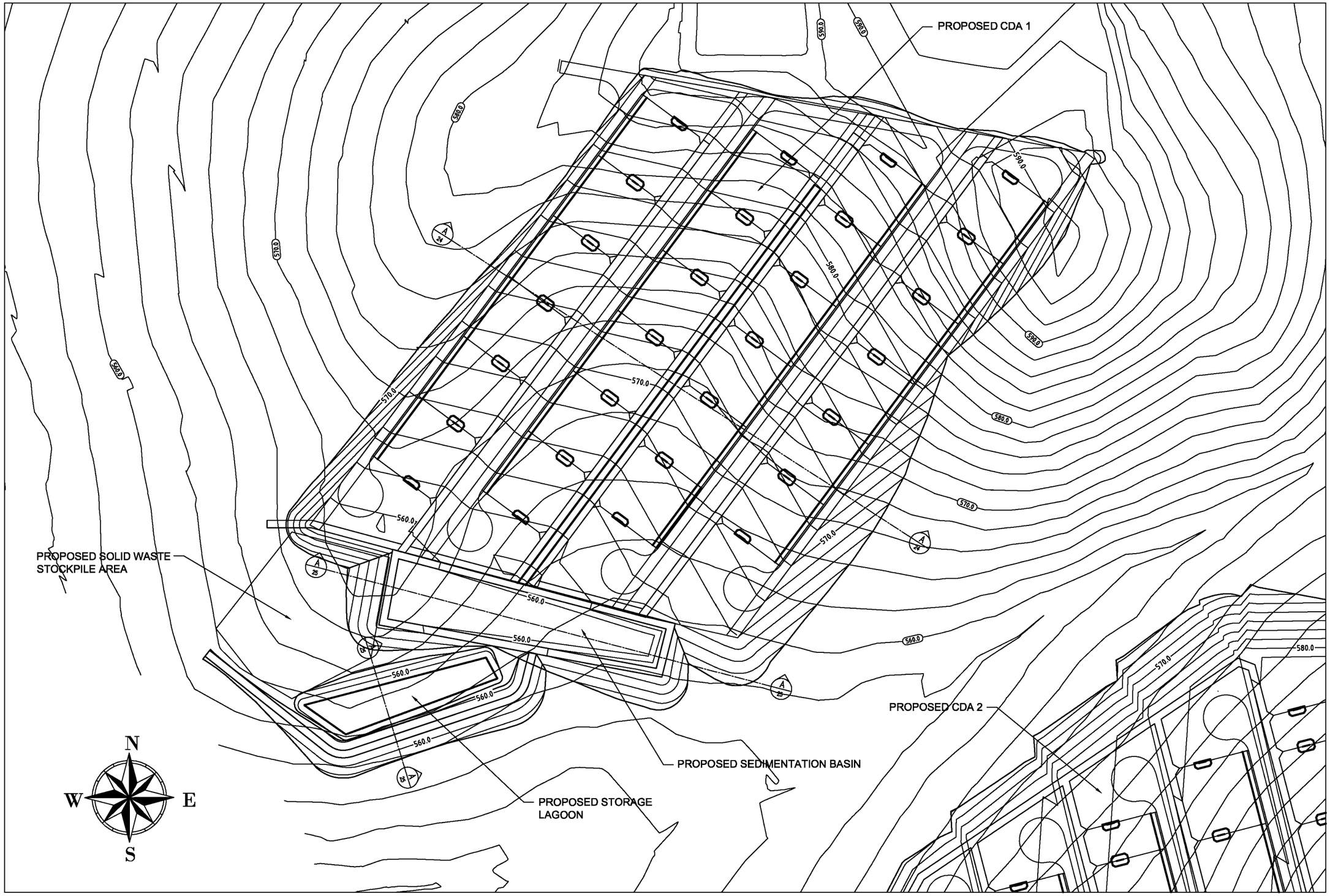
Project
PRINCESS ROYAL STATION
DEVELOPMENT APPLICATION -
PROPOSED FEEDLOT EXPANSION

Drawing Title
OVERALL SITE PLAN

Scales	1= 2,500 (A1) 1= 5,000 (A3)		
Drawn	P.G.	Date	30/03/17
Approved	BJO	Designed	R.S
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-IR-EW-18	A



LAYOUT PLAN

PROPOSED CDA 1

SCALE 0 25 50 75 100 125 150 175 200 225 250m 1=1,250 (A1)

Legend:

590.0 EXISTING SURFACE CONTOURS AT 2.0m INTERVALS

8.5 DESIGN CONTOURS AT 2.0m INTERVALS

Name	Area (m2)	Cut (m3)	Fill (m3)	Balance (m3)
CDA 1 EWORKS	142,547	211,691	193,074	18,617<Fill>

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Date	Issue	Amendment	Init	App
30/03/17	A	ISSUE FOR REVIEW	P.G.	R.D.

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Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
CDA 1 - LAYOUT PLAN

Scales 1= 1,250 (A1) 1= 2,500 (A3)

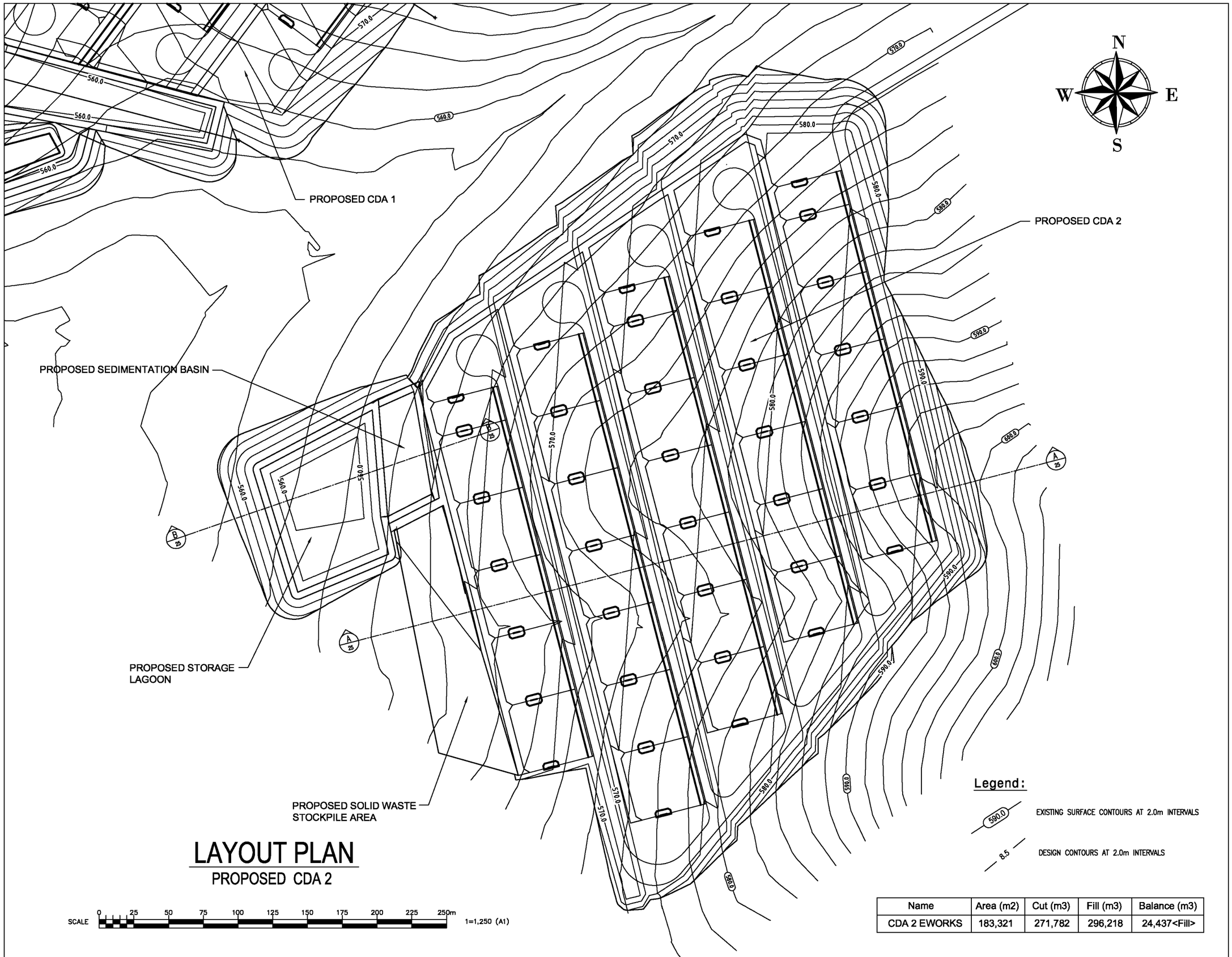
Drawn P.G. | Date 30/03/17

Approved BJO | Designed R.S.

Datum WGS84 | Zone UTM54H

Project No. RU050500 | Bldg No

Drawing No. RU050500-IR-EW-19 | Issue A



LAYOUT PLAN

PROPOSED CDA 2

SCALE 0 25 50 75 100 125 150 175 200 225 250m 1=1,250 (A1)

Name	Area (m2)	Cut (m3)	Fill (m3)	Balance (m3)
CDA 2 EWORKS	183,321	271,782	296,218	24,437<Fill>

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Date	Issue	Amendment	Init	App
30/03/17	A	ISSUE FOR REVIEW	P.G.	R.D.

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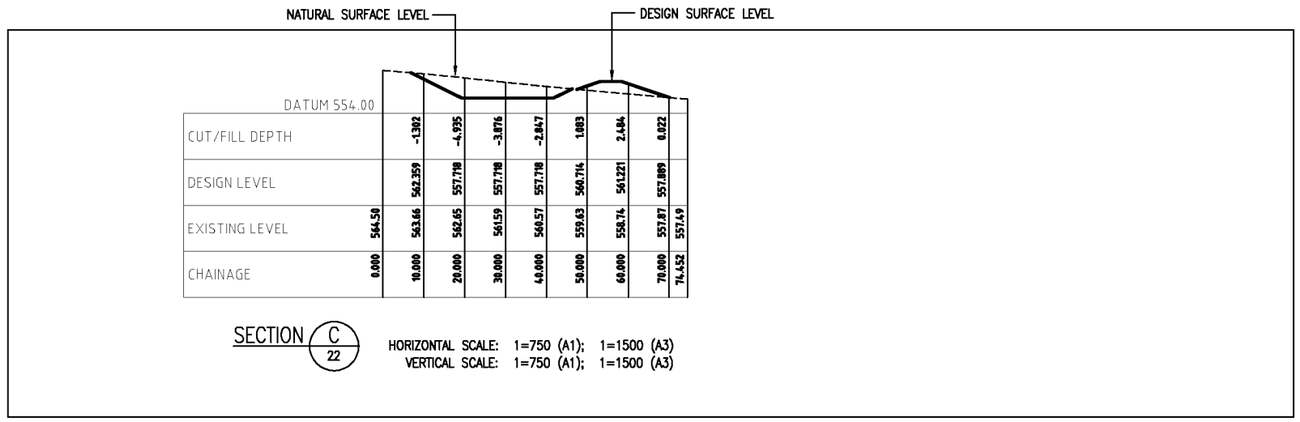
Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
CDA 2 - LAYOUT PLAN

Scales	1= 1,250 (A1) 1= 2,500 (A3)		
Drawn	P.G.	Date	30/03/17
Approved	BJO	Designed	R.S.
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	

Drawing No.	Issue
RU050500-IR-EW-20	A



DATUM 554.00										
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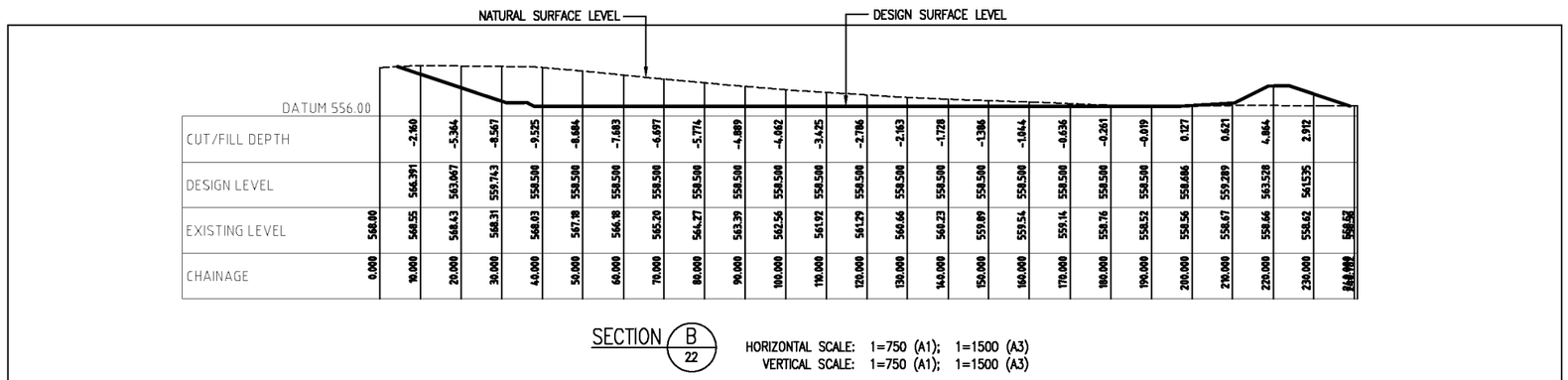
DESIGN LEVEL		562.359	557.798	557.798	557.798	560.714	561.221	557.889		
EXISTING LEVEL	564.50	563.66	562.45	561.59	560.57	559.63	558.74	557.87	557.69	
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	74.452	

SECTION C 22

HORIZONTAL SCALE: 1=750 (A1); 1=1500 (A3)
VERTICAL SCALE: 1=750 (A1); 1=1500 (A3)



DATUM 556.00																									
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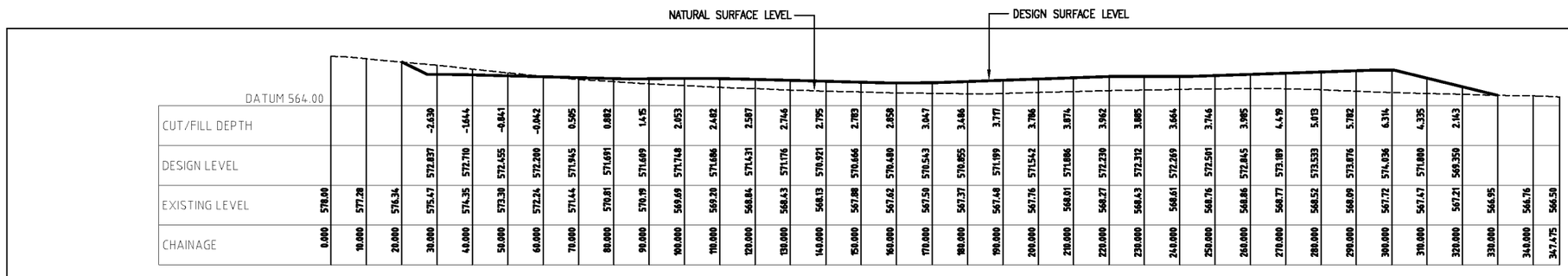
DESIGN LEVEL		566.391	563.047	559.743	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.500	558.686	559.289	563.528	561.535	
EXISTING LEVEL	568.00	568.55	568.43	568.31	568.03	567.18	566.18	565.20	564.27	563.39	562.56	561.92	561.29	560.66	560.23	559.89	559.54	559.14	558.76	558.52	558.56	558.67	558.66	558.62	558.57
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000

SECTION B 22

HORIZONTAL SCALE: 1=750 (A1); 1=1500 (A3)
VERTICAL SCALE: 1=750 (A1); 1=1500 (A3)



DATUM 564.00																																					
CUT/FILL DEPTH				-2.630	-1.644	-0.841	-0.842	0.595	0.882	1.415	2.053	2.482	2.587	2.746	2.795	2.783	2.858	3.047	3.486	3.717	3.786	3.874	3.962	3.885	3.664	3.746	3.985	4.479	5.013	5.782	6.314	4.335	2.143				
DESIGN LEVEL				572.837	572.710	572.455	572.280	571.945	571.691	571.699	571.748	571.686	571.431	571.176	570.921	570.666	570.480	570.543	570.855	571.199	571.542	571.886	572.230	572.312	572.269	572.591	572.845	573.189	573.533	573.876	574.036	571.880	569.350				
EXISTING LEVEL	578.00	577.20	576.34	575.47	574.35	573.30	572.24	571.44	570.81	570.19	569.69	569.20	568.84	568.43	568.13	567.88	567.62	567.50	567.37	567.48	567.76	568.01	568.27	568.43	568.61	568.76	568.86	568.77	568.52	568.09	567.72	567.47	567.21	566.95	566.76	566.59
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	347.475

SECTION A 22

HORIZONTAL SCALE: 1=750 (A1); 1=1500 (A3)
VERTICAL SCALE: 1=750 (A1); 1=1500 (A3)

SECTION DETAILS

PROPOSED CDA 1

SCALE 0 10 20 30 40 50 60 70 80 90 100m

1=750 (A1)

Date	Issue	Amendment	Init	App
30/03/17	A	ISSUE FOR REVIEW	P.G.	R.D.

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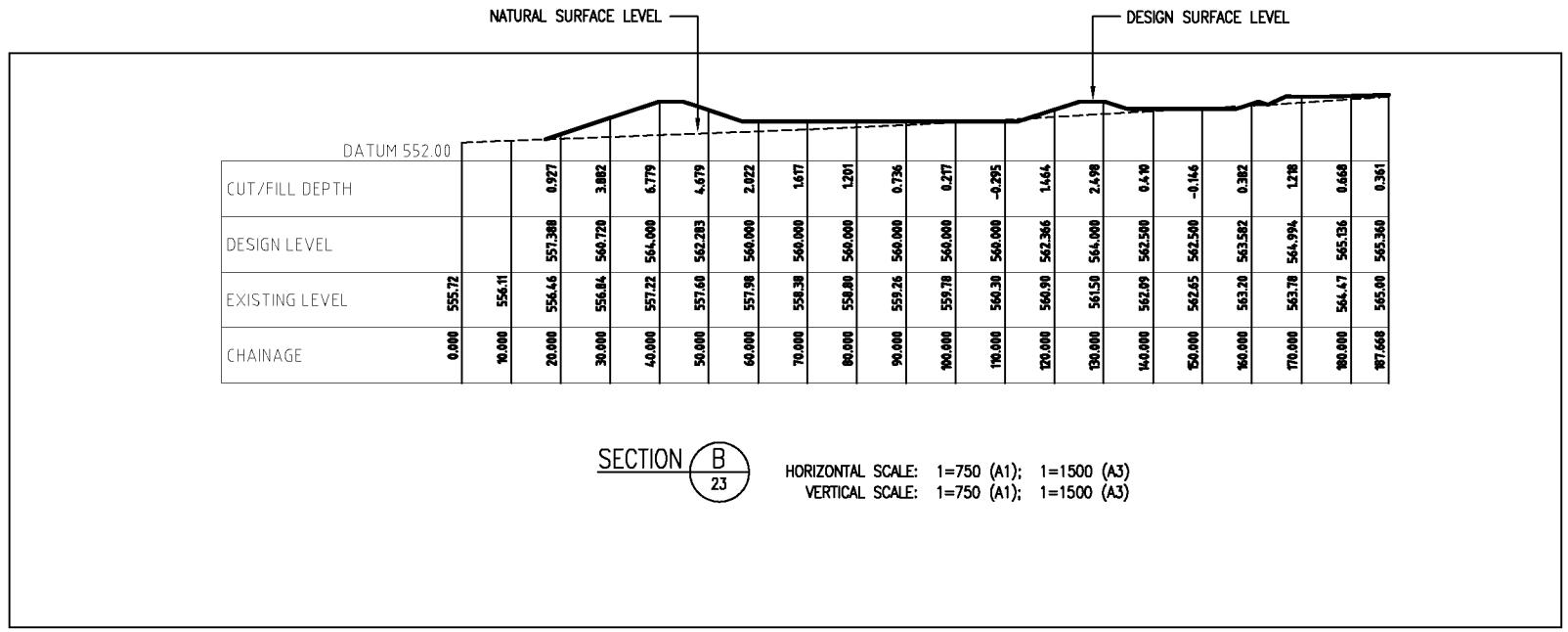
Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
CDA 1 - SECTION VIEWS

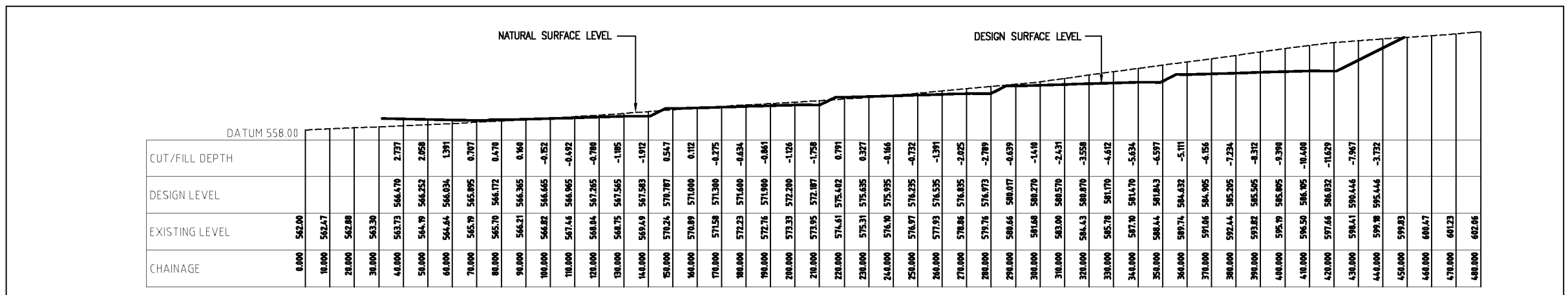
Scales	AS SHOWN		
Drawn	P.G.	Date	30/03/17
Approved	BJO	Designed	R.S.
Datum	WGS84	Zone	UTM54H
Project No.	RU050500	Bldg No	
Drawing No.	RU050500-IR-EW-21	Issue	A



CUT/FILL DEPTH			0.927	3.882	6.779	4.679	2.822	1.617	1.201	0.736	0.217	-0.295	1.464	2.498	0.490	-0.146	0.382	1.298	0.668	0.361
DESIGN LEVEL			557.388	560.720	564.000	562.283	560.000	560.000	560.000	560.000	560.000	560.000	562.366	564.000	562.500	562.500	563.582	564.994	565.136	565.360
EXISTING LEVEL	555.72	556.11	556.46	556.84	557.22	557.60	557.98	558.38	558.80	559.26	559.78	560.30	560.90	561.50	562.09	562.65	563.20	563.78	564.47	565.00
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	187.668

SECTION B / 23

HORIZONTAL SCALE: 1=750 (A1); 1=1500 (A3)
VERTICAL SCALE: 1=750 (A1); 1=1500 (A3)



CUT/FILL DEPTH					2.737	2.058	1.391	0.707	0.470	0.160	-0.152	-0.492	-0.780	-1.185	-1.912	0.547	0.112	-0.275	-0.634	-0.861
DESIGN LEVEL					566.470	566.252	566.034	565.895	566.172	566.365	566.665	566.965	567.265	567.565	567.583	570.787	571.000	571.300	571.600	571.900
EXISTING LEVEL	562.00	562.47	562.88	563.30	563.73	564.19	564.64	565.19	565.70	566.21	566.82	567.46	568.04	568.75	569.49	570.24	570.89	571.58	572.23	572.76
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000

CUT/FILL DEPTH	-1.126	-1.758	0.791	0.327	-0.166	-0.732	-1.391	-2.025	-2.789	-6.639	-14.10	-2.431	-3.558	-4.612	-5.634	-6.597	-5.111	-4.156	-7.234	-8.312
DESIGN LEVEL	571.900	572.200	572.187	575.412	575.835	575.935	576.235	576.535	576.835	576.973	580.077	580.270	580.570	580.870	581.170	581.470	581.843	584.832	584.905	585.205
EXISTING LEVEL	573.33	573.95	574.61	575.31	576.10	576.97	577.93	578.86	579.76	580.66	581.68	583.00	584.43	585.78	587.10	588.44	589.74	591.06	592.44	593.82
CHAINAGE	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000

CUT/FILL DEPTH	-9.390	-10.400	-11.629	-7.947	-3.732															
DESIGN LEVEL	585.895	586.195	586.832	590.446	595.446															
EXISTING LEVEL	595.19	596.50	597.66	598.41	599.18	599.83	600.47	601.23	602.06											
CHAINAGE	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000	480.000											

SECTION A / 23

HORIZONTAL SCALE: 1=1000 (A1); 1=2,000 (A3)
VERTICAL SCALE: 1=1000 (A1); 1=2,000 (A3)

SECTION DETAILS

PROPOSED CDA 2

SCALE 0 25 50 75 100 125 150 175 200m 1=1000 (A1)

SCALE 0 10 20 30 40 50 60 70 80 90 100m 1=750 (A1)

ostwald BROS

Date	Issue	Amendment	Init	App
30/03/17	A	ISSUE FOR REVIEW	P.G.	R.D.

OSTWALD BROS PTY LTD

Phone: 1300 678 925
Fax: (07) 4669 9450
Email: info@ostwaldbros.com.au
Web: www.ostwaldbros.com.au

Project
PRINCESS ROYAL STATION DEVELOPMENT APPLICATION - PROPOSED FEEDLOT EXPANSION

Drawing Title
CDA 2 - SECTION VIEWS

Scales	AS SHOWN		
Drawn	P.G.	Date	30/03/17
Approved	BJO	Designed	R.S.
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	

Drawing No.	Issue
RU050500-IR-EW-22	A

2.9.3 Site Plan

An amended site plan that incorporates the backgrounding areas to the north of the production pens is provided and shown in Figure 23. The amended site plan provides the additional area to be captured by the existing sedimentation basin and storage lagoon.

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

ostwald BROS

Date	Issue	Amendment	Init	App
24/03/17	A	ISSUE FOR REVIEW	RJD	BJO

OSTWALD BROS PTY LTD

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Fax: (07) 4669 9450
Email: info@ostwaldbros.com.au
Web: www.ostwaldbros.com.au

Project
PRINCESS ROYAL STATION – DA422-E003-16 – REQUEST FOR INFORMATION

Drawing Title
OVERALL SITE PLAN

Scales	1= 2,750 (A1) 1= 5,500 (A3)		
Drawn	RJD	Date	24/03/2017
Approved	BJO	Designed	RJD
Datum	WGS84	Zone	UTM54H

Project No.	Bldg No
RU050500	
Drawing No.	**Issue**
RU050500-PRS-IR-SP-23	A

3. References

Bloss C., Montazeri M. and Eckert G., 2015, Flood mapping of the River Murray floodplain in South Australia, DEWNR Technical report 2015/57, Government of South Australia, through Department of Environment, Water and Natural Resources, Adelaide

Davis, RJ, Watts, PJ and McGahan, EJ, 2010, Quantification of feedlot manure output for BEEF-BAL model upgrade, RIRDC Project No. PRJ-004377, Rural Industries Research and Development Corporation, Canberra.

Department of Primary Industries and Resources (SA) (PIRSA) (2006) Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia, Second Edition, February 2006, Department of Primary Industries and Resources, The Government of South Australia.

McGahan, EJ and Tucker, RW, 2003, Resource Manual of Development of Indicators of Sustainability for Effluent Reuse in the Intensive Livestock Industries: Piggeries and Cattle Feedlots. Project No 1816, Australian Pork Limited, Canberra Australia, May 2003.

Michell, AR, Bywater,RJ, Clarke, KW, Hall LW, Waterman, AE, 1989, Veterinary Fluid Therapy, Oxford; Boston: Blackwell Scientific ; Chicago, Ill: Year Book Medical Publishers, 1989.

Ostwald Bros Pty Ltd, 2016, Development Application – Proposed Beef Cattle Feedlot Expansion, Princess Royal Station, Hills Road, Burra, SA, Project No: RU050500 V01R01, Dalby, QLD.

Queensland Primary Industries and Fisheries, 2004, BEEFBAL - a nutrient mass balance model for beef cattle feedlots, v9.1 – May 2003, Department of Employment, Economic Development and Innovation, Queensland Primary Industries and Fisheries, accessed September 2015< http://www2.dpi.qld.gov.au/environment/1240.html >.

Skerman, A, 2000, Reference manual for the establishment and operation of beef cattle feedlots in Queensland, Information Series QI99070, Queensland Cattle Feedlot Advisory Committee (FLAC), Department of Primary Industries, Queensland.

van Sliedregt, H, McGahan, EJ and Casey, KD, 2000, Predicting waste production from feedlot cattle, Unpublished Confidential Report prepared for Cattle and Beef CRC (Meat Quality) Sub-program 6 - Feedlot Waste Management, DPI Intensive Livestock Environmental Management Services, August 2000, Toowoomba, Queensland.

Appendix A.

Construction and liner specifications

Appendix 2 Table of suggested construction and lining categories

1 The EPA may consider an alternative lining technology or combination other than those suggested in this table provided the proponent can demonstrate that it would achieve a similar or better outcome than that prescribed under the relevant category.

2 High risk lagoons (e.g. those with large capacities or located in sensitive areas) may be required to submit an 'As Constructed Report' (ACR).

3 The EPA may consider a lower construction and lining category than the one determined from Appendix 1 if risk management measures are to be implemented with approval from the EPA.

4 Please refer to Appendix 3B for definition of key technical terminologies.

	Ponds lined with clay materials		**Ponds lined with geomembrane materials**			
	Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**	**Category 6**
Lining and quality assurance	**If clay is used** • Minimum 300 mm thick clay liner (or 2 layers with minimum of 150 mm compacted thickness each) **If GCL is used:** • Minimum 300 mm soil confining layer (<10 mm grain size).	**If clay is used** • Minimum 300 mm thick compacted clay liner with $k \leq 1x10^{-9}$ m/s (or 2 layers with minimum of 150 mm compacted thickness each) • Construction Quality Assurance (CQA) plan for clay lining that includes Level 1 supervision (in accordance with AS 3798:2007) unless other CQA measures are undertaken in accordance with AS 1289 and Appendix 4A with the approval of the EPA.	• 1.5 mm thick HDPE or greater[#] • Leakage detection required	• 1.5 mm thick HDPE or greater[#] • CQA plan for HDPE placement • CQA plan for subgrade preparation. • Leakage detection required	• Double HDPE lining (1.5 mm thick or greater for each liner)[#] with CQA plan for HDPE placement **or** • A combination of **HDPE liner** (1.5 mm thick or greater; with CQA plan for HDPE placement as in category 4) and a **clay liner** (with CQA plan as in category 2) • CQA plan for subgrade preparation	• Site generally not suitable for wastewater lagoon construction unless effective drainage control is put in place • If to be allowed, apply category determined after Question (A) in Appendix 1 plus drainage provision.

	Ponds lined with clay materials		Ponds lined with geomembrane materials			
	Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**	**Category 6**
		• CQA plan for subgrade preparation **If GCL is used** • CQA plan for GCL placement • Minimum 300 mm soil confining layer (<10mm grain size). • CQA plan for subgrade preparation			• Leakage detection required	
Subgrade	Minimum 150 mm subgrade preparation to provide a sound and stable base for liner construction or installation. Subgrade preparation should include compaction until no rutting or pumping is observed. Workmanship should be supervised by a suitably qualified and experienced professional. Level 2 Supervision may be required.					

[#] Appropriate thickness of HDPE liner must be determined by the proponent's engineer/consultant based on wastewater characteristics, groundwater/aquifer characteristics, climatic factors and warranty considerations.

Appendix B.

Traffic Impact Statement

Government of South Australia
Department of Planning, Transport and Infrastructure

TRAFFIC IMPACT STATEMENT

KNet File No: 5079846

PROJECT: Princess Royal Feedlot, Burra-Spalding Road / Hills Road Junction

DRAWING NO.	SHEET NO.	AMENDMENT NO.
3-85465	51	1

LOCATION: Burra-Spalding Road / Hills Road Junction, Booborowie

BACKGROUND

Ilira Pty Ltd ATF Bob Rowe Class Trust and Sihero Pty Ltd ATF Simon Rowe Class Trust (trading as Princess Royal Station) own and operate a beef cattle feedlot known as Princess Royal Feedlot on Mackerode Station, near Burra.

Princess Royal Feedlot is accessed from Hills Road off the Burra-Spalding Road. The existing development was approved in 2008 and constructed in 2010.

To cater for the additional vehicle movements and B-Double access along Hills Road, a condition of the development approval (422/0068/07) was an upgrade of the Burra-Spalding Road/Hills Road Junction including widening to accommodate B-Double turn paths.

Princess Royal Station are now proposing to expand Princess Royal Feedlot and this will generate vehicle movements in addition to those generated by the existing development.

Current AADT volumes along Burra-Spalding Road in the vicinity of the junction are approximately 400 vehicles per day (vpd), with 17.5% heavy vehicle traffic.

PROPOSAL

The proposal involves an upgrade of the Burra-Spalding Road/Hills Road Junction and the sealing of the Hills Road approach to the junction to accommodate the proposed volume of vehicle movements and B-Double access from the existing and expanded development.

The proposed arrangement is indicated in the attached Traffic Control Plan (Drawing 8-85465 Sheet 51).

IMPACTS

The arrangement will:

- Improve access to and from the Burra-Spalding Road for all vehicles due to the sealing of the Hills Road approach.
- Accommodate the turn paths for 26m long B-Double vehicles.

Traffic Volumes

It is projected that the feedlot will develop approximately 22 trips per day, or five trips during the peak hour. It is anticipated that the additional traffic volumes will have a minimal impact on the operation of the junction.

Lane Widths
Proposed traffic lane widths on the junction approaches are outlined below. Corner widening is provided for the junction to accommodate turning movements for a 26m long B Double design vehicle.

Burra-Spalding Road
- 3.5m eastbound traffic lane
- 3.0m westbound traffic lane

Hill Road
- 9.0m carriageway width, no centreline

Turn Path Analysis
Turn path analysis has been undertaken on the junction arrangement using a 26m long B Double design vehicle for all movements. Design vehicles and movements are in accordance with Austroads Design Vehicle and Turning Path Templates Guide.

Lighting
There is currently no street lighting, and this is consistent with other junctions of this type along the Burra-Spalding Road.

Sight Distance
Sight lines along the Burra-Spalding Road are considered adequate and beyond the recommended minimum Safe Intersection Sight Distance of 300m indicated by Austroads Guide to Traffic Engineering Part 4A Unsignalised and Signalised Intersections.

Based on a 110km/h speed limit, a design speed of 120km/h was adopted for the Burra-Spalding Road approaches. Required Safe Intersection Sight Distance (SISD) for a design speed of 120km/h, based on a reaction time of 2.0 seconds, is 325m, as specified by Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections, Table 3.2. The available sightlines at the junction are outlined in the following table.

Approach	Required SISD	Available SISD	Meets Requirement
Burra-Spalding Road (Westbound)	325m	>400m	Yes
Burra-Spalding Road (Westbound)	325m	>400m	Yes

A design speed of 70km/h was adopted for the Hills Road analysis. Based on the narrow width of Hills Road (5m travel path) and the presence of a number of horizontal curves on approach to the junction, this speed is considered to be suitable. Approach Sight Distance (ASD) for a design speed of 70km/h, based on a reaction time of 2.0 seconds, is 95m, as specified by Austroads Part 4A, Table 3.1.

Approach	Required ASD	Available ASD	Meets Requirement
Hills Road	92m	130m	Yes

The required sight distances are achieved on both of the Burra-Spalding Road approaches and on Hills Road.

Signage

To improve the delineation of the Burra-Spalding Road for traffic approaching along Hills Road, particularly at night, a D4-SA2-1 Bidirectional Hazard Board is proposed to be installed at the head of the junction.

The D4-SA2-1 is the only new sign to be installed as part of the upgrade. It is considered that the T-Junction Rule will function adequately and no additional signage is considered necessary.

OUTCOME

The works proposed will assist in improving the safety of the Burra-Spalding / Hills Road Junction and accommodate the maximum size vehicle that will legally use the junction. The signage proposed is considered to be in accordance with AS1742.2. The junction has sufficient capacity to accommodate the increase in traffic volumes resulting from the feedlot development.

CONSULTATION

The upgrade has been developed liaison with officers from the Department of Planning, Transport and Infrastructure.

TRAFFIC IMPACT STATEMENT CERTIFICATION AND ENDORSEMENT

Select one of the following:

☒ **For proposals with standard traffic control devices only**
I certify that the installation, alteration or removal of the traffic control devices described in this TIS and shown on the attached plan(s) is appropriate to achieve the desired traffic management and road safety outcomes at the location, **and** is in accordance with the Australian Standards, DPTI's *Code of Technical Requirements* and DPTI's *Operational Instructions*, and I endorse this traffic impact statement.

or

☐ **For proposals with non-standard traffic control devices**
I certify that the installation, alteration or removal of the traffic control devices described in the TIS and shown on the attached plan(s) is an appropriate treatment at the location and I endorse this traffic impact statement.

<table>
<tr><td rowspan="2">PREPARED BY:
(Traffic Control Device Proposer)

Signed:  </td><td>Name: Heath Blacker</td><td>Date: 28.02.17</td></tr>
<tr><td colspan="2">Position: Traffic Engineer</td></tr>
<tr><td rowspan="2">ENDORSED:
(Recognised traffic engineering practitioner)
Signed:</td><td>Name:</td><td>Date:</td></tr>
<tr><td colspan="2">Position:</td></tr>
</table>

LEGEND

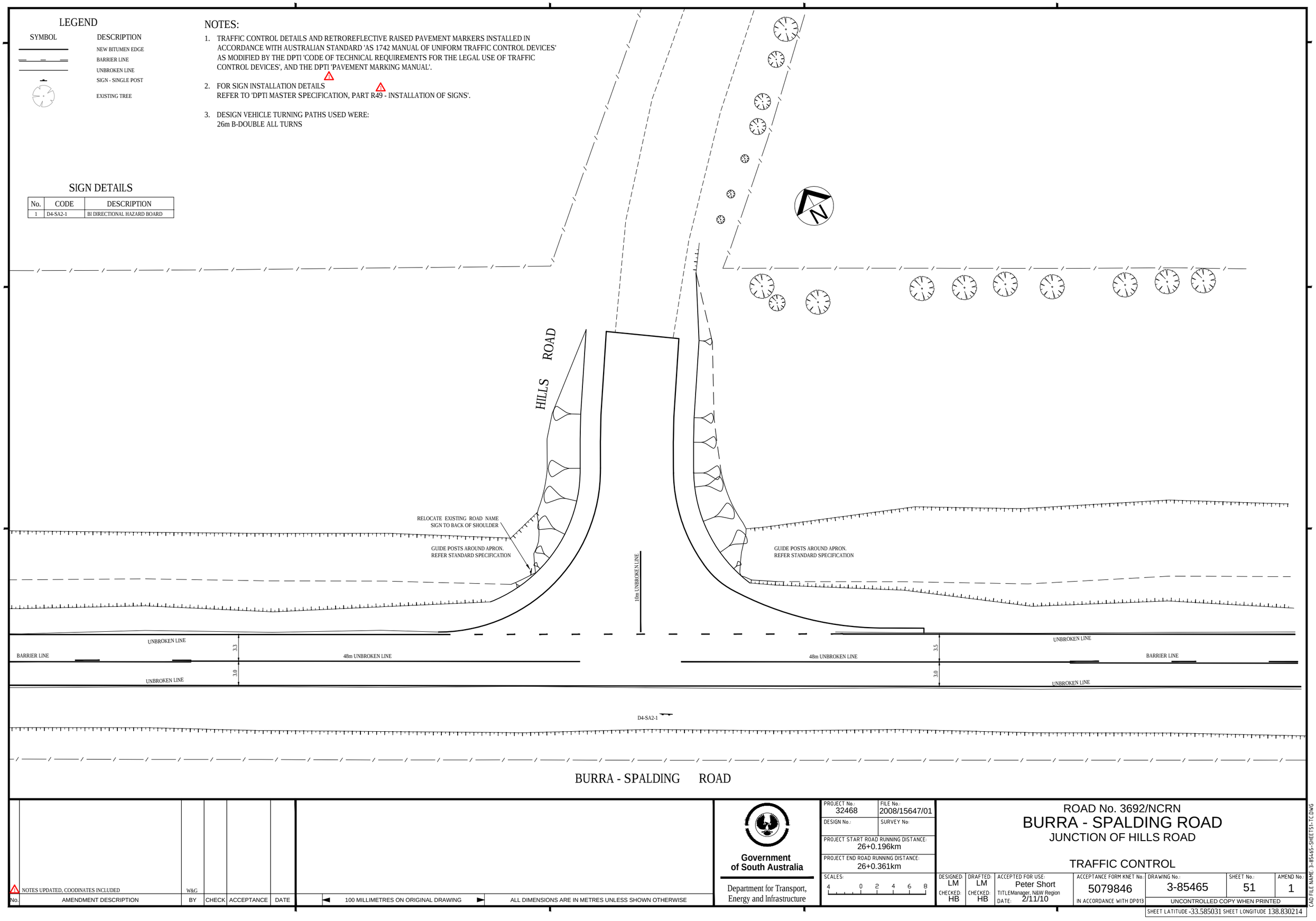
SYMBOL	DESCRIPTION
———	NEW BITUMEN EDGE
— — —	BARRIER LINE
———	UNBROKEN LINE
⊸	SIGN - SINGLE POST
	EXISTING TREE

NOTES:

1. TRAFFIC CONTROL DETAILS AND RETROREFLECTIVE RAISED PAVEMENT MARKERS INSTALLED IN ACCORDANCE WITH AUSTRALIAN STANDARD 'AS 1742 MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES' AS MODIFIED BY THE DPTI 'CODE OF TECHNICAL REQUIREMENTS FOR THE LEGAL USE OF TRAFFIC CONTROL DEVICES', AND THE DPTI 'PAVEMENT MARKING MANUAL'.
2. FOR SIGN INSTALLATION DETAILS REFER TO 'DPTI MASTER SPECIFICATION, PART R49 - INSTALLATION OF SIGNS'.
3. DESIGN VEHICLE TURNING PATHS USED WERE: 26m B-DOUBLE ALL TURNS

SIGN DETAILS

No.	CODE	DESCRIPTION
1	D4-SA2-1	BI DIRECTIONAL HAZARD BOARD



No.	AMENDMENT DESCRIPTION	BY	CHECK	ACCEPTANCE	DATE
1	NOTES UPDATED, COODINATES INCLUDED	W&G			

100 MILLIMETRES ON ORIGINAL DRAWING

ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE

Government of South Australia

Department for Transport, Energy and Infrastructure

PROJECT No.: 32468	FILE No.: 2008/15647/01
DESIGN No.:	SURVEY No:
PROJECT START ROAD RUNNING DISTANCE: 26+0.196km	
PROJECT END ROAD RUNNING DISTANCE: 26+0.361km	
SCALES: 4 0 2 4 6 8	

ROAD No. 3692/NCRN

BURRA - SPALDING ROAD

JUNCTION OF HILLS ROAD

TRAFFIC CONTROL

DESIGNED:	DRAFTED:	ACCEPTED FOR USE:	ACCEPTANCE FORM KNET No.:	DRAWING No.:	SHEET No.:	AMEND No.:
LM	LM	Peter Short	5079846	3-85465	51	1
CHECKED: HB	CHECKED: HB	TITLEManager, N&W Region DATE: 2/11/10	IN ACCORDANCE WITH DP013	UNCONTROLLED COPY WHEN PRINTED		

SHEET LATITUDE -33.585031 SHEET LONGITUDE 138.830214

CAD FILE NAME 3-85465-SHEET51-TCDWG

LEGEND

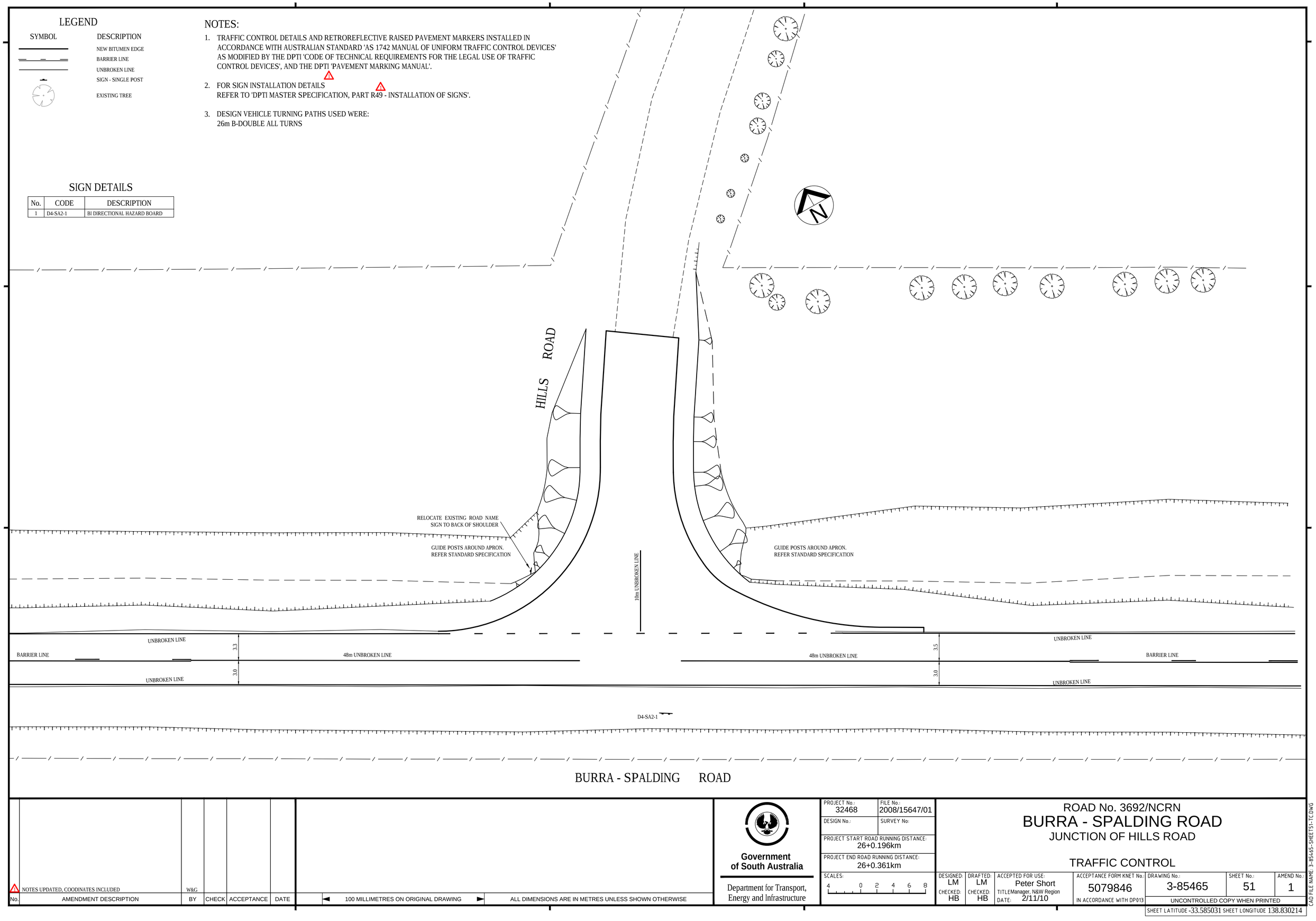
SYMBOL	DESCRIPTION
	NEW BITUMEN EDGE
	BARRIER LINE
	UNBROKEN LINE
	SIGN - SINGLE POST
	EXISTING TREE

NOTES:

1. TRAFFIC CONTROL DETAILS AND RETROREFLECTIVE RAISED PAVEMENT MARKERS INSTALLED IN ACCORDANCE WITH AUSTRALIAN STANDARD 'AS 1742 MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES' AS MODIFIED BY THE DPTI 'CODE OF TECHNICAL REQUIREMENTS FOR THE LEGAL USE OF TRAFFIC CONTROL DEVICES', AND THE DPTI 'PAVEMENT MARKING MANUAL'.
2. FOR SIGN INSTALLATION DETAILS
   REFER TO 'DPTI MASTER SPECIFICATION, PART R49 - INSTALLATION OF SIGNS'.
3. DESIGN VEHICLE TURNING PATHS USED WERE:
   26m B-DOUBLE ALL TURNS

SIGN DETAILS

No.	CODE	DESCRIPTION
1	D4-SA2-1	BI DIRECTIONAL HAZARD BOARD



No.	AMENDMENT DESCRIPTION	BY	CHECK	ACCEPTANCE	DATE
1	NOTES UPDATED, COODINATES INCLUDED	W&G			

◄ 100 MILLIMETRES ON ORIGINAL DRAWING ► ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE

Government of South Australia

Department for Transport, Energy and Infrastructure

PROJECT No.: 32468	FILE No.: 2008/15647/01
DESIGN No.:	SURVEY No:
PROJECT START ROAD RUNNING DISTANCE: 26+0.196km	
PROJECT END ROAD RUNNING DISTANCE: 26+0.361km	
SCALES: 4 0 2 4 6 8	

ROAD No. 3692/NCRN

BURRA - SPALDING ROAD

JUNCTION OF HILLS ROAD

TRAFFIC CONTROL

DESIGNED:	DRAFTED:	ACCEPTED FOR USE:	ACCEPTANCE FORM KNET No.:	DRAWING No.:	SHEET No.:	AMEND No.:
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CHECKED: HB	CHECKED: HB	TITLE Manager, N&W Region	IN ACCORDANCE WITH DP013	UNCONTROLLED COPY WHEN PRINTED		
		DATE: 2/11/10		SHEET LATITUDE -33.585031 SHEET LONGITUDE 138.830214		

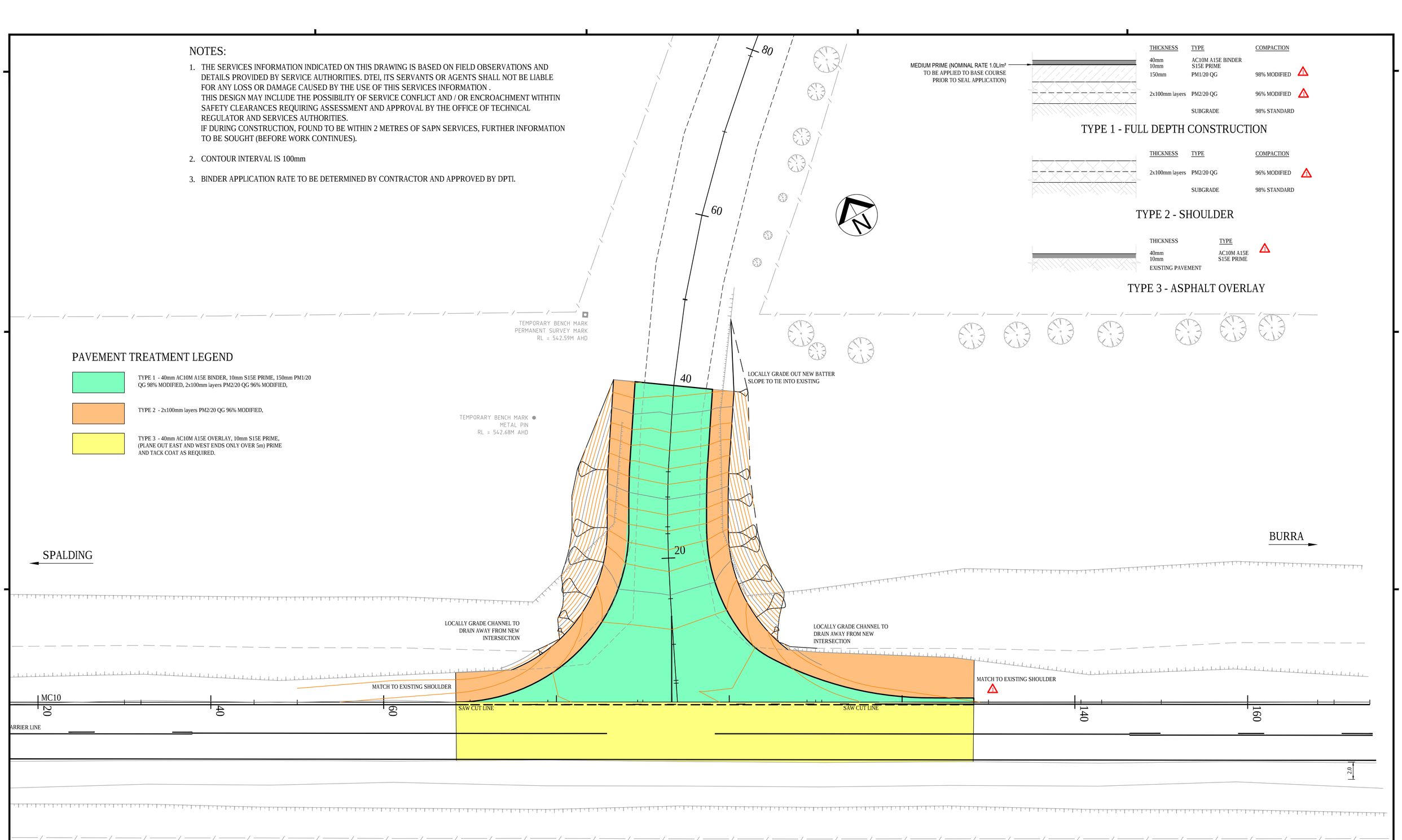
CAD FILE NAME: 3-85465-SHEET51-TC.DWG

NOTES:

1. THE SERVICES INFORMATION INDICATED ON THIS DRAWING IS BASED ON FIELD OBSERVATIONS AND DETAILS PROVIDED BY SERVICE AUTHORITIES. DTEI, ITS SERVANTS OR AGENTS SHALL NOT BE LIABLE FOR ANY LOSS OR DAMAGE CAUSED BY THE USE OF THIS SERVICES INFORMATION .
   THIS DESIGN MAY INCLUDE THE POSSIBILITY OF SERVICE CONFLICT AND / OR ENCROACHMENT WITHTIN SAFETY CLEARANCES REQUIRING ASSESSMENT AND APPROVAL BY THE OFFICE OF TECHNICAL REGULATOR AND SERVICES AUTHORITIES.
   IF DURING CONSTRUCTION, FOUND TO BE WITHIN 2 METRES OF SAPN SERVICES, FURTHER INFORMATION TO BE SOUGHT (BEFORE WORK CONTINUES).
2. CONTOUR INTERVAL IS 100mm
3. BINDER APPLICATION RATE TO BE DETERMINED BY CONTRACTOR AND APPROVED BY DPTI.

PAVEMENT TREATMENT LEGEND

- TYPE 1 - 40mm AC10M A15E BINDER, 10mm S15E PRIME, 150mm PM1/20 QG 98% MODIFIED, 2x100mm layers PM2/20 QG 96% MODIFIED,
- TYPE 2 - 2x100mm layers PM2/20 QG 96% MODIFIED,
- TYPE 3 - 40mm AC10M A15E OVERLAY, 10mm S15E PRIME, (PLANE OUT EAST AND WEST ENDS ONLY OVER 5m) PRIME AND TACK COAT AS REQUIRED.



MEDIUM PRIME (NOMINAL RATE 1.0L/m²
TO BE APPLIED TO BASE COURSE
PRIOR TO SEAL APPLICATION)

THICKNESS	TYPE	COMPACTION
40mm	AC10M A15E BINDER	
10mm	S15E PRIME	
150mm	PM1/20 QG	98% MODIFIED
2x100mm layers	PM2/20 QG	96% MODIFIED
	SUBGRADE	98% STANDARD

TYPE 1 - FULL DEPTH CONSTRUCTION

THICKNESS	TYPE	COMPACTION
2x100mm layers	PM2/20 QG	96% MODIFIED
	SUBGRADE	98% STANDARD

TYPE 2 - SHOULDER

THICKNESS	TYPE
40mm	AC10M A15E
10mm	S15E PRIME
EXISTING PAVEMENT	

TYPE 3 - ASPHALT OVERLAY

No.	AMENDMENT DESCRIPTION	BY	CHECK	ACCEPTANCE	DATE
1	PAVEMENT DETAILS UPDATED	W&G	W&G		

100 MILLIMETRES ON ORIGINAL DRAWING

ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE

Government of South Australia

Department for Transport, Energy and Infrastructure

PROJECT No.: 32468	FILE No.: 2008/15647/01
DESIGN No.:	SURVEY No:
PROJECT START ROAD RUNNING DISTANCE: 26+0.196km	
PROJECT END ROAD RUNNING DISTANCE: 26+0.361kn	
SCALES: 4 0 2 4 6 8	

ROAD No. 3692/NCRN

BURRA - SPALDING ROAD

JUNCTION OF HILLS ROAD

GENERAL CONSTRUCTION

DESIGNED:	DRAFTED:	ACCEPTED FOR USE:	ACCEPTANCE FORM KNET No.:	DRAWING No.:	SHEET No.:	AMEND No.:
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CHECKED: HB	CHECKED: HB	TITLEManager, N&W Region	IN ACCORDANCE WITH DP013	UNCONTROLLED COPY WHEN PRINTED		
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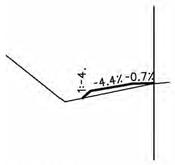

REF. STRING MC10 R.L.539.000

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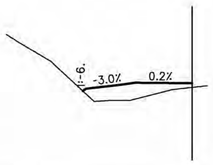
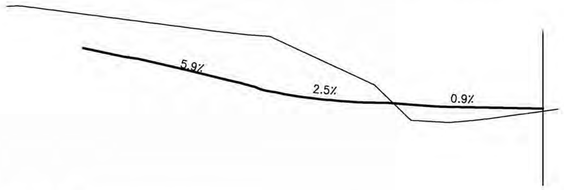
CH. 110.000





REF. STRING MC10 R.L.539.000

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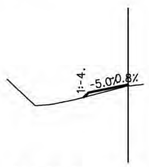
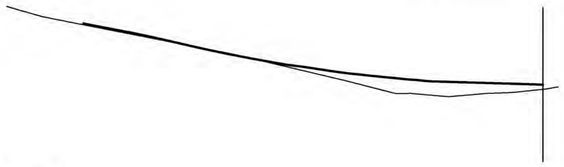
CH. 80.000

REF. STRING MC10 R.L.539.000

DESIGN LABEL			ESOI			ESIJ			MROI			MC10
DESIGN OFFSET	-30.000	-27.465	-26.440	-23.793	-23.413	-20.499	-19.742	-18.783	-17.993	-17.001	-16.097	-15.173	-14.223	-13.241	-12.220	-11.905	-11.152	-10.162	-10.030	-8.994	-8.116	-7.380	-6.465	0.001
DESIGN LEVEL	541.778	541.643	541.605	541.454	541.431	541.254	541.212	541.144	541.081	541.033	540.997	540.965	540.938	540.916	540.900	540.896	540.880	540.885	540.886	540.863	540.846	540.834	540.823	540.793

CH. 100.000





REF. STRING MC10 R.L.539.000

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CH. 70.000

REF. STRING MC10 R.L.539.000

DESIGN LABEL																								MC10
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DESIGN LEVEL	541.810	541.798	541.655	541.548	541.489	541.473	541.440	541.297	541.283	541.234	541.187	541.135	541.097	541.023	540.988	540.965	540.898	540.876	540.867	540.820	540.813

CH. 90.000

No.	AMENDMENT DESCRIPTION	BY	CHECK	ACCEPTANCE	DATE

◄ 100 MILLIMETRES ON ORIGINAL DRAWING ► ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE

Government of South Australia

Department for Transport, Energy and Infrastructure

PROJECT No.: 32468 | FILE No.: 2008/15647/01
DESIGN No.: | SURVEY No:
PROJECT START ROAD RUNNING DISTANCE: 26+0.196km
PROJECT END ROAD RUNNING DISTANCE: 26+0.361km
SCALES: 4 0 2 4 6 8

DESIGNED: LM CHECKED: HB | DRAFTED: LM CHECKED: HB | ACCEPTED FOR USE: Peter Short TITLE Manager, N&W Region DATE: 2/11/10 | ACCEPTANCE FORM KNET No.: 5079846 IN ACCORDANCE WITH DP013 | DRAWING No.: 3-85465 | SHEET No.: 53 | AMEND No.: A

ROAD No. 3692/NCRN

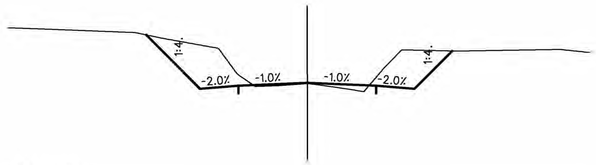
BURRA - SPALDING ROAD

JUNCTION OF HILLS ROAD

CROSS SECTIONS SHEET 2 (MC10)

UNCONTROLLED COPY WHEN PRINTED

CAD FILE NAME: 3-85465-SHEET53-XS2.DWG



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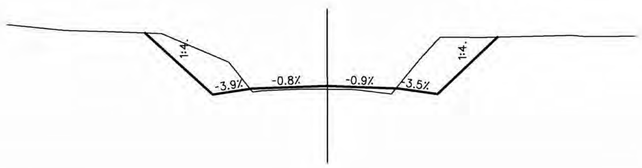
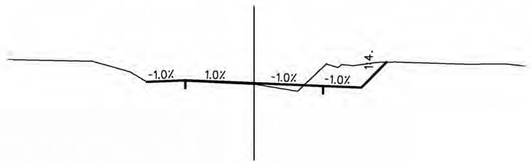
CH. 30.000





REF. STRING MC00 R.L.539.000

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CH. 20.000

REF. STRING MC00 R.L.540.000

DESIGN LABEL	ES00	CE00	MC00	CE01	ES01	IA01
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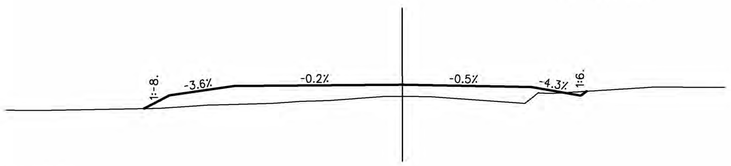
CH. 40.000



REF. STRING MC00 R.L.539.000

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DESIGN LEVEL	540.468	540.683	540.836	540.859	540.820	540.681	540.751

CH. 10.000

No.	AMENDMENT DESCRIPTION	BY	CHECK	ACCEPTANCE	DATE

100 MILLIMETRES ON ORIGINAL DRAWING

ALL DIMENSIONS ARE IN METRES UNLESS SHOWN OTHERWISE

Government of South Australia

Department for Transport, Energy and Infrastructure

PROJECT No.: 32468 | FILE No.: 2008/15647/01

DESIGN No.: | SURVEY No:

PROJECT START ROAD RUNNING DISTANCE: 26+0.196KM

PROJECT END ROAD RUNNING DISTANCE: 26+0.361KM

SCALES: 4 0 2 4 6 8

ROAD No. 3692/NCRN

BURRA - SPALDING ROAD

JUNCTION OF HILLS ROAD

CROSS SECTIONS SHEET 1 (MC00)

DESIGNED:	DRAFTED:	ACCEPTED FOR USE:	ACCEPTANCE FORM KNET No.:	DRAWING No.:	SHEET No.:	AMEND No.:
LM	LM	Peter Short	5079846	3-85465	52	A
CHECKED: HB	CHECKED: HB	TITLE: Manager, N&W Region DATE: 2/11/10	IN ACCORDANCE WITH DP013	UNCONTROLLED COPY WHEN PRINTED		

CAD FILE NAME: 3-85465-SHEET52-XS1.DWG

Government of South Australia
South Australian Murray-Darling Basin
Natural Resources Management Board

Murray Bridge
Head Office
PO Box 2343
MURRAY BRIDGE SA 5253
Tel 08 8532 9100
Fax 08 8531 1843
ABN 14 305 414 800
www.samdbnrm.sa.gov.au

8 December 2016

Simon Nelder
Planning Officer
Department of Planning, Transport and Infrastructure
Level 1, 211 Victoria Square
ADELAIDE SA 5000

Dear Mr Nelder,

Development No. 422/E003/16
Applicant: Ilira Pty Ltd & Sihero Pty Ltd
Proposal: Expansion of an existing beef cattle feedlot
Subject Land: 8117 Barrier Highway, Mount Bryan SA 5418

Thank you for providing the Department of Environment, Water and Natural Resources (DEWNR), the SA Murray-Darling Basin Natural Resources Management (SAMDB NRM) Board and the Northern and Yorke Natural Resources Management (N&Y NRM) Board with the opportunity to comment on the proposed expansion of an existing beef cattled feedlot prepared by Ilira Pty Ltd & Sihero Pty Ltd.

It is understood that the proposed expansion facility will have a development footprint of 24.8ha and seeks to establish: water supply, storage and reticulation system, fenced pens, new site entrance and internal access roads, controlled drainage areas, solid and liquid waste management (and utilisation areas). Temporary construction and erosion control measures, bulk earthworks, and native vegetation clearance will also be required during construction. The proposed capacity of the expanded feedlot will be 16,642 head of cattle-on-feed (from 6090). Existing livestock handling, feed processing and administration / maintenance areas are already established on-site.

A site inspection was undertaken with DEWNR and DPTI staff on Wednesday 16th November at which DEWNR staff noted the following:

- Proposal to increase feedlot capacity from 6090 head to 16,642 (by replicating feedlots)
- Proposed feedlot expansion footprint approximately 24.8ha
- Increased water usage to 157 mega litres
- Applicants want to purchase adjoining property (currently owned by the Weddings)
- Looking at converting entire operation to solar as there is no grid power to property
- In the future looking at converting to methane power as the power station that the wind turbines tap into are not far from the feedlot
- Currently have equipment onsite that will process 120 heads of cattle per hour (microchips, tagging, injections)
- Each new feedlot stage will have its own catchment containment
- Excess manure spread along windrows
- DPTI staff have advised that the EPA will look at the catchment proposal and requirements

- Estimated cost is about $50,000 per pen to build
- Currently 8 bores on the property
- Topography of the station naturally blocks both the existing feedlot and the proposed new feedlot site; can be partially seen by traffic on the Spalding/Booborowie Highway
- Proposed development will be built in stages with a time frame of around 5 years
- Approximately 3 trucks will be moving through the site each day
- Key issues that relate to our organisation are ground water usage, native vegetation clearance and ongoing weed management

The proposal documents have been reviewed and we provide the following comments for your consideration.

Pest Plant and Animal Control

All contractors have a basic responsibility or duty of care to present the spread of Declared Weeds in line with *The Natural Resources Management Act 2004* and unwanted pests, such as insects and diseases. A basic Biosecurity Plan that sets out procedures to minimise the risk, particularly during the construction phase for all those when entering or leaving the property should be considered in the application. Biosecurity guidelines can include wash down procedures to remove any contaminated soil or weed material from vehicles and machinery before entering the property and or if landfill is required ensure weed free soil is delivered or removed from the site.

Soil Management

Conditions for soil management on the development site:

- All scarring or physical disturbance of the land surface during any excavation work shall be restricted to only that which is shown on the approved plan as required for construction and access purposes. All exposed faces and spoil on and around such scarred areas shall be covered with suitable ground cover so as to reduce the potential for soil erosion.
- The proposed works and ongoing management of the site must be undertaken in a manner that prevents silt, sediments, manures or other pollutants leaving the site, including but not limited to, the use of erosion and sediment control measures such as catch/diversion drains, filter fences, sediment fences, sediment traps and basins, re-vegetation and straw bale barriers.
- Effective measures must be implemented during the construction of the development and ongoing use of the land in accordance with this consent to:
    - Prevent soil, silt and / or sediment run off from the land to adjoining properties, roads and drains.
    - Prevent soil, silt and / or sediment run off from entering any nearby watercourses.
    - Control and suppress dust arising from the site during construction and whilst in operation as a feed lot, so as not to be a nuisance to residents or occupiers on adjoining or nearby properties, and so as not to deposit dust in nearby watercourses and lands
    - Ensure that soil or mud is not transferred onto the adjacent roadways by vehicles leaving the site.

A suitable vegetation buffer should be planted between the development and neighbouring properties to assist in dust mitigation. This should be revegetated using local native plant species.

Water Resources

The conditions of the DA should include a requirement for the works to be undertaken in a manner consistent with the relevant Objectives and Principles of the following sections of Volumen D of the Norther and Yorke Regional Natural Resources Management Plan:

- Chapter 4. Best practices in land management p12
- Chapter 5. Water Affecting Activities
  - General Objectives and Principles pp14-15
  - Section 5.2.3. Management of Wells pp16-17
  - Section 5.2.5. Management of Dams pp19-20
  - Section 5.2.6. Management of Infrastructure pp21-22
  - Section 5.2.7. Management of Discharge pp22-23

A copy of Volume D of the Northern and Yorke Natural Resources Management Plan can be found at www.naturalresources.sa.gov.au/northernandyorke/about-us/our-regions-plan.

The proposed development is not located within a prescribed water resource area. Using the information provided by the applicant for water use on the proposed increase in stock numbers and pro-rata against the current stock numbers the total water demand for the feed lot can just be met by the capacity of the two bores supplying the ground water, pumping 24 hours a day every day. With this in mind it's uncertain the proposed development and use of water is within sustainable limits let alone what impact the extraction of such volumes will have on the resource and if there would be any detrimental impact on the hydrological and hydrogeological systems and any dependent environmental assets. The hydrological report provided with the application dates back to 2008.

Therefore it is recommended that a condition of the DA should require that a baseline monitoring report for all bores included in the proposed development be provided to the Department of Environment, Water and Natural Resources prior to the commencement of operation of the feedlot. A further condition should be included that would require an annual report on the water use and water level of the bores by provided to DEWNR.

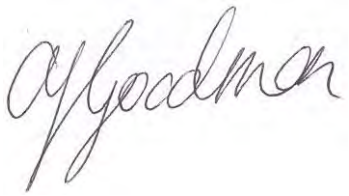
A further condition on the development approval should be that at no stage should any surface water be allowed to leave the development site and find its way into the watercourse. The proposed design appears to achieve this outcome.

Also the applicant should ensure that any works or activities be undertaken in a manner that reduces the risk of any sediment, pollutants etc from entering the watercourse by implementing appropriated sediment control measures and by undertaking such works during the dryer months of the year.

If you require further information on this matter, please contact Lyndal Densley, Assistant Policy Officer in the SAMDB region on telephone (08) 8532 9116 or via the email address below. Please note that future correspondence can be directed to:

Email: DEWNR.SAMDBReferrals@sa.gov.au
Address: South Australian Murray-Darling Basin NRM Board
Attention: Referrals
110A Mannum Road
MURRAY BRIDGE SA 5253

Yours Sincerely



Amy Goodman
Manager, Planning and Evaluation
Natural Resources, SAMDB

Environment Protection Authority
www.epa.sa.gov.au

EPA
South Australia

GPO Box 2607 Adelaide SA 5001
250 Victoria Square Adelaide SA
T (08) 8204 2000 F (08) 8204 2020
Country areas 1800 623 445

EPA Reference: 34066

5 May 2017

Dr Simon Neldner
Planning Officer
Development Assessment Commission
GPO Box 1815
ADELAIDE SA 5001

Dear Dr Neldner

DIRECTION - Activities of Major Environmental Significance

Development Application No.	422/E003/16 A1
Applicant	Ilira Pty Ltd and Sihero Pty Ltd
Location	B27, B28 DP2033, Hundred Ayers, 8117 Barrier Highway, Mount Bryan SA 5418.
Activity of Environmental Significance	Schedule 8 Item 11; Schedule 22 Part A Activities, Item 22-5(1), 22-6(3)
Proposal	Expansion of an existing cattle feedlot.

Decision Notification	A copy of the decision notification must be forwarded to: Client Services Officer Environment Protection Authority GPO Box 2607 ADELAIDE SA 5001

I refer to the above development application forwarded to the Environment Protection Authority (EPA) in accordance with Section 37 of the *Development Act 1993*. The proposed development involves an activity of major environmental significance as described above.

The following response is provided in accordance with Section 37(4)(b)(ii) of the *Development Act 1993* and Schedule 8 Item 11 of the *Development Regulations 2008*.

In determining this response the EPA had regard to and sought to further the objects of the *Environment Protection Act 1993*, and also had regard to:

- the General Environmental Duty, as defined in Part 4, Section 25 (1) of the Act; and
- relevant Environment Protection Policies made under Part 5 of the Act.

Please direct all queries relating to the contents of this correspondence to Melissa Chrystal on telephone (08) 8204 1318 or facsimile (08) 8124 4673 or email Melissa.Chrystal@epa.sa.gov.au.

THE PROPOSAL

This Development Application proposes the expansion of an existing cattle feedlot (known as Princess Royal Station) from 4,409 standard cattle units (SCU) to 13,492 SCUs (being equivalent to 16,642 head of cattle).

The proposed feedlot would operate as a Class 1 feedlot, as described by the *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia* (2006) ('the SA Guidelines'). The stocking density of cattle would be 12.9 square metres per animal or 15 square metres per SCU.

The proposal includes additional solid and liquid waste management areas, solid and liquid waste utilisation areas, and ancillary infrastructure including internal road and drainage systems.

The composting of solid waste, including manure scraped from pens and deceased cattle, would occur onsite. In excess of 3,000 tonnes per year of solid waste would be composted onsite.

SITE DESCRIPTION

The site of the proposed development is 8117 Barrier Highway, Mount Bryan (also described as B27 and B28 of DP2033).

The subject site is located within the Primary Production Zone of the *Goyder Council Development Plan* (consolidated 18 October 2012).

The site is currently operated as the Princess Royal feedlot. The existing feedlot is constructed and operated at a Class 1 standard for 4,409 SCUs (being equivalent to 6,090 head of cattle). The existing feedlot is licenced by the EPA (license no. 33182).

Surrounding land uses are predominantly rural or agricultural in nature.

The nearest dwelling not associated with the proposed cattle feedlot is located approximately 2,000 metres from the proposed feedlot.

The site has not been inspected during the EPA's consideration of this DA but has been viewed using mapping information available to the EPA, including recent aerial imagery, and considered according to existing knowledge of the site and the locality.

CONSIDERATION

Advice in this letter includes consideration of the location with respect to existing land uses and is aimed at protecting the environment and avoiding potential adverse impacts upon the locality.

When assessing the proposed development, the EPA considered the plans and specifications supplied in the application including the following documents:

- Development Application - Beef Cattle Feedlot Expansion report prepared by Ostwald Bros, dated 29/07/2016 and associated plans and attachments; and
- DPTI Information Request - DA 422_E003_16 - Beef Cattle Feedlot Expansion report prepared by Ostwald Bros, dated 31/03/2017.

When assessing development applications referred to the EPA in accordance with the requirements of the *Development Act 1993*, section 57 of the *Environment Protection Act 1993* ('the EP Act') states that the EPA must have regard to the general environmental duty, any relevant environment protection policies and the waste strategy for the State adopted under the *Zero Waste SA Act 2004* (if relevant).

The general environmental duty, as described at section 25 of the EP Act, states:

A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

ENVIRONMENTAL ISSUES

Interface with Existing Land Uses

If not appropriately designed and managed, the odour, dust and noise impacts may arise from cattle feedlots.

The nearest residential dwelling is located approximately 2,000 metres from the activity boundary of the expanded feedlot. The nearest town is Mount Bryan which is approximately 4,650 metres from the subject site.

The EPA's *Evaluation distances for effective air quality and noise management* (2016) http://www.epa.sa.gov.au/files/12193_eval_distances.pdf ('the Evaluation Distance publication') is designed to manage the risks to sensitive land uses resulting from exposure to adverse air quality and noise impacts. The Evaluation Distance publication recommends that the appropriate distance between cattle feedlots and sensitive land uses (including dwellings) should be determined having regard to the *National Guidelines for Beef Cattle Feedlots in Australia* (2012) ('the National Guidelines').

The National Guidelines uses a formula to calculate recommended separation distances that takes into account the proposed cattle density, receptor type, and surrounding topography and vegetation.

The applicant has provided calculations of separation distances in support of the proposal. The calculations consider the separation between the expanded feedlot and five rural dwellings, as well as the separation distance to the towns of Mount Bryan, Booborowie and Burra. The calculated minimum recommended separation between the feedlot and nearby rural dwellings is 1,268 metres and the minimum separation to towns is 4,650 metres.

The EPA has reviewed the separation distance calculations provided by the applicant and is satisfied they can be achieved.

Air Quality

Odour is produced by the biological decomposition of manure, spilt feed and other organic matter. There are a number of odour sources including feedlot pens, handling yards, effluent treatment systems, and composting or manure stockpile pads.

Dust sources include the movement of cattle or vehicles (light and heavy vehicles), and dust from stockpiled material or on pen/yard surfaces which may be blown around by the wind during drier months.

When considering a DA referred to the EPA, the *Environment Protection (Air Quality) Policy 2016* ('the Air Quality EPP') requires the EPA to take into account the Evaluation Distance publication. As discussed above, the Evaluation Distance publication in turn refers to the National Guidelines to determine the appropriate separation distance to effectively manage potential odour and dust impacts arising from a cattle feedlot.

Given the separation distance of no less than 2,000 metres between the feedlot and nearby sensitive land uses (meeting the calculated minimum separation distance), the EPA considers that odour from the operations of the feedlot is unlikely to exceed the odour levels specified in the Air Quality EPP and dust is unlikely to cause a nuisance to nearby receivers. As such the proposal does not require specific onsite odour or dust mitigation measures.

Further the current EPA licence contains conditions relating to odour and dust prevention.

This is acceptable to the EPA.

Noise

Noise associated with cattle feedlots is typically generated by delivery trucks, feed milling and handling, other plant and equipment, and cattle noise.

The *Environment Protection (Noise) Policy 2007* ('the Noise EPP') establishes the relevant noise criteria for the undertaking of activities including cattle feedlots. Further the general environment duty is deemed to be satisfied if the noise goals are met at noise-affected premises.

The National Guidelines state that "separation distances have traditionally been applied to address feedlot odour impacts; however, these distances will typically be more than sufficient to mitigate noise, dust, and most other aesthetic impacts from a feedlot development".

Given the separation distance of 2,000 metres between the feedlot and the nearest sensitive receptor, the EPA considers that noise from the operations of the feedlot is unlikely to exceed the noise goals of the Noise EPP and as such does not require specific onsite noise mitigation measures.

Further the current EPA licence contains a condition relating to noise management.

This is acceptable to the EPA.

Water Quality

Wastewater generated by the proposal would include animal faeces and contaminated stormwater from the production area, containing high levels of organic matter. Therefore, any overflow to surface water and seepage to groundwater may cause environmental risks if wastewater is not managed properly.

It is a mandatory provision of the *Environment Protection (Water Quality) Policy 2015* ('the Water Quality EPP') that a cattle feedlot incorporates a wastewater management system that operates effectively during the use of the cattle feedlot to ensure that waste is not discharged into any waters.

The applicant proposes several design and operational measures to minimise the likelihood of wastewater accessing ground or surface waters, including (but not limited to):

- controlled drainage areas would be constructed to include feedlot pens and associated hard and soft catchment areas such as road and cattle lanes. All runoff from these areas would be conveyed via the wastewater management system to sedimentation basins and storage lagoons
- diversion banks prevent the flow of clean stormwater through the controlled drainage area
- drains, sedimentation basins and lagoons are designed having regard to the National Guidelines
- additional wastewater storage lagoons have been designed in accordance with the EPA's *Wastewater Lagoon Construction Guidelines* (2014) ('the Lagoon Guidelines') as required by the Water Quality EPP; and
- hazardous liquids including cleaning agents, petrol, oils, solvents and veterinary medicines would be stored in a shipping container designated for the storage of hazardous chemicals. The shipping container would be sealed and contain a bunded area no less than 25% of the total volume of the stored products (contained in drums and other small containers) as recommended by the EPA's *Bunding and spill management guidelines* (2012).

This is acceptable to the EPA subject to the conditions directed below.

The DA documentation does not specifically describe the pen floor construction details, however it does state that the feedlot would be constructed to Class 1 standard as defined by the SA Guidelines. As such, al condition to this effect is directed below.

The DA documentation indicates that, to cater for additional contaminated stormwater within the controlled drainage areas, either a new storage lagoon would be constructed or the

existing lagoon would be extended. As the DA documentation does not include details for an extension of the existing lagoon, the EPA has only assessed the proposal for a new lagoon. Therefore if the applicant intends to extend the existing lagoon, further approval should be sought from the EPA (and the planning authority as necessary). A note to this effect is recommended below.

Waste Management

The wastes generated by the proposed activities include solid and liquid effluent generated by the cattle confined in the feedlot pens and cattle laneways, spilt feed and water leakage from troughs located in feedlot pens, and deceased cattle carcasses. Such wastes contain organic and mineralised manure constituents that could have adverse impacts on the environment if released uncontrolled from the site.

Solid and liquid effluent

Each controlled drainage area of the expanded feedlot would have a dedicated solid waste storage and processing area. The solid waste storage and processing areas are proposed to be constructed on a low permeability clay liner with a minimum thickness of 300 mm in accordance with the SA Guidelines.

Solid and liquid wastes would be stored and composted onsite before being utilised for pasture enrichment on both the subject site and on nearby land owned by the feedlot operator. Solid wastes would not be applied to land within 20 metres of a property boundary or 20 metres of drainage lines. Annual application rates would be based on annual soil tests.

The majority of the water stored on site and would be reused for dust suppression, construction water and landscaping.

This is acceptable to the EPA.

Mortalities

The SA Guidelines estimate an industry average of 0.7% morality rate. For a feedlot comprising up to 16,642 head of cattle, this equates to up to 117 mortalities per year.

Carcasses are to be removed from the pens on a daily basis and relocated to the existing solid waste storage area. The solid waste storage area is located within the controlled drainage area of the feedlot.

Carcasses would be composted in separate windrows to the bulk manure windrows. The windrows would be managed to ensure an effective aerobic composting process.

The applicant has also given consideration to an emergency management procedure in the case of mass mortalities. The applicant has provided details of where on-site burial would be located and how on-site burial would be managed. The emergency management burial procedure is consistent with the provisions of the SA Feedlot Guidelines.

This is acceptable to the EPA.

Environmental Authorisation

The EP Act requires the issue of an environmental authorisation (EPA licence) prior to operating land for the activities of:

5(1) Cattle Feedlots; and

6(3) Composting.

The existing feedlot currently holds EPA licence 33182. The existing licence authorises the operation of a cattle feedlot for up to 4,409 SCUs at any one time. The existing licence does not authorise the production of compost at a rate exceeding 200 tonnes per year. As such the operator of the feedlot will need to contact the EPA to update the activities referenced on the licence as well as the number of cattle permitted to be held onsite.

A note to this effect is recommended below.

It is noted that the existing wastewater storage lagoon, sedimentation basin and solid waste storage area is located on an allotment known as B27 DP2033. Allotment B27 DP2033 does not form part of the existing EPA licence. Therefore the existing licence should be updated to include B27 DP2033.

A note to this effect is recommended below.

CONCLUSION

This DA proposes to expand an existing cattle feedlot to increase the number of cattle from 4,409 SCUs to 13,492 SCUs and provide additional infrastructure including sedimentation basins and wastewater storage lagoons.

Provided the proposed expansion of the feedlot is constructed and operated in accordance with the DA documentation and the conditions directed below, the EPA is satisfied that the proposal would not result in adverse environmental impacts having regard to the separation between the subject site and nearby rural dwellings and towns and the proposed liquid and solid waste management systems.

Notes are recommended below advising the applicant to contact the EPA prior to acting on this approval to ensure the EPA licence is updated to reflect any approval granted.

DIRECTION

The planning authority is directed to attach the following conditions to any approval:

1. Prior to the commencement of operation, all feedlot pens must be constructed to a Class 1 standard described in Appendix 2 of the *Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia* (2006).
2. Prior to the commencement of operation, all drains, solid waste storage and composting areas must be lined with a minimum thickness of 300mm of compacted clay or similar low permeability barrier which has a design permeability of no greater than $1x10^{-9}$ m/s.

3. Prior to the commencement of operation, all wastewater lagoons must be lined with a minimum thickness of 600mm of compacted clay or similar low permeability barrier which has a design permeability of no greater than $1x10^{-9}$ m/s.
4. Prior to the commencement of operation, all controlled drainage areas must be connected to the wastewater management system.
5. An "As-constructed Report" for the production pen floor, drains, solid wastes storage, composting area, sedimentation pond and storage lagoons must be provided to the satisfaction of the EPA to demonstrate compliance with the designed specifications prior to introducing any cattle into the proposed production pens.

The following notes provide important information for the benefit of the applicant and are requested to be included in any approval:

- The applicant is reminded of its general environmental duty, as required by Section 25 of the *Environment Protection Act*, to take all reasonable and practicable measures to ensure that the activities on the whole site, including during construction, do not pollute the environment in a way which causes or may cause environmental harm.
- An environmental authorisation in the form of a licence is required for the operation of this development. The applicant is required to contact the Environment Protection Authority before acting on this approval to ascertain licensing requirements. In particular the applicant is advised that the EPA licence must be updated to refer to the approved number of cattle (or SCUs) and the allotment on which the wastewater storage lagoon and composting area are located.
- A licence may be refused where the applicant has failed to comply with any conditions of development approval imposed at the direction of the Environment Protection Authority.
- If the applicant / operator wishes to expand the existing lagoon instead of constructing the proposed new lagoon, the applicant should contact the planning authority to ensure the necessary approvals are obtained.
- EPA information sheets, guidelines documents, codes of practice, technical bulletins etc can be accessed on the following web site: http://www.epa.sa.gov.au

Yours faithfully

Courtney Stollznow
Delegate
ENVIRONMENT PROTECTION AUTHORITY

In reply please quote 2016/00183/01, *Process ID:* 428943
Enquiries to Matthew Henderson
Telephone 0419 747 010
Facsimile (08) 8226 8330
E-mail dpti.luc@sa.gov.au

Government of South Australia
Department of Planning, Transport and Infrastructure

SAFETY AND SERVICE – Traffic Operations

GPO Box 1533
Adelaide SA 5001

Telephone: 61 8 8226 8222
Facsimile: 61 8 8226 8330

ABN 92 366 288 135

19/05/2017

Development Assessment Commission
C/- Dr Simon Neldner
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5001

Dear Simon,

CONSULTATION ADVICE

Development No.	422/E003/16
Applicant	Ilira Pty Ltd & Sihero Pty Ltd
Location	Hills Road, Booborowie
Proposal	Expansion of the existing beef cattle feedlot

I refer to the above development application forwarded to the Safety and Service Division of the Department of Planning, Transport and Infrastructure (DPTI) requesting informal comment. DPTI provides the following report to assist the planning authority with its decision.

THE PROPOSAL

The subject development proposes to expand an existing feedlot located on a site approximately 13km north-west of Burra. The site is located on Hills Road, a Council road, and accessed via the Goyder Highway / Hills Road junction. Goyder Highway is an arterial road under the care, control and management of DPTI, with an AADT of 400 vehicles per day (17.5% commercial vehicles) and a speed limit of 110 km/h at this location. Goyder Highway is gazetted for vehicles up to and including 26 metre B-doubles. As such, any development along this road must be carefully managed to ensure that the safety and efficiency of the road is not compromised.

CONSIDERATION

It is understood that the feedlot was established under DA 422/0064/07, and that the conditions of approval for that application required upgrades to the Goyder Highway / Hills Road junction, including apron widening/sealing and shoulder widening. These works are now being progressed through DPTI (RAMA North). However, these works are based on the scope of development approved under DA 422/0064/07. Consequently, it has been necessary for further traffic analysis to be undertaken to identify whether additional work is required to ensure that road safety and efficiency will be maintained for the expanded development.

SSD has recently completed review of the last pieces of outstanding information provided by the applicant's consultant, and concludes that it is necessary for the minimum right turn treatment (a Rural Basic Right-turn Treatment (BAR)) defined in Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, to be installed at the Goyder Highway / Hills Road junction in conjunction with the development. This will complement the currently progressing works on the Hills Road side of the junction and maximise road

safety in this high speed environment. All costs associated with the road upgrades required to facilitate the development will be borne by the applicant.

ADVICE

SSD does not object in-principle to the proposed development. The planning authority is advised to attach the following conditions to any approval:

1. Access to serve the development will be via the upgraded Goyder Highway / Hills Road junction. In addition to the upgrade works required under DA 422/0064/07, a Rural Basic Right-turn Treatment (BAR), consistent with Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, any relevant Australian Standards and any DPTI requirements, shall be installed at the junction.

2. All costs associated with the design and construction of the road upgrades required to facilitate the development (including, but not limited to, project management and any necessary road drainage upgrades) shall be borne by the applicant. The applicant shall enter into a Developer Agreement with DPTI regarding these works and shall contact DPTI's Asset Enhancement Engineer, Mr Victor Ling on (08) 8104 5630 or via email victor.ling@sa.gov.au.

3. The upgrades to the Goyder Highway / Hills Road junction shall be completed prior to operation of the development.

Yours sincerely,

MANAGER, TRAFFIC OPERATIONS

For **COMMISSIONER OF HIGHWAYS**

A copy of the decision notification would be appreciated and can be forwarded to dpti.developmentapplications@sa.gov.au

Rep#1

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

Applicant:	422/E003/16
Development Number:	Ilira Pty Ltd & Sihero Pty Ltd
Nature of Development:	Staged expansion of an existing cattle feedlot and associated works / activities – Princess Royal Station
Type of development:	Merit
Zone / Policy Area:	Primary Production Zone
Subject Land:	Hills Road, Booborowie (Blocks 27-28, DP2033: CT 5475/736; s894, Hundred of Ayers: CT 5469/103).
Contact Officer:	Simon Neldner
Phone Number:	7109 7058
Close Date:	17 May 2017

My name: DON WHITE

My phone number: (08) 88922367

PRIMARY METHOD(s) OF CONTACT: Email address:

Postal address: PO BOX 55

BURRA SA Postcode 5417

You will be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard in support of your submission.

My interests are:

- [x] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is WHITE ROAD, BURRA SECTIONS 508, 208, 210, 209, 207, 206, 205, 204 203, 202, 201, 200 HUNDRED OF AYERS Postcode 5417

The specific aspects of the application to which I make comment on are:

I have concerns regarding the adequacy of water supply in the recharge area & would like to see ongoing and historical data kept to ensure no disadvantage to neighbouring groundwater users.
I have no objections to the proposal and indeed it has my support.
I do however, question the adequacy of data on groundwater supplies & would like an assurance that our supply would not be affected by this development in the future.

I

- [ ] wish to be heard in support of my submission
- [x] do not wish to be heard in support of my submission

(Please tick one)

By

- [ ] appearing personally
- [ ] being represented by the following person:

(Please tick one)

Date 7/5/2017 Signature gm Comerville for D.A. WHITE (daughter)

Return Address: The Secretary, Development Assessment Commission, GPO Box 1815, Adelaide SA 5001 or dacadmin@sa.gov.au.

Rep 2

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

Applicant:	422/E003/16
Development Number:	Ilira Pty Ltd & Sihero Pty Ltd
Nature of Development:	Staged expansion of an existing cattle feedlot and associated works / activities – Princess Royal Station
Type of development:	Merit
Zone / Policy Area:	Primary Production Zone
Subject Land:	Hills Road, Booborowie (Blocks 27-28, DP2033: CT 5475/736; s894, Hundred of Ayers: CT 5469/103).
Contact Officer:	Simon Neldner
Phone Number:	7109 7058
Close Date:	17 May 2017

My name: James & Julia Clarke

My phone number: 08 8934029

PRIMARY METHOD(s) OF CONTACT: Email address: pamatta@bigpond.com

Postal address: PO Box 199

Burra Postcode 5417

You will be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard in support of your submission.

My interests are:

- [x] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is potentially 622 Belcunda Rd, Mt Bryan Postcode 5417

The specific aspects of the application to which I make comment on are:

- We would like to see more current and appropriate data regarding groundwater. Specifically around standing water levels and water usage by cattle.
- Will bores need to be metered.
- If there is a change in the status of the bores what is the alternative proposed water source for the development

I

- [x] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission

(Please tick one)

By

- [x] appearing personally
- [ ] being represented by the following person:

(Please tick one)

Date 16/5/17 Signature J Clarke

Return Address: The Secretary, Development Assessment Commission, GPO Box 1815, Adelaide SA 5001 or dacadmin@sa.gov.au.

Rep 3

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

Applicant:	422/E003/16
Development Number:	Ilira Pty Ltd & Sihero Pty Ltd
Nature of Development:	Staged expansion of an existing cattle feedlot and associated works / activities – Princess Royal Station
Type of development:	Merit
Zone / Policy Area:	Primary Production Zone
Subject Land:	Hills Road, Booborowie (Blocks 27-28, DP2033: CT 5475/736; s894, Hundred of Ayers: CT 5469/103).
Contact Officer:	Simon Neldner
Phone Number:	7109 7058
Close Date:	17 May 2017

My name: W. D GEBHARDT

My phone number: 0409 934010

PRIMARY METHOD(s) OF CONTACT: Email address: WD GEBHARDT 57 @ gmail.com

Postal address: Box 264 BURRA

Postcode 5417

You will be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard in support of your submission.

My interests are:

- [x] owner of local property
- [x] occupier of local property
- [x] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is RANGE Road M^T BRYAN Postcode 5418

The specific aspects of the application to which I make comment on are:

MORE UP TO DATE WATER DATA
WHAT MEASURES TO BE TAKEN FOR AIR QUALITY & FLY CONTROL
DURING MANAGEMENT IS NOT EFFECTIVE OF WEB CONTROL

I

- [x] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission

(Please tick one)

By

- [x] appearing personally
- [ ] being represented by the following person:

(Please tick one)

Date 16/5/17 Signature W D Gebhardt

Return Address: The Secretary, Development Assessment Commission, GPO Box 1815, Adelaide SA 5001 or dacadmin@sa.gov.au.

Rep 4

11517209

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

RECEIVED
17 MAY 2017
DAC

Applicant:	422/E003/16
Development Number:	Ilira Pty Ltd & Sihero Pty Ltd
Nature of Development:	Staged expansion of an existing cattle feedlot and associated works / activities – Princess Royal Station
Type of development:	Merit
Zone / Policy Area:	Primary Production Zone
Subject Land:	Hills Road, Booborowie (Blocks 27-28, DP2033: CT 5475/736; s894, Hundred of Ayers: CT 5469/103).
Contact Officer:	Simon Neldner
Phone Number:	7109 7058
Close Date:	17 May 2017

My name: R.B & J.J Riggs P/L (Richard & Tom Riggs)

My phone number: 0438046691 0419 822 140

PRIMARY METHOD(s) OF CONTACT: Email address: rbjjriggs2@bigpond.com

Postal address: P.O Box 46 Burra

Postcode 5417

You will be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard in support of your submission.

My interests are:

- [x] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is 7731 Barrier Highway Burra Postcode 5417

The specific aspects of the application to which I make comment on are:

BEING IMMEDIATE NEIGHBOUR TO THE SOUTH OF MACKLODE WE ARE VERY CONCERNED ABOUT WHAT MAY HAPPEN TO OUR WATER TABLES WE ARE FULLY DEPENDANT ON UNDER GROUND WATER FOR OUR FARM. OUR WATER TABLES HAVE ALL LOWERED BY AT LEAST 6 METRES OVER THE LAST FEW YEARS. ALL OUR WELLS HAVE GONE DRY & ONE BORE ALSO. SMELL & FLIES IS ALSO A CONCERN.

I

- [x] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission

(Please tick one)

By

- [x] appearing personally
- [ ] being represented by the following person:

(Please tick one)

Date 12/5/17 Signature Richard B Riggs

Return Address: The Secretary, Development Assessment Commission, GPO Box 1815, Adelaide SA 5001 or dacadmin@sa.gov.au.

Neldner, Simon (DPTI)

From: Rebecca Rowe <becrowe@princessroyal.com.au>
Sent: Monday, 17 July 2017 12:06 PM
To: Neldner, Simon (DPTI)
Cc: Simon Rowe; Graham Chandler
Subject: RE: PRS feedlot responses
Attachments: AGT 1638-17-PAF_Final_Report - July 2017.pdf

Hi Simon,

I have attached the final hydrological report, prepared by Australian Groundwater Technologies (AGT) 14th July 2017. AGT were commissioned to test the capacity of the Mackerode groundwater supply which is to support to feedlot expansion development and to assess any potential adverse impacts on adjoining neighbour's water supply. The two bores currently utilised to supply the existing site (Registered No 663003420 and Registered No 663003421) would continue to supply the current site, to reduce the reliance on the well 6630-1026, which is of a higher capacity and will supply the proposed feedlot expansion capacity.

The two bores currently utilised to supply the existing site (Registered No 663003420 and Registered No 663003421) were tested by AGT in 2007 and a full hydrological report was completed for the original development application. In 2007 AGT concluded that the two bores had the capacity to supply the feedlot with no adverse effects on adjoining neighbours groundwater supply. These bores, along with 3 of the neighbour's bores (P.Y & B.J Wedding Bore 1100, A, P & P Stockman Bore 1104, R.W. Shattock Bore 1793) have been tested every month since development consent was granted in 2008 as a condition of development approval by the Regional Council of Goyder. SWL and salinity were tested by Graham Chandler, Princess Royal Station's Major Projects and Maintenance Manager, and sent to the Goyder Council until it was no longer necessitated. This data was compiled by myself and also supplied to AGT, which they have supplied in the appendix of their 2017 report. The depth to water (m) and salinity (ppm) have remained stable over the entire testing period, indicating no impact to groundwater supply or quality. Please notify me if you require the full logs.

The capacity of well 6630-1026 was tested by AGT. AGT concluded that this well has the capacity to supply the development at full capacity using a maximum of 152ML/year, and made a number of recommendations for well monitoring and review to prevent overuse in the long term. AGT identified that pumping at a higher than required annual rate of 158ML/year for two years or more could potentially produce a drawdown of between 0.1m and 0.8m for wells at a distance of 2km. As no neighbouring bores are within this distance of the water source, management have proposed that bores located at 2km on the Mackerode property could also monitored by Princess Royal Station staff to test any potential adverse impacts on neighbouring groundwater sources.

AGT and Princess Royal Station are confident that well 6630-1026 has the capacity to supply the proposed feedlot development with no adverse effects on groundwater quality or supply. Continuous long-term monitoring and reporting will further assure the capacity of supply and quality over the long-term. In the event of an extreme drought, various mitigation procedures may be implemented in consideration with Australian animal health legislative requirements and will be assessed by management at a case by case level.

Please do not hesitate to contact either Simon Rowe or myself if you require any additional information.

Regards,
Bec Rowe
040 0097 919

Princess Royal Station
P: (08) 88 922 421 F: (08) 88 923 066 A: Box 160 Burra SA 5417
E: admin@princessroyal.com.au ABN: 65 050 531 556
www.princessroyal.com.au

From: Neldner, Simon (DPTI) [mailto:Simon.Neldner@sa.gov.au]
Sent: Friday, 19 May 2017 11:34 AM
To: Rebecca Rowe <becrowe@princessroyal.com.au>
Subject: Re: PRS feedlot responses

Hi Rebecca

The main issue raised by the representations (see x3 additional reps attached) relates to the use of groundwater to support both the existing and proposed development, and the concerns raised in respect to the level of use and drawdown of the existing resource to service the expanded feedlot. I've gone back over the information supplied with the application, and the following is noted –

- 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.

- 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.
- 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.
- The estimated total drinking water requirements are approximately 137 ML/year or equivalent to about 13 ML/1000 head-on-feed/year.
- 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.
- 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.

In order to better understand the current resource and the expected future demand, the Commission would need to ascertain the potential longer-term impact on groundwater, and as such, the following information is requested –

- The two bores to be relied upon for the existing and expanded development (Registered No 663003420 and Registered No 663003421) were drilled in 2007. What was their respective standing water level in 2007, and how has this changed (time series to 2016/7) since then in respect to water quality (pH, salinity/EC), flow rates, water levels?
- What is the capacity of the existing ground water resource (from which the nominated bores will take water from) to support the expanded development? This would take into account its compartmentalised nature and configuration, and the envisaged daily and long-term water use, drawdowns for various pumping rates and durations, and the effective recharge rate from the catchment to maintain sustainable levels (including quality)? This would require an update the 2008 report, documenting any material changes, including a comparison of existing well data within the locality (from that previously available in 2008 and today), and the ability of the existing bores to meet expected demand. This would also assist in answering those queries from nearby landowners re: potential impacts.
- At completion of the expanded development, it would appear the exiting bores would need to operate 24/7 to maintain supply, what contingency measures will be in place to manage interruptions to or loss of supply? This would include any potential scenario where the proposed bores could not supply the volume and rates of water required (for whatever reason).
- Was any consideration given to using a potable supply (i.e. SAW)? It is understood, however, this may not be possible for many reasons: ability to access, distance to source, available volumes and pressure, quality, unit / long-term costs etc.

The local NRM Boards have also sought to have conditions imposed in respect to the provision of baseline monitoring (prior to the operation of the expanded feedlot) and annual reports thereafter provided to DEWNR. You will need to consider how such requirements might be met – particularly the baseline measurements (which overlap with that information sought above).

What the Commission needs to be satisfied with, and for which the Development Plan alludes to, is the capacity of an existing natural resource (ground water) to support additional development without adverse environmental or water quality impacts (within the locality or other users more generally). As a number of representors have indicated a wish to be heard, the matter will need to be scheduled for a formal hearing in Adelaide before the Development Assessment Commission.

Kind Regards - Simon

From: Rebecca Rowe <becrowe@princessroyal.com.au>
Sent: Thursday, 18 May 2017 10:45 AM
To: Neldner, Simon (DPTI)
Subject: PRS feedlot responses

Hi Simon,

Have you received any more responses from the development notification?

Regards,
Bec Rowe
040 0097 919

PRINCESS ROYAL STATION
Princess Royal Station
P: (08) 88 922 421 F: (08) 88 923 066 A: Box 160 Burra SA 5417
E:admin@princessroyal.com.au ABN: 65 050 531 556
www.princessroyal.com.au

Water Supply for Feedlot Development

Prepared for Princess Royal Station

AGT Report no: 1638-17-PAF
14th July 2017

Australian Groundwater Technologies

"making water work"

Document Control

Document Title

Water Supply for Feedlot Development

Report no

1638-17-PAF

Prepared for

Princess Royal Station

Author	Date
T. Watson	14th July 2017

Reviewed by	Date
G. Bekesi	5th July 2017
G. Bekesi	8th July 2017

Approved by	Date
J. Schaeffer	13th July 2017

Revision history

Revision No.	Date Issued	Reason/Comments

Distribution

Copy No.	Location

Note: This is a controlled document within the document control system.
If revised, it must be marked SUPERSEDED and returned to the AGT QA Representative

Statement of Limitations

The services performed by AGT have been conducted in a manner consistent with the level of quality and skills generally exercised by members of its profession and consulting practice. This report is solely for the use of Princess Royal Station and may not contain sufficient information for purposes of other parties or for other uses. Any reliance on this report by third parties shall be at such parties' sole risk.

The information in this report is considered to be accurate with respect to information provided or conditions encountered at the site during the investigation. AGT has used the methodology and sources of information outlined within this report and have made no independent verification of this information beyond the agreed scope of works. AGT assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that the information provided to AGT was false.

AUSTRALIAN GROUNDWATER TECHNOLOGIES PTY LTD
ABN 97 110 928 928
Ground Floor, 80 Currie Street ADELAIDE 5000

PH: (08) 8352 4262
FAX: (08) 8354 3076
www.agwt.com.au

Executive Summary

Princess Royal Station are seeking to secure approval from the South Australian Department for Planning, Transport and Infrastructure (DPTI) to increase their current groundwater consumption approval to support the development of a new feedlot on Mackerode Station, located on land parcel D2033 B28, Hundred of Ayers.

Australian Groundwater Technologies (AGT) was commissioned to test the production well identified as most likely to supply the increased water quantity, Well 6630-1026. The testing is to evaluate the capacity of the supply aquifer(s) to support the new development and estimate drawdown across property boundaries.

In June 2017, AGT completed aquifer tests on production well 6630-1026 that consisted of a step-drawdown test, a recovery, followed by a constant rate discharge test (CRDT) and another recovery. Well 6630-1025, situated approximately 1 km from the production well, was also monitored throughout the entire testing period.

Results indicate that existing production well 6630-1026 has the capacity to yield the increased annual production rate of 152 ML/y in the short- and medium term without the water level within production well 6630-1026 falling below the current pump depth. More specifically:

- At a long-term continuous pumping rate of 5 L/s, drawdown is predicted to remain above the current pump depth in production well 6630-1026.
- An intermittent pumping scenario at 10 L/s in a 6-hours-on-6-hours-off cycle is predicted to cause a maximum drawdown within production well 6630-1026 that approaches the pump depth. This, in addition to the steepening of the drawdown curve observed towards the end of the CRDT, highlights the need for long-term testing or monitoring.
- Aquifer transmissivity is estimated at between 80 and 180 m^2/day and storativity (specific yield) as > 0.001.
- Drawdown at a distance of 2 km from production well 6630-1026 after two years of pumping (at a rate of 158 ML/y) is estimated to be between 0.1 and 0.8 m, based on the ranges of feasible aquifer transmissivity and storativity determined by AGT's hydraulic testing/analysis.

Detailed recommendations, focussing on reducing the risk of overusing the well, having to lower the pump, or unexpected large drawdowns in the long-term are also provided in the report. These concentrate on what, where and when to monitor and annual reviews of the acquired data.

In order to abstract the desired volume of groundwater from production well 6630-1026, use of a lower pumping rate for a longer time period is also recommended. This will not only reduce drawdown in the production well but would also increase energy efficiency by reducing well losses.

Contents

Figures & Tables

1 Introduction

1.1 Background

Princess Royal Station are seeking to secure approval from the South Australian Department for Planning, Transport and Infrastructure (DPTI) to increase their current groundwater consumption approval to support the development of a new feedlot on Mackerode Station, on land parcel D2033 B28, Hundred of Ayers.

Current groundwater extracted to service the existing feedlot is approximately 75 ML/y. Requirements of the expanded feedlot are estimated to increase the total usage to 152 ML/yr. This quantity is based on approximately 13 ML/1000-head-on-feed/year, totalling 137 ML/y, and an additional 10% for sundry uses such as feed processing, trough cleaning, and vehicle and facility cleaning, as well as indirect 'usage' such as evaporation.

Figure 1 displays a map of the site and relevant wells. The existing feedlot is visible in the Figure 1 aerial image immediately southeast of well 6630-3420. The proposed new development sites are located immediately north and immediately east of well 6630-3421. The production well identified as most likely to supply the increased water quantity (unit number 6630-1026) is currently used for irrigation and as a backup water supply to the existing Princess Royal Feedlot (an accredited beef cattle feedlot). Production well 6630-1026 is located approximately 2-3 km from the feedlot. In the current system groundwater is pumped from well 6630-1026 into a storage tank. This water is subsequently piped to the feedlot to supplement the groundwater supply provided by two production wells near the feedlot, namely 6630-3420 (PN129293) and 6630-3421 (PN129800). The construction and discharge testing details of these wells are provided in two previous reports by AGT (2008a; 2008b).

Current available infrastructure/power supply necessitates a sequential system in which groundwater is pumped from well 6630-1026 before being subsequently piped to the feedlot after pumping ceases. However, AGT understands that there are plans in place to upgrade the power supply in order to allow simultaneous pumping from 6630-1026 and piping to the feedlot. This would allow for more continuous pumping at lower rates in order to achieve the same extraction volume.

AGT (2008b) estimated a combined average sustainable yield from production wells 6630-3420 and 6630-3421 of 26 ML/y to 39 ML/y. Appendix A displays long-term (since 2008) monitoring of the depth to groundwater in production wells 6630-3420 and 6630-3421, as well as in surrounding bores 1104, 1100 and 1793 (see Figure 1). Long-term trends (ignoring seasonal/short-term fluctuations) are stable, supporting sustainable current use (although precise records of volumetric extraction from 6630-3420 and 6630-3421 are not available).

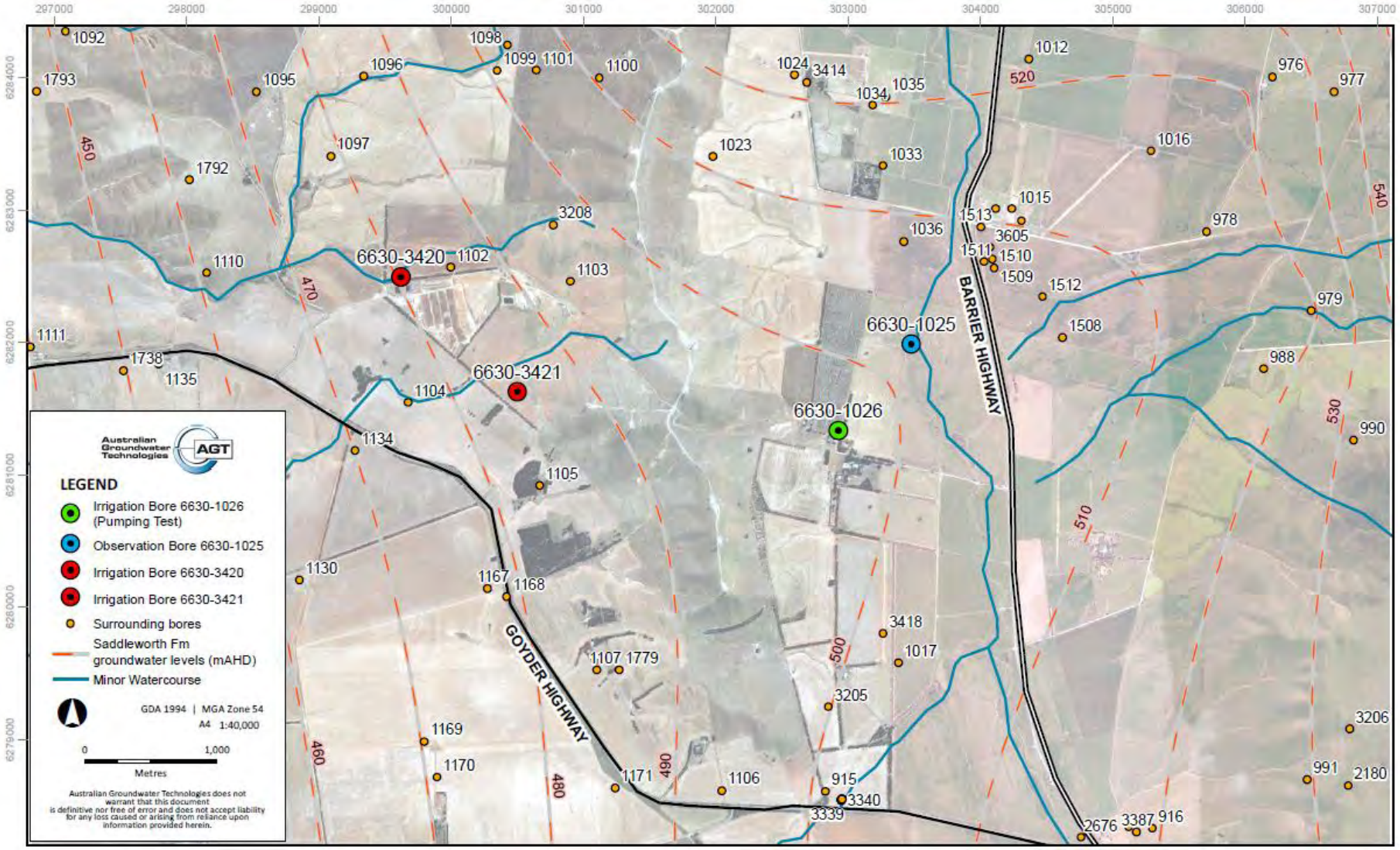


Figure 1. Site map, production/irrigation well locations, and regional (Saddleworth Formation aquifer) groundwater level contours (mAHD).

1.2 Objective and Scope

The testing of production well 6630-1026 is to achieve the following objectives:

- Evaluate the capacity of the supply aquifer(s) to support the new development;
- Evaluate the potential for hydraulic connection and associated impacts across property boundaries (i.e. ability of Princess Royal Station and neighboring bores to meet current and future demand);
- Estimate of most appropriate pumping schedule to meet Princess Royal Station demands and maintain sustainability.

2 Local Setting

Figure 1 displays the site, identifying the key wells relevant to the present study and the locations of known surrounding wells. It is pertinent to note that the location of well 6630-1025 was previously significantly in error (in the order of 1 km) displayed on other maps provided to AGT, as well as the online groundwater database *WaterConnect* maintained by the Department of Environment, Water and Natural Resources (DEWNR). AGT surveyed its location by GPS and ground truthed the new coordinates based on aerial imagery.

The site is underlain by the Saddleworth Formation, a fractured rock aquifer that is widely utilised for irrigation in this region (e.g., Morton et al., 1998). Figure 1 displays the interpreted regional groundwater level contours, which were interpolated using Saddleworth Formation aquifer groundwater levels available on *WaterConnect* and the (pre-pumping) measurements for 6630-1025 and 6630-1026 recorded by AGT. (Contoured groundwater levels are presented in mAHD, i.e., metres above the Australian Height Datum, which is approximately equal to mean sea level.)

A minor watercourse flows through Mackerode Station (i.e., the watercourse displayed in Figure 1 that passes close to well 6630-1025). Images of the watercourse are provided as Appendix C. Anecdotally, this watercourse is spring-fed some distance upstream from Mackerode Station. Personal communication with the proprietors of Princess Royal Station indicates that this watercourse has flowed perennially during the past year, which supports the notion of groundwater contribution.

3 Data Acquisition and Interpretation

3.1 Aquifer Discharge Testing

The aquifer tests conducted on production well 6630-1026 consisted of the following:

- a step-drawdown test consisting of three steps
- recovery
- a constant rate discharge test (CRDT)
- another recovery

Apart from 6630-1026, well 6630-1025 was also monitored throughout the entire testing period. This well is in closest proximity to well 6630-1026, at a radial distance of approximately 1 km, and targets the same hydrostratigraphic unit according to information obtained via *WaterConnect*. Appendix D displays all aquifer test field data recorded by AGT (excluding the logger datasets due to their large size).

Groundwater elevations (RSWLs) for 6630-1026 and 6630-1025 obtained by AGT are 498 mAHD and 502 mAHD, respectively. These values are consistent with the general groundwater head and flow pattern of the regional Saddleworth Formation aquifer (Figure 1), supporting this interpretation. Furthermore, electrical conductivity (EC) measurements of the groundwater pumped from 6630-1026 is on the order of 2600 µS/cm (see Appendix D), and a historical EC measurement for 6630-1025 (in 1944) is comparable (approximately 3000 µS/cm), further supporting the common aquifer concept.

3.1.1 Methodology

Table 1 provides further details of the aquifer testing. The pumping rate is time-averaged for each step, with small variations (+/- 0.05 L/s – see Appendix D) occurring during the test.

Table 1. Aquifer testing schedule

Test Type	Test Commence Date; Time	Step / Stage	Duration (minutes)	Pumping rate (L/s)
Step drawdown	22/06/2017; 19:22	1	100	7.0
	22/06/2017; 21:02	2	100	10.0
	22/06/2017; 22:42	3	100	12.3
Recovery	23/06/2017; 00:22	-	614	0
Constant rate discharge	23/06/2017; 11:36	-	1440	10.0
Recovery	24/06/2017; 11:36	-	1200	0

3.1.2 Analysis

Figure 2 displays all data collected during the hydraulic testing program at Mackerode Station. The data obtained include manual dip data and continuous (2-minute intervals) logger data for both production well 6630-1026 and observation well 6630-1025.

Figure 2 demonstrates that the manual dip data and the logger data are in good agreement. Due to its smaller size, the dataset obtained through manual dipping was primarily used for the analyses. The logger data were used to supplement the manual dip dataset: data points at 30-minute intervals during the overnight periods when manual dips were not taken (these periods correspond to 400-800, 1500-2300 and 2800-3500 minutes in Figure 2).

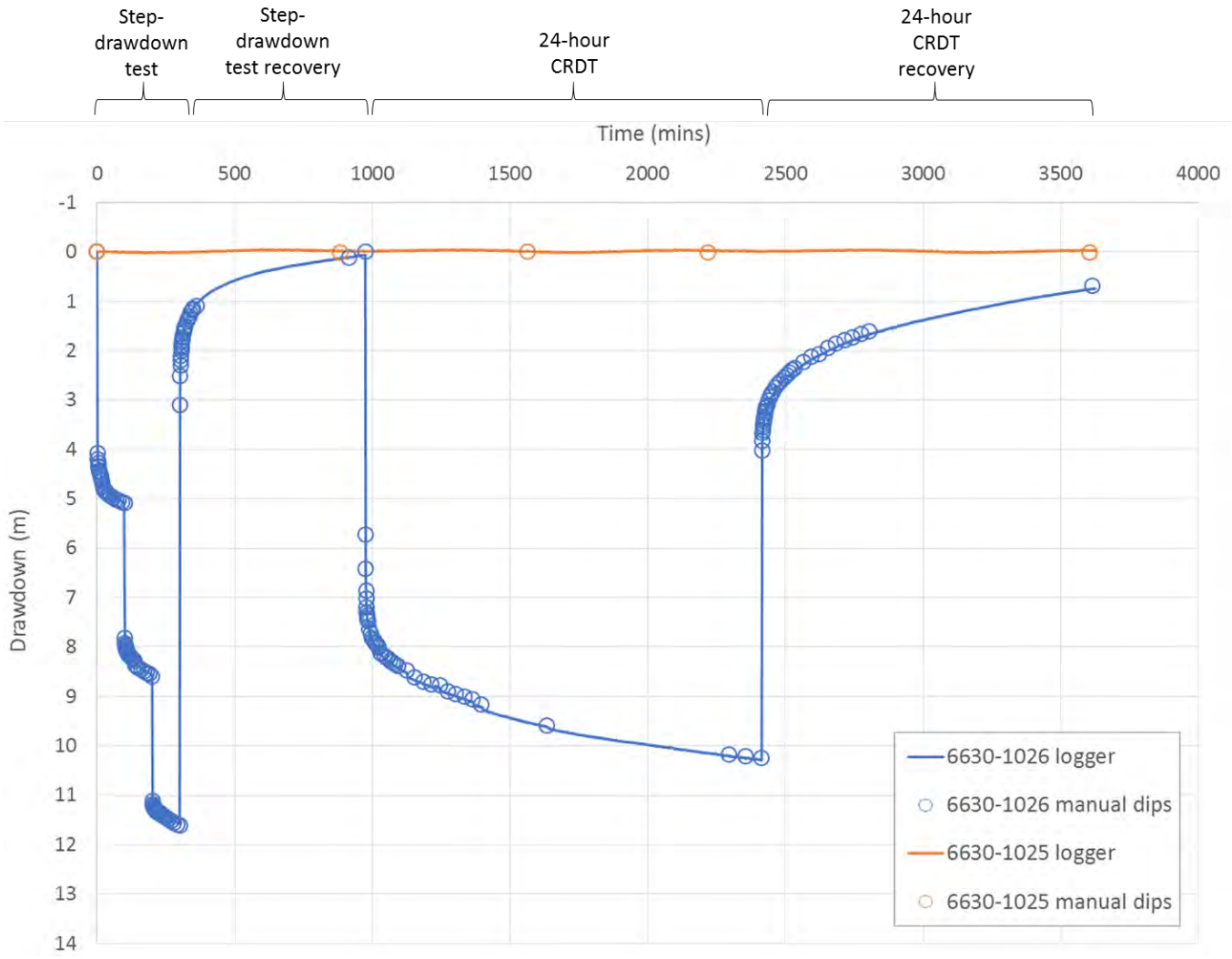


Figure 2. Drawdown vs time for 6630-1026 (production well) and 6630-1025 (observation well)

As Figure 2 indicates, maximum drawdown in the production well was less than 12 m (at the 12.3 L/s step) and no drawdown was observed in the observation well.

3.1.2.1 Step-drawdown Test

For the purpose of the step-drawdown test analysis (and all other analyses in this report), it was assumed that well 6630-1026 fully penetrated the target aquifer (supported by the fact that the well is uncased from a depth of 4 m to its total depth of 102 m) and is either confined, or unconfined with a saturated thickness that is considerable larger than drawdown.

The Eden-Hazel method, applicable to the conditions described above, was employed for the step-test analysis. This method was developed for porous aquifers, but was used here in a fractured rock environment based on the *equivalent porous media* concept. In that concept, a larger volume of fractured rock is considered by its 'average' hydraulic parameters (representing both the fractures and solid rock). Adoption of the equivalent porous media concept is considered appropriate in this case because it is supported by the drawdown patterns measured throughout the testing. The drawdown pattern shown in Figure 2 appears to be identical to that expected from a porous media aquifer. The drawdown increased logarithmically with time during each step of the step-drawdown test (Figure 3a), as well as during the CRDT (Figure 4a) and recovery periods (Figures 3b and 4b).

The Eden-Hazel method yields the following well equation for well 6630-1026:

$$s(t) = 5.14Q + 1.47Qlog(t) + 9.75Q^2$$

where *s(t)* is drawdown in the well in metres, as a function of time *t* in minutes, and *Q* is pumping rate in cubic metres per minute. The first term in the right-hand side describes drawdown associated with aquifer losses, the second the time-dependency or increase-in-time of the drawdown; the third term is known as 'well loss', assumed to be proportional to the square of the pumping rate. As the pumping rate increases, the well loss will increase more than the aquifer loss does. Doubling the pumping rate, for example, will more than double the drawdown.

The aquifer transmissivity *T,* estimated using the Eden-Hazel method for the step-drawdown test analysis, is 180 m^2/d (rounded value).

The step-drawdown analysis steps leading to the derivation of the well equation for well 6630-1026 and estimation of transmissivity are attached as Appendix B.

Figures 3a and 3b display the drawdown and the residual drawdown, respectively, for the step drawdown test on well 6630-1026. Residual drawdown is the 'drawdown remaining to be recovered', i.e., residual drawdown is zero when full recovery to the pre-test condition is completed.

As stated earlier, Figure 3a shows the increase of drawdown, for each step, with time logarithmically that is typical to porous media. Figure 3b indicates that well 6630-1026 may have been recovering from pumping prior to the testing (i.e., the extrapolated residual drawdown curve appears to intersect the *t/t'* = 1 line at a residual drawdown value of < 0).

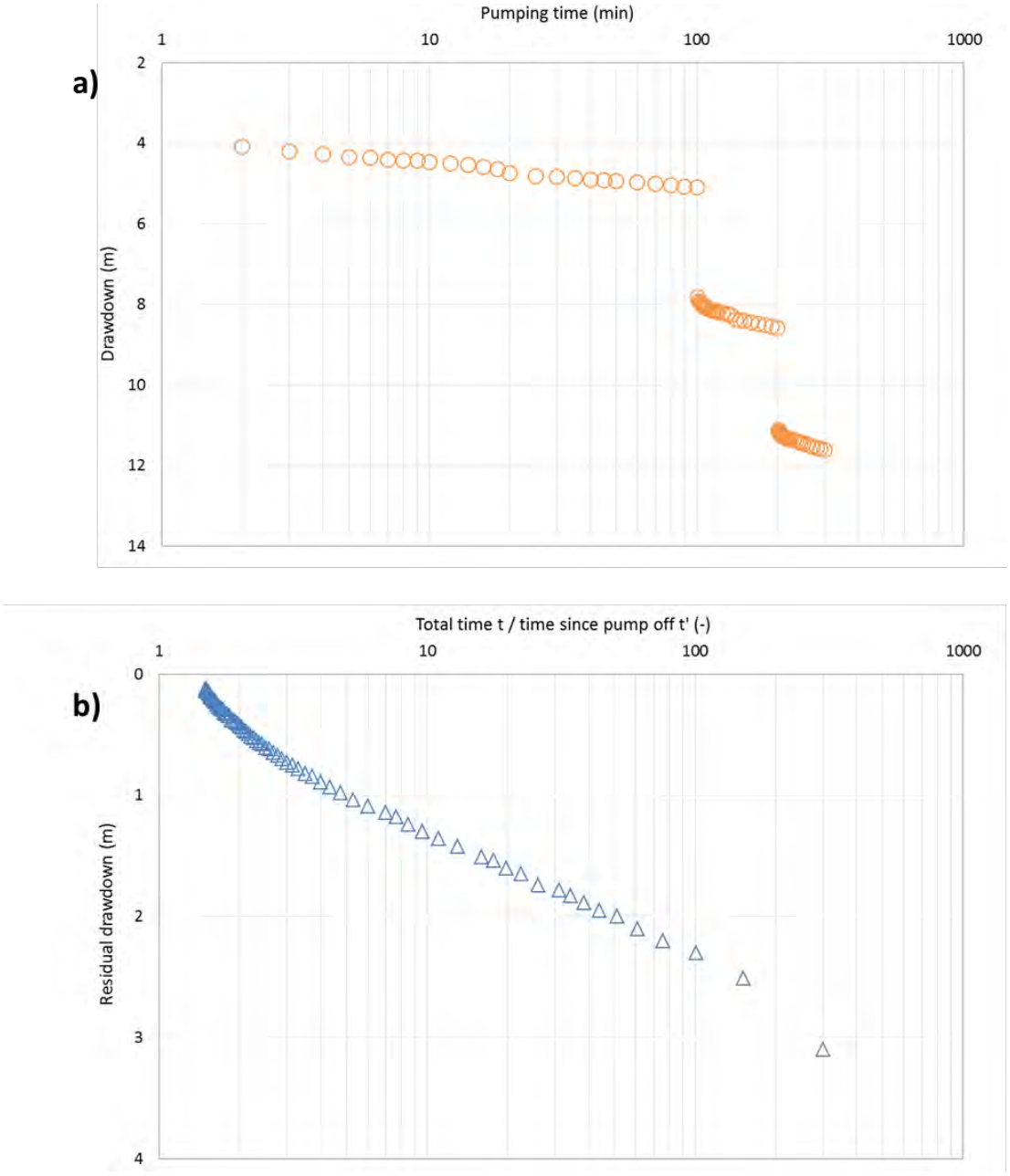


Figure 3. Drawdown/residual drawdown plot for step test performed on well 6630-1026

3.1.2.2 Constant Rate Discharge Test

Figures 4a and 4b display the measured drawdown and residual drawdown, respectively, for the 24-hour CRDT performed on production well 6630-1026. An important feature of Figure 4a is the apparent steepening of the drawdown curve for times > 400 mins. An explanation for such an increase in the slope of the curve is that a zone of lower transmissivity was reached after 400 mins. As transmissivity is the product of hydraulic conductivity and aquifer thickness, a decrease in either of those or both may have caused the steeper slope. This includes the potential effect of combined primary (fractures) and secondary (matrix) hydraulic conductivity in fractured rock aquifers (this is analysed via the Barker (1988) method below). The increase in slope may also be caused by the encountering of a flow boundary (potential aquifer compartmentalisation in this region was postulated by AGT (2008a)).

Another possible explanation is that the aquifer(s) tapped by 6636-1026 are both unconfined and confined and the steepening is caused by reducing unconfined saturated aquifer thickness with increasing pumping time. As stated earlier in 3.1.2.1, 6636-1026 is open (uncased) from a depth of 4 m to its total depth of 102 m and therefore is likely to draw groundwater from both unconfined and confined aquifer(s).

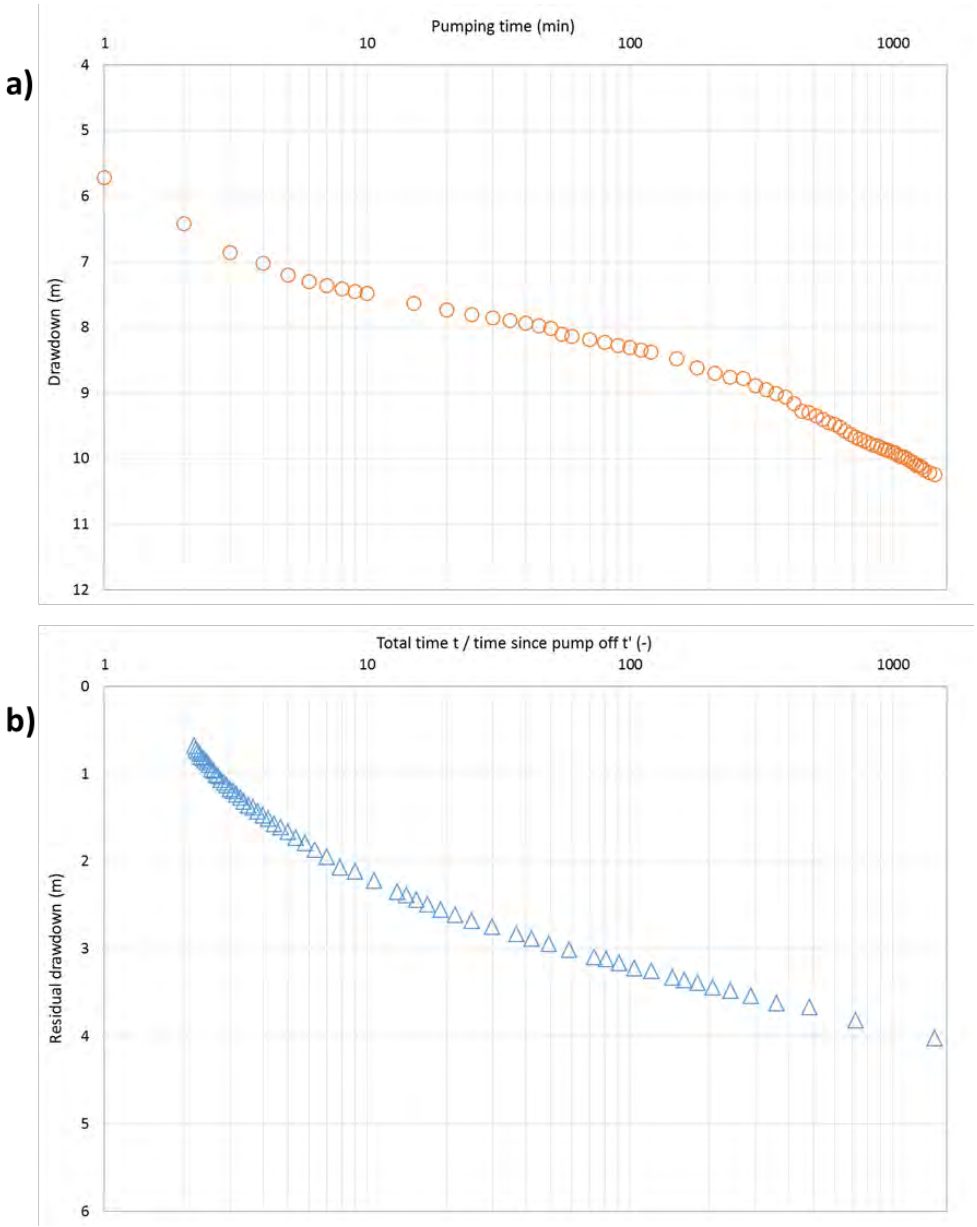


Figure 4. Drawdown/residual drawdown for 24-hour CRDT, well 6630-1026

The maximum drawdown observed during the CRDT was 10.25 m. The trend in residual drawdown (Figure 4b) is similar to that observed for the water level recovery following the step-drawdown test (Figure 3b). That is, the extrapolated curve appears to intersect the t/t' = 1 line at a residual drawdown value of < 0 m, indicating incomplete recovery prior to the CRDT test. This characteristic is slightly more prominent in Figure 4b due to incomplete recovery prior to the CRDT following the step-drawdown test (i.e., 0.08 m – see Appendix D), in addition to the abovementioned incomplete recovery from pumping prior to the step-drawdown test).

The CRDT drawdown results (Figure 4a) were interpreted to estimate *T* using the Cooper-Jacob (1946) method through the analytical software package AQTESOLV (Duffield, 2007). Figure 5

displays the results for all data points, T = 100 m^2/day (rounded value). The Cooper-Jacob (1946) analysis was repeated with an emphasis on late-time data (Figure 6, T = 80 m^2/day, rounded value).

The interpreted transmissivity from the step-drawdown test is 180 m^2/day; for the CRDT either 80 or 100 m^2/day. The predicted 24-hour drawdown at 10 L/s, from the well equation from the step test analysis is 9.4 m; during the CRDT, 10.24 m drawdown was observed (the difference being 0.84 m (or 8.5%).

An explanation for the differences is likely provided by the steepening drawdown curve after about 400 mins in Figure 4a, during the CRDT. The step-drawdown test steps were each of 100 mins duration and correspond to a flatter drawdown curve for < 100 mins in Figure 4a (flatter drawdown curve means in general higher T). The CRDT interpretation is influenced (Figure 5) or determined (Figure 6) by the steeper drawdown curve, hence the lower interpreted T from the CRDT. As a consequence, the CRDT will also predict higher drawdown than the step-drawdown test. In AGT's view, the CRDT may therefore provide a more reasonable representation of long-term behaviour, both in terms of T and drawdown.

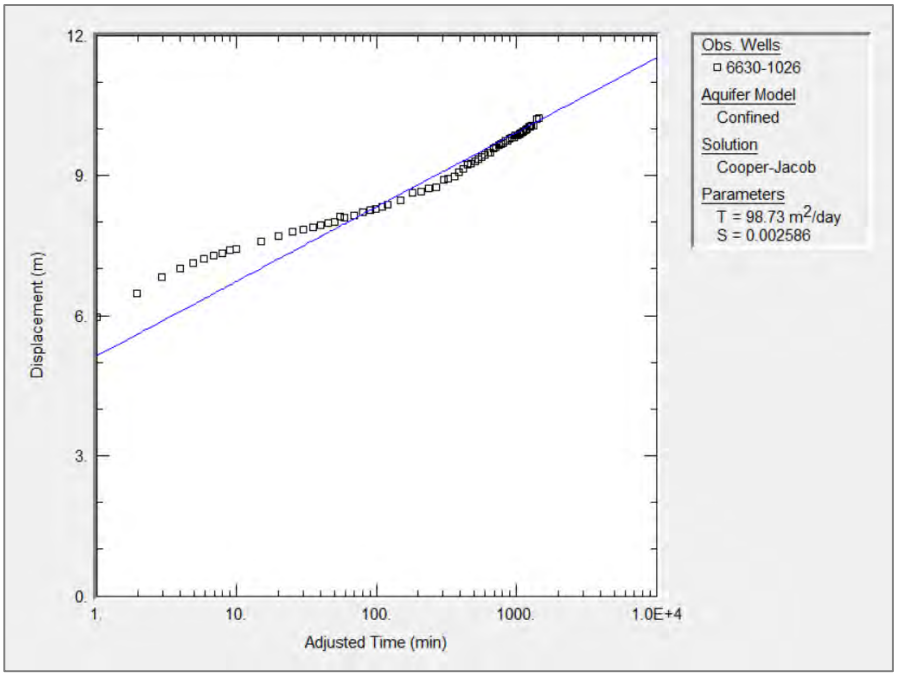


Figure 5. Cooper-Jacob (1946) interpretation of the CRDT test on 6630-1026

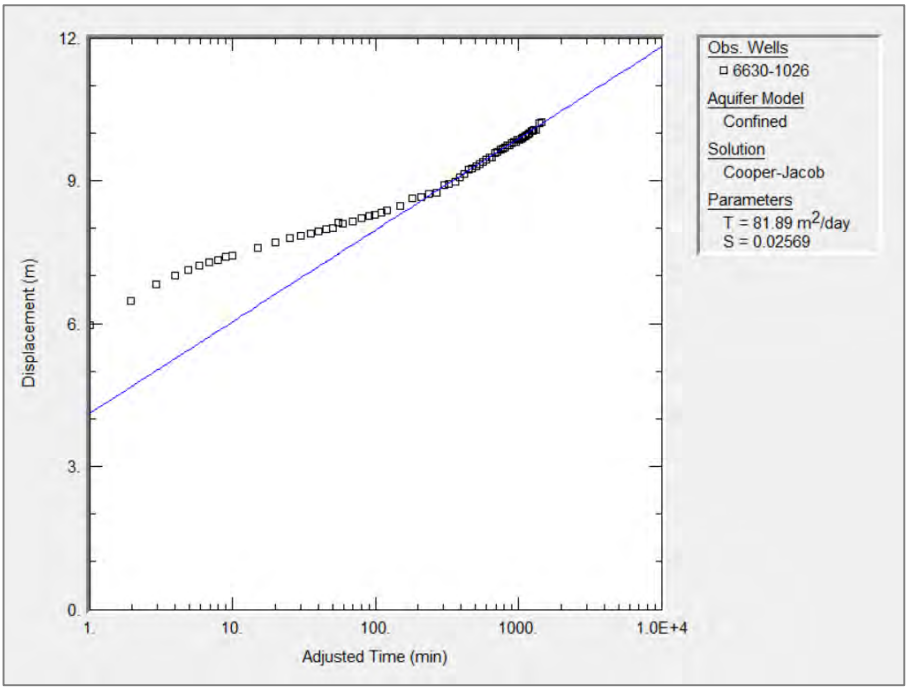


Figure 6. Cooper-Jacob (1946) interpretation of the CRDT test on 6630-1026, with emphasis on fitting late-time data

3.1.2.3 Alternative solutions

Additional interpretations, based on methods that are alternative, but not completely independent to those described in Section 3, were obtained using AQTESOLV and are presented here. Results are shown for the widely used Theis method (Figure 7, suitable for porous aquifers and related to the Cooper-Jacob (1946) method used in Section 3.1.2.2), and the Barker method (Figure 8, dual porosity method, for both porous and fractured rocks). Both methods suggest a transmissivity of approximately 100 m^2/day, consistent with that previously obtained from the CRDT analysis (Section 3.1.2.2).

Table 2 collates the results of all solution methods. AGT can offer the following comments:

1. Table 2 indicates transmissivities between 80 and 180 m^2/day. Assuming a 70 m thick aquifer, the resultant hydraulic conductivity range, between 1 and 2.5 m/day (rounded values) appears to be high for a fractured rock that is described as siltstone.

2. In AGT's experience, the interpretation of storativity without observation well data that is impacted by drawdown is uncertain and therefore the storativities listed in Table 2 (and Figures 5-8) are order of magnitude indications only. Notwithstanding, the storativities, listed in Table 2, are in the order of 10^{-3} to 10^{-2}, falling between the unconfined (approximately >0.01) and confined (approximately <10^{-4}) ranges, supporting the theory that 6630-1026 taps both unconfined and confined aquifer(s).

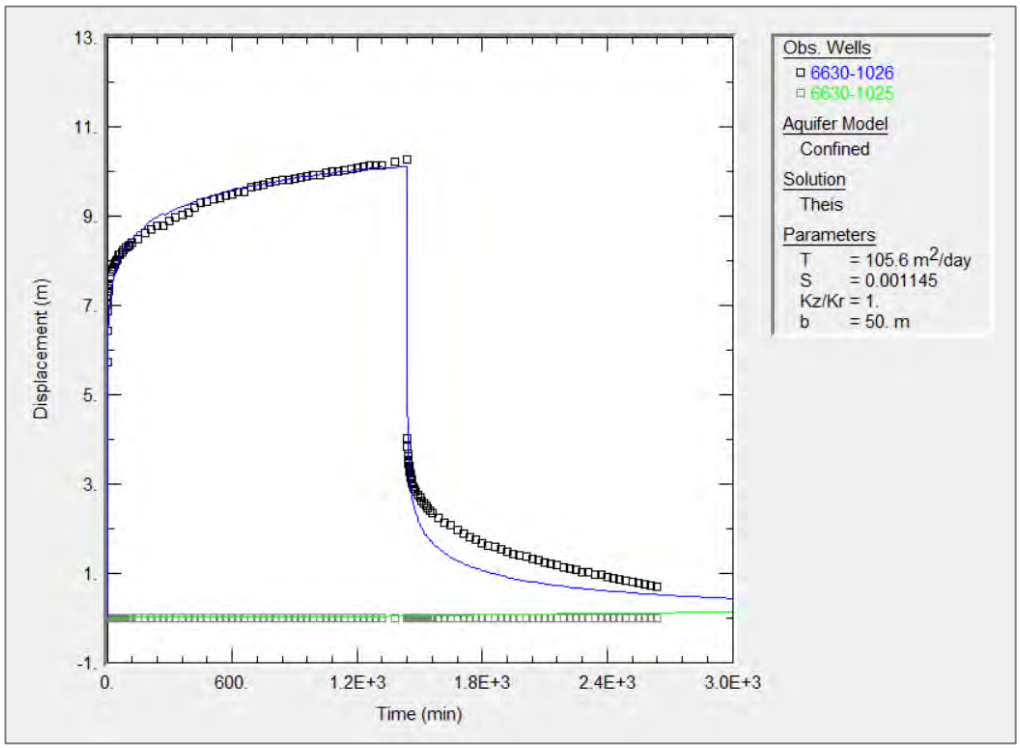


Figure 7. Theis (1935) interpretation of both drawdown and recovery, CRDT

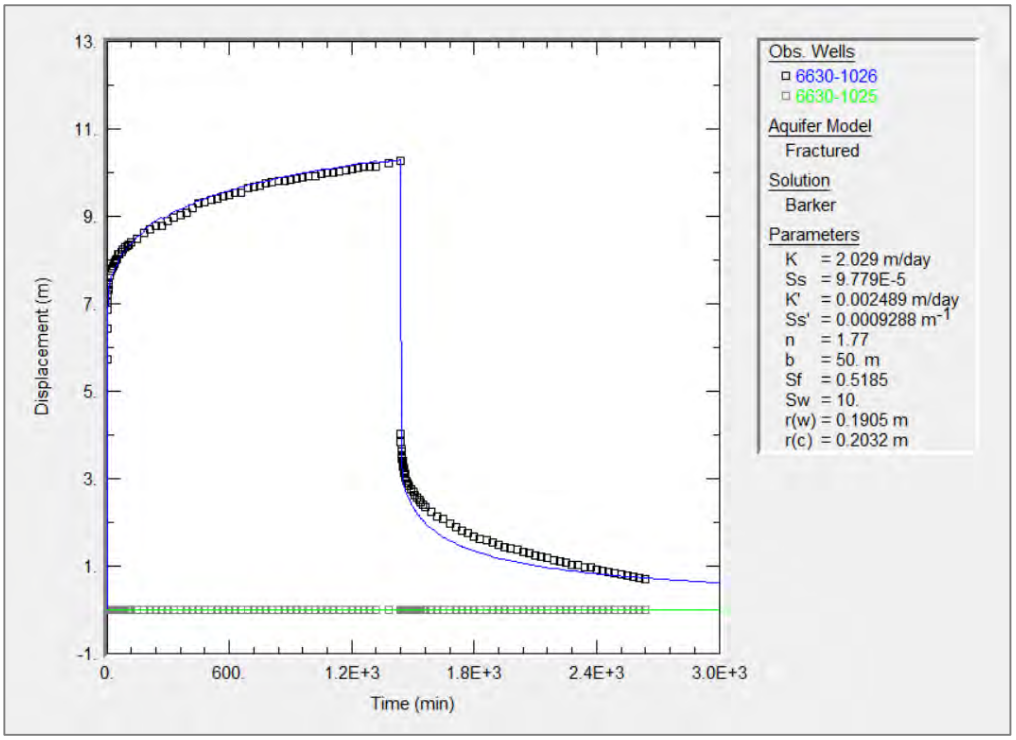


Figure 8. Barker (1988, dual-porosity fractured rock) interpretation, CRDT

3.1.2.4 Predicted drawdown with time

AGT (2008b) estimates a combined average sustainable yield from production wells 6630-3420 and 6630-3421 of 26 ML/y to 39 ML/y. As discussed above, long-term monitoring of the groundwater level within these and surrounding wells to date suggests sustainable use. Nonetheless, as actual pumping volumes from these wells since 2008 is associated with a degree of uncertainty, and to provide a contingency buffer, AGT's conservative predictions in the current study assume that pumping from 6630-1026 alone will be able to supply the entire annual expanded feedlot water requirement of 152 ML/y.

As discussed in Section 1.1, there are plans to upgrade power supply infrastructure to allow for continuous pumping from production well 6630-1026. Nonetheless, two predictive scenarios of long-term future pumping are considered:

- Continuous pumping from well 6630-1026 at a rate of 5 L/s (a total of 158 ML/y) – Figures 9-10, 11a and 12a;
- Intermittent pumping from well 6630-1026 at 10 L/s in a 6-hours-on-6-hours-off cycle (a total of 158 ML/y) – Figures 11b and 12b.

The predictive time period of 1,000,000 minutes (approximately 2 years) is adopted as a representative long-term behaviour prediction following AGT (2008a) and Lawson and Howles (2015).

In Figures 11b and 12b the assumed 6-hours-on-6-hours-off pumping scenario predicts the drawdown to oscillate between minima and maxima resulting in (for the time scale used) the solid blue patch.

That is, the solid blue area is made up of many drawdown-recovery cycles that can only be distinguished at a finer time scale.

A comparison between Figures 11a and 11b; and 12a and 12b indicates that the predicted long-term maximum drawdowns will be lower at the continuous 5 L/sec pumping rate than those predicted for the 10 L/sec intermittent (six-hours-on-six-hours-off) cycle.

The current pump depth in production well 6630-1026 is understood to be approximately 42 m below the reference point used by AGT during the testing (i.e., approximately 41 m below top of casing). Considering the initial depth to groundwater measured within 6630-1026 of approximately 27 m (see Appendix D), the assumed maximum available drawdown is approximately 15 m.

In the case of the Barker method and the 10 L/s six-hours-on-six-hours off cycle scenario, the predicted drawdown within production well 6630-1026 approaches the assumed 15 m maximum available drawdown (see Table 2).

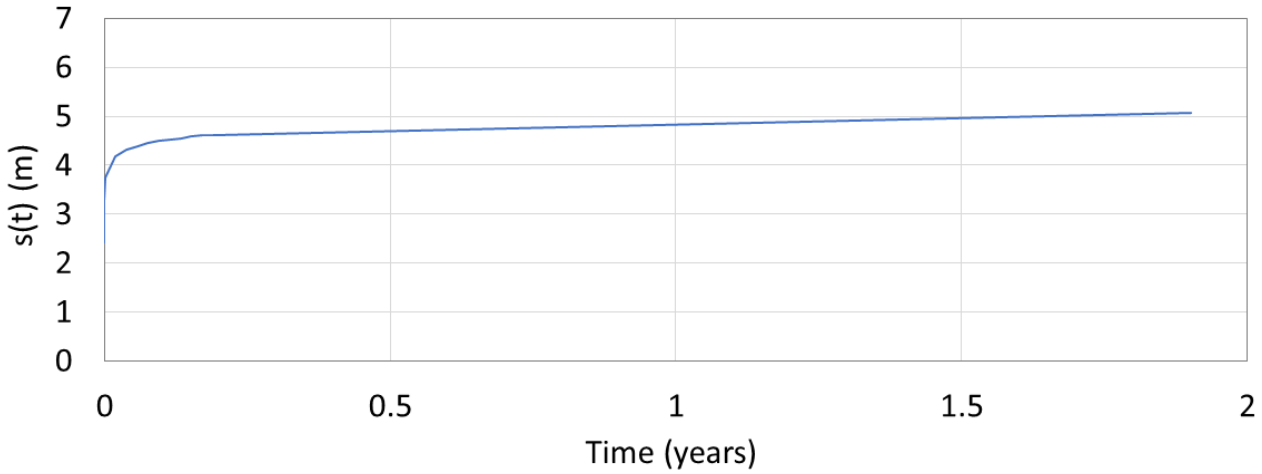


Figure 9. Predicted drawdown for production well 6630-1026, continuous pumping at 5 L/s, Eden-Hazel well equation

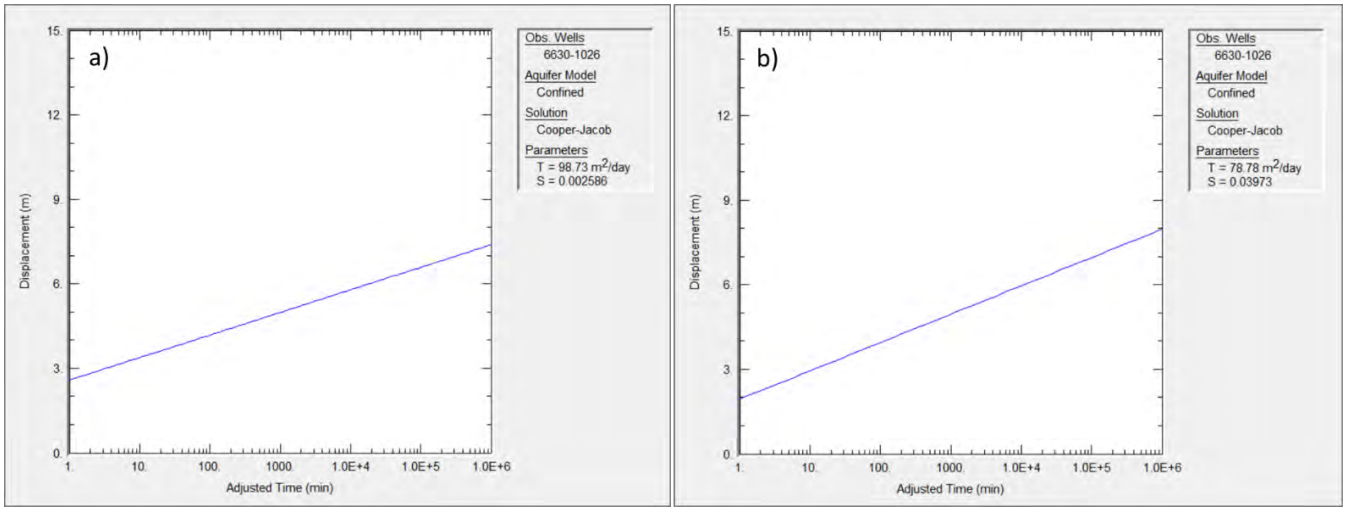


Figure 10. Predicted drawdown for production well 6630-1026, continuous pumping at 5 L/s): Cooper-Jacob (1946) method, a) all data; and b) for late-time data

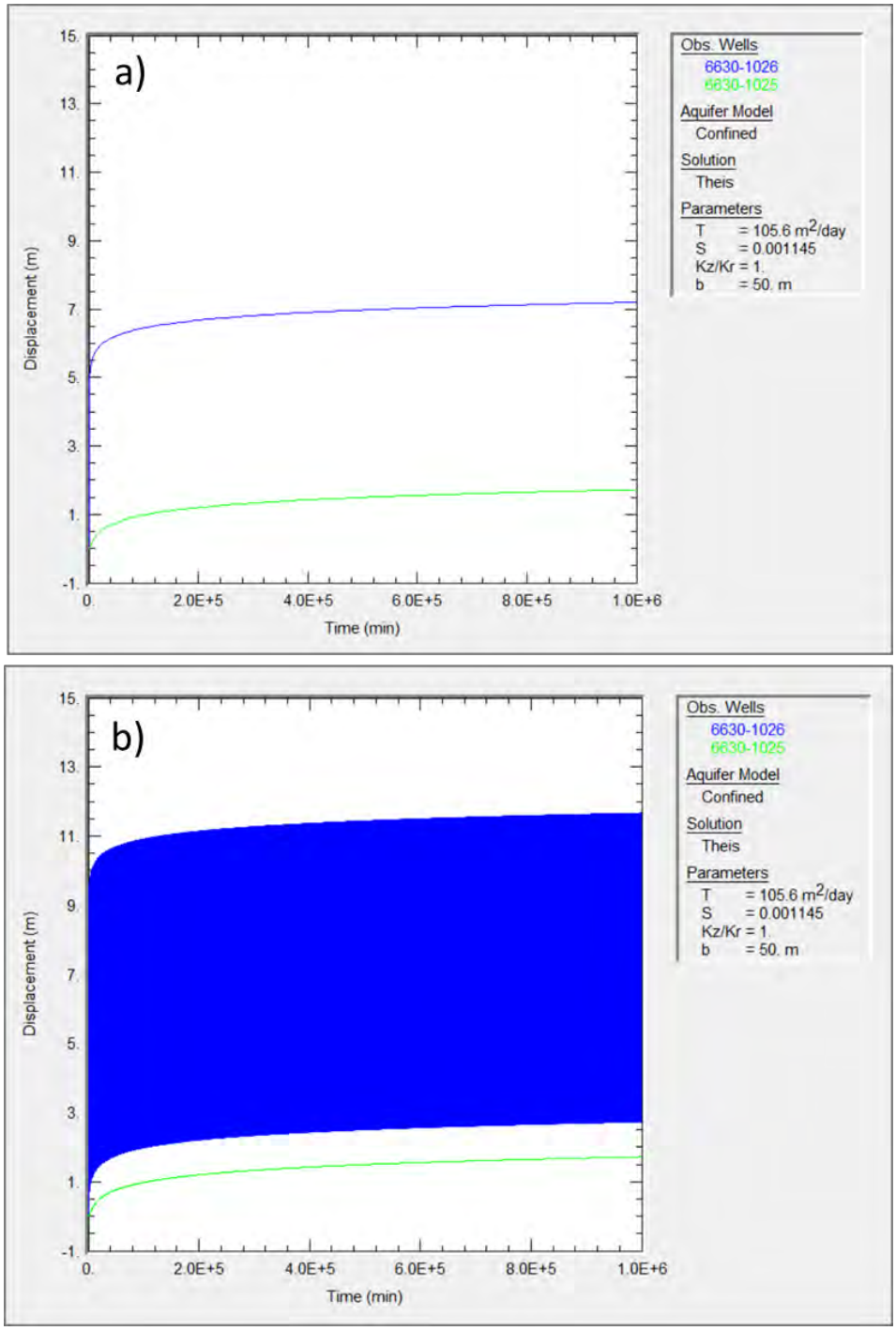


Figure 11. Predicted drawdown, Theis (1935) solution for a) continuous pumping at 5 L/s and b) at 10 L/s 6-hours-on-6-hours-off cycle

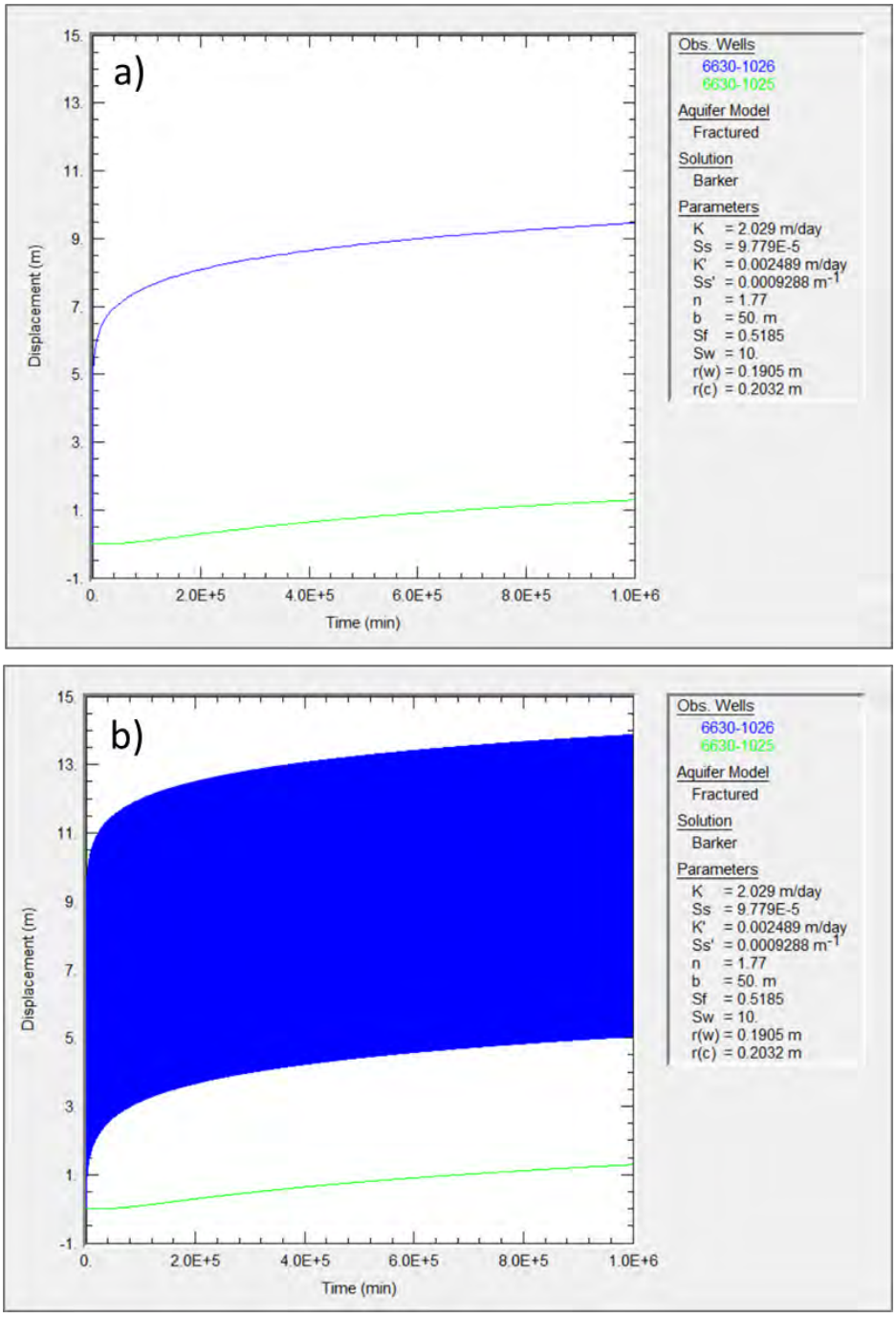


Figure 12. Predicted drawdown, Barker (1988) dual-porosity fractured aquifer solution for a) continuous pumping at 5 L/s and b) at 10 L/s 6-hours-on-6-hours-offcycle

Table 2. Summary of predicted drawdown range obtained through various methods/conceptual models.

Analysis method	Transmissivity T (m²/d)	Storativity S* (-)	6630-1026 Predicted 24 hour drawdown (m) ** 10 L/s continuous pumping	6630-1026 Predicted 1,000,000 min (approx. 2 yrs) drawdown (m) *** 5 L/s continuous pumping	6630-1026 Predicted 1,000,000 min (approx. 2 yrs) drawdown (m) 10 L/s 6 hours on, 6 hours off	6630-1025 Predicted 1,000,000 min drawdown (m)
Eden-Hazel	180	-	9.4	5	-	-
Cooper-Jacob	100	2.6e-3	10.2	7.5	-	-
Cooper-Jacob (late-time)	80	0.04	10.2	8	-	-
Theis	100	1.15e-3	10.1	7	11.5	1.5
Barker (fractured aquifer, dual porosity)	100 (0.12)****	4.9e-3 (0.046)	10.2	9.5	14	1.5

** In AGT's experience, the interpretation to storativity without observation well data that were impacted by drawdown, is uncertain and therefore the storativities listed are order of magnitude indications only*

*** True 24-hour drawdown at 10 L/s measured for CRDT was 10.25 m*
**** Maximum available drawdown within well 6630-1026 is 15 m (i.e., initial depth to water – pump set depth)*
***** Values in parentheses indicate interpreted secondary (matrix) T or S*

3.1.2.5 Predicted spatial drawdown extent

The fact that well 6630-1025 was not influenced by the CRDT may be used to estimate an upper bound for aquifer storativity. For a 24-hour long CRDT at 10 L/s not to influence a well at 1 km distance, the storativity, in general, has to be more than 0.001 (based on the Theis (1935) method and assuming the transmissivity is between 80 and 180 m²/day).

Following the concept of equivalent porous media and the method of Bekesi and Hodges (2002), Figure 13 displays a range of predicted drawdowns (each colour represents a combination of a randomly selected transmissivity and storativity from the following ranges):

- Transmissivity: 80-180 m²/day
- Storativity: 0.001-0.05

Both continuous pumping at 5 L/s and the intermittent 10 L/s pumping scenario give equivalent results when considering drawdown at distance from the pumping well. Figure 13 indicates that after two years of pumping, drawdown at a distance of 2 km from 6630-1026 is predicted as between 0.1 m and 0.8 m, based on these ranges of possible aquifer transmissivity and storativity values. Two kilometres

was selected as this is the approximate distance from 6630-1026 of the nearest surrounding wells (excluding observation well 6630-1025) according to Figure 1. However, the details and status of these mapped wells (i.e., which ones are operational and which aquifer(s) they target) has not been investigated as part of the present study.

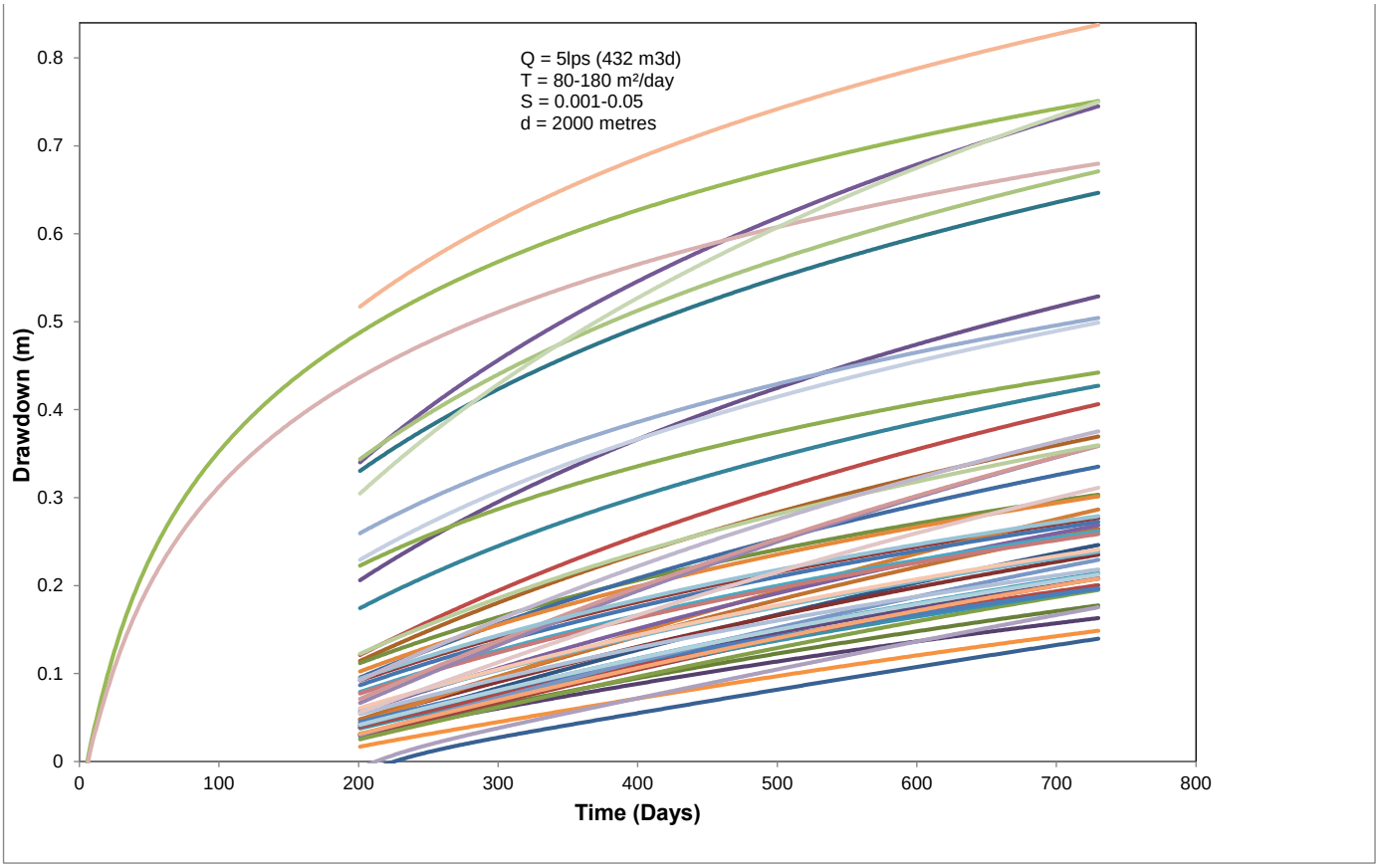


Figure 13. Predicted range of possible drawdowns at a 2 km distance from 6630-1026, based on ranges of possible T and S values obtained through aquifer testing (each colour represents a combination of a randomly selected T and S from these ranges)

The higher drawdown predictions in Figure 13, in general, correspond to lower storativities while the lower drawdown predictions correspond to large storativities (specific yields in the unconfined range).

Most drawdowns in Figure 13 are biased towards the smaller values (a larger number of curves are visible in Figure 13 in the lower end (between 0.1 and 0.4 m) than at the higher end. Thus the most likely drawdown is towards the lower end of the range.

3.2 Conclusions

The pumping test results indicate that existing production well 6630-1026 has the capacity to yield the increased annual production rate of 152 ML/y in the short- and medium term without the water level within production well 6630-1026 falling below the current pump depth. More specific outcomes of the study are as follows:

- At a long-term pumping rate of 5 L/s, drawdown is predicted to remain above the current pump depth in production well 6630-1026.
- The intermittent pumping scenario at 10 L/s in a 6-hours-on-6-hours-off cycle is predicted to cause a maximum drawdown within production well 6630-1026 that approaches the pump set depth (i.e., 14 m of the available 15 m drawdown occurs after approximately 2 years of pumping, based on the Barker method, Table 2). This, in addition to the steepening of the drawdown curve observed towards the end of the CRDT, highlight the need for cautious approach and long-term monitoring.
- Aquifer transmissivity was estimated at between 80 and 180 m^2/day and storativity (specific yield) as > 0.001.
- Drawdown at a distance of 2 km from production well 6630-1026 is estimated at between 0.1 m and 0.8 m after 2 years of pumping at an annual rate of 158 ML/y.

3.3 Recommendations

AGT's recommendations, listed below, focus on reducing the risk of overusing the well, having to lower the pump or unexpected large drawdowns in the long-term.

- For the long-term, as much as possible use a lower pumping rates for longer time periods in order to extract the required volume. This will not only reduce drawdown in the production well but would also increase energy efficiency by reducing well losses.
- From the time of increased water production from 6630-1026, monitor pumping rates in 6630-1026 and drawdown (depth to groundwater), preferably continuously with a logger. If measuring manually, long-term monthly measurements are recommended. AGT understands that water consumption requirements are expected to increase progressively from late 2017 through 2022. Following any changes to the pumping rate from 6630-1026 during this period, a short-term higher frequency of measurements immediately following the change (daily then weekly, before returning to monthly) is strongly recommended. For each record measure depth to groundwater both at the end of a pumping cycle and after recovery (at the start of the next pumping).
- If monitoring indicates that the groundwater level within 6630-1026 is nearing the current pump depth (approximately 41 m below top of casing), it is recommended that pumping is reduced/ceased to avoid potential damage to the pump, and data review/analysis is undertaken.
- Following each change to the 6630-1026 pumping regime as feedlot development progresses, make a record of the new pumping rate (i.e., pumping rate and hours per day of pumping).

- Monitor groundwater level in observation well 6630-1025, preferably continuously with a logger, otherwise via manual measurements at times corresponding to the measurements recorded for production well 6630-1026.

- Between present-day and the onset of increased production from well 6630-1026, measure depth to groundwater in both 6630-1026 (both during pumping and after recovery as described above) and 6630-1025 every two months to establish a reliable baseline for future monitoring.

- At a minimum record the date and time of the measurement, together with pumping rate (if applicable) and depth to groundwater. Also record pertinent notes such as observations on the surrounding environment, pumping cycle, and any changes in groundwater abstraction locally. In AGT's experience these narrative comments are invaluable because they may explain the reasons for anomalous measurements. The depth-to-water should be measured from a fixed reference point of a known height relative to the top of the well casing and any change in the reference point should be recorded.

- Review the data collected annually and amend the monitoring if warranted.

- If the review suggests an increased drawdown, or reduced pumping rates, repeat the step drawdown and CRDT to evaluate temporal changes in well efficiency.

4 References

AGT (2008a), *Well discharge test analysis Mackerode Station*, AGT report no.: 2008/16.

AGT (2008b), *Results of 8hr constant discharge test on well P.N.129293*.

Bekesi, G., Hodges, S. (2002). A statistical assessment of bore interference. *Journal of Hydrology* (NZ) 41 (1): 47-52. Wellington.

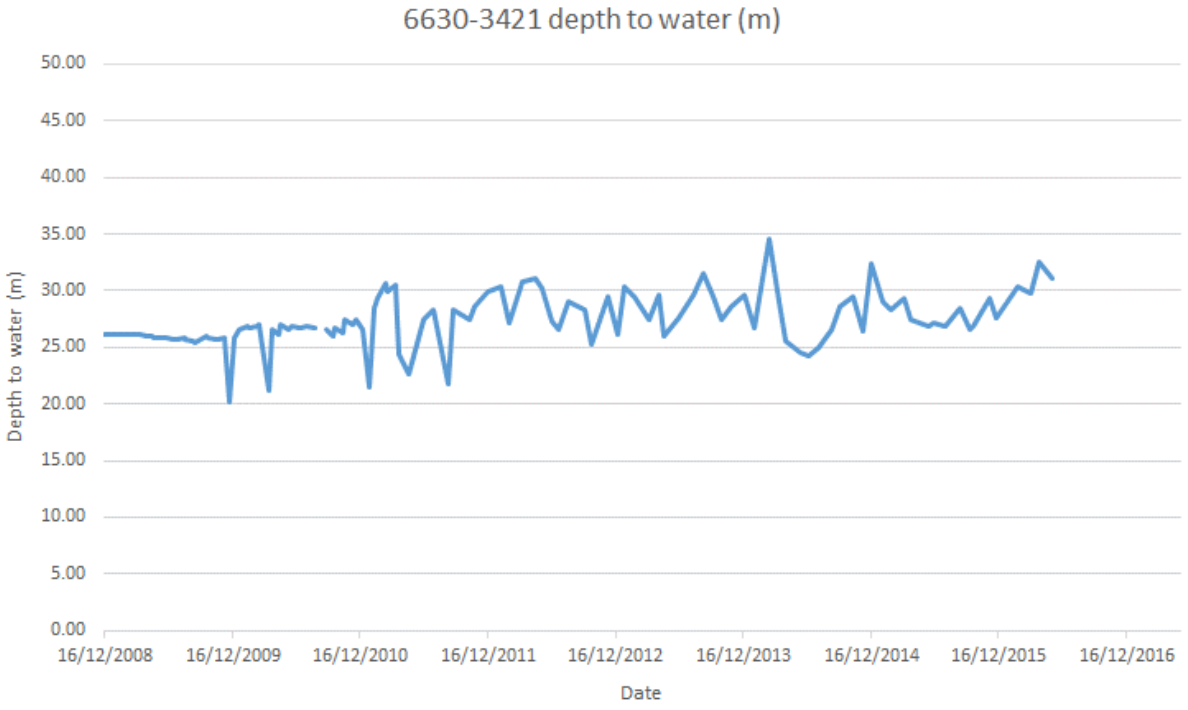
Duffield, G. M. (2007), *Aqtesolv Pro 4.0. Aquifer Test Analysis Software*. HydroSOLVE Inc.

Lawson J., and S. Howles (2015), *Investigative Drilling, Aquifer and Groundwater Salinity Testing - Naracoorte Water Supply, Bool Lagoon Investigation*, DEWNR Technical note 2015/03, Government of South Australia, through the Department of Environment, Water and Natural Resources, Adelaide.

Morton, D, Love, AJ, Clarke, D, Martin, R, Cook, PG & McEwan, K, 1998. *Clare Valley groundwater resources: progress report 1. Hydrogeology, drilling and groundwater monitoring*. South Australia. Department of Primary Industries and Resources. Report Book 98/015.

Appendix A Historical Bore Monitoring Data

Figure A1. Historical monitoring data (depth to water and salinity) for bore 6630-3420



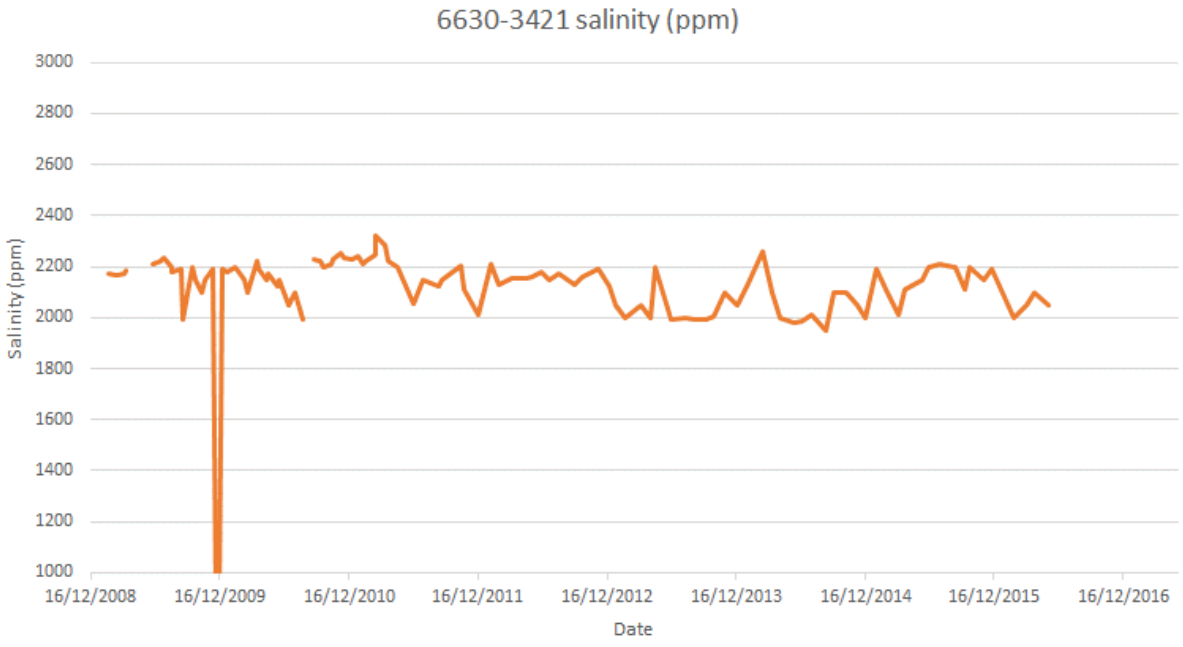


Figure A2. Historical monitoring data (depth to water and salinity) for bore 6630-3421

Figure A3. Historical monitoring data (depth to water and salinity) for bore 1104

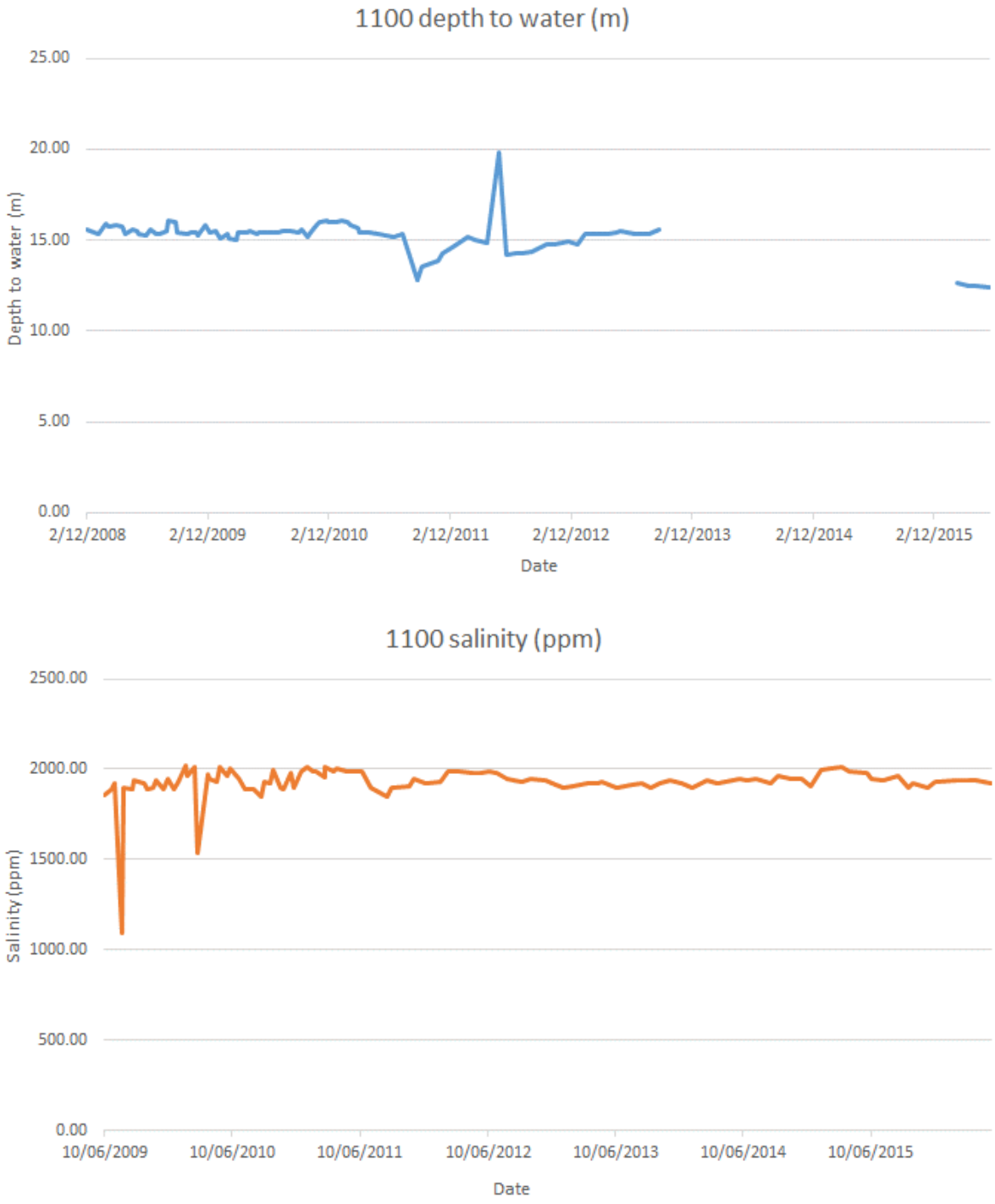


Figure A4. Historical monitoring data (depth to water and salinity) for bore 1100

Figure A5. Historical monitoring data (depth to water and salinity) for bore 1793

Appendix B Step-drawdown test interpretation

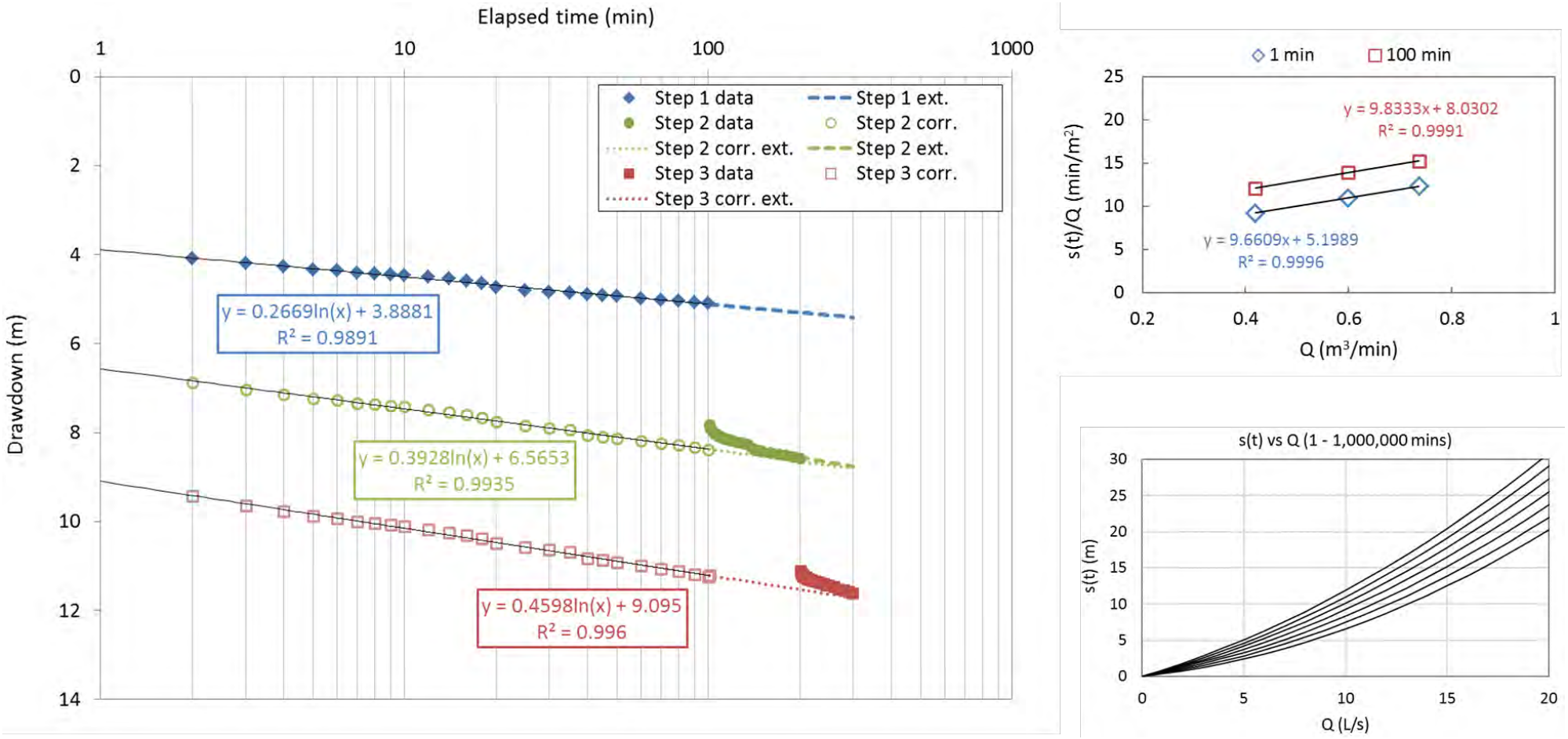


Figure B1. Step-drawdown test analysis components, including plot of drawdown versus pumping rate for times 1 – 1,000,000 mins (showing increments of one order of magnitude)

Appendix C Watercourse Images

Figure C1. Images of watercourse through Mackerode Station (provided by Princess Royal Station)

Figure C2. Images of watercourse through Mackerode Station taken by AGT (from the location of observation well 6630-1025)

Appendix D Aquifer Test Field Data

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 1 of 4

Australian Groundwater Technologies

Step Discharge Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW
Principal:
Checked:
Project: PRS Pumping Test
Measuring / Reference Point (RP): PVC Conduit (1.075m above bore flange)
Location: Markerode Homestead.
Height of RP Above Ground Level: 0.35m (flange) + 1.075 = 1.425m
Pumping Bore: 6630-1026
Pump Make & Model: Grundfos SP46-8 13kw
Observation Bore: Windmill bore (6630-1025)
Pump Inlet Setting: ~41.2m
Pre Test Standing Water Level: 26.90 mVRP
Discharge Measurement Method: Flow meter (magnetic)
Distance from Pumping Bore (m): ?
Pumping Test Start Date & Time: 22/6/17 19:22

24 Hour Time hour	min	Elapsed Time (mins)	Water Level /Pressure (mbRP/kPa)	Drawdown (m)	Pumping Rate (L/s)	Notes	pH	temp	EC
19	22	0 (pre-test)	26.90	0.00	7.08	motor Hz 35.3 for 7L/s			
19	23	1				missed (dinner issue)			
19	24	2	30.98		7.05				
19	25	3	31.10		7.05				
19	26	4	31.17		7.04				
19	27	5	31.24		7.03				
19	28	6	31.26		7.01				
19	29	7	31.32		6.99				
19	30	8	31.33		6.96				
19	31	9	31.34		6.96				
19	32	10	31.36		6.95				
19	34	12	31.40		6.94				
19	36	14	31.44		6.93	upped Hz			
19	38	16	31.49		6.95				
19	40	18	31.55		6.98	upped Hz			
19	42	20	31.64		7.05				
19	47	25	31.71		7.04		7.15	18.3	2434
19	52	30	31.74		7.03		7.28	19.4	2428
19	57	35	31.77		7.02				
20	02	40	31.80		7.01				
20	07	45	31.82		7.00		7.40	17.3	2485
20	12	50	31.84		7.00				
20	22	60	31.88		6.98		7.39	19.3	2532
20	32	70	31.915		6.98		7.38	19.2	2547
20	42	80	31.94		6.97		7.42	19.3	2546
20	52	90	31.97		6.97		7.41	19.3	2557
21	02	100	31.99		6.97				

Australian Groundwater Technologies

Job No: 1638-17-PAF

Sheet 2 of 4

Step Discharge Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION — Recorded by: AR, TW

Principal: — Checked:

Pumping Bore: 6630-1026 — Pre Test SWL: 26.90 m BRP

Observation Bore: Windmill Bore 6630-1025

24 Hour Time hour	min	Elapsed Time (mins)	Water Level (mbRP)	Drawdown (m)	Pumping Rate Step 2 (L/s)	Notes	pH	temp	EC
	:	100.5				motor Hz 42.0 for 10 l/s			
21	:03	101	34.72		10.04				
21	:04	102	34.82		10.02				
21	:05	103	34.86		10.01				
21	:06	104	34.90		9.99				
21	:07	105	34.93		9.99				
21	:08	106	34.94		9.99				
21	:09	107	34.95		9.98				
21	:10	108	34.975		9.98				
21	:11	109	34.99		9.98				
21	:12	110	35.00		9.97				
21	:14	112	35.03		9.97				
21	:16	114	35.05		9.98		7.39	19.4	2587
	:	115							
21	:18	116	35.06		9.97				
21	:20	118	35.07		9.96				
21	:22	120	35.09		9.95				
21	:27	125	35.12		9.96		7.38	19.4	2588
21	:32	130	35.145		9.96		7.41	19.3	2593
21	:37	135	35.17		9.95		7.42	19.3	2595
21	:42	140	35.27		10.02		7.43	19.3	2595
21	:47	145	35.295		10.01		7.43	19.3	2601
21	:52	150	35.32		10.02		7.44	19.3	2597
22	:02	160	35.355		10.00		7.44	19.3	2600
22	:12	170	35.39		10.00		7.40	19.4	2605
	:	175					7.39	19.4	2609
22	:22	180	35.42		9.99		↓	↓	↓
22	:32	190	35.45		9.99		7.38	19.4	2619
22	:42	200	35.49		9.99				
	:	201							
	:	202							
	:	203							

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 3 of 4

Step Discharge Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW
Principal:
Checked:
Pumping Bore: 6630-1026
Pre Test SWL: 26.90 m bRP
Observation Bore: Windmill Bore 6630-1025

24 Hour Time hour	min	Elapsed Time (mins)	Water Level (mbRP)	Drawdown (m)	Pumping Rate Step 3 (L/s)	Notes	pH	temp	EC
	:					motor Hz 48.7 for 12.35 L/s			
22	: 43	201				missed			
22	: 44	202	38.02		12.37	Max pump rate as motor was drawing 29 Amps!			
22	: 45	203	38.08		12.35				
22	: 46	204	38.09		12.35				
22	: 47	205	38.115		12.34				
22	: 48	206	38.14		12.32				
22	: 49	207	38.15		12.32				
22	: 50	208	38.155		12.32				
22	: 51	209	38.16		12.34				
22	: 52	210	38.17		12.33				
22	: 54	212	38.19		12.32				
22	: 56	214	38.205		12.31				
		215							
22	: 58	216	38.22		12.31				
23	: 00	218	38.225		12.32				
23	: 02	220	38.24		12.33		7.41	19.5	2,615
23	: 07	225	38.245		12.29		7.38	19.5	2629
23	: 12	230	38.27		12.29		7.38	19.4	2629
23	: 17	235	38.29		12.29		~~7.38~~ 7.40	19.4	2627
23	: 22	240	38.31		12.28		7.40	19.4	2625
23	: 27	245	38.335		12.28		7.42	19.4	2624
23	: 32	250	38.35		12.27		7.41	19.4	2633
23	: 42	260	38.385		12.27		↓	↓	↓
23	: 52	270	38.43		12.27		7.42	19.4	26362
	:	275							
00	: 02	280	38.45		12.27		7.40	19.5	2637
00	: 12	290	38.49		12.25		7.42	19.4	2637
00	: 22	300	38.515		12.26				
	:	301				END OF TEST			
	:	302				175.95 KL			
	:	303							

RECOVERY

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 4 of 4

Step Discharge Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW
Principal:
Checked:
Pumping Bore: 6630-1026
Pre Test SWL: 26.90 m bRP
Observation Bore (if applicable): Windmill Bore 6630-1025

24 Hour Time hour	min	Elapsed Time (mins)	Water Level (mbRP)	Drawdown (m)	Pumping Rate Step 4 (L/s)	Notes	pH	temp	EC
00	:23	301	30.0		0				
00	:24	302	29.41		0				
00	:25	303	29.20		0				
00	:26	304	29.10		0				
00	:27	305	29.00		0				
00	:28	306	28.90		0				
00	:29	307	28.85		0				
00	:30	308	28.79		0				
00	:31	309	28.73		0				
00	:32	310	28.68		0				
00	:34	312	28.64		0				
00	:36	314	28.55		0				
00	:38	316	28.50		0				
00	:40	318	28.44		0				
00	:42	320	28.41		0				
00	:47	325	28.32		0				
00	:52	330	28.26		0				
00	:57	335	28.20		0				
01	:02	340	28.14		0				
01	:07	345	28.08		0				
01	:12	350	28.045		0				
01	:22	360	27.99		0				
23/6/17	:	370				Left site.			
10	:36	~~380~~ 914	27.02		0				
	:	390							
	:	400							

540
1554
360
914

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 1 of 4

Constant Rate Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW
Principal:
Checked:
Project: PRS PUMPING TEST
Measuring / Reference Point (RP): PVC Conduit (1.075m above bore flange)
Location: MACKERODE HOMESTEAD
Height of RP Above Ground Level: 0.35m (flange) + 1.075 = 1.425m
Pumping Bore: 6630 - 1026
Pump Make & Model: Grundfos SP46-8 13 kW
Observation Bore: Windmill Bore (3.01m BRP 10.05am) 6630-1025
Pump Inlet Setting: 41.2m
Pre Test Standing Water Level: 26.98 m BRP
Discharge Measurement Method: Flow meter magnetic
Distance from Pumping Bore (m): 1 (GPS)
Pumping Test Start Date & Time: 23/6/17 11:36

24 Hour Time hour	min	Elapsed Time (mins)	Water Level /Pressure (mbRP/kPa)	Drawdown (m)	Pumping Rate (L/s)	Notes	pH	temp	EC
11	18	0 (pre-test)	26.98	0.00		42.0 Hz for 10 L/s			
11	37	1	32.7		9.55				
11	38	2	33.40		9.86				
11	39	3	33.84		10.01				
11	40	4	34.00		9.97				
11	41	5	34.18		10.07				
11	42	6	34.28		10.07				
11	43	7	34.34		10.06				
11	44	8	34.39		10.04				
11	45	9	34.43		10.03				
11	46	10	34.46		10.01		7.57	20	2,634
11	51	15	34.61		10.01		7.46	20	2,630
11	56	20	34.71		9.98		7.45	19.8	2,631
12	01	25	34.79		9.97		7.43	19.8	2,624
12	06	30	34.835		9.96		7.44	19.8	2629
12	11	35	34.88						
12	16	40	34.92		9.95				
12	21	45	34.96		9.95				
12	26	50	34.995		9.93		7.40	19.8	2619
12	31	55	35.09		10.01				
12	36	60	35.115		9.99		7.40	19.7	2617
12	46	70	35.165		9.98		7.39	19.9	2633
12	56	80	35.21		9.97				
13	06	90	35.255		9.98		7.39	19.8	2630
13	16	100	35.29		9.96		7.40	19.9	2621
13	26	110	35.325		9.95				
13	36	120	35.36		9.96		7.42	19.8	2625

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 2 of 4

Constant Rate Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW
Principal:
Checked:
Pumping Bore: 6630-1026
Pre Test SWL: 26.98m bRP
Observation Bore: Windmill Bore 6630-1025

24 Hour Time hour	min	Elapsed Time (mins)	Water Level (mbRP)	Drawdown (m)	Pumping Rate Step 2 (L/s)	Notes	pH	temp	EC
13	:36	120	35.36		9.96		7.42	19.8	2625
14	:06	150	35.46		9.94		7.45	19.7	2,626
14	:36	180	35.60		10.00		7.45	19.7	2637
15	:06	210	35.68		10.00		7.44	19.7	2,631
15	:36	240	35.74		9.99		7.45	19.7	2634
16	:06	270	35.755		9.94		7.44	19.7	2633
16	:36	300	35.87		9.98		7.43	19.7	2633
17	:06	330	35.93		9.97		7.44	19.7	2634
17	:36	360	35.985		9.95		7.45	19.7	2629
18	:06	390	36.04		9.97		7.43	19.7	2631
18	:36	420	36.145		10.00	Left site	7.44	19.7	2629
19	:06	450							
19	:36	480							
20	:06	510							
20	:36	540							
21	:06	570							
21	:36	600							
22	:36	660	36.565		10.01	Windmill bore WL=3.04m 10:56pm	7.46	19.5	2,590
	:	720				Left running at 10.05 l/s overnight			
	:	780							
	:	840							
	:	900							
	:	960							
	:	1020							
	:	1080							
	:	1140							
	:	1200							
	:	1260							
9	:36	1320	37.15		9.96	Windmill bore WL=3.02m 9:53am	7.37	19.8	2,566
10	:36	1380	37.19		9.96		7.38	19.9	2,627
11	:36	1440	37.225		9.95		7.40	20.1	2,636
11	:37	1441 (1)	31.00		0	END OF TEST 863.34 KL			

* After this reading flow rate increased to 10.06 l/s.

24/6/17

* 42.3 Hz 22.3 Amps 2542 rpm

RECOVERY

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 3 of 4

Constant Rate Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW.
Principal:
Checked:
Pumping Bore: 6630-1026
Pre Test SWL: 26.98m bRP
Observation Bore: Windmill Bore 6630-1025

24 Hour Time hour	min	Elapsed Time (mins)	Water Level (mbRP)	Drawdown (m)	Pumping Rate ~~Step 3 (L/s)~~	Notes	pH	temp	EC
11	: 37	1	31.00		0				
11	: 38	2	30.80		0				
11	: 39	3	30.65		0				
11	: 40	4	30.60		0				
11	: 41	5	30.52		0				
11	: 42	6	30.46		0				
11	: 43	7	30.42		0				
11	: 44	8	30.37		0				
11	: 45	9	30.34		0				
11	: 46	10	30.305		0				
11	: 48	12	[illegible]	30.23	0				
11	: 50	14	30.20		0				
11	: 52	16	30.14		0				
11	54	18	30.10		0				
11	: 56	20	30.075		0				
12	: 01	25	29.99		0				
12	: 06	30	29.925		0				
12	: 11	35	29.865		0				
12	: 16	40	29.815		0				
[illegible]		45	[illegible]						
12	: 26	50	29.73		0				
12	: 36	60	29.66		0				
12	: 46	70	29.595		0				
12	: 56	80	29.53		0				
13	: 06	90	29.475		0				
[illegible]		100							
13	: 16	100	29.42		0				
13	: 26	110	29.37		0				
13	: 36	120	29.33		0				
14	: 06	150	29.205		0				
14	: 36	180	29.095		0				
15	: 06	210	29.05		0				

10.24 4.74 27.49 21.66

Recovery (2)

Australian Groundwater Technologies

Job No: 1638-17-PAF
Sheet 4 of 4

Constant Rate Pumping Test - drawdown recording sheet

Client: PRINCESS ROYAL STATION
Recorded by: AR, TW
Principal:
Checked:
Pumping Bore: 6630-1026
Pre Test SWL: 26.98m bRP
Observation Bore (if applicable): Windmill Bore 6630-1025

24 Hour Time hour	min	Elapsed Time (mins)	Water Level (mbRP)	Drawdown (m)	Pumping Rate Step 4 (L/s)	Notes	pH	temp	EC
15	:36	240	28.93		0				
16	:06	270	28.845		0				
16	:36	300	28.77		0				
17	:06	330	28.715		0				
17	:36	360	28.645		0				
18	:06	390	28.59		0				
	:								
	:								
25/4/17	:								
07	:36	1200	27.66		0	loggers removed			
	:					8.58m Windmill bore 3.02m bRP (logger removed)			
	:								
	:								
	:								
	:								
	:								
	:								
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	:								
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2640
+60
33.4
22
2640
+87
2727

REGIONAL COUNCIL OF GOYDER

Phone 08 8892 0100 Fax 08 8892 2467

DECISION NOTIFICATION FORM	Development Plan Consent, or Building Rules Consent, or Development Approval

South Australia - Regulations under the Development Act 1993
Regulation 42

FOR DEVELOPMENT APPLICATION	Registered Date 6/07/20078

Development No: 422/0068/07	Assessment No: 42075691044

To:	SIMON ROWE PO BOX 160 BURRA SA 5417

Location of Proposed Development:	SECS 216/219 894 BLKS 27 28 ETC HUNDRED OF AYERS & KINGSTON

Nature of Proposed Development:	3000 STANDARD CATTLE UNIT FEEDLOT-STAGE 1 F 3-GENERAL EARTHWORKS

In respect of this proposed development you are informed that:-

Nature of Decision	Consent Granted	No. of Conditions	Consent Refused	Not Applicable
Development Plan Consent	YES	18		
Building Rules Consent	YES			
Land Division				
Land Division (Strata)				
Public Space				
Other				
DEVELOPMENT APPROVAL	YES			

Details of the building classification and the approved number of occupants under the Building Code are attached.

...11.....representation(s) from third parties concerning your proposal were received.

If there were third party representations, any consent/approval with conditions does not operate until the periods specified in the Act have expired. Reasons for this decision, any conditions imposed, and the reasons for imposing those conditions, are set out in the attached sheet.
No work can commence on this development unless a Development Approval has been obtained. If one or more consents have been granted on this Notification Form you must not start any site works or building work or change the use of the land until you have also received a notification of a Development Approval.

Date of Decision 17/10/2008	☐ Development Assessment Commission or Delegate
	☒ Council Chief Executive Officer or Delegate
Signed:	☐ Private Certifier
Date: 17/07/2009	☐ Sheets Attached

REGIONAL COUNCIL OF GOYDER

Phone 08 8892 0100 Fax 08 8892 2467

CONDITIONS ATTACHING TO NOTIFICATION OF A DECISION

DEVELOPMENT NUMBER: 422/0068/07

DEVELOPMENT AT:	SECTION 216/219 894 BLKS 27 28 ETC HUNDRED OF AYERS & KINGSTON

APPLICANT:	SIMON ROWE PO BOX 160 BURRA SA 5417
OWNER :	ILIRA PTY LTD, SIHERO PTY LTD PO BOX 160 BURRA SA 5417

The Purpose of implementing these conditions is to ensure all development complies with requirements of all Acts of Parliament and that the development is orderly and comparable with adjacent developments as allowed in the Council's Supplementary Development Plans.

CONDITIONS: As listed below.

1. **The development must be undertaken in accordance with the plans and proposals submitted, and written text provided in development application 422/0068/07 including the report titled "Development Application for the Development of a Beef Cattle and Lamb Feedlot on 'Mackerode' Station Mount Bryan" by Rural Solutions SA dated 28 June 2007, except for as otherwise varied by any of the following conditions and varied by the applicant, as per the letters, documentation and plans dated 21 August 2008. It should be noted that the applicant varied the proposal to a 3000 SCU feedlot only.**
2. **A twice monthly check detailing the quantity of water extracted for use on the feedlot, the salinity of that water and the levels of at least three surrounding wells within 1 Km of the bores proposed to be used. The three bores shall be designated and Council satisfied with the selection, with the neighbouring properties of PY & BJ Wedding, Ron Shattock and A, P & P Stockman to have one bore on each property monitored. The monitoring shall be performed by an Independent Entity and funded by the applicant and the findings shall be relayed to the Northern and Yorke Natural Resources Board, The Department of Water, Land and Biodiversity and the Regional Council of Goyder. The monitoring shall commence at least three (3) months prior to the any work on the site starting to establish a 'base line' for the subsequent monitoring to be compared to. If work on the site starts within three (3) months of the approval, then the monitoring shall have commenced for at least a month.**
3. **The site and buildings and structures forming part of the development herein approved being maintained in a clean, tidy and environmentally sound condition at all times to the reasonable satisfaction of Council.**
4. **The applicant is to make provision to ensure that any prescribed pest plants and other nuisance weeds are contained and controlled on the site of the feedlot so as to prevent translocation.**
5. **The applicant is to ensure that the exclusion contour bank is cleared of debris on a regular occasion so as to prevent blockage and to maximise sheet water catchment and dispersal away from the feedlot site.**
6. **The applicant is to engage, at the applicant's own cost, a suitably qualified Engineer to undertake an assessment of that section of the unsealed Hill Road, commencing from the intersection of the Burra-Spalding Road in an northerly direction to the existing gate access to the development, and including the access off Hill Road to that access gate; such assessment report is to be in writing and is to detail the nature and extent of road works required to enable all traffic associated with the construction, maintenance**

and operation of the development to safely access the site, and is to be submitted to Council prior to the commencement of any site works, and/or the construction of the development,

and further,

the assessment report is to provide engineering design detail for use as the basis for the undertaking of the required upgrade work on that section of Hill Road, including the access off Hill Road to the site,

and further,

all upgrade work required to be undertaken on that section of Hill Road, including the access off Hill Road to the site, is to be performed to the satisfaction of the Council and at no cost to the Council, and is to be undertaken prior to the commencement of any site works, and/or the construction of the development,

and further,

that section of Hill Road, including the access off Hill Road to the site, is to be maintained to the standard post upgrade, as detailed in the assessment report, by the applicant for the life of the operation of the development so proposed and such maintenance work is to be performed to the satisfaction of the Council and at no cost to the Council.

and subject to the following conditions as originated from the Department for Transport, Energy and Infrastructure:

7. The applicant is to upgrade and seal the Burra-Spalding Road / Hill Road junction apron to protect the shoulder and ensure safety of traffic movement through the junction to improve user safety by minimising the deposition of loose material on the Spalding-Burra Road and to provide traction for heavy vehicles entering the Spalding to Burra Road, such upgrade to include additional delineation in the form of guide posts and a hazard board.

   and further,

   the required roadwork's are be designed and constructed to the satisfaction of Transport SA, with all costs (design, construction and project management) being borne by the applicant, and is to be undertaken prior to the commencement of any site works, and/or the construction of the development.

NOTE

- The applicant is required to contact DTEI's Operations Engineer, Crystal Brook office on 8638 5500 to organise an in site meeting to discuss the required roadworks.

and subject to the following conditions as directed by the Environment Protection Authority:

8. The feedlot shall be designed and constructed to the Class 1 standard as described in the *"Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia", Second Edition, Feb 2006".*
9. The effluent storage lagoon must have sufficient capacity to hold a minimum 1 in 20 year average return interval rainfall event of 1 hour duration, and be lined with a minimum thickness of 600mm of compacted clay or similar low permeability barrier which has an hydraulic conductivity of 1 x 10-9 m/s or less. The lagoon must be covered with a compacted layer of gravel or sand (minimum thickness of 100mm) and wetness of this layer must be maintained at all times to prevent cracking of any clay lining/barrier.
10. The 'Solids Settlement Area' must be lined with a minimum thickness of 300mm of compacted clay or similar low permeability barrier that has a hydraulic conductivity of 1 x 10-9 m/s or less. The surface must be must be covered with a compacted layer of gravel or sand (minimum thickness of 100mm) and wetness of this layer must be maintained at all times to prevent cracking of any clay lining/barrier.
11. The number of cattle to be kept in the facility at any one time shall not exceed 4,409 Standard Cattle Units as defined by the Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia, Second Edition, February 2006 (Note by Council Development Assessment Panel: The actual approved capacity of the feedlot is 3000 SCU-advice from EPA was to keep this condition intact, noting this

condition does not enable the applicant to develop a 4,409 SCU feedlot)

12. The number of sheep to be kept in the facility at any one time shall not exceed 464 Standard Cattle Units as defined by the Guidelines for the Establishment and Operation of Cattle Feedlots in South Australia, Second Edition, February 2006, assuming a lamb of 40 kg is equivalent to 0.155 SCU. (Note by Council Development Assessment Panel: The lamb feedlot was removed from the application by applicant-advice from EPA was to keep this condition intact, noting this condition does not enable the applicant to develop a lamb feedlot).
13. All feedlot pen floors must be compacted to a standard which ensures that effluent does not infiltrate and contaminate groundwater or the soil, and must be graded to have a consistent uniform slope of 4.5 to 7%.
14. All liquid effluent (wastewater) and manures must be collected, treated as necessary, and disposed of in a manner and at a rate which ensures that the nutrients and salt levels in the soil of the disposal area do not pose a threat to soil quality, vegetation, and surface and/or groundwater quality, and also ensures that odour does not become a nuisance off the site.
15. All mortalities must be disposed of immediately upon discovery. Acceptable disposal methods are:
    a) removal to a disposal area/rendering works, or
    b) composting - which shall be carried out on an impervious base of compacted clay or similar impervious barrier which has an hydraulic conductivity of 1 x 10-9 m/s or less. The base must be maintained at all times to prevent cracking of any clay lining/barrier, and on an area from which clean rainfall runoff is excluded, such that no contamination of soil, surface water, or ground water occurs. Leachate from the composting area must be diverted to the effluent storage lagoon.
16. Manure and other sludge material, which is removed from the storage lagoon, pens or solids settlement area and allowed to dry out, must be contained on an impervious surface that drains to the effluent storage lagoon.
17. An 'As Constructed Report' for the pen floor, compost pad, settlement lagoon and the storage lagoon must be provided to the satisfaction of the Environment Protection Authority to demonstrate compliance with the design specifications for the feedlot infrastructure.
18. The feedlot shall not be stocked with cattle or sheep until the effluent management system is constructed and operational.

NOTES

- The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act, to take all reasonable and practical measures to ensure that the activities on the whole site, including during construction, do not pollute the environment in a way which causes or may cause environmental harm.
- An environmental authorisation in the form of a licence is required for the operation of this development. The applicant is required to contact the Environment Protection Authority before acting on this approval to ascertain licensing requirements. The licence may include a condition requiring the development and implementation of an Environment Management Plan to ensure the sustainable management and spreading of solid and liquid wastes generated on site.
- A licence may be refused where the applicant has failed to comply with any conditions of development approval imposed at the direction of the Environment Protection Authority.
- Any information sheets, guidelines documents, codes of practice, technical bulletins etc that are referenced in this response can be accessed on the following web site:
  http://www.epa.sa.gov.au/pub.html

Date: 17/07/2009 Authorised Officer: .....

NOTES FOR APPLICANTS

1. You may have a right of appeal if this Decision Notification is:

   ☐ a refusal

   or

   ☐ a consent or approval with conditions.

   Your appeal must be lodged with the Environment, Resources and Development Court, together with the designated fee, within two (2) months of you receiving notice of this decision.

   A copy of your receipted appeal notice must also be served by you on the planning authority which issued this Decision Notification form within the same two (2) month period.

   Please contact the Environment, Resources and Development Court if you wish to appeal (. 08 8204 0300).

2. If your Application was the subject of third-party representations, any consent or approval, whether subject to conditions or not, shall not operate until the determination of any appeal. A representor has fifteen (15) business days from the date of this Decision Notification to lodge an appeal. Please contact the Environment, Resources and Development Court to see of an appeal has been lodged.

3. If this is a Development Approval:

   ☐ the development must be substantially commenced

   or

   ☐ for land division, you must apply to the Development Assessment Commission for a certificate.

   Within twelve (12) months of the date of this Decision Notification (or alternatively the date of the determination of any appeal) unless this period has been extended by the relevant planning authority.

   AND

   Any act or work authorised or required by this Decision Notification must be substantially or fully completed within three (3) years of the date of this Notification or a longer time as allowed by the relevant authority.

   You will require a fresh Development Approval before commencing or continuing the development if you are unable to satisfy these requirements.

BUILDING RULES - CONDITIONS

DEVELOPMENT NUMBER: 422/0074/07

Location	SECS 216/219 894 BLKS 27 28 ETC HUNDRED OF AYERS & KINGSTON
APPLICANT:	SIMON ROWE PO BOX 160 BURRA SA 5417
OWNER :	ILIRA PTY LTD, SIHERO PTY LTD PO BOX 160 BURRA SA 5417

BUILDING CLASSIFICATION: N/A

APPROVED NO. OF OCCUPANTS UNDER THE BUILDING CODE: N/A

Building work can commence on this site subject to the following conditions and notifications.

CONDITIONS OF APPROVAL: as listed below

1. All raodworks shall allow vehicles to past at all times and the section of raod that is upgraded shall be maintained by the owner of the feedlot for the life of the feedlot. All work is to be to the satisfaction of Council

2. The person proposing to undertake building work on land (or who is in charge of such work) is warned of their obligation to give the Council notice at stages prescribed in Regulation 74. This approval does not imply compliance with the Electricity Trust of South Australia Act, 1996 as amended, or with the (State) Equal Opportunity Act, 1984, or with the Commonwealth Disability Discrimination Act, 1993 as amended or with any of the regulations under those Acts. It is the responsibility of the owner and the person erecting the building to ensure compliance with same.

Date: 17/07/2009

Authorised Officer: .....

NOTES FOR APPLICANTS

Lapse of consent or approval

48. (1) Subject to this or any other regulation, any consent or approval under Part 4 of the Act (whether subject to conditions or not) will lapse at the expiration of-

(a) subject to the operation of paragraph (b) - 12 months from the operative date of the consent or approval;

(b) if-

(i) the relevant development has been lawfully commenced by substantial work on the site of the development within twelve months from the operative date of the approval - three years from the operative date of the approval, unless the development has been substantially or fully completed within those three years (in which case the approval will not lapse); or

(ii) if the relevant development involves the division of land and an application for a certificate under Section 51 of the Act has been lodged with the Development Assessment Commission within twelve months from the operative date of the relevant consent - three years from the operative date of consent.

(2) A period prescribed by subregulation (1) may be extended by a relevant authority -

(a) when the relevant consent or approval is given; or

(b) at such later time as may be appropriate.

(3) Where an approval is given, any consent which was necessary for that approval will not lapse unless or until the approval lapses.

DIVISION 2 - DISPUTES AND APPEALS

General right to apply to Court

86. (1) The following applications may be made to the Court-

(a) a person who has applied for a development authorisation may appeal to the Court against-

(i) a refusal to grant the authorisation; or

(ii) the imposition of conditions in relation to the authorisation; or

(iii) subject to any exclusion prescribed by the regulations, any other assessment, request, decision, direction or act of a relevant authority under this Act in relation to the authorisation;

(b) a person who is entitled to be given a notice of a decision in respect of a Category 3 development under Section 38 may appeal to the Court against that decision (to the extent that it relates to the assessment of the relevant development against a Development Plan);

(c) a person who has applied to a council for a certificate of occupancy or an approval to occupy a building on a temporary basis may appeal to the court against a refusal by the Council to grant the certificate or to give the approval:

(d) a person who has-

(i) been served with an order under Section 55 or 56; or

(ii) been served with an enforcement notice under Section 84; or

(iii) been served with a notice or order under Part 6,

may appeal to the Court against the notice or order;

(e) a person who is a party to a dispute relating to-

(i) the effect of the Building Rules in specific circumstances: or

(ii) the manner in which the provisions of the Building Rules are, or ought to be, carried into effect; or

(iii) whether or not the application of the Building Rules should be modified in a particular case: or

(iv) whether the requirements of the Building Rules in any matter relating to building work have been satisfied in a particular case, or what is necessary for the satisfaction of those requirements; or

(v) the construction of a party wall or the proportion or amount of the expense to be borne by the respective owners of premises separated by a party wall; or

(vi) any other prescribed matter,

may apply to the Court for determination of the dispute.