



LEAP

Livestock Environmental and Planning

Windridge Farms Pty Ltd: Proposed Expansion of Koorani Piggery



Environmental Impact Statement

Private Bag 260 (110 Natimuk Road) Horsham Vic 3401

P: 03 5381 0530 F: 03 5381 0719 M: 0419 787 137

robyn@leap-consulting.com.au www.leap-consulting.com.au ABN: 48 557 393 171

Document Status Record

Client: Windridge Farms Pty Ltd
PO Box 50
Young NSW 2594

Document Title: Windridge Farms Pty Ltd: Proposed Expansion of Koorani Piggery – Environmental Impact Statement

Job No: 68

Document File Name: 68 EIS Final2b.docx

Version No	Date of Issue	Description	Signatures		
			Author	Checked	Approved
1	26 th October 2020	Draft 1	RWT	AR	RWT
2	9 th August 2023	Draft 2	RWT	PH	RWT
3	15 th September 2023	Draft 3	RWT	PH & EW	RWT
4	25 th October 2023	Consultation draft	RWT	PH	RWT
5	27 th November 2023	Final	RWT	AR	RWT
6	30 th July 2024	Final2	RWT	AR	RWT

Notes:

Version 1 This is a draft report.
Version 2 Second draft.
Version 3 Third draft.
Version 4 Consultation draft.
Version 5 Final draft
Version 6 Final for submission.

This EIS has been prepared in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Government, 1979) and the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) (NSW Government, 2021). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEAR) 1707 provided by NSW Department of Planning and Environment (DPE) on 18th August 2022.

Disclaimer:

- Livestock Environmental and Planning has taken all reasonable steps to ensure that the information contained in this publication is accurate at the time of production. In some cases, Livestock Environmental and Planning has relied on information supplied by the client.
- This report has been prepared in accordance with good professional practice. No other warranty, expressed or implied, is made as to the professional advice given in this report.
- Livestock Environmental and Planning maintains **NO** responsibility for the misrepresentation of results due to incorrect use of information contained within this report.
- This report should remain together and be read as a whole.
- This report has been prepared solely for the benefit of the client listed above. No liability is accepted by Livestock Environmental and Planning with respect to the use of this report by third parties without prior written approval.
- Where soil testing has been undertaken, it should be noted that soil conditions can vary significantly even over relatively short distances. Under no circumstances will any claim be considered because of lack of description of the strata and site conditions as shown in the report. In addition, the client or contractor shall be responsible for satisfying themselves as to the nature and extent of any proposed works and the physical and legal conditions under which the work would be carried out, including means of access, type and size of mechanical plant required, location and suitability of water supply for construction and testing purposes and any other matters affecting the construction of the works.

This document should be cited as follows: Livestock Environmental and Planning, 2024, "Windridge Farms Pty Ltd: Proposed Expansion of Koorani Piggery - Environmental Impact Statement", Livestock Environmental and Planning, Horsham, VIC, 3400.

Copyright:

© Livestock Environmental and Planning, Private Bag 260, Horsham, Vic, 3401

Table of Contents

EXECUTIVE SUMMARY	10
1. Introduction	18
2. B. THE PROPOSAL	19
2.1. B.1. OBJECTIVES AND CHARACTERISTICS	19
2.1.1. B.1.b Method of Production	21
2.1.2. B.1.d The Number of Employees.....	31
2.1.3. B.1.e The Volume and Nature of Wastes, including Water, Nutrient & Salt Balances 31	
2.1.4. B.1.f Waste Handling, Treatment & Utilisation.....	33
2.1.5. B.1.g Crop Management and Nutrient Removal.....	62
2.1.6. B.1.h Volume and Nature of Truck Movements	62
2.1.7. B.1.i Heating and Cooling	63
2.1.8. B.1.j The Frequency of Effluent Pond Clean Out.....	63
2.1.9. B.1.k Chemical Usage & Storage	64
2.1.10. B.1.j The Projected Life of the Operation	64
2.1.11. B.1.m Staging	64
2.2. B.2 DESCRIPTION OF OPERATIONS.....	65
2.2.1. B.2.a Location, Elevation and Materials of Buildings	65
2.2.2. B.2.b Earthworks, Fencing, Dams and Ponds.....	65
2.2.3. B.2.c Waste Management Facilities and Effluent Holding and Utilisation Areas	66
2.2.4. B.2.d Type of Machinery to be Used.....	66
2.2.5. B.2.e Silt Traps, Drainage & Stormwater Facilities.....	67
2.2.6. B.2 f Storage Areas and Sheds	67
2.2.7. B.2.g Processing, Storage and Loading Facilities for Transport	68
2.3. B.3. SITE LAYOUT	69
2.3.1. B.3.a Vegetation to be Cleared or Disturbed	69
2.3.2. B.3.b Internal Access Roads, Truck Parking, Loading & Turning Areas	70
2.3.3. B.3.c Effluent Storage, Land Application Areas, Controlled Drainage Areas and Waste Disposal Areas	70
2.3.4. B.3.d Site Drainage, Erosion and Sediment Control During Construction	71
2.3.5. B.3.e Landscaping.....	71
2.3.6. B.3.f Dimensions and Construction Details of Storage Ponds Used for Liquid Effluent	71
2.3.7. B.3.g Assumptions Regarding Seasonal Variations, Meteorological Conditions and Storm Events used to Estimate the Required Capacity	72
2.4. B.4 INFRASTRUCTURE AND SERVICES REQUIREMENTS	73
2.4.1. B.4 A Energy Supply	73
2.4.2. B.4.b Total Water Requirements	73
2.4.3. B.4.c Sources of Water Supply	73
2.4.4. B.4.d Off-site Waste Disposal Requirements	73
2.4.5. B.4.e Road Condition and Transport Requirements	74
2.5. B.5 PREVIOUS AND EXISTING OPERATIONS ON THE SITE	78
2.6. B.6 CONSIDERATION OF ALTERNATIVES	78

3.	C THE LOCATION	79
3.1.	C.1 PLANNING INFORMATION.....	79
3.1.1.	C.1.a Zoning, Permissibility and Land Use Constraints	79
3.1.2.	C.1.b Local and State Environmental Plans and Policies.....	82
3.1.3.	C.1.c Compatibility with Existing and Potential Land Uses	95
3.1.4.	C.1 d Urban Expansion, Rural Residential Development, Recreation, Tourism or Community Facilities	96
3.1.5.	C.1.e Heritage Items for Environmental Protection.....	96
3.2.	C.2. SITE AND LOCALITY DESCRIPTION	97
3.2.1.	C.2.a Title Details and Land Tenure.....	97
3.2.2.	C.2.b Location of the Proposal	97
3.2.3.	C.2.c Surrounding Roads	98
3.2.4.	C.2 d Drainage Lines, Waterways, Natural and Artificial Waterbodies	98
3.2.5.	C.2.e Adjoining Communities, Dwellings and Existing Land Uses.....	108
3.2.6.	C.2.f Sight Lines from Dwellings or Public Places	110
3.2.7.	C.2 g Utilities	112
3.3.	C.3 OVERVIEW OF THE AFFECTED ENVIRONMENT	113
3.3.1.	C.3.a Surface Water and Groundwater.....	113
3.3.2.	C.3.b Geology	121
3.3.3.	C.3.c Soils.....	121
3.3.4.	C.3.e Slope of the Land and Topography	132
3.3.5.	C.3.f Adjoining Land Use	133
3.3.6.	C.3.g Vegetation.....	133
3.3.7.	C.3.h Water Quality.....	136
4.	D IDENTIFICATION AND PRIORITISATION OF ISSUES.....	138
4.1.	D.1 OVERVIEW OF THE METHODOLOGY	138
4.1.1.	Review of Relevant Information	138
4.1.2.	D.1.b Outcome of Consultation with Stakeholders	138
4.2.	D.2 Outcomes of the Process	138
5.	E THE ENVIRONMENTAL ISSUES.....	140
5.1.	E.1 CUMULATIVE IMPACTS.....	140
5.1.1.	E.1.a Baseline Conditions	140
5.1.2.	E.1.b Impact Analysis	140
5.1.3.	E.1.c Mitigation, Management and Monitoring	140
5.2.	E.2. ODOUR.....	140
5.2.1.	E.2.a Baseline Conditions	140
5.2.2.	E.2.b Impact Analysis	140
5.2.3.	E.2.c Mitigation, Management and Monitoring	148
5.1.	PUBLIC HEALTH.....	149
5.1.1.	E.17.a Baseline Conditions	149
5.1.2.	E.17.b Impact Analysis	149
5.1.3.	E.2.c Mitigation, Management and Monitoring	150
5.2.	E.3 WASTE MANAGEMENT.....	151
5.2.1.	E.3.a Baseline Conditions	151

5.2.2.	E.3.b Impact Analysis	151
5.2.3.	E.2.c Mitigation, Management and Monitoring	152
5.3.	E.4 WATER QUALITY AND CATCHMENT PROTECTION	152
5.3.1.	E.4.a Baseline Conditions	152
5.3.2.	E.4.b Impact Analysis	153
5.3.3.	AE.4.c Mitigation, Management and Monitoring	156
5.4.	E.5 LAND CAPABILITY AND PROTECTION.....	156
5.4.1.	E.5.a Baseline Conditions	156
5.4.2.	E.5.b Impact Analysis	156
5.4.3.	E.5.c Mitigation, Management and Monitoring	157
5.5.	E.6 DRAINAGE AND STORM WATER MANAGEMENT	157
5.5.1.	E.6.a Baseline Conditions	157
5.5.2.	E.6.b Impact Analysis	157
5.5.3.	E.6.c Mitigation, Management and Monitoring	157
5.6.	E.7 FLOODING	158
5.6.1.	E.7.a Baseline Conditions	158
5.6.2.	E.7.b Impact Analysis	158
5.6.3.	E.7.c Mitigation, Management and Monitoring	158
5.7.	E.8 TRAFFIC AND ROAD IMPACTS.....	158
5.7.1.	E.8.a Baseline Conditions	158
5.7.2.	E.8.b Impact Analysis	158
5.7.3.	E.8.c Mitigation, Management and Monitoring	159
5.8.	E.9 NOISE	160
5.8.1.	E.9.a Baseline Conditions	160
5.8.2.	E.9.b Impact Analysis	160
5.8.3.	E.9.c Mitigation, Management and Monitoring	162
5.9.	E.10 DUST	162
5.9.1.	E.10.a Baseline Conditions	162
5.9.2.	E.10.b Impact Analysis	162
5.9.3.	E.10.c Mitigation, Management and Monitoring	163
5.10.	E.11. VISUAL IMPACTS.....	163
5.10.1.	E.11.a Baseline Conditions	163
5.10.2.	E.11.b Impact Analysis	163
5.10.3.	E.11.c Mitigation, Management and Monitoring	163
5.11.	E.12. PEST AND INSECT CONTROL	163
5.11.1.	E.12.a Baseline Conditions	163
5.11.2.	E.12.b Impact Analysis	163
5.11.3.	E.12.c Mitigation, Management and Monitoring	164
5.12.	E.13. FLORA AND FAUNA.....	164
5.12.1.	E.13.a Baseline Conditions	164
5.12.2.	E.13.b Impact Analysis	165
5.12.3.	E.13.c Mitigation, Management and Monitoring	165
5.13.	E.14. HERITAGE.....	165
5.13.1.	E.14.a Baseline Conditions	165

5.13.2.	E.14.b Impact Analysis	165
5.13.3.	E.14.c Mitigation, Management and Monitoring	166
5.14.	E.15. HAZARDOUS CHEMICALS.....	166
5.14.1.	E.15.a Baseline Condition.....	166
5.14.2.	E.15.b Impact Analysis	166
5.14.3.	E.15.c Mitigation, Management and Monitoring	166
5.15.	E.16. ANIMAL WELFARE AND BIOSECURITY	166
5.15.1.	E.16.a Baseline Conditions	166
5.15.2.	E.16.b Impact Analysis	168
5.15.3.	E.16.c Mitigation, Management and Monitoring	168
5.1.	E.17. BUSHFIRE MANAGEMENT	169
5.1.1.	E.17.a Baseline Conditions	169
5.1.2.	E.17.b Impact Analysis	169
5.1.3.	E.17.c Mitigation, Management and Monitoring	169
5.1.	E.17. GREENHOUSE GAS EMISSIONS.....	172
5.1.1.	E.16.a Baseline Conditions	172
5.1.2.	E.16.b Impact Analysis	172
5.1.3.	E.16.c Mitigation, Management and Monitoring	172
5.2.	E.17. ECONOMIC AND SOCIAL EFFECTS	172
5.2.1.	E.17.a Baseline Conditions	172
5.2.2.	E.17.b Impact Analysis	172
5.2.3.	E.17.c Mitigation, Management and Monitoring	173
6.	F LIST OF APPROVALS AND LICENCES	174
6.1.	Required Approvals and Licences.....	174
6.2.	Integrated Approvals Required	174
7.	G COMPILATION OF MITIGATION MEASURES	175
7.1.	G.a Environmental Management Outline	175
7.1.1.	G.a.i Management of Construction Impacts	175
7.1.2.	G.a.ii Management of Operational Impacts.....	178
7.1.3.	G.a.iii Strategies to Improve Management using Monitoring Data	183
7.1.4.	G.a.iv Training Programs for Operational Staff.....	184
7.2.	G.b MONITORING OUTLINE.....	184
7.2.1.	G.b.i Key Information to be Monitored	184
7.2.2.	G.b.ii Monitoring Location, Intervals & Duration.....	187
7.2.3.	G.b.ii Procedures for Monitoring	187
7.2.4.	G.b.iv Compliance and Reporting Procedures	187
8.	H JUSTIFICATION FOR THE PROPOSAL.....	188
8.1.	H.a The Precautionary Principle	188
8.2.	H.b Inter-generational Equity.....	188
8.3.	H.c Conservation of Biological Diversity and Ecological Integrity	189
8.4.	H.d Improved Valuation and Pricing of Environmental Resources	189

8.5. Ability to Satisfy Objectives	190
9. References	191

List of Tables

Table 1 – Herd Composition and Housing – Fully Developed Piggery	21
Table 2 – Expected Feed Usage by Pig Class – Fully Developed Piggery	30
Table 3 – Expected Water Usage – Fully Developed Piggery	30
Table 4 – Weekly and Annual Pig Sales – Fully Developed Piggery	30
Table 5 – Expected Annual Mortalities – Fully Developed Piggery	31
Table 6 – Liquid Effluent Volume Discharged from Sheds – Fully Developed Piggery	32
Table 7 – Composition of Liquid Effluent Discharged from Sheds	32
Table 8 – Quantity and Composition of Spent Bedding Removed from Sheds – Fully Developed Piggery	33
Table 9 – Estimated Mass and Volume of Spent Bedding – Fully Developed Piggery	33
Table 10 – Effluent Partitioning Between Liquid and Sludge in the CAL	35
Table 11 – Approximate Dimensions of SEPS Channels	39
Table 12 – SEPS Solids Composition	41
Table 13 – Recycle Dam Effluent Quality	42
Table 14 – 1 in 20 Year, 24 Hour Storm Inflows to Pond System	45
Table 15 – Dimensions of Spent Bedding Storage Pads	46
Table 16 – Quantity and Composition of Aged Spent Bedding	48
Table 17 – Spent Bedding Analysis Results	48
Table 18 – Buffers for Reuse Areas in Relevant Guidelines	51
Table 19 – Proposed Reuse Area Buffers	52
Table 20 – Adopted Crop Nutrient Removal Rates	56
Table 21 – Nutrient Removal by 5 Years of Cropping on Reuse Areas	57
Table 22 – Minimum Area Needed for Sustainable Effluent and Manure Reuse Under Proposed Cropping Rotation	57
Table 23 – Estimated Mass and Rate of Salt Added to Soils of Cropped Effluent Reuse Areas	59
Table 24 – Weekly and Annual Vehicle Movements	63
Table 25 – Breakdown of Clean Water Requirements	73
Table 26 – Real Property Description for Koorani	79
Table 27 – Soil Test Results (0-10 cm) February 2020 & December 2019	125
Table 28 – Soil Test Results (0-10 cm) January 2019 & May 2018	126
Table 29 – Soil Test Results (0-10 cm) May 2021	127
Table 30 – Climate Data (Monthly)	129
Table 31 – Rainfall Intensity, Duration, Frequency	130
Table 32 – Groundwater Chemistry Monitoring Results	137
Table 33 – Identified Issues and their Priority	139
Table 34 – S Factors and Calculated Maximum SPU Numbers Based on Distance to a House	147
Table 35 – Recommended Noise Levels from Industrial Noise Sources for Residences in Rural Areas	160

List of Figures

Figure 1 – Current Piggery Shed Layout.....	20
Figure 2 – Layout of Fully-Developed Piggery.....	22
Figure 3 – Shed Details.....	23
Figure 4 – Finisher Shed Floor Plan	26
Figure 5 – Drainage Layout	27
Figure 6 – Finisher Shed Elevations	28
Figure 7 – Finisher Shed Elevation and Cross-Section.....	29
Figure 8 – Proposed CAL Plan View	36
Figure 9 – Proposed CAL Cross Sections	37
Figure 10 – Proposed SEPS channel.....	38
Figure 11 – Runoff Collection Area for SEPS and Recycling Dam	40
Figure 12 – Watbal Model Pond Dimensions	43
Figure 13 – Watbal Model Results	44
Figure 14 – Spent Bedding Storage Pads	47
Figure 15 – On-Farm Land Available for Effluent and Mortalities Compost Reuse.....	54
Figure 16 – On-Farm Land Available for Spent Bedding Reuse	55
Figure 17 – Silo Details.....	68
Figure 18 – Location of Confirmed Plant Community Types (PCTs) and Habitat Features.....	69
Figure 19 – Junction of Old Forbes Road and Henry Lawson Way	74
Figure 20 – Property Entrance off Old Forbes Road.....	75
Figure 21 – Traffic Route from Wonga to Koorani – Feed and Incoming Pigs.....	76
Figure 22 – Traffic Route to Diamond Valley Pork – Outgoing Pigs.....	77
Figure 23 – Cadastral Details.....	79
Figure 24 – Site Aerial Photo	80
Figure 25 – District Land Use Zoning	81
Figure 26 – Natural Resources Sensitivity - Water.....	88
Figure 27 – Areas of High Biodiversity Value.....	89
Figure 28 – Bushfire Prone Land.....	90
Figure 29 – Heritage Areas.....	92
Figure 30 – Location of Property – District Scale	98
Figure 31 – Lachlan River Water Quality and River Flow Objectives.....	99
Figure 32 – Extract from Bendick Murrell District Topographic Details	106
Figure 33 – Local Waterways	107
Figure 34 – Watershed and Piezometers.....	108
Figure 35 – Nearby Houses.....	109
Figure 36 – Groundwater Sources	114
Figure 37 – Groundwater Dependent Ecosystems Ecological Value	116
Figure 38 – Groundwater-Dependent Ecosystems at Subject Property	116
Figure 39 – Location of Groundwater Bores in the Vicinity of the Property.....	118
Figure 40 – Boundary of Zone 1 of Lachlan Alluvium WRP Area	120
Figure 41 – Soil Landscapes.....	122
Figure 42 – Soils of the Subject Property.....	124
Figure 43 – Koorani Paddocks Map	128
Figure 44 – Mean Annual Wind Directions at Young 9 AM and 3 PM.	131
Figure 45 – Topographic Map of Property and Surrounds.....	132
Figure 46 – Topographic Map – Koorani.....	133
Figure 47 – Native Vegetation Regulatory (NVR) Mapping – Farm and Surrounds	136
Figure 48 – Elevation Profile – Northern End of SEPS to House 1	143
Figure 49 – Elevation Profile – Southern Extent of SEPS to House 1	143
Figure 50 – Elevation Profile – South West Corner of Pig Sheds to House 1	144

Figure 51 – Local Topographic Details	144
Figure 52 – Elevation Profile – Shortest Distance from Piggery Complex to House 2.....	145
Figure 53 – Elevation Profile – South East Corner of Piggery Complex to House 8.....	145
Figure 54 – Elevation Profile – North East Corner of Piggery Complex to House 8.....	146
Figure 55 – Elevation Profile – Shortest Distance from Piggery Complex to House 5.....	146
Figure 56 – Elevation Profile – Shortest Distance from Piggery Complex to House 10.....	146
Figure 57 – Elevation Profile – Shortest Distance from Piggery Complex to House 9.....	147
Figure 58 – Common Sounds and their Typical Noise Level	161
Figure 59 – Site Access and On-Site Fire Evacuation Point.....	171

List of Photographs

Photograph 1 – Deep Litter Housing	24
Photograph 2 – Conventional Shed	25
Photograph 3 – Pond Desludging Infrastructure	41
Photograph 4 – Spent Bedding Storage Pad	47
Photograph 5 – View from House 1 to Piggery Complex	110
Photograph 6 – View from House 3 to Piggery Site	111
Photograph 7 – View from House 5 to Piggery Site	112

List of Appendices

Appendix A – SEARS.....	197
Appendix B – Consultation Undertaken in Preparing EIS.....	198
Appendix C – CV for Robyn Tucker	203
Appendix D – PigBal Output.....	219
Appendix E – Watbal Output	220
Appendix F – Duty of Care Statement: Spent Bedding and Compost (sourced from APL Piggery Manure and Effluent Management and Reuse Guidelines).....	224
Appendix G – Biodiversity Assessment Report.....	226
Appendix H – Biosecurity Procedure.....	227
Appendix I – Traffic Impact Statement.....	231
Appendix J – Young Aboriginal Land Council Report	232
Appendix K – ACHAR.....	238
Appendix L – Draft Environmental Management Plan	239
Appendix M – Summary of Mitigation Measures.....	240

Environmental Planning and Assessment Act 1979 Statement & Certification

This Environmental Impact Assessment (EIS) has been prepared by:

Robyn Tucker (responsible person)

Talona Evermore Pty Ltd T/A Livestock Environmental and Planning (LEAP) (ACN: 600 322 736)

Private Bag 260

Horsham Vic 3401

M: 0419 787 137

Email: robyn@leap-consulting.com.au

Qualifications: B. App. Sci. (Rur. Tech), MBA

Chartered Agriculturalist, Certified Professional Soil Scientist, Environmental Management System Auditor

The applicant is:

Peter Hanna

Windridge Farms Pty Ltd (ACN 127 963 008)

PO Box 50 Young NSW 2594.

Address of land: 345 Old Forbes Road, Young, NSW, 2594

RPD of Land included: Lot 1 DP217627, Lot B DP372950, Lots 3 & 34 DP754581, Lots 1, 2 & 3 DP1049163, Hilltops Shire

This EIS has been prepared to accompany a Development Application made to the Hilltops Shire Council as the consent authority. It has been prepared in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Government, 1979) and the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) (NSW Government, 2021). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEAR) 1707 provided by NSW Department of Planning and Environment (DPE) on 18th August 2022 (see Appendix A) and a letter from NSW Fire Service dated 7th October 2022. The EIS follows the format of the Piggeries: EIS Guidelines (NSW Department of Urban Affairs and Planning, 1996).

Certification

I certify that I have prepared the contents of this EIS and to the best of my knowledge:

- It is in accordance with sections 190 and 192 of the *Environmental Planning and Assessment Regulation 2021*
- it contains all available information that is relevant to the environmental assessment of the development.
- the information contained in the statement is not false or misleading.



Robyn Tucker

Principal Consultant

Livestock Environmental and Planning

30th July 2024

EXECUTIVE SUMMARY

Introduction

This Environmental Impact Statement (EIS) identifies and assesses the environmental issues associated with the expansion of the existing Koorani grow-out piggery to 16,221 grower pigs or 23,284 standard pig units (SPU). Livestock Environmental and Planning has prepared the EIS on behalf of the proponent, Windridge Farms Pty Ltd.

This EIS has been prepared in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Government, 1979) and the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) (NSW Government, 2021). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEAR) 1707 provided by NSW Department of Planning and Environment (DPE) on 18th August 2022 (see Appendix A) and a letter from NSW Fire Service dated 7th October 2022. The EIS follows the format of the Piggeries: EIS Guidelines (NSW Department of Urban Affairs and Planning, 1996).

The Proposal

The proponent is Windridge Farms Pty Ltd. The piggery is situated at 345 Old Forbes Road, Young which includes Lot 1 DP217627, Lot B DP372950, Lots 3 & 34 DP754581, Lots 1, 2 & 3 DP1049163, Hilltops Shire which is owned by Windridge Farms Pty Ltd.

The objectives of the proposal are:

- to expand an existing 9,600 pig grower-finisher unit into a 23,284 SPU grower-finisher unit that will deliver efficient pork production in a welfare friendly way.
- to operate in a way that protects the environment including air; water; land; biodiversity; items, and sites and places of Aboriginal cultural heritage sensitivity.
- to operate in a way that is compatible with surrounding land uses.
- to beneficially use the nutrients, water and carbon in spent bedding, effluent and mortalities within on and off-site farming systems.
- to maximise profitability within the constraints of the previous objectives.

The existing piggery permissions allow for the keeping of 9,600 pigs in ten deep litter sheds and six conventional sheds. The expansion described in this EIS will involve the addition of a further six conventional sheds to bring the total capacity to 16,221 pigs or 23,284 SPU. It is proposed that the expansion of the piggery will be undertaken in a single stage. The projected life of the operation is 20 years.

The existing deep litter sheds have concrete slabs, cement walls and corrugated iron rooves. Mash feed is provided using self-feeders. The deep litter sheds are bedded with straw or straw and rice hulls that absorbs manure, providing a dry environment for the pigs. Spent bedding is aged on existing dedicated pads that will be upgraded to have low permeability bases and bunding to protect surface waters. Space on the pad near the piggery provides for mortalities composting. The spent bedding is an excellent soil conditioner and nutrient source. Spent bedding is spread on Koorani but also on other land managed by Windridge Farms Pty Ltd and by others. It is expected that this would continue post-expansion.

Conventional housing accommodates pigs within steel-framed sheds with walls that are half solid and half nylon curtain, iron roofing and slatted flooring over concreted under-floor effluent pits with pull

plugs (existing sheds) or under-floor flush channels (proposed sheds). Feed is provided ad-lib as mash (growers) and pellets (finishers). The existing effluent system consists of a two-channel sedimentation and evaporation pond system (SEPS). The SEPS channels drain to a recycle dam from which treated effluent is drawn for shed flushing and for irrigation. The effluent system will be upgraded as part of the development. Effluent will be directed into a new covered anaerobic lagoon (CAL) for treatment. CALs are popular in larger pig farms as the cover eliminates odour releases from the primary pond and also allow for the capture of biogas that can be used as a power source. Surplus liquid effluent and settled sludge from the CAL will be regularly transferred to SEPS channels. SEPS are an effective method for managing the sludge that settles in the bottom of anaerobic ponds. Once in the SEPS, the sludge is referred to as SEPS solids. Liquid from the SEPS will drain to the recycle dam. Effluent from this dam will be recycled as shed flushing water and will also be irrigated onto land on-farm, providing a valuable source of nutrients for cropping systems. The SEPS solids are currently being sold to nearby farmers. However, it is expected that most SEPS solids will be reused on other farms operated by Windridge Farms Pty Ltd in the future, including a new farm next to Wonga which is another farm operated by the proponent.

Careful management of reuse is important in protecting the environment. Buffers to sensitive land uses and natural resources will provide additional protection. The good management practices described in *Use of Effluent for Irrigation* (Department of Environment and Conservation (NSW), 2004) and the *National Environmental Guidelines for Indoor Piggeries* (Tucker, 2018) will be adopted. Sustainable nutrient application rates have been determined based on expected crop rotations and conservative average yield data. A total of 499.8 ha of land on-farm has been allocated for reuse (421.8 ha can be used for effluent, mortalities compost or spent bedding and SEPS solids with a further 78 ha also suitable for spent bedding or SEPS solids only due to differences in buffers between different types of by-products). On average, there is ~280 ha under crop in any year. This is more than enough land on which to safely reuse the nutrients in liquid effluent and mortalities compost, although some may also be used on grazed pastures. Some of the spent bedding can also be reused on-farm. Soil testing will be regularly undertaken to check on nutrient levels and plan for future application rates. Crop rotations can also be varied to increase nutrient removal if necessary. Any off-farm recipients of SEPS solids or spent bedding will be provided with a handout including good management principles, an analysis for the product they are receiving and a duty of care statement.

Trucks will need to transport pigs and prepared feed to the site. Finished pigs, some of the spent bedding and SEPS solids will need to be transported from the farm. On average, there will be about 20 trucks in and out per week. The property entry point will be off Old Forbes Road with all traffic turning right on exit, towards Henry Lawson Way. Weaner pigs and feed will come from the Wonga piggery located to the south of Young. Finished pigs will also head south to an abattoir located in Lavington North in Melbourne. It is expected that spent bedding and SEPS solids going off-farm will mostly go onto farms managed by the applicants and will stay within the district.

The primary power supply for the site will be mains electricity. There is also a diesel generator for back-up. Biogas generated from the CAL may be used as a fuel source in the future, although this is not part of this proposal.

Water is needed for pig consumption and cleaning the conventional sheds. Treated recycled effluent will be used for shed cleaning, which minimises the fresh water requirement. Water will be sourced from two bores that share a groundwater allocation of 69 ML for industrial, stock and domestic. It is

estimated that about 55 ML/yr will be needed to operate the fully developed piggery. The bores are capable of supplying the water requirement.

The fully developed piggery will be staffed by six full-time equivalents, representing an increase of two. Operational activities will generally be restricted to 7 AM to 3 PM weekdays and 7 AM to 1 PM on weekends. The expansion of the Koorani farm will also mean that more employment at the Wonga site where there will be more breeding pigs.

The Location

The piggery complex will be sited on Lot 2 DP1049163. The subject property, and all surrounding land, is zoned RU1 Primary Production. Intensive livestock agriculture is permitted in the RU1 zone, with consent. As the proposed piggery expansion is designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 2021, an EIS must be submitted with a development application.

The proposed development is subject to:

- Environmental Planning & Assessment Act NSW (1979) (NSW Government, 1979)
- Environmental Planning & Assessment Regulation NSW (2021) (NSW Government, 2021)
- Protection of the Environment Operations Act (1997) (NSW Government, 1997)
- Protection of the Environment Operations (General) Regulation NSW (2022) (NSW Government, 2022)
- NSW Department of Planning (1996) EIS Guideline Piggeries (NSW Department of Planning, 1996)
- Hilltops Local Environmental Plan (LEP) (2022) (Hilltops Council, 2022)
- Young Development Control Plan (DCP) (2011 updated January 2019) (Hilltops Council, 2011).

The site is suitable for the proposed purpose. The land surrounding the piggery and reuse areas is zoned RU1 and used for cropping and grazing. A pig farm is an allowable use in the zone and will not restrict the use of surrounding land for agricultural purposes, unless someone wanted to operate their own intensive livestock facility. It is intended that straw for bedding will be sourced from on-farm but also from surrounding land owners. There may also be opportunities for nearby farmers to use spent bedding and SEPS solids as cropping system inputs.

The piggery is located in a rural area. However, there are some nearby houses with the closest house one located approximately 1.04 km to the west of the piggery. Two houses are ~ 2 km from the site with three other houses within 3 km. Because of the topography, the piggery complex is not visible from Old Forbes Road and it is unlikely that it will be visible after the expansion. It is also unlikely that it will be visible from the nearby houses.

The Hilltops LEP does not identify any heritage areas on or near the pig farm. To determine the impacts of the development, a due diligence assessment was undertaken in accordance with the Due Diligence Code of Practice (OEH 2010) by Past Traces in 2024. The due diligence assessment identified five isolated finds, with three of these sites within the proposed area of works. As the due diligence assessment found Aboriginal heritage sites within the project area, an Aboriginal Cultural Heritage Assessment (ACHAR) was prepared to determine the extent and significance of potential heritage impacts. This assessment included consultation with the Aboriginal community through the

participation of the Young LALC in the field survey and inviting comments on methodology and report findings from Registered Aboriginal Parties for the project. Granting of an Aboriginal Heritage Impact Permit (AHIP) will be necessary before works can proceed.

There are no major rivers close to Koorani, which sits within the catchment of the Cudgell and Burrangong Creeks. Both these creeks are considered environmentally sensitive. Cudgell Creek is an intermittent but perennial stream that runs alongside the eastern boundary of the property. It has relatively saline water, although this fluctuates with rainfall. Burrangong Creek flows to the north drains to the Bland Creek that is a mostly-perennial watercourse that drains into Lake Cowal. Because of its elevation, the site of the existing piggery is not subject to flooding. There is a waterway running through the existing site. This terminates through two farm dams.

In the vicinity of the property, the underlying geology is the Young Granodiorite and the Lachlan Fold Belt. The Young granodiorite is a fractured rock aquifer. In this formation, groundwater would typically be stored and move through faults, cavities, joints and fractures within the rock mass. Weathering has increased the porosity and the permeability of the granite. It is likely that the water-bearing zone extends to 80 m or more. Recharge of the bores is mainly by infiltration from rainfall and runoff. The Lachlan Fold Belt covers a very large area and water quality varies widely depending on rock type, fracture density, aquifer depth, and climate. Alluvial groundwater is present at shallower depths near watercourses. No groundwater dependent ecosystems have been identified near the piggery complex site.

The Water Sharing Plan for the Murray-Darling Basin Fractured Rock Groundwater Sources 2020 includes the Young Granite groundwater source and the Lachlan Fold Belt MDB (NSW Government, 2020). The NSW water sharing plans set rules for sharing water between all water users and the environment and provide for water licensing on a single platform managed under the *Water Management Act 2000*. Hence, they aim to achieve sustainable groundwater extraction by limiting extractions to part of the aquifer recharge, leaving the balance to meet environmental requirements. Two bores situated on Lot B 372950 on the eastern side of the property near Cudgell Creek share an associated water access licence number of WAL 29028 / Approval number 70WA609923 providing a groundwater allocation of 35 ML for industrial, stock and domestic. An additional 34 ML allocation was transferred as WAL29034 in 2021. A study undertaken by CM Jewell & Associates Pty Ltd (Jewell, 1994) for a previous EIS for the Koorani property measured groundwater conductivities ranging from 1,020 uS/cm to 2,500 uS/cm. Somewhat higher measurements (up to 3,300 uS/cm) have been recorded during routine groundwater monitoring. Groundwater salinity can be expected to fluctuate. As the corresponding nitrate-nitrogen concentration was acceptably low, these results are not of concern.

The soils of the farm were described by a survey undertaken in 1993 by Midstate Planning (Zinga, 1993). Red brown earths are widespread on the farm, particularly on the broad hillcrests, upper and mid-slope terrain locations. These are texture-contrast soils with hard-setting surfaces. Yellow earths are found in similar terrain locations to the red-brown earths, although more commonly on the mid-slope positions. These are fine sandy clay loams showing a gradual increase in clay content with depth. The topsoil is structureless with a hard-setting surface. Yellow podzolics are found on the lower, flatter and more poorly drained terrain. These are texture contrast soils. They have a hard setting surface over brown sandy loam topsoils that are typically 1.3 m deep, with a yellowish-brown, sandy-clay to

medium clay subsoil. Alluvial soils are present along Cudgell Creek. The soils mostly have good fertility. The soils are mostly non-sodic. Adding organic matter would improve the soil structure.

The topography of the farm consists of the typical gently undulating hills and valleys associated with granite, rising in elevation by 60 m from north to south (340 m to 400 m). Slopes range from 2-11%, averaging about 8%. The piggery site itself has an elevation of approximately 375 m AHD.

Like most of the land in the district, the farm has largely been cleared and developed for cropping. However, there are some areas of remnant vegetation and planted trees on the farm. To assess biodiversity, OzArk prepared a Biodiversity Assessment Report (BAR) for the project. The only plant community type recorded near the piggery site was PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. This PCT occurred as small derived (0.70 ha) and planted (0.14 ha) forms. All areas of PCT 277 met the condition thresholds for the *Biodiversity Conservation Act 2016* (NSW Government, 2016) listed critically endangered ecological community (CEEC): White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar. As such, up to 0.84 ha of this CEEC could be directly impacted by the proposal. However, any clearing of this vegetation would not exceed the clearing threshold for the lot size, impact an area mapped on the Biodiversity Values Map or result in a significant impact to one or more listed threatened entities. The potential biodiversity impacts to a minor unnamed watercourse within the subject site were also considered. The watercourse is connected to two farm dams and does not flow into any other watercourses. However, as the proposal includes the dredging and/or remediation of the unnamed minor watercourse within the subject site, a permit issued by the Minister will be required under Section 201 the *Fisheries Management Act 1994*. Overall, the development is not expected to have any significantly impacts on biodiversity. This proposal does not trigger the need to offset, prepare a Biodiversity Development Assessment Report (BDAR) or to refer the matter to the Minister.

The Young area experiences warm summers with cool to cold winters. Rainfall is reasonably evenly spread throughout the year. In the summer, the winds are mostly from the north or east at 9 am and from the west to south-west at 3 PM. In the winter, the winds are mostly from the west at 9 am and from the west to south-west at 3 PM.

The surrounding land is used for mixed farming with cattle, sheep and cereal and oilseed cropping.

Identification and Prioritisation of Issues

The process used to identify and prioritise issues included:

- a review of federal, state and local government acts, regulations, policies and plans.
- a review of applicable industry and environmental guidelines and recent NSW piggery EIS.
- site investigations by LEAP Consulting, the company agronomist, representatives of Young Local Aboriginal Land Council, OzArk Consultants and Past Traces Heritage Consultants.
- consultation with various agencies, Hilltops Council and other relevant bodies.
- following the Secretary's Environmental Assessment Requirements (SEAR).

Consultation with all nearby neighbours about the proposed piggery expansion was undertaken through informal discussions. Most neighbours said the existing piggery had not had the (adverse) impact they expected. One neighbour raised concerns about odour, in particular when spreading manure. Other neighbours seemed generally accepting of the proposal and interested in taking spent

bedding and SEPS solids. There has been no odour complaints made to the EPA in over ten years. One neighbour has called Windridge directly on three or four occasions in the last five years complaining of odour nuisance from spreading manure. This was resolved by changing manure spreading practices to undertake spreading at more suitable times and further from the neighbours' house.

The identified issues and their priority are summarised below:

Issues identified	Priority
Cumulative impacts	Low
Odour Impact	High
Effluent and manure management and reuse	Medium-high
Water quality & catchment protection	Medium
Land capability & protection	Medium
Drainage and stormwater management	Medium
Flooding	Low
Traffic and road impacts	Low
Noise	Low
Dust	Low
Visual impacts	Low
Pest & insect control	Low
Flora and fauna	Low
Heritage	Medium-high
Hazardous chemicals	Low
Animal welfare	Low
Economic and social effects	Positive

Because it is a sensitive issue and a concern raised by some neighbours, odour is a high priority. Like any intensive animal facility, the proposed piggery expansion will create some odour. The most effective way of protecting amenity is by implementing good design, good management practices and appropriate separation distances. It is proposed to construct a state-of-the-art facility that is easy to keep clean and to implement standard operating procedures that ensure the likelihood of odour nuisance is minimised. The closest house is located approximately 1,040 m to the west of the piggery. There is a significant ridge between the piggery and this house and the house is also at a higher elevation than the piggery complex. The predominant wind direction is mostly from the north or east at 9 AM in summer and from the west at this time in winter, and from the west to south-west in the afternoons, so mainly it is not carrying towards the house. In accordance with EPA advice, a level 1 odour assessment was undertaken using the NSW EPA's policy framework for managing odour, the Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW (Department of Environment and Conservation NSW, 2006). This demonstrates that the expanded piggery will be adequately separated from the closest house and other nearby houses, providing suitable protection from the risk of odour, dust and noise nuisance. Nevertheless, ongoing mitigation, management and monitoring are warranted. Should nuisance occur, a responsive odour management process will be triggered. Details of the complaint/s will be thoroughly recorded, the cause of any problem promptly and thoroughly investigated, corrective and preventative action promptly implemented and details of these steps communicated back to the submitter/s who will also be asked whether the issues has been satisfactorily resolved. If not, the process would recommence with the

aim of effectively resolving the issue as soon as practicable. In the event of a complaint, liaison with council and EPA will also be important in resolving the issue.

This EIS provides detailed information about the proposed land use change and the associated reuse activities along with appropriate risk reduction and mitigation techniques. Effluent and manure management and reuse is closely related to water quality and catchment protection, land capability and protection and drainage and stormwater management. Effluent and sludge / SEPS solids will be treated in the CAL and SEPS prior to reuse, which will reduce odour and nutrient levels. Spent bedding will be aged and mortalities properly composted which will reduce odour and pathogen levels ahead of on-farm reuse. These by-products will be applied to land at sustainable rates with the aim of providing nutrients for crop uptake. The use of suitable application rates and practices will mitigate any risks of nutrient and sediment transfer to waterways, with buffers used to filter stormwater runoff from the paddocks. Similarly, suitable application rates and practices will minimise the risk of excess nutrients seeping below the crop root zone and into groundwater via fractured aquifers.

It is not expected that the piggery will be clearly visible from the Old Forbes Road or from nearby houses. Tree plantings around piggery over the last 20 years have created a visual buffer between the road and the piggery. Consultation with neighbours suggests they are satisfied with the effectiveness of the tree screening. To further minimise the possibility of visual impacts, new buildings will be constructed from cladding in muted colours.

Another relatively high priority is Aboriginal cultural heritage sensitivity. Aboriginal artefacts were found at the site and the construction of the piggery, particularly excavation for shed bases, and the effluent ponds, pose a risk. An AHIP will be needed before works can proceed. Windridge Farms Pty Ltd has committed to having two members of the Young Local Aboriginal Land Council on-site during the soil excavation that occurs during construction. This is to help with the identification of Aboriginal items that may be unearthed, and to ensure these are treated with respect. In the event that an Aboriginal object is found during construction, work will immediately stop until appropriate protection measures can be undertaken and the Office of Environment and Heritage will be notified as soon as practical. If human remains are found, work will stop, the site will be secured and the NSW Police and the Office of Environment and Heritage will be notified as soon as practical.

Animal welfare is a sensitive societal issue. It is in the proponent's interests to optimise animal welfare, so all facilities and management will meet or exceed the standards, as they do now. Persons responsible for the care of the pigs will be skilled in piggery work and competent to ensure the health and welfare of the animals or will be under the direct supervision of skilled personnel. Strict quarantine rules will apply. The farm is already and will continue to be accredited under the APIQ[✓]® industry quality assurance program, which includes a module on animal welfare.

List of Approvals and Licences

The piggery will require the following approvals and licences:

- | | |
|--------------------------|--|
| • Hilltops Shire Council | Development Consent |
| • NSW EPA | License and approval to operate a piggery under Protection of the <i>Protection of the Environment Operations Act 1997</i> |

Amendment of the Pollution Incident Response Management Plan (PIRMP) held for the premises.

- NSW Office of Water Bore licences / allocations meeting the licencing requirements of *Water Management Act 2000* (NSW Government, 2000). Note: these are already in place.
- NSW DPI permit for dredging and/or remediation a watercourse
- NSW Heritage AHIP

Environmental Monitoring

Mitigation measures have been summarised above. These will be supported by regular environmental monitoring. This will include:

- complaints recording and investigation
- testing of effluent, spent bedding and SEPS solids six monthly
- annual testing of the soils of reuse areas receiving effluent, mortalities compost or spent bedding in a given year (one set of samples per agronomic management unit)
- recording of all reuse details
- recording the details of any sales or transfers of SEPS solids and spent bedding to others
- testing of groundwater quality six monthly

Justification of Proposal

The proposed piggery expansion offers an opportunity for Windridge Farms to improve the viability of their farm and business. The applicants understand that such a development can only be viable if it operates in harmony with the community and with protection of the environment as a cornerstone. To that end, the design and management of the piggery has been carefully considered to ensure risks are mitigated. This proposal does not involve any threat of serious or irreversible environmental damage and therefore poses no threat to inter-generational equity or conservation of biological diversity and ecological integrity. The proponents will bear the cost of managing the effluent, spent bedding, SEPS solids and mortalities arising from their activities including monitoring for impacts and reporting on environmental outcomes. However, they will also reap the benefits of the nutrients and carbon that will improve the agronomic properties of their soils.

1. Introduction

Windridge Farms Pty Ltd proposes to expand the capacity of its existing 9,600 pig Koorani grow-out piggery to 16,221 grower pigs or 23,284 standard pig units (SPU). The piggery is situated at 345 Old Forbes Road, Young.

This EIS has been prepared in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Government, 1979) and the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) (NSW Government, 2021). The structure and content of the EIS address the Secretary's Environmental Assessment Requirements (SEAR) 1707 provided by NSW Department of Planning and Environment (DPE) on 18th August 2022 (see Appendix A) and a letter from NSW Fire Service dated 7th October 2022. The EIS follows the format of the Piggeries: EIS Guidelines (NSW Department of Urban Affairs and Planning, 1996).

In preparing the EIS, it was necessary to consult with the relevant local and state government authorities, service providers, nearby landholders and other interested parties and address any issues raised. Details of the consultation undertaken, and the issues raised, are provided as Appendix B.

This EIS was prepared by Livestock Environmental and Planning (LEAP). A CV for Robyn Tucker, Principal Consultant, is provided as Appendix C.

2. B. THE PROPOSAL

2.1. B.1. OBJECTIVES AND CHARACTERISTICS

Windridge Farms Pty Ltd currently operates a grower piggery unit on their property at 345 Old Forbes Road, Young. The piggery has development consent to run 9,600 pigs (2000/DA-00035) and an EPA POEO Licence (11314) for 250-500 t of pigs. The pigs include grower and finisher pigs that are currently accommodated in a combination of deep litter and conventional housing. Effluent is treated in a two-channel sedimentation and evaporation system (SEPS) that drains into a recycle dam. The treated effluent is drawn from this dam for flushing the under-floor channels of the conventional sheds and for irrigation. Figure 1 shows the current layout of the pig sheds. There are sixteen existing stocked sheds. The piggery is APIQ[✓]® certified. APIQ[✓]® is the industry quality assurance program.

It is proposed that the capacity of the piggery will be increased to 16,222 pigs capacity or 23,284 standard pig units (SPU) of grower and finisher pigs, housed in a combination of deep litter and conventional sheds. A SPU is a unit for defining piggery capacity by manure production where the manure and waste feed produced by one SPU contains the mass of volatile solids (VS) equivalent to that typically produced by one average sized grower pig (90 kg VS/yr). The SPU multipliers used in the Technical Notes: Assessment and Management of Odour from Stationery Sources in NSW (Department of Environment and Conservation NSW, 2006) were used to calculate the number of SPU since this is an input to the separation distance formula and nothing else. The proposed expansion will involve the addition of six conventional sheds and upgrades to the effluent treatment system.

Effluent from the conventional sheds will undergo treatment in a covered anaerobic lagoon (CAL) with the treated liquid and sludge extracted from the CAL transferring to a three-channel sedimentation and evaporation system (SEPS). The solids will settle in the SEPS channels while liquid effluent will drain to a recycle dam. From here, the liquid will be drawn for flushing the underfloor effluent pits in some of the conventional sheds. Surplus liquid effluent will be irrigated on-farm (current practice). SEPS solids will be dried and aged (current practice) before being spread off farm on land owned by the proponent (current practice). Spent bedding removed from the deep litter housing will be aged prior to spreading either on land on-farm and other land owned by the proponents (current practice). However some spent bedding may also be sold directly ex-shed clean-out.

It is intended that the development will occur in a single stage. Development consent will be needed for the expansion of the piggery. Because the scale of the proposal means it will be a designated development, this Environmental Impact Statement (EIS) was needed as part of the application process.

The objectives of the proposal are:

- to expand an existing 9,600 pig grower-finisher unit into a 23,284 SPU grower-finisher unit that will deliver efficient pork production in a welfare friendly way.
- to operate in a way that protects the environment including air; water; land; biodiversity; items, and sites and places of Aboriginal cultural heritage sensitivity.
- to operate in a way that is compatible with surrounding land uses.
- to beneficially use the nutrients, water and carbon in spent bedding, effluent and mortalities within on and off-site farming systems.
- to maximise profitability within the constraints of these objectives.



Figure 1 – Current Piggery Shed Layout

The piggery will operate in accordance with the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018). The National Environmental Guidelines for Rotational Outdoor Piggeries (Tucker RW, 2013) are not applicable to this type of piggery.

B.1.a Pig Numbers

Table 1 provides a summary of the proposed herd composition for the fully developed piggery and the type of pig housing to be used by each class.

Table 1 – Herd Composition and Housing – Fully Developed Piggery

Pig Class	Head	SPU multiplier	SPU*	Weight range (kg)	Housing
Grower 12-16 wks	5,368	1.0	5,368.0	35-60	Deep litter
Finishers 13-22 wks	8,099	1.6	12,958.4	60-100	Conventional
Heavy Finishers 22-24 wks	2,754	1.8	4,957.2	100-115	Conventional
Total	16,221		23,284		5,368 SPU deep litter 17,915.6 SPU conv.

2.1.1. B.1.b Method of Production

Grower pigs will arrive at the site at ~12 weeks of age and 35 kg. They will remain at the site until they are up to 24 weeks of age when they are ready for market at a weight of approximately 115 kg. The pigs will be raised using a combination of conventional sheds and deep litter sheds. The classes of pig that will utilise each type of shed is shown in Table 1. Figure 2 shows the layout of the fully developed piggery, including each type of shed (details on Figure 3). Note that the stage one sheds on both figures have already been constructed.

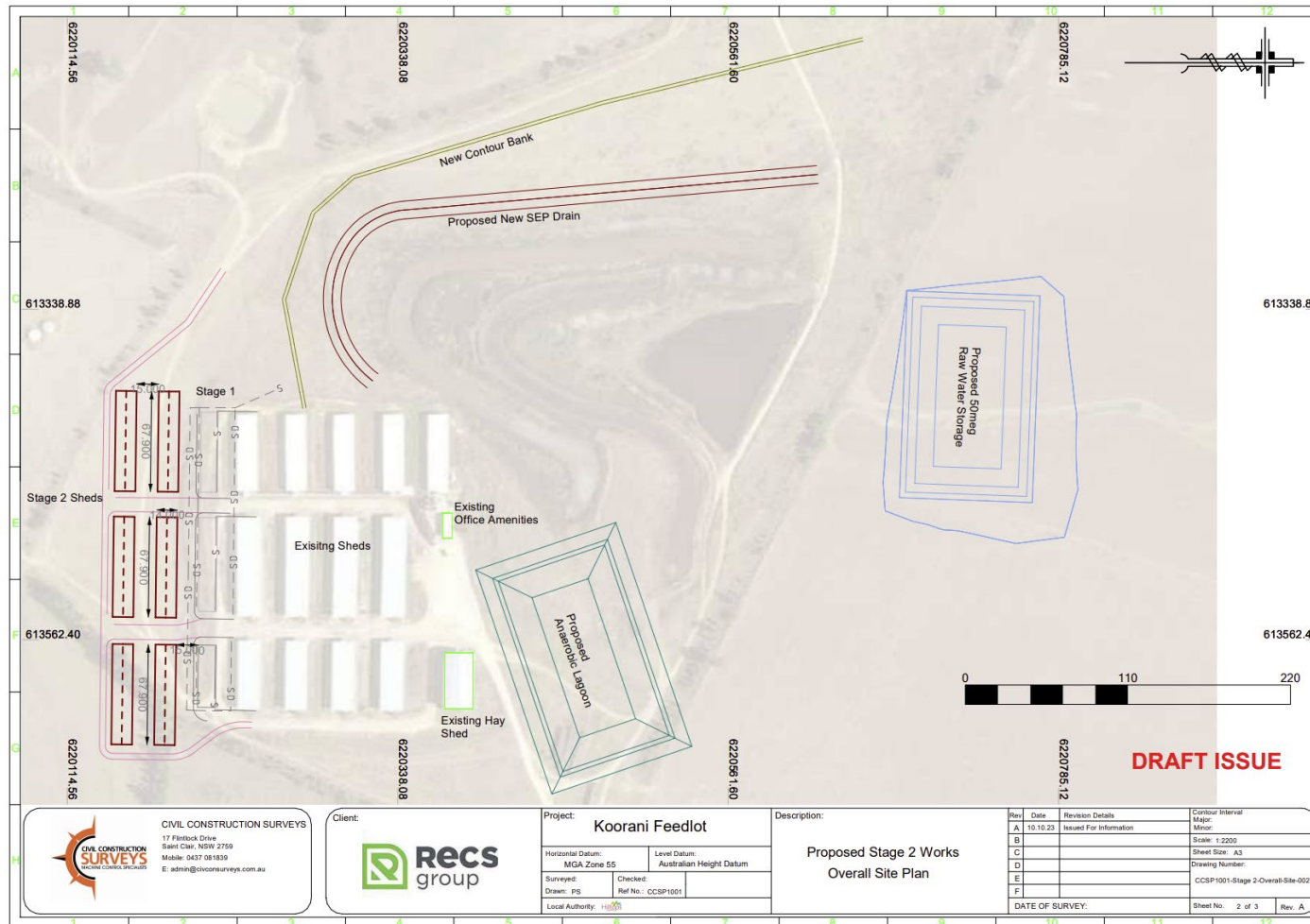


Figure 2 – Layout of Fully-Developed Piggery

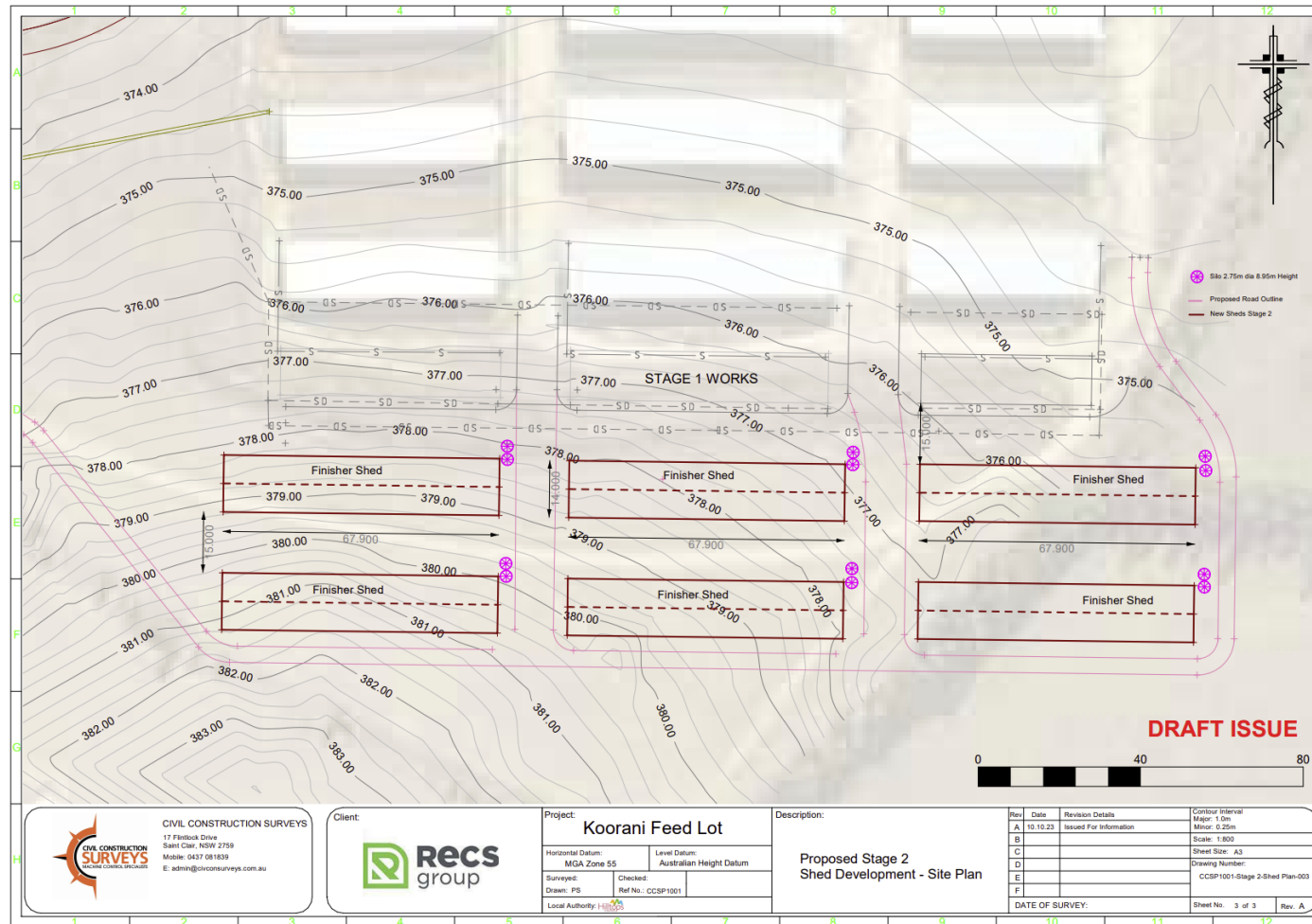


Figure 3 – Shed Details

Deep litter housing will be used for younger / grower pigs. These sheds are already in place. They consist of steel-framed sheds that are open on three sides, with concreted floors that are covered with straw bedding (or similar absorptive material such as rice hulls) to keep the pigs warm and absorb manure and spilt feed and water. Hence, these sheds produce spent bedding but no liquid effluent. Photograph 1 shows this type of housing at Koorani.



Photograph 1 – Deep Litter Housing

Straw for bedding will be sourced from the proponents' own farms, and from other local farmers. A good layer of straw will cover the floor of the sheds at all times and this will be topped up as needed. Based on experience at Koorani, and in accordance with the recommendations of the National Environmental Guidelines for Indoor Piggeries, about 0.7 kg/SCU/day of bedding will be used. Spent bedding will be removed and replaced as needed, but at least every seven weeks, to provide dry, low odour bedding for the pigs to lie on. The removed bedding will be aged before being used as an input to cropping systems on farms operated by Windridge Farms Pty Ltd. However, some spent bedding may also be provided to nearby landholders straight after removal from the sheds. Details of the quantity and composition of the spent bedding are provided in section 2.1.3. Details of the management and reuse of the spent bedding are provided in section 2.1.4.

The conventional housing will house the finisher and heavy finisher pigs. The tighter environmental controls within this type of housing allow for more even finishing of pigs. Some of this housing is already in place, with a further six sheds to be added. The existing conventional sheds have pull plug effluent pits that are emptied once every two weeks. The new housing will be steel-framed sheds built from sandwich panel, with automatically-controlled nylon blinds and fans for ventilation and slatted flooring over concreted under-floor effluent channels. Photograph 2 shows an example of this type of housing at Koorani. Figure 4-Figure 7 show details of the six proposed sheds.



Photograph 2 – Conventional Shed

These sheds produce liquid effluent made up of cleaning water, manure, waste feed and spilt drinking water that is captured in the under-floor channels or pits (pull plug sheds) The pits will be shallow with sloping floors to promote drainage of effluent from them. They will be flushed three times daily to ensure a low odour environment within the sheds and regular inflows to a pond-based effluent treatment system. Section 2.1.3 provides details of the expected quantity and composition of the effluent properties. Sections 2.1.4, 2.2.3 and 2.3.3 provide details of effluent treatment and reuse.

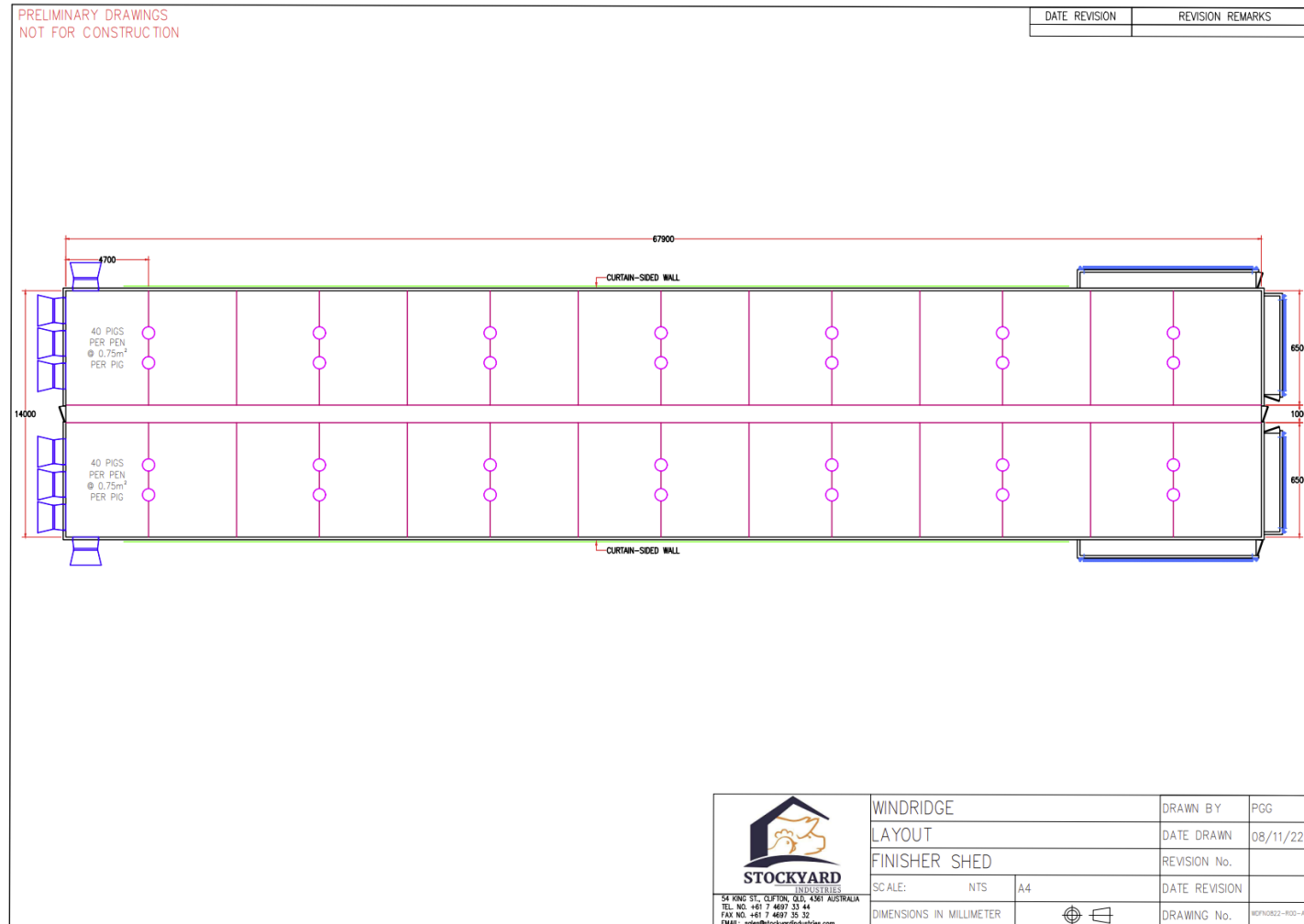


Figure 4 – Finisher Shed Floor Plan

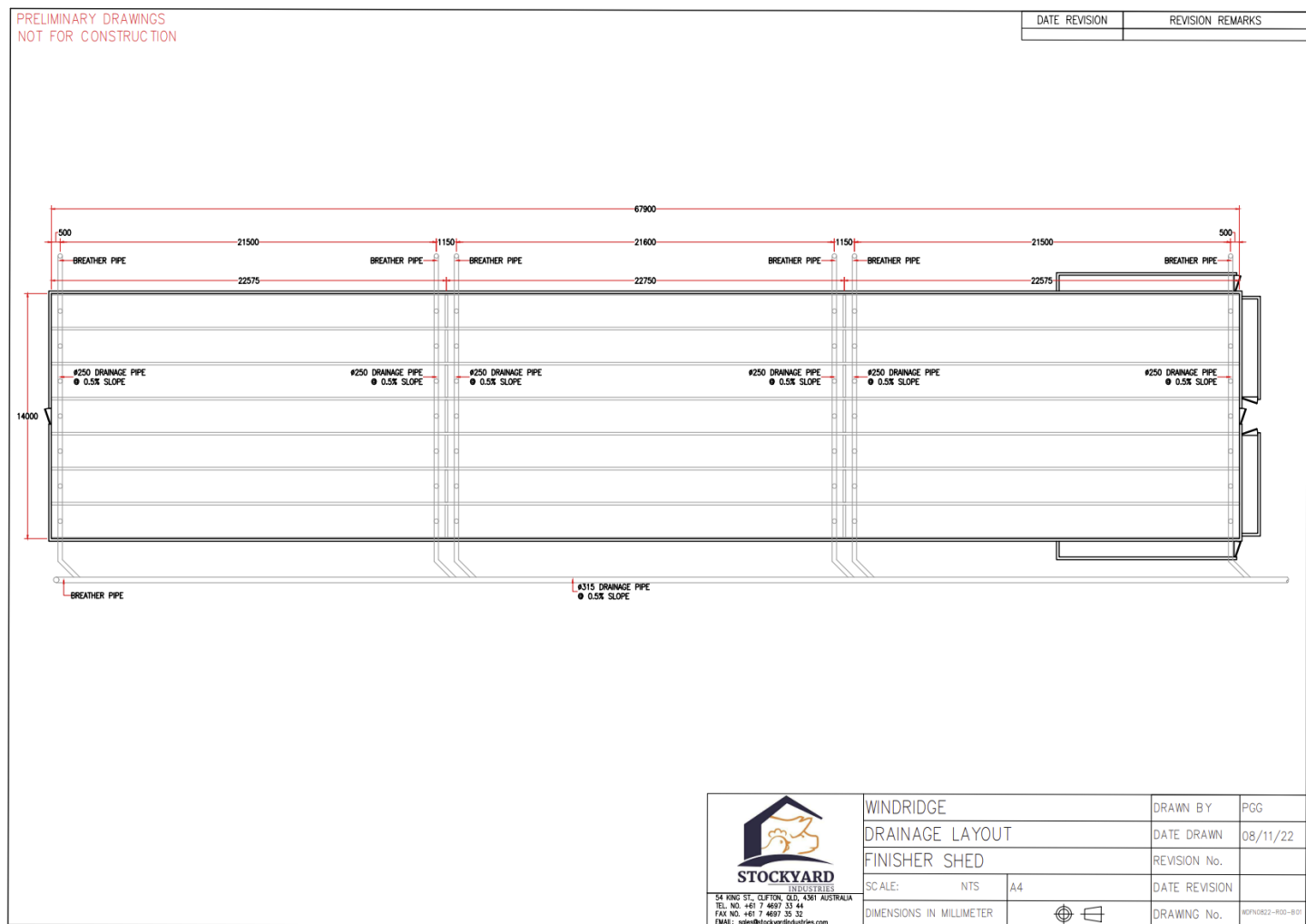


Figure 5 – Drainage Layout

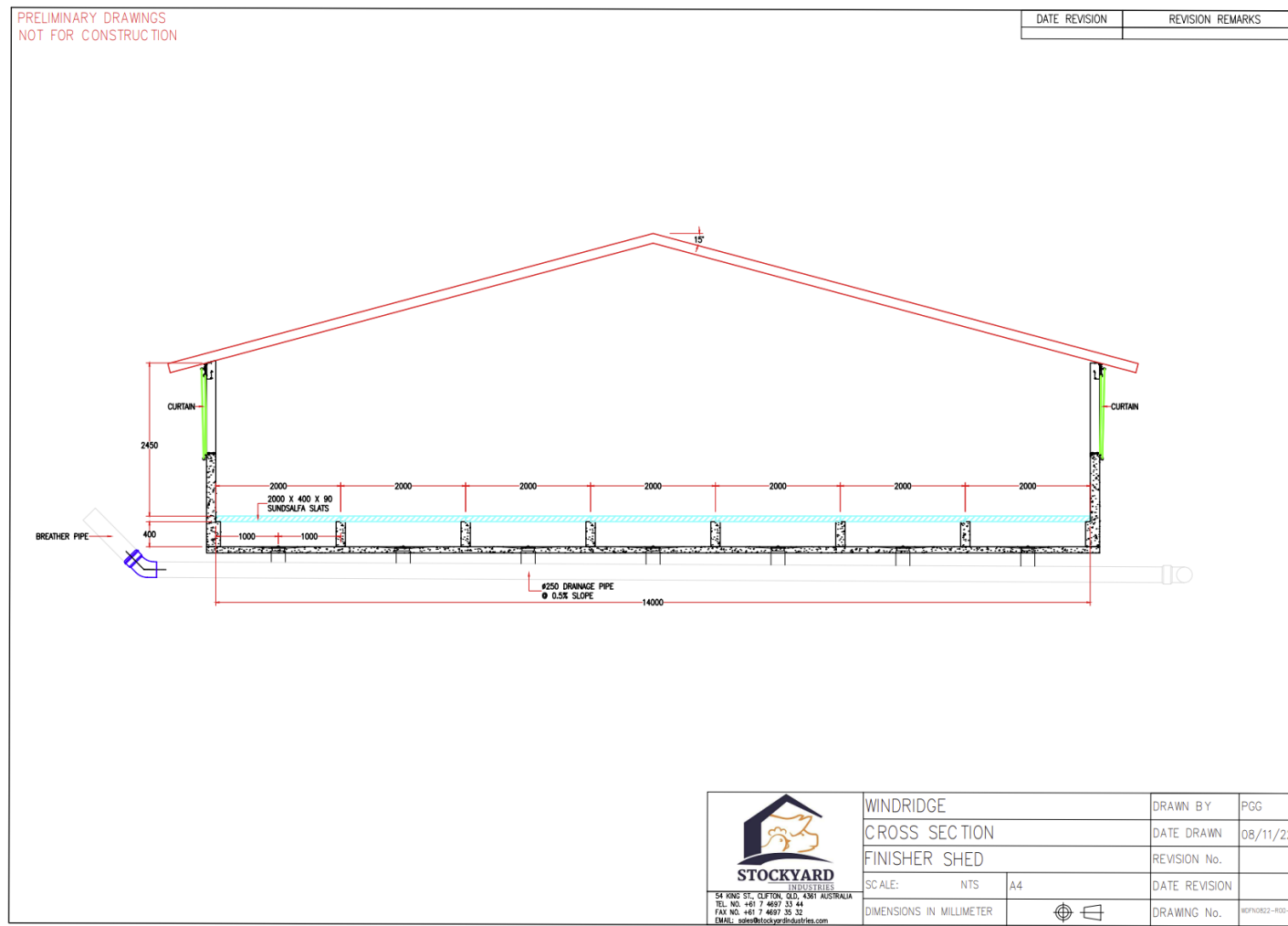


Figure 6 – Finisher Shed Elevations

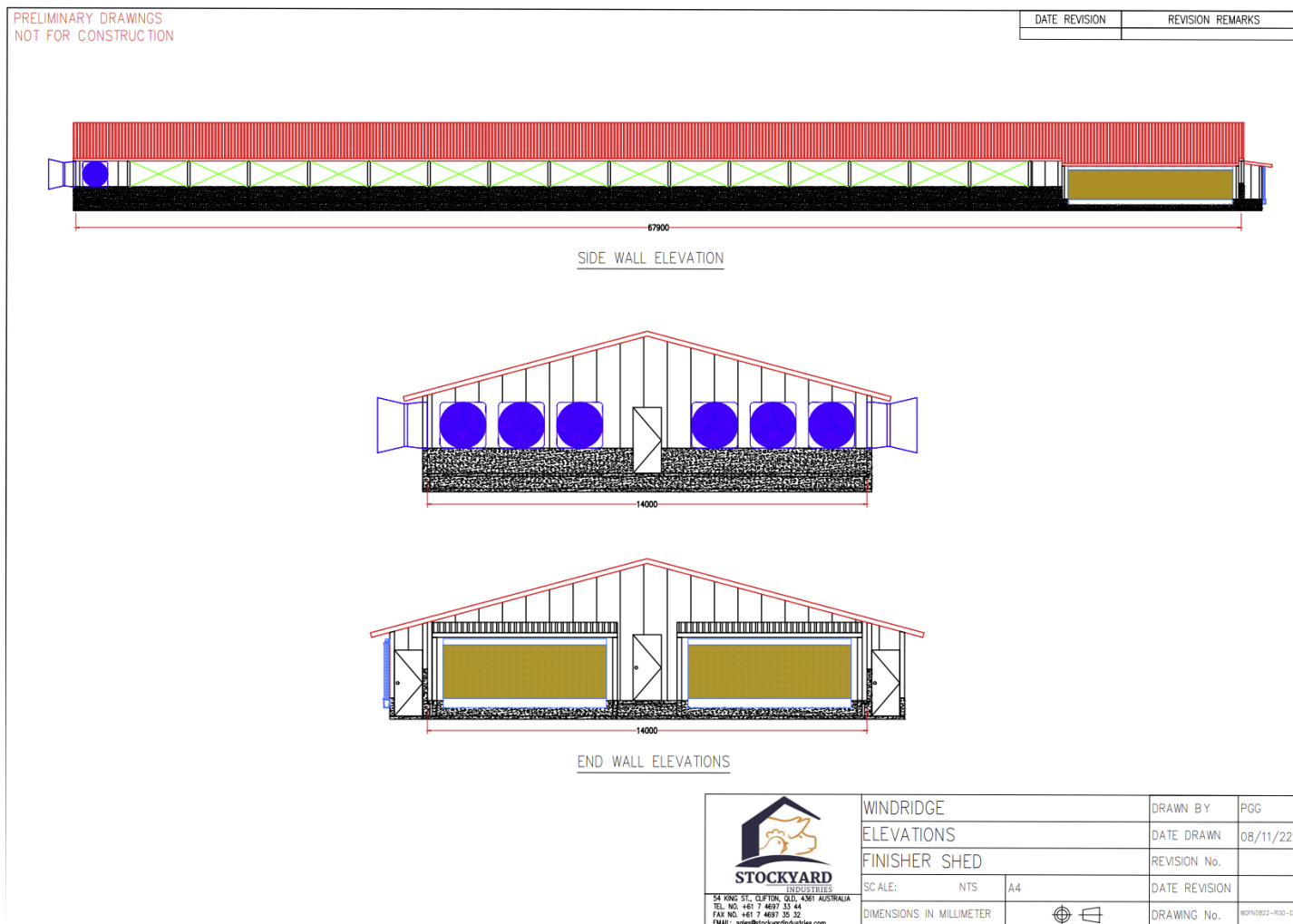


Figure 7 – Finisher Shed Elevation and Cross-Section

The feed for the piggery will be milled and mixed at the Windridge Farms Pty Ltd Wonga piggery. The main ingredient will be grain and this will be grown on other farms managed by the proponents or sourced from local farmers.

Table 2 shows a breakdown of expected feed type by class of pig. Diets will be carefully formulated to match production requirements for the different classes of pigs. Feed presentation has also been carefully considered; self-feeders will provide the grower pigs with mash while the finishers and heavy finishers will be supplied with liquid feed. Low wastage feeder designs will be selected.

Table 2 – Expected Feed Usage by Pig Class – Fully Developed Piggery

Pig Class	Daily Feed Usage* (kg/pig/day)	Annual Feed Fed (t/yr)	Feed Type
Grower	1.64	3,406	Mash
Finisher	2.35	7,364	Mash
Heavy finisher	2.90	3,090	Pellets
Total		13,860	

* includes 6% wastage allowance

Expected clean water usage is summarised in Table 3. The main water usage will be from pig consumption; the pigs will have continuous access to clean drinking water. Low wastage drinkers will be installed. Water will also be needed for cooling the pigs in conventional housing during hot weather. On average, the total requirement will be about 150,300 L/day or about 55 ML/yr.

Table 3 – Expected Water Usage – Fully Developed Piggery

Purpose	Daily Usage (L/day)	Annual Usage (ML/yr)
Drinking	107,100	39.1
Drinker waste	20,800	7.6
Cleaning	20,000	7.3
Cooling	2,400	0.9
Total	150,300	54.9

Expected pig sales for are summarised in Table 4.

Table 4 – Weekly and Annual Pig Sales – Fully Developed Piggery

Frequency	Number	Weight (t)
Per year	69,284	7,968
Per week	1,329	153

Some mortalities are inevitable for any livestock operation. Table 5 shows the expected annual number and mass of mortalities. For the fully developed piggery, it is expected that there will be approximately 61 t/yr of mortalities to manage.

Table 5 – Expected Annual Mortalities – Fully Developed Piggery

Mortalities	Number
Number (pigs/yr)	826
Mass (t/yr)	61

The existing office with staff facilities (lunch room, and showers and toilets) and other facilities will continue to be used.

Two silos will be added on the end of each new shed. The dimensions of these are shown on Figure 17.

Refer to Figure 2 for the location of these facilities.

B.1.c The Hours of Operational Activities

Operational activities will generally be to 7 AM to 3 PM weekdays and 7 AM to 1 PM on weekends. There will be occasions when it may be necessary to operate outside these hours, for example, pigs may need to be loaded and transported in the early hours of the morning in very hot weather for welfare reasons. However, extraordinary work hours will only be used as a contingency to manage unusual events.

2.1.2. B.1.d The Number of Employees

The fully developed piggery will be staffed by six full-time equivalents, representing an increase of two. However, the expansion of the Koorani farm will also mean that more employment at the Wonga site where there will be more breeding pigs.

Additional employment will be indirectly provided through the contractors engaged during construction.

2.1.3. B.1.e The Volume and Nature of Wastes, including Water, Nutrient & Salt Balances

The main “wastes” from the piggery are liquid effluent, settled SEPS solids (sludge removed from the CAL for drying), spent bedding and mortalities compost. These wastes essentially comprise waste feed, manure, bedding materials and water. These wastes will be minimised through source reduction by feeding the animals efficiently by tailoring diets and the quantity of feed required to the animals’ needs, minimising feed wastage through good feeder design and feeding practices and using bedding and water efficiently. Small amounts of rubbish will also be generated.

Liquid Effluent

The conventional sheds will produce liquid effluent consisting of shed pressure washing water, flushing water, drinking water wastage, waste feed and manure. The conventional pig sheds will be pressure-washed each time a batch of pigs is removed to ensure a high standard of hygiene is

maintained. The water, waste feed and manure will fall through the slatted shed flooring and collect in concreted under-floor pits. The existing finisher sheds have pull plug systems that are only emptied about once a fortnight. The new sheds will have flushing pits and water will be flushed through these three times a day. The stream will be directed to an effluent treatment system that will consist of a covered anaerobic lagoon (CAL), a sedimentation and evaporation basin system (SEPS) and a recycle dam. To keep the microorganisms in the CAL stable, the pits on different sheds will be emptied regularly on different days to maintain a relatively uniform flow. The PigBal 4 model developed by the Queensland Department of Agriculture and Fisheries (2019) for Australian Pork Ltd was used to estimate the properties of the raw liquid effluent stream and also to size the CAL (refer to Appendix D for output). PigBal 4 is a validated model that uses herd composition, feed usage, diet composition and water usage to provide a good estimate of the properties of the effluent stream. In-shed gaseous losses are also accounted for; for sheds with flushing systems these are: 2% of total solids, 3% of volatile solids and 10% of nitrogen.

Table 6 shows the estimated volume of effluent that will be discharged from the conventional sheds. Table 7 shows the solids and macro-nutrients contained in the effluent ex-sheds. PigBal does not estimate the salt content of effluent. However, the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018) provide tabulated data showing an electrical conductivity (EC) range of 2.5-11.7 dS/m with a mean of 6.4 dS/m for effluent for irrigation. Recent farm-specific data showed the liquid in the effluent recycle pond typically has a higher EC e.g. 13-14 dS/m (30th March 2022, 16th November 2021) but this can also be lower e.g. 6.9 dS/m (29th December 2022) (see Table 13). EC levels in effluent depend on the EC of the water used, the level of salt inclusion in the diet, whether effluent is recycled as cleaning water, and evaporation and rainfall rates. The fresh water used for drinking and pressure washing has a relatively low salt content and salt levels in the diets will be kept low to ensure the effluent does not become too saline.

Table 6 – Liquid Effluent Volume Discharged from Sheds – Fully Developed Piggery

Item	Volume
Water (L/d)	20,000
Manure + waste feed (L/d)	38,780
Drinker waste water (L/d)	14,220
Total (L/d)	73,000
Total (ML/yr)	26.65

Table 7 – Composition of Liquid Effluent Discharged from Sheds

Item	Rate (kg/d)	Rate (t/yr)	Concentration (mg/L)
Total solids	3,875	1,414	53,082
Volatile solids	3,254	1,188	44,574
Nitrogen	221	80.7	3,027
Phosphorus	66	24.1	904
Potassium	62	22.5	849

Spent Bedding

The deep litter housing will produce spent bedding consisting of a mixture of bedding, waste feed and manure. The spent bedding will be regularly removed from the shelters and replaced as needed to provide dry, low odour bedding for the pigs to lie on. PigBal 4 was used to estimate the composition of the spent bedding including nutrients added by feed and bedding, and in-shed losses of 20% of total solids, 25% of volatile solids and 17% of nitrogen. The results are shown in Table 8.

Table 9 provides an estimate of the expected mass and volume of spent bedding to be removed annually assuming a moisture content ex-sheds of 40% and a bulk density of 0.6 t/m³. As a percentage of dry matter, the nutrient concentrations equate to 2.53% nitrogen, 1.03% phosphorus and 1.06% potassium. The removed bedding will be stored and aged on hardstand, banded areas (see section 2.1.4 for details).

Table 8 – Quantity and Composition of Spent Bedding Removed from Sheds – Fully Developed Piggery

Item	Mass
Total solids (t/yr)	1,676
Volatile solids (t/yr)	1,424
Nitrogen (t/yr)	42.4
Phosphorus (t/yr)	17.2
Potassium (t/yr)	17.8

Table 9 – Estimated Mass and Volume of Spent Bedding – Fully Developed Piggery

Item	Quantity
Wet Mass (t/yr)*	2,793
Volume (m ³ /yr)#	4,655

* assuming a moisture content of 40% ex-sheds

assuming a bulk density of 0.6 t/m³

The deep litter shelters will be pressure washed each time litter is removed. This will generate a relatively small amount of dilute wastewater that will be captured in concreted, in-ground sumps. The wastewater volume, which is included in the total estimated cleaning water for the piggery, drains by gravity from the sumps to the SEPs channels.

Other Wastes

The piggery will generate very little rubbish type waste. The commodities for the pig feed will be mostly delivered in bulk, without packaging. There will be some pharmaceutical and cleaning product packaging and some office wastes. There will also be sharps from administering animal treatments.

2.1.4. B.1.f Waste Handling, Treatment & Utilisation

This section describes the handling, treatment and reuse of effluent, spent bedding, separated manure solids and SEPS solids (sludge removed from the base of the CAL and dried in the SEPS). A life cycle approach will be adopted with the “wastes” becoming valuable inputs to cropping systems on and off-farm.

Effluent Treatment

Overview of Effluent Treatment Process

The effluent treatment process will consist of a CAL, SEPS and recycle dam. There are two existing SEPS channels and a recycle dam. A new CAL and SEPS channel will need to be constructed. Figure 8-Figure 11 provide details of the CAL and SEPS.

Effluent Release from Sheds

The effluent will be released from the shed under-floor pits by daily flushing of flush channels and regular release of pull plug pits. This is important in ensuring a regular feed supply for the microorganisms in the anaerobic effluent pond that are responsible for treating the effluent.

Covered Anaerobic Lagoon (CAL)

The CAL will provide primary effluent treatment. Anaerobic ponds use microorganisms that can function in the absence of free oxygen to reduce the organic matter of effluent. Anaerobic decomposition is a multi-stage process. First, enzymes degrade the organic matter into soluble molecules. Next, acid-forming bacteria break these down into volatile fatty acids (VFAs). Finally, they are converted into low odour methane and carbon dioxide. To minimise odours, it is important that the process is complete. The methane-formers are pH sensitive and also slow-growing, so excessive production of VFAs can result in incomplete breakdown and increased odour. To promote stable treatment bacteria populations, the anaerobic pond will be sized to ensure there is sufficient treatment capacity, the pond effluent volume will be kept relatively stable, and the feed to the pond will be kept regular by keeping the flow of effluent to the pond regular.

CALs are a mainstream effluent treatment option for larger Australian piggeries, providing a means to significantly reduce odour and greenhouse gas (GHG) emissions by burning the biogas either through a flare or in a generator. Hence, CALs represent environmental best practice for piggeries with a capacity of ~5,000 SPU or more in conventional sheds when site power demand may be high enough to make the technology economically viable. While Windridge Farms Pty Ltd plans to use the CAL for power generation at this site in the future, this is not part of this proposal.

In sizing an anaerobic pond there is a need to provide treatment capacity but also space to store the less digestible matter that is a by-product of the digestion process and accumulates as sludge on the floor of the pond. The volatile solids (VS) and total solids (TS) loads in the effluent stream are used to size the active volume and sludge storage volume, respectively.

The required treatment pond volume depends on the pond activity ratio and the pond design criteria (in this case, CAL). The activity of the microorganisms in an anaerobic pond depends on temperature. In the PigBal 4 model, it is possible to select a pond activity ratio by location or to manually input same. For Young, the pond activity ratio is 0.66. From PigBal 4, the recommended baseline VS loading rate for a CAL is 300 g VS/m³/day. Hence, the adjusted VS loading rate for the CAL at this site is 198 g VS/m³/day (i.e. 300 g VS/m³/day X 0.66). From Table 7, the volatile solids load to the anaerobic pond is 3,254 kg VS/d. Hence, the required treatment volume is 16,435 m³. A pond also needs sufficient hydraulic retention time (HRT) to ensure effective anaerobic digestion and biogas production, typically a minimum of 40 days. From Pigbal 4 modelling, the inflow of effluent into the anaerobic pond is estimated at 73,000 L/d. The required treatment volume provides for a hydraulic retention time of 225 days in the CAL, which greatly exceeds the recommended minimum. The minimum active pond

volume based on HRT is 2,920 m³. Consequently, the pond will need an active treatment volume of at least 16,435 m³ (16.435 ML).

The required sludge storage volume depends on the sludge management. From Table 7, it is expected that some 3,875 kg/d or 1,414 t/yr of total solids will enter the CAL. Using the PigBal 4 sludge accumulation factor of 0.00137 m³/kg TS (ASABE Standards, 2011), the annual sludge accumulation rate is 1,938 m³/yr. As they do at other farms, Koorani Farms propose to extract sludge from the CAL on an ongoing basis so that sludge accumulation in the pond will be minimal. This avoids future problems with desludging ponds. The sludge will be transferred to the SEPs for drying. Allowing for two years' sludge storage capacity, the CAL sludge storage volume is 3,876 m³ (3.876 ML).

Consequently the recommended CAL capacity is at least 20,311 m³ or 20.3 ML (16.435 ML + 3.876 ML). The proposed CAL will have a capacity of 28.25 ML. Hence, it has generous capacity.

Arete Survey Solutions were instructed by Koorani Farms to draw up plans for a new CAL. Figure 8 and Figure 9 show the details. The CAL is 110 m X 45 m at crest and 8.5 m deep with 1:1 H:V internal batters. Assuming 0.5 m of freeboard, this gives an operating capacity of 28.25 ML. Further details are given in section 2.3.6.

Assuming treatment removes 70-90% of the 3,254 kg VS/d entering the pond system, some 325-976 kg VS/d will exit the pond, transferring to one of the three SEPs channels.

During CAL treatment, some nutrients will deposit as sludge and some will remain in the supernatant. In the absence of data specific to CALs, we have assumed that 23.5% of nitrogen, 90% of phosphorus and 5% of potassium of the nitrogen in the effluent will deposit to sludge with the balance staying in the liquid fraction (based on the work of McGahan et al (2010) on anaerobic ponds at pig farms). Table 10 shows the estimated partitioning of nutrients between liquid and sludge. (Note: as the CAL is covered, there will not be ammonia losses at this point. However, ammonia will be lost from the effluent in the SEPs channel).

Table 10 – Effluent Partitioning Between Liquid and Sludge in the CAL

Item	Initial mass	Liquid	Sludge
Nitrogen (kg/yr)	80,657	61,703	18,954
Phosphorus (kg/yr)	24,119	2,412	21,707
Potassium (kg/yr)	22,538	21,411	1,127



Figure 8 – Proposed CAL Plan View

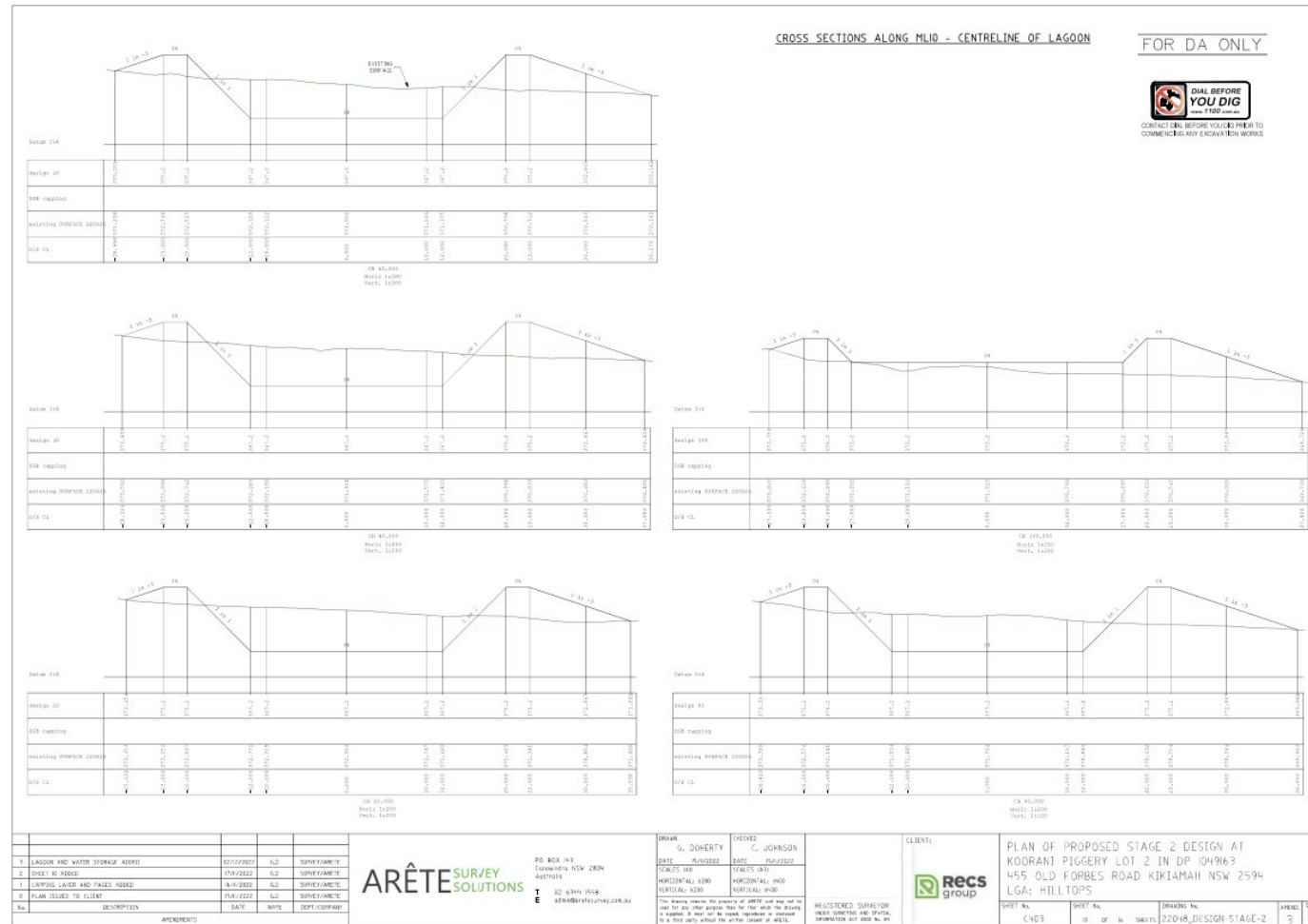


Figure 9 – Proposed CAL Cross Sections



SEPS and Recycle Dam

The SEPS will consist of three separate storage channels that drain independently to the recycle dam via a channel. The use of these will rotate. At any time, one storage channel will receive liquid effluent from the CAL via a pipeline. This channel will drain to the recycle dam from which effluent will be drawn for irrigation. The second storage channel will receive sludge that will be pumped regularly from the CAL. The third storage channel will be used for drying the sludge / SEPS solids; this channel will be cleaned out during the year so that it is ready to receive effluent in the next year. Two of these channels are currently in place and one needs to be constructed. Figure 10 shows the dimensions of the proposed SEPS channel. Table 11 shows the estimated dimensions of each channel.

Table 11 – Approximate Dimensions of SEPS Channels

Dimensions	Channel 1	Channel 2	Proposed Channel 3	Total
Inside crest length (m)	337	487	410	-
Inside crest width (m)	14	13	15	-
Inside crest area (m ²)	4,718	6,331	6,150	17,199
Top water level length (m)	335	485	408	-
Top water level width (m)	12	11	13	-
Top water level crest area (m ²)	4,020	5,335	5,304	14,659
Depth to top water level (m)	1.0	1.0	1.0	-
Freeboard (m)	0.5	0.5	0.5	-
Total depth (m)	1.5	1.5	1.5	-
Estimated usable volume (ML)	3.32	6.77	4.45	14.54

SEPS channels for primary treatment of effluent are typically designed to receive raw effluent, providing a minimum volume of 0.5 m³/SPU, a maximum VS loading rate of 1000 g VS/m³/day and typically have a hydraulic retention time (HRT) of 10-25 days (Tucker, RW, 2015). In this case, the SEPS will be receiving effluent that has already undergone primary treatment, with 70-90% of VS removed. Based on 0.5 m³/SPU for untreated effluent, a volume of 0.05-0.15 m³/SPU would provide adequate treatment capacity for effluent that has had 70-90% of VS removed. With ~17,916 SPU in conventional sheds, this equates to 896-2,687 m³ per channel. The VS loading rate method produces a different result. From Table 7, the VS load to the anaerobic pond is 2,375 kg VS/d. With 70-90% removal, some 325-976 kg VS/d would enter the channel. At a loading rate of 1,000 g VS/m³/day, a volume of 325-976 m³ would be required.

Calculation of the HRT is a function of the inflow volume (effluent and rainfall) and SEPS volume. The effluent inflow into the active SEPS channel is estimated to be 67,700 L/day (inflow to CAL 73,000 L/day less 5,300 L/day of solids accumulation that is ultimately diverted to a different channel). The estimated area of the SEPS is 14,659 m² (see Table 11) and a further 20,594 m² drains into them (see Figure 11). The annual rainfall is 595 mm while the decile 9 rainfall is 792.2 mm (see Table 30). Using the decile 9 data, the average daily rainfall is 2.17 mm. Hence, in a wet year, some 37,322 L/day would land directly in the SEPS. Assuming a runoff coefficient of 0.7 for the 18,054 m² of mostly grassed areas (35,253 m² less 17,199 m² of SEPS) between the channels, a further 27,424 L/day would enter the SEPS from these areas for a total of 64,746 L/day. (Note: these areas are used to store dried solids removed from the SEPS channels. These areas will be compacted for low permeability as part of the piggery development. However, because the solids stored on them will absorb significant rainfall and

compromise runoff, using a runoff coefficient for grass is considered reasonable). Hence, effluent plus decile 9 rainfall averages ~ 132,446 L/day. The smallest SEPS channel has a volume of 3.32 ML, so the HRT in a wet year is 25 days which is suitable. (Using average annual rainfall, it is 29 days).

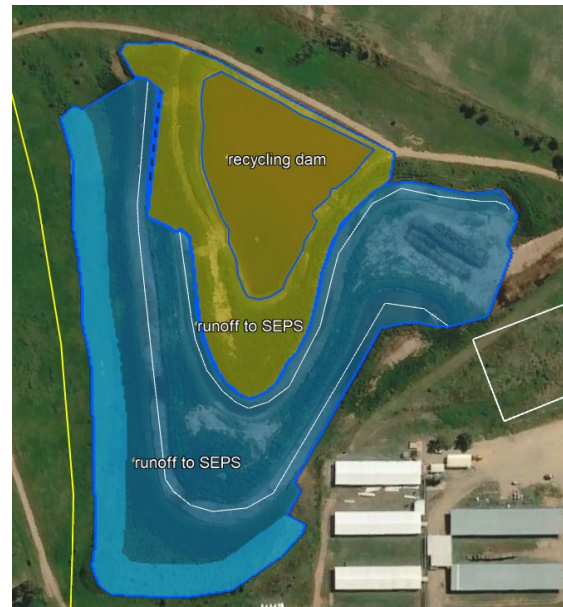


Figure 11 – Runoff Collection Area for SEPS and Recycling Dam

While in SEPs storage, some of the nitrogen will volatilise from the channel surface. In an uncovered anaerobic pond, total gaseous losses of nitrogen can range from 40% to over 90% for ponds, with higher rates expected for ponds with large surface areas in warm climates. The SEPs channels provide a large surface area but the climate is cool. Hence, a rate of 60% is considered a reasonable estimate of losses. With 61,703 kg N/yr in the supernatant ex-CAL, it is estimated that some 37,022 kg N/yr would be lost and 24,681 kg N/yr would remain.

It is intended that the sludge will be extracted regularly from the CAL and pumped into a dedicated SEPS channel. A number of permanent sludge extraction pipelines will be installed through the bank of the CAL, pointing downwards towards the base. Photograph 3 shows an example of pond desludging infrastructure. When sludge extraction is due, a suction pipe will be threaded through these portals and a pump used to draw out the sludge. This method of desludging has been selected as it allows for frequent sludge removal without pond dewatering, which maintains the function of the pond (O’Keefe, MF, McDonald, SA, Yan, MJ, Davis, RJ, Watts, PJ, McGahan, EJ and Tucker, RW, 2013).



Photograph 3 – Pond Desludging Infrastructure

Because they are used in rotation, each channel will need to be large enough to store a years' solids. From PigBal 4, annual sludge production is estimated at 1,938 m³. The channels are easily able to store this volume. The solids will be allowed to dry in the channel for up to 12 months. During this time, the crust will be mechanically broken as necessary to promote more rapid drying. This will be done by using a tractor to drag tyres through the SEPS solids. The solids will then be extracted from the channel and held in the area between the channels until it can be spread. As a condition of their current EPA POEO licence 11314, Windridge Farms Pty Ltd is required to sample and test the quality of SEPS solids (EPA identification point 11) at six monthly intervals for electrical conductivity (EC), nitrate-nitrogen, pH and total phosphorus levels. Table 12 shows a recent analysis result. It should be noted that this is for solids removed prior to pond treatment. Hence, the composition may be different to that of the solids produced by the expanded piggery.

Table 12 – SEPS Solids Composition

Parameter	SEPS Stockpile (composted) 18/12/2019	SEPS Stockpile (composted) 24/5/2021
Total N (%)	2.24	1.9
Total P (%)	5.65	4.92
Total K (%)	2.08	0.922
Total Na (%)	1.3	0.338
pH (1:5 water)	6.61	6.51
EC (uS/m)	9500	2580
TOC (%)	20.0	20.8
MC (%)	28.9	39.6
C:N	8.93	10.95

Liquid that drains from the effluent SEPS channel will be stored in the recycle dam (triangular dam shown on Figure 11 and Figure 10). This dam has an estimated capacity of 13.2 ML. It has an irregular shape but some approximate dimensions are shown below:

- Surface area at crest 8,130 m²
- Surface area at top water level 7,600 m²
- Total depth 2.5 m
- Freeboard 0.5 m
- Estimated usable volume 13.2 ML
- Additional surface area draining into pond 10,070 m²

Treated effluent will be drawn from the recycle dam for use as shed flushing water. This reduces both the volume of clean water used and the volume of effluent for irrigation. Further details are provided in section 2.3.3 and 2.3.6.

Recent analysis results for effluent sampled from the recycle dam are presented in Table 13.

Table 13 – Recycle Dam Effluent Quality

Parameter	16 Nov 2021	30 Mar 2022	29 Dec 2022
EC (dS/m)	14	13	6.9
Nitrate-N (mg/L)	<5	-	-
Nitrate + Nitrite N (mg/L)	-	0.09	-
pH	8.0	7.8	7.8
Phosphate P (mg/L)	36	43	36
Total N (mg/L)	84	320.09	550
TKN (mg/L)	84	320	-
Calcium (mg/L)	63	55	110
Magnesium (mg/L)	25	39	41
Potassium (mg/L)	-	-	790
Sodium (mg/L)	890	1,100	620
SAR	24	27	13

Water balance

The Australian Pork Limited Watbal model was used to evaluate the water holding capacity of the pond system. Watbal is only able to handle a two pond system. Since the CAL is covered, no rainfall lands on it and there is no evaporation from it. It was therefore assumed that the three SEPS channels form a single primary pond and the recycle dam a secondary pond.

The model was set up to use climate data for Young Post Office for 1900 to present. The soil selected was an average sandy loam (PAWC 80). The crop type was set to Winter reduced till.

The pond catchment areas were set as:

- 3,820 m² of hard catchment being the spent bedding and mortalities area;
- 310 m² of earth catchment being the bare earth visible between the SEPS channels; and
- 24,000 m² of the currently grassed area being the remainder of the area. It is proposed that the base of this area will be compacted to provide for further drying and storage of dried SEPS

solids removed from the SEPS (see section 2.2.3). However, it is expected that significant quantities of this material will be stored at any time and that this will adsorb some rainfall thereby substantially influencing runoff volumes. Hence, it is considered that using grass as the catchment type is fair.

The pigs on a flushing system was set to 17,916 SPU.

The hosing water use was set to 20,000 L/day. No flushing water was added as only recycled water is used (i.e. water that is pumped out goes straight back in).

Effluent total solids was set to 800 kg/day and volatile solids to 500 kg/day (the model only provides for 100 kg increments).

The closest pond design philosophy for the SEPS was heavily loaded anaerobic pond. A desludging interval of 1 year was used to match what happens in practice. The recycle pond was set up as a storage pond. The pond dimensions used in the model are shown in Figure 12.

The effluent irrigation was set up to use low pressure travelling spray irrigators to apply effluent to 50 ha of land. In practice, an area of ~200 ha will be required but 50 ha was a practical area to use at one time. Having a larger area to irrigate could increase the amount of irrigation and further reduce the pond spill frequency. The existing travelling irrigator is able to cover 200 ha. The pump capacity was assumed to be 1 ML/day. Irrigation would be cancelled if there is 5 mm of rain and triggered at a soil moisture deficit of 10 mm.

A summary of the model water balance pond results is shown in Figure 12. Inputs results are provided in Appendix E. Spills are predicted to occur less than once every ten years with an average annual spill volume of 229 m³. Given the large area that generates runoff into the system, any spills would be relatively dilute.

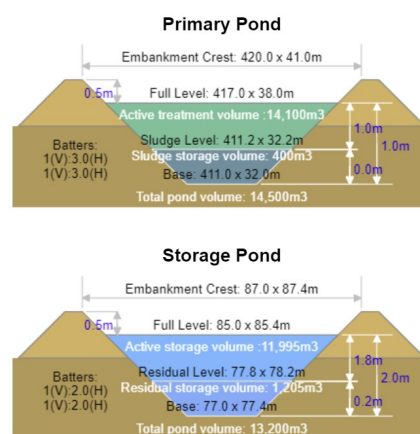
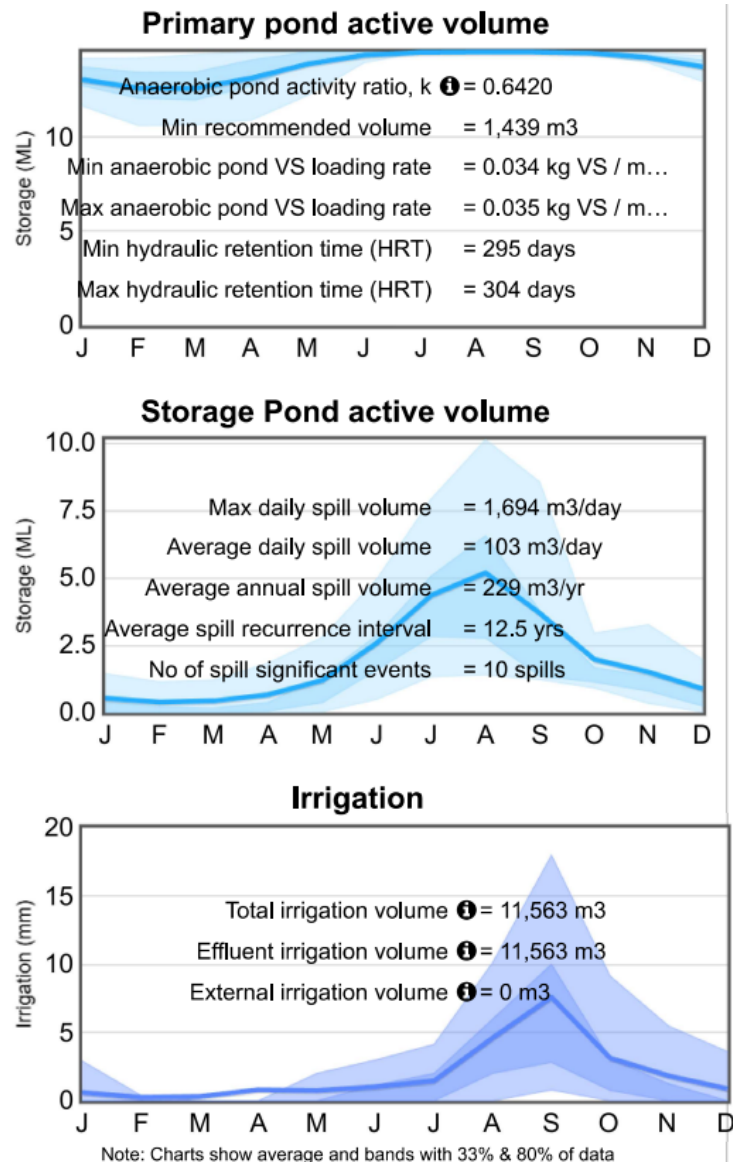


Figure 12 – Watbal Model Pond Dimensions



Storage Pond Water balance

Output	m ³ /yr
Inflow from Primary Pond	12,178
Inflow from Pond Rainfall	4,969
Outflow from Recycling	24
Outflow from Irrigation	11,563
Outflow from Pond Evaporation	5,461
Outflow from Overtopping	229

Figure 13 – Watbal Model Results

The pond system must also be large enough to store the 1 in 20 year, 24 hour storm. From Table 31, this event would produce 3.38 mm/hr of 81.12 mm of rain. Table 14 shows the inflows of effluent, rainfall and runoff that would be expected in a 1 in 20 year, 24 hour storm. The total inflow is 3,485 m³. The estimated capacity of the recycling dam is 13.2 ML. Assuming the dam is less than one-third full at the beginning of the rainfall event, the recycling dam could contain a rainfall event of this size.

Table 14 – 1 in 20 Year, 24 Hour Storm Inflows to Pond System

Item	Amount
Effluent (m ³)	68
Crest surface area of SEPS (m ²)	17,199
Rainfall inflow (m ³)	1,395
Crest area of recycle dam (m ²)	8,130
Inflow (m ³)	659
Compost / mortalities pad (hard catchment) (m ²)	3,815
Pad runoff coefficient*	0.95
Inflow (m ³)	294
Other catchment (m ²)	20,594
Runoff coefficient#	0.7
Inflow (m ³)	1,169
Total inflow (m ³)	3,585

* From the Engineers Australia publication “Project 13 Stage 3: Urban Rational Method Review” Goyen et al. (2014), an impervious clay is likely to yield a runoff coefficient of 0.9-0.95. For the purpose of this assessment, a value of 0.95 will be used for the pad area.

although much of the remaining catchment area will be compacted clay, it will hold significant quantities of drying SEPS solids. This stored material will retain water, reducing runoff volumes. Consequently, a coefficient of 0.7 is used.

Aging of Spent Bedding

Spent bedding for reuse on-farm or on other properties managed by Windridge Farms Pty Ltd will be aged in one of six dedicated areas shown on Figure 14, although some spent bedding for use by other nearby farmers may leave the property without first being aged. Photograph 4 shows a photo of one of the spent bedding aging areas. The purpose of aging is to stabilise the material, reduce the pathogen load through heat generated within the piles and to store the material until spreading fits in with other farm activities.

The spent bedding storage areas will be designed generally in accordance with the environmental guidelines for “Composting and Related Organics Processing Facilities” (Department of Environment and Conservation (NSW), 2004). The permeability of the base of the storage areas is unknown. The bases will therefore be compacted to achieve a permeability of 1×10^{-9} m/s for a depth of at least 300 mm and with a slope of 1% from one end to another. The finished surfaces will be durable all-weather surfaces that prevent leaching to groundwater. Currently the only spent bedding storage area within a controlled drainage area is the one adjacent to the SEPS; the runoff from this area drains to the

recycling dam. It is proposed that banks at least 300 mm high will be installed around each of the other spent bedding storage areas to exclude the entry of extraneous stormwater runoff and contain contaminated leachate. Stormwater landing within the area will be confined by the bund at the lower end of the slope until it evaporates. Table 15 shows the approximate dimensions of each of the storage pads.

Table 15 – Dimensions of Spent Bedding Storage Pads

Spent bedding storage pad	Dimensions	Windrow configuration
SEPS	80 m X 40 m	Five X 72 m x 4 m
North west of piggery	140 m X 22 m	Three 132 m X 4 m
South west of piggery	30 m X 30 m	Three 22 m X 4 m
South south west of piggery	45 m X 40 m	Five X 37 m X 4 m
South of piggery	40 m X 38 m	Five X 30 m X 4 m
East of piggery	45 m X 35 m	Four X 37 m X 4 m

Three of the spent bedding storage pads are located relatively close to the closest house to the piggery which is shown on Figure 14. To minimise the risk of odour nuisance from these pads, spent bedding will only be moved to these areas in the two weeks immediately prior to spreading. They will not be used for long-term storage of spent bedding.



Figure 14 – Spent Bedding Storage Pads



Photograph 4 – Spent Bedding Storage Pad

Aging Process

The material will be formed into windrows for aging. There will be no routine turning of the material, which will minimise odour and dust releases. From

Table 9, there will be about 2,793 t/year of spent bedding (wet mass) with a volume of ~4,655 m³. This will consist of 1,686 t/yr of TS and 1,107 t/yr of water.

Depending on the length of aging, some VS and moisture will be lost during storage. According to the Piggery Manure and Effluent Management and Reuse Guidelines (Tucker, 2015), loss of 50-60% of the initial volume could be expected during storage. Assuming a loss of 60% of VS (854 t) and moisture (554 t), if all the material were aged there would be some 1,385 t of material remaining or ~50% of the initial mass. Assuming a bulk density of 0.6 t/m³, the finished volume will be about 2,308 m³/yr. If 40% of nitrogen is lost by volatilisation, some 25.4 t would remain. Table 16 provides a summary.

Table 16 – Quantity and Composition of Aged Spent Bedding

Item	Mass
Total solids (t/yr)	832
Volatile solids (t/yr)	570
Nitrogen (t/yr)	25.4
Phosphorus (t/yr)	17.2
Potassium (t/yr)	17.8

As a condition of the EPA POEO licence 11314, Windridge Farms Pty Ltd is currently required to sample and test the quality of spent bedding (EPA identification point 10) at six monthly intervals for electrical conductivity (EC), nitrate-nitrogen, pH and total phosphorus levels. Examples of results are presented in Table 17.

Table 17 – Spent Bedding Analysis Results

Parameter	Spent Bedding Stockpile 18/12/2019	Spent Bedding Stockpile 14/5/2021
Total N (%)	10.4	3.89
Total P (%)	1.5	1.63
Total K (%)	2.01	1.14
Total Na (%)	0.577	0.303
pH (1:5 water)	6.17	5.76
EC (uS/m)	8200	3960
TOC (%)	5.19	29.4
MC (%)	54.8	18.2
C:N	0.5	7.56

The area required for spent bedding storage depends on the storage time, the quantities of raw materials but also the windrow configuration. On average, spent bedding will be aged for about six

months. Hence, there will be 1,397 t / 2,328 m³ of material incoming and 693 t / 1,154 m³ outgoing every six months. The loss of organic matter and moisture is expected to happen mostly in the first six weeks of storage. Hence, space for 1,448 m³ (i.e. (25% X 2,328 m³)+(75% X 1,154 m³)) will be required. If this material is stored in windrows with a triangular cross section that are 4 m wide at the base and 2 m high, ~362 m of windrow length would be needed, or 12 X 30 m windrows. Some 4 m of manoeuvring space will be provided alongside and around the ends of each windrow.

In addition, space will be required for mortalities composting which will occur in the storage immediately to the north of the sheds. As Table 5 shows, there will be approximately 61 t/yr of mortalities to manage. As the highest-risk material, the mortalities will go at the bottom of the pad. As a guide, 4 m³ of storage space is needed per tonne of mortalities annually, or about 244 m³.

Mortalities Management

Composting Facility

As per current practice, mortalities will be composted with spent bedding in piles within the curved area above the SEPS with all runoff going back into the SEPS system and ultimately the recycling dam. Composting is recognised in the AUSVETPLAN Disposal Manual (Animal Health Australia, 2021) as a proven method for the disposal of pig mortalities. Composting in a controlled drainage area is the most environmentally-friendly method for mortalities disposal. It poses a very low risk of groundwater or surface water contamination. Composting uses micro-organisms to break-down organic matter to form a humus-like substance. Spent bedding will provide the carbon and cover material for the process. Providing sufficient cover material is used, composting is a low odour, aerobic process and it yields a valuable soil amendment.

Composting Method

The following procedure will be used for composting mortalities as it has been proven to produce low odour levels while effectively breaking-down the carcasses:

- place at least 0.3 m of spent bedding over the base of the area to be used
- cover each carcass with at least 0.5 m of spent bedding before placing the next carcass. (Stack up to two carcasses high with good coverage between and around each carcass)
- ensure the carcasses are always well covered. Good coverage promotes composting by adding a carbon source, and is essential for controlling odours and in vermin control
- active composting will typically occur over a three to four-month period. Aging for at least two months will follow.

Compost produced from mortalities will be spread on land on-farm. This typically occurs only once a year. From the Piggery Manure and Effluent Management and Reuse Guidelines (Tucker, 2015), mortalities compost typically contains 1.5% nitrogen, 0.5% phosphorus and 0.3% potassium. Assuming 6 m³ (or ~3.6 t) of spent bedding is used to compost each tonne of mortalities, there will initially be ~708 t/yr (154 t + 554 t of spent bedding) or 770 m³ of material to manage (154 m³ of mortalities (assuming 1 m³/t) + 616 m³ of spent bedding). If the combined mortalities plus spent bedding have an initial moisture content of 50%, the dry matter content is 354 t. If there is a 50% loss of material during the composting process (remaining total solids of 177 t) and the product has a moisture content of 30%, the finished mass will be about 253 t/yr. This could contain about 3,795 kg of nitrogen, 1,265 kg of phosphorus and 759 kg of potassium.

Mass Mortalities

In the event of mass mortalities, Windridge Farms Pty Ltd will act under the direction of the Chief Veterinary Officer and EPA with regard to disposal method, with the AUSVET Disposal manual (Animal Health Australia, 2021) informing the decision. If composting is a suitable disposal method, the bodies could be windrow-composted at one of the manure storage areas. A contingency site for mass burials has also been identified. These will be buried within the fenced tree line between the Burr and South Tank paddocks (see Figure 2 for location). This site is suitable as it is readily accessible but well separated from waterways, houses, public roads and the piggery.

Reuse

The products for reuse are:

- effluent
- SEPS solids
- spent bedding
- mortalities compost.

Designated Reuse Areas

As per current practice, most of the farm will be designated for reuse with the exception of environmental buffers. The priority is for reuse of all liquid effluent and mortalities compost on-farm, with limited spent bedding spreading on-farm. In the future, the SEPS solids and most of the spent bedding will be spread off-site on other Windridge Farms land. Some spent bedding may be provided to other nearby farmers.

The “Effluent Management Guidelines for Intensive Piggeries” (ARMCANZ and ANZECC, 1991) identify that land for effluent reuse should have the following properties:

- structure allows for air and water movement;
- sufficient depth for root penetration;
- adequate drainage;
- sufficient capacity to hold water
- nutrients are available in sufficient quantities to provide for optimal plant growth;
- moderate pH; and
- ease of cultivation.

The land and soils of the farm are generally suitable for the purpose (refer to section 3.3.3 for details).

Environmental Buffers

It is necessary to provide environmental buffers to protect environmentally sensitive natural resources and land uses. The National Environmental Guidelines for Indoor Piggeries (Tucker, 2018) recommend minimum buffers to provide between manure reuse areas and sensitive features as an adjunct to good management. Buffers for reuse of effluent (but not manure) are also provided in the environmental guidelines: “Use of Effluent by Irrigation” (Department of Environment and Conservation (NSW), 2004). The buffers from both these guidelines are summarised in Table 18.

Table 18 – Buffers for Reuse Areas in Relevant Guidelines

Sensitive Use	National Environmental Guidelines for Indoor Piggeries		Use of Effluent by Irrigation		EPA Licence
	Manure products (e.g. separated solids, SEPS solids or spent bedding) that remain on the soil surface for more than 48 hrs without being ploughed in	Spent bedding and manure products that are incorporated into the soil within 48 hours of spreading	Low strength effluent*	High strength effluent*	Effluent
Major water supply storage	800 m	800 m	800 m	800 m	-
Cudgell Creek	-	-	-	-	200 m
Waterway	50 m	25 m	-	-	100 m
Natural waterbody e.g. river or lake	-	-	50 m	80 m	-
Other waters e.g. artificial waters with beneficial uses, small streams, intermittent streams, water distribution and drainage channels and farm dams	-	-	Site-specific	Site-specific	-
Domestic well used for household water supply	-	-	Site-specific	250 m	-
Town water supply bores	-	-	Site-specific	1000 m	-
Where spray irrigation gives rise to aerosols near houses, schools, playing fields, roads, public open space and waterbodies	-	-	50 m	50 m	-
Other sensitive areas (e.g. waters in drinking water catchments, aquatic ecosystems with high conservation value, wetlands, native stands of vegetation)	-	-	Site-specific	250 m	-
Property boundary	-	-	-	-	75 m

* applies to effluent irrigation, not manure or compost

There are no major water supply storages (within 800 m), town water supply bores or rivers within 1,000 m of the reuse areas and there are no receptor houses within 50 m. Nearby is Cudgell Creek (see section 3.2.4, Figure 33 and Figure 39), other waterways, some farm dams, bores for stock and domestic purposes (see Figure 39), vulnerable vegetation along Cudgell Creek (see Figure 27 and Figure 47) and Old Forbes Road (northern boundary). For each reuse product, the buffers that will be used are shown in Table 19.

Table 19 – Proposed Reuse Area Buffers

	Effluent / mortalities compost	Spent Bedding and SEPS Solids
Cudgell Creek	80 m	25 m
Waterways	50 m	25 m
Farm dams	50 m	10 m
Stock bores	50 m	25 m
Old Forbes Road	75 m	10 m
Property boundary	75 m	10 m
Other sensitive areas: sensitive native vegetation	80 m	25 m
Neighbouring house	250 m	250 m

The buffers for effluent are mostly in accordance with the recommendations for “high strength” effluent. While the effluent will be “high strength”, it will be spray irrigated using low-pressure travelling irrigators and this will minimise aerosol production and spread. The risk will be further reduced by avoiding irrigation on windy days or when significant rain is expected. Hence, an 80 m buffer to Cudgell Creek is proposed. This is shorter than the buffer on the current EPA licence, but consistent with high strength effluent in “Use of Effluent by Irrigation”. It is noted that there is sensitive vegetation along Cudgell Creek and that the proposed buffer is shorter than the 250 m buffer in “Use of Effluent by Irrigation”. We consider the likelihood of effluent or effluent nutrients moving 80 m to be virtually nil under the proposed management regime. Hence, leniency in relation to this distance is requested. There are no functional wells or bores on-farm or close by that are used for domestic purposes, although a 50 m buffer to the bores used for stock water is proposed.

The proponents would like to be able to irrigate effluent onto the whole farm (excluding buffers), but particularly the paddocks closest to the piggery such as Coddingtons, North Tank, Long, Bywong House, Bywong Front, Koorani House and Hayshed. These paddocks also provide good buffers to waterways and sensitive vegetation (see Figure 15 and Figure 43 for paddock locations). However, a total of 421.8 ha can be used for effluent and mortalities compost, providing for management flexibility

Mortalities compost will likely be spread on cropped (rather than grazed) paddocks further from the piggery complex for biosecurity reasons. It will be applied with a manure spreader that drops material low to the ground, ensuring it is spread evenly over the target area. The mortalities compost will be incorporated into the soil within 48 hours of spreading to reduce the likelihood of nutrient movement to sensitive areas. Because mortalities compost may pose different risks to spent bedding, the effluent irrigation buffers will be used for mortalities compost.

Figure 15 shows the areas available for effluent and mortalities compost reuse.

The proponents would also like to be able to spread spent bedding over the whole farm (excluding buffers) although this will be limited by the need to allocate land for effluent and mortalities compost reuse first. They will also spread spent bedding on other land they manage and may also sell some spent bedding to nearby land owners. Spent bedding would be applied with a manure spreader that

drops material low to the ground, ensuring it is spread evenly over the target area. It is proposed that spent bedding would be incorporated into the soil within 48 hours of spreading to reduce the likelihood of nutrient movement to sensitive areas. Consequently, the risks of nutrient export and odour nuisance are lower than for other by-products and less stringent buffers are appropriate. The 25 m buffer to a waterway matches the recommendation for incorporated spent bedding and manure solids in the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018). The 25 m buffer to a bore is appropriate as this material is most unlikely to enter bore casing which would usually have a pump or cap attached. The Young Shire DCP specifies a minimum buffer of 250 m between reuse areas and a house. A 10 m buffer to Old Forbes Road and other property boundaries will protect against inadvertent off-farm movement of material. Figure 16 shows the areas available for spent bedding reuse.

The proponents maintain open and good communication with neighbours in relation to spreading. If neighbours report odour from manure spreading near houses, the activity ceases until weather conditions improve or spreading occurs at a more suitable time of day when nuisance would not be expected to occur.

SEPS solids and some of the spent bedding will be used on other land managed by Windridge Farms Pty Ltd, with surplus spent bedding also offered to nearby farmers for use in their farming systems. Any recipients of SEPS solids or spent bedding will be made aware of the need to respect the buffers proposed in Table 19.

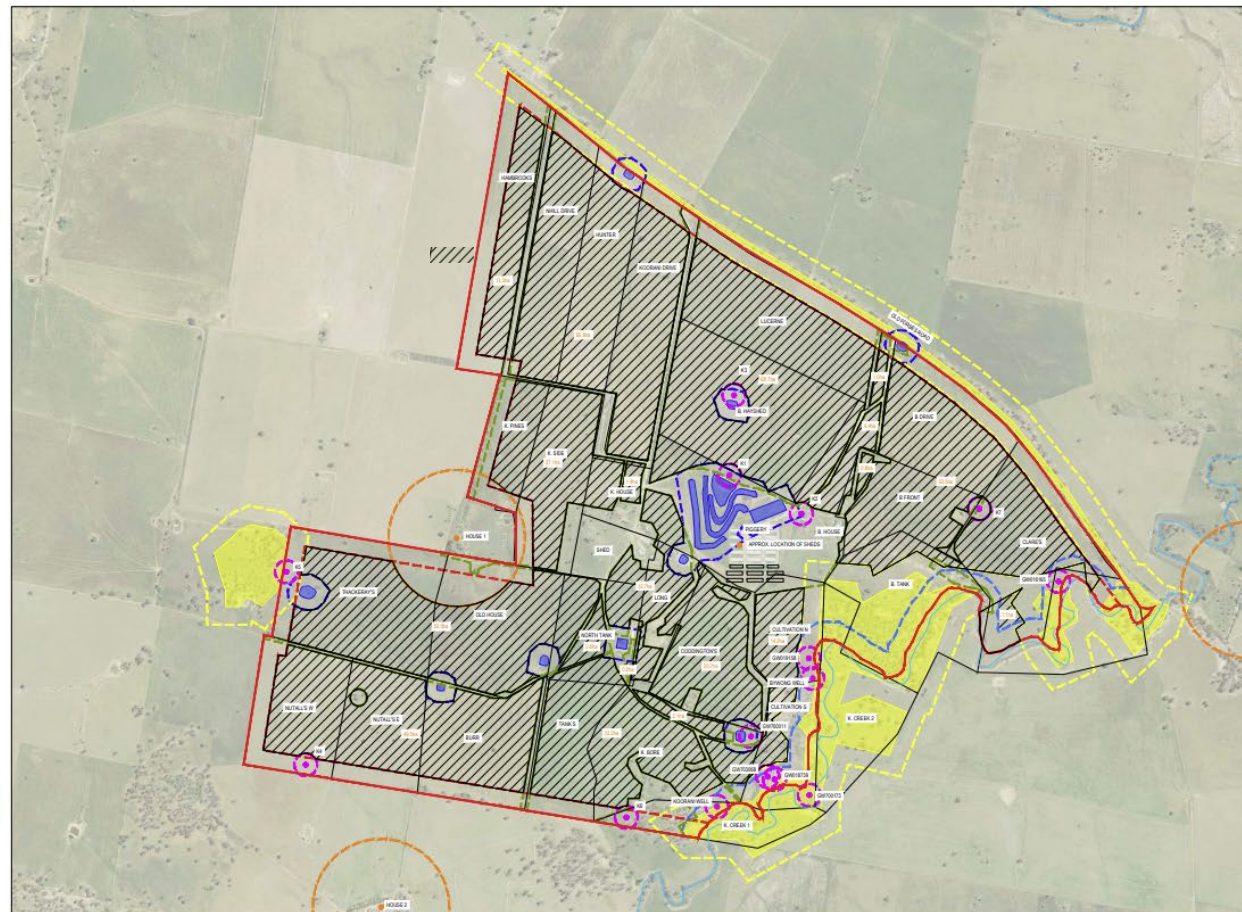
Effluent, SEPS Solids, Spent Bedding and Mortalities Compost Reuse Rates

Effluent, SEPS solids, spent bedding and mortalities compost reuse rates can be considered sustainable if the nutrients added are removed by harvesting crops grown on the land with adjustments to account for gaseous losses of nitrogen, soil nutrient deficiencies or surpluses and acceptable soil storage (of phosphorus). Section 3.3.3 provides soil test results for the property. The soils have good fertility, mostly with ideal levels of available nitrogen, optimal to high levels of available phosphorus and relatively high available potassium levels. The phosphorus buffer index (PBI) was very, very low to low indicating very limited capacity for the soil to hold phosphorus. The land is suitable for reuse, but nutrient addition rates should not exceed harvest or grazing removal rates over the course of a land use rotation.

The farm is used mostly for mixed farming with the rotation typically consisting of five years of cropping (wheat and canola in rotation) and then five years of pasture (typically lucerne and clover) that is grazed by fat lambs. It is also expected that ~50 ha/yr of lucerne-clover silage will be grown in the future. Consultation with David Crowley of Delta Ag (pers comm 22nd October 2020) identified the following typical yields:

- wheat av. 3.5 t/ha (range 3-5 t/ha) with straw also harvested (yield 5 t/ha)
- canola av. 1.75 t/ha (range 1.5-2.5 t/ha)
- lucerne and clover cut for silage av. 7 t/ha (range 6-8 t/ha)

Note that the grain yields over the past three years have been 4.5 t/ha for wheat and 2 t/ha for canola so the calculations based on the typical yields from David Crowley are likely conservative.



EFFLUENT / MORTALITIES PLAN
SCALE 1:10000
0 200 400m
SCALE 1:10000 @A1

LEGEND

- SITE BOUNDARY
- WATER COURSE
- 10M BUFFER ZONE (10M)
- 20M BUFFER ZONE (20M)
- 30M BUFFER ZONE (30M)
- 40M BUFFER ZONE (40M)
- 50M BUFFER ZONE (50M)
- 60M BUFFER ZONE (60M)
- 70M BUFFER ZONE (70M)
- 80M BUFFER ZONE (80M)
- 90M BUFFER ZONE (90M)
- 100M BUFFER ZONE (100M)
- 120M BUFFER ZONE (120M)
- 140M BUFFER ZONE (140M)
- 160M BUFFER ZONE (160M)
- 180M BUFFER ZONE (180M)
- 200M BUFFER ZONE (200M)
- 220M BUFFER ZONE (220M)
- 240M BUFFER ZONE (240M)
- 260M BUFFER ZONE (260M)
- 280M BUFFER ZONE (280M)
- 300M BUFFER ZONE (300M)
- 320M BUFFER ZONE (320M)
- 340M BUFFER ZONE (340M)
- 360M BUFFER ZONE (360M)
- 380M BUFFER ZONE (380M)
- 400M BUFFER ZONE (400M)
- 420M BUFFER ZONE (420M)
- 440M BUFFER ZONE (440M)
- 460M BUFFER ZONE (460M)
- 480M BUFFER ZONE (480M)
- 500M BUFFER ZONE (500M)
- 520M BUFFER ZONE (520M)
- 540M BUFFER ZONE (540M)
- 560M BUFFER ZONE (560M)
- 580M BUFFER ZONE (580M)
- 600M BUFFER ZONE (600M)
- 620M BUFFER ZONE (620M)
- 640M BUFFER ZONE (640M)
- 660M BUFFER ZONE (660M)
- 680M BUFFER ZONE (680M)
- 700M BUFFER ZONE (700M)
- 720M BUFFER ZONE (720M)
- 740M BUFFER ZONE (740M)
- 760M BUFFER ZONE (760M)
- 780M BUFFER ZONE (780M)
- 800M BUFFER ZONE (800M)
- 820M BUFFER ZONE (820M)
- 840M BUFFER ZONE (840M)
- 860M BUFFER ZONE (860M)
- 880M BUFFER ZONE (880M)
- 900M BUFFER ZONE (900M)
- 920M BUFFER ZONE (920M)
- 940M BUFFER ZONE (940M)
- 960M BUFFER ZONE (960M)
- 980M BUFFER ZONE (980M)
- 1000M BUFFER ZONE (1000M)
- 1020M BUFFER ZONE (1020M)
- 1040M BUFFER ZONE (1040M)
- 1060M BUFFER ZONE (1060M)
- 1080M BUFFER ZONE (1080M)
- 1100M BUFFER ZONE (1100M)
- 1120M BUFFER ZONE (1120M)
- 1140M BUFFER ZONE (1140M)
- 1160M BUFFER ZONE (1160M)
- 1180M BUFFER ZONE (1180M)
- 1200M BUFFER ZONE (1200M)
- 1220M BUFFER ZONE (1220M)
- 1240M BUFFER ZONE (1240M)
- 1260M BUFFER ZONE (1260M)
- 1280M BUFFER ZONE (1280M)
- 1300M BUFFER ZONE (1300M)
- 1320M BUFFER ZONE (1320M)
- 1340M BUFFER ZONE (1340M)
- 1360M BUFFER ZONE (1360M)
- 1380M BUFFER ZONE (1380M)
- 1400M BUFFER ZONE (1400M)
- 1420M BUFFER ZONE (1420M)
- 1440M BUFFER ZONE (1440M)
- 1460M BUFFER ZONE (1460M)
- 1480M BUFFER ZONE (1480M)
- 1500M BUFFER ZONE (1500M)
- 1520M BUFFER ZONE (1520M)
- 1540M BUFFER ZONE (1540M)
- 1560M BUFFER ZONE (1560M)
- 1580M BUFFER ZONE (1580M)
- 1600M BUFFER ZONE (1600M)
- 1620M BUFFER ZONE (1620M)
- 1640M BUFFER ZONE (1640M)
- 1660M BUFFER ZONE (1660M)
- 1680M BUFFER ZONE (1680M)
- 1700M BUFFER ZONE (1700M)
- 1720M BUFFER ZONE (1720M)
- 1740M BUFFER ZONE (1740M)
- 1760M BUFFER ZONE (1760M)
- 1780M BUFFER ZONE (1780M)
- 1800M BUFFER ZONE (1800M)
- 1820M BUFFER ZONE (1820M)
- 1840M BUFFER ZONE (1840M)
- 1860M BUFFER ZONE (1860M)
- 1880M BUFFER ZONE (1880M)
- 1900M BUFFER ZONE (1900M)
- 1920M BUFFER ZONE (1920M)
- 1940M BUFFER ZONE (1940M)
- 1960M BUFFER ZONE (1960M)
- 1980M BUFFER ZONE (1980M)
- 2000M BUFFER ZONE (2000M)
- 2020M BUFFER ZONE (2020M)
- 2040M BUFFER ZONE (2040M)
- 2060M BUFFER ZONE (2060M)
- 2080M BUFFER ZONE (2080M)
- 2100M BUFFER ZONE (2100M)
- 2120M BUFFER ZONE (2120M)
- 2140M BUFFER ZONE (2140M)
- 2160M BUFFER ZONE (2160M)
- 2180M BUFFER ZONE (2180M)
- 2200M BUFFER ZONE (2200M)
- 2220M BUFFER ZONE (2220M)
- 2240M BUFFER ZONE (2240M)
- 2260M BUFFER ZONE (2260M)
- 2280M BUFFER ZONE (2280M)
- 2300M BUFFER ZONE (2300M)
- 2320M BUFFER ZONE (2320M)
- 2340M BUFFER ZONE (2340M)
- 2360M BUFFER ZONE (2360M)
- 2380M BUFFER ZONE (2380M)
- 2400M BUFFER ZONE (2400M)
- 2420M BUFFER ZONE (2420M)
- 2440M BUFFER ZONE (2440M)
- 2460M BUFFER ZONE (2460M)
- 2480M BUFFER ZONE (2480M)
- 2500M BUFFER ZONE (2500M)
- 2520M BUFFER ZONE (2520M)
- 2540M BUFFER ZONE (2540M)
- 2560M BUFFER ZONE (2560M)
- 2580M BUFFER ZONE (2580M)
- 2600M BUFFER ZONE (2600M)
- 2620M BUFFER ZONE (2620M)
- 2640M BUFFER ZONE (2640M)
- 2660M BUFFER ZONE (2660M)
- 2680M BUFFER ZONE (2680M)
- 2700M BUFFER ZONE (2700M)
- 2720M BUFFER ZONE (2720M)
- 2740M BUFFER ZONE (2740M)
- 2760M BUFFER ZONE (2760M)
- 2780M BUFFER ZONE (2780M)
- 2800M BUFFER ZONE (2800M)
- 2820M BUFFER ZONE (2820M)
- 2840M BUFFER ZONE (2840M)
- 2860M BUFFER ZONE (2860M)
- 2880M BUFFER ZONE (2880M)
- 2900M BUFFER ZONE (2900M)
- 2920M BUFFER ZONE (2920M)
- 2940M BUFFER ZONE (2940M)
- 2960M BUFFER ZONE (2960M)
- 2980M BUFFER ZONE (2980M)
- 3000M BUFFER ZONE (3000M)
- 3020M BUFFER ZONE (3020M)
- 3040M BUFFER ZONE (3040M)
- 3060M BUFFER ZONE (3060M)
- 3080M BUFFER ZONE (3080M)
- 3100M BUFFER ZONE (3100M)
- 3120M BUFFER ZONE (3120M)
- 3140M BUFFER ZONE (3140M)
- 3160M BUFFER ZONE (3160M)
- 3180M BUFFER ZONE (3180M)
- 3200M BUFFER ZONE (3200M)
- 3220M BUFFER ZONE (3220M)
- 3240M BUFFER ZONE (3240M)
- 3260M BUFFER ZONE (3260M)
- 3280M BUFFER ZONE (3280M)
- 3300M BUFFER ZONE (3300M)
- 3320M BUFFER ZONE (3320M)
- 3340M BUFFER ZONE (3340M)
- 3360M BUFFER ZONE (3360M)
- 3380M BUFFER ZONE (3380M)
- 3400M BUFFER ZONE (3400M)
- 3420M BUFFER ZONE (3420M)
- 3440M BUFFER ZONE (3440M)
- 3460M BUFFER ZONE (3460M)
- 3480M BUFFER ZONE (3480M)
- 3500M BUFFER ZONE (3500M)
- 3520M BUFFER ZONE (3520M)
- 3540M BUFFER ZONE (3540M)
- 3560M BUFFER ZONE (3560M)
- 3580M BUFFER ZONE (3580M)
- 3600M BUFFER ZONE (3600M)
- 3620M BUFFER ZONE (3620M)
- 3640M BUFFER ZONE (3640M)
- 3660M BUFFER ZONE (3660M)
- 3680M BUFFER ZONE (3680M)
- 3700M BUFFER ZONE (3700M)
- 3720M BUFFER ZONE (3720M)
- 3740M BUFFER ZONE (3740M)
- 3760M BUFFER ZONE (3760M)
- 3780M BUFFER ZONE (3780M)
- 3800M BUFFER ZONE (3800M)
- 3820M BUFFER ZONE (3820M)
- 3840M BUFFER ZONE (3840M)
- 3860M BUFFER ZONE (3860M)
- 3880M BUFFER ZONE (3880M)
- 3900M BUFFER ZONE (3900M)
- 3920M BUFFER ZONE (3920M)
- 3940M BUFFER ZONE (3940M)
- 3960M BUFFER ZONE (3960M)
- 3980M BUFFER ZONE (3980M)
- 4000M BUFFER ZONE (4000M)
- 4020M BUFFER ZONE (4020M)
- 4040M BUFFER ZONE (4040M)
- 4060M BUFFER ZONE (4060M)
- 4080M BUFFER ZONE (4080M)
- 4100M BUFFER ZONE (4100M)
- 4120M BUFFER ZONE (4120M)
- 4140M BUFFER ZONE (4140M)
- 4160M BUFFER ZONE (4160M)
- 4180M BUFFER ZONE (4180M)
- 4200M BUFFER ZONE (4200M)
- 4220M BUFFER ZONE (4220M)
- 4240M BUFFER ZONE (4240M)
- 4260M BUFFER ZONE (4260M)
- 4280M BUFFER ZONE (4280M)
- 4300M BUFFER ZONE (4300M)
- 4320M BUFFER ZONE (4320M)
- 4340M BUFFER ZONE (4340M)
- 4360M BUFFER ZONE (4360M)
- 4380M BUFFER ZONE (4380M)
- 4400M BUFFER ZONE (4400M)
- 4420M BUFFER ZONE (4420M)
- 4440M BUFFER ZONE (4440M)
- 4460M BUFFER ZONE (4460M)
- 4480M BUFFER ZONE (4480M)
- 4500M BUFFER ZONE (4500M)
- 4520M BUFFER ZONE (4520M)
- 4540M BUFFER ZONE (4540M)
- 4560M BUFFER ZONE (4560M)
- 4580M BUFFER ZONE (4580M)
- 4600M BUFFER ZONE (4600M)
- 4620M BUFFER ZONE (4620M)
- 4640M BUFFER ZONE (4640M)
- 4660M BUFFER ZONE (4660M)
- 4680M BUFFER ZONE (4680M)
- 4700M BUFFER ZONE (4700M)
- 4720M BUFFER ZONE (4720M)
- 4740M BUFFER ZONE (4740M)
- 4760M BUFFER ZONE (4760M)
- 4780M BUFFER ZONE (4780M)
- 4800M BUFFER ZONE (4800M)
- 4820M BUFFER ZONE (4820M)
- 4840M BUFFER ZONE (4840M)
- 4860M BUFFER ZONE (4860M)
- 4880M BUFFER ZONE (4880M)
- 4900M BUFFER ZONE (4900M)
- 4920M BUFFER ZONE (4920M)
- 4940M BUFFER ZONE (4940M)
- 4960M BUFFER ZONE (4960M)
- 4980M BUFFER ZONE (4980M)
- 5000M BUFFER ZONE (5000M)
- 5020M BUFFER ZONE (5020M)
- 5040M BUFFER ZONE (5040M)
- 5060M BUFFER ZONE (5060M)
- 5080M BUFFER ZONE (5080M)
- 5100M BUFFER ZONE (5100M)
- 5120M BUFFER ZONE (5120M)
- 5140M BUFFER ZONE (5140M)
- 5160M BUFFER ZONE (5160M)
- 5180M BUFFER ZONE (5180M)
- 5200M BUFFER ZONE (5200M)
- 5220M BUFFER ZONE (5220M)
- 5240M BUFFER ZONE (5240M)
- 5260M BUFFER ZONE (5260M)
- 5280M BUFFER ZONE (5280M)
- 5300M BUFFER ZONE (5300M)
- 5320M BUFFER ZONE (5320M)
- 5340M BUFFER ZONE (5340M)
- 5360M BUFFER ZONE (5360M)
- 5380M BUFFER ZONE (5380M)
- 5400M BUFFER ZONE (5400M)
- 5420M BUFFER ZONE (5420M)
- 5440M BUFFER ZONE (5440M)
- 5460M BUFFER ZONE (5460M)
- 5480M BUFFER ZONE (5480M)
- 5500M BUFFER ZONE (5500M)
- 5520M BUFFER ZONE (5520M)
- 5540M BUFFER ZONE (5540M)
- 5560M BUFFER ZONE (5560M)
- 5580M BUFFER ZONE (5580M)
- 5600M BUFFER ZONE (5600M)
- 5620M BUFFER ZONE (5620M)
- 5640M BUFFER ZONE (5640M)
- 5660M BUFFER ZONE (5660M)
- 5680M BUFFER ZONE (5680M)
- 5700M BUFFER ZONE (5700M)
- 5720M BUFFER ZONE (5720M)
- 5740M BUFFER ZONE (5740M)
- 5760M BUFFER ZONE (5760M)
- 5780M BUFFER ZONE (5780M)
- 5800M BUFFER ZONE (5800M)
- 5820M BUFFER ZONE (5820M)
- 5840M BUFFER ZONE (5840M)
- 5860M BUFFER ZONE (5860M)
- 5880M BUFFER ZONE (5880M)
- 5900M BUFFER ZONE (5900M)
- 5920M BUFFER ZONE (5920M)
- 5940M BUFFER ZONE (5940M)
- 5960M BUFFER ZONE (5960M)
- 5980M BUFFER ZONE (5980M)
- 6000M BUFFER ZONE (6000M)
- 6020M BUFFER ZONE (6020M)
- 6040M BUFFER ZONE (6040M)
- 6060M BUFFER ZONE (6060M)
- 6080M BUFFER ZONE (6080M)
- 6100M BUFFER ZONE (6100M)
- 6120M BUFFER ZONE (6120M)
- 6140M BUFFER ZONE (6140M)
- 6160M BUFFER ZONE (6160M)
- 6180M BUFFER ZONE (6180M)
- 6200M BUFFER ZONE (6200M)
- 6220M BUFFER ZONE (6220M)
- 6240M BUFFER ZONE (6240M)
- 6260M BUFFER ZONE (6260M)
- 6280M BUFFER ZONE (6280M)
- 6300M BUFFER ZONE (6300M)
- 6320M BUFFER ZONE (6320M)
- 6340M BUFFER ZONE (6340M)
- 6360M BUFFER ZONE (6360M)
- 6380M BUFFER ZONE (6380M)
- 6400M BUFFER ZONE (6400M)
- 6420M BUFFER ZONE (6420M)
- 6440M BUFFER ZONE (6440M)
- 6460M BUFFER ZONE (6460M)
- 6480M BUFFER ZONE (6480M)
- 6500M BUFFER ZONE (6500M)
- 6520M BUFFER ZONE (6520M)
- 6540M BUFFER ZONE (6540M)
- 6560M BUFFER ZONE (6560M)
- 6580M BUFFER ZONE (6580M)
- 6600M BUFFER ZONE (6600M)
- 6620M BUFFER ZONE (6620M)
- 6640M BUFFER ZONE (6640M)
- 6660M BUFFER ZONE (6660M)
- 6680M BUFFER ZONE (6680M)
- 6700M BUFFER ZONE (6700M)
- 6720M BUFFER ZONE (6720M)
- 6740M BUFFER ZONE (6740M)
- 6760M BUFFER ZONE (6760M)
- 6780M BUFFER ZONE (6780M)
- 6800M BUFFER ZONE (6800M)
- 6820M BUFFER ZONE (6820M)
- 6840M BUFFER ZONE (6840M)
- 6860M BUFFER ZONE (6860M)
- 6880M BUFFER ZONE (6880M)
- 6900M BUFFER ZONE (6900M)
- 6920M BUFFER ZONE (6920M)
- 6940M BUFFER ZONE (6940M)
- 6960M BUFFER ZONE (6960M)
- 6980M BUFFER ZONE (6980M)
- 7000M BUFFER ZONE (7000M)
- 7020M BUFFER ZONE (7020M)
- 7040M BUFFER ZONE (7040M)
- 7060M BUFFER ZONE (7060M)
- 7080M BUFFER ZONE (7080M)
- 7100M BUFFER ZONE (7100M)
- 7120M BUFFER ZONE (7120M)
- 7140M BUFFER ZONE (7140M)
- 7160M BUFFER ZONE (7160M)
- 7180M BUFFER ZONE (7180M)
- 7200M BUFFER ZONE (7200M)
- 7220M BUFFER ZONE (7220M)
- 7240M BUFFER ZONE (7240M)
- 7260M BUFFER ZONE (7260M)
- 7280M BUFFER ZONE (7280M)
- 7300M BUFFER ZONE (7300M)
- 7320M BUFFER ZONE (7320M)
- 7340M BUFFER ZONE (7340M)
- 7360M BUFFER ZONE (7360M)
- 7380M BUFFER ZONE (7380M)
- 7400M BUFFER ZONE (7400M)
- 7420M BUFFER ZONE (7420M)
- 7440M BUFFER ZONE (7440M)
- 7460M BUFFER ZONE (7460M)
- 7480M BUFFER ZONE (7480M)
- 7500M BUFFER ZONE (7500M)
- 7520M BUFFER ZONE (7520M)
- 7540M BUFFER ZONE (7540M)
- 7560M BUFFER ZONE (7560M)
- 7580M BUFFER ZONE (7580M)
- 7600M BUFFER ZONE (7600M)
- 7620M BUFFER ZONE (7620M)
- 7640M BUFFER ZONE (7640M)
- 7660M BUFFER ZONE (7660M)
- 7680M BUFFER ZONE (7680M)
- 7700M BUFFER ZONE (7700M)
- 7720M BUFFER ZONE (7720M)
- 7740M BUFFER ZONE (7740M)
- 7760M BUFFER ZONE (7760M)
- 7780M BUFFER ZONE (7780M)
- 7800M BUFFER ZONE (7800M)
- 7820M BUFFER ZONE (7820M)
- 7840M BUFFER ZONE (7840M)
- 7860M BUFFER ZONE (7860M)
- 7880M BUFFER ZONE (7880M)
- 7900M BUFFER ZONE (7900M)
- 7920M BUFFER ZONE (7920M)
- 7940M BUFFER ZONE (7940M)
- 7960M BUFFER ZONE (7960M)
- 7980M BUFFER ZONE (7980M)
- 8000M BUFFER ZONE (8000M)
- 8020M BUFFER ZONE (8020M)
- 8040M BUFFER ZONE (8040M)
- 8060M BUFFER ZONE (8060M)
- 8080M BUFFER ZONE (8080M)
- 8100M BUFFER ZONE (8100M)
- 8120M BUFFER ZONE (8120M)
- 8140M BUFFER ZONE (8140M)
- 8160M BUFFER ZONE (8160M)
- 8180M BUFFER ZONE (8180M)
- 8200M BUFFER ZONE (8200M)
- 8220M BUFFER ZONE (8220M)
- 8240M BUFFER ZONE (8240M)
- 8260M BUFFER ZONE (8260M)
- 8280M BUFFER ZONE (8280M)
- 8300M BUFFER ZONE (8300M)
- 8320M BUFFER ZONE (8320M)
- 8340M BUFFER ZONE (8340M)
- 8360M BUFFER ZONE (8360M)
- 8380M BUFFER ZONE (8380M)
- 8400M BUFFER ZONE (8400M)
- 8420M BUFFER ZONE (8420M)
- 8440M BUFFER ZONE (8440M)
- 8460M BUFFER ZONE (8460M)
- 8480M BUFFER ZONE (8480M)
- 8500M BUFFER ZONE (8500M)
- 8520M BUFFER ZONE (8520M)
- 8540M BUFFER ZONE (8540M)
- 8560M BUFFER ZONE (8560M)
- 8580M BUFFER ZONE (8580M)
- 8600M BUFFER ZONE (8600M)
- 8620M BUFFER ZONE (8620M)
- 8640M BUFFER ZONE (8640M)
- 8660M BUFFER ZONE (8660M)
- 8680M BUFFER ZONE (8680M)
- 8700M BUFFER ZONE (8700M)
- 8720M BUFFER ZONE (8720M)
- 8740M BUFFER ZONE (8740M)
- 8760M BUFFER ZONE (8760M)
- 8780M BUFFER ZONE (8780M)
- 8800M BUFFER ZONE (8800M)
- 8820M BUFFER ZONE (8820M)
- 8840M BUFFER ZONE (8840M)
- 8860M BUFFER ZONE (8860M)
- 8880M BUFFER ZONE (8880M)
- 8900M BUFFER ZONE (8900M)
- 8920M BUFFER ZONE (8920M)
- 8940M BUFFER ZONE (8940M)
- 8960M BUFFER ZONE (8960M)
- 8980M BUFFER ZONE (8980M)
- 9000M BUFFER ZONE (9000M)
- 9020M BUFFER ZONE (9020M)
- 9040M BUFFER ZONE (9040M)
- 9060M BUFFER ZONE (9060M)
- 9080M BUFFER ZONE (9080M)
- 9100M BUFFER ZONE (9100M)
- 9120M BUFFER ZONE (9120M)
- 9140M BUFFER ZONE (9140M)
- 9160M BUFFER ZONE (9160M)
- 9180M BUFFER ZONE (9180M)
- 9200M BUFFER ZONE (9200M)
- 9220M BUFFER ZONE (9220M)
- 9240M BUFFER ZONE (9240M)
- 9260M BUFFER ZONE (9260M)
- 9280M BUFFER ZONE (9280M)
- 9300M BUFFER ZONE (9300M)
- 9320M BUFFER ZONE (9320M)
- 9340M BUFFER ZONE (9340M)
- 9360M BUFFER ZONE (9360M)
- 9380M BUFFER ZONE (9380M)
- 9400M BUFFER ZONE (9400M)
- 9420M BUFFER ZONE (9420M)
- 9440M BUFFER ZONE (9440M)
- 9460M BUFFER ZONE (9460M)
- 9480M BUFFER ZONE (9480M)
- 9500M BUFFER ZONE (9500M)
- 9520M BUFFER ZONE (9520M)
- 9540M BUFFER ZONE (9540M)
- 9560M BUFFER ZONE (9560M)
- 9580M BUFFER ZONE (9580M)
- 9600M BUFFER ZONE (9600M)
- 9620M BUFFER ZONE (9620M)
- 9640M BUFFER ZONE (9640M)
- 9660M BUFFER ZONE (9660M)
- 9680M BUFFER ZONE (9680M)
- 9700M BUFFER ZONE (9700M)
- 9720M BUFFER ZONE (9720M)
- 9740M BUFFER ZONE (9740M)
- 9760M BUFFER ZONE (9760M)
- 9780M BUFFER ZONE (9780M)
- 9800M BUFFER ZONE (9800M)
- 9820M BUFFER ZONE (9820M)
- 9840M BUFFER ZONE (9840M)
- 9860M BUFFER ZONE (9860M)
- 9880M BUFFER ZONE (9880M)
- 9900M BUFFER ZONE (9900M)
- 9920M BUFFER ZONE (9920M)
- 9940M BUFFER ZONE (9940M)
- 9960M BUFFER ZONE (9960M)
- 9980M BUFFER ZONE (9980M)
- 10000M BUFFER ZONE (10000M)

WARNING

BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

BEFORE YOU DIG
www.7700.com.au

Figure 15 – On-Farm Land Available for Effluent and Mortalities Compost Reuse



Consultation with Ben Lane, Windridge Farms (pers. comm 28th October 2020) Identified that ~ 120 heifers are run on ~80-120 ha of Phalaris and rye grass pastures on Koorani. The weight of the animals on arrival is ~280 kg and they weigh around 480 kg on exit. Hence, there is a total of 24 t of weight gain in these animals annually. Based on data in Beefbal (Davis RJ, Watts PJ & McGahan EJ, 2012), weight gain in growing cattle is likely to include ~24 g N/kg, 7 g P/kg and 1.8 g K/kg. Hence, these cattle would strip ~576 kg N/yr, 168 kg P/yr and 43 kg K/yr. Assuming they run on 100 ha, this is a rate of ~5.8 kg N/ha/yr, 1.7 kg P/ha/yr and 0.43 kg K/ha/yr.

In addition, about 4,500 lambs per year are raised on Koorani on clover and lucerne. The average lamb stocking density over the whole year is ~10-12 DSE/ha. However, not all of the lambs are on the farm at the same time. The average weight of the incoming lambs is 28-30 kg and they weigh ~50-52 kg on exit. Based on an average liveweight gain of 22 kg/hd/yr, there is a total of ~99 t of liveweight gain annually. Assuming the composition of the weight gain of lambs is similar to that of cattle, this equates to uptake of ~2,376 kg N/yr, 693 kg P/yr and 178 kg K/yr. If the lambs are run on 200 ha of land (i.e. half the farm less the land used for the heifers), the nutrient removal rate is ~11.9 kg N/ha, 3.5 kg K/ha and 0.9 kg K/ha.

Table 20 shows expected crop nutrient removal rates using conservative long-term yields. National Environmental Guidelines for Indoor Piggeries (Tucker, 2018) except where marked.

Table 20 – Adopted Crop Nutrient Removal Rates

Crop	DM Yield (t/ha)	Nitrogen (kg/t)	Phosphorus (kg/t)	Potassium (kg/t)	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)
Canola*	1.75	40	7	9	70	12.3	15.8
Wheat grain	3.5	19	4	5	66.5	14.0	17.5
Wheat straw	5	6	0.5	14	30	2.5	70
Grain + straw					96.5	16.5	87.5
Clover + lucerne#	7	34	2.5	22.3	238	17.5	156
Heifer grazing	0.24	24	7	1.8	5.8	1.7	0.43
Lamb grazing Weight gain^	0.162	27	6.7	1.7	4.4	1.1	0.28

* source: (GRDC, 2015) # source: (National Research Council, 1984)

^ Based on 9 DSE/ha gaining 18 kg/hd = 162 kg/ha and using data for mineral content of starter / intermediate cattle as presented in (Watts PJ, 2011)

The nutrient removal rate by the typical cropping rotation is shown in Table 21. Over the five years of the rotation, the average nutrient removal rate is 86 kg/ha for nitrogen, 15 kg/ha for phosphorus and 60 kg/ha for potassium. Canola removes significantly less nutrients than wheat and straw, so nutrients will accumulate during the years canola is grown if the average nutrient removal rate is used. Crop rotations can be varied to allow for increased nutrient removal if necessary.

Table 21 – Nutrient Removal by 5 Years of Cropping on Reuse Areas

Crop	Nutrient Removal Rate (kg/ha/yr)		
	N	P	K
Wheat + straw	96.5	16.5	87.5
Canola	70	12.3	15.8
Wheat + straw	96.5	16.5	87.5
Canola	70	12.3	15.8
Wheat + straw	96.5	16.5	87.5
Av.	86	15	60

Since effluent, SEPS solids, spent bedding and mortalities compost contain nutrients in different ratios, it is necessary to prepare a nutrient balance for each product type. The minimum area of land (ha) needed to reuse the nitrogen, phosphorus and potassium in the effluent, SEPS solids, spent bedding and mortalities compost can be calculated by dividing each nutrient mass (kg) by the nutrient harvest rate (kg/ha) for the crops or grazing. As a starting point, the theoretical nutrient masses estimated from PigBal and typical crop yields and uptakes have been used to estimate the required area. Table 22 shows the minimum area needed for sustainable effluent and manure reuse under the proposed / typical cropping rotation.

Table 22 – Minimum Area Needed for Sustainable Effluent and Manure Reuse Under Proposed Cropping Rotation

Item	N (kg/yr)	Gaseous losses (%)*	N after losses (kg/yr)	P	K
Crop removal (kg/ha/yr)	84.4	-	84.4	13.6	60.9
Liquid effluent (kg/yr)	24,681	20%	19,745	2,412	21,411
Area (ha)	-	-	217	161	357
SEPS solids (kg/yr)	18,954	20%	15,163	21,707	1,127
Area (ha)	-	-	167	1,447	19
Spent bedding (kg/yr)	25,400	15%	21,590	17,200	17,800
Area (ha)	-	-	237	1,147	297
Mortalities compost (kg/yr)	3,795	10%	3416	1,265	759
Area (ha)	-	-	40	93	12

* volatilisation rates sourced from (Tucker, 2015). Rate for spent bedding midway between fresh bedding and compost

If the minimum land area is based on both nitrogen and phosphorus, the land areas required are estimated to be:

- liquid effluent irrigation area 217 ha
- SEPS solids 1,447 ha
- spent bedding 1,147 ha
- mortalities compost 93 ha

Effluent Reuse

As Table 22 shows, potassium appears to be a more limiting macro-nutrient for effluent reuse than nitrogen; with largest land area (357 ha) theoretically needed to manage this nutrient. However, since potassium has few environmental impacts, the area needed for nitrogen (217 ha) will be used. While this will over-apply potassium, no environmental impacts would be expected. If potassium reaches levels that may become problematic, for example posing a grass tetany risk for later grazing stock or contributing to soil structural concerns, hay crops (that strip large amounts of potassium) could be harvested when the area is in the grazing stage of the rotation. Over the long term, the effluent may not provide enough phosphorus to produce optimal crop yields if the area is sized based on nitrogen load. Other nutrients may also be lacking. This could possibly be remedied by applying the mortalities compost and / or fertiliser in conjunction with effluent. The farm's consulting agronomist will advise on crop nutrition and fertiliser recommendations. SEPS solids, spent bedding and mortalities compost are excellent sources of phosphorus and this is the limiting nutrient.

If effluent is applied to the 50 ha of silage to be grown each year, a slightly smaller total area is needed for sustainable reuse. The 50 ha of silage can use 36.3% of the total effluent. This is because 50 ha of silage is expected to take up some 875 kg of phosphorus and 7,800 kg of potassium or ~36.3% of the total quantity of these nutrients. Nitrogen will be under-supplied and fertiliser (e.g. urea) will need to be supplied to enable the crop to grow optimally. Matching the effluent application rate on this area to the phosphorus requirement of the crop will leave ~12,580 kg of nitrogen, 1,537 kg of phosphorus and 13,644 kg of potassium for reuse on the wheat-canola (five year) / grazing (five years) land use rotation. The land area required for sustainable reuse of the nitrogen in this land use is 138 ha. Consequently, a total cropping area of 188 ha is needed at any time (138 ha + 50 ha).

The areas calculated above are based on theoretical estimates of the nutrient content of the effluent. In practice, analysis results for the effluent will be used to determine suitable reuse rates based on the composition of the effluent and the expected crop or grazing removal. Table 13 shows examples of analysis results for effluent from the recycle dam. These show:

- total nitrogen range 84-550 mg/L, average 318 mg/L
- phosphate phosphorus rate 36-43 mg/L, average 38 mg/L
- potassium 790 mg/L

Using the average irrigation rate of 11.593 ML/yr (from section 2.1.4) and the average nutrient concentration, this equates to total annual nutrient masses of:

- 3,697 kg N (2,958 kg N after volatilisation losses during irrigation)
- 441 kg P
- 9,158 kg K.

All of these values are considerably lower than those estimated using PigBal (nitrogen ~19% of PigBal, phosphorus ~18% of PigBal, potassium ~43% of PigBal). Consequently, the area of land needed for sustainable reuse may be significantly lower than the areas calculated in Table 22. It is possible that a portion of the effluent nutrients expected to remain in the effluent are being deposited to the SEPS solids during the solids settling process. However, it is also important to note the considerable variation in the nitrogen results. This confirms the importance of analysing the effluent prior to major irrigation events and using the results and the type of crop and expected nutrient removal rates to determine the land area needed for sustainable reuse.

Because the EC of effluent can be quite high, the risk of salinisation of the effluent reuse areas needs to be considered. Data in the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018) shows that the EC of effluent for irrigation can range from 2.5 dS/m to 11.7 dS/m with a mean of 6.4 dS/m. One of the results given in Table 13 is typical of this range (6.9 dS/m) while the other two are a little higher than the upper level (13 dS/m, 14 dS/m). It is worth noting that EC measures not just potentially harmful dissolved salts like sodium and chloride, but inorganic compounds like carbonate and bicarbonate salts, magnesium and calcium sulphates and potassium (Natural Resources South Australia, 2015) so the salt contribution may be over-estimated. Nevertheless, an approximation of the mass and rate of salt added to the soils of the reuse areas can be calculated from the likely EC of the effluent, the effluent volume (11,593 ML) and the area of land available for effluent reuse (minimum of 188 ha). Estimates based on an EC of 6.9 dS/m (lowest value) and 13.5 dS/m (mean of 13 dS/m and 14 dS/m) are shown in Table 23. Using the higher value for EC, the salt addition rate will be 533 kg/ha/yr for years when effluent irrigation occurs on cropping land. To put this in perspective, on average ~11 teaspoons of salt would be added to each square metre of soil annually. However, as effluent reuse rates will be lower during the grazing part of the land use rotation, the long term average salt application rate over the whole land use rotation will also be lower.

Table 23 – Estimated Mass and Rate of Salt Added to Soils of Cropped Effluent Reuse Areas

Item	Quantity @ 6.9 dS/m	Quantity at 13.5 dS/m
Effluent volume (m ³)	11,593	11,593
Area for reuse (ha)	188	188
Av. effluent rate (m ³ /ha)	61.7	61.7
Salt		
TDS (mg/L)	4,416	8,640
Total salt added (t)	51.2	100.2
Salt addition rate over crop phase (kg/ha/yr)	272	533
Salt addition rate over crop phase (g/m ² /yr)	27	53
Salt addition rate over whole land use rotation (kg/ha/yr)	136	267
Salt addition rate over whole land use rotation (g/m ² /yr)	14	27

A better indicator of harmful salts is the quantity of sodium added to the soil. From the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018), piggery effluent can contain 41-1132 mg/L of sodium with an average of 399 mg/L. The three measurements in Table 13 for the recycle dam effluent are 620 mg/L, 890 mg/L and 1,100 mg/L. The mean of these values is 870 mg/L. At this rate, the effluent will add just 54 kg Na/ha/yr (5.4 g/m²/yr).

The soils of the site are non-saline and generally non-sodic and these small amounts of salt and sodium should be readily leached through the well-drained sandy clay loam topsoil and through the sandy clay to light and medium clay subsoil. Given the relatively small salt addition rate and the absence of issues

to date, effluent reuse is not expected to result in significant adverse impacts to soils. Salinity is rarely induced on piggery effluent reuse areas when nutrients are applied at sustainable rates.

The other potential impact of salt on reuse areas is reduced crop yields, which in turn affects nutrient removal rates. Crops differ in their salt tolerance. Canola is salt-tolerant and wheat has moderately high tolerance so neither of these is likely to be affected. Effluent could also be applied to land planted to less tolerant crops just before planting to provide nutrients without risking leaf burn. Other areas could be planted with more tolerant crops and these could then have effluent applied during the growing season.

The land will be managed to avoid salinity and sodicity concerns. Soil salinity and sodicity will both be monitored. If salinity or sodicity become an issue, Windridge Farms Pty Ltd will take corrective and mitigation action. This could include taking affected paddocks out of the reuse areas (temporarily), growing more salt tolerant plants or using lime or gypsum to displace sodium to address sodicity.

Mortalities Compost

In any year, Table 22 indicates that some 93 ha of cropping land needs to be available for reuse of mortalities compost. Analysis of the compost would allow for more accurate determination of the area required in any year depending also on the crop being grown and the expected nutrient uptake rates.

Spent Bedding and SEPS Solids

A total of 499.8 ha of land on-farm has been allocated for reuse (421.8 ha can be used for effluent, mortalities compost or spent bedding and SEPS solids with a further 78 ha also suitable for spent bedding or SEPS solids only due to differences in buffers between different types of products). Hence, there is sufficient land for the reuse of the nutrients in the effluent and mortalities compost. Land that is not needed for reuse of effluent or mortalities compost in any year may be spread with spent bedding. However, it is intended that the spent bedding and SEPS solids will mostly be used on other land managed by Windridge Farms Pty Ltd or by nearby farmers for use in their farming systems. Recent analysis results for SEPS solids are provided in Table 12 and recent results would be provided to recipients to enable them to calculate suitable reuse rates.

Reuse Management Practices

Good management practices are vital in protecting the environment and amenity. Use of Effluent for Irrigation (Department of Environment and Conservation (NSW), 2004) includes environmental performance objectives applicable to the use of effluent by irrigation. The principles are relevant for both effluent and manure reuse. They are:

- protection of surface water – effluent irrigation systems should be located, designed, constructed and operated so that surface waters do not become contaminated by any flow from irrigation areas, including effluent, rainfall runoff, contaminated sub-surface flows or contaminated groundwater.
- protection of groundwater - effluent irrigation areas and systems should be located, designed, constructed and operated so that the current or future beneficial uses of groundwater do not diminish as a result of contamination by the effluent or runoff from the irrigation scheme or changing water tables.
- protection of lands – an effluent irrigation system should be ecologically sustainable. In particular, it should maintain or improve the capacity of the land to grow plants and should

result in no deterioration of land quality through soil structure degradation, salinisation, waterlogging, chemical contamination or soil erosion.

- protection of plant and animal health – design and management of effluent irrigation systems should not compromise the health and productivity of plants, domestic animals, wildlife and the aquatic ecosystems. Risk management procedures should avoid and or manage the impacts of pathogenic micro-organisms, biologically active chemicals, nutrients and oxygen depleting substances.
- prevention of public health risks – the effluent irrigation scheme should be sited, designed, constructed and operated so as to not to compromise public health. In this regard, special consideration should be given to the provision of barriers that prevent human exposure to pathogens and contaminants.
- resource use – potential resources in effluent, such as water, plant nutrients and organic matter, should be identified, and agronomic systems developed and implemented for their effective use.
- community amenity – the effluent irrigation system should be located, designed, constructed and operated to avoid unreasonable interference with any commercial activity or the comfortable enjoyment of life and property off-site. In this regard, special consideration should be given to odour, dust, insects and noise.

The National Environmental Guidelines for Indoor Piggeries (Tucker, 2018) identify a range of recommended reuse practices that will help in meeting these objectives and will be adopted here. These include:

- analysing effluent and spent bedding annually before the main reuse period to confirm its nutrient content then determining sustainable reuse rates that balance nutrient applications with nutrient removals (and acceptable gaseous losses). SEPS solids will also be analysed annually (or every year that it is extracted), although for practical reasons the analysis from the previous year can be used to determine reuse rates.
- applying effluent, spent bedding and SEPS solids evenly and at controlled rates
- spreading effluent, spent bedding and SEPS solids just before sowing and / or when the crop is actively growing
- delaying reuse if the soil is saturated, or if it is raining or forecast to rain heavily within 24 hours
- incorporating SEPS solids into the soil where practical
- providing suitable vegetated buffers between reuse areas and water bodies
- providing suitable buffers to sensitive land uses (as discussed above)
- avoiding reuse close to neighbouring houses when the wind is carrying towards them
- avoiding effluent, spent bedding and SEPS solids spreading early in the morning or in the evening when odour is less likely to disperse.

Off-farm recipients of spent bedding or SEPS solids will be provided with a handout including these principles, an analysis for the product they are receiving and a copy of the duty of care statement from the Australian Pork Ltd “Piggery Manure and Effluent Management and Reuse Guidelines” (Tucker, 2015) guidelines which is included in this EIS as Appendix F.

Other Wastes

Management of other wastes will accord with the waste reduction and recycling principles of the “NSW Waste and Sustainable Materials Strategy 2041” (NSW Department of Planning, Industry and

Environment, 2021). Packaging and office wastes (e.g. office paper, plastic containers) will be collected in bins or skips and, where practical, will be recycled. The small amount of rubbish for disposal will be collected in skips and the contents will go to off-farm waste facilities. Sharps will be collected in suitable containers and the contents will be collected for disposal by a contractor.

2.1.5. B.1.g Crop Management and Nutrient Removal

In the Young region, the timing of the Autumn break, liming and nutrient management are all important determinants of yield. As they do now, Windridge Farms Pty Ltd will consult with their agronomists for liming and nutrient recommendations (including nutrients added by piggery effluent and manure). Expected average crop yield data is provided in section 2.1.4. This data was used in the estimation of nutrient removal rates which are provided in the same section.

2.1.6. B.1.h Volume and Nature of Truck Movements

Trucks will need to transport prepared feed and incoming pigs to the site and finished pigs, SEPS solids and spent bedding from the site. It is expected that most of the straw for bedding will be grown on-farm. In the past, the balance has been obtained by baling straw on neighbouring farms. These are accessed by gates between the farms, so the transportation is via on-farm roads, not public roads. Only twice, in very dry years, has straw been obtained and transported from further afield. Hence, straw transportation has not been factored into the truck movement calculations.

From section 2.1.1:

- the annual feed usage is expected to be: ~13,860 t/yr (Table 2). All pig feed comes from the Wonga feedmill. The feed is all carted in semi-trailers belonging to PM & DL Reynolds Bulk Haulage Pty Ltd which is based in Young. Currently there are four trucks a week coming into Koorani. With the doubling in size, this will increase to eight trucks per week (~33 t loads).
- Pigs will be transported to the farm from Wonga. These are transported in B-doubles. Currently one truck per week transports the pigs to the site. Hence, post-expansion there will be two trucks per week.
- Sale pigs are transported weekly to the Diamond Valley Abattoir at Laverton North. Currently the piggery fills four B-doubles per week. After the expansion, there would be eight B-doubles per week (Table 4).

From section 2.1.4:

- the annual mass of aged spent bedding is estimated at 1,385 t/yr or 2,308 m³/yr. If all of this goes off-farm in 26 t loads, this equates to 53 trucks per year. (This should be considered a maximum as some spent bedding may be spread on-farm).
- annually some 3,876 m³ of sludge will be extracted from the CAL and transferred to the SEPS for drying. It is expected that this material this will initially have a very high moisture content (e.g. 87%) (Australian Pork Limited, 2014), so it is reasonable to assume the wet mass is ~3,876 t and that the total solids content is ~504 t. If the material is dried to 40% moisture, there will be ~1,260 t of SEPS solids for transport. If all this goes off-farm, and it is carried in 26 t loads, this equates to 49 trucks per year.

Table 24 shows estimated truck movements.

On average, there will be up to about 20 truck movements in and out each week.

It could be expected that feed and stock truck movements would occur regularly throughout the year. However, there will be more demand for spent bedding and SEPS solids in the late summer / early Autumn when land is being prepared for planting. If these trucks all occur over a three month period, there will be an average of 26 trucks per week over that time (18 trucks for stock and feed and up to eight trucks for spent bedding and SEPS solids).

Staff will access the site using cars or utility vehicles. It is likely that there will be limited car-pooling. The six staff (FTE) would need about six car trips in and out of the site each weekday (six cars X 5 days = 30 trips in and 30 trips out). On weekends, there would be say three staff (three cars X 2 days = 6 trips in and out).

Section 2.4.5 provides details of road condition and transport requirements.

Table 24 – Weekly and Annual Vehicle Movements

Type	Vehicle type	Quantity for transport	Av. no. trips/wk (in and out)	Av. no. trips/yr (in and out)	Destination
Staff	Car/utility	6 weekdays, 3 weekends	36	1877	Local
Feed Trucks	B-double 33 t	13,860 t	8	420	Ex-Wonga Piggery
Stock In	B-double	70,110	2	102	Ex-Wonga Piggery
Stock Out	B-double	69,824	8	416	Laverton North
Spent bedding Out	Semi-trailer 26 t	1,385 t	1	53	District
SEPS Out	Semi-trailer 26 t	1,260 t	1	49	Local
Total trucks			20	1,040	

2.1.7. B.1.i Heating and Cooling

The piggery will be designed to be energy efficient to minimise the need for artificial heating and cooling. Design and management elements to manage heating and cooling:

- sheds will run east west (to limit sun exposure);
- finisher sheds roofs will be insulated;
- sheds will have automatically controlled natural ventilation (side curtains). The curtains that run the full length of the sheds will open and close under the control of a thermostat set to optimise the shed temperatures. Generally, the curtains will be open most of the time in summer and during the warmer hours of the day in winter;
- drip and spray coolers will be used for cooling;
- the new finisher sheds will be mechanically ventilated to optimise welfare for the heaviest pigs; and
- straw bedding used in most of the sheds helps pigs insulate from heat and cold

2.1.8. B.1.j The Frequency of Effluent Pond Clean Out

It is intended that the anaerobic pond will be desludged regularly throughout the year. Sludge will be drawn from the pond using a pipe attached to a pump that is inserted through built-in desludging

portals, with the sludge emptying into a SEPS channel. Several portals will be installed along the long bank of the pond. Each portal will consist of a permanent pipe inserted at an angle through the wall of the pond that extends down to the bottom of the pond. Photograph 3 shows an example of a desludging port at a piggery (top of bank), with a pipe attached for sludge extraction. Sludge will be dried in the SEPs ahead of off-farm spreading as SEPS solids.

2.1.9. B.1.k Chemical Usage & Storage

Chemical usage will be minimised and relatively small quantities of chemicals will be kept on-farm at any time. This will include veterinary chemicals, disinfectants for cleaning the sheds, rodenticides and insect baits, and small amounts of pump fuel.

All chemicals will be stored indoors on areas with concrete floors. Spill containment equipment will be kept with the chemicals in or near these storage areas. Veterinary chemicals requiring refrigeration will be kept in a refrigerator in a lockable area of the office. These chemicals will be stored, used and disposed strictly in accordance with package directions or veterinary advice. Disinfectants and other chemicals will be kept in locked areas within the piggery.

The piggery will maintain certification under the APIQ[✓]® Quality Assurance Program which necessitates proper handling and record keeping for chemicals.

2.1.10. B.1.j The Projected Life of the Operation

The projected life of the operation is at least 30 years but likely longer. Should the use cease, the sheds would be removed and the building materials removed from the site. The effluent management facilities would be decommissioned and the site of these levelled. The site would be rehabilitated and restored so it could be farmed. The SEPP Resilience and Hazards (NSW Government, 2021) will guide the rehabilitation.

2.1.11. B.1.m Staging

It is intended that the extension of the piggery will be built in a single stage. Earthworks will be undertaken first, followed by construction of the bases of the deep litter shelters and the drainage and effluent system of the conventional sheds and finally the sheds themselves. The sheds will be built one row at a time.

Figure 2 shows the layout of the piggery facilities.

2.2. B.2 DESCRIPTION OF OPERATIONS

2.2.1. B.2.a Location, Elevation and Materials of Buildings

The location of the piggery on the farm is shown on Figure 24. The layout of the sheds, effluent ponds and composting pad for the fully developed piggery is shown on Figure 2.

As detailed in section 2.1.1, the pigs will be raised using a combination of deep litter sheds and conventional sheds. The classes of pig that will utilise each type of shed are shown in Table 1. The conventional housing will accommodate the pigs within steel-framed sheds with walls that are half solid and half nylon curtain, sandwich panel roofing and slatted flooring over concreted under-floor flush channels. The exterior materials for the sheds will be light in colour so excess heat is not absorbed, and non-reflective so glare is not created.

The deep litter housing will also consist of steel-framed sheds with walls that are half solid and half nylon curtain, iron roofing and solid concrete flooring. The exterior materials for the sheds will be light in colour to minimise heat absorbance, and non-reflective to avoid glare creation.

Currently the site has:

- five existing weaner sheds – deep litter (42.0 m X 12.2 m)
- four existing grower sheds – deep litter (63.0 m X 12.2 m)
- six existing finisher sheds – conventional (slatted pull plug, ridge ventilated) (50.7 m x 11.2 m)

For the development covered by this EIS, it is proposed to add a further six sheds. These will each be 67.9 X 14 m in size. Figure 4 to Figure 7 show plans for these sheds.

Two additional steel silos will also be constructed near each new pig shed. Full dimensions of these are shown Figure 17.

The location of these facilities is shown on Figure 2.

2.2.2. B.2.b Earthworks, Fencing, Dams and Ponds

Earthworks will be needed to construct:

- building pads
- new SEPS channel
- CAL
- an impervious base and bunding on each of the manure storage pads.

The most significant earthworks will be for the construction of the SEPS channel and the CAL which will be excavated into the ground. Section 2.3.6 provides construction details and dimensions.

The piggery site will be fenced with a stock and wild pig-proof fence. Vehicles will need to go through entrance gates. Signage at the entry to the site will alert people of the biosecurity requirements and provide a phone number for them to call should they wish to enter the farm. The effluent pond and SEPS will not be separately fenced but will carry appropriate signs warning of deep water.

2.2.3. B.2.c Waste Management Facilities and Effluent Holding and Utilisation Areas

Liquid effluent will be treated in a CAL and SEPS with an associated recycle pond. Sections 2.1.4 and 2.3.6 and Figure 8-Figure 10 provide details of the dimensions and construction of the CAL and SEPS. In summary, the CAL will provide primary effluent treatment. Treated effluent from the CAL will be directed into one of three SEPS channels which will, in turn, drain to the recycle pond. Sludge from the CAL will be regularly pumped into another of the SEPS channels. Here it will be dried and, once dry, the SEPS solids will be removed as to make room for new material. The area between the sludge channels will be used to store dried material until it can be spread. The base of this area will consist of two 150 mm deep layers (total depth 300 mm) constructed to produce a maximum pad permeability of 1×10^{-7} m/s. From the soil properties, it is expected that the permeability of the compacted in situ subsoil will be able to meet this criterion. If the in-situ soil cannot be compacted to achieve this permeability, suitable material will be imported. The base of the pad will be at least 2 m above the highest seasonal groundwater table at all times. Runoff from this area will be directed into the channel below. The recycle dam has been sized to manage this runoff (see section 2.3.6 for pond sizing and construction details).

Spent bedding will be aged in six dedicated areas on the farm; the location of these is shown on Figure 14. The base of these areas will consist of two 300 mm deep layers compacted to produce a maximum pad permeability of 1×10^{-7} m/s. A 300 mm high bund will surround each area. The base of these areas will be graded to provide a slope of ~2% so that runoff moves away from the spent bedding piles and is captured by a bund (0.3 m high) at the bottom of the area.

Figure 15 and Figure 16 show the proposed on-farm reuse areas. Details of these are provided in sections 2.1.4 and 2.1.5.

The piggery will generate very little other waste. The principles of the waste hierarchy described in the “NSW Waste Avoidance and Resource Recovery Strategy 2014-21” (NSW Department of Planning, Industry and Environment, 2021) will be adopted, with waste avoided and reduced where possible. The commodities for the pig feed will be mostly delivered in bulk, without packaging. There will be some pharmaceutical and cleaning product packaging and some office wastes. Wastes (e.g. office paper, plastic containers) will be collected in bins or skips and, where practical, will be recycled. The small amount of rubbish for disposal will be collected in skips and the contents will go to off-farm waste facilities. Sharps will be collected in suitable containers and the contents will be collected for disposal by a contractor.

2.2.4. B.2.d Type of Machinery to be Used

Feed for the piggery will be processed off-site at another piggery operated by Windridge Farms Pty Ltd. It will be distributed to the pigs using an automatic system powered by electricity.

A diesel pressure washer will be used for cleaning pens.

An electric pump will be used to transfer water around the piggery.

Mechanical ventilation will provide for climate control in the new pig sheds.

A front-end loader or telehandler will be used to clean spent bedding from the deep litter shelters. This material will be loaded into a tip-truck for transportation to the manure storage areas.

Spent bedding will be spread using a tractor-pulled or truck-mounted manure spreader.

A small tractor will be used to pick-up dead pigs and transport these to the mortalities composting area.

2.2.5. B.2.e Silt Traps, Drainage & Stormwater Facilities

Stormwater protection has been carefully considered in the piggery design. The sheds will be designed to exclude the entry of runoff and to prevent the uncontrolled exit of effluent or leachate. All sheds will have impervious floors and solid lower-walls that will prevent manure and effluent from inadvertently leaving the sheds. The conventional sheds will have impervious underfloor pits; all manure, waste feed, wastewater and wash water will be captured in these.

The crest of the CAL and the recycle dam will sit at least ~0.6 m above ground level to prevent the entry of any stormwater runoff. The pond system has been sized for a 1 in 10 year spill frequency and also to contain the 1 in 20 year, 24 hour storm.

The manure storage areas and the lower side of each SEPS channel will have a bank at least 0.3 m high to exclude stormwater runoff. Runoff caught within the area above the middle and lower SEPS channel that is used to stored removed solids will drain to the channel below. Further details of controls to be used during construction are provided in section 2.3.4. Spent bedding from the deep litter shelters will be directly transferred from the sheds to the manure storage area.

There will be no gutters on the pig sheds as these fill with leaves and dust. Instead, stormwater drains will direct rainwater runoff into dams. From section 2.2.1, the completed development will include:

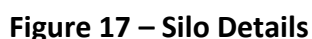
- fourteen sheds 54.0 m X 11.4 m, or a combined area of 8,618.4 m²
- one shed 42.0 m X 12.2 m, or an area of 512.4 m²
- one shed 63.5 m X 12.2 m, or an area of 774.7 m²
- six sheds 67.9 m X 14 m, or a combined area of 5,703.6 m²
- combined area of all sheds 15,609 m²

Based on shed floor area (which will under-estimate roof area slightly), the total volume of water that can be captured from shed roofs is 8.83 ML. The roof runoff is based on an average annual rainfall of 595.5 mm, and a roof runoff coefficient of 0.95. The actual volume collected will vary with rainfall received in any given year and it may not be possible to collect all runoff as the dams may occasionally over-fill.

2.2.6. B.2 f Storage Areas and Sheds

In addition to the piggery sheds, the piggery includes various other buildings. These include a small office with staff facilities (lunch room, showers and toilets connected to septic) and a lockable area for storing veterinary chemicals. It is not proposed to construct any additional office or amenities buildings.

It is proposed to add two additional steel silos on each new shed. Details of the dimensions of these are shown on Figure 17.



2.3. B.3. SITE LAYOUT

2.3.1. B.3.a Vegetation to be Cleared or Disturbed

The piggery site is within a paddock that has been cleared for agriculture for decades. As Figure 18 (reproduced from the Biodiversity Assessment Report provided as Appendix G shows), there are two predicted plant community types (PCTs) in the proximity of the development site. These are PCT 277 (derived) Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (0.7 ha) and PCT 277 (planted) Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (0.14 ha).

A small number of the planted trees comprising PCT 277 will need to be removed. Due to the small amount of native vegetation intended to be removed or modified and the absence of significant habitat features, it is unlikely that such works will significantly impact any threatened, migratory of marine fauna species that are present in the study area providing there is adherence to the mitigation measures outlined in section 7 of Appendix G).

When the Koorani piggery was first built, extensive tree lines were planted around the piggery site and along the Old Forbes Road to shield the view of the piggery from the road. These tree lines are now well established and the piggery site is not visible from the road or the neighbouring houses. The reuse areas have all been cleared and farmed for decades and no native vegetation will be removed from these areas. Buffers between reuse areas and remnant native vegetation along Cudgell Creek will ensure they are protected from aerosols and inadvertent nutrient movement in runoff.

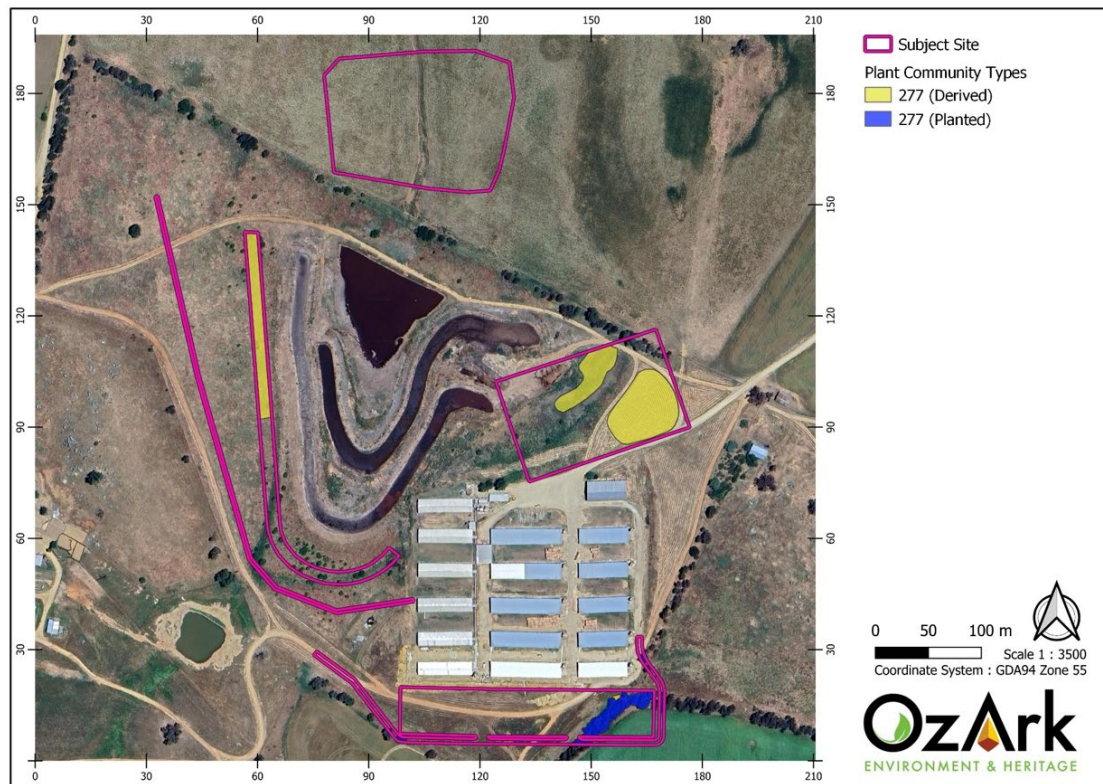


Figure 18 – Location of Confirmed Plant Community Types (PCTs) and Habitat Features

2.3.2. B.3.b Internal Access Roads, Truck Parking, Loading & Turning Areas

All piggery and construction vehicles will enter the property at a single, existing property entry point from Old Forbes Road (see Figure 2 for location). The existing on-farm road to the piggery provides suitable all-weather access and suitable drainage.

During the construction phase, trucks will park and unload adjacent to the construction site. Most construction will occur at the site of the proposed sheds, CAL and SEPS channel. Some earthworks will be required at the spent bedding storage pads but there will be no unloading of materials at these sites.

There is car parking space for approximately six staff and essential visitor cars close to the office. Sufficient space is available at the piggery site for trucks to park for unloading and loading pigs, and for off-loading feed and bedding. Trucks loading pigs may pose a biosecurity risk if they access other farms to collect pigs. To avoid this risk, the existing Farm Biosecurity Management Procedure (see Appendix H) which is based on the National Farm Biosecurity Manual for Pork Production (Animal Health Australia, 2021) includes policies pertaining to subcontractors and haulage. Trucks for stock transportation must be clean on arrival. Drivers must declare when they or their vehicles were last in contact with pigs and whether they have been overseas recently. They must also sign the APIQ visitor movement record. Feed trucks must also be clean on arrival and follow the biosecurity protocols that are detailed in SOP 11 which is included as Appendix H of this EIS.

2.3.3. B.3.c Effluent Storage, Land Application Areas, Controlled Drainage Areas and Waste Disposal Areas

Effluent will be stored in a CAL, a SEPS channel and the recycle dam. Details of these facilities are provided in sections 2.1.4 and 2.3.6 and on Figure 8- Figure 10.

Effluent and mortalities compost produced at the farm will be beneficially reused on-farm. For a number of years all the SEPS solids have been purchased by other farmers as fertiliser for their farms. While this demand is likely to continue, it is expected that SEPS solids will mostly be used on other farms managed by Windridge Farms Pty Ltd. While some spent bedding could be reused on-farm, it is expected that most will be reused on other land nearby owned by Windridge Farms Pty Ltd or by nearby land owners for use in their farming systems. See section 2.1.4 for details.

All of the sheds and the effluent treatment system will be constructed to prevent the entry of stormwater runoff or uncontrolled exit of contaminated water. The sheds will sit within a controlled drainage area. The CAL, the recycle dam and the top SEPS channel will have above-ground banks that prevent the entry of stormwater runoff, creating a controlled drainage area. The compacted areas above the SEPS channels will be used to store dried SEPS solids removed from the channels. Stormwater from this area will drain to the SEPS system. Manure storages areas will be bunded.

Sewage from the staff toilets and showers will be treated using an existing, suitably sized and designed septic system.

No on-farm waste disposal areas are planned. For details of rubbish management, see section 2.2.3.

2.3.4. B.3.d Site Drainage, Erosion and Sediment Control During Construction

Best management practices will be used to minimise the risk of soil erosion and for sediment control during construction. These include:

- integrating project design with site constraints
- preserving and stabilising drainage ways
- providing access and general construction controls
- constraining construction works and vehicle access to the construction site to the minimum area practical
- minimising the extent and duration of disturbance
- consolidating material stockpiles, equipment and machinery storage and laydown areas within the confines of the site to the extent practicable
- using previously cleared areas to stockpile soil where practicable
- controlling stormwater flows onto, through and from the site in stable drainage structures
- installing perimeter controls
- stabilising disturbed areas promptly
- spreading topsoil over cleared areas on completion of works
- using sediment control measures to prevent on-site and off-site damage
- protecting inlets, storm drain outlets and culverts
- inspecting and maintaining sediment and erosion control measures regularly
- implementing dust suppression as needed.

There is a moderate risk of site erosion during construction. Hence, a 0.3 m high bund will be installed around the construction areas of the sheds, CAL and SEPS channel before construction commences to minimise stormwater movement through the area and to protect external areas from sediment transfer. The area stripped of vegetation at any time will be limited to areas where construction is actually occurring. Stripped areas will be stabilised as quickly as practical, with building footings, SEPS and ponds being built in a short-time frame. Groundcover around these areas will be maintained where possible to prevent topsoil losses through wind erosion. Excavated subsoil will be stockpiled and contained within the bunded area to minimise potential dispersion and sediment removal.

Guidance in Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) will be used in developing an Erosion and Sediment Control Plan (ESCP) for this project.

2.3.5. B.3.e Landscaping

There are already established tree lines to the north of the piggery (along Old Forbes Road and another line of trees closer to the piggery), another tree line to the east of the piggery and a third to the west at a slightly further distance from the piggery site. As these provide effective visual screening of the piggery complex, no further tree planting is proposed.

2.3.6. B.3.f Dimensions and Construction Details of Storage Ponds Used for Liquid Effluent

Figure 8 and Figure 9 provide details of the proposed CAL sizing. In summary, the CAL will have dimensions of 110 m X 45 m at crest and will be 8.5 m deep with 1:1 H:V internal batters. Assuming 0.5 m of freeboard, this gives an operating capacity of 28.25 ML. The bank crest will be built 5 m wide

to allow for trenching of the cover and to provide safe access. Angled pipes for pond desludging will be inserted through the walls of the banks and down to the pond base. Several pipes will be installed along the section of the wall closest to the wastewater entry point to provide for good extraction. The sludge will be pumped from the pipes to whichever one of three SEPS channels is in active use. The treated effluent will be pumped into a dedicated SEPS channel from which it will drain to the recycle dam. Approximately a dozen similar covered anaerobic lagoons with in situ sludge removal pipes have been installed at Australian piggeries.

It is intended that the CAL will be constructed from in-situ earth with the base and sides lined with a 1.5-2 mm thick high-density polyethylene (HDPE) or 1 mm thick polypropylene (PP) to prevent seepage from the CAL. The base of the CAL will be at least 2 m above the highest seasonal groundwater table.

The pond cover will likely be constructed from either high-density polyethylene (HDPE) or 2 mm low density polyethylene. It will be embedded into a trench in the pond crest to create a gas-tight seal. The cover will be held down with water-filled weight pipes. These will guide stormwater collecting on the cover into a sump built into the cover, from where it can be pumped off the cover to either the rainwater tanks or a farm dam. Slotted pipes under the cover will collect the biogas released as a consequence of anaerobic digestion. The collected biogas will be burnt through a flare (Pork CRC, 2016). Although not part of this proposal, it is intended that the biogas will be used to generate power in the future. The CAL will therefore be constructed and pipework installed to allow it to operate in accordance with the Code of Practice for On-Farm Biogas Production and Use at Piggeries (Australian Pork Limited, 2015) and the NSW Energy from Waste Policy Statement (EPA, 2021) in the future. When this occurs, a biogas safety management plan will be developed using the Australian Pork Limited template (Gas Advisory Services Pty Ltd, 2014). Biogas recovery is consistent with the “NSW Waste and Sustainable Materials Strategy 2041” (NSW Department of Planning, Industry and Environment, 2021).

It is intended that the new SEPS channel will be constructed from in-situ earth. The base of this channel will be at least 2 m above the highest seasonal groundwater table at all times. The channel base will be lined with clay compacted to have a maximum permeability of 1×10^{-9} m/s for a depth of 450 mm consisting of three 150 mm layers. It is intended that in-situ soil will be used to line the channels. However, if the in-situ soil cannot be compacted to achieve this permeability, suitable material will be imported.

2.3.7. B.3.g Assumptions Regarding Seasonal Variations, Meteorological Conditions and Storm Events used to Estimate the Required Capacity

For the CAL sizing, SILO temperature data for Young was used to determine the appropriate pond activity rate for the anaerobic ponds.

SILO data for Young was used with the WatBal model to size the holding pond. The WatBal model determines the average spill frequency of effluent ponds using water balance modelling. A 1 in 10 year spill frequency from the ponds was used as the design criteria. This is consistent with the recommendations of the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018). The holding pond sizing also used the 1 in 20 year, 24 hour storm event as a sizing criterion. From www.bom.gov.au, for the farm’s location, the 1 in 20 year, 24 hour storm produces 81.12 mm of rainfall.

2.4. B.4 INFRASTRUCTURE AND SERVICES REQUIREMENTS

2.4.1. B.4 A Energy Supply

Mains electricity is connected at the site and will initially provide the primary power supply for the development. A 45 KVA portable generator will be kept on site in case of power system failure. It is intended that biogas collected by the CAL will eventually become the primary power supply for the site but this is not part of this proposal.

2.4.2. B.4.b Total Water Requirements

Water is needed for pig consumption, cleaning the conventional sheds and cooling the pigs. The estimated usage is presented in Table 25. Default drinking water consumption data in PigBal 4 was used. Recycled treated effluent is used for all shed cleaning water. The cooling water usage was based on 540 hr/yr of spray or drip cooling.

Table 25 – Breakdown of Clean Water Requirements

Requirement	Volume (L/d)	Volume (ML/yr)
Drinking	107,080	39.08
Drinker waste	20,800	7.59
Cleaning	20,000	7.30
Cooling	2,400	0.88
Total	150,280	54.85

A minimum of two days total water requirement will be stored in tanks close to the piggery sheds. There are currently two 90,000 L tanks and a further two 90,000 L tanks are planned.

2.4.3. B.4.c Sources of Water Supply

Groundwater will provide the primary water supply for the piggery. An allocation of 69 ML of groundwater is in place (see section 3.3.1). Approximately 55 ML/year of water will be needed for the fully developed piggery. Hence, there is sufficient allocation to meet requirements. From section 3.3.1, two bores provide this allocation. Bore GW700011 has a pumping capacity of 8,550 L/hr. Hence, it has sufficient capacity to meet the needs of the piggery. The pumping capacity of GW703068 is not specified. However, it provides additional capacity.

2.4.4. B.4.d Off-site Waste Disposal Requirements

Consistent with the “NSW Waste Avoidance and Resource Recovery Strategy 2014-21” (NSW Department of Planning, Industry and Environment, 2021), waste will be avoided and reduced where possible. Effluent, SEPS solids, spent bedding and mortalities compost will all be beneficially reused as a nutrient source for growing crops.

The piggery will generate few other wastes. Feed will be brought to the site ready mixed and in bulk, avoiding packaging. The only off-site waste disposal will be for a small amount of chemical packaging, non-recyclable office wastes and other non-recyclables which will go to a local waste facility. Sharps will be collected in suitable containers and the contents will be disposed of through a suitable

contractor (currently Daniels Health) Recyclable containers and packaging will be transferred to appropriate recycling facilities.

2.4.5. B.4.e Road Condition and Transport Requirements

Road conditions and transport requirements are detailed in Appendix I. However, the property entry point will be off Old Forbes Road, with local access via the southern end of Old Forbes Road and Henry Lawson Way. Heavy vehicles will not come from the north. Old Forbes Road is a sealed dual-lane road. Henry Lawson Way is a gazetted main road between Young and Grenfell. It is a classified Regional Road between Young and Grenfell. It is a two-lane single carriage way that supports heavy vehicle movements (B-doubles).

Figure 19 shows that the junction of Old Forbes Road and Henry Lawson Way is on a straight stretch of road with good visibility in both directions. The intersection is designed for long vehicles to safely turn left or right; most piggery trucks will be travelling to and from the direction of Young.



Figure 19 – Junction of Old Forbes Road and Henry Lawson Way

Old Forbes Road forms the northern boundary of the property. It connects with Henry Lawson Way approximately 3.5 km to the south-east of the property entrance. Old Forbes Road is a sealed two-lane road in reasonable condition. The road is greater mass limit (GML) and concessional mass limit

(CML) approved (25 m B-double) except on school days between 7:15 AM to 8:00 AM and 4:00 PM to 4:45 PM. It is not higher mass limit (HML) approved (PSA Consulting Australia, 2019). Figure 20 shows that the property entrance is located on a straight stretch of road with good visibility in both directions with an intersection that is designed for vehicles turning towards Young.



Figure 20 – Property Entrance off Old Forbes Road

Semi-trailers (general access heavy vehicles) will be used to cart feed from the Windridge Farms Pty Ltd Wonga site, so they will enter the site from the south. B-doubles will be used to transport pigs, also from the Wonga site. Figure 21 shows the route.

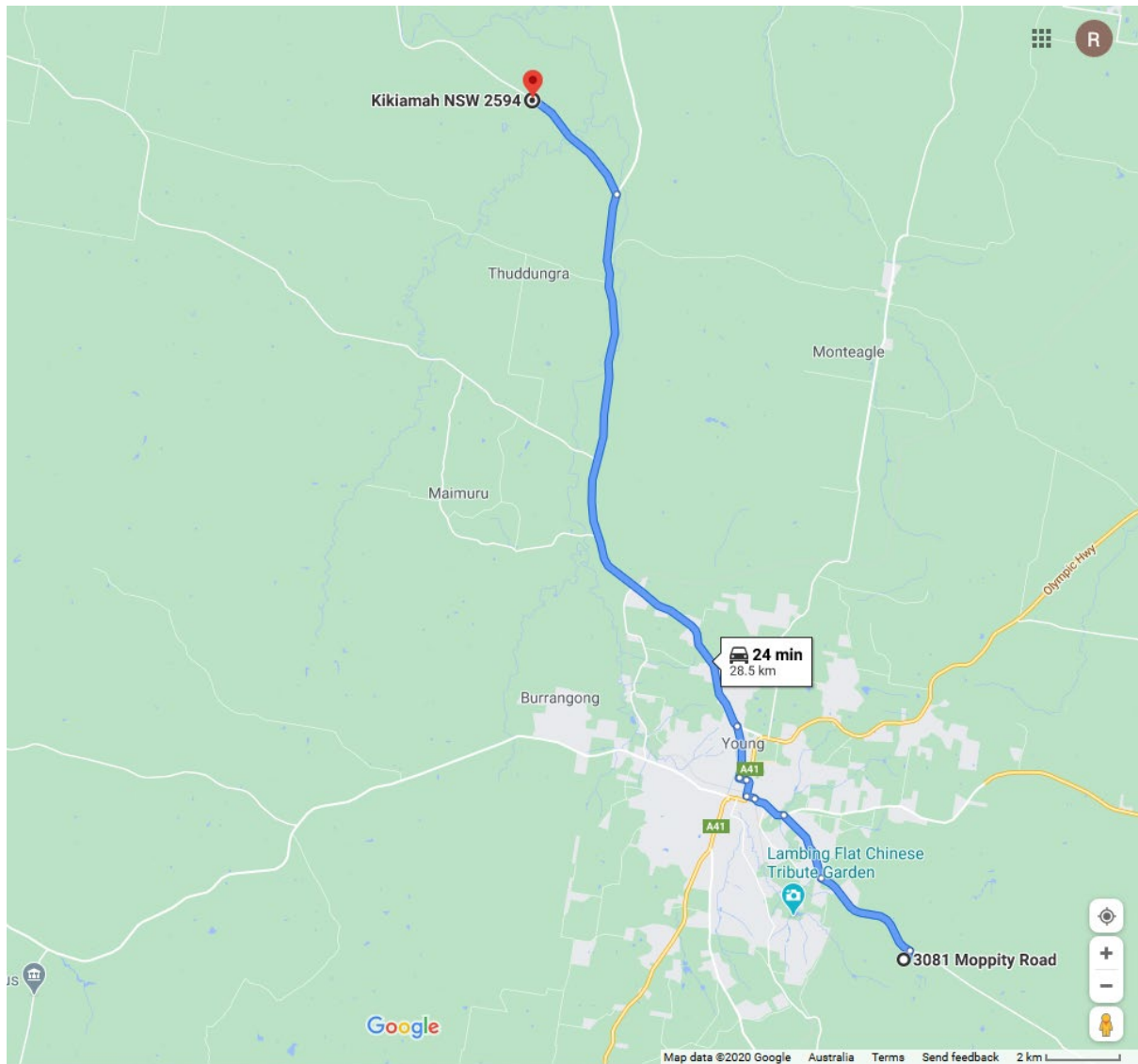


Figure 21 – Traffic Route from Wonga to Koorani – Feed and Incoming Pigs

Finished pigs will be loaded onto B-doubles for travel to the Diamond Valley Pork abattoir in Laverton North, Melbourne. Figure 22 shows the route to the abattoir. This is via Old Forbes Road, Henry Lawson Way, the Olympic Highway, Old Gundagai Road, Muttama Road, the Hume Freeway to Melbourne, the Western Ring Road, Boundary Road, Raymond Road, Thomas Road.

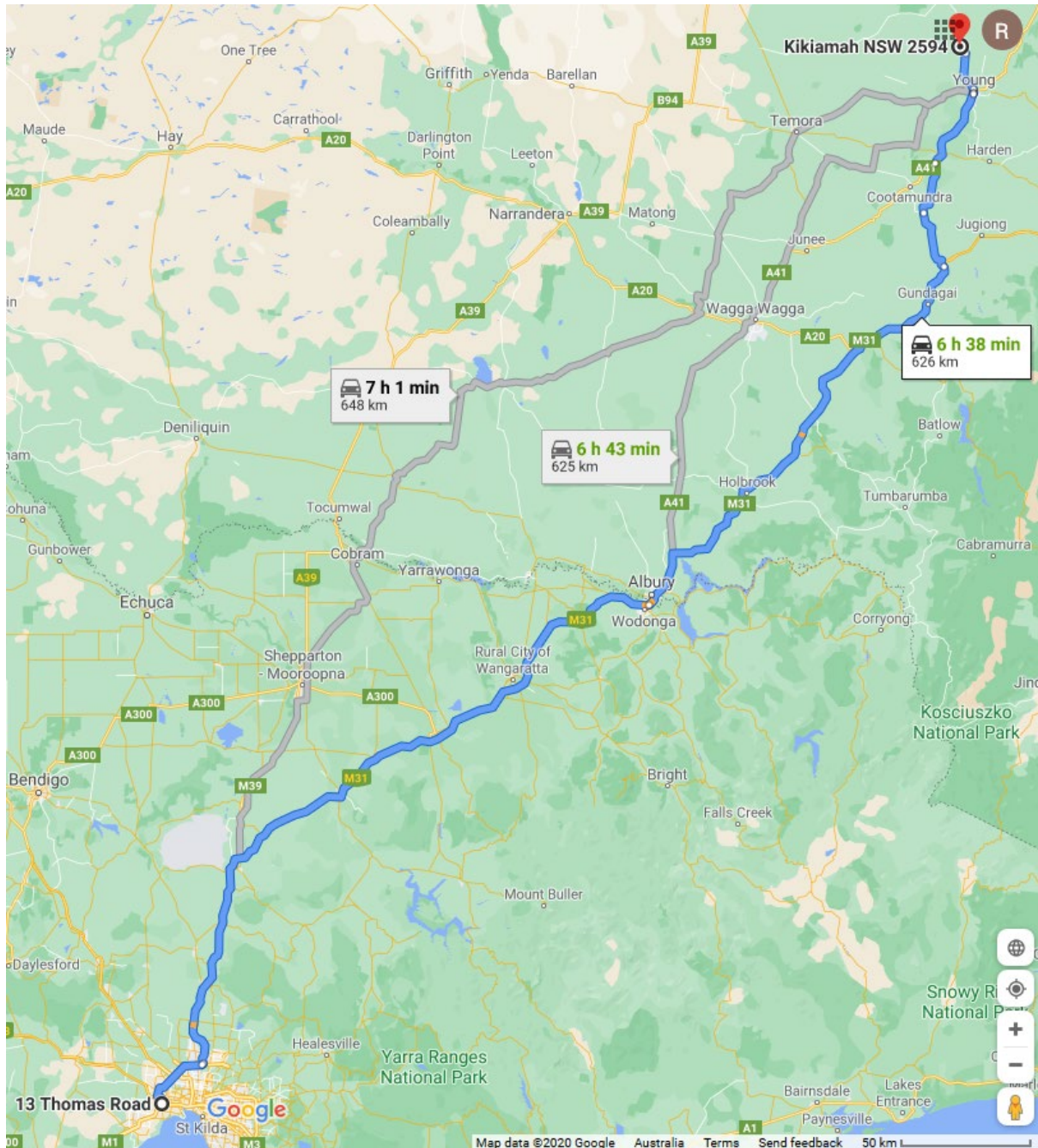


Figure 22 – Traffic Route to Diamond Valley Pork – Outgoing Pigs

Internal roads will provide suitable all-weather access for trucks carrying feed, straw, pigs, SEPS solids and spent bedding. The roads will provide suitable access for emergency vehicles if required.

2.5. B.5 PREVIOUS AND EXISTING OPERATIONS ON THE SITE

A 9,600 head piggery has operated on the site for approximately 20 years. The surrounding farm has been used from mixed farming for many years.

2.6. B.6 CONSIDERATION OF ALTERNATIVES

The applicants propose to expand the piggery to consolidate operation and improve the biosecurity of having growing pigs only on this site and breeding and weaner pigs only at the Wonga site. Expanding the piggery at this site will also improve the profitability of the farm.

The reasons for expanding at this particular site are:

- expansion of the existing piggery will allow for better utilisation of infrastructure.
- the site is suitably separated from houses; there are no neighbours within the calculated minimum separation distances.
- road access and mains electricity are excellent.
- the site has a topography and soil types that suit construction.
- the site is well separated from waterways.
- the soils of the reuse areas are healthy and suitable for the purpose.
- currently much of the pork consumed in Australia is imported. The owners of Windridge Farms Pty Ltd believe there is need and demand for Australia to be self-sufficient in its pork production.

The applicants have considered different sized options and have elected to apply for a 16,221 grower pigs or 23,284 SPU facility since this is big enough to be competitive in the current market.

The applicants considered adding conventional sheds, deep litter sheds or a combination. Conventional sheds provide for very good production control but are expensive to construct. Deep litter sheds are relatively lower cost but offer less control (e.g. over feed intake) and are less suitable for some stock classes. The pigs arriving at Koorani will be old enough to grow efficiently and well in deep litter sheds. The older pigs at the site will be housed in conventional sheds with smaller pen sizes to enable drafting and selection to meet the very specific weight ranges required by supermarkets and other pork purchasers. The pigs' skins are also cleaner after being in conventional sheds, which has been a requirement of abattoirs. Adding conventional sheds to provide a combination conventional-deep litter unit provides a good compromise for capital cost, pig health and customer requirements.

When designing the effluent treatment system, a range of options were considered. However, using a CAL for effluent treatment will significantly reduce odour and greenhouse gas emissions, thereby providing a very eco-friendly option. This system also creates the potential for Windridge Farms Pty Ltd to generate power and heat for use within the piggery in the future. SEPS provide a practical means for managing sludge, often a challenge at piggeries. The applicants have experience with managing a similar system at another farm and intend to install such a system in the future (not as part of this proposal).

When considering access, the proponents selected an entrances and routes that provide for safe property access via sealed roads.



Figure 24 – Site Aerial Photo

The NSW Planning Portal, the Hilltops Local Environmental Plan 2022 (LEP) and the Young Development Control Plan (DCP) (2011, updated 2019) were used to identify specific planning controls. The subject property and immediately surrounding land is zoned Rural Use 1 (RU1). Figure 25, from the NSW Planning Portal, shows the lot on which the piggery is situated and the surrounding land. Minimum lot size (170 ha) applies.

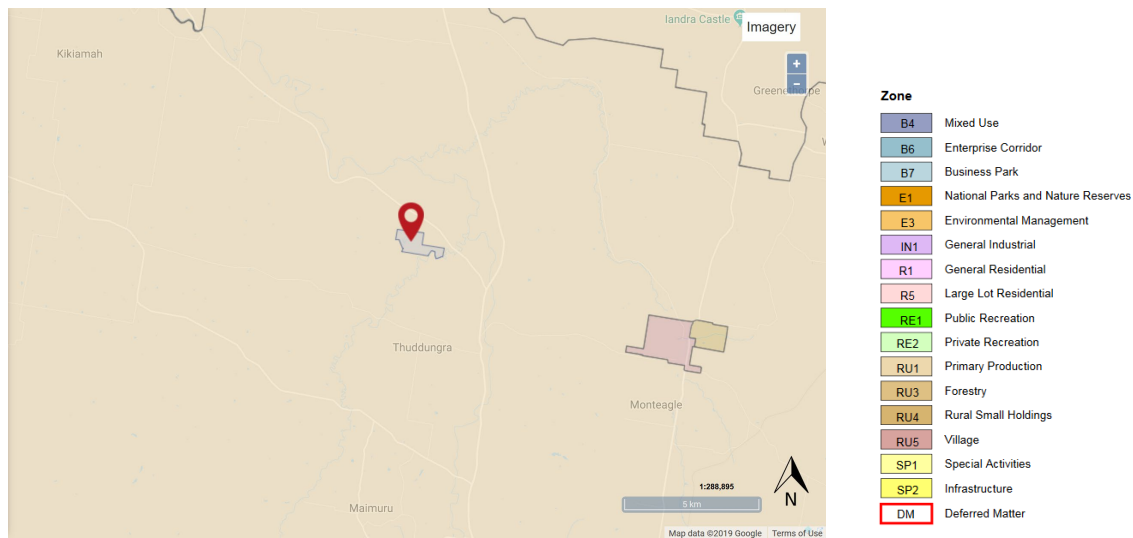


Figure 25 – District Land Use Zoning

The objectives of the RU1 zone are:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- to encourage diversity in primary industry enterprises and systems appropriate for the area.
- to minimise the fragmentation and alienation of resource lands.
- to minimise conflict between land uses within this zone and land uses within adjoining zones.
- to encourage competitive rural production and associated economic development by maintaining and enhancing:
 - a. local and regional transport and communications connectivity, and
 - b. accessibility to national and global supply chains.
- to maintain areas of high conservation value vegetation.
- to encourage development that is in accordance with sound management and land capability practices, and that takes into account the natural resources of the locality.
- to protect and maintain water quality of receiving watercourses and groundwater systems and to reduce land degradation.
- to encourage the development of non-agricultural land uses that are compatible with the character of the zone and sustain high quality rural amenity.

Intensive livestock agriculture is permitted with consent.

The proposed use is consistent with the objectives of the RU1 zone. The expansion of the piggery will help to maintain a diversity of agricultural land uses in the area. It is suitably sited, being sufficiently separated from sensitive land uses to protect amenity, minimising the risk of conflict with other nearby land uses (see section 3.1.3). It is also well separated from waterways, native vegetation, groundwater and items of Aboriginal cultural heritage sensitivity (see sections 2.1.4 and 3.1.5). It has

been designed to operate in an environmentally sustainable way: manure and effluent will be carefully managed to ensure there is no pollution of surface water, groundwater, soils, habitats or items, sites or places of Aboriginal cultural heritage significance (see sections 2.1.4 and 2.1.5 for more details). The manure and effluent will be reused within cropping systems to enhance the structure and fertility of the soils and to productively grow crops (see sections 2.1.4 and 2.1.5 for more details). While the proposed piggery complex will occupy a small footprint, it is part of a larger system, drawing inputs of grain and straw from a larger local area and providing manure (SEPS solids and spent bedding) for enhancement of the soils of nearby land. Hence, it will not alienate or fragment resource lands.

3.1.2. C.1.b Local and State Environmental Plans and Policies

This development is subject to:

- Environmental Planning & Assessment Act NSW (1979) (NSW Government, 1979)
- Environmental Planning & Assessment Regulation NSW (2021) (NSW Government, 2021)
- Protection of the Environment Operations Act (1997) (NSW Government, 1997)
- Protection of the Environment Operations (General) Regulation NSW (2022) (NSW Government, 2022)
- SEPP (Biodiversity and Conservation) 2021 (NSW Government, 2021)
- SEPP (Transport and Infrastructure) 2021 (NSW Government, 2021)
- SEPP (Primary Production) 2021 (NSW Government, 2021)
- SEPP (Resilience and Hazards) 2021, Chapter 3 (NSW Government, 2021)
- NSW Department of Planning (1996) EIS Guideline Piggeries (NSW Department of Planning, 1996)
- NSW Government “Planning Guidelines: Intensive Livestock Agriculture Development” (NSW Government, 2019)
- NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027 (NSW Department of Planning, Industry and Environment, 2021)
- Hilltops Local Environmental Plan (LEP) (Hilltops Council, 2022)
- Young Development Control Plan (DCP) (2011)
- Hilltops Community Strategic Plan 2030 (Hilltops Council, ND)
- Hilltops 2040: Hilltops Council Local Strategic Planning Statement (LSPS) 2020-2040 (Hilltops Council, 2020)
- Section 7.11 Plans under the Environmental Planning and Assessment Act (1979) Section 94 Developer Contributions Plans (Young Shire Council, 2016)

Environmental Planning and Assessment Act 1997

The objects of the Environmental Planning and Assessment Act 1997 are:

- a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State’s natural and other resources,
- b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,
- c) to promote the orderly and economic use and development of land,
- d) to promote the delivery and maintenance of affordable housing,

- e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,
- f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),
- g) to promote good design and amenity of the built environment,
- h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,
- i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,
- j) to provide increased opportunity for community participation in environmental planning and assessment.

This EIS demonstrates that the proposed piggery development satisfies all of these objectives.

Environmental Planning and Assessment Regulation 2021

Schedule 3 of the Environmental Planning and Assessment Regulation 2021 identifies that piggeries are designated development if they:

- 1) accommodate more than 2,000 pigs or 200 breeding sows or:
- 2) accommodate more than 200 pigs or 20 breeding sows and are located:
 - (i) within 100 metres of a natural waterbody or wetland, or
 - (ii) in an area of high water table, highly permeable soils or acid sulphate, sodic or saline soils, or
 - (iii) on land that slopes at more than 6 degrees to the horizontal, or
 - (iv) within a drinking water catchment, or
 - (v) on a floodplain, or
 - (vi) within 5 kilometres of a residential zone and, in the opinion of the consent authority, considering topography and local meteorological conditions, is likely to significantly affect the amenity of the neighbourhood by reason of noise, odour, dust, traffic or waste.

This proposal represents designated development since it will accommodate more than 2000 pigs or 200 breeding sows. An EIS must therefore be submitted with a development application.

Protection of the Environment Operations Act 1997

The Objects of the Protection of the Environment Operations Act 1997 are as follows:

- a) to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development,
- b) to provide increased opportunities for public involvement and participation in environment protection,
- c) to ensure that the community has access to relevant and meaningful information about pollution,
- d) to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote the following:
 - (i) pollution prevention and cleaner production,
 - (ii) the reduction to harmless levels of the discharge of substances likely to cause harm to the environment,
 - (iii) the elimination of harmful wastes,
 - (iv) the reduction in the use of materials and the re-use, recovery or recycling of materials,

- (v) the making of progressive environmental improvements, including the reduction of pollution at source,
- (vi) the monitoring and reporting of environmental quality on a regular basis,
- e) to rationalise, simplify and strengthen the regulatory framework for environment protection,
- f) to improve the efficiency of administration of the environment protection legislation,
- g) to assist in the achievement of the objectives of the *Waste Avoidance and Resource Recovery Act 2001*.

The purpose of this EIS is to ensure this proposal satisfies the objects of the Act.

Schedule 1, which covers EPA-licensed activities, includes piggeries that are intended to accommodate more than 2,000 pigs or 200 breeding sows. It therefore applies to this proposal.

Protection of the Environment Operations (General) Regulation 2022

The Protection of the Environment Operations (General) Regulation NSW (2022) sets out licencing fees and regulatory requirements.

SEPP (Biodiversity and Conservation) 2021

Chapter 3 of this SEPP is entitled “koala habitat protection. It aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

- a. by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and
- b. by encouraging the identification of areas of core koala habitat, and
- c. by encouraging the inclusion of areas of core koala habitat in environment protection zones.

The subject site is zoned RU1, and the Hilltops LGA is listed in Schedule 2 of the SEPP. Consequently, the provisions of Chapter 3 of the SEPPBC 2021 apply. The subject property is not mapped by the koala habitat map or the koala management plan map. No koala records occur within the 10 km of the site. As the Biodiversity Assessment Report provided Appendix G explains, the subject land does not constitute potential Koala habitat as tree species listed in Schedule 1 of the SEPP do not constitute at least 15% of the total number of trees in the upper or lower strata of the treed area. Potential impacts to the Koala have been additionally assessed under the BC and EPBC Act.

SEPP (Transport and Infrastructure) 2021

The aim of the infrastructure chapter of SEPP (Transport and Infrastructure) is to facilitate the effective delivery of infrastructure across the State by:

- a. improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services, and
- b. providing greater flexibility in the location of infrastructure and service facilities, and
- c. allowing for the efficient development, redevelopment or disposal of surplus government owned land, and
- d. identifying the environmental assessment category into which different types of infrastructure and services development fall (including identifying certain development of minimal environmental impact as exempt development), and

- e. identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development,
- f. providing for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing, and
- g. providing opportunities for infrastructure to demonstrate good design outcomes.

This proposal does not pertain to public infrastructure.

SEPP (Primary Production) 2021

In relation to primary production and rural development, SEPP (Primary Production) 2021 aims:

- a. to facilitate the orderly economic use and development of lands for primary production,
- b. to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,
- c. to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,
- d. to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts,
- e. to encourage sustainable agriculture, including sustainable aquaculture,
- f. to require consideration of the effects of all proposed development in the State on oyster aquaculture,
- g. to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.

SEPP (Resilience and Hazards) 2021

Chapter 3 of the SEPP (Resilience and Hazards) 2021 aims:

- a. to amend the definitions of hazardous and offensive industries where used in environmental planning instruments, and
- b. to render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the ground that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in this Chapter, and
- c. to require development consent for hazardous or offensive development proposed to be carried out in the Western Division, and
- d. to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account, and
- e. to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact, and
- f. to require the advertising of applications to carry out any such development.

In this Chapter, potentially hazardous industry means a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example,

isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality—

- a. to human health, life or property, or
- b. to the biophysical environment,

While the pig farm has the potential to be offensive due to the possibility of odour nuisance if no controls were in place, the proposed development will not be offensive industry as this EIS demonstrates that the proposed controls will prevent emissions from resulting in a significant level of offence.

EIS Guideline: Piggeries

The NSW Department of Planning (1996) EIS Guideline Piggeries (NSW Department of Planning, 1996) sets out the format and information for inclusion in an EIS for a piggery. It has been used to structure this EIS.

Planning Guidelines: Intensive Livestock Agriculture Development

The “Planning Guidelines: Intensive Livestock Agriculture Development” (NSW Government, 2019) includes key guidance for preparing a development application for a piggery. These have been considered in preparing this EIS.

Waste Classification Guidelines 2014

The purpose of these guidelines is to assist readers to classify their wastes.

The very small quantities of sharps and clinical wastes produce through veterinary and husbandry procedures are special wastes. Construction wastes are pre-classified wastes. Effluent fits under liquid wastes. Mortalities compost, SEPS solids and spent bedding are general solid waste (putrescible).

Hilltops Local Environment Plan

The Hilltops LEP sets out the local environmental requirements. This section of this EIS addresses the LEP requirements as they pertain to the piggery site and the surrounding farm.

Based on mapping from the NSW Planning Portal, some surface waters reasonably close to the piggery are considered sensitive; see Figure 26.

Clause 6.4 of the Hilltops Local Environment Plan (LEP) relates to riparian land and watercourses. The objective of this clause is to maintain the hydrological functions of riparian land, waterways and aquifers, including by protecting:

- a. water quality,
- b. natural water flows and
- c. the stability of the bed and banks of waterways and groundwater systems.

In deciding whether to grant development consent for development on land to which this clause applies, the consent authority must consider:

- a) whether or not the development is likely to have an adverse impact on:
 - (i) the water quality and flows within the watercourse,

- (ii) aquatic and riparian species, habitats and ecosystems of the watercourse,
- (iii) the stability of the bed and banks of the watercourse,
- (iv) the free passage of fish and other aquatic organisms within or along the watercourse,
- (v) any future rehabilitation of the watercourse and riparian area, and
- b) whether or not the development is likely to increase water extraction from the watercourse, and
- c) appropriate measures to avoid, minimise or mitigate the effects of the development.

Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

- a. the development is designed, sited and will be managed to avoid any adverse environmental impact, or
- b. if a significant adverse environmental impact cannot be reasonably avoided by adopting feasible alternatives – the development is designed, sited and will be managed to minimise the impact, or
- c. if a significant adverse environmental impact cannot be minimised – the development will be managed to mitigate the impact.

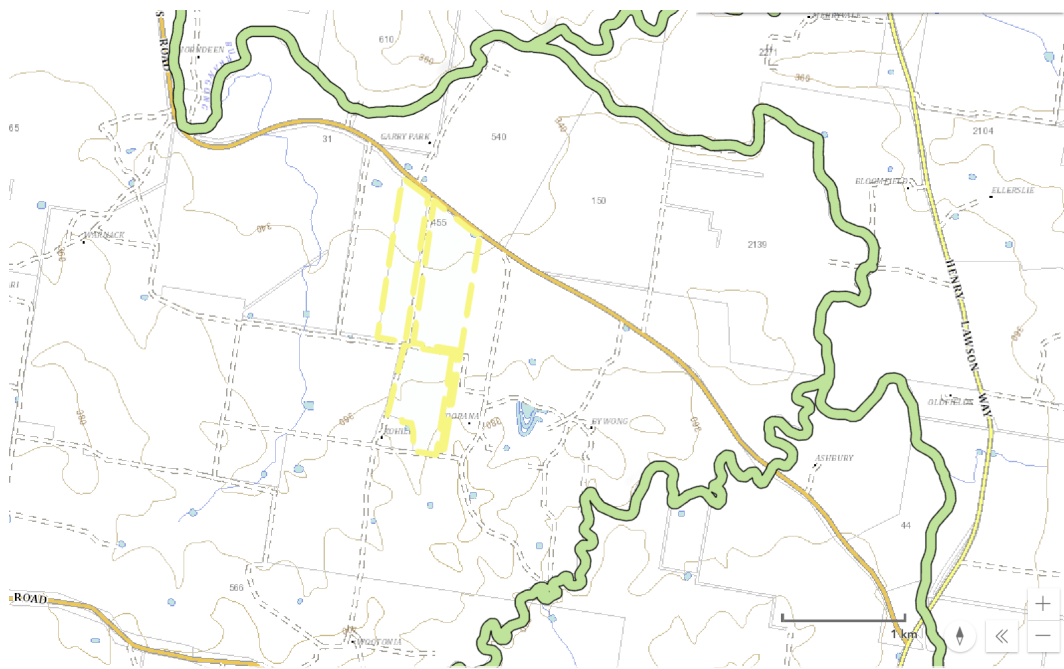
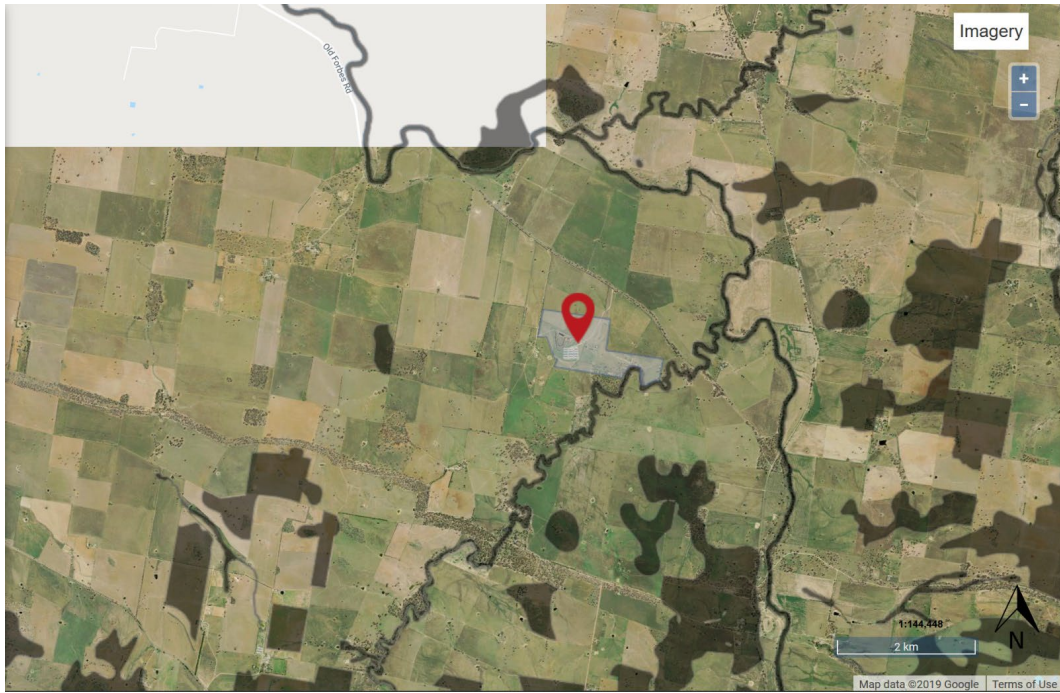


Figure 26 – Natural Resources Sensitivity - Water

Also from the NSW Planning Portal, there are areas of high biodiversity on the farm and close to it. These areas are consistent with the mapping in the Hilltops LEP. Mostly these areas are associated with waterways or road reserves (Figure 27). The strip of trees along the stock route to the south of the property is also considered bushfire prone (Figure 28). This area is over 2.5 km from the proposed site.

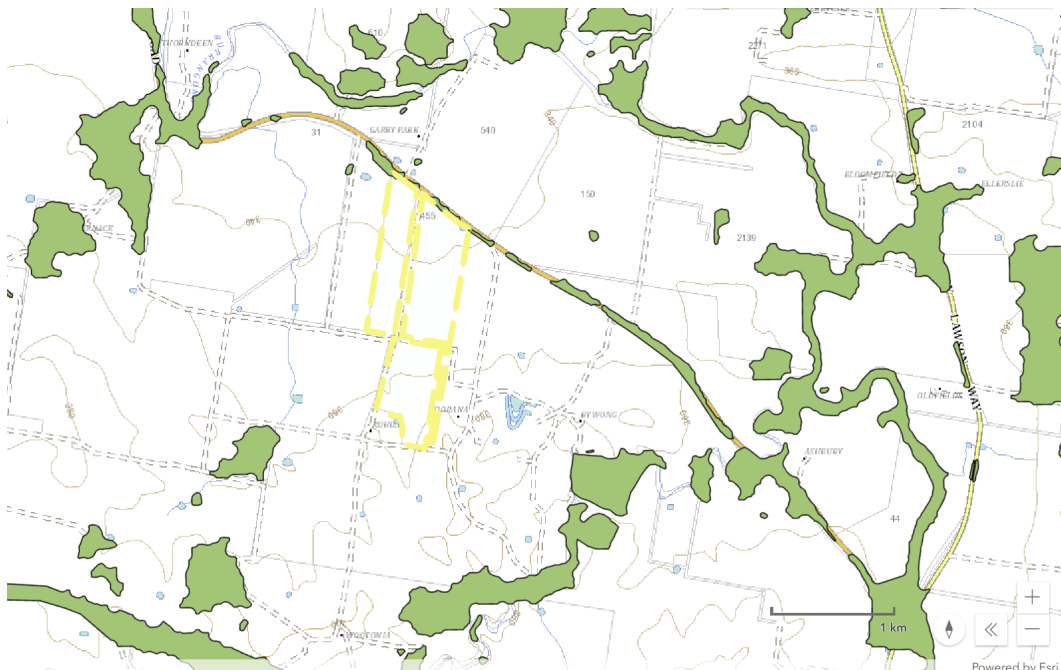
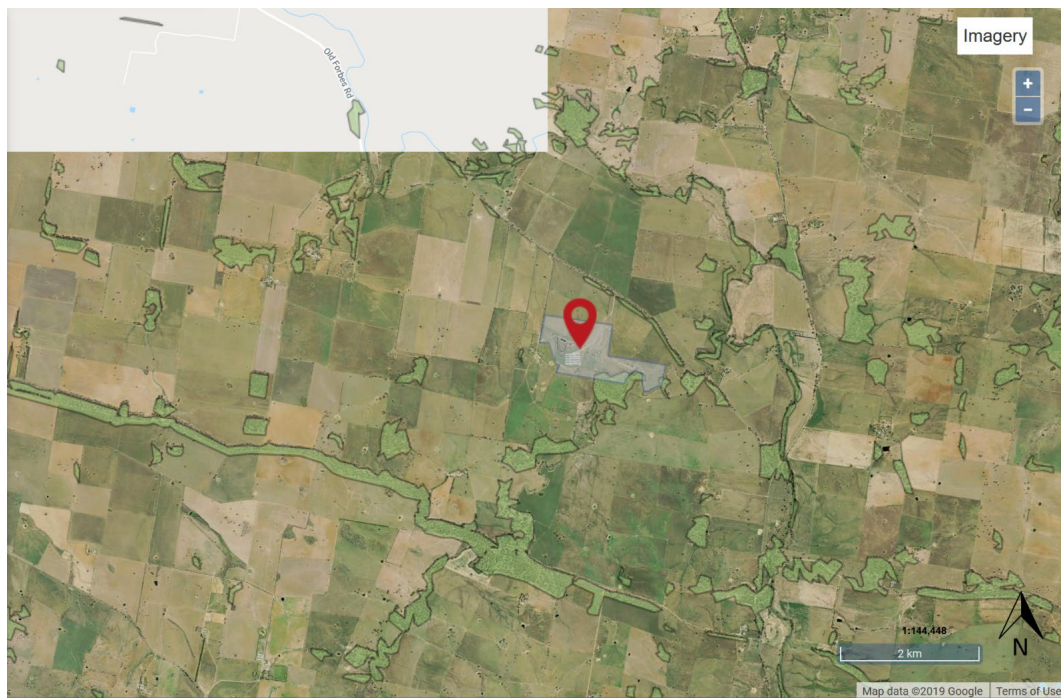


Figure 27 – Areas of High Biodiversity Value



Your search result

You have conducted a search of the online bush fire prone land tool for the land in the map above. This search result is valid for the date the search was conducted. If you have any questions about the Bush Fire Prone Land Tool please contact bushfireprone.mapping@rfs.nsw.gov.au

The parcel of land selected is not identified as bush fire prone however you could still be affected by a bush fire.

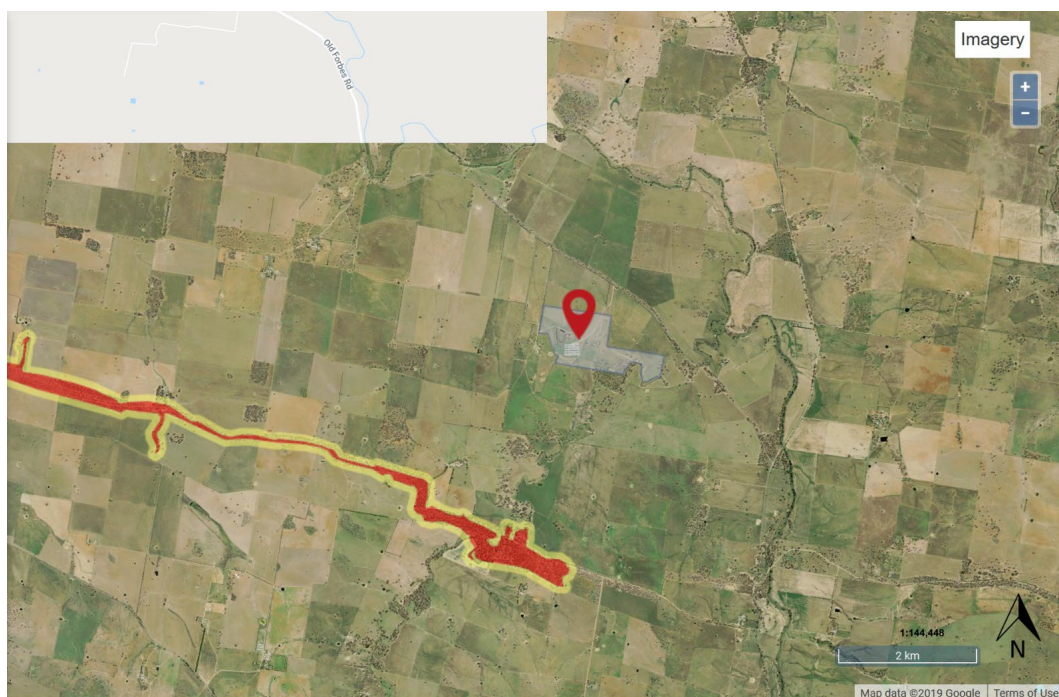


Figure 28 – Bushfire Prone Land

Clause 6.3 of the Hilltops LEP applies to terrestrial biodiversity. The objective of this clause is to maintain and enhance terrestrial biodiversity, by:

- a. protecting native fauna and flora, and
- b. protecting the ecological processes necessary for their continued existence, and
- c. encouraging the conservation and recovery of native fauna and flora and their habitats.

In deciding whether to grant development consent for development of land to which this clause applies, the consent authority must consider:

- a. whether the development is likely to have:
 - (i) an adverse impact on the habitat, condition, ecological value and significance of threatened species, populations or ecological communities on the land, and
 - (ii) an adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and
 - (iii) the potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and
 - (iv) an adverse impact on a regionally significant species of fauna and flora, or habitat, and
 - (v) an adverse impact on the habitat elements providing connectivity on the land, and
- b. appropriate measures to avoid, minimise or mitigate the impacts of the development.

Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

- a. the development is designed, sited and will be managed to avoid an adverse environmental impact, or
- b. if a significant adverse environmental impact cannot be reasonably avoided by adopting feasible alternatives - the development is designed, sited and will be managed to minimise the impact, or
- c. if a significant adverse environmental impact cannot be minimised - the development will be managed to mitigate that impact.

There are no heritage areas on the property, or the immediately surrounding area. Figure 29 shows the mapping from the NSW Planning Portal.

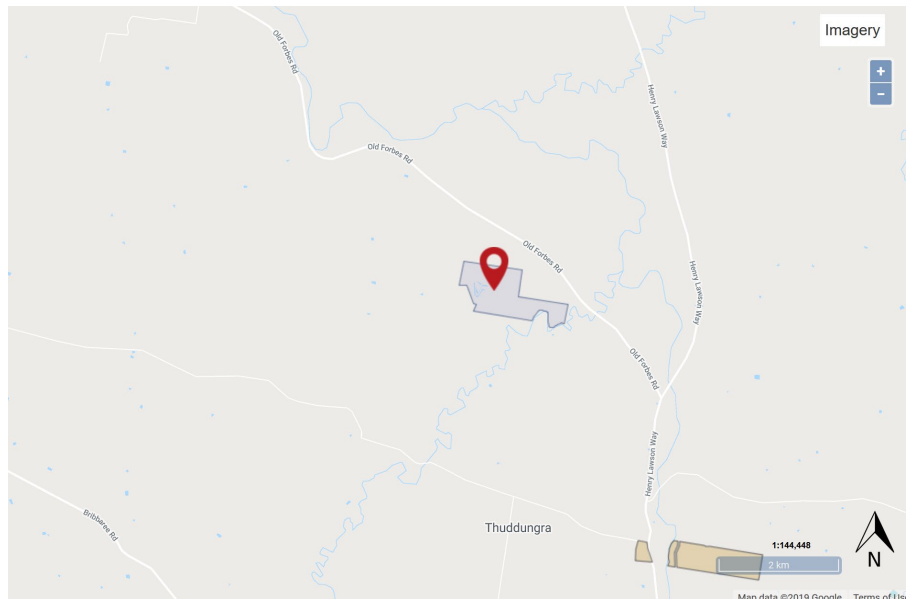


Figure 29 – Heritage Areas

There are no land acquisition reservation or heritage areas on the subject property or immediate surrounds.

Clause 5.18 of the Hilltops LEP is entitled “Intensive livestock agriculture”. The objectives of this clause are:

- a. to ensure appropriate environmental assessment of development for the purpose of intensive livestock agriculture that is permitted with consent under this Plan, and
- b. to provide for certain capacity thresholds below which development consent is not required for that development subject to certain restrictions as to location.

In determining whether or not to grant development consent under this Plan to development for the purpose of intensive livestock agriculture, the consent authority must take the following into consideration:

- a. the adequacy of the information provided in the statement of environmental effects or (if the development is designated development) the environmental impact statement accompanying the development application,
- b. the potential for odours to adversely impact on the amenity of residences or other land uses within the vicinity of the site,
- c. the potential for the pollution of surface water and ground water,
- d. the potential for the degradation of soils,
- e. the measures proposed to mitigate any potential adverse impacts,
- f. the suitability of the site in the circumstances,
- g. whether the applicant has indicated an intention to comply with relevant industry codes of practice for the health and welfare of animals,
- h. the consistency of the proposal with, and any reasons for departing from, the environmental planning and assessment aspects of any guidelines for the establishment and operation of relevant types of intensive livestock agriculture published, and made

available to the consent authority, by the Department of Primary Industries (within the Department of Industry) and approved by the Planning Secretary.

There are some provisions for small pig farms that don't apply here.

Young Development Control Plan

The objectives of the Young Shire DCP are:

- a. to provide detailed provision for regulating development;
- b. to protect and improve the environment;
- c. to protect and improve amenity and design of development;
- d. to conserve, protect and enhance environmental heritage;
- e. to encourage a diversity of housing to meet the needs of the residents; and
- f. to facilitate development that is environmentally sustainable.

Table 2.1 of the 2.1 identifies that piggeries must provide minimum buffers to a rural dwelling of 500 m from housing and waste storage and 250 m from waste utilisation areas.

Section 1.3 is entitled DA Notification Policy. Section 1.3.4 Notification – Advertised Development states that notification will be given in a local newspaper on at least two occasions for intensive livestock keeping.

Appendix A – Applicable State Environmental Planning Policy notes that SEPP 30 Intensive Agriculture (NSW Government, 2009) applies. This SEPP was repealed and replaced with SEPP (Primary Production and Rural Development) (NSW Government, 2019) which was in turn replaced with SEPP (Primary Production) (NSW Government, 2021).

This EIS demonstrates that the requirements of the DCP will be satisfied.

Hilltops Community Strategic Plan 2030

This is a high level strategic plan. Its vision is that “In 2030 the Hilltops is a thriving region offering a relaxed country lifestyle and diverse economy. We value and protect our friendly community spirit, pristine natural environment, and deep cultural heritage. There are strong connections between our community, environment, economy, infrastructure and Council, making the Hilltops region a vibrant place to live, work, invest and visit for all.”

The plan includes objectives and strategies based around five Wellbeing Pillars identified by the community:

1. Community – Loving where we live,
2. Nurturing our natural environment,
3. Building a strong and robust regional economy,
4. Strengthening the region's connectivity and maintenance of assets and infrastructure, and
5. Ethical, proactive and effective leadership and governance.

The outcome of nurturing our natural environment is “we are custodians of our natural environment and landscapes and will protect and improve it for future generations”. The pillar has three objectives, each with various strategies:

1. Maintain the environmental integrity of the region,
2. Protect and rehabilitate our native habitat and natural resources, and
3. The Hilltops communities maximise renewables and affordable energy resources.

In terms of maintaining the environmental integrity of the region, the proposed piggery development will:

- operate in a way that enhances and protects biodiversity in balance with other considerations. This will be done by using sustainable effluent and manure reuse practices and providing suitable buffers to sensitive biodiversity.
- effectively manage waste streams to maximise reuse.
- implement weed management strategies.
- maintain and enhance the health of waterways by using sustainable reuse practices and providing suitable buffers.
- adopt sustainable farming practices that meet environmental best practice.

The outcome of building a strong and robust regional economy is “Hilltops is a connected and growing region, with both the local society and economy driven by a culture of innovation and collaboration, capitalising on our agricultural strength.” One of the objectives of the pillar is “an agricultural region of excellence in innovation, technology & high quality local produce”. The proposed piggery development is consistent with the strategy to promote diversification of the agriculture sector to increase innovation and adaption. It is also consistent with the strategy to support the development of sustainable agriculture that protects the environment, public health, human communities and animal welfare.

Hilltops 2040: Hilltops Council Local Strategic Planning Statement (LSPS) 2020-2040

Hilltops 2040 provides the strategic direction as to how, what and where infrastructure and land use will be allocated, planned and managed to achieve the objectives of the communities within the shire. It adopts the vision and the five Wellbeing Pillars identified in the Hilltops Community Strategic Plan 2030.

Hilltops 2040 identifies a range of activities that need to occur for Hilltops communities to be sustainable and grow. Among these is recognition and support for the capacity of Hilltops to accommodate intensive agriculture activities and food processing. The proposed piggery development fits with this activity.

Hilltops 2040 notes that rural production lands dominate the shire and have a huge impact on the local economy. It is in fact essential to sustain the capacity of these lands to support sustainable and productive agricultural activities and mining. Hilltops 2040 identifies that the rural landscapes have seen a significant increase in the number of intensive agricultural activities, such as pig and poultry farms, and has the capacity to support a further increase in the number and size of these activities along with other value adding industries. However, it emphasises the need to consider topography, water catchments, soil types, indigenous values, natural conservation values and the amenity and quality of life in Hilltops towns and villages. The purpose of this EIS is to demonstrate that the proposed piggery expansion will operate in harmony with the environment and the local community.

Section 7.11 Plans under the Environmental Planning and Assessment Act (1979)

The relevant plan is Section 94a Developer Contributions Plans (Young Shire Council, 2016) (section 94 plans are now called section 7.11 plans).

The Section 94a Contributions Plan addresses the public facilities and amenities that will be required to meet the needs of the incoming population of Young.

The purposes of this contributions plan are:

- to authorise the imposition of a condition on certain development consents and complying development certificates requiring the payment of a contribution pursuant to section 94A of the *Environment Planning and Assessment Act 1979*;
- to assist the Council to provide the appropriate public facilities which are required to maintain and enhance amenity and service delivery within the area; and
- to identify publicly the purposes for which the levies are required.

3.1.3. C.1.c Compatibility with Existing and Potential Land Uses

Appraisal of the proposal suggests that the site is well suited to the proposed purpose. All of the land surrounding the piggery and reuse areas is zoned RU1 and used for cropping and grazing. The site itself has been the site of a grower piggery for many years. The proposed development is an allowable use in the zone and will not restrict the use of surrounding land for agricultural purposes, except perhaps if someone wanted to operate their own intensive livestock facility close to the proposed development. It is intended that grain and straw will be sourced from surrounding land owners and others in the district, and there may be opportunities for nearby farmers to access SEPS solids or spent bedding for use as cropping system inputs. Separation distances need to be provided between piggeries and nearby houses and other sensitive land uses to minimise the risk of odour, dust and noise nuisance. The adequacy of the available separation distance to nearby houses is dealt with in section 5.2.2.

Land use conflicts can arise when one land user is thought to impinge on the rights, values and amenity of another. Most rural land use conflicts pertain to amenity (e.g. odour, dust, noise, visual amenity), but environmental concerns also arise. A land use conflict risk assessment (LUCRA) can help to identify and address potential land use conflicts before a new land use proceeds, objectively assess the effects of a proposed land use on neighbours, increase understanding of potential land use conflicts and recommend strategies to help minimise the potential for land use conflicts and contribute to the development and implementation of separation strategies. NSW Department of Primary Industries has developed a “Land Use Conflict Risk Assessment Guide” (NSW Department of Primary Industries, 2011) that has been used to inform the following LUCRA.

The four key steps in a LUCRA are:

1. gather information about proposed land use change and associated activities
2. evaluate the risk level of each activity
3. identify risk reduction management strategies
4. record LUCRA results.

This EIS provides detailed information about the proposed land use change and the associated reuse activities. The amenity and environmental risks are assessed in section 4. Risk reduction strategies

are incorporated throughout section 2, but particularly in the mitigation strategies included throughout section 5. It effectively includes all elements of a LUCRA.

3.1.4. C.1 d Urban Expansion, Rural Residential Development, Recreation, Tourism or Community Facilities

Urban expansion and rural residential development are most unlikely to ever become an issue since the subject property and surrounding land is all zoned RU1 and is productive cropping and grazing country. The zoning, particularly the minimum sub-division lot size, would be a barrier to rural residential development. The proponents are not aware of any plans for diversification of any land close to the proposed piggery development for recreational or tourism uses.

3.1.5. C.1.e Heritage Items for Environmental Protection

The Hilltops LEP does not identify any heritage areas on the pig farm or immediately adjoining land (refer to section 3.1.2 and Figure 29).

The site has been used for a piggery for many years. The surrounding land has been used for mixed farming for decades and experienced high levels of ground surface disturbance from cropping and farming practices. Nevertheless, items of Aboriginal cultural heritage significance may be present at the site and it is important to identify and protect these. To gather preliminary information about site sensitivity, the Young Local Aboriginal Land Council was invited to undertake an Aboriginal cultural heritage survey. A copy of the Young LALC Aboriginal Cultural Heritage Assessment and Survey Report is provided as Appendix J. The report identified some artefacts. Past Traces Heritage Consultants were subsequently engaged to undertake a due diligence assessment then prepare an Aboriginal Cultural Heritage and Archaeological Report (ACHAR) for the site. The ACHAR is provided as Appendix K.

To determine the impacts of the development a due diligence assessment was undertaken in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (Department of Environment, Climate Change & Water, 2010). This assessment identified five isolated finds, three within the proposed area of works. Consequently, an ACHAR was prepared to determine the extent and significance of potential heritage impacts. This assessment included consultation with the Aboriginal community through the Young LALC participating in the field survey and inviting comments on methodology and report findings from the Registered Aboriginal Parties (RAPs) for the project. This consultation was undertaken to assist the heritage team in assessing the significance of identified heritage sites and to provide guidance in the development of culturally appropriate management strategies. Consultation was undertaken in accordance with the Consultation Guidelines for Proponents NSW (Department of Environment, Climate Change and Water NSW, 2010) with a number of RAPs participating in the project.

The management recommendations for the project are:

- five heritage sites consisting of isolated lithic sites were identified. All of these sites are within the project area or directly adjacent and are at direct risk of impact from the proposed works. Application of an Aboriginal Heritage Impact Permit (AHIP) will be required to allow works to proceed. No impacts can occur to the heritage sites prior to the approval of an AHIP by NSW Heritage.
- due to the low significance attributed to the five identified heritage sites, it is recommended that surface collection be completed prior to works and following the granting on an AHIP.

This salvage will be conducted according to the methodology set out in Section 8.1.1 of Appendix K.

- The collected artefacts will be returned to country. The return to country will be follow the methodology and proposed location described in Section 8.1.2 of Appendix K.
- No areas of Potential Archaeological Deposit are located within the project area. No areas of archaeological sensitivity are present.
- As initially stated in the 2020 Young Local Aboriginal Land Council (LALC) report (Appendix J) and reiterated in the field during the 2024 survey, the Young LALC wish to monitor the initial soil disturbance in the vicinity of the sites. This is not required by legislation but can be undertaken at the proponent's discretion.
- Following granting of AHIP and completion of surface collection, an AHIP compliance works report, including the results of the return to country at completion of works, will be provided to NSW Heritage. A site Impact card with updated details will be submitted to AHIMS for inclusion into the database at completion of works.
- As all Aboriginal objects are protected under the *NSW National Parks and Wildlife Act 1974*, it is an offence to disturb an Aboriginal site without an AHIP. Should any Aboriginal objects be encountered during works outside of the AHIP area, then works will cease and a heritage professional contacted to assess the find. Works may not recommence until cleared by NSW Heritage

It is also recommended that:

- In the highly unlikely event that human remains are discovered during the construction, all work must immediately cease, the police notified and police directions followed. Further assessment would be undertaken to determine if the remains are Aboriginal or non-Aboriginal.
- Ongoing consultation with the RAPs for the project should occur. RAPs should be informed of any major changes in project design or scope, further investigations or finds.

3.2. C.2. SITE AND LOCALITY DESCRIPTION

3.2.1. C.2.a Title Details and Land Tenure

The title deeds are freehold and the piggery site is owned by Windridge Farms Pty Ltd. Title deeds, title searches and plans will accompany the development application.

3.2.2. C.2.b Location of the Proposal

The subject property is situated on the western side of Old Forbes Road, approximately 17 km north of Young. The street address is 345 Old Forbes Road, Kikiamah. The latitude and longitude of the piggery are -34°15'14.15"S and 148°23'10.10" E. Figure 30 shows the location of the property in relation to the nearby town of Young.

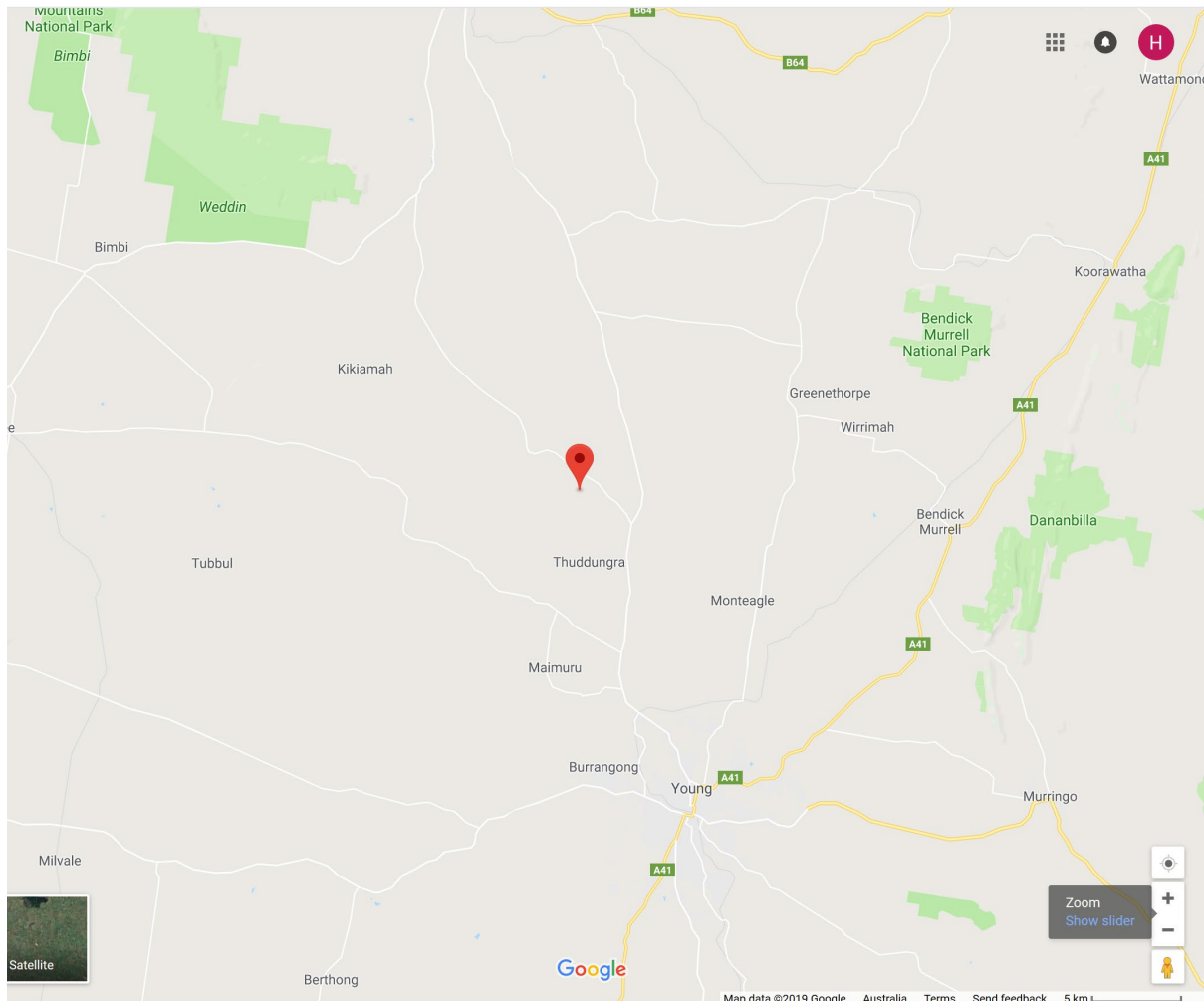


Figure 30 – Location of Property – District Scale

3.2.3. C.2.c Surrounding Roads

Old Forbes Road forms the north and north-eastern boundary of the property. The road is a sealed two-lane road in reasonable condition. The road is greater mass limit (GML) and concessional mass limit (CML) approved (25 m B-double) except on school days between 7:15 AM to 8:00 AM and 4:00 PM to 4:45 PM. It is not higher mass limit (HML) approved (PSA Consulting Australia, 2019). Refer to section 2.4.5 and Appendix I for further details.

3.2.4. C.2 d Drainage Lines, Waterways, Natural and Artificial Waterbodies

The topographic features of the farm and surrounds are shown on Figure 32 which is an extract from the 1:50,000 Bendick Murrell topographic map from <https://maps.six.nsw.gov.au/etopo.html>. Local waterways and drainage lines are shown on Figure 26 and Figure 33.

Koorani sits within the catchment of the Cudgell and Burrangong Creeks catchment. Cudgell Creek is an intermittent but perennial stream that runs alongside the eastern boundary of the property (see Figure 45 and Figure 46). Cudgell Creek flows to the north-east to merge with Burrangong Creek and

unnamed tributaries of Burrangong Creek close to Koorani. As Figure 34, which is taken from the hydrogeological report prepared for the previous EIS (Jewell, 1994) shows, most of the property drains towards Cudgell Creek, while a small area on the eastern side of the property drains towards Burrangong Creek. There are also minor waterways through the property, including one running through the area where the current SEPS are located (see Figure 45 and Figure 46).

As Figure 26 (from the NSW Planning Portal) shows, both Cudgell Creek and Burrangong Creek are considered environmentally sensitive. Burrangong Creek flows to the north drains to the Bland Creek that is a mostly-perennial watercourse that drains into Lake Cowal. These watercourses are part of the Lachlan sub-catchment of the Murrumbidgee catchment within the Murray-Darling Basin. Both the Lachlan and Murrumbidgee Rivers need to be in flood for the Bland Creek to drain into the Murray-Darling Basin.

The water quality and river flow objectives that apply to surface water in the Lachlan River catchment, as taken from <https://www.environment.nsw.gov.au/ieo/Lachlan/caag.htm>, are summarised on Figure 31. Cudgell Creek can be considered an uncontrolled stream.

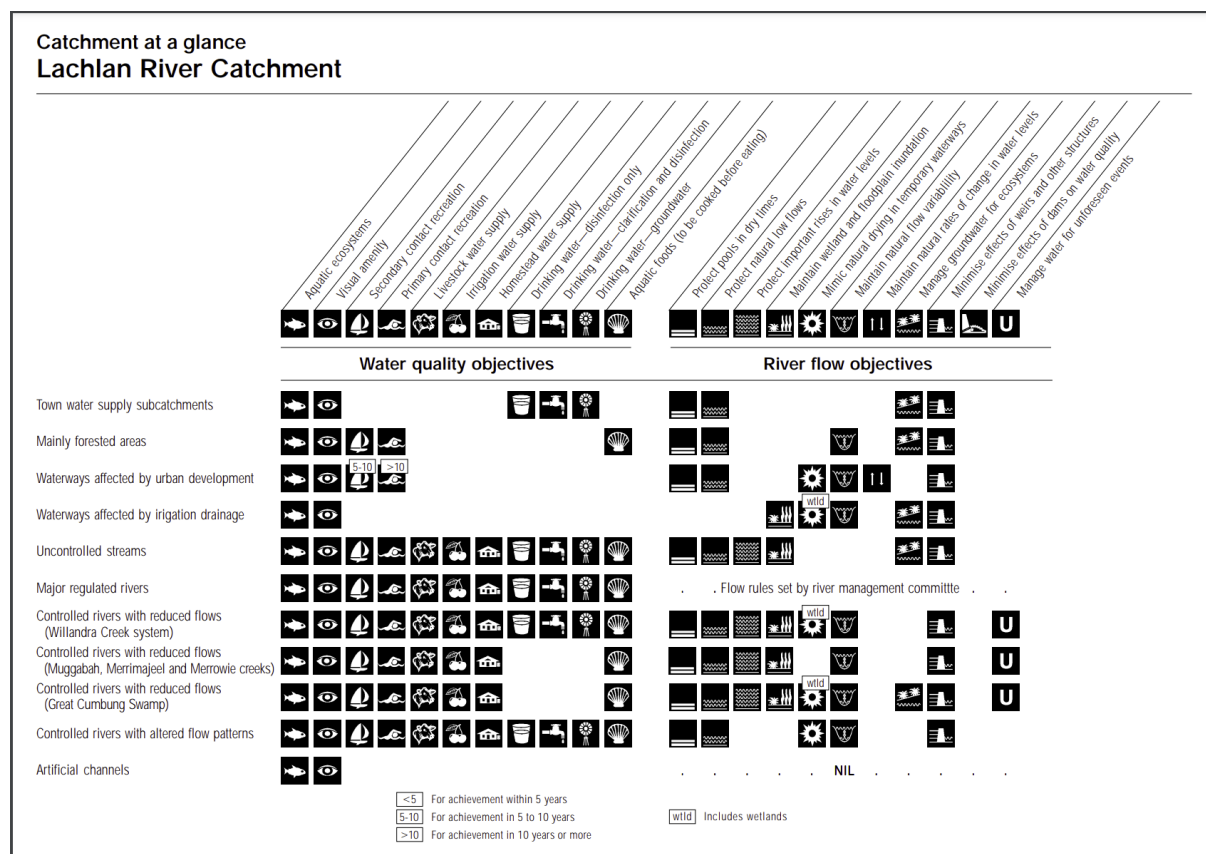


Figure 31 – Lachlan River Water Quality and River Flow Objectives

All 11 water quality objectives apply to uncontrolled streams. These include:

- Aquatic ecosystems: maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term.

Suggested trigger values for water quality indicators for upland rivers include:

- total phosphorus 20 µg/L
- total nitrogen 250 µg/L
- turbidity 2-5 NTU
- EC 30-350 µS/cm
- dissolved oxygen 90-110%
- pH 6.5-8.0
- temperature see ANZECC 2000 guidelines
- chemical contaminants see ANZECC 2000 guidelines, chapter 3.4 and table 3.4.1

- Visual amenity: aesthetic qualities of waters.

Suggested indicators include:

- visual clarity and colour – natural visual clarity should not be reduced by >20%
- natural hue should not be changed by more than 10 points on the Munsell Scale.
- the natural reflectance of the water should not be changed by >50%.
- oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour.
- water should be free from floating debris and litter.
- macrophytes, phytoplankton scums, filamentous algal mats, blue-green algae,
- sewage fungus and leeches should not be present in unsightly amounts.

- Secondary contact recreation: maintaining or improving water quality for activities such as boating or wading, where there is a low probability of water being swallowed.

Suggested indicators include:

- faecal coliforms – median bacterial content of <1,000 faecal coliforms/100 mL, with 4 of 5 samples <4,000/100 mL (min. of 5 samples taken at regular intervals not exceeding one month).
- enterococci – median bacterial count of <230 enterococci/100 mL (max. number in any sample 450-700 organisms/100 mL).
- algae and blue-green algae <15,000 cells/mL
- nuisance organisms – use visual amenity guidelines. Large numbers of midges and aquatic worms are undesirable.
- chemical contaminants – water that contains chemicals that are either toxic or irritating to skin or mucous membranes are unsuitable for recreation.
- toxic substances should not exceed values in tables 5.2.3 or 5.2.4 of the ANZECC 2000 guidelines.
- visual clarity and colour – use visual amenity guidelines.
- surface films – use visual amenity guidelines.

- Primary contact recreation – maintaining or improving water quality for activities such as swimming where there is a high probability of water being swallowed.

Suggested indicators include:

- turbidity – a 200 mm diameter black disc should be able to be sighted horizontally from a distance of >1.6 m (approx. 6 NTU).
 - faecal coliforms - <150 CFU/100 mL for five samples taken at regular intervals not exceeding one month, or the second highest sample contains <600 cfu/100 mL for five samples taken at regular intervals not exceeding one month; OR median over bathing season of <150 faecal coliforms/100 mL, with 4 out of 5 samples <600/100 mL (min. five samples taken at regular samples not exceeding one month).
 - enterococci - the median enterococci density <350 CFU/100 mL for five samples taken at regular intervals not exceeding one month, or the second highest sample contains <100 cfu/100 mL for five samples taken at regular intervals not exceeding one month; OR median over bathing season of <35 enterococci /100 mL (max. number in any sample 60-100 organisms/100 mL).
 - protozoans – pathogenic free-living protozoans should be absent from bodies of fresh water. Note: it is not necessary to analyse water for these pathogens unless temperature >24°C.
 - algae and blue-green algae - <15,000 cells/mL.
 - nuisance organisms – use visual amenity guidelines. Large numbers of midges and aquatic worms are undesirable.
 - pH – 5.0-9.0
 - temperature 15-35°C for prolonged exposure.
 - chemical contaminants – water that contains chemicals that are either toxic or irritating to skin or mucous membranes are unsuitable for recreation.
 - toxic substances should not exceed values in tables 5.2.3 or 5.2.4 of the ANZECC 2000 guidelines.
 - visual clarity and colour – use visual amenity guidelines.
 - surface films – use visual amenity guidelines.
- Livestock water quality – Protecting water quality to maximise the production of healthy livestock.

Suggested indicators include:

- algae and blue-green algae – risk increases when cell counts of microcystins >11,500 cells/mL and / or concentrations of microcystins >2.3 ug/L expressed as microcystin-Lr toxicity equivalents
- salinity – recommended concentrations of TDS in drinking water for livestock are given in table 4.3.1 of ANZECC 2000
- thermotolerant coliforms – drinking water for livestock should contain <100 thermotolerant coliforms / 100 mL (median value)
- chemical contaminants – refer to table 4.3.2 of ANZECC guidelines for heavy metals and metalloids. Refer to Australian Drinking Water Guidelines 2004 for information regarding pesticides and other organic contaminants, using criteria for raw drinking water.

- Irrigation water supply – protecting the quality of waters applied to crops and pastures.

Suggested indicators include:

- algae and blue-green algae – should not be visible. No more than low algal levels are desired to protect irrigation equipment.
- salinity – to assess the salinity and sodicity of water for irrigation use, a number of interactive factors must be considered including irrigation water quality, soil properties, plant salt tolerance, climate, landscape and water and soil management. For more information, refer to chapter 4.2.4 of ANZECC 2000
- thermotolerant coliforms – trigger values for thermotolerant coliforms in irrigation water used for food and no-food crops are provided in table 4.2.2 of ANZECC 2000
- heavy metals and metalloids – long term trigger values (LTV) and short-term trigger values (STV) for heavy metals and metalloids in irrigation water are presented in table 4.2.10 of ANZECC 2000

- Homestead water supply – protecting water quality for domestic use in homesteads, including drinking, cooking and bathing.

Suggested indicators are:

- blue-green algae – recommended twice weekly inspections during danger period for storages with history of algal blooms. No guideline values are set for cyanobacteria in drinking water. In water storages,
 - counts of <1,00 algal cells/mL are of no concern.
 - >500 algal cells/mL – increase monitoring.
 - >2,000 cells/mL – immediate action indicated; seek expert advice.
 - >6,500 cells/mL – seek advice from health authority.
 - turbidity – 5 NTU; <1 NTU desirable for effective disinfection; >1 NTU may shield some microorganisms from disinfection
 - TDS:
 - <500 mg/L is regarded as good quality water based on taste.
 - 500-1,000 mg/L is acceptable based on taste.
 - >1,000 mg/L may be associated with excessive scaling, corrosion and unsatisfactory taste.
 - faecal coliforms – 0 faecal coliforms per 100 mL. If microorganisms are detected in water, advice should be sought from the relevant health authority. See also, the Guidelines for Microbial Quality in Relation to Monitoring, Monitoring Frequency and Assessing Performance in the Australian Drinking Water Guidelines.
 - pH – 6.5-8.5
 - chemical contaminants – see guidelines for Inorganic Chemicals in the Australian Drinking Water Guidelines refer to table 4.3.2 of ANZECC guidelines for heavy metals
- Drinking water – disinfection only, or
 - Drinking water – clarification and disinfection, or
 - Drinking water – Groundwater - refers to the quality of drinking water drawn from the raw surface and groundwater sources before any treatment.

Suggested indicators are:

- blue-green algae – recommended twice weekly inspections during danger period for storages with history of algal blooms. No guideline values are set for cyanobacteria in drinking water.
 - >500 algal cells/mL – increase monitoring.
 - <2,000 cells/mL – water may be used for potable supply.
 - >2,000 cells/mL – immediate action indicated; seek expert advice.
 - >6,500 cells/mL – seek advice from health authority.
 - >15,000 cells/mL – may not be used for potable supply except with full water treatment which incorporates filtration and activated carbon.
 - turbidity – site-specific determinant.
 - EC - <1,500 uS/cm , >800 uS/cm causes a deterioration in taste.
 - faecal coliforms – 0 faecal coliforms per 100 mL.
 - total coliforms – 95% of samples should be 0 coliforms / 100 mL throughout the year.
 - up to 10 coliform organisms may be accepted occasionally in 100 mL. Coliform organisms should not be detected in 100 mL in any two consecutive samples.
 - dissolved oxygen >6.5 mg/L (>80% saturation)
 - pH – 6.5-8.5
 - chemical contaminants – see ANZECC guidelines, section 6.2.2
- Aquatic foods (cooked) – refers to protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquatic activities.

Examples of indicators –

- algae and blue-green algae – no guideline is directly applicable, but toxins present in blue-green algae may accumulate in other aquatic organisms.
 - faecal coliforms – for shellfish: median faecal coliform concentration should not exceed 14 MPN/100 mL; with no more than 10% of samples exceeding 43 MPN/100 mL. For edible tissue: fish for human consumption should not exceed 2.3 MPN *E. coli*/g of flesh with a standard plate count of 100,000 organisms/g.
 - toxicants: metals <5 ug/L, mercury <1ugm/L, zinc <5 ug/L;
 - organochlorides: chlordane <0.004 ug/L (saltwater production), PCBs <2 Ug/L.
 - physico-chemical indicators – suspended solids <40 ug/L (freshwater) ; temperature <2°C change over one hour.
- Industrial water supplies – the high economic value of water taken from rivers and lakes for use by industry needs recognition in water quality planning and management due to its important environmental value. However, industry needs are diverse so relevant water quality criteria are not specified.

The applicable river flow objectives for uncontrolled streams include:

- Protect pools in dry times – protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows.

Measures to achieve objectives:

- there should be no water extraction from streams or wetlands during periods of no flow.
- If conditions on water licences do not provide for this condition to be met, priority should be given to implementing it by actions appropriate to local circumstances.

- Protect natural low flows – protect natural low flows.

Measures to achieve objectives:

- share low flows between the environment and water users and fully protect all very low natural flows.
 - very low flows: flows below the level naturally exceeded on 95% of all days with flow.
 - low flows: flows below the level naturally exceeded on 80% of all days with flow.
- unless environmental, social and economic evaluations give an appropriate alternative, the following limits on water extraction apply:
 - environmental share in high-conservation-value streams: to be all very low flows and most of the low flows. There should be no increase in extraction of low flows.
 - environmental share in other streams: all very low flows and 50-70% of daily low levels.
 - do not allow extraction during low flows below the 80th percentile in any new or transferred licences.
 - in streams with little water use or important conservation values, minimise risks to ecosystems during low flows.
 - review management of town water supplies to assess whether changes may help achieve the objective without significantly affecting reliability.

- Protect important rises in water levels – protect or restore a proportion of moderate flows ('freshest') and high flows.

Measures to achieve objectives:

- unless local information shows appropriate alternative targets, the following limits on extraction are recommended:
 - no extraction of more than 30-50% of moderate to high flows on a daily basis. (This means that, for each stream, the WSP may recommend an appropriate limit on the proportion of flows that may be extracted whenever flows are greater than the level that would naturally be exceeded on 80% of all days with flow. For some streams, this limit may be 30%; for other streams it may be as high as 50%).
 - no increase in extractions in high-conservation streams.

Where use exceeds the above limit, appropriate ways of limiting the volume or controlling the timing of extraction are needed.

- Maintain wetland and floodplain inundation – maintain or restored the natural inundation patterns and distribution of floodwaters supporting natural wetland and floodplain ecosystems.

Measures to achieve objectives:

- WSPs and actions need to include strategies to:
 - maintain, restore or mimic natural inundation and drying patterns in natural and semi-natural wetlands and remaining native floodplain ecosystems.
 - ensure adequate access to native fish to and from floodplain wetlands.
 - flooding patterns should not be altered without proper environmental assessment.
 - property protection issues need to be taken into account.
- Manage groundwater ecosystems – maintain groundwater within natural levels and variability, critical to surface flows and ecosystems.

Measures to achieve objectives:

- implement the State Groundwater Policy
 - identify any streams or ecosystems that may depend on high groundwater levels and assess impacts of reduced recharge or excessive pumping.
 - identify where groundwaters may be rising and likely to threaten ecosystems or surface water quality.
 - determine appropriate action to keep groundwater level changes within acceptable bounds.
- Minimise effects of weirs and other structures – minimise the impacts of in-stream structures.

Measures to achieve objectives:

- implement the NSW Weirs Policy.
- identify and take action to improve fish passage on other structures that impeded the two-way movement of native fish along streams or natural high-flow channels.

On 21st October 2019, Kirstyn Goulding of DPIE Crown Lands advised that Cudgell Creek is a crown waterway on the land adjoining the proposed site and that there were to be no impacts to this waterway. No development close to Cudgell Creek or discharge to this waterway is planned. Nor will water be sourced from Cudgell Creek. The proposed development is not expected to influence surface or groundwater quality or river flow. Nor is it expected to impact aquatic ecosystems. The Biodiversity Assessment Report included as Appendix G identifies that the proposed development is unlikely to significantly impact any threatened aquatic species or populations, assuming suitable mitigations are adopted.

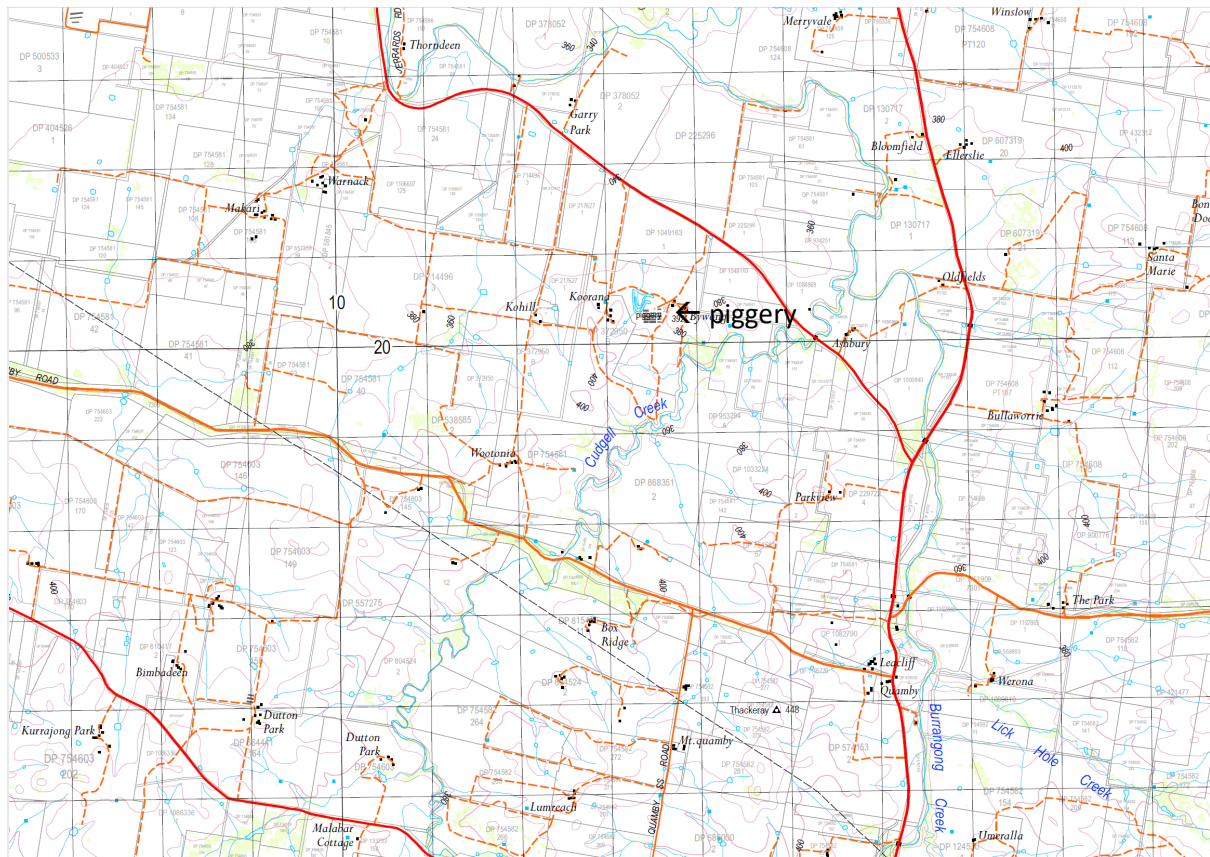


Figure 32 – Extract from Bendick Murrell District Topographic Details

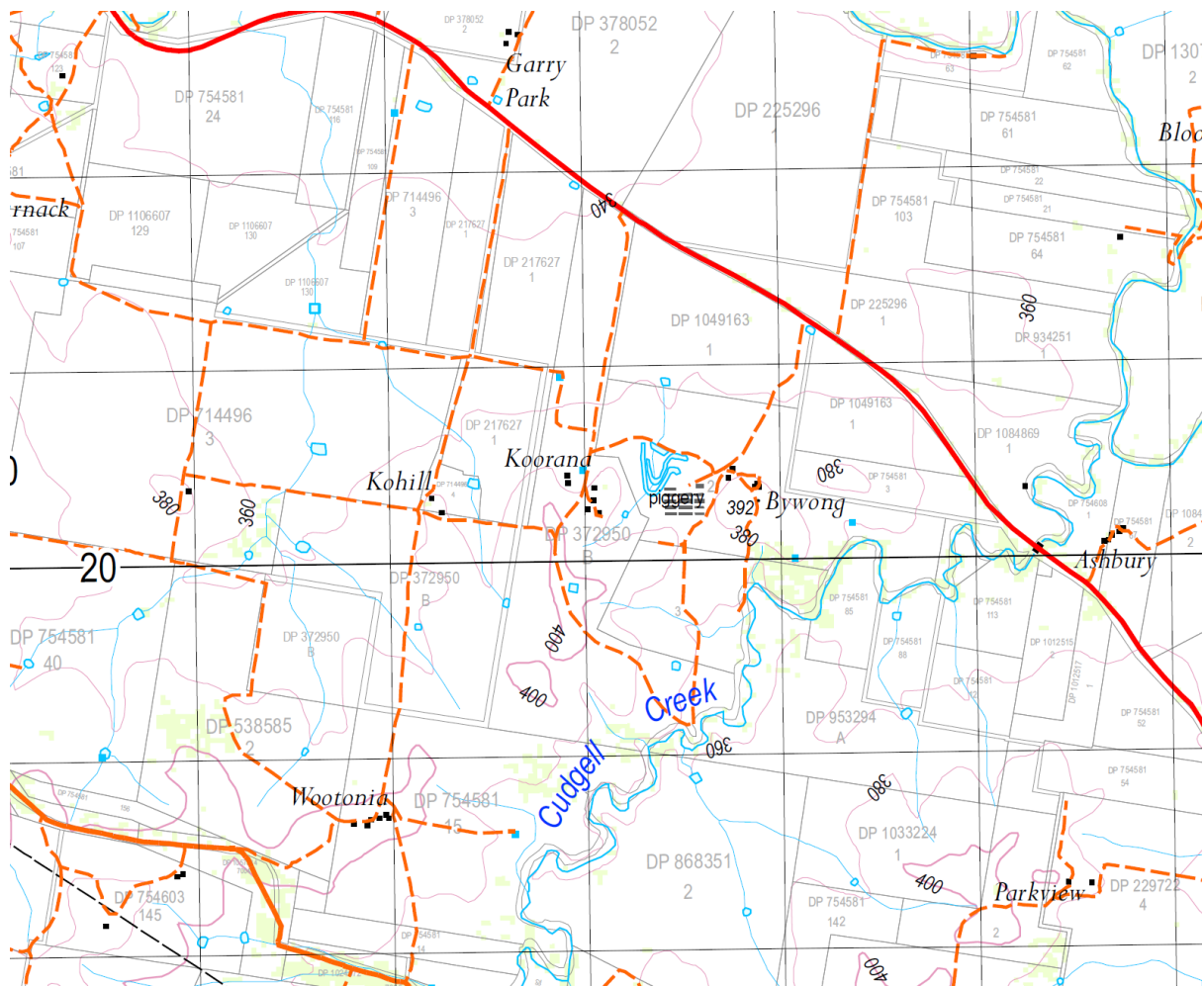


Figure 33 – Local Waterways

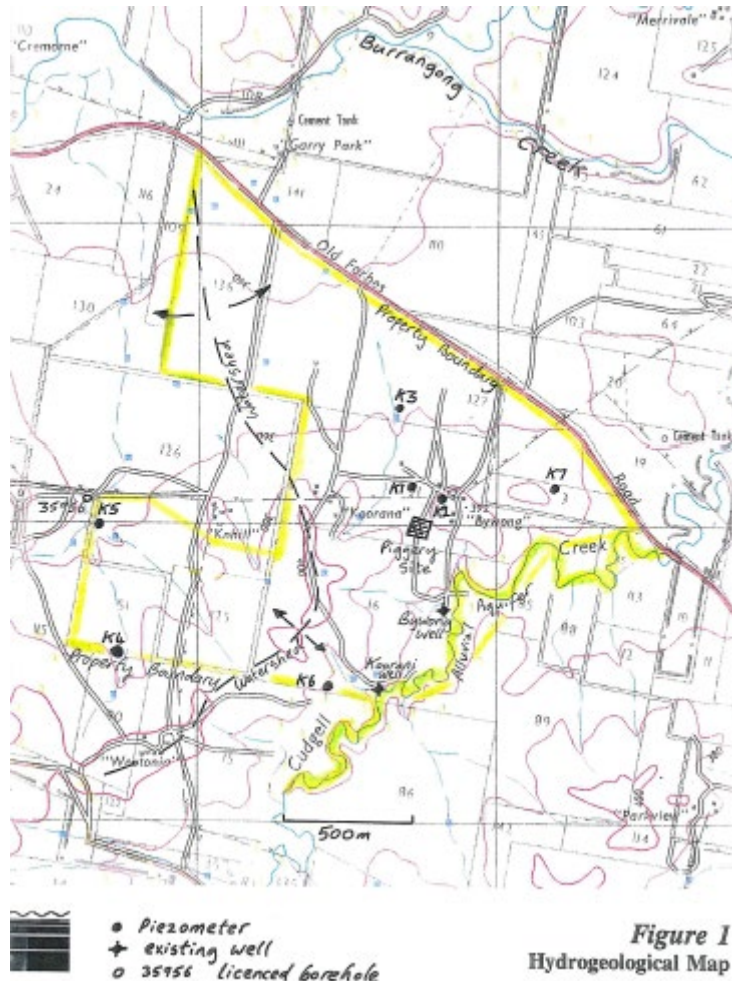


Figure 34 – Watershed and Piezometers

3.2.5. C.2.e Adjoining Communities, Dwellings and Existing Land Uses

The main surrounding land uses include broadacre cropping and grazing.

There are no close towns or rural residential developments. However, there are a number of houses on nearby farms; Figure 35 shows the location of these. The closest residences not owned by one of the owners of Windridge Farms Pty Ltd are house 1, house 2, house 8 and house 5, which will be separated from the expanded piggery by distances of approximately 1,040 m, ~2,000 m, ~2,000 m and ~2,150 m respectively.

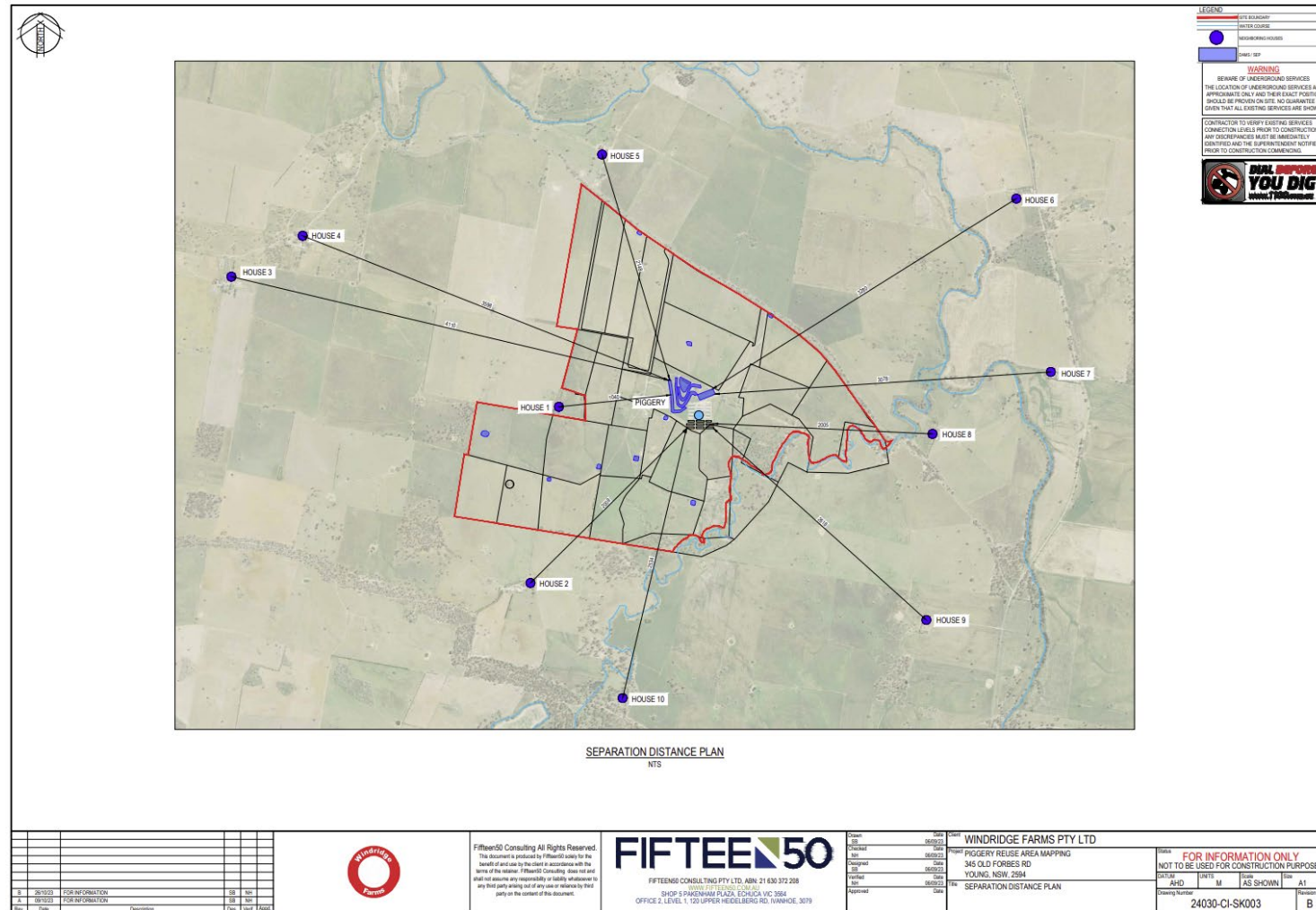


Figure 35 – Nearby Houses

3.2.6. C.2.f Sight Lines from Dwellings or Public Places

The piggery complex is not clearly visible from the road. Nor is it clearly visible from any of the nearby houses. The exterior materials for the sheds will be light, non-reflective colours so as not to cause glare. The terrain (see Figure 48 to Figure 57) and vegetation helps to soften the view in some directions.

Photograph 5, Photograph 6 and Photograph 7 show the view from houses 1, 3 and 5 looking towards the piggery complex. The piggery could not be seen from other houses. The views of the piggery are softened by several rows of established trees and shrubs planted on the western and northern sides of the piggery sheds. Details are provided in section 2.3.5.



Photograph 5 – View from House 1 to Piggery Complex



Photograph 6 – View from House 3 to Piggery Site



Photograph 7 – View from House 5 to Piggery Site

3.2.7. C.2 g Utilities

Three phase mains power is connected to the site and this will provide the primary power source. It is possible that biogas collected from the CAL will be used to generate power in the future. However, this is not part of this proposal.

The main clean water source is groundwater from on-farm bores (see section 2.4.3 and 3.3.1). This water is needed for stock drinking water and cooling water (see Table 25). Sheds and pens are also hosed and cleaned with bore water. Treated effluent is recycled and used to flush underfloor pits to minimise water usage and wastage (see section 2.4.2).

Telephone and internet are connected to the site.

The piggery will utilise existing roads for transport. Traffic routes are described in section 2.4.5. Site access will be via Old Forbes Road. Refer to section 2.4.5 and Appendix I for details.

3.3. C.3 OVERVIEW OF THE AFFECTED ENVIRONMENT

3.3.1. C.3.a Surface Water and Groundwater

There are no major rivers close to Koorani, which sits within the catchment of the Cudgell and Burrangong Creeks. Cudgell Creek is an intermittent but perennial stream that runs alongside the eastern boundary of the property (see Figure 45 and Figure 46). An unnamed, non-perennial waterway passes through the piggery site. This waterway is connected to two farm dams and does not flow into any other watercourses. However, because the proposal includes the dredging and/or remediation of this watercourse, a permit issued by the Minister will be required in accordance with Section 201 of the *Fisheries Management Act 1994*.

Cudgell Creek has relatively saline water, although this fluctuates with rainfall. A study undertaken by CM Jewell & Associates Pty Ltd (Jewell, 1994) for a previous EIS for the Koorani property measured conductivities ranging from 1020 uS/cm to 2500 uS/cm. Cudgell Creek flows to the north-east to merge with Burrangong Creek and unnamed tributaries of Burrangong Creek close to Koorani. As Figure 26 (from the NSW Planning Portal) shows, both Cudgell Creek and Burrangong Creek are considered environmentally sensitive (see section 3.2.4 for more information). Cudgell Creek is recognised as key fish habitat by the Department of Primary Industries (DPI) - Fisheries. It is also associated with protected riparian land. At its closest point, Cudgell Creek occurs ~345 m from the piggery site. Burrangong Creek flows to the north drains to the Bland Creek that is a mostly-perennial watercourse that drains into Lake Cowal. These watercourses are part of the Lachlan sub-catchment of the Murrumbidgee catchment within the Murray-Darling Basin. Both the Lachlan and Murrumbidgee Rivers need to be in flood for the Bland Creek to drain in the Murray-Darling Basin. Because of its elevation, the site of the existing piggery is not subject to flooding.

CM Jewell & Associates Pty Ltd (Jewell, 1994) prepared a report on hydrogeological conditions at the property to support a previous development application. The report identified that the whole site and area are underlain by the Young Granodiorite, which is a fractured rock aquifer. A map provided in the Young Granite Groundwater Source Status Report 2012 (Kumar, 2013) indicates that the property, which is within the Parish of Barramunda, is immediately north of the Young Granite groundwater source and is part of the Lachlan Fold Belt MDB (see Figure 36, taken from (Kumar, 2013)).



Figure 36 – Groundwater Sources

In the Young granodiorite, groundwater would typically be stored and move through faults, cavities, joints and fractures within the rock mass. The extent of water movement depends on the interconnectedness of the more permeable features and their orientation. Weathering, particularly in the heavily fractured and faulted zones, has increased the porosity and the permeability of the granite. Typically, the weathering depth is at about 28 m depth. However, the average depth of irrigation production bores within the Young Granodiorite groundwater source is 79 m suggesting that the water-bearing zone extends to 80 m or more. Recharge of the bores is mainly by infiltration from rainfall and runoff (Kumar, 2013).

The Jewell & Associates report (Jewell, 1994) identified that the Young Granodiorite is usually overlain by a colluvial and deeply weathered residual soil profile that is typically 11 m to >20 m in thickness. Boulder outcrops occur in the vicinity of Cudgell Creek. The pattern of regional drainage is to the north-north-east. Water-bearing fractures are most commonly found in valleys. Aquifers of this type tend to be local rather than regional with higher terrain providing recharge through runoff and infiltration, and valleys providing discharge. In this locality, low-yielding fractured aquifers can be found at depths of 20-80 m.

The Lachlan Fold Belt covers a very large area and water quality varies widely depending on rock type, fracture density, aquifer depth, and climate. Data from NSW Government monitoring bores indicates that groundwater within the Young Granite water source has salinity concentrations ranging from 470-3,200 $\mu\text{S}/\text{cm}$. Sodium and chloride are the dominant cations and anions. Groundwater residence times are expected to be young given the generally low salinity results and relatively higher rainfall of about 650 mm/year (NSW Department of Planning, Industry and Environment, 2019).

No groundwater dependent ecosystems (GDE) have been identified near the piggery site (see Figure 37 taken from (NSW Department of Planning, Industry and Environment, 2019) and Figure 38 reproduced from Appendix G). However, areas with low potential for terrestrial GDE interaction occur to the west and south of the subject site, along with areas with high potential for aquatic GDE interaction (Cudgell Creek). No significant impacts are anticipated to GDEs provided there is adherence to the mitigation measures specified in section 7 of Appendix G.

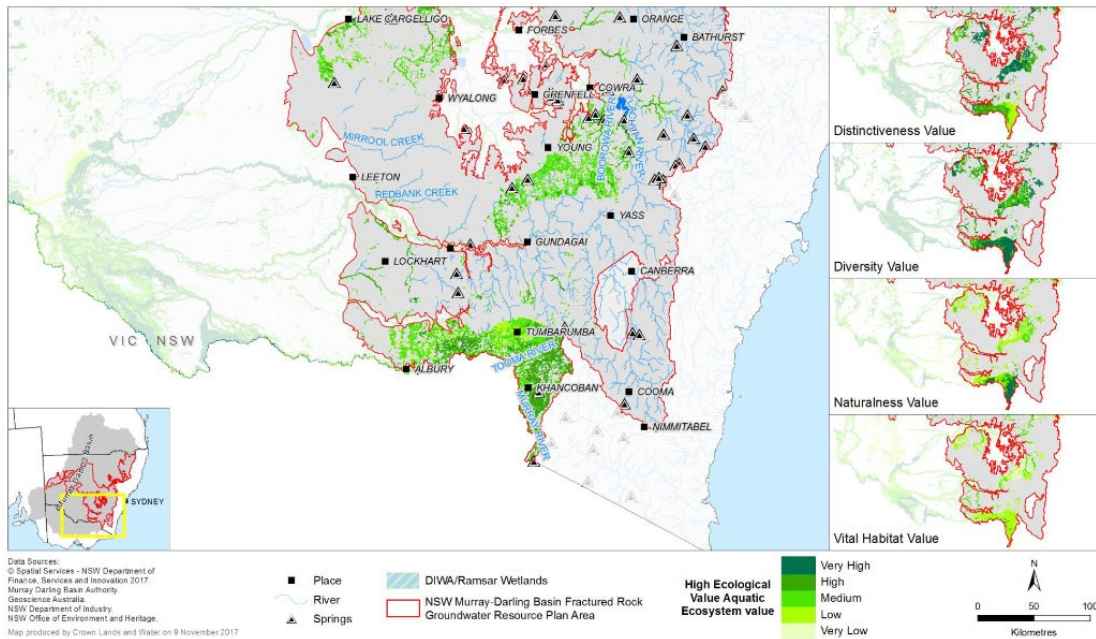


Figure 37 – Groundwater Dependent Ecosystems Ecological Value

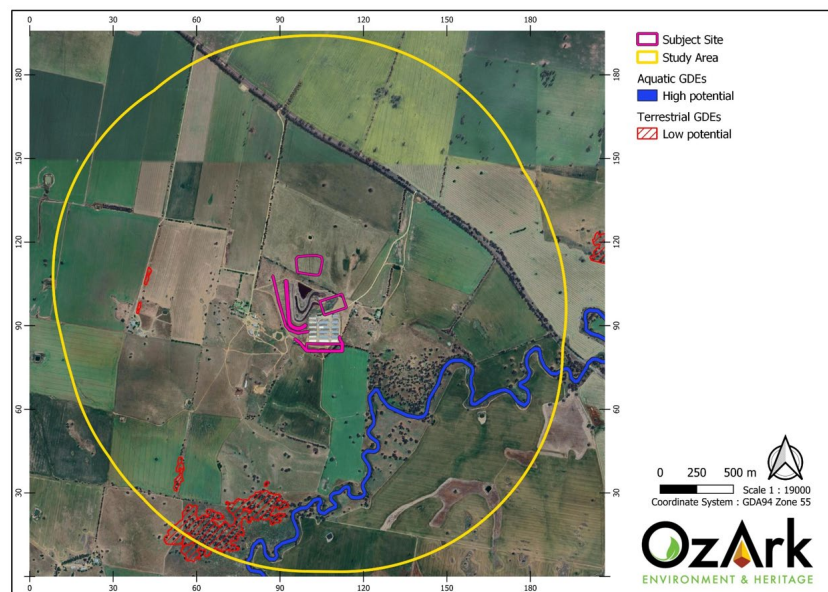


Figure 38 – Groundwater-Dependent Ecosystems at Subject Property

Bore and well data was obtained from the NSW Office of Water groundwater portal. The location of nearby bores and wells is shown on Figure 39. Shallow alluvial wells and bores may be found along Cudgell Creek and other waterways. These aquifers are shallow, unconfined and flows are likely closely related to those of the waterway (Jewell, 1994). The deeper bores tap into the granodiorite. The following data was available for the bores and wells shown on Figure 39:

- GW458844
stock well adjacent to Bulla Creek.
Drillers notes: dug to 6 m depth and cased with concrete
- GW035956, Licence 70WA606993:
Stock bore located on western side of property on Lot B DP372950.
Drilling notes: 0-27.43 m of clay, 27.43-77.72 m decomposed granite with water supply (50.29 m depth), 77.72-99.06 m granite; water bearing zone 70.10 to 77.70 m; standing water level 30.4 m, yield 0.64 L/s; bore cased with threaded steel to 61.5 m, drilled to 99.1 m, final depth 99 m, water depth below ground level at 18/3/2002 9.06 m
- GW0161165, Licence 70WA606641:
Stock and domestic well located on Lot 34, DP754581 adjacent to Cudgell Creek.
Drillers notes: well dug to 6.1 m, cased with concrete cylinder, 0-6.1 m of black light soil, 6.1-6.1 m soft granite
- GW019158, Licence 70WA606642:
Stock well dug to 27.40 m on Lot 34, DP754581
Drilling notes: final depth 27.4 m. Timber, brick casing.
- GW700011, Licence 70WA609923:
Stock, domestic and industrial bore on Koorani located adjacent to Cudgell Creek on Lot B 372950
Drilling notes: 0-0.2 m of topsoil, 0.2-12 m (11.8 m depth) of dry clay, 12-16.5 m (4.5 m depth) of damp clay, 16.5-32 m (15.5 m depth) sands, 32-35 m weathered granite (3.5 m depth).
bore drilled to 35 m, water bearing zone 21-33 m (12 m depth), standing water level of 4 m, yield of 2.375 m/s. Bore cased with steel -0.4-30 m, vertical slots 21-33 m and steel 27-33 m.
- GW703068
Stock, domestic and industrial bore on Koorani located adjacent to Cudgell Creek on Lot B 372950
Drilling notes: 0-3 m of brown loamy topsoil, 3-16 m (13 m depth) of multi-coloured clay, 16-20 m (4 m depth) clay bound sand, 20-33.5 m (13.5 m depth) brown sand some a bit clayed, 33.5-33.5 m into hard rock.
bore drilled to 33.5 m, water bearing zone 22-33.5 m (11.5 m depth), standing water level of 5 m, Bore cased with PVC Class 12 0-27 m, slots 22-27 m, screen wedge wire 27-30 m and PVC Class 12 30-33.5 m

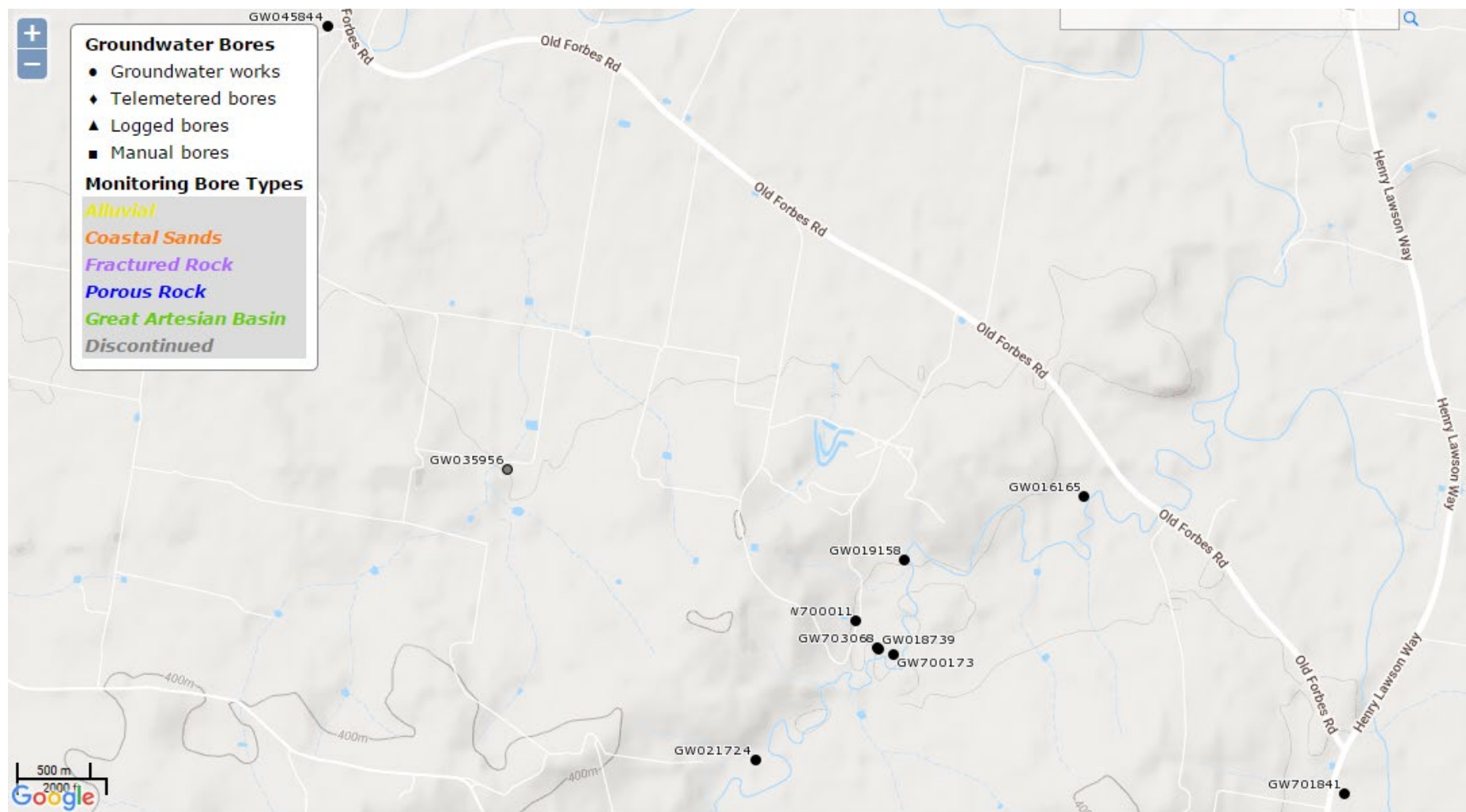


Figure 39 – Location of Groundwater Bores in the Vicinity of the Property

- GW018739, Licence 70WA606426:
Stock well located on Lot B, DP362950 adjacent to Cudgell Creek.
Drillers notes: well dug to 3.7 m, water bearing zone from 1.2-2.4 m, cased with concrete cylinder
- GW700173
Stock and domestic bore abandoned. Located adjacent to Cudgell Creek.
Drillers notes: bore drilled to 53 m, water bearing from 6-12 m and 28.8-29 m, cased with steel from -0.3 m-12 m with vertical slots from 6-12 m
- GW701841
Stock bore located on Lot 4, DP229722
Drilling notes: 0-5 m topsoil (5 m depth), 5-6 m grey and brown clay (1 m depth), 6-16 m (10 m) sand, 16-26 m (10 m depth) weathered granite and 26-30 m quartz gravel (4 m depth).
Bore is 30 m deep and case from -0.13 m to 40 m depth with slots from 20-30 m.
Depth is 30 m and standing water level is 78 m. Yield is 2.27 L/s.

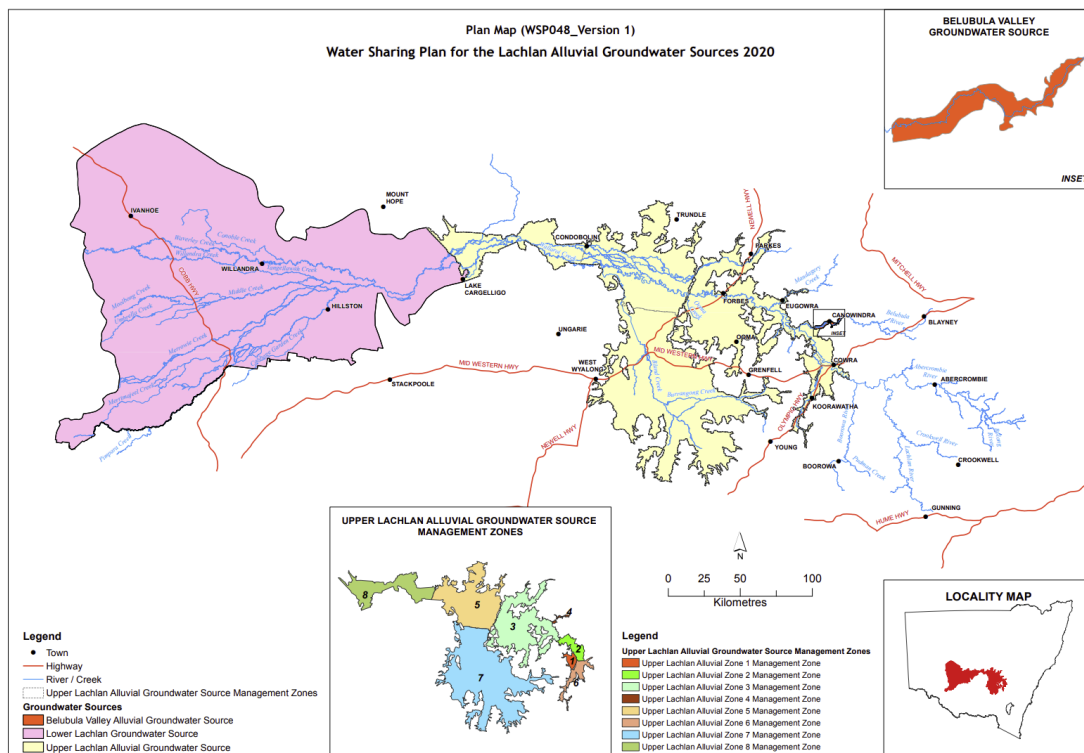
The CM Jewell & Associates report noted that while groundwater salinity tended to be high, there was considerable variation in salinity, suggesting a close connection with Cudgell Creek.

The Water Sharing Plan for the Murray-Darling Basin Fractured Rock Groundwater Sources 2020 (NSW Government, 2020) includes the Young Granite groundwater source and the Lachlan Fold Belt MDB. The NSW water sharing plans are the main tool for managing water in NSW. The plans set rules for sharing water between all water users and the environment and provide for water licensing on a single platform managed under the *Water Management Act 2000*. Hence, they aim to achieve sustainable groundwater extraction by limiting extractions to part of the aquifer recharge, leaving the balance to meet environmental requirements, via aquifer through flow and groundwater dependent ecosystem needs (NSW Office of Water, 2011).

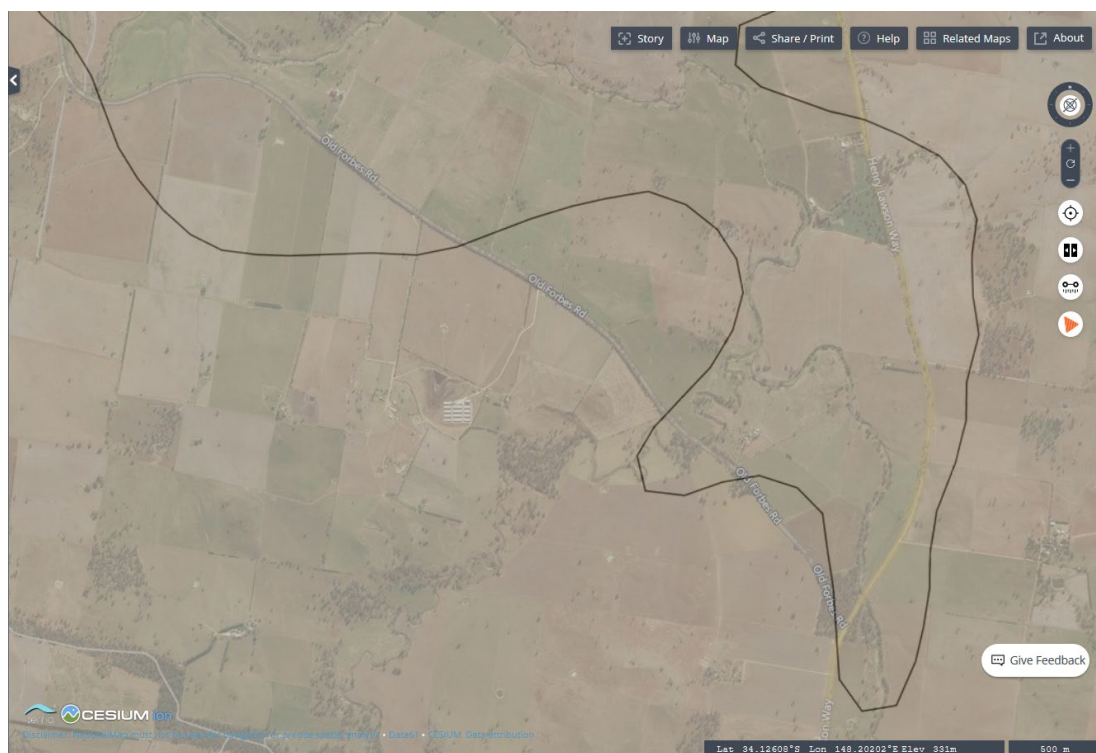
The Water Sharing Plan for the Murray-Darling Basin Fractured Rock Groundwater Sources uses long-term average annual recharge as the basis for water sharing, with the long term average annual extraction limit for the Young granite groundwater source set at 7,110 ML/yr, and the Lachlan Fold Belt MDB groundwater source sustainable diversion limit set at 253,788 ML/yr (including Yass catchment) (NSW Government, 2020).

Two bores situated on Lot B 372950 on the eastern side of the property near Cudgell Creek share an associated water access licence number of WAL 29028 / Approval number 70WA609923 providing a groundwater allocation of 35 ML for industrial, stock and domestic. An additional 34 ML allocation was transferred as WAL29034 in 2021. From data on the NSW groundwater portal, bore GW700011 has a pumping capacity of 2.375 L/s or 8,550 L/hr. The pumping capacity of GW703068 is not specified.

There is no alluvial water plan that covers the property which is located to the south of the Boundary of Zone 1 of Lachlan Alluvium WRP Area (see Figure 40).



https://water.nsw.gov.au/_data/assets/pdf_file/0003/540039/plan-map-wsp-lachlan-alluvial-groundwater-sources-2020-WSP048_V1.pdf



3.3.2. C.3.b Geology

The subject property is located within the Inland Slopes subregion of the NSW South Western Slopes Bioregion (Thackway & Cresswell 1995). The geology of the upper slopes of the Southern slopes bioregion includes Ordovician to Devonian folded and faulted sedimentary sequences including embedded volcanic rocks and extensive areas of granites. The lower slopes have similar geology but greater areas of Tertiary and Quaternary alluvium. (NSW National Parks & Wildlife Service, 2003) (NSW National Parks & Wildlife Service 2003).

From the 1:250,000 Cootamundra geological mapping, the subject property is underlain by the Young Granite. The Young Granite is part of the larger Lachlan Fold Belt complex, a zone of folded and faulted rocks of the Late Cambrian (600 million years) to Early Carboniferous (360 million years) age. The granodiorite body was placed during the Silurian and Devonian periods (440-360 million years) (Kumar, 2013).

In their investigations of the site, CM Jewell & Associates Pty Ltd (Jewell, 1994) drilled piezometers on the site which showed that beneath the property, the granodiorite is generally overlain by colluvial and deeply weathered soil. Granite outcrops may be found in and near Cudgell Creek. However, elsewhere the weather mantle is 11-20 m thick. There is a dominant north-north-east trend in the granodiorite.

3.3.3. C.3.c Soils

The soils of the South Western slopes bioregion generally include shallow stony soils on the top of ridges and hills with texture contrast soils downslope. Figure 41 shows a soil landscapes map sourced from eSpade. Soil landscapes on the property include:

- Crowther (Cr) predominant
- Crowther variant A (Cra)
- Harlestone (Ha)

The Crowther landscape consists of rolling hills formed from Silurian granodiorite. The soil descriptions taken from eSpade include:

- moderately deep (>30 cm), well-drained paralithic leptic rudosols (lithosols) on upper slopes and crests,
- moderately deep to deep (>50 cm), well-drained haplic eutrophic red chromosols (red podzolic soils) on hill crests and mid to upper slopes.
- deep (>100 cm), well-drained haplic eutrophic red kandosols (red earths; earthy sands; siliceous sands) on some mid to upper slopes,
- deep (>100 cm), moderately well-drained haplic eutrophic brown kandosols (yellow earths) on lower slopes,
- deep (>50 cm), mottled/bleached-mottled eutrophic red and brown chromosols (red and yellow podzolic soils) also on mid to lower slopes.
- deep (>100 cm), imperfectly drained bleached-mottled eutrophic brown chromosols and eutrophic mottled hypernatric yellow sodosols (solodic Soils) on lower slopes and drainage depressions.

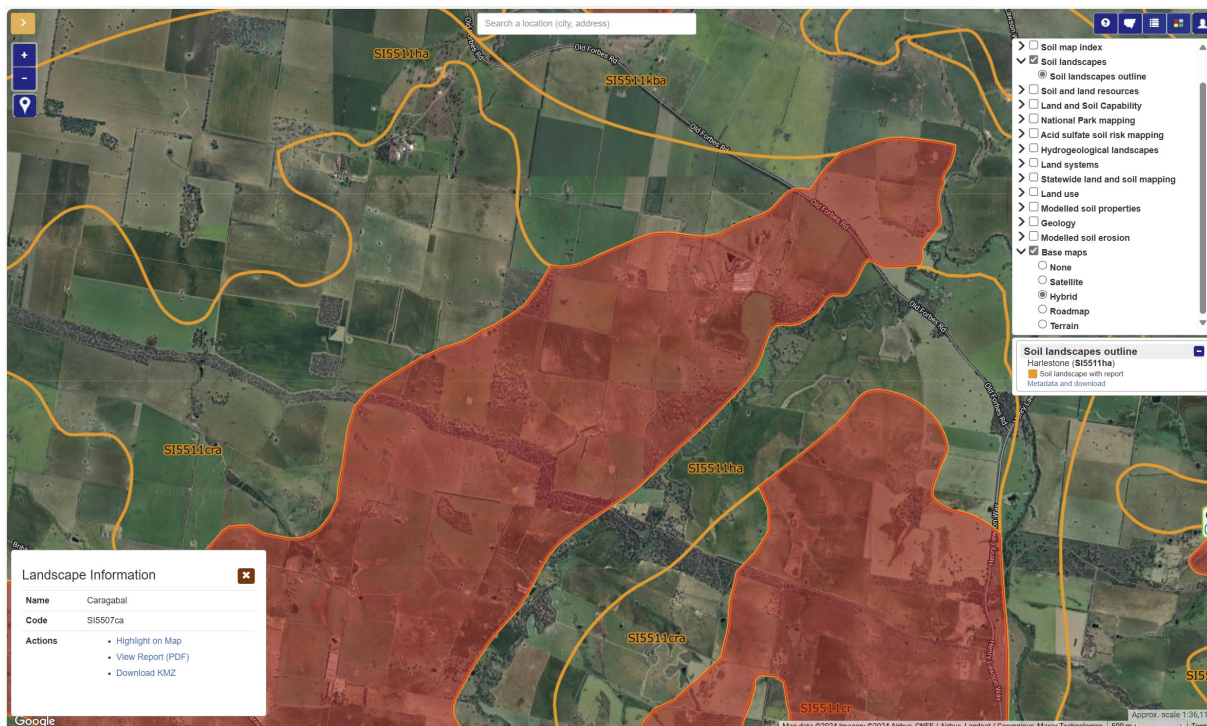


Figure 41 – Soil Landscapes

Soil materials are often coarse to gravelly, with shallow soils at higher elevations associated with rock outcrops. Red kandosols grade to brown kandosols (red earths to yellow earths), and red chromosols grade to brown chromosols (red podzolic soils to yellow podzolic soils) to sodosols (solodic soils) in lower lying areas. Soils in low-lying areas tend to be poorly drained and may be sodic.

The Crowther variant A is located on lower hills and rises. Rock outcrops are less common in this variant.

The Harlestone landscape consists of gently undulating footslopes and plains formed on Quaternary colluvium. The soil descriptions taken from eSpade include:

- moderately deep (<100 cm) imperfectly drained mottled hypocalcic red chromosols (red brown earths) and mottled eutrophic brown chromosols (non-calcic brown soils) on mid to upper slopes,
- deep (>100 cm), imperfectly drained mottled eutrophic brown chromosols (brown and yellow podzolic soils) on mid to lower slopes, and
- moderately deep (<100 cm), poorly drained bleached-sodic eutrophic brown chromosols (solodic soils) in drainage depressions.

In 1993, Midstate Planning undertook a soil survey of the property (Zinga, 1993) which provides a good guide to the soil types and their distribution. They drilled ten representative soil profiles over the property. These are reported on eSpade. On the undulating to hilly areas, the geology comprises of Devonian granite mainly consisting of gneissic granite and granodiorite. The lower sloping land in the northern part of the property is derived from Quaternary sediments. Three major soil types were identified on the property.

Red brown earths (Dr2.22) are widespread on the farm, particularly on the broad hillcrests, upper and midslope terrain locations. These were described as texture-contrast soils with hard-setting surfaces. The A horizons are typically brown to reddish-brown sandy clay loams that are about 35 cm deep with weak pedality and a pH of 5.5-6.5. These are underlain by bright brown to reddish brown sandy clay to light and medium clay with weak-moderate pedality and a pH of 7-8. The B horizon is typically 1.9 m deep. Overall, these soils are well drained with moderate to good water holding capacity. There is a low-moderate erosion hazard.

Yellow earths (Gn2.62 and Gn2.66) are found in similar terrain locations to the red-brown earths, although more commonly on the midslope positions. These soils were described as having a hard-setting surface with an A horizon that is about 50 cm deep. They are dark reddish-brown, fine sandy clay loams with a gradual increase in clay content with depth. The topsoil is structureless with a pH of 5-6. The subsoils are porous, structureless yellow-brown, mottled, silty to medium clays with a pH of 7.5-8. This layer is 1.3-1.5 m deep. The yellow earths are moderately well drained with moderate water holding capacity. The soil erosion hazard is low to moderate.

Yellow podzolics (Dy3.42) are found on the lower, flatter and more poorly drained terrain. These soils were described as texture contrast soils with a hard setting surface on their brown sandy loam topsoils. This layer is typically 1.3 m deep and has a neutral pH. The subsoil consists of yellowish-brown, sandy-clay to medium clay soils 40-165 cm deep. These soils are weakly pedal, with a pH of 7 and mottling and iron and manganiferous segregations common. These soils have moderate to good water holding capacity and are fairly poorly drained. Erosion hazards are moderate.

Alluvial soils were also present along Cudgell Creek which runs alongside the eastern boundary of the property.

Figure 42, taken from the Midstate Planning report, shows the location of the ten soil profiles drilled on the property.

- Profiles 1, 9 & 10 were yellow podzolics
- Profiles 2, 4 & 7 were red-brown earths
- Profiles 3 & 8 were yellow earths
- Profiles 5 & 6 are alluvial soils.

Soil testing is routinely undertaken for agronomic management with some paddocks tested each year. As a condition of the EPA POEO licence 11314, Windridge Farms Pty Ltd is required to monitor paddocks that have been irrigated with liquid effluent or spread with spent bedding or SEPS solids (EPA identification points 6-8) in the past 12 months. The results of some relatively recent testing are shown in Table 27 and Table 28. Figure 43 shows the location of the paddocks.

The results show that the soils mostly have a moderately acidic pH, with a few sites (Nhill Drive 2020 and 2019, and Coddingtons) just falling into the strongly acidic class (pH 1:5 water) <5.4). The soil electrical conductivity saturated extract (EC_{se}) is unlikely to impact the yields of the types of crop grown on the farm; salt sensitive plants may be impacted in the range of 2-4 dS/m, while many plants will be affected once the EC_{se} >4 dS/m. Organic carbon and organic matter levels are a little low, the soils would benefit from the addition of spent bedding and effluent.

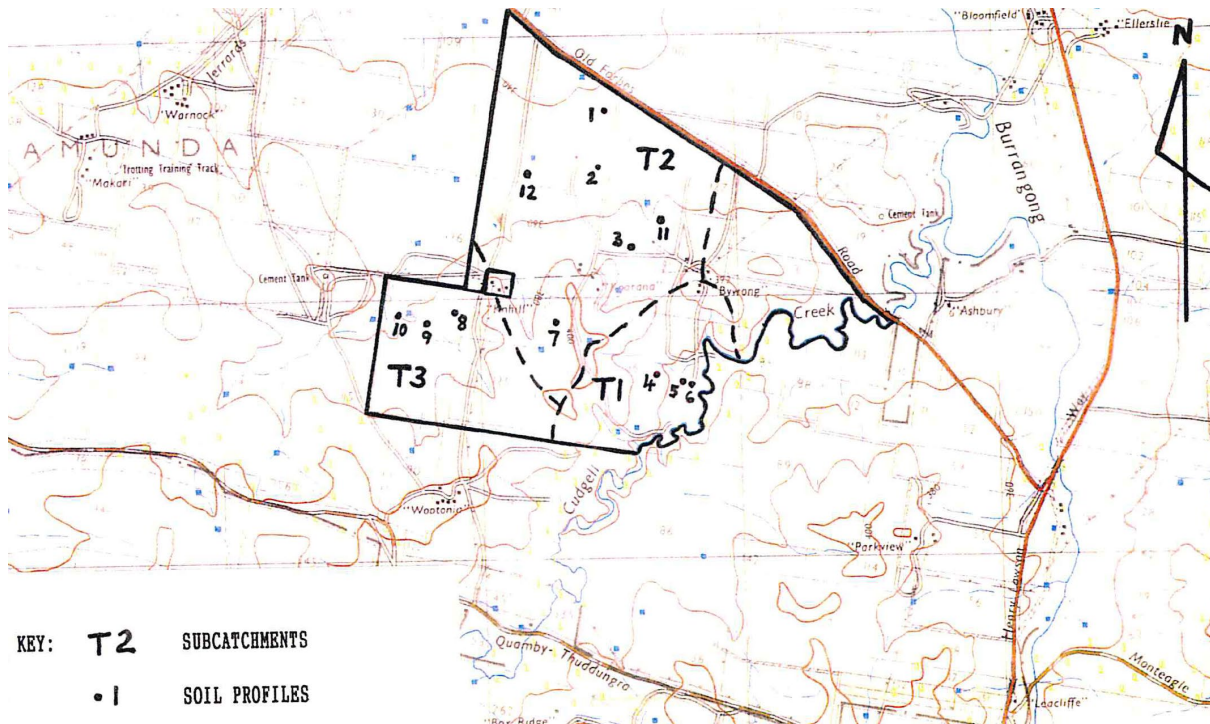


Figure 42 – Soils of the Subject Property

Table 27 – Soil Test Results (0-10 cm) February 2020 & December 2019

Parameter	17/02/2020		20/12/2019			
	Nhill Drive	Coddingtons	Koorani Lucerne	Koorani Hunter	Koorani Hayshed	Koorani Bywong Front
Soil Colour	-	-	-	-	-	-
Soil Texture	-	-	-	-	-	-
pH (1:5 water)	5.4	5.3	6.8	5.7	5.7	6.6
pH (1:5 CaCl ₂)	4.9	4.8	6.26	5.06	5.24	6.1
EC (1.5 water) (dS/m)	0.280	0.260	0.195	0.133	0.186	0.144
EC Sat Ext (dS/m) (est)	2.1-2.5*	2.0-2.3*	-	-	-	-
Chloride (mg/kg)	-	-	-	-	-	-
Org C (%)	-	-	1.57	1.30	2.395	1.145
Org Matter (%)	-	-	-	-	-	-
Total N (mg/kg)	-	-	1370	1050	2030	984
Nitrate-N (mg/kg)	-	-	39.8	19.6	41.2	17.4
Colwell P (mg/kg)	28	62	84.2	72.9	144	84.8
PBI	-	-	-	-	-	-
Avail. K (mg/kg)	470	350	-	-	-	-
Sulphur (mg/kg)	-	-	-	-	-	-
CEC (cmol/kg)	6.7	5.5	11.22	9	12.4	7.78
Ca (cmol/kg)	4.7	3.6	6.39	3.33	4.68	3.26
%	70	66.0				
Mg (cmol/kg)	0.7	0.7	0.83	0.65	1.14	0.58
%	9.8	13.0				
Na (cmol/kg)	0.04	0.17	0.1	0.07	0.14	0.15
%	0.57	3.20				
K (cmol/kg)	1.20	0.89	1.01	0.95	1.32	1.23
%	18.0	16.00				
Al (cmol/kg)	0.1	0.1	0.011	0.0021	0.0036	0.0011
%	1.6	1.9				
H (cmol/kg)	-	-	2.88	4	5.12	2.56
%	-	-				
Ca/Mg Ratio	7.1	5.0	7.7	5.1	4.1	5.7
Zinc (mg/kg)	-	-	-	-	-	-
Copper (mg/kg)	-	-	-	-	-	-
Iron (mg/kg)	-	-	-	-	-	-
Mn (mg/kg)	-	-	-	-	-	-

Table 28 – Soil Test Results (0-10 cm) January 2019 & May 2018

Parameter	11/01/2019			14/5/2018			
	Hunter	Pines	Koorani Side	Coddingtons	Thackerays	Koorani Drive	Bywong Side
Soil Colour	Brown	Brown	Brown	-	-	-	-
Soil Texture	Clay	Clay	Clay loam	-	-	-	-
pH (1:5 water)	5.9	6.4	6.1	5.6	6.2	6.1	6.1
pH (1:5 CaCl ₂)	5.2	5.7	5.4	5.1	5.74	5.57	5.61
EC (1.5 water) (dS/m)	0.21	0.19	0.16	0.504	0.145	0.183	0.532
EC Sat Ext (dS/m) est.	1.3	1.2	1.3	3.8-4.5*	1.1-1.3*	1.4-1.7*	4.0-4.8*
Chloride (mg/kg)	36	25	18	-	-	-	-
Org C (%)	1.4	1.5	1.4	1.27	1.645	1.445	1.47
Org Matter (%)	2.4	2.6	2.4	-	-	-	-
Total N (mg/kg)	-	-	-	1240	1400	1230	1370
Nitrate-N (mg/kg)	66	51	44	114	41.8	45	112
Colwell P (mg/kg)	59	72	65	51.8	28.9	45	78.8
PBI	25	34	17	-	-	-	-
Avail. K (mg/kg)	490	570	390	-	-	-	-
Sulphur (mg/kg)	17	19	13	-	-	-	-
CEC (cmol/kg)	7.2	8.7	5.4	5.68	9.66	8.76	6.48
Ca (cmol/kg)	4.9	6.0	3.6	1.55	4.73	3.98	2.2
%	68.0	69.0	66.0	27.3	49.0	45.4	34.0
Mg (cmol/kg)	0.9	1.1	0.8	0.28	0.68	0.83	0.38
%	13.0	13.0	14.0	4.9	7.0	9.5	5.9
Na (cmol/kg)	0.11	0.08	0.06	0.36	0.04	0.08	0.39
%	1.60	0.97	1.10	6.30	0.4	0.9	6.0
K (cmol/kg)	1.30	1.50	1.00	0.59	1.01	0.87	0.81
%	17.00	17.00	19.00	10.3	10.5	9.9	12.5
Al (cmol/kg)	<0.1	<0.1	<0.1	0.02	0.01	0.01	0.01
%	<1.0	<1.0	<1.0	0.35	-	-	-
H (cmol/kg)	-	-	-	2.9	3.2	3	2.7
%	-	-	-	51.1	33.1	34.2	41.7
Ca/Mg Ratio	5.3	5.5	4.7	5.5	7.0	4.8	5.8
Zinc (mg/kg)	4.30	5.1	7.3	-	-	-	-
Copper (mg/kg)	1.40	1.6	1.9	-	-	-	-
Iron (mg/kg)	84	54	93	-	-	-	-
Mn (mg/kg)	31	28	24	-	-	-	-

Table 29 – Soil Test Results (0-10 cm) May 2021

Parameter	18/5/2021	
	Koorani Hayshed	Coddingtons
Soil Colour	-	-
Soil Texture	-	-
pH (1:5 water)	5.7	6.2
pH (1:5 CaCl ₂)	5.14	5.74
EC (1.5 water) (dS/m)	0.154	0.111
Chloride (mg/kg)		
Org C (%)	2.165	1.405
Org Matter (%)		
Total N (mg/kg)	0.185	0.133
Nitrate-N (mg/kg)	42.6	42.1
Colwell P (mg/kg)	80.3	64.1
PBI		
Avail. K (mg/kg)		
Sulphur (mg/kg)		
CEC (cmol/kg)	10.7	9.06
Ca (cmol/kg)	3.61	4.91
%	33.74	54.19
Mg (cmol/kg)	0.786	0.605
%	7.35	6.68
Na (cmol/kg)	0.215	0.0385
%	2.01	0.43
K (cmol/kg)	1.41	0.648
%	13.18	7.15
Al (cmol/kg)	0.01	0.00
%	0.001	0.00
H (cmol/kg)	4.68	2.86
%	43.74	31.57
Ca/Mg Ratio	4.59	8.12
Zinc (mg/kg)	-	-
Copper (mg/kg)	-	-
Iron (mg/kg)	-	-
Mn (mg/kg)	-	-

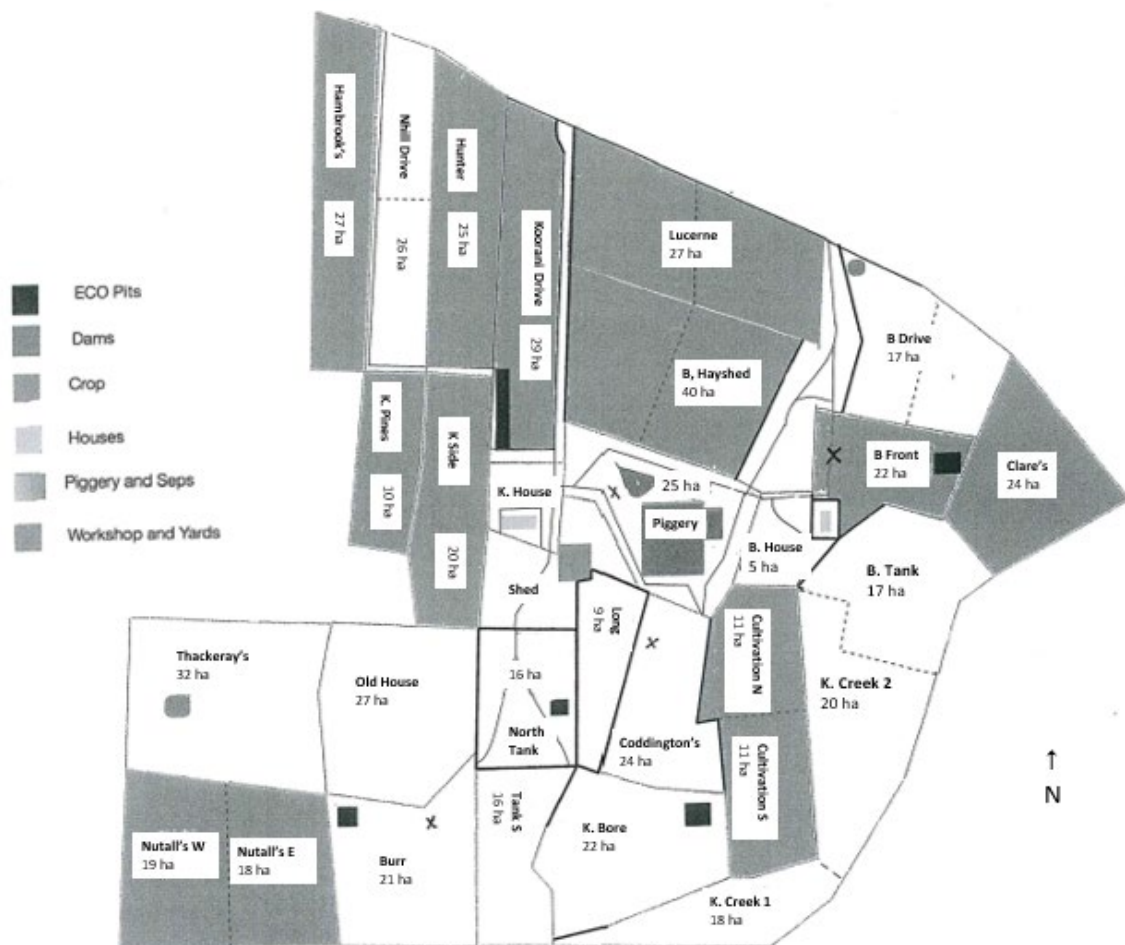


Figure 43 – Koorani Paddocks Map

Nitrate-nitrogen levels are mostly ideal. The concentration is on the low side for the Koorani Hunter and Koorani Bywong Front paddocks. Levels are elevated in Coddingtons and Koorani Bywong Front paddocks in 2018. However, given that the soils were sampled around crop planting time / before the peak growing time, these levels would likely have dropped significantly by the end of the year. Colwell phosphorus levels are optimal to high. The few PBI results available represent a very, very low level. This means that when phosphorus is applied to the soil, very little of it will be bound up and most will be readily available for plant uptake. Available potassium levels are relatively high. Sulphur levels are adequate. Zinc, copper, iron and manganese levels are generally reasonable to ideal.

In all cases, cation exchange capacity (CEC) is moderate. In most cases, levels and percentages of individual cations are ideal. Exchangeable calcium and magnesium levels are relatively low (below 6 cmol./kg) in most cases. The exchangeable calcium percentage was optimal (65-80%) in about half the samples and exchangeable magnesium percentage was optimal (10-20%) in about a third of samples. Exchangeable potassium levels were relatively high, with the exchangeable potassium percentage

above the optimal range (3-8%) in all samples. Sodium levels were generally low, with two paddocks (Coddington's and Bywong Side) considered sodic in 2018. The EC of the Coddington's paddock had dropped from 0.506 ds/m in 2018 to 0.26 dS/m in 2020 while the ESP had dropped from 6% to 3.2% suggesting movement of salt and sodium through the soil. Interestingly, the 2018 samples all showed high levels of exchangeable hydrogen. This suggests that they are strongly leached soils; hydrogen has replaced other cations. Adding organic matter would improve the soil structure and liming would add calcium and help to lift the pH.

There are no known contaminated sites on the property and no contamination of soil is expected to occur as a result of the operation of the piggery. Acid sulphate soils are not expected on the subject property.

C.3 d Meteorological Characteristics

The Young area experiences warm summers with cool to cold winters. Climate data for Young Airport was sourced from www.bom.gov.au. Evaporation data was not available for Young, so these data are for Wagga Wagga. The results are summarised in Table 30. Rainfall intensity, frequency and duration data for the site is presented in Table 31.

Table 30 – Climate Data (Monthly)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)													
Mean	42.6	50.8	44.7	30.8	40.7	61.4	57.9	50.2	51.0	44.6	64.0	58.9	595.5
Decile 9	90.0	128.3	112.5	68.8	62.1	113.5	105.5	89.7	85.6	86.2	131.1	124.6	792.2
Temperature (°C)													
Mean Max.	32.0	30.5	27.3	22.9	17.8	13.9	13.0	14.6	17.9	22.2	26.1	29.3	22.3
Mean Min.	14.9	14.6	11.3	6.7	3.3	2.3	0.9	1.2	3.0	5.4	9.5	12.1	7.1
Pan Evaporation (mm)													
Mean	316.2	252	210.8	120	65.1	39	37.2	58.9	90	161.9	216	291.4	1862

Table 31 – Rainfall Intensity, Duration, Frequency

Location: 34.150S 148.225E NEAR.. Koorani Issued: 4/3/2019

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	57.4	75.7	102	119	142	174	200
6Mins	53.5	70.5	95.0	111	132	161	185
10Mins	43.5	57.3	76.8	89.4	106	129	148
20Mins	31.6	41.6	55.4	64.3	76.0	92.4	106
30Mins	25.6	33.5	44.5	51.5	60.8	73.7	84.1
1Hr	17.0	22.2	29.1	33.6	39.4	47.6	54.0
2Hrs	10.7	13.9	18.1	20.7	24.2	28.9	32.7
3Hrs	8.09	10.5	13.5	15.3	17.8	21.2	23.9
6Hrs	4.96	6.38	8.07	9.10	10.5	12.4	13.9
12Hrs	3.07	3.93	4.90	5.48	6.30	7.38	8.22
24Hrs	1.93	2.46	3.04	3.38	3.86	4.50	4.99
48Hrs	1.20	1.52	1.86	2.06	2.34	2.72	3.01
72Hrs	.868	1.11	1.34	1.48	1.68	1.94	2.14

(Raw data: 22.77, 3.97, 1.12, 45.91, 7.06, 1.87, skew=0.23, F2=4.32, F50=15.47)

© Australian Government, Bureau of Meteorology

Figure 44 shows the mean annual wind direction and speed at Young at 9 am and 3 pm. In the summer, the winds are mostly from the north or east at 9 am and from the west to south-west at 3 PM. In the winter, the winds are mostly from the west at 9 am and from the west to south-west at 3 PM.

Rose of Wind direction versus Wind speed in km/h (05 Aug 1989 to 10 Aug 2018)

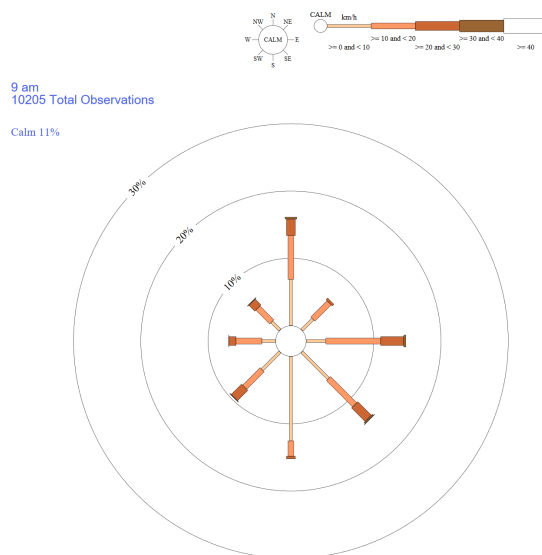
Custom times selected, refer to attached note for details

YOUNG AIRPORT

Site No: 073138 • Opened Dec 1988 • Still Open • Latitude: -34.2493° • Longitude: 148.2475° • Elevation 379 m

An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



Rose of Wind direction versus Wind speed in km/h (05 Aug 1989 to 10 Aug 2018)

Custom times selected, refer to attached note for details

YOUNG AIRPORT

Site No: 073138 • Opened Dec 1988 • Still Open • Latitude: -34.2493° • Longitude: 148.2475° • Elevation 379 m

An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.

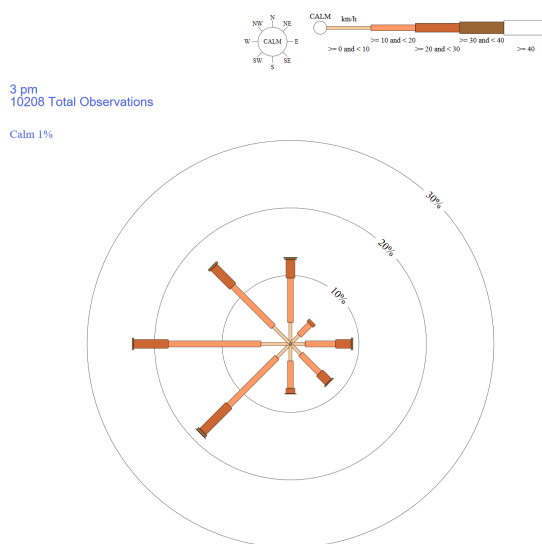
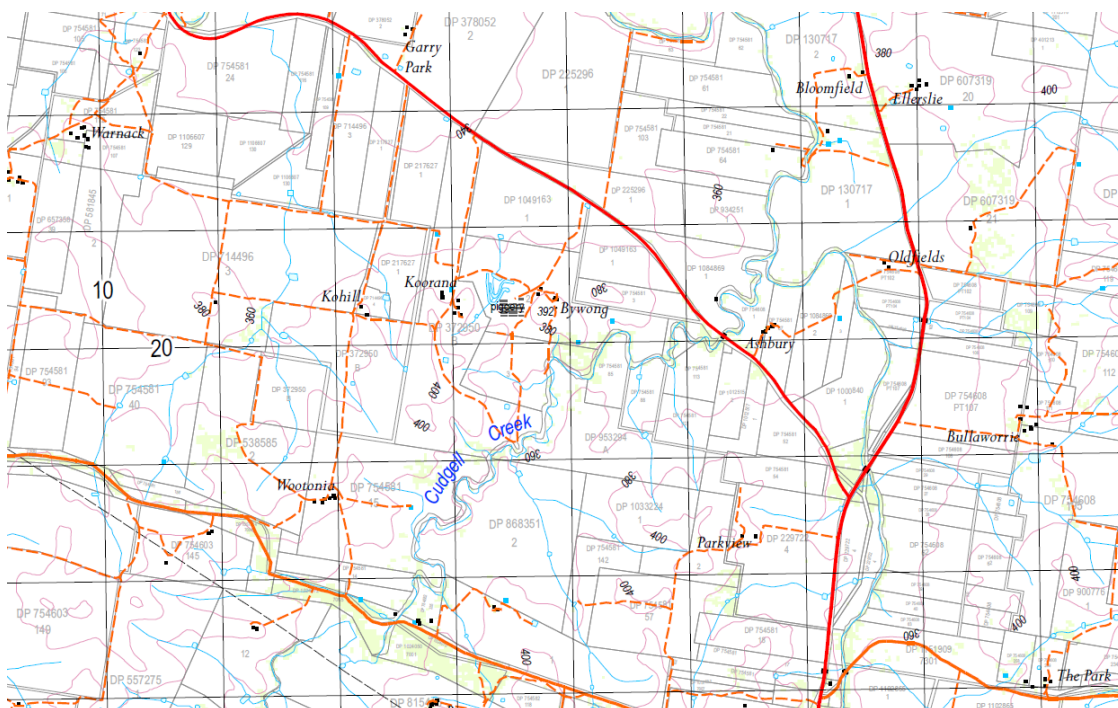


Figure 44 – Mean Annual Wind Directions at Young 9 AM and 3 PM.

3.3.4. C.3.e Slope of the Land and Topography

The subject property is located within the Inland Slopes subregion of the NSW South Western Slopes Bioregion (Thackway I & Cresswell R, 1995). This bioregion comprises of a large area of foothills and ranges falling from the western side of the Great Dividing Range to the Riverina Bioregion. The subject property falls with the Young Hills and Slopes landscape. These are described as “Rounded hills and some steep slopes to tor covered ridges on massive and gneissic Silurian-Devonian granites and granodiorite, general elevation 400 to 730m, local relief 100 to 250m. Gradational red earths on upper slopes and red-yellow texture-contrast soils on lower slopes reflecting poorer drainage. Extensively cleared with patches of remaining woodland of white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*), broad-leaved peppermint (*Eucalyptus dives*), red stringybark (*Eucalyptus macrorhyncha*) and Blakely’s red gum (*Eucalyptus blakelyi*).” (Mitchell P, 2002)

Figure 45 shows the topography of the property and surrounds. Figure 46 shows the property in more detail. Both figures are taken from the 8529-N Bendrick Murrell 1:50,000 topographic map from Six Maps. The farm consists of the typical gently undulating hills and valleys associated with granite, rising in elevation by 60 m from north to south (340 m to 400 m). Slopes range from 2-11%, averaging about 8%. The piggery site itself has an elevation of approximately 375 m AHD.



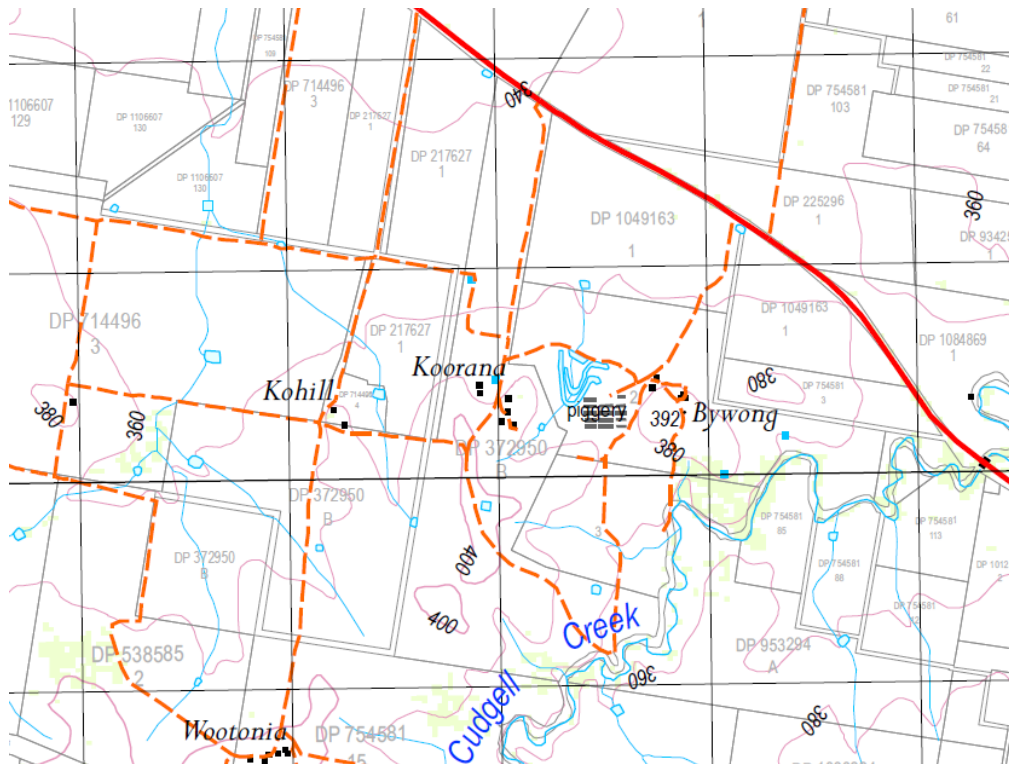


Figure 46 – Topographic Map – Koorani

3.3.5. C.3.f Adjoining Land Use

The surrounding land is used for mixed farming with cattle, sheep and cereal and oilseed cropping. There are a number of other piggeries in the district but none is close enough to cause cumulative odour impacts or biosecurity concerns.

3.3.6. C.3.g Vegetation

Like most of the land in the district, the farm has largely been cleared and developed for cropping. Figure 24, taken from Google Earth Pro, shows the piggery, remnant trees on the farm and tree lines planted over the last 20 years. Figure 27 shows the areas of high biodiversity value along Cudgell Creek identified in the Hilltops LEP (see section 3.1.2 for more detail). As per mapping within the Hilltops LEP (2022), the site of the piggery complex does not contain areas of high biodiversity value.

OzArk was engaged to assess the potential biodiversity impacts of the proposed piggery expansion. OzArk identified that a Biodiversity Assessment Report (BAR), rather than a Biodiversity Development Assessment Report (BDAR), was appropriate as the proposed works do not trigger entry into the NSW Biodiversity Offsets Scheme (BOS). Full details are provided in the BAR which is included as Appendix G of this EIS.

As part of the BAR, a Senior Ecologist holding Biodiversity Assessment Method (BAM) accreditation conducted a field survey of the site on 21st February 2024. They recorded one PCT during this assessment: PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western

Slopes Bioregion. This PCT occurred as small derived (0.70 ha) and planted (0.14 ha) forms. All areas of PCT 277 met the condition thresholds for the *Biodiversity Conservation Act 2016* (NSW Government, 2016) listed critically endangered ecological community (CEEC): White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar. As such, up to 0.84 ha of this CEEC will be directly impacted by the proposal. However, the areas of PCT 277 did not satisfy the requirements for the *Commonwealth Environment Protection and Biodiversity Act 1999* (Australian Government, 1999) listed CEEC: White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland, because they lacked the required native understorey diversity and failed to meet the size threshold for a patch of the community.

The senior ecologist observed no hollow-bearing trees, nests, bushrock or burrows at the subject site.

One minor unnamed Strahler 1st order non-perennial watercourse is mapped as crossing through the subject site. A further nine watercourses occur within the wider 1.5 km study area, including:

- Eight minor unnamed Strahler 1st order non-perennial watercourses, and
- Cudgell Creek, a minor Strahler 4th order perennial watercourse.

The Department of Primary Industries – Fisheries considers Cudgell Creek a key fish habitat. Cudgell Creek is also associated with protected riparian land, as recognised by the NSW Department of Climate Change, Energy, the Environment and Water. No watercourses within the study area contain mapped threatened fish species or populations. Consequently, no tests of significance were completed for threatened species or populations under the *NSW Fisheries Management Act 1994* (NSW Government, 1994). As the proposal includes the dredging and/or remediation of the unnamed minor watercourse within the subject site, a permit issued by the Minister will be required under Section 201 the *Fisheries Management Act 1994*.

As the unnamed minor non-perennial watercourse that crosses the subject site is connected to two farm dams and does not flow into any other watercourses, it is not part of a threatened aquatic ecological community. However, the endangered ecological community (EEC) “the aquatic ecological community in the natural drainage system of the lowland catchment of the Lachlan River” does occur within the wider study area (e.g. Burrangong Creek and its tributaries). Considering the lack of unimpeded waterflow between the subject site and the EEC, no significant impacts are expected on this EEC, providing the mitigation measures described in section 7 of the BAR are implemented.

A total of 13 fauna species (12 native, one introduced) and 52 flora species (15 native, 37 introduced) were observed during the field survey. No threatened species were observed. Due to the short duration of the surveys, and the lack of detailed targeted surveys for threatened species, non-detection of a species cannot be considered as confirmation of the absence of that species from the subject site.

Of the 37 introduced plant species recorded during the field survey, six are listed as high threat exotics. However, none are categorised as weeds of national significance or as a priority weed for the Riverina Local Land Services Region.

Although no threatened species were detected during the field survey, based on habitat requirements and nearby records a total of 40 species listed as threatened under the *Biodiversity and Conservation Act 2016* and/or as threatened or migratory fauna species under the *Environment Protection and Biodiversity Act 1999* and seven flora species listed as threatened under these Acts were assessed as having a moderate or greater likelihood of occurring at the subject site based on habitat requirements and nearby records. An *Environment Protection and Biodiversity Act 1999* protected matters search identified four wetlands of international importance, four threatened ecological communities, 31 threatened species, ten migratory species, and 17 marine species that are predicted or known to occur within 10 km of the subject site. No significant impact to a threatened, migratory, or marine species likely to result in the extinction of a local population was identified. Consequently, this proposal does not trigger the need to prepare a BDAR or to refer the matter to the Minister.

Native vegetation regulatory (NVR) mapping covering the farm is provided as Figure 47. The orange line along the creek in proximity to the property is vulnerable regulated land; clearing of native vegetation may not be permitted under the Land Management (Native Vegetation) Code 2017, and a limited suite of allowable activities apply. Vulnerable regulated land comprised of three layers. These being: riparian, steep or highly erodible and special category which is land susceptible to erosion or land that is otherwise environmentally sensitive, such as mass movement and salinity. (NSW Office of Environment and Heritage, ND).

The piggery site and reuse areas are not situated on vulnerable vegetation as shown by the NVR mapping.

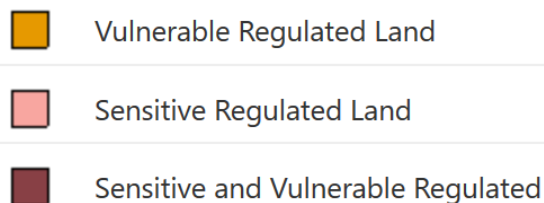


Figure 47 – Native Vegetation Regulatory (NVR) Mapping – Farm and Surrounds

3.3.7. C.3.h Water Quality

A study undertaken by CM Jewell & Associates Pty Ltd (Jewell, 1994) for a previous EIS for the Koorani property measured groundwater conductivities ranging from 1,020 uS/cm to 2,500 uS/cm.

As a condition of the EPA POEO licence 11314, Windridge Farms Pty Ltd is required to monitor groundwater quality at EPA Identification Points 1-4 at six monthly intervals for electrical conductivity (EC), nitrate-nitrogen, pH and standing water levels. It is not always possible to monitor at all points as sometimes there is no water to sample. A set of monitoring results from December 2019 are summarised in Table 32. The salinity results for MP2/K5 are within the range nominated in the report by CM Jewell & Associates Pty Ltd (Jewell, 1994) while the MP3/K6 sample showed a considerably higher salinity level. In both cases the pH and nitrate-nitrogen levels are acceptable.

Table 32 – Groundwater Chemistry Monitoring Results

Parameter	MP2/K5	MP3/K6
	Thackeray's Creek	Koorani Creek
EC (uS/cm)	1,700	3,300
Nitrate-N (mg/L)	6.3	1.3
pH	6.9	7.7

4. D IDENTIFICATION AND PRIORITISATION OF ISSUES

4.1. D.1 OVERVIEW OF THE METHODOLOGY

4.1.1. Review of Relevant Information

The process used to identify and prioritise issues included:

- Preliminary discussions between the proponents, council and relevant agencies.
- A review of applicable federal, state and local government acts, regulations, policies and plans.
- A review of applicable industry and environmental guidelines and online sources of information. A complete list of the references used to develop this EIS is provided in the reference list (section 9), with references used in Appendices provided in the reference lists for these.
- A site investigation by Robyn Tucker in the company of the proponents (represented by Andree Rowntree).
- Biodiversity assessment undertaken by OzArk Consultants (see Appendix G)
- A site investigation (22nd June 2020) by Ms Norma Freeman of the Young Aboriginal Land Council. A report was prepared and this is provided as Appendix J.
- ACHAR prepared by Past Traces Heritage Consultants (see Appendix K)
- Consultation with a range of state government bodies, Hilltops Shire Council and other relevant bodies as documented throughout this EIS.
- Reviewing recent EIS prepared to support NSW piggery applications.
- Following the Secretary's Environmental Assessment Requirements.
- Consultation with the closest neighbours.

4.1.2. D.1.b Outcome of Consultation with Stakeholders

In addition to the stakeholders mentioned in the previous section, information was provided to the closest neighbours (representatives for houses 1, 2, 3, 4, 5, 8, 9 – refer to Figure 35 for the location of these) with consultation undertaken through informal discussions where possible.

One of those consulted stated that “your farming operation has zero effect on my life” and did not require full details of the proposal.

A couple of those consulted indicated that odour could be smelt when manure is spread prior to sowing. The preference seems to be for it to be spread over a short time period in the right weather conditions so that the window for nuisance is short. In previous consultation the owner of house 1 had observed that spreading manure could result in odour nuisance but noted that the company addresses any problems as soon as he raises them. No one raised odour from the piggery complex as a concern.

One neighbour asked if he could buy spent bedding to use in his own farming operations.

4.2. D.2 Outcomes of the Process

The identified issues and their priority are summarised in Table 33. Details are provided in section 5.

Table 33 – Identified Issues and their Priority

Issues identified	Priority
Cumulative impacts	Low
Odour Impact	High
Waste management	Medium-high
Water quality & catchment protection	Medium
Land capability & protection	Medium
Drainage and stormwater management	Medium
Flooding	Low
Traffic and road impacts	Medium
Noise	Medium
Dust	Medium
Visual impacts	Low
Pest & insect control	Low
Flora and fauna	Low
Heritage	Low
Hazardous chemicals	Low
Animal welfare	Low
Greenhouse gas emissions	Positive
Economic and social effects	Positive

5. E THE ENVIRONMENTAL ISSUES

This section summarises the identified environmental issues including baseline conditions, impact analysis and mitigation, management and monitoring. A draft Environmental Management Plan included as Appendix L provides further detail on monitoring.

5.1. E.1 CUMULATIVE IMPACTS

5.1.1. E.1.a Baseline Conditions

There are no other intensive piggeries or other intensive livestock facilities close by. Hence, there will be no cumulative impacts.

5.1.2. E.1.b Impact Analysis

As there are no other intensive livestock facilities near the piggery site, there will be no cumulative impacts.

5.1.3. E.1.c Mitigation, Management and Monitoring

As no cumulative impacts are expected, no mitigation, management or monitoring are required.

5.2. E.2 ODOUR

5.2.1. E.2.a Baseline Conditions

Odour levels for the subject property and surrounds are typical of those of any farming area. There is occasionally odour from reuse of effluent and manure but never complaints about shed odour alone.

5.2.2. E.2.b Impact Analysis

Clause 129 of the *Protection of the Environment Operations Act 1997*, prohibits the emission of any offensive odour from the premises. Like any other intensive animal facility, the expanded piggery will create some odour. Odour sources include the piggery sheds, SEPS, recycle dam, spent bedding storage areas and reuse areas. The most effective way of protecting amenity, particularly air quality, at nearby houses is by implementing good design, good management practices and appropriate separation distances. The Young Shire DCP specifies a minimum buffer of 500 m between a piggery and a house on other land, and 250 m for reuse areas. Figure 35 shows that there are no houses within 500 m of the piggery. However, the separation distance needed to protect amenity is a function of the size of the piggery, design and management features, type of receptor (e.g. house, rural residential, town etc), terrain, vegetation and wind patterns. Nigel Sargent, Manager Regional Operations, South East NSW EPA was consulted regarding the assessment of separation distances on 18th February 2019. He recommended using the NSW EPA's policy framework for managing odour, the Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW (Department of Environment and Conservation NSW, 2006). Nigel commented that a pass at level 1 represented a very conservative determination of minimum separation distances to sensitive land uses.

The approach uses the following formula:

$$D = \sqrt{N} \times 50 \times S$$

Where:

D = Separation distance in metres between the closest points of the piggery and the most sensitive receptor or impact location

N = number of standard pig units (SPU) (23,294 SPU)

S = Composite site factor = $S_1 \times S_2 \times S_3 \times S_4 \times S_5$.

Site factors S1, S2, S3, S4 and S5 are determined according to site-specific information relating to shed design, maintenance schedule, receptor, terrain, vegetation and wind factor.

For conventional sheds, the S1 is determined using five multipliers. Approximately half the SPU kept in conventional sheds will be kept in slatted floor pull plug sheds and half in slatted floor flushing sheds. The values selected for each shed type are:

Existing slatted pull plug sheds (8,958 SPU):

- A Type of building: 4 partly slatted floor and pull plug and recharge system = 0.6
- B Ventilation of building: 1 limited ridge and side-ventilators (or side only) or limited forced (fan) ventilation 1.0
- C Effluent collection frequency within all pig buildings: 1 faeces, urine and other biological material removed from the confines of the building every 24 hours or less often 0.9
- D Effluent treatment system (within the piggery compound): covered anaerobic lagoon with secondary treatment by SEPS 0.6*
- E Feeding: 3 phase-feeding with optimal protein 0.8

Proposed slatted flushing sheds (8,958 SPU):

- A Type of building: 2 partly slatted floor, sloping floor, regular flushing = 0.8
- B Ventilation of building: 3 fan forced ventilated shed with well-designed uniform ventilation throughout the shed 0.9
- C Effluent collection frequency within all pig buildings: 2 faeces, urine and other biological material removed from the confines of the building while essentially aerobic but in no case less often than 24 hours 0.9
- D Effluent treatment system (within the piggery compound): covered anaerobic lagoon with secondary treatment by SEPS 0.6*
- E Feeding: 3 phase-feeding with optimal protein 0.8

* The policy does not include an option for an effluent treatment system with a covered pond. Nor does it include SEPS. However, it states that "The S1 factor could be adjusted if there is new technology, which can be demonstrated and quantified to reduce the odour".

Covering the anaerobic pond eliminates odour emissions from this important source. The separation distance methodology provided in the National Environmental Guidelines for Indoor Piggeries (Tucker,

2018) reflect this, providing an S factor value of 0.5 for an anaerobic pond with an impermeable cover, compared with 1 for an uncovered pond.

Effluent treatment ponds are the main source of odours in typical Australian piggeries, contributing about 75% of total odours (Smith et al. 1999 cited by McGahan et al 2001), with the balance (25%) from the sheds. The odour emission rates from different types of effluent treatment ponds have been measured; anaerobic ponds produce 20-40 OU m/s (say 30 OU m/s) and facultative ponds <10 OU m/s with many producing <5 OU m/s (say 7 OU m/s) (Smith et al. 1999 cited by McGahan et al 2001).

Odour emission rate measurements from SEPS used for primary effluent treatment show that they have similar or lower odour emission rates to anaerobic ponds, although the odour is mostly emitted from a relatively small area close to the inlet point. Consequently, overall odour emissions from SEPS for primary treatment are likely to be lower than those of conventional ponds due to the significantly smaller surface area of the main odour source (near the inlet point of the active channel) and the similar or lower emission rates per unit area (Skerman, 2013). At Koorani, the effluent would have undergone primary treatment in the CAL before entering the SEPS. Hence, some 70-90% of volatile solids will have been removed and it is expected that odour emissions would be significantly lower, possibly more like that of a facultative pond (e.g. 7.5 OU m/s).

Assuming an uncovered anaerobic pond produces 30 OU m/s and a SEPS for secondary treatment has double the surface area, producing an average of 7.5 OU m/s (i.e. 2×7.5 OU m/s), the uncovered anaerobic pond is responsible for 67% of the odour (i.e. $(30 \text{ OU m/s} / 45)$) and the SEPS 33% of the odour ($(7.5 \text{ OU m/s} \times 2) / 45$) from the effluent treatment system. If covering the anaerobic pond reduces odour to 33%, a multiplier of 0.35 would appear appropriate. However, given that the lowest value available for a pond close to a piggery complex is 0.6, this will be adopted. Using 0.6 can be considered a very conservative approach given that covering the anaerobic pond eliminates ~50% of total piggery odour (pond odour = 75% of total odour and reduction of pond odour is 67%).

When the S1 factors are multiplied together, the combined value is 0.3456. The lowest value that can be used for S1 is 0.5. Hence, that is the value adopted.

Further testing of the component D Effluent treatment system has been undertaken.

- S1D Effluent treatment system within piggery compound – if this value becomes: 0.7 (or roughly double the calculated value), the overall S1 factor becomes 0.4032.
- S1D Effluent treatment system within piggery compound – if this value becomes: 0.8, the overall S1 factor becomes 0.432.

The factor for S1 D would need to exceed 0.85 before the combined S1 factor exceeded 0.5. Hence, 0.5 seems a reasonable value to use.

For deep litter housing that uses the recommended stocking rates with good management practices, the SI factor is 0.5. Bedding usage and management will be consistent with the recommendations of the National Environmental Guidelines for Indoor Piggeries and can be considered best practice.

The S2 factor considers different types of receptors. There are no public areas or towns close to Koorani, the town of Young being 16 km to the south south east of the site. However, there are a

number of houses nearby. These are shown on Figure 35. S2 receptor values of 0.3 for a single rural residence and 1.6 for a large town (Young) are applicable.

S3 pertains to terrain. This varies with direction from the piggery. The terrain to the closest house in each direction within 3 km of the proposed site is addressed below. The house numbers are taken from Figure 35.

House 1 is the closest house being ~1,040 m to the west of the site. There is a significant ridge between the piggery and this house, rising ~15-24 m in height at a distance of ~500 m from the piggery (see (Figure 48, Figure 49 and Figure 50). To be classified as high relief, which offers an S3 factor of 0.7, the terrain must consist of upslope terrain or a hill that projects above the 10% rising slope from the piggery. The average slope from the piggery to the ridge top is insufficient to achieve this gradient. A more suitable classification is undulating terrain consisting of continuous rolling, generally low-level hills and valleys with minimal vegetation cover, but without sharply defined ranges, ridges or escarpments. Consequently, an S3 value of undulating country (0.9) has been adopted for this receptor.

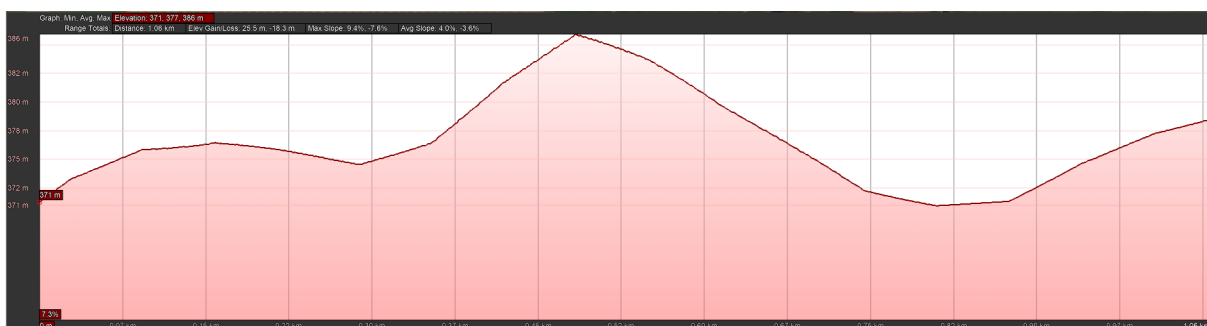


Figure 48 – Elevation Profile – Northern End of SEPS to House 1

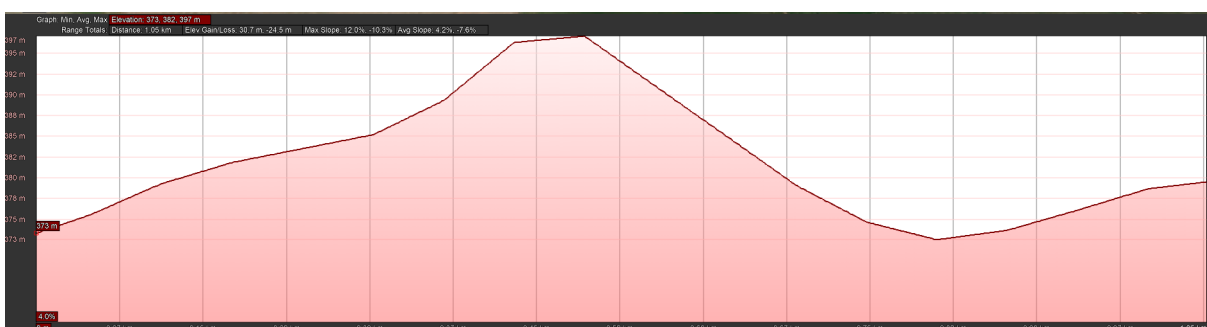


Figure 49 – Elevation Profile – Southern Extent of SEPS to House 1



Figure 50 – Elevation Profile – South West Corner of Pig Sheds to House 1

The change in elevation is also shown on Figure 51.



Figure 51 – Local Topographic Details

Because this is the closest house, it is worth considering wind direction. Figure 44 shows mean annual wind direction and speed at Young at 9 AM and 3 PM. In the summer, the winds are mostly from the north or east at 9 AM and from the west to south-west at 3 PM. In winter, they are predominantly from the west at 9 AM and the west to south west at 3 PM. This data suggests that the wind seldom carries from the piggery towards this house. Storage of spent bedding in the three storage areas on the western side of the farm will be avoided in summer. While the wind direction will be checked before undertaking any reuse activities, this will be particularly important in summer. Reuse will not occur on the western side of the property if the wind is carrying towards the neighbour.

House 2, to the south-west, is next closest at about 2,000 m from the closest extent of the piggery complex. Although there is rising terrain, the slope of 3% suggests that a terrain class of flat (S3 = 1.0) is appropriate. (Flat is less than 10% upslope, 2% downslope and not in a valley drainage zone).

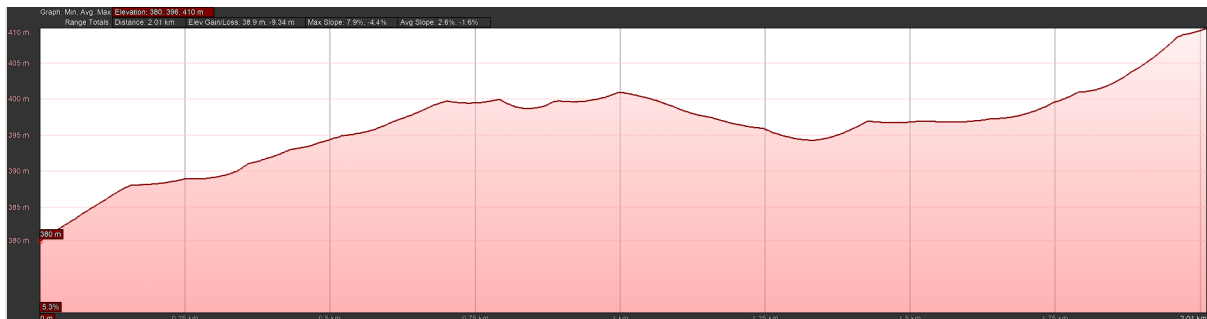


Figure 52 – Elevation Profile – Shortest Distance from Piggery Complex to House 2

The next closest house to the site is house 8 which is ~2,000 m to the east of the piggery. Although there is a 9-13 m high ridge between the piggery and the house the terrain is primarily downslope. As the terrain is generally below the 2% falling slope from the piggery, it has been classed a low relief (1.2).



Figure 53 – Elevation Profile – South East Corner of Piggery Complex to House 8

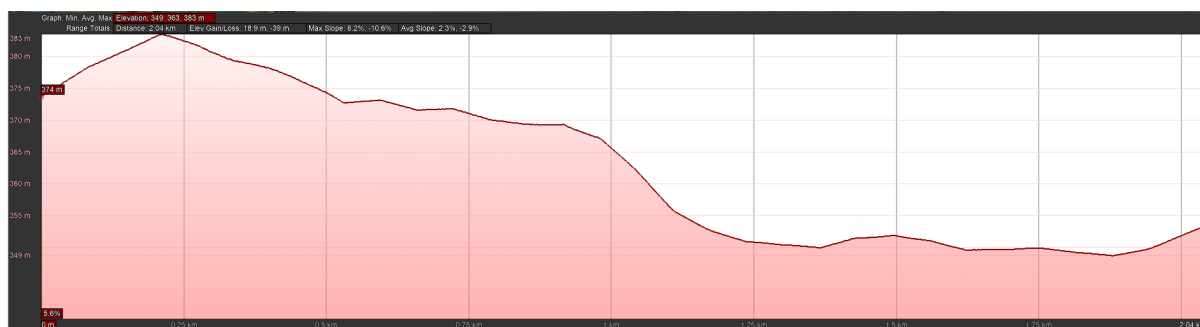


Figure 54 – Elevation Profile – North East Corner of Piggery Complex to House 8

House 5 is about 2,150 m to the north-north-west of the piggery complex. There is an average slope down to this house of <2% (see Figure 55) which satisfies the criteria for “flat” (S3 = 1.0) and the terrain is certainly near flat for about half the distance. Hence, an S3 value of 1.0 is appropriate.

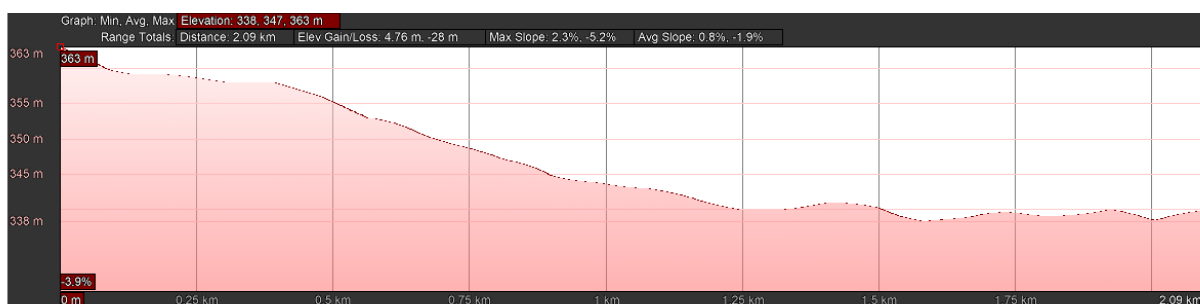


Figure 55 – Elevation Profile – Shortest Distance from Piggery Complex to House 5

House 10 is about 2,530 m to the south-south-west of the site. The house is at a slightly lower elevation to the piggery, although there are some intervening undulations. An S3 value of flat (1.0) has been adopted for this house.

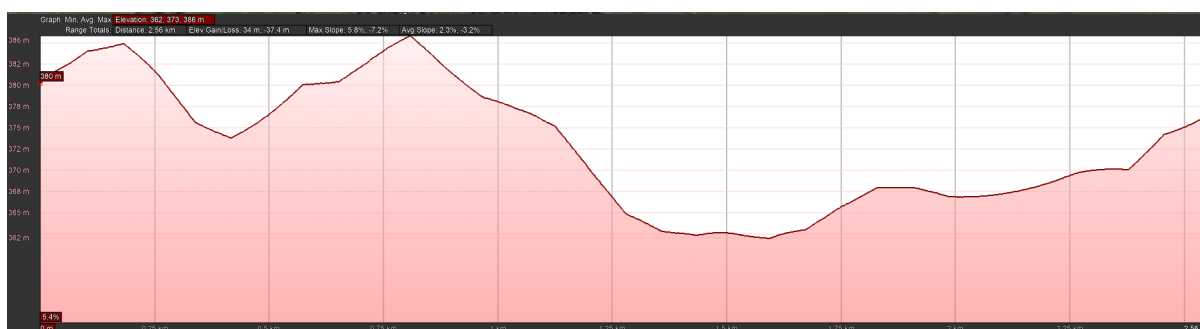


Figure 56 – Elevation Profile – Shortest Distance from Piggery Complex to House 10

House 9 is about 2,618 m to the south-east of the site. The house is at a higher elevation than the piggery. Because the intervening topography is undulating with a significant fall then rise between the piggery and the house, a value of undulating (0.9) has been adopted.

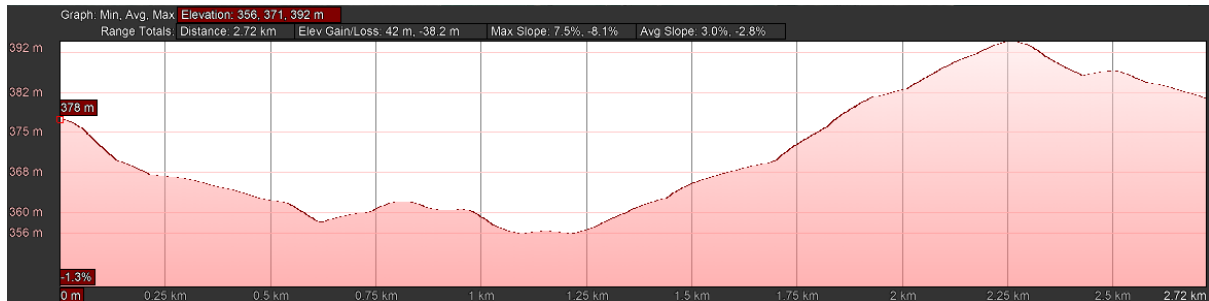


Figure 57 – Elevation Profile – Shortest Distance from Piggery Complex to House 9

In all directions, there is limited vegetation so a factor of 1 (crops only, no tree cover) has been applied across all receptors for S4.

S5 is a wind frequency factor. In all cases, normal wind conditions (value of 1.0) are assumed.

The factors and calculated separation distances to houses 1, 2, 8, 5, 10 and 9 are shown in Table 34. As House 1 is closer to the piggery than house 2, 10, 9 and 6 and has similar intervening topography and vegetation, separation distances have not been calculated to these houses. The maximum SPU numbers for the separation distances are all covered in Table 34.

Table 34 – S Factors and Calculated Maximum SPU Numbers Based on Distance to a House

Receptor	House 1 West	House 2 SW	House 8 East	House 5 NNW	House 10 SSW	House 9 SE
Approx. Avail. Distance	1,040 m	~2,000 m	~2,000 m	~2,150 m	~2,530 m	~2,620 m
<i>S factors</i>						
S1	0.5	0.5	0.5	0.5	0.5	0.5
S2	0.3	0.3	0.3	0.3	0.3	0.3
S3	0.9	1.0	1.2	1.0	1.0	0.9
S4	1	1	1	1	1	1
S5	1	1	1	1	1	1
Combined S factors	0.135	0.15	0.18	0.15	0.15	0.135
Calculated Distance for 23, 824 SPU	1,030 m	1,144 m	1,373 m	1,373 m	1,144 m	1,030 m

The calculated separation distance required to the town of Young is 5,493 m. The available distance is ~17 km. Hence, all of the separation distances are met.

5.2.3. E.2.c Mitigation, Management and Monitoring

Odour minimisation relies on good design and maintaining suitable operational standards. The piggery will be a modern facility incorporating best management practices and design which will optimise hygiene and mitigate odour from the piggery complex. This includes:

- smooth surfaces within housing that are easy to clean
- selection of feeders that minimise feed wastage
- phase feeding with optimal protein to minimise organic matter and nutrients to effluent and spent bedding
- regular emptying of the effluent pits in series to keep a consistent flow of effluent to the CAL (necessary to maintain the food supply for the treatment microorganisms)
- CAL and SEPS sized by organic matter load and hydraulic load
- covering of the anaerobic pond
- using plenty of bedding in the deep litter shelters and replacing this frequently (at least every seven weeks).
- composting mortalities with good cover maintained over the bodies at all times.
- low pressure spray irrigation of effluent from a height of less than 2 m above the ground; this minimises aerosol formation and drift.

Odour nuisance at piggeries can sometimes result from activities that are unfrequently undertaken or at locations away from the piggery complex, like effluent and spent bedding spreading. To mitigate potential odour nuisance from these activities, effluent, mortalities compost and spent bedding that is spread on-farm will be:

- spread frequently (every year to fit with sowing program) to minimise the likelihood of large, odour generation events
- distributed evenly over the land being irrigated / spread
- spread close to the ground
- incorporated into the soil (manure).

Effluent, spent bedding and mortalities compost will not be irrigated / spread:

- when the wind is blowing directly towards a nearby house or public area
- when the material (spent bedding and mortalities compost) is very dry and dusty and spreading could result in dust being carried to nearby houses or public areas
- if significant rain is expected later that day
- close to nearby houses or public areas

When spreading is planned, management will advise close neighbours beforehand so they are aware of what is happening.

The proposed location of the piggery complex provides the recommended variable separation distances to neighbouring houses and communities. Anecdotally, farms that provide the recommended variable separation distances rarely cause odour issues for nearby receptors.

An odour management process will be implemented at the piggery, whereby complaints will be managed by:

- talking with the complainant about the issue with the aim of finding out what the problem is, what date and time it occurred, how long the nuisance lasted, whether the complainant can help identify the cause and any other useful information.

- investigating possible causes by considering what activities were being undertaken (including where and when) and the weather conditions at the time the nuisance occurred.
- gathering evidence and identifying and implementing strategies to remedy the problem and prevent it from happening again.
- talking with the complainant about the identified cause and the corrective and / or preventative actions taken recording all details of the complaint, the investigation, actions taken and the communication with neighbours.
- monitoring the effectiveness of the implemented strategies on an ongoing basis and adjusting if necessary.

Should odour issues arise, liaison with the affected party, Hilltops Shire Council and EPA will be important in reaching a resolution.

5.1. PUBLIC HEALTH

5.1.1. E.17.a Baseline Conditions

Public health risks may arise from contact with pathogens present in effluent and manure. Suitable handling and reuse of effluent and manure minimises any public health risks that may arise through contact (e.g. inhalation of aerosols or dust) with irrigated effluent or manure dust containing pathogens, or through consumption of pathogens on produce that has been irrigated with effluent. The by-product streams (effluent, SEPS solids, mortalities compost, spent bedding) will not change from the status quo. Nor will the reuse methods (low pressure spray irrigation, manure spreader) or the crops grown. The reuse methods (low pressure spray irrigation, manure spreader) have been selected to minimise risk of aerosols (effluent) and drift. The grain and canola crops to be grown on the reuse areas would not normally be eaten raw, reuse would not normally occur within two weeks of harvest and the product is generally not eaten raw / unprocessed. Consequently, the risks from consumption of produce are very low while there may be some risks associated with inhalation of aerosols or dust.

5.1.2. E.17.b Impact Analysis

The enHealth guidelines provide a generic methodology for public health risk assessment (enHealth, 2012). However, some pig industry research into public health risks associated with effluent reuse provide more specific data on the possible impacts.

The most comprehensive studies were undertaken by eminent microbiologist, Dr Pat Blackall (Blackall, Pathogens and Piggery Effluent, 2001) (Blackall, 2004). His research developed a quantitative microbial risk assessment (QMRA) approach for the reuse of effluent from Australian piggeries. The research found that there was a much narrower range of pathogens potentially present in Australian piggery effluent than in human sewage. The only pathogens in piggery effluent warranting consideration were bacteria as the only virus likely to be present is rotavirus and this virus does not generally cross the species-host barrier.

The pathogens potentially present in piggery effluent that are likely of most interest from a public health perspective are *campylobacter*, *salmonella*, *erysipelo**thrix* and *E. coli* (as an indicator organism). Analysis of effluent from the effluent treatment ponds of thirteen southeast Queensland piggeries identified low campylobacter counts in eleven final ponds, and low salmonella counts in only three final ponds. *Erysipelothrix* and *rotavirus* were not detected in any final pond. The results

were evaluated using a quantitative microbial risk assessment approach for a real-life scenario in which piggery effluent was being used to irrigate turf. For the scenario modelled, infection risk was higher with:

- higher pathogen concentration
- smaller separation distances to sensitive areas
- higher wind speed (for spray irrigation)
- more stable atmosphere
- lower relative humidity

The study found that relatively small separation distances (e.g. 125 m at a wind speed of 0.5 m/s and 300 m at a wind speed of 2.5 m/s) were needed to minimise any health risks from campylobacter and salmonella in the irrigation aerosols. Hence, providing appropriate buffers between reuse areas and sensitive land uses and adopting good reuse practices will limit the pathogen risk during reuse. Ensuring a suitable withholding period between reuse and harvesting (two weeks) will minimise health risks when the crop is eaten.

Spent bedding may create dust when handled or spread. Research by Dr Sasha Jenkins (Jenkins, 2014) identified that spent bedding that has been stockpiled for at least three months has a low pathogen risk. This was done by rating the risk after using molecular methods to determine pathogen types and levels in a range of pig manure products, including bedding that had been stockpiled for three months of twelve months. In her report, Dr Jenkins stated: “Fortunately, the presence of pathogenic bacteria is relatively low for all of the by-products meaning their re-use in agriculture poses a minimal risk to animal and human health.” Hence, it is expected that the buffers for odour, coupled with good land use practices, will minimise human health risks.

Given the low population density in the vicinity of the piggery and associated reuse areas, the consequences are limited and moderate at most. The likelihood is low. The overall risk is low to moderate. Active management of the risks is appropriate.

5.1.3. E.2.c Mitigation, Management and Monitoring

General recommendations for the use of piggery effluent in irrigation were proposed by (Blackall, 2001). These were:

- minimise aerosol production from irrigators
- ensure pathogen concentrations are no higher than the concentrations existing at present
- avoid spraying under very stable atmospheric conditions
- avoid spraying when wind speeds exceed 1.6 m/d (6 km/hr)
- avoid spraying under low relative humidity
- day time irrigation provides conditions that promote dispersion, but farm workers will be more active and less likely to maintain adequate separation distance from the irrigator.

Research by Dr Sasha Jenkins (2014) identified that spent bedding that has been stockpiled for at least three months has a low pathogen risk. This was done by rating the risk after using molecular methods to determine pathogen types and levels in a range of pig manure products, including bedding that had been stockpiled for three months of twelve months. In her report, Dr Jenkins stated: “Fortunately, the presence of pathogenic bacteria is relatively low for all of the by-products meaning their re-use in

agriculture poses a minimal risk to animal and human health.” Hence, it is expected that the buffers for odour, coupled with good land use practices, will minimise human health risks.

Hence, to minimise the infection risk for potential receptors, the following measures will be adopted:

- where practical, spent bedding will be stockpiled for at least three months prior to reuse.
- handling and turning of spent bedding will be avoided under windy conditions.
- reuse will not occur within 250 m of a receptor house.
- a low-pressure travelling spray irrigator will be used so as to minimise aerosol production.
- reuse will be avoided under very stable atmospheric conditions (e.g. early in the morning, evening). Effluent irrigation will generally not occur on weekends or public holidays.
- reuse will cease when wind speeds are expected to exceed 6 km/hr
- reuse will be avoided under low relative humidity conditions.

For spent bedding, buffers for odour, coupled with good land use practices, will minimise human health risks.

It is considered that these measures will ensure the health of piggery staff, nearby neighbours, consumers of products grown on the reuse areas and stock grazing those areas.

5.2. E.3 WASTE MANAGEMENT

5.2.1. E.3.a Baseline Conditions

Effluent and spent bedding have been spread on-farm for many years. The soils are in good condition with healthy nutrient levels. Only a couple of paddocks show sodicity. This could easily be addressed with soil ameliorants.

5.2.2. E.3.b Impact Analysis

The piggery has been planned with an emphasis on waste minimisation. For example:

- diets will be formulated to meet the nutritional needs of each class of stock (phase feeding with optimal protein),
- low wastage feeders will be used,
- low wastage drinkers will be used,
- effluent, mortalities compost and some spent bedding will be reused as valuable inputs to the farming system.

The effluent treatment system has been designed to ensure all wastewater is effectively contained and treated:

- the CAL, SEPS and recycle dam have been sized based on the effluent volume and composition. They will have impermeable bases (1×10^{-9} m/s permeability), above-ground banks to prevent stormwater ingress, and a design spill frequency of 1 in 10 years and also able to contain the 1 in 20 year, 24 hour storm.
- effluent will be directed into the CAL regularly to ensure stable function is maintained.
- the anaerobic pond will be covered to minimise the odour and greenhouse gas emissions of the piggery.

The manure storage areas have also been designed to ensure the environment is protected:

- these have been sized to manage the expected volume of spent bedding from the piggery.
- the pad has been constructed for a low permeability (1×10^{-7} m/s permeability) and bunded to prevent ingress of extraneous stormwater and to control drainage water from the area.
- all water captured within the manure storage areas is confined within the bunding.

Wastewater from staff amenities is treated using a septic system.

Effluent, mortalities compost and possibly some spent bedding will be used as cropping system inputs on-farm. However, it is expected that the SEPS solids and most spent bedding will be spread on other land managed by Windridge Farms Pty Ltd and will be made available to other nearby landholders as cropping system inputs. It is expected that the nutrients and organic matter in these products will enhance soil structure, water holding capacity and nutrient quality.

Reuse practices that will be used by Windridge Farms Pty Ltd on Koorani will include:

- spreading the nutrients in the effluent, spent bedding and mortalities compost at sustainable rates, with the aim of ensuring applied nutrients can be removed by crop harvest.
- regularly testing the soils of reuse areas to confirm that soil nutrients are at suitable levels that won't put the quality of soil, runoff water or groundwater at risk.
- providing suitable buffers to waterways and sensitive native vegetation.
- using good farming practices (e.g. reduced till).

The piggery will generate very little rubbish. Pig feed commodities will be delivered in bulk and without packaging. There will be some pharmaceutical and cleaning product packaging and some office wastes. No on-farm waste disposal areas are planned. Wastes that cannot be practically recycled will be collected in skips and the contents will continue to be dispatched to off-farm waste facilities. Sharps will continue to be collected in suitable containers for disposal through an appropriate facility.

5.2.3. E.2.c Mitigation, Management and Monitoring

The reuse of effluent, manure and spent bedding in the farming system is expected to enhance soil properties. However, it is important to ensure nutrients are applied at sustainable rates. For each paddock on the piggery property, reuse rates will be calculated based on the nutrient content of the material for spreading, soil properties (excesses or deficits of nitrogen, phosphorus and potassium), and the expected nutrient uptake of the crops or grazing. Soil monitoring is described in section 7.2. Where SEPS solids or spent bedding are provided to other farmers, they will continue to be provided with a recent analysis and directed to consult with their agronomist or to the Australian Pork Limited (Tucker, RW, 2015) "Piggery Manure and Effluent Reuse Glovebox Guide" to calculate spreading rates.

5.3. E.4 WATER QUALITY AND CATCHMENT PROTECTION

5.3.1. E.4.a Baseline Conditions

There are no major rivers close to Koorani. However, Cudgell Creek, an intermittent but perennial stream, runs alongside the eastern boundary of the property. There are also minor waterways including one that starts to the south-east of the SEPS then runs a short distance to the north of these to a dam (see Figure 14, Figure 45 and Figure 46). However, the SEPS and sheds are bunded, diverting runoff around the site.

The water in Cudgell Creek is relatively saline, although this fluctuates with rainfall. Burrangong Creek flows to the north and drains to the Bland Creek that is a mostly-perennial watercourse that drains into Lake Cowal. As Figure 26 (from the NSW Planning Portal) shows, both Cudgell Creek and Burrangong Creek are considered environmentally sensitive (see section 3.2.4 for more information). Because of its elevation, the site of the existing piggery is not subject to flooding.

In the vicinity of the property, the underlying geology is the Young Granodiorite and the Lachlan Fold Belt. The Young granodiorite is a fractured rock aquifer. In this formation, groundwater would typically be stored and move through faults, cavities, joints and fractures within the rock mass. Weathering has increased the porosity and the permeability of the granite. It is likely that the water-bearing zone extends to 80 m or more. Alluvial groundwater is present at shallower depths near watercourses. This groundwater would be more vulnerable. No groundwater dependent ecosystems have been identified near the site.

It is not expected that any proposed works will intersect or connect with groundwater.

It is not expected that groundwater allocations will be exceeded.

5.3.2. E.4.b Impact Analysis

Water quality objectives have been specified for the Lachlan River (NSW Office of Environment, ND). The subject property fits in the category for uncontrolled streams. The water quality objectives are to protect:

- aquatic ecosystems
- visual amenity
- secondary contact recreation
- primary contact recreation
- livestock water supply
- irrigation water supply
- homestead water supply
- drinking water at point of supply – disinfection only
- drinking water at point of supply – clarification and disinfection
- drinking water at point of supply – groundwater
- aquatic foods (cooked).

Refer to section 3.2.4 for details. The existing water quality may be too saline to support some of the current uses and desired objectives, particularly swimming and irrigation of moderately salt-tolerant crops.

River flow objectives are also specified but these are less relevant since surface water will not be used by the piggery and on-farm activities are not expected to affect flow.

If monitoring were considered necessary, potential impacts to surface waters could be assessed using selected criteria derived from <https://www.environment.nsw.gov.au/ieo/Lachlan/caag.htm>, the Revised Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2018) and the (ANZECC and ARMCANZ, 2000). These guidelines include criteria for aquatic

ecosystems, cultural and spiritual values, primary industries, human drinking water and recreational water including direct and indirect measures.

For aquatic ecosystems, impacts could be assessed using selected criteria derived from <https://www.environment.nsw.gov.au/ieo/Lachlan/caag.htm> and some of the default trigger values for upland rivers in south-east Australia (tables 3.3.2 & 3.3.3) from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality guidelines (ANZECC and ARMCANZ, 2000), for example:

- total phosphorus 20 mg/L
- total nitrogen 250 mg/L
- nitrates + nitrites 15 mg/L
- ammonium 15 mg/L
- dissolved oxygen 90-110% saturation
- pH 6.5-8.0
- EC 30-350 uS/cm
- dissolved oxygen 90-110%

For primary industries, impacts could be assessed using the default trigger values in tables 4.2.10, 4.2.11, 4.3.1 & 4.3.2) from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality guidelines (ANZECC and ARMCANZ, 2000):

The Revised Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2018) identify that aesthetic and health-related guideline values for drinking-water quality are provided in the Australian Drinking Water Guidelines (2011) Updated 2016 (NHMRC, 2016). For human drinking water, cultural and spiritual values and primary contact recreational water, it may be appropriate to use some of the health and aesthetic values for common analytes given in table 10.6 of the Australian Drinking Water Guidelines for:

- pH 6.5-8.5 (aesthetic)
- ammonia 0.5 mg/L (aesthetic)
- boron 4 mg/L (health)
- chloride 250 mg/L (aesthetic)
- copper 2 mg/L (health), 1 mg/L (aesthetic)
- manganese 0.5 mg/L (health), 0.1 mg/L (aesthetic)
- nitrate 50 mg/L (health)
- sodium 180 mg/L (aesthetic)
- hardness as CaCO₃ 200 mg/L (aesthetic)

The NSW Groundwater Quality Protection Policy (Department of Land & Water Conservation, 1998) aims to manage the state's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW. It is policy of the NSW Government to encourage the ecologically sustainable management of the State's groundwater resources so as to:

- slow and halt, or reverse any degradation of groundwater resources;
- ensure sustainability of groundwater dependent ecosystems;
- maintain the full range of beneficial uses of these resources;
- maximise economic benefit to the region, state and nation;

The policy objectives are:

1. all groundwater systems should be managed such that the most sensitive identified beneficial use (or environmental value) is maintained.
2. town water supplies should be afforded special protection against contamination.
3. groundwater pollution should be prevented so that future remediation is not required.
4. for new developments, the scale and scope of work required to demonstrate adequate groundwater protection shall be commensurate with the risk the development poses to the groundwater system and the value of the groundwater resource.
5. a groundwater pumper shall bear the responsibility for environmental damage or degradation caused by using groundwaters that are incompatible with soil, vegetation or receiving waters.
6. groundwater dependent ecosystems will be afforded protection.
7. groundwater quality protection should be integrated with the management of groundwater quantity.
8. the cumulative impacts of the developments on groundwater quality should be recognised by all those who manage, use or impact on the resource.
9. where possible and practical, environmentally degraded areas should be rehabilitated and their ecosystem support functions restored.

No impacts to surface water or groundwater quality from the piggery complex are expected because:

- the piggery will not directly discharge to waterways.
- waterways on the subject property will be protected through piggery design that protects stormwater quality, good effluent and manure reuse practices and provision of suitable buffers to waterways.
- shallow groundwater is not present beneath the piggery site or the proposed reuse areas.
- the effluent treatment system, which will capture all effluent from the piggery itself as well as runoff from the area above the second and third SEPS channels, has been designed for an average spill frequency of 1 in 10 years, and is also able to contain the 1 in 20 year, 24 hour storm. The base of the CAL, SEPS channels, recycle dam and manure storages will be impervious (1×10^{-9} m/s permeability).

Reuse practices have also been designed to protect surface water and groundwater quality. These include:

- selecting soil that is suitable for cropping or pasture production (arable land, low slope, no major impediments to crop production) for reuse
- fresh water only used for pigs drinking water, in liquid feed system (which reduces amount of pigs drinking water), and to hose inside sheds
- all flush water (used to remove manure from under conventional sheds) is currently draw from the recycle dam and this will continue in the future
- very little water is used in deep litter housing
- planning for nutrients in effluent, mortalities compost, spent bedding and SEPS solids to be spread at rates determined from soil nutrient levels and expected crop harvest removals.
- providing suitable buffers between reuse areas and watercourses.
- using practices that minimise soil erosion e.g. minimum tillage.
- monitoring effluent, spent bedding and soil nutrient levels and adjusting reuse rates to ensure soil nutrient levels do not exceed good agronomic levels.

These measures will offer a good protection of soil, surface water and groundwater.

5.3.3. AE.4.c Mitigation, Management and Monitoring

The mitigation and management measures detailed in section 5.3.2 are sufficient to ensure good protection of both surface water and groundwater. Given that effluent and manure will be fully managed within the piggery complex to protect stormwater runoff and groundwater, the only risk area would be the reuse areas. However, these are unlikely to pose a significant risk to surface water or groundwater due to the good nutrient management and agronomic practices proposed, and the buffers between reuse areas and waterways that will filter and absorb runoff.

As the on-farm watercourses are intermittent, there is little point in monitoring water quality in these. Similarly, the depth to groundwater away from Cudgell Creek means that impacts to water quality are unlikely. Under Environment Protection Licence 11,314 Windridge Farms Pty Ltd is currently required by EPA to monitor groundwater quality in four piezometers (K4, K5, K6 and K7) six monthly. The location of these is shown on Figure 34. It is proposed that this monitoring will continue post-expansion. Any monitoring will be undertaken in accordance with “Approved Methods for the Sampling and Analysis of Water Pollutions in NSW” (NSW EPA, 2022). It is worth noting that quite a few of these piezometers have been dry on many occasions when testing is due.

5.4. E.5 LAND CAPABILITY AND PROTECTION

5.4.1. E.5.a Baseline Conditions

Section 3.3.3 of this EIS summarises the main findings of a soil survey of the farm undertaken by Midstate Planning in 1993 (Zinga, 1993). Red brown earths (Dr2.22) are widespread on the farm, particularly on the broad hillcrests, upper and midslope terrain locations. These are texture-contrast soils with hard-setting surfaces. Yellow earths (Gn2.62 and Gn2.66) are found in similar terrain locations to the red-brown earths, although more commonly on the midslope positions. These soils are dark reddish-brown, fine sandy clay loams with a gradual increase in clay content with depth. Yellow podzolics (Dy3.42) are found on the lower, flatter and more poorly drained terrain. These are texture contrast soils with a hard setting surface on their brown sandy loam topsoils. Alluvial soils were also present along Cudgell Creek.

The soils generally have good nutrient levels. The soils are mostly acidic with a few sites (Nhill Drive 2020 and 2019, and Coddington’s) just falling into the strongly acidic class. The soil electrical conductivity saturated extract (EC_{se}) is unlikely to impact the yields of the types of crop grown on the farm; salt sensitive plants may be impacted in the range of 2-4 dS/m, while many plants will be affected once the $EC_{se} > 4$ dS/m. The soils were generally non-sodic.

Under Environment Protection Licence 11,314 Windridge Farms Pty Ltd is currently required by EPA to monitor soil properties in areas irrigated with effluent, spread with spent bedding and spread with SEPS solids in the previous 12 months (one set of samples per agronomic management unit). They are also required to analyse effluent six monthly and spent bedding and dried SEPS solids every 12 months.

5.4.2. E.5.b Impact Analysis

Irrigation of effluent onto the soil will add organic matter which will help to improve soil structure, and nutrients which will maintain fertility. However, effluent also contains dissolved mineral salts that include both potentially harmful salts as well as plant nutrients. In particular, sodium salts are of concern as an excess of sodium relative to calcium and magnesium can impede plant growth, and adversely affect soil structure by increasing dispersion and erodibility while reducing permeability. If

these accumulated in the soil to excessive levels, they could eventually induce salinity or topsoil sodicity. Given that effluent has been irrigated for many years with no serious impacts, this is not considered a concern.

Mortalities compost and spent bedding additions will enhance soil quality by adding significant organic matter and nutrients that will be used by crops. Because very little water is used in deep litter housing, the salt load will be relatively low. No negative effects are expected.

5.4.3. E.5.c Mitigation, Management and Monitoring

The organic matter and nutrients added to soil by effluent, mortalities compost and spent bedding will improve soil structure and enhance the nutrient status. Nutrients will be applied at rates determined from soil properties and nutrient removal rates through crop harvest or grazing. Testing of the soils of areas on which reuse has occurred will detect any issues with nutrient imbalances, salinity or sodicity. Nutrient surpluses will be addressed by adjusting future reuse rates or crops. Nutrient imbalances will be corrected by adjusting reuse rates or through fertiliser or amendment additions. Testing of effluent, SEPS solids and spent bedding for reuse on-farm is appropriate. Soil monitoring is also recommended.

5.5. E.6 DRAINAGE AND STORM WATER MANAGEMENT

5.5.1. E.6.a Baseline Conditions

Stormwater is kept well separated from effluent and manure within the piggery complex. Good reuse practices, coupled with generous buffers alongside waterways, mean that drainage and stormwater are well protected.

5.5.2. E.6.b Impact Analysis

Stormwater captured within a piggery complex can be contaminated with manure and sediment. However, in this case, stormwater runoff from the piggery will be completely controlled. Sheds will be designed to prevent ingress of stormwater and any outflows from conventional sheds will be directed to the effluent treatment system. Banks around the CAL, SEPS, recycle dam and manure storage areas will prevent ingress of extraneous stormwater and also prevent outflows.

A Stormwater Management Plan will be developed to ensure sediment escape during construction and operation is minimised. Section 7.1.1 provides further detail. No impacts to storm water quality are expected.

Effluent, mortalities compost and spent bedding reuse will be managed to minimise exports. These products will be spread at sustainable rates and only under suitable weather conditions. They will not be spread if the soil is wet, a major rainfall event is imminent or under windy conditions. Buffers will provide secondary protection for waterways.

5.5.3. E.6.c Mitigation, Management and Monitoring

The piggery has been designed to exclude extraneous stormwater and to prevent effluent, manure and potentially contaminated stormwater from leaving the site.

Banks and bunds around piggery facilities, and the volume of water in the recycle dam, will be regularly monitored. These will also be checked after rainfall events.

Buffers will be provided between the reuse areas and the waterways. These will help to prevent stormwater carrying sediment or dissolved nutrients from entering waterways.

5.6. E.7 FLOODING

5.6.1. E.7.a Baseline Conditions

The piggery site is not subject to flooding. There has never been flooding at the piggery site and the SEPS have never overflowed. Cudgell Creek does occasionally come up over its banks and onto the road but not onto Koorani.

5.6.2. E.7.b Impact Analysis

Since the piggery site is not subject to flooding, there is no risk of impacts to water quality or to infrastructure from a flood. For reuse areas, the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018) suggest a maximum flood frequency of one in five years. The piggery site and the reuse area flood frequencies do not exceed these limits.

5.6.3. E.7.c Mitigation, Management and Monitoring

There is no need for mitigation, management or monitoring at the piggery complex site, as this is not affected by flooding. Nor is flooding likely to result in significant impacts to water quality on the proposed reuse areas.

5.7. E.8 TRAFFIC AND ROAD IMPACTS

5.7.1. E.8.a Baseline Conditions

Road condition and transport requirement are detailed in section 2.4.5, including Figure 19 to Figure 22 and in Appendix I. Henry Lawson Way and Old Forbes Road provide site access from the south.

The property entry point is off Old Forbes Road. Old Forbes Road is a sealed two-lane road. The road is greater mass limit (GML) and concessional mass limit (CML) approved (25 m B-double) except on school days between 7:15 AM to 8:00 AM and 4:00 PM to 4:45 PM. It is not higher mass limit (HML) approved (PSA Consulting Australia, 2019). Figure 20 shows that the property entrance is located on a straight stretch of road with good visibility in both directions with a design that is suitable for heavy vehicles turning towards Young. The property entrance point is suitable for the entry of B-doubles.

Henry Lawson Way is a gazetted main road. It is a two-lane single carriage way that supports heavy vehicle movements (B-doubles). The junction of Old Forbes Road and Henry Lawson Way is shown on Figure 19. The junction provides clear visibility with a near straight stretch of road for >250 m in both directions. The intersection has been designed to accommodate heavy vehicles turning from Old Forbes Road onto Henry Lawson Way with channelised left and right turn provisions.

5.7.2. E.8.b Impact Analysis

Traffic to the site will temporarily increase during the construction phase. Machinery, construction materials and labour movements will all contribute to traffic on local roads.

The increase in the capacity of the piggery will also increase heavy vehicle numbers, doubling the number of feed and pig trucks, and increasing the number of trucks transporting spent bedding and SEPS solids from the site. From section 2.1.1, annually there will be about:

- 420 X 33 t feed trucks
- 102 X B-double of pigs in each week.
- 416 X B-doubles per week transporting finished pigs from the site
- up to 53 X 26 t loads of spent bedding
- 49 X 26 t loads of SEPS solids

This is a maximum of 1,040 trucks per year or an average of 20 per week. Peak traffic volumes are likely to occur in the first few months of each year when spent bedding will be transported from the site for spreading. If this occurs evenly in February, March and April peak truck movements in these months will average 26 trucks per week.

No traffic count data is available for Old Forbes Road to its intersection with Henry Lawson Way. However, a doubling of piggery truck numbers to 20 per week may represent a significant increase in heavy vehicles using this road.

Traffic count data for Henry Lawson Way west of Chillingworks Road Young for 2018 is available from the PSA Report (PSA Consulting Australia, 2019). The AADT was 2,050 vehicles and growing by 4% per year which equates to 2,494 AADT in 2023. Some 10% of these vehicles were heavy vehicles or ~250 vehicles per day. To put this in perspective, total piggery trucks would make up about 1.13% of these numbers with the increase in traffic numbers resulting from the expansion making up ~0.57% of the total traffic (assuming all piggery vehicles use Henry Lawson Way, which would not be the case). Consequently, the total number of piggery truck movements on Henry Lawson Way does not represent a significant increase in truck movements along this road.

Given that the heavy vehicles (semi-trailers/B-Doubles) to be used are permissible on Henry Lawson Way and Old Forbes Road and currently use the roads, the roads and intersections can be considered to be at a suitable standard and no impacts are expected.

5.7.3. E.8.c Mitigation, Management and Monitoring

No upgrades to Henry Lawson Way, Old Forbes Road or their intersection are proposed for either the construction phase or the operational phase. Nor is there a need to upgrade the property entry point. There is ample room for on-site parking in the vicinity of the piggery so this is not a concern in either phase.

All trucks coming to the piggery site will need to drive at speeds that are suitable for road conditions. Drivers will be expected to consider other users on the road and slow down or stop for stock on roads. During both the construction and operational phases, trucks will be scheduled to come during the day whenever practical. However, occasional night transportation of pigs will be required during very hot weather for animal welfare reasons.

No significant impacts to road maintenance requirements or road safety are expected.

5.8. E.9 NOISE

5.8.1. E.9.a Baseline Conditions

The subject property is situated within a farming area. Noise is currently generated from tractors planting and harvesting crops, trucks transporting inputs and produce and livestock noise. Background and ambient noise levels have not been measured for the site. Very little noise is generated by the piggery complex. Given the distance to the closest houses (>1 km) noise is most unlikely to cause a nuisance.

5.8.2. E.9.b Impact Analysis

Noise from industry can directly impact nearby residents (noise-induced hearing loss, speech interference, sleep disturbance and annoyance) and can cause long term effects on physical and mental health due to long-term annoyance and prolonged sleep disturbance. The NSW Noise Policy for Industry (Environment Protection Authority, 2017) sets out recommended amenity noise levels from industrial noise sources to residential uses including houses in RU1 – primary production. These are shown in Table 35. Operations at the piggery complex are most unlikely to exceed these recommended limits at the property boundary.

Table 35 – Recommended Noise Levels from Industrial Noise Sources for Residences in Rural Areas

Time of Day	Acceptable Level
Day	50
Evening	45
Night	40

Traffic servicing the piggery is another source of noise. From the NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011), the assessment criteria for existing residences affected by additional traffic on existing local roads generated by land use developments are:

- $L_{Aeq,(1\text{ hour})}$ 55 (external) in the day
- $L_{Aeq,(1\text{ hour})}$ 50 (external) at night

To assist with interpreting these limits, Figure 58 is provided. This figure shows common sounds and their typical noise level. It is reproduced from the NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011).

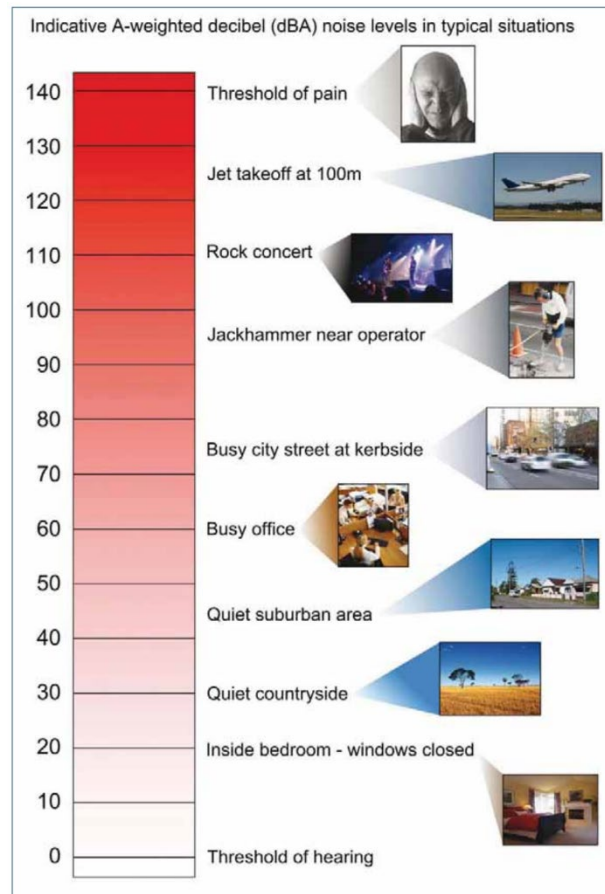


Figure 58 – Common Sounds and their Typical Noise Level

The machinery used within the piggery complex will generate low level noise. This includes noise from stock feeding and pumping of water and effluent. Because the pigs will be fed automatically, pig squealing noise will not be triggered by feeding. However, some short-term squealing could be expected when pigs are moved between housing or loaded for sale. These activities are generally undertaken either intermittently or at regular intervals of short duration, generally less than one hour. In most cases they will occur during the day. The exception is that pig loading will occasionally need to occur early in the morning in exceptionally hot weather for welfare reasons. The noise from these sources will not exceed the acceptable levels at the boundary of the property. It is expected that this noise will be inaudible at the nearest houses.

The piggery will generate some additional truck movements on Old Forbes Road and Henry Lawson Way. These roads already carry heavy vehicles. It is not expected that noise from these will cause noise nuisance as there are no houses within a kilometre of the property entry point. The closest house to Old Forbes Road is house 8 which is about 215 m from the road. As this house is about 2 km by road from the property entry point, it is unlikely to be impacted by braking noise. Nevertheless, to minimise the risk of noise nuisance, truck movements will be scheduled to occur during the day, although there will be occasional stock trucks early in the morning. Assuming trucks travel at a speed of 90 km/hr along Old Forbes Road, and the noise affects the houses for 150 m either side of the houses, the noise

impact will be for 12 seconds per vehicle going past one way. (90 km/hr = 1500 m/min. It will therefore take 300 m / 1500 m = 0.2 X 60 seconds = 12 seconds).

In the NSW Road Noise Policy, noise is calculated as an average maximum one-hour noise level using 15 minute intervals. The limit is 55 dB during the day and 50 dB at night. If we assume that the truck noise level is 90 dB & the background noise level is 30 dB, the increase in noise can be estimated. Assuming that at peak times there could be an absolute maximum of four truck movements in one hour, one every fifteen minutes, the noise based on 15 minute averaging will be:

12 seconds per 15 minutes (900 seconds) = 1.33% of the time X 90 dB = 1.2 dB
900 seconds less 12 seconds per 15 minutes (888 seconds) = 98.7% of the time X 30 dB = 29.6 dB
Total = 30.8 dB.

This is well below the maximum limit of 55 dB (day) and 50 dB (night) specified in the NSW Road Noise Policy.

The NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011) also notes that new developments must not increase noise by more than 12 dB. The additional noise from the operation of the pig farm and from associated occasional truck movements will be well below this level. Hence, noise is most unlikely to create nuisance.

5.8.3. E.9.c Mitigation, Management and Monitoring

The suitable separation distances to neighbouring houses from both the piggery and the farm entrance mean that noise from the piggery complex is expected to be inaudible at the closest houses and create no more impact than other farming operations in the area. Truck movements will be scheduled to occur during the day whenever practical to minimise the likelihood of night-time impacts.

Noise generated by on-farm reuse area activities will be no different from the current position.

5.9. E.10 DUST

5.9.1. E.10.a Baseline Conditions

Under baseline conditions, dust is produced by farming activities, wind movement across bare paddocks and by vehicle movements along unsealed roads.

5.9.2. E.10.b Impact Analysis

The piggery complex is unlikely to generate significant dust. Dust will not be released when feed is unloaded or distributed as enclosed augers will be used for this activity. Prepared feed will be stored in sealed silos which will also prevent dust releases. As the pigs will be kept in sheds or shelters, they won't produce any significant dust. Moisture from manure will minimise dust release from the bedding within the deep litter shelters. The spent bedding will be moist on removal from the sheds so it is unlikely that this will create any dust. However aged spent bedding may be dusty and handling of dry spent bedding under windy conditions will be avoided.

As the access roads are sealed, these will not be a source of dust. Minimal dust will be created through the use of the on-farm road during dry weather. Given the separation distances to houses, this will not cause nuisance.

5.9.3. E.10.c Mitigation, Management and Monitoring

Dust from the piggery complex is unlikely to reach the neighbours' houses due to the separation distances available. Nor is road dust likely to be an issue.

To avoid dust from spreading spent bedding, mortalities compost and SEPS solids, these materials will not be handled or spread under windy conditions which could cause dust to carry to nearby houses.

5.10. E.11. VISUAL IMPACTS

5.10.1. E.11.a Baseline Conditions

The land surrounding the piggery is mostly cleared for farming. There are areas marked in the Hilltops LEP as having high biodiversity value to the south-east and south of the piggery, along Old Forbes Road and along Cudgell Creek. However, these are farm tree lines of trees about 20 years old. These trees provide some screening of the piggery but are not of high biodiversity value.

5.10.2. E.11.b Impact Analysis

The additional sheds will be placed to the south of the existing sheds, minimising visual impacts from Old Forbes Road. The exterior materials for the sheds will be light, non-reflective colours to avoid glare. A small number of trees will need to be removed to make way for the new sheds.

5.10.3. E.11.c Mitigation, Management and Monitoring

There are already tree lines on Koorani, including the entire length of the boundary with Old Forbes Rd. These were planted when the first part of the piggery was built in about 2000 and effectively screen the piggery from traffic on road. The piggery is not clearly visible now from any houses. Hence, no mitigation is needed or proposed.

5.11. E.12. PEST AND INSECT CONTROL

5.11.1. E.12.a Baseline Conditions

Like other farms in the area, there are occasional foxes and feral cats at the farm. There have been no feral pigs. At times, mice, rats and locust are experienced. Introduced bird species are also observed. The piggery operates as a high health herd and it is important to maintain this status.

The biodiversity assessment included as Appendix G identified a range of introduced plant species, including six listed as high threat exotics. However, none were weeds of national significance or priority weeds for the Riverina Local Land Services Region. Weeds are effectively controlled as a routine part of farm management.

5.11.2. E.12.b Impact Analysis

Controlling pest animals is vital to good farm biosecurity since pest animals may pose disease and possibly scavenging risks. The consequence of pest animals to biosecurity could be high. An outbreak of disease within the herd would have welfare, production and economic costs. It is therefore important to ensure optimal herd health is maintained. However, with good design and management the likelihood can be restricted to low with a moderate overall risk.

It is not expected that the proposed piggery expansion will have any significant impact on pests and insects. The piggery site will be fenced with a stock-proof fence. While foxes and feral cats could access the site, these can be managed. It is worth noting that grow-out piggeries are not attractive to feral cats. Birds, rodents and insects will be attracted to grain. A clean and tidy site will provide less habitats and feed sources and will be the key to managing pest numbers. If this is supported by strategic control of pests, significant off-site impacts are unlikely. The biosecurity procedure included as Appendix H describes the current and proposed risk mitigation strategies.

Weed control is important particularly since the farm is also used to grow crops. Poorly managed weeds could have significant consequences for crop productivity. With good management weeds are being effectively controlled.

5.11.3. E.12.c Mitigation, Management and Monitoring

Good management practices such as site cleanliness, good hygiene and strategic rat baiting and fly baiting will effectively control insect and rodent pests. Currently the site is slashed to keep grass down for fire safety and pest control, and management will continue to do this. All feed storage silos, feed bins and feed lines will either be enclosed or designed to prevent access by rodents and birds. Feed spills will be cleaned as soon as practicable. The conventional sheds will be built from easily-cleaned materials and will be regularly pressure-washed to remove manure and feed residues from the flooring.

A strategic rodent baiting program will be used to control rodents and insects. This is likely to include rat bait stations external to the pig housing with regular inspection and bait top-up if required. Insect bait stations will also be used if required. There is an APIQ[✓]® procedure for rat baiting and management will follow this.

Diseases are prevented and herd health managed through a rigorous biosecurity protocol based on the National Farm Biosecurity Manual for Pork Production (Animal Health Australia, 2021) as detailed in SOP 11 which is included as Appendix H of this EIS.

Entry of weed seeds onto the farm is avoided by inspecting machinery entering the property. Machinery must be clean of mud, soil and vegetation. Weeds are controlled through good paddock management. Weeds are identified and removed through physical means or herbicide application.

5.12. E.13. FLORA AND FAUNA

5.12.1. E.13.a Baseline Conditions

The farm on which the piggery is sited has been cleared and farmed for many years. However, there are also areas of high biodiversity on the farm and close to it. These include clumps to the south-east and south of the piggery, along Old Forbes Road and along Cudgell Creek (see Figure 27 and Figure 47). Mapping within the Hilltops LEP (2022) indicates that the development site does not contain areas of high biodiversity value. However, a Biodiversity Assessment Report (BAR) prepared by OzArk for the project identified the plant community type PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion in the vicinity of the development area. This PCT occurred as small derived (0.70 ha) and planted (0.14 ha) forms. Although all areas of PCT 277 met the condition thresholds for the *NSW Biodiversity Conservation Act 2016* (NSW Government,

2016) listed critically endangered ecological community (CEEC): White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar the total area of this CEEC that could be directly impacted by the proposal was 0.84 ha. Any clearing of this vegetation would not exceed the clearing threshold for the lot size, impact an area mapped on the Biodiversity Values Map or result in a significant impact to one or more listed threatened entities. A minor unnamed watercourse within the subject site that is connected to two farm dams and does not flow into any other watercourses. As the proposal includes the dredging and/or remediation of the unnamed minor watercourse within the subject site, a permit issued by the Minister will be required under Section 201 the *Fisheries Management Act 1994*. However, the development is not expected to have any significant impacts on biodiversity. This proposal does not trigger the need to offset, prepare a Biodiversity Development Assessment Report (BDAR) or to refer the matter to the Minister.

All of the land identified for reuse is fully cleared for the cropping that has been undertaken for many years.

5.12.2. E.13.b Impact Analysis

While the expansion of the piggery complex will require the removal of a small number of trees, this is not expected to have any significant impacts to biodiversity.

Reuse of effluent and manure adds nutrients to the soil which is generally beneficial for plants if managed well. However, elevated nutrients in the soil (which may result in runoff from reuse areas) and spray drift of irrigated effluent can adversely affect native vegetation.

5.12.3. E.13.c Mitigation, Management and Monitoring

To protect remnant vegetation, an 80 m wide buffer will be provided between the effluent reuse areas and any native vegetation mapped on Figure 27 and Figure 47.

5.13. E.14. HERITAGE

5.13.1. E.14.a Baseline Conditions

Although the Hilltops LEP and the AHIMS system have not recorded any Aboriginal heritage items on or near the proposed pig farm, further investigation by Wiradjuri Cultural and Heritage Site Officers from the Young Local Aboriginal Land Council (LALC) identified one artefact (chert) in the vicinity of the piggery complex and a possible artefact (grinding stone) towards the cultivation indicating past use of the land by Wiradjuri people. Due diligence investigations were undertaken by Past Traces Heritage Consultants who found five additional artefacts. An ACHAR was subsequently prepared.

The applicants are not aware of any items of European heritage significance on the pig farm or any of the reuse areas.

5.13.2. E.14.b Impact Analysis

The construction of the piggery, particularly excavation for shed bases and the effluent treatment system, poses a risk of damaging Aboriginal artefacts if these are present. An ACHAR was prepared for the site. An AHIP will be needed prior to any works commencing.

5.13.3. E.14.c Mitigation, Management and Monitoring

Five newly identified heritage sites are located either within or adjacent to areas where machinery movement and soil impacts are anticipated during development. As a result, a program of surface collection and return to country will be undertaken to preserve the artefacts from harm following granting of an AHIP. Details are provided in Appendix K.

In accordance with the recommendation of Young LALC, two site officers from Young LALC will be in attendance during the soil excavation that occurs during construction. This is to help with the identification of Aboriginal items that may be unearthed, and to ensure these are treated with respect. In the event that an Aboriginal object is found during construction, work will immediately stop until appropriate protection measures can be undertaken and the Office of Environment and Heritage will be notified as soon as practical. If human remains are found, work will stop, the site will be secured and the NSW Police and the Office of Environment and Heritage will be notified as soon as practical.

If any Aboriginal items are recorded in the future on-farm, these will remain at the property and will only be moved in the presence of a site officer from Young LALC. Where items cannot be moved, consultation with Young LALC and the Office of Environment and Heritage will be used to determine suitable buffers around them.

5.14. E.15. HAZARDOUS CHEMICALS

5.14.1. E.15.a Baseline Condition

The chemicals stored at the piggery include veterinary chemicals, disinfectants for shed cleaning, rodent and fly baits and small quantities of herbicides. Diesel is stored in the pastoral work shop area which is separate from the piggery. All chemicals will be suitably stored in lockable areas. A material safety data sheet (MSDS) for each hazardous chemical will be prominently located near the chemical. The spill containment equipment specified on the MSDS will be kept in or near the chemical storages.

5.14.2. E.15.b Impact Analysis

The piggery expansion is not expected to result in any changes to chemical storage or usage. Only relatively small quantities of chemicals will be kept on-farm at any time. The likelihood of a chemical contamination incident is very low.

5.14.3. E.15.c Mitigation, Management and Monitoring

All chemicals will be stored and used in accordance with the packaging directions or veterinary advice. A MSDS for each hazardous chemical will be prominently located near the chemical. Spill containment equipment will be kept in or near the chemical storages. Details of all chemical purchases, usage and disposal will be recorded.

5.15. E.16. ANIMAL WELFARE AND BIOSECURITY

5.15.1. E.16.a Baseline Conditions

It is in the proponent's interests to optimise animal welfare since this influences production and profitability. This means that all facilities and management need to meet or exceed the standards. Pig housing will comply with all the design requirements of the various codes.

The applicable animal welfare standards are the:

- Model Code of Practice for the Welfare of Animals – Pigs (Primary Industries Standing Committee, 2008)
- Australian Animal Welfare Standards and Guidelines —Land Transport of Livestock (Animal Health Australia, 2012)
- Animal Welfare Code of Practice – Commercial Pig Production (NSW Government Industry & Investment, 2009).

Animal Welfare Code of Practice – Commercial Pig Production is prescribed under the Prevention of Cruelty to Animals (General) Regulation 2006 (NSW Government, 2006).

All pigs will be group-housed and the space requirements in Appendix 3 of the Model Code of Practice for the Welfare of Animal – Pigs and Schedule 1 of the Animal Welfare Code of Practice – Commercial Pig Production will be provided.

Persons responsible for the care of the pigs will be skilled in piggery work and competent to ensure the health and welfare of the animals or will be under the direct supervision of skilled personnel. Personnel will be appropriately instructed on how their actions may impact a pig's welfare. Staff will undergo formal or on-the-job training under the supervision of experienced staff within the first six months of their employment, with ongoing training provided. All pigs will be inspected at least daily by a competent stockperson and managed to optimise health. Sick pigs will be treated in accordance with veterinarian advice.

All pigs will have constant access to water. The salinity of the bore water on-site is suitable for pig consumption. Water will be checked daily. Back-up water will be stored in tanks and can be provided as required.

Every day, all pigs will be provided with feed designed to meet their nutritional and production needs.

Pigs will always be transported in accordance with the Animal Welfare (Land Transport of Livestock) Code of Practice (Animal Health Australia, 2012).

Good biosecurity is vital in protecting animal health. Risk assessment is about identifying hazards and considering the possible consequences and likelihood to determine the severity of the risk. The effectiveness of the existing controls can be evaluated and the need for further actions to control the risk identified (Animal Health Australia, ND).

The greatest hazard to biosecurity is through direct contact between other livestock and the pigs. However, staff and visitors may also pose a significant risk. Without good design management, the consequences could be high. However, the likelihood is being well managed at the existing piggery and this will continue with the expanded piggery. To protect biosecurity, a procedure consistent with the National Farm Biosecurity Manual for Pork Production (Animal Health Australia, 2021) has been developed and implemented (see Appendix H). The piggery will be designed and managed to prevent other livestock and feral pigs from having direct contact with the pigs. Biosecurity conditions for entry to the site will apply to staff and visitors. Strict quarantine rules will apply. Visitors will be restricted, with management considering time since last visit to a pig farm or abattoir (3 days minimum) and recent overseas travels before permitting site access. The date, time, name, contact details and purpose of visit will be recorded for all site visitors. Visitors will also be required to change into farm

overalls and boots before entering the site. No pork products at all can be brought on-site. With the existing control measures in place, the likelihood of a disease incursion is low. The overall risk is moderate which means active management (through the biosecurity protocol) is appropriate.

JEV has been topical in the past couple of years. JEV is a disease found mainly in water birds and mosquitoes, occasionally affecting other animals including humans and pigs. While the virus is endemic in northern Queensland, it rarely occurs in southern Australia. The wet weather conditions of 2020-21 resulted in the migration of water birds from the north to southern Australia, bringing JEV with them, although this was the first incursion in southern Australia in over 50 years. Fortunately very few people were infected with JEV as a result. It is unlikely that there will be another JEV incursion until water birds again migrate from south east Asia / northern Australia. When this occurs is highly dependent on the weather. Removal of vegetation and still water removes habitats, assisting in risk minimisation. JEV could have significant production effects, particularly on the younger pigs so the consequence is high. However, because JEV rarely occurs in southern Australia the likelihood is low, with an overall risk of moderate. Minimising mosquito habitats is the key to minimising the risk. To that end, Windridge Farms Pty Ltd will maintain short vegetation and eliminate standing water in the vicinity of the pig sheds. Staff will be encouraged to protect themselves through vaccination and the use of appropriate clothing and insect repellent. JEV is a notifiable disease in New South Wales. If suspected, it would be immediately reported to the Emergency Animal Disease Hotline.

In the event of an emergency animal disease incident, the AUSVETPLAN Enterprise Manual Pork Industry (Animal Health Australia, 2021) would be followed.

5.15.2. E.16.b Impact Analysis

Any compromise of animal welfare will compromise productivity and profitability but also has the potential to cause reputational harm.

5.15.3. E.16.c Mitigation, Management and Monitoring

It is intended that the piggery will continue to be accredited under the APIQ[✓]® industry quality assurance program, which includes a module on animal welfare. Records demonstrating compliance will be maintained continuously.

The APIQ[✓]® standards identify a need to have contingency arrangements in place to manage pigs in the event of a delay in feed and/or water delivery, through mechanical or facility breakdown, extremes of weather, or other emergencies. These plans need to be carried out in a timely manner to minimise risk to pigs. With regard to feed, the silos adjacent to the sheds will be kept as full as practical to ensure there is adequate feed in the event of a mill breakdown. Windridge Farms Pty Ltd could also bring feed from another farm or could source feed from other mills in the district in an emergency. A generator is kept on site in the event of a power supply failure impacting either feed preparation or delivery. Water is pumped to the tanks to the west of the pig sheds and is distributed from these under gravity flow. These tanks will have sufficient capacity to provide 2.4 days water supply. There are two bores from which water can be drawn, which provides back-up. However, common spare parts and equipment for the water supply system will be kept on farm. Other parts can be sourced from suppliers in Young. In the event of a more serious problem, water could be purchased if required.

5.1. E.17. BUSHFIRE MANAGEMENT

5.1.1. E.17.a Baseline Conditions

The Hilltops Shire experiences a temperate climate. The bush fire season generally runs from October to March although prolonged dry periods can see fire danger extend into April. Weather conditions associated with the bush fire season include high daytime temperatures, low relative humidity and north-westerly to south-westerly winds. Dry lightning storms also occur during the bush fire season. On average, the South West Slopes bushfire management committee (BFMC) area, which includes the Hilltops and Cootamundra-Gundagai Regional Council areas, experiences some 97 bush, grass, and scrub fires annually, two of which can be considered to be major fires (South West Slopes Bushfire Management Committee, 2020).

The main sources of ignition in the South West Slopes BFMC area are: harvesting / farm machinery, lightning, stubble burning and accidents.

5.1.2. E.17.b Impact Analysis

The site of the piggery development is not within a bushfire prone area (see Figure 28). Nevertheless, the piggery buildings and equipment, the stock and the people who work in the piggery could all be at risk in the event of a bushfire. It is possible that a bushfire impacting the piggery could occur at some point. The consequence could be moderate to major with an overall risk of medium to high. While there are limited trees in the vicinity of the piggery, the property is also used for crop production and harvesting / farm machinery fires, lightning and stubble burning could all trigger a fire on the farm or on nearby farms.

In a letter dated 7th October 2022, the NSW Rural Fire Service indicated that a bushfire assessment report shall be provided that identifies the extent to which the proposed development conforms with or deviates from the relevant provisions of Planning for Bush Fire Protection 2019 (NSW Rural Fire Service, 2019). The aim of Planning for Bush Fire Protection is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment. The objectives are to:

- afford buildings and their occupants protection from exposure to a bush fire;
- provide for a defensible space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;
- ensure that appropriate operational access and egress for emergency service personnel and occupants is available;
- provide for ongoing management and maintenance of BPMs; and
- ensure that utility services are adequate to meet the needs of firefighters.

Applications for developments on bushfire prone land must meet the aim and objectives of Planning for Bush Fire Protection 2019 and this development will also.

5.1.3. E.17.c Mitigation, Management and Monitoring

Planning for Bush Fire Protection 2019 (NSW Rural Fire Service, 2019) provides bushfire protection measures that are the requirements and specifications that must be satisfied to improve life safety, property protection and community resilience to a bushfire attack.

They include:

- asset protection zones;
- access;
- construction, siting and design;
- landscaping;
- services; and
- emergency and evacuation planning.

For each measure, a broad intent is described along with performance criteria and acceptable solutions. The performance criteria specified in Planning for Bush Fire Protection 2019 are outcomes that must be met to satisfy the intent. These can be satisfied through acceptable solutions, or performance based solutions or a combination of both. Chapter 8 of Planning for Bush Fire Protection 2019 identifies that acceptable solutions for meeting the performance criteria under section 8 Other Developments. The best fit for the proposed pig sheds is found under section 8.3 Other Non-Residential Development, particularly section 8.3.1 Buildings of Class 5 to 8 under the NCC. No specific bushfire performance requirements are specified in the NCC for these types of buildings. However, the following objectives apply under Planning for Bush Fire Protection 2019:

- to provide safe access to / from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation;
- to provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development;
- to provide adequate services of water for the protection of buildings during and after the passage of bushfire, and to locate gas and electricity so as not to contribute to the risk of fire to a building; and
- to provide for the storage of hazardous materials away from the hazard where possible.

Suitable ways to meet these objectives were discussed with David Webster of RFS (pers. comm. 15th September 2023) and these are detailed below.

Ahead of the main bushfire season (October to March), management will prepare for the possibility of a bushfire. This will involve site inspections, maintenance and staff training. To minimise the risks of a fire directly impacting the piggery, the buildings and surrounds will be tidied of vegetation. Grass surrounding the sheds will be grazed or slashed so that it is short. It will be maintained this way throughout the fire season. The water tanks near the piggery will be continually kept as full as practical.

Staff will be trained in the need to be vigilant throughout the fire season and in the company's expectations and emergency and evacuation plan in the event of an approaching bushfire. The first priority will be the safety of all people at Koorani. The emergency and evacuation plan will be enacted as soon as anyone becomes aware of an approaching bushfire. The first step will be contacting the rural fire service immediately for advice and assistance. All staff and any contractors or visitors to the site will then be notified of the situation. Staff, contractors and visitors will be expected to leave the site early while it is still safe to do so. Staff will be trained in alternative access options for leaving the site (see Figure 59). Anyone leaving Koorani will be encouraged to return to their homes (if these are safe) or to the nearby towns of Young or Grenfell. Where it is not possible to leave the site, staff will

evacuate to the area immediately to the west of the SEPS (see Figure 59). This area has been selected as it is a clear area away from the sheds and CAL and adjacent to a road providing site access.



Figure 59 – Site Access and On-Site Fire Evacuation Point

The piggery currently has two 90,000 L tanks to the west of the sheds and an additional two 90,000 L tanks will be installed. The new tanks will have signage indicating “static water supply” and will be fitted with appropriate couplings (65 mm Storz).

The biogas collected under the cover of the anaerobic lagoon (CAL) poses a risk in the event of a fire. Fire hazard / no parking signage will be installed along the road to the sides of the CAL to assist the RFA in the event of a bushfire.

All electrical and gas works will be located and installed in accordance with the building code. Diesel for use in piggery operations is stored in the pastoral workshop area which is at a site that is separate from the pig sheds. Minimal quantities of other chemicals are used in the piggery. These will be stored indoors in areas away from other sources of fuel.

Management will remain vigilant throughout the usual fire season. If it is necessary to light a fire these will only be lit and managed in accordance with permits. Harvesting will not occur on days of total fire ban.

5.1. E.17. GREENHOUSE GAS EMISSIONS

5.1.1. E.16.a Baseline Conditions

Greenhouse gases (GHG) are chemicals that contribute to global warming. Like most agricultural businesses, the current piggery is contributing to GHG emissions. An expansion in the size of the piggery carries the potential to further increase these emissions.

5.1.2. E.16.b Impact Analysis

GHG emissions from piggeries vary depending on the type of piggery. Including deep litter housing as part of the accommodation significantly reduces GHG emissions compared with conventional piggeries with uncovered ponds. The Australian Pork Limited "Low Carbon Emission Roadmap for the Australian Pork Industry rates the mitigation potential of deep litter shelters as medium (Wiedemann S, 2021). At conventional piggeries, about 66% of total GHG emissions arise from effluent treatment systems. Covering the pond to capture these gases and burning them with a flare, as is proposed in this application, eliminates their global warming contribution (Australian Pork Limited, ND). The Australian Pork Limited "Low Carbon Emission Roadmap for the Australian Pork Industry rates the mitigation potential of deep litter shelters as very high (Wiedemann S, 2021).

5.1.3. E.16.c Mitigation, Management and Monitoring

The combination of some deep litter housing and the CAL for effluent treatment mean the piggery will be effectively mitigating GHGs. Conversion of biogas to energy to use on farm (rather than flaring) is another opportunity that will be explored in the future. Other good practices, such as minimising feed wastage through the use of pellets, well designed feeders and a liquid feeding system will also help in that regard.

5.2. E.17. ECONOMIC AND SOCIAL EFFECTS

5.2.1. E.17.a Baseline Conditions

In a submission to the Productivity Commission, the Pork Council of Australia (2004) identified that the income multiplier for pork was the highest of all industries in the Australian economy (with every dollar in wages and salaries in pork production generating \$6.57 in income in the rest of the economy). The study also found the employment multiplier was second only to poultry amongst agricultural industries, generating almost one extra job in the economy for each job in the industry.

5.2.2. E.17.b Impact Analysis

Significant work will be involved in constructing the pig sheds and effluent treatment system. Local builders will be given preference for undertaking this work.

On completion the expanded pig farm will employ six full time staff (there are four currently). Most of these positions will be working directly with pigs.

Assuming new salaries total \$120,000 per year, the income for the rest of the economy (using 2004 figures) will be \$788,400 per year. This will significantly help the local economy. Additionally, local farmers will benefit from the opportunity to sell grain and straw locally. Local transport companies will benefit from the opportunity to take up regular livestock transportation work.

5.2.3. E.17.c Mitigation, Management and Monitoring

The proposed piggery expansion will only produce positive economic and social impacts. The positive impact on the Hilltops Shire should be very significant.

6. F LIST OF APPROVALS AND LICENCES

6.1. Required Approvals and Licences

The piggery will require the following approvals and licences:

- Hilltops Shire Council Development Consent for the piggery.
Constructions certificates will also be needed.
- NSW EPA Licence and approval to operate a piggery under Protection of the Environment Operations Act 1997
The piggery has an existing licence (11314) for >250-500 t of pigs. This will need to be expanded as there will be ~1,200 t of pigs at a time. The Pollution Incident Response Management Plan (PIRMP) held for the premises will also require amendment.
- NSW Office of Water Groundwater allocation WAL 29028 / Approval number 70WA609923 which allows for the use of 35 ML of water annually. Groundwater allocation WAL29034 which allows for the use of 34 ML of water annually.
These allocations are in place.
- NSW DPI Fisheries permit for dredging and/or remediation a watercourse
- NSW Heritage AHIP

6.2. Integrated Approvals Required

Integrated approvals required include:

- NSW EPA: Licence and approval to operate a piggery under Chapter 3 particularly Part 3.2 Clause 48 and Schedule 1, Clause 22 of *Protection of the Environment Operations Act 2009*. PIRMP will need to be amended in accordance with section 153A of the *Protection of the Environment Operations Act 2009*.
- NSW DPI Fisheries: permit for dredging and/or remediation of a watercourse under Section 201 of the *Fisheries Management Act 1994*.
- NSW Heritage: Aboriginal Heritage Impact Permit (AHIP) under Part 6 of the National Parks and Wildlife Act 1974

7. G COMPILATION OF MITIGATION MEASURES

This sections details the mitigation measures for the proposed development. A summary of the measures is provided as Appendix M.

7.1. G.a Environmental Management Outline

7.1.1. G.a.i Management of Construction Impacts

Most of the potential impacts during construction will pertain to earthworks. Earthworks will be needed to construct:

- building pads
- CAL
- SEPS
- recycle dam

Potential impacts include soil erosion; impacts to amenity and health through dust, noise, vibration (from earth moving equipment) and light spill from machinery and vehicles; vegetation removal and surface waters. It is not envisaged that blasting will be required.

Soil Erosion

It is proposed that a Soil and Water Management Plan (SWMP) will be prepared and implemented for the construction phase and that a Stormwater Management Scheme will be implemented for the operational phase. The SWMP will be prepared in accordance with the requirements outlined in Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

The purpose of this SWMP is to detail the measures that will be implemented to mitigate potential soil erosion and resulting water quality impacts on land and water resources within and beyond the areas disturbed during the construction of the facility and during the operational phase. The SWMP will:

- describe the measures that will be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and / or waters during construction activities.
- describe the measures that will be employed to mitigated the impacts of stormwater runoff from and within the premises following the completion of construction activities.
- maximise the diversion of run-on water from lands up-slope and around the site.
- maximise the diversion of stormwater runoff containing suspended solids to sediment removal structures installed on the premises.
- ensure the drainage from all areas that will mobilise suspended solids and organic contaminants when stormwater runs over these areas is controlled and diverted through appropriate solids removal facilities.
- minimise the area of the site that generates suspended material or contaminated stormwater when water runs over it.
- maximise the reuse of captured stormwater at the premises.
- ensure the effluent treatment system from the piggery has sufficient capacity to contain all effluent generated at the premises to ensure there are no uncontrolled discharges to the environment.

- ensure the liner for the effluent treatment system consists of either re-compacted clay or similar material at least 450 mm thick with an in-situ co-efficient of permeability of less than 10^{-9} m/s or an alternative liner system producing equivalent or better performance.

Its objectives will be to:

- specify relevant erosion and sediment controls to be implemented to control soil erosion and water management on-site
- document maintenance measures for soil erosion and water management controls
- establish an inspection framework to ensure proactive management of erosion and sedimentation impacts
- outline reporting and reviewing requirements
- detail responsibilities pertaining to erosion and sedimentation management.

Good control of stormwater will be critical for minimising soil erosion and the quality of water leaving the property during construction.

Soil erosion and stormwater contamination with sediment are the main construction risks for the proposed development. Particular care will be needed during construction to minimise erosion and soil loss. This will involve controlling stormwater runoff and limiting vegetation removal and ground disturbance to the minimum practical area at any time. The site will be continually visually monitored for signs of erosion and excessive soil loss with prompt corrective action taken as needed. Measures to be used will include:

- integrating project design with site constraints
- preserving and stabilise drainage ways
- providing access and general construction controls
- constraining construction works and vehicle access to the construction site to the minimum area practical
- minimising the extent and duration of disturbance
- consolidating material stockpiles, equipment and machinery storage and laydown areas within the confines of the site to the extent practicable
- using previously cleared areas to stockpile soil where practicable
- controlling stormwater flows onto, through and from the site in stable drainage structures
- installing perimeter controls
- stabilising disturbed areas promptly
- spreading topsoil over cleared areas on completion of works
- using sediment control measures to prevent on-site and off-site damage
- protecting inlets, storm drain outlets and culverts
- inspecting and maintaining sediment and erosion control measures regularly
- implementing dust suppression as needed.

Before each section of the construction occurs, a perimeter bank will be built to divert rainfall runoff around the site, minimising the area of the site able to generate suspended material or contaminated stormwater as a result of water running over it.

Next, the effluent treatment system and building pads will be land-formed in readiness for further construction. The most significant earthworks will be for the construction of the effluent system which will be partly excavated into the ground. The conventional sheds will have below-floor effluent pits that will need to be excavated. The deep litter shelters will need to have pads formed up, upon which concreted footings will sit.

In all cases, topsoil removal will occur just prior to bulk earthworks. Soil piles will be stored within the piggery complex area for later use. Where practical, topsoil will be handled when moist to prevent structural decline. As soon as practical after disturbance, the soil will be stabilised to minimise sediment removal in the event of rain. Wastes will also be stored in on-site waste receptacles or piles within this area.

Since robust groundcover effectively prevents soil erosion, the land surrounding the buildings and piggery facilities will be spread with topsoil and planted to lawn as soon as practical after construction is completed. These areas will be watered to ensure the grass establishes.

The earthworks contractor will be responsible for establishing, inspecting and maintaining all sediment and erosion control measures during construction. This will occur on a daily basis whenever the contractor is working on the site. It is expected that any issues will be promptly addressed.

Should any item of heritage or archaeological significance be unearthed during construction, further disturbance will immediately cease. The item/s will be assessed by relevant heritage authorities and any necessary preservation measures enacted.

Amenity

Separation distances exceeding 1 km to nearby houses will largely prevent amenity impacts during construction. Good management will be used to further mitigate the risk. While it is not expected that there will be nuisance from light, vibration or noise, to minimise the risk of nuisance, construction will only occur between 7 AM and 6 PM. Vibration at the closest residences will not exceed the levels stated in "Assessing Vibration: a Technical Guideline" (Department of Environment and Conservation, 2006). Noise levels will not exceed the recommended levels from industrial noise sources to residential uses including houses in RU1 – primary production specified in the NSW Noise Policy for Industry (Environment Protection Authority, 2017).

.

Vegetation

Removal of native vegetation will be minimised. All construction personnel will be inducted to be aware that any deliberate or accidental damage of a stand of native vegetation outside the subject site has legislative consequences under Part 4 or Part 5 of the *Environment Planning and Assessment Act 1979*. During induction, all construction personnel will be made aware that threatened species may be present at the site (refer to table 5.2 of Appendix G). If threatened species are identified, an ecologist should be consulted prior to proceeding with construction. Before construction commences, a physical vegetation clearing boundary is to be demarcated. Vegetation removal methods must avoid damage to surrounding vegetation. Groundcover disturbance will be minimised. If practical, removed vegetation will be mulched on-site and used to stabilise disturbed areas.

To avoid impacts associated with weed introduction and spread, all machinery will be inspected prior to entering the construction site. Machinery must be clean of mud, soil and vegetation material.

Surface Waters

A permit will be required under the *Fisheries Management Act 1994* prior to any dredging or reclamation work on water land.

7.1.2. G.a.ii Management of Operational Impacts

Operational impacts could include impacts to:

- amenity
- surface waters
- groundwater
- flora and fauna
- Aboriginal cultural heritage
- soils

Amenity

Piggeries have the potential to impact on comfortable enjoyment or life or property in many ways, including nuisance from odour, dust, noise and light spill; changes to visual amenity; impacts from increased traffic; increased vermin and insects; inappropriate waste management and health impacts. The piggery is suitably sited, which is important in preventing most amenity impacts. With good management, the residual risks can be effectively managed.

The separation distances between the piggery complex and nearby houses are sufficient to protect air quality from odour, dust, with good design and management. These include:

- slatted flooring over effluent channels in the conventional sheds, with frequent and regular pressure-washing of sheds and pit flushing to keep the sheds clean and odour down.
- concrete bases on the deep litter housing, with enough straw provided to absorb manure and provide a dry place for pigs to rest.
- a CAL that is adequately sized to treat the expected effluent stream.
- a suitable process for composting mortalities. At all times during active composting the bodies will be kept well covered with a high carbon material. Composting mortalities on a compacted, bunded pad and using a suitable process represents best practice as odour is controlled and risks to surface water and groundwater are eliminated.
- prompt clean-up and disposal of spilt feed.
- reuse of effluent and manure only under suitable weather conditions. This will be avoided early in the morning and in the evening, if the wind is drifting towards a close neighbour, under gusty conditions, or if the soil is too wet to absorb the application.

While some noise will be generated by the piggery itself, associated traffic movements and machinery used to spread SEPS solids, spent bedding and mortalities compost, it is not expected that this will cause nuisance. To minimise risks:

- piggery activities, including truck movements and reuse activities will be scheduled to occur during the day whenever possible.
- Feed will be automatically distributed to the pigs which will eliminate the pig squealing that can result from hand feeding.

- machinery, pumps and vehicles associated with the piggery will be regularly serviced.
- effective mufflers will be fitted to pumps, machinery and vehicles used by the piggery.

The piggery site is well separated from nearby houses and is not visible from any of the neighbouring houses.

The road providing primary site access, Old Forbes Road is a sealed road so this will not be a source of dust. Nor is it expected that traffic movements along internal roads will cause nuisance dust. Manure products may contain pathogens and these can be dispersed with dust. The separation distances between reuse areas and houses (minimum of 250 m) will assist with this. However, risk will be managed by avoiding the handling and spreading of very dry spent bedding but particularly under windy conditions.

Good hygiene will be key to controlling insect and vermin. This will include:

- good manure management (described above).
- prompt clean up and disposal of feed spills and waste feed.
- slashing around the piggery complex to remove potential habitats.
- strategic use of baits to control flies, rats and mice.

The piggery will produce very little waste and this will be managed carefully with no on-farm disposal. However:

- where practical, wastes will be recycled (e.g. office paper, plastic containers).
- other waste will be collected in skips and dispatched to off-farm waste facilities.
- sharps disposal will be through a suitable facility.

It is not expected that the piggery will have any adverse human health impacts since:

- herd health status will be protected through a rigorous biosecurity protocol detailed in SOP 11 which is included as Appendix H of this EIS. This protocol is based on the National Farm Biosecurity Manual for Pork Production (Animal Health Australia, 2021) All staff must sign a personal biosecurity declaration on commencing employment. There is also a policy covering staff movement between sites; this goes in one direction only from highest health quarantine (breeder) to lowest (grow-out sites) to ensure the health status of the breeder units is maintained. Visitors are only allowed on-site with the permission of management and taking into account time elapsed since contact with pigs (four days minimum). Staff are also required to advise managers if they are travelling overseas so that biosecurity can be managed on their return. All third parties coming on-site, including sub-contractors and haulage, will need to declare the date when they and their vehicles were last in contact with pigs and whether they have been overseas recently. For every visitor, the date, time, name, contact details and purpose of visit will be recorded to allow for investigation of any incidents. Staff and visitors will not be permitted to bring any pork products onto site.

Japanese encephalitis virus (JEV) has been topical in the past couple of years. However, while the virus is endemic in northern Queensland, it rarely occurs in southern Australia. It is unlikely that there will be another JEV incursion until water birds again migrate from south east Asia / northern Australia. Removal of vegetation and still water removes habitats, assisting in risk minimisation. To that end, Windridge Farms Pty Ltd will maintain short vegetation and

eliminate standing water in the vicinity of the pig sheds. Staff will be encouraged to protect themselves through vaccination and the use of appropriate clothing and insect repellent.

- there is a plan to manage an unexpected disease suspected at the piggery or an increase in the number of sick pigs. The farm veterinarian would be immediately asked to come and investigate. The Chief Veterinary Officer and the Hilltops Council would be advised of any disease outbreak. In the event of mass mortalities, the Chief Veterinary Officer, Hilltops Council and the NSW EPA would be advised and consulted regarding disposal options. Where mass deaths were not the result of disease, rendering may be an option. Otherwise, composting would be preferred. It is understood that burial or incineration may be required in some circumstances.
- health risks associated with reuse of manure and effluent will be effectively managed. The aging of SEPS solids, spent bedding and the composting of mortalities will create significant heat which will effectively destroy most pathogens. Effluent will only be irrigated post-pond treatment. It will be irrigated using low pressure spray within 2 m of the ground to minimise aerosol production and drift. Effluent, mortalities compost and spent bedding will not be applied when the wind is carrying towards nearby houses. Reuse activities will only be spread during the day-time, avoiding times when inversion layers are likely (early morning, evening) as aerosols and dust may carry further under these conditions. Reuse will only occur under suitable weather conditions. It will be avoided when significant rain is forecast within 24 hours or if the soil is too wet to absorb the application. The crops to which effluent, spent bedding and mortalities compost will be applied (grain, oilseed and fodder crops) are not typically eaten raw by humans.

Surface Waters

The piggery complex has been designed to protect surface water quality. Measures include:

- very good control over the movement of manure and effluent within the piggery complex, preventing uncontrolled releases.
- bases of pig sheds designed to prevent entry of stormwater runoff
- effluent pits under conventional sheds suitably sized to contain effluent between emptying of pits
- above-ground banks on effluent treatment system to prevent extraneous ingress of stormwater runoff. There will be deliberate capture of runoff from the compacted areas between SEPS channels.
- effluent treatment system sized to restrict spill events to less than 1 in 10 years
- monitoring of the depth of water in the effluent recycle dam weekly but also if rain is forecast and after significant rainfall events to allow corrective action to be taken as needed
- bunding around spent bedding storage areas to prevent ingress of stormwater runoff and uncontrolled release of stormwater caught within the area.

Surface water contamination can also result from poor reuse of effluent, mortalities compost and spent bedding. The required land area for effluent, mortalities compost, spent bedding and SEPS solids reuse has been estimated based on the expected nutrient composition of the effluent and the types of crops to be grown. Management practices that will be adopted to minimise the risks of nutrients and sediment export from reuse areas in stormwater runoff include:

- applying effluent, mortalities compost and spent bedding evenly and at rates designed to achieve a balance between nutrients applied and nutrients removed through crop harvest or grazing
- spreading effluent, mortalities compost and spent bedding just before sowing or when the crop is actively growing (effluent)
- delaying reuse if the soil is saturated, or if it is raining or forecast to rain significantly within 24 hours
- not using high-pressure spray guns
- using minimum till farming methods to avoid soil disruption
- providing suitable buffers between reuse areas and surface waters

Surface water quality can also be impacted through poor reuse practices, particularly nutrient overloading with soil. This will be prevented using the measures detailed in the section on soils below.

Groundwater

The piggery complex has been designed to protect groundwater quality. Measures include:

- very good control over the movement of manure and effluent within the piggery complex, preventing uncontrolled releases.
- impervious concrete bases beneath the deep litter shelters
- impervious concrete flooring and effluent collection pits beneath the conventional sheds
- low permeability effluent treatment system (1×10^{-9} m/s) and composting pad (1×10^{-7} m/s).

Hence, it is very unlikely that groundwater will be impacted by activities within the piggery complex.

However, groundwater quality could also be impacted through poor reuse practices, particularly nutrient overloading that could result in leaching through the soil to unconfined aquifers. The risk of groundwater contamination will be monitored through annual testing of the subsoil of reuse areas (see section 7.2). This is considered a more pro-active measure than piezometers as it will provide for early detection and correction of an emerging issue and will cover more sites. However, six monthly sampling from the four piezometers will continue.

Groundwater will be the major clean water supply for the piggery. The allocation is sufficient to meet the needs of the expanded piggery. To limit groundwater use:

- clean water will be used efficiently. In many piggeries, cleaning water is a major water use. For the conventional sheds, recycled treated effluent will be used to clean the under-floor effluent channels. Deep litter shelters, which require no water cleaning, have been selected where suitable. Low wastage bite rather than push nipple drinkers will be used for other stock to minimise water wastage.
- roof runoff will be collected and used as an additional water source.

Flora and Fauna

The piggery has been sited on land that has been cleared and farmed for many decades. To prevent impacts to vegetation, and subsequent impacts to fauna:

- the piggery complex has been designed so that only a small number of trees will need to be removed.
- a screen consisting of native trees has already been planted to the east and north of the piggery sheds to visually screen the piggery.

Native vegetation, which may be intolerant of increased nutrient levels, may be adversely affected by nutrients from spray drift of effluent. To minimise the risk to remnant stands:

- effluent will not be irrigated within 80 m of remnant vegetation

Entry of weed seeds onto the farm is avoided by inspecting machinery entering the property. Machinery must be clean of mud, soil and vegetation. Weeds are controlled through good paddock management. Weeds are identified and removed through physical means or herbicide application.

Aboriginal Cultural Heritage

Five newly identified heritage sites are located either within or adjacent to areas where machinery movement and soil impacts are anticipated during development. As a result, a program of surface collection and return to country will be undertaken to preserve the artefacts from harm following granting of an AHIP. Details are provided in Appendix K.

In accordance with the recommendation of Young LALC, two site officers from Young LALC will be in attendance during the soil excavation that occurs during construction. This is to help with the identification of Aboriginal items that may be unearthed, and to ensure these are treated with respect. In the event that an Aboriginal object is found during construction, work will immediately stop until appropriate protection measures can be undertaken and the Office of Environment and Heritage will be notified as soon as practical. If human remains are found, work will stop, the site will be secured and the NSW Police and the Office of Environment and Heritage will be notified as soon as practical.

If any Aboriginal items are recorded in the future on-farm, these will remain at the property and will only be moved in the presence of a site officer from Young LALC. Where items cannot be moved, consultation with Young LALC and the Office of Environment and Heritage will be used to determine suitable buffers around them.

Land

Once the piggery is fully constructed and lawns established over disturbed areas within the piggery complex, there should be not impacts to soils within that area.

With good management, it is expected that the soils and crops grown on reuse areas will benefit from effluent and manure additions. This will be achieved through:

- application of effluent, mortalities compost and spent bedding at sustainable rates. Nitrogen, phosphorus and potassium application rates will not exceed expected harvest removal (plus acceptable losses of nitrogen) except to correct soil deficiencies, although some phosphorus surpluses between years are acceptable.
- even spreading of effluent, mortalities compost and spent bedding.
- recording the quantity of effluent, mortalities compost and spent bedding applied to each area and the type and yield of crops harvested.
- undertaking regular soil testing, with interpretation of results. Soil samples will be collected from areas that have been spread with effluent or spent bedding in the previous 12 months (one sample per agronomic management unit).
- adjusting cropping programs and nutrient management to respond to nutrient surpluses and imbalances.

- addressing soil salinity or sodicity concerns.
- regularly inspecting reuse areas for signs of structural decline and weed infestation and taking remedial actions as necessary.

It is expected that the SEPS solids and some spent bedding will be sold to nearby farmers. If this occurs:

- the following details will be recorded: date, recipient details, type of material traded, amount of material traded
- the recipient will be made aware that the Australian Pork Limited Manure and Effluent Management and Reuse Guidelines (Tucker, 2015), particularly the glovebox guide, provide practical information for sustainable reuse.

7.1.3. G.a.iii Strategies to Improve Management using Monitoring Data

Regular monitoring of potential environmental risk areas, and interpretation of monitoring data, will allow for a more rapid response that prevents impacts.

Each morning, as staff arrive from work, they will subjectively check the odour, dust and noise coming from the piggery complex both at the property boundary and at the complex itself. Where there is an issue, potential sources will be promptly investigated. This will include consideration of weather conditions. Once any particular sources have been identified, suitable corrective and preventative measures will be actioned. Details will be recorded and, if appropriate, standard operating procedures adjusted to ensure future management is improved.

Details of all complaints received about the piggery will be recorded, including the name of the complainant (where available), the nature of the complaint (e.g. odour, dust, noise), the date and time of day of the nuisance, any suspected sources and weather data at the time of the problem. The collected data will be analysed and used in investigating the issue. Details of findings, including ongoing communication with the complainant, along with corrective and preventative actions will be recorded.

Numbers of rodents and insect pests will be subjectively monitored on a continual basis and used in planning strategic control. Use of baits to control rodents and insect pests will be recorded.

Details of all visitors to the piggery will be logged to assist with investigating any disease or biosecurity incidents. Full details of protocols are provided in in SOP 11 which is included as Appendix H of this EIS.

Stock numbers will be monitored, with deaths and sales recorded daily. Detection of sick animals and treatment of same will also be recorded daily. Daily recording will allow any unusually high numbers of sick or dead animals to be quickly picked up and acted upon.

Use of pharmaceuticals will be recorded for each animal as part of the quality assurance program.

Feed wastage will be monitored through visual inspection of pens and by recording and analysing feed usage data. This will allow excessive wastage, which may adversely impact effluent treatment and also the financial performance of the piggery, to be quickly detected and fixed.

Details of mortality numbers will be recorded.

Details of reuse of effluent, mortalities compost and spent bedding will be recorded. This will include: date of spreading, paddock, material spread and application rate. Effluent, SEPS solids and spent bedding will also be analysed annually. The type of crop grown on each reuse area, and the harvested yield will be recorded. These data will be used to assess whether the nutrient balance budget was accurate. In conjunction with soil test results, it will also be used to adjust future reuse activities to optimise agronomic and environmental outcomes.

The depth of effluent in the recycle dam will be checked weekly but also if rain is forecast and after significant rainfall events to allow corrective action to be taken as needed

Banks around the effluent ponds, the SEPS, the recycle dam and the spent bedding storage areas will be checked after rainfall events to ensure they are intact and structurally stable. Any required repairs will be promptly made to ensure runoff is protected.

7.1.4. G.a.iv Training Programs for Operational Staff

All staff members will be trained in all areas relevant to their work area.

All people involved in stock handling will have suitable training or work under the direct supervision of a trained person.

All staff members involved in reuse of effluent, mortalities compost and spent bedding will be provided with on-the-job training in the where these materials can be spread, the buffers that must be maintained, times of day and weather conditions that are unsuitable for spreading and the importance of spreading these materials evenly and at suitable rates. These staff members will be made aware that any spill or unusual occurrence must be reported to senior management immediately.

7.2. G.b MONITORING OUTLINE

7.2.1. G.b.i Key Information to be Monitored

Amenity

Complaints recording will include:

- date & time of complaint
- method complaint was made
- details of complainant (if available)
- nature of complaint
- weather conditions at time of the complaint
- investigations into possible causes
- actions taken to resolve complaint

Weather

Good quality weather data is continually collected at Young airport, which is approximately 11 km from the site, and is reported on www.bom.gov.au. If requested by council or EPA, on-site weather monitoring will include:

- wind direction morning and evening
- rainfall daily

Effluent

Effluent will be tested twice a year ahead of the main reuse period using the parameters recommended in the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018):

- total nitrogen or TKN
- ammonium nitrogen
- nitrate nitrogen
- total phosphorus
- available phosphorus
- potassium
- EC
- SAR

SEPS Solids & Spent Bedding

SEPS solids and spent bedding will be tested annually for the parameters recommended in the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018):

- dry matter content
- pH
- total nitrogen or TKN
- ammonium nitrogen
- nitrate nitrogen
- total phosphorus
- available phosphorus
- potassium
- organic carbon
- EC
- sodium

Soils

The soils of on-farm reuse areas receiving effluent, mortalities compost or spent bedding (SEPS solids to go off-farm) in a given year will be tested for the parameters recommended in the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018):

Soil test parameter	Depth (down profile)	Justification
pH	0-0.1 m 0.3-0.6 m or base of root zone	influences nutrient availability
EC _{se} (can measure EC _{1:5} and convert to EC _{se})	0-0.1 m ^a 0.3-0.6 m or base of root zone ^b	measure of soil salinity
Nitrate-nitrogen	0-0.1 m 0.3-0.6 m or base of root zone	measure of nitrogen available for plant uptake, and also to detect leaching
Colwell phosphorus and phosphorus buffering index (PBI)	0-0.1 m ^c	measure of phosphorus available for plant uptake, and also to detect leaching
Potassium	0-0.1 m 0.3-0.6 m or base of root zone	measure of potassium available for plant uptake, and also to detect leaching
Sulfur	0-0.1 m	necessary nutrient for plant growth
Organic carbon	0-0.1 m	influences soil stability, and consequently, soil erosion
Exchangeable cations (calcium, sodium, potassium, magnesium) and cation exchange capacity (CEC)	0-0.1 m 0.3-0.6 m or base of root zone	Needed to calculate ESP, EKP and Ca: Mg, which have important implications for soil structure

One set of soil samples will be collected per agronomic management unit.

Each time effluent, mortalities compost or spent bedding are spread, the following details will be recorded:

- date
- weather conditions
- paddock spread
- spreading rate
- land use of paddock

Additionally, records of grain, hay or fodder harvested will be kept.

Each time spent bedding or SEPS solids are taken off-site, the following details will be recorded:

- date
- material
- quantity
- destination

Where spent bedding or SEPS solids are dispatched to other land managed by Windridge Farms, the spreading rate and land use of the area will also be recorded.

7.2.2. G.b.ii Monitoring Location, Intervals & Duration

Complaints recording will occur at the time of complaints receipt. Following a complaint, further notation will be added as complaints investigation and consultation with the complainant progresses.

Effluent will be tested at least once every six months. A composite sample will be collected from the pipeline of a pump from the recycle dam.

Composite samples of mortalities compost, spent bedding and SEPS solids will be tested at least annually before the main reuse periods.

The soils of any on-farm areas spread with effluent, mortalities compost or spent bedding in a given year will be sampled and tested (one set of samples per agronomic management unit).

7.2.3. G.b.ii Procedures for Monitoring

All sampling will be in accordance with Appendix D of the National Environmental Guidelines for Indoor Piggeries (Tucker, 2018).

7.2.4. G.b.iv Compliance and Reporting Procedures

A comprehensive Environmental Management Plan will be developed prior to the expansion of the piggery. A draft has been submitted with this EIS (see Appendix L).

The results of monitoring will be reported to the NSW Environmental Protection Authority as part of the Annual Return for the piggery Environmental Protection License.

8. H JUSTIFICATION FOR THE PROPOSAL

The proposed piggery expansion offers an opportunity for Windridge Farms to improve the viability of their farm and business. The applicants understand that such a development can only be viable if it operates in harmony with the community and with protection of the environment as a cornerstone. To that end, the design and management of the piggery has been carefully considered to ensure risks are mitigated.

8.1. H.a The Precautionary Principle

The precautionary principle means that if there are serious threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (Department of Land and Water Conservation, 2000), (NSW Department of Planning, 1996).

The expansion of the existing piggery has been carefully considered. The site is effectively separated from neighbours, well separated from major watercourses; does not have shallow, vulnerable groundwater; will not have significant impacts to native vegetation and has soils that are expected to be suitable for construction of ponds and footings. Aboriginal cultural heritage can be suitably protected. The proposal has been carefully designed to further mitigate environmental risks. The planned environmental monitoring will provide early warning of any emerging impacts, allowing for their management.

The soils of the reuse areas are suitable for the proposed purpose, having been used for sustainable cropping and grazing for many years. Effluent, spent bedding and mortalities compost will be applied at rates that result in sustainable nutrient applications consistent with good agronomic and environmental practice. Reuse will build soil carbon and microbial levels which is important for soil structure and health. It is acknowledged that piggery effluent may contain surplus sodium that could accumulate in the soil and induce salinity or topsoil sodicity. However, this has not been a serious concern to date. Ongoing soil testing will monitor this concern. If required, a calcium amendment could correct this imbalance. To protect soil and runoff water quality, effluent, spent bedding and mortalities compost will only be applied when the soil is too dry enough to absorb the application and not if significant rain is forecast. Buffers around remnant vegetation and waterways will provide additional protection of these more sensitive areas. To protect air quality, reuse will only occur at times of the day and under weather conditions that minimise the risk of drift to nearby neighbours.

This proposal does not involve any threat of serious or irreversible environmental damage.

8.2. H.b Inter-generational Equity

Inter-generational equity means that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (Department of Land and Water Conservation, 2000), (NSW Department of Planning, 1996).

The piggery site offers effective separation distances to the closest houses and no particularly vulnerable natural resources. However, the expansion of the piggery will require significant modification of the land within the bounds of the complex piggery. Suitable measures are proposed to guard against soil erosion and surface water contamination during construction. The proposed design incorporates a raft of measures to protect amenity, surface waters, groundwater, biodiversity

and soils during the operation of the piggery. It will be possible to fully remediate the site at the end of the development's life.

The addition of effluent, mortalities compost and spent bedding to the soils of the reuse areas will build nutrients, add carbon and bolster soil microbial levels, thereby enhancing soil properties. Sodium accumulation in effluent reuse areas could induce salinity or topsoil sodicity although this has not been a serious concern to date and can be monitored through regular soil testing and mitigated using calcium amendments.

It is not expected that the construction and operation of the piggery will have any significant adverse impacts to community amenity, surface waters groundwater, native vegetation or soils. Given that the proposal involves a small footprint for the piggery complex, and that the site can be remediated, the health, diversity and productivity of the environment will be maintained or enhanced for the benefit of future generations.

8.3. H.c Conservation of Biological Diversity and Ecological Integrity

Conservation of biological diversity and ecological integrity should be a fundamental consideration in any development (Department of Land and Water Conservation, 2000; NSW Department of Urban Affairs and Planning, 1996).

Most of the proposed development site has been cleared and cropped for many decades. While a few trees will need to be removed to make way for the development, no significant impacts to biodiversity are expected. Plantings of indigenous trees and shrubs to the north and west of the piggery sheds have already enhanced the biological diversity and ecological integrity of the land around the piggery complex

The reuse areas have also been cleared and cropped for many years. No trees will be removed and a buffer will be maintained between reuse areas and vulnerable remnant vegetation. It is expected that the properties of the soils will be enhanced through reuse activities. There will be no significant impacts to biological diversity and ecological integrity.

8.4. H.d Improved Valuation and Pricing of Environmental Resources

Environmental factors should be included in the valuation of assets and services, such as:

- (1) polluter pays, that is, those that generate pollution and waste should bear the cost of containment, avoidance or abatement,
- (2) the users of the goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.

Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems (Department of Land and Water Conservation, 2000; NSW Department of Urban Affairs and Planning, 1996).

The piggery will produce very little in the way of true “wastes” since effluent, SEPS solids, spent bedding and mortalities compost will be beneficially reused in farming systems. While the proponents will bear the cost of managing these materials, monitoring for impacts and reporting on environmental outcomes, they will also reap the benefits of the nutrients and carbon that will improve the agronomic properties of their soils.

8.5. Ability to Satisfy Objectives

The stated objectives of the proposal are:

- to expand an existing 9,600 pig grower-finisher unit into a 23,284 SPU grower-finisher unit that will deliver efficient pork production in a welfare friendly way.
- to operate in a way that protects the environment including air; water; land; biodiversity; items, and sites and places of Aboriginal cultural heritage sensitivity.
- to operate in a way that is compatible with surrounding land uses.
- to beneficially use the nutrients, water and carbon in spent bedding, effluent and mortalities within on and off-site farming systems.
- to maximise profitability within the constraints of these objectives.

The proposal is for an expansion to 23,284 SPU. Various housing systems have been considered and the proposed housing is welfare-friendly and will optimise production. Trained staff will ensure the pigs are well cared for.

Protection of the environment has been considered in all aspects of this proposal through suitable siting, design and management. The proposal will not only protect, but will enhance the quality of soil in reuse areas through the additional of carbon and nutrients.

The siting and design of the piggery complex will ensure it can operate in a way that is compatible with surrounding land uses. The choice of deep litter shelters for part of the housing and a covered anaerobic pond for primary effluent treatment effectively reduce risk. Suitable reuse practices, particularly careful management of the timing of reuse activities, minimise the likelihood of conflict with neighbours.

The proponents have been operating piggeries for many years and recognise the value of the carbon and nutrients in effluent and manure. Beneficial reuse of spent bedding, effluent and mortalities compost will be integral to their cropping systems.

The profitability of the proposed expansion to the piggery will be maximised through efficient, welfare-friendly production.

9. References

- Animal Health Australia. (2012). *Australian Animal Welfare Standards and Guidelines - Land Transport of Livestock*. Canberra: Animal Health Australia.
- Animal Health Australia. (2021). *AUSVETPLAN Disposal Version 5.0*. Canberra: Animal Health Australia.
- Animal Health Australia. (2021). *AUSVETPLAN Enterprise Manual Pork Industry Version 5.0*. Canberra: Animal Health Australia.
- Animal Health Australia. (2021). *National Farm Biosecurity Manual for Pork Production*. Canberra: Animal Health Australia.
- Animal Health Australia. (2021). *National Farm Biosecurity Manual for Pork Production*. Canberra: Animal Health Australia.
- Animal Health Australia. (ND). *Animal Health Australia Risk Assessment Fact Sheet*. Canberra: Animal Health Australia.
- ANZECC and ARMCANZ. (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Vol. 1 The Guidelines*. Artamon: ANZECC and ARMCANZ.
- ANZECC and ARMCANZ. (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. ANZECC and ARMCANZ.
- ARMCANZ and ANZECC. (1991). *Effluent Management Guidelines for Intensive Piggeries in Australia*. Canberra: ARMCANZ and ANZECC.
- ASABE Standards. (2011). *Design of Anaerobic Lagoons for Animal Waste Management, ANSI/ASBE EP403.4, FEB2011*. St Joseph, MI, USA.: ASABE.
- Australian Government. (1999). *Commonwealth Environment Protection and Biodiversity Conservation Act*. Sydney: Australian Government.
- Australian Pork Limited. (2014). *Characteristics and Accumulation of Sludge*. Barton: Australian Pork Limited.
- Australian Pork Limited. (2015). *Code of Practice for On-Farm Biogas Production and Use at Piggeries, APL Project 2011/1013.423*. Deakin: Australian Pork Limited.
- Australian Pork Limited. (ND). *Reducing Greenhouse Gas (GHG) Emissions from Piggeries*. <https://australianpork.com.au/sites/default/files/2022-04/033022%20-%20APL%20-%20Reducing%20GHG%20emissions%20from%20piggeries.pdf>.
- Blackall, P. (2001). *Pathogens and Piggery Effluent*. Canberra: Pig Research and Development Corporation.
- Blackall, P. (2004). *Establishing Guidelines for the Safe Application of Piggery Waste to Pastures*. Canberra: Australian Pork Limited.

- Davis RJ, Watts PJ & McGahan EJ. (2012). *Quantification of Feedlot Manure Output for Beef-Bal Model Upgrade*. Barton, ACT: Rural Industries Research and Development Corporation.
- Department of Environment and Conservation (NSW). (2004). *Composting and Related Organics Processing Facilities*. Sydney South: Department of Environment and Conservation (NSW).
- Department of Environment and Conservation (NSW). (2004). *Use of Effluent for Irrigation*. Sydney: Department of Environment and Conservation (NSW).
- Department of Environment and Conservation. (2006). *Assessing Vibration: a Technical Guideline*. Sydney: Department of Environment and Conservation.
- Department of Environment and Conservation NSW. (2006). *Technical Notes Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Sydney: Department of Environment and Conservation NSW.
- Department of Environment, Climate Change & Water. (2010). *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. Sydney: Department of Environment, Climate Change & Water.
- Department of Environment, Climate Change and Water. (2011). *NSW Road Noise Policy*. Sydney: Department of Environment, Climate Change and Water.
- Department of Environment, Climate Change and Water NSW. (2010). *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. Sydney: Department of Environment, Climate Change and Water NSW.
- Department of Land & Water Conservation. (1998). *The NSW Groundwater Quality Protection Policy*. Sydney: Department of Land & Water Conservation.
- Department of Land and Water Conservation. (2000). *Soil and Landscape Issues in Environmental Impact Assessment, Technical Report No. 34, 2nd Edition*. Sydney: Department of Land and Water Conservation.
- enHealth. (2012). *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards*. Canberra: Australian Government: Department of Health.
- Environment Protection Authority. (2017). *Noise Policy for Industry*. Sydney: Environment Protection Authority.
- EPA, N. (2021). *NSW Energy from Waste Policy Statement*. Sydney: NSW EPA.
- Gas Advisory Services Pty Ltd. (2014). *Gas Safety at Piggery Biogas Installations*. Sydney: Australian Pork Limited.
- Goyen A, Phillips BC and Pathiraja S. (2014). *Project 13 Stage 3: Urban Rational Method Review*. Barton: Engineers Australia: Water Engineering.
- GRDC. (2015). *GRDC Grownotes: Canola Southern Region*. Barton: GRDC.

- Hilltops Council. (2011). *Young Development Control Plan*. Boorowa: Hilltops Council (Updated January 2019).
- Hilltops Council. (2020). *Hilltops 2040: Hilltops Council Local Strategic Planning Statement (LSPS) 2020-2040*. Young: Hilltops Council.
- Hilltops Council. (2022). *Hilltops Local Environmental Plan*. Young: Hilltops Council.
- Hilltops Council. (ND). *Hilltops Community Strategic Plan 2030*. Young: Hilltops Council.
- Jenkins, S. (2014). *Development of Microbial Indicators of Soil Quality to Quantify the Benefits and Risks Associated with Applying Piggery By-Products to Land*". Barton: Australian Pork Limited.
- Jewell, C. (1994). *Hydrogeological Conditions at 'Kooranie-Bywong', Young, NSW*. Orange: CM Jewell & Associates Pty Ltd.
- Kumar, P. (2013). *Young Granite Groundwater Source Status Report 2012*. Sydney: NSW Office of Water.
- Kumar, P. (2013). *Young Granite Groundwater Source Status Report 2012*. Sydney: NSW Office of Water.
- Landcom. (2004). *Guidance in Managing Urban Stormwater: Soils and Construction Volume 1*. Sydney: NSW Government.
- Landcom. (2004). *Managing Urban Stormwater: Soils and Construction*. Sydney: Landcom.
- McGahan E, Willis S and Skerman A. (2010). *Validation and Development of the PigBal Model (Stage 1), Final Report of APL Project 4446*. Deakin: Australian Pork Ltd.
- Mitchell P. (2002). *Descriptions for NSW (Mitchell) Landscapes*. Sydney: NSW Department of Planning and Environment.
- National Research Council. (1984). *Nutrient Requirements of Beef Cattle, Sixth Revised Edition*. Washington DC: National Academy Press.
- Natural Resources South Australia. (2015). *Measuring Salinity*.
<https://www.naturalresources.sa.gov.au/samurraydarlingbasin/publications/measuring-salinity>: Natural Resources South Australia, Adelaide.
- NHMRC. (2016). *Australian Drinking Water Guidelines (2011) Updated 2016*. Canberra: NHMRC.
- NSW Department of Planning. (1996). *EIS Guideline Piggeries*. Sydney: NSW Department of Planning.
- NSW Department of Planning, Industry and Environment. (2019). *Murray-Darling Basin Fractured Rock Water Resource Plan - Groundwater Resource Description - Appendix A*. Sydney: NSW Department of Planning, Industry and Environment.
- NSW Department of Planning, Industry and Environment. (2021). *NSW Waste and Sustainable Materials Strategy 2041 Stage 1: 2021-2027*. Sydney: Department of Planning, Industry and Environment.

- NSW Department of Primary Industries. (2011). *Land Use Conflict Risk Assessment Guide*. Orange: NSW Department of Primary Industries.
- NSW Department of Urban Affairs and Planning. (1996). *Piggeries EIS Guidelines*. Sydney: NSW Department of Urban Affairs and Planning.
- NSW EPA. (2022). *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW*. Sydney: NSW EPA.
- NSW Government. (1979). *Environmental Planning and Assessment Act 1979*. Sydney: NSW Government.
- NSW Government. (1994). *Fisheries Management Act*. Sydney: NSW Government.
- NSW Government. (1997). *Protection of the Environment Operations Act*. Sydney: NSW Government.
- NSW Government. (2000). *Water Management Act 2000*. Sydney: NSW Government.
- NSW Government. (2006). *Prevention of Cruelty to Animals (General) Regulation 2006*. Sydney: NSW Government.
- NSW Government. (2009). *State Environmental Planning Policy (SEPP) No 30 – Intensive Agriculture*. Sydney: NSW Government.
- NSW Government. (2016). *Biodiversity Conservation Act 2016*. Sydney: NSW Government.
- NSW Government. (2019). *Planning Guidelines: Intensive Livestock Agriculture Development*. Sydney: NSW Government.
- NSW Government. (2019). *Primary Production and Rural Development*. Sydney: NSW Government.
- NSW Government. (2020). *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources Order 2020*. Sydney: NSW Government.
- NSW Government. (2021). *Environmental Planning & Assessment Regulation NSW (2000)*. Sydney: NSW Government.
- NSW Government. (2021). *Environmental Planning and Assessment Regulation 2021*. Sydney: NSW Government.
- NSW Government. (2021). *State Environmental Planning Policy (Biodiversity and Conservation)*. Sydney: NSW Government.
- NSW Government. (2021). *State Environmental Planning Policy (Primary Production)*. Sydney: NSW Government.
- NSW Government. (2021). *State Environmental Planning Policy (Resilience and Hazards)*. Sydney: NSW Government.
- NSW Government. (2021). *State Environmental Planning Policy (Transport and Infrastructure)*. Sydney: NSW Government.

- NSW Government. (2022). *Protection of the Environment Operations (General) Regulation NSW*. Sydney: NSW Government.
- NSW Government Industry & Investment. (2009). *Animal Welfare Code of Practice – Commercial Pig Production*. Sydney: NSW Government Industry & Investment.
- NSW National Parks & Wildlife Service. (2003). *The Bioregions of New South Wales - Their Biodiversity, Conservation and History*. Sydney: NSW National Parks & Wildlife Service.
- NSW Office of Environment and Heritage. (ND). *Native Vegetation Regulatory Map*. www.environment.nsw.gov.au/biodiversity/regulatorymap.html, accessed 21st May 2018: NSW Office of Environment and Heritage.
- NSW Office of Environment. (ND). *Lachlan River Water Quality and River Flow Objectives*. <https://www.environment.nsw.gov.au/ieo/Lachlan/report-02.htm>, accessed 26th October 2020 : NSW Office of Environment, Sydney.
- NSW Office of Water. (2011). *Water Sharing Plan: Inland NSW Groundwater Sources Overview*. Sydney: NSW Office of Water.
- NSW Rural Fire Service. (2019). *Planning for Bush Fire Protection*. Sydney: NSW Rural Fire Service.
- NSW Rural Fire Service. (2019). *Planning for Bush Fire Protection 2019*. Granville: NSW Rural Fire Service.
- O’Keefe, MF, McDonald, SA, Yan, MJ, Davis, RJ, Watts, PJ, McGahan, EJ and Tucker, RW. (2013). *O’Keefe, MF, McDonald, SA, Yan, MJ, Davis, RJ, Watts, PJ, McGahan, EJ and Tucker, RW, 2013, ‘Sludge Handling and Management’, Project No. 2012/1029, Australian Pork Limited, Canberra, Australia, January 2014*. Canberra: Australian Pork Limited.
- Pork Council of Australia. (2004). *Submission to Productivity Commission*. Canberra: Pork Council of Australia.
- Pork CRC. (2016). *Talking Topics 3: Covered Lagoons*. Roseworthy: Pork CRC.
- Primary Industries Standing Committee. (2008). *Model Code of Practice for the Welfare of Animals – Pigs*. Collingwood: CSIRO Publishing.
- PSA Consulting Australia. (2019). *Hilltops Freight and Transport Study: Final Report*. Brisbane: PSA Consulting Australia.
- Queensland Department of Agriculture and Fisheries. (2019). *Pigbal 4*. Brisbane: Queensland Department of Agriculture and Fisheries.
- Skerman, A. (2013). *Queensland Sedimentation and Evaporation Pond System (SEPS) Trial, Final Report APL Project 2009/2248*. Deakin: Australian Pork Ltd.
- South West Slopes Bushfire Management Committee. (2020). *South West Slopes Bushfire Management Committee Bushfire Management Plan*. https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0011/2630/South-West-Slopes-BFRMP.pdf: South West Slopes Bushfire Management Committee.

- Thackway I & Cresswell R. (1995). *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program*. Canberra: Australian Nature Conservation Agency.
- Tucker RW. (2013). *National Environmental Guidelines for Rotational Outdoor Piggeries*. Canberra: Australian Pork Limited.
- Tucker, R. (2015). *Piggery Manure and Effluent Management and Reuse Guidelines*. Deakin: Australian Pork Ltd.
- Tucker, R. (2018). *National Environmental Guidelines for Indoor Piggeries*. Deakin: Australian Pork Ltd.
- Tucker, RW. (2015). *Piggery Manure and Effluent Reuse Glovebox Guide*. Deakin: Australian Pork Limited.
- Tucker, RW. (2015). *SEPS: Sedimentation and Evaporation Pond Systems*. Deakin: Australian Pork Ltd.
- Watts PJ, M. E. (2011). *Feedlot Mass Balance and Greenhouse Gas Emissions - A Literature Review*. North Sydney: Meat & Livestock Australia.
- Wiedemann S, M. E. (2021). *Low Carbon Emission Roadmap for the Australian Pork Industry*. Barton: Australian Pork Limited.
- Young Shire Council. (2016). *Section 94a Developer Contributions Plans*. Young: Young Shire Council.
- Zinga, D. (1993). *Reconnaissance Soil Investigation "Bywong" and "Koorani", Old Forbes Road, Young, NSW 2594*. Orange: Midstate Planning.

Appendix A – SEARS

Provided as separate document.

Appendix B – Consultation Undertaken in Preparing EIS

Hilltops Council:

Andrew Raines, Team Leader Statutory Planning and Bill Vantry, Senior Statutory Planner

13th December 2023 – pre-lodgement meeting between Andree Rowntree and Peter Hanna (Windridge Farms) and Andrew Raines and Bill Vantry from Hilltops Council.

Follow up emails to Andrew Raines on 19th December 2023 and 16th January 2024 requesting further detail on whether a draft EIS satisfied the SEAR requirements for Aboriginal heritage assessment. The reply on 30th January 2024 identified that the EIS provided to Council does not contain a report that shows how the steps in the due diligence guidelines have been considered. The report in your email below indicates Aboriginal objects were found at the site and there was no visibility at the time of survey. You may wish to obtain advice from Heritage NSW if the report is acceptable given the findings or if further assessment is required.

Department of Climate Change, Energy, the Environment and Water (DEECA)

Alison Lamond, Senior Assessments Officer

Phoned Heritage NSW, 26th February 2024 and emailed their mailbox re same. Email communications with **Alison Lamond, Senior Assessments Officer**, DCCEEW followed.

6th March 2024 email from Alison Lamond Alison responded by email on 6th March 2024 requesting more information (e.g. letter from LALC). Information provided by email on 7th March 2024

Phone call from Alison Lamond 14th March 2024: She recognised that DCCEEW had a record of a request for Aboriginal stakeholders (12th November 2019) to which they had never responded. She noted that because objects were found by the Local Aboriginal Land Council there is a need for an Aboriginal Cultural Heritage Assessment in order to get Aboriginal Heritage Impact Permit. Typically this would be done through an archaeologist.

Email from Alison Lamond 14th March 2024 to advise that as the project has Hilltops Shire Council as the consenting authority an impacts to Aboriginal Heritage will require an Aboriginal Heritage Impact permit (AHIP). Link to Heritage NSW guidance document: [Aboriginal objects and places | NSW and Heritage](#) and [Apply for an Aboriginal heritage impact permit | NSW Environment and Heritage](#)

An application for an Aboriginal Heritage Impact permit requires an Aboriginal Cultural Heritage Assessment (ACHA) which involves the investigation and assessment of Aboriginal cultural heritage to explore the harm of a proposed activity on Aboriginal objects and to clearly set out which impacts are avoidable and which are not.

An Aboriginal cultural heritage assessment report is a written report detailing the results of the assessment, the results of consultation with the Aboriginal Community and recommendations for actions to be taken before, during and after an activity to manage and protect Aboriginal objects identified by the investigation and assessment.

[Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales | NSW Environment and Heritage](#)

[Aboriginal Cultural Heritage Consultation Requirements for Proponents | NSW Environment and Heritage](#)

14th March 2024 – a list of Aboriginal stakeholders was provided by email by **Barry Gunther, Aboriginal Senior Assessment Officer**.

Department of Planning, Industry and Environment (DPIE) / DEECA

Alison Treweek, Senior Team Leader Planning, South East, Biodiversity and Conservation Division

Tried phoning DPIE on 22nd February 2020 and 27th February 2020 – email reply from Alison Treweek on 28th February 2020 to say their requirements had not been attached to the SEARs.

Tried calling on 26th February 2024, tried calling and emailing on 7th March 2024 re new requirements for Biodiversity and Conservation. Email reply on 7th March 2024. Phoned conversation on 19th March 2024. Alison said that her experience with that landscape indicates that there may be remnants of Box gum woodland (critically endangered) and may include habitats superb parrot habitat. Get the biodiversity consultants to make contact with them prior to finalising assessment.

Rural Fire Service (RFS)

David Webster RFS emailed 29th August 2022 re fire requirements.

Suitable ways to meet the objectives specified in Planning for Bush Fire Protection 2019 were discussed with David Webster RFS (pers. comm. 15th September 2023).

New South Wales Environment Protection Authority (NSW EPA)

Nigel Sargent, Manager Regional Operations, South East, EPA various emails / phone calls re separation distances approach: 18th February 2019, 5th March 2019, 6th March 2019, 12th April 2019. Preliminary advice was that the NSW air policy should be used for the odour assessment. A proposal that passes tier 1 or tier 2 it is probably OK.

Janelle Pickup, A/Manager, Technical Air Advice, email communications 1st April 2019, 8th April 2019 re separation distance methodology, particularly the factor value to use for a covered pond with SEPS. Emailed 26th February 2024. Janelle replied confirming methodology had not changed since communications in 2019.

Janine Goodwin Acting Manager – Operations consultation meeting 1st March 2024 (online). Went through information requirements and approach to management. Also discussed odour approach. She was happy with consultation with Janelle Pickup and overall approach.

New South Wales Department of Primary Industries (NSW DPI)

Wendy Goodburn Agricultural Land Use Planner Agriculture Strategic Policy and Initiatives – tried phoning on 26th February 2024 and 7th March 2024. Also emailed 7th March 2024. No reply.

Emailed DPIE Water Licensing Service Centre 30th August 2022 regarding requirements. Email reply from Licensing and Approvals indicating that the assigned officer was Jessica Braden. Jessica never replied. Re-initiated contact (by email) on 7th March 2024. 20th March 2024: Letter received from **Sandra White, Manger Licencing and Approvals**: identifying that, for the purposes of the Water Management Act (2000), the proposed works do not required the approval of the Department of Climate Change, Energy, the Environment and Water (i.e. Controlled Activity Not Required). The proposed works are not located on waterfront land as defined by the Water Management Act. However, the Department recommended seeking comments from Water NSW for all matters relating to proposed water requirements, water supply work and use approvals and Water Access Licences.

Phone call in from **David Zerafa**. 15th March 2024. David said it may be required to demonstrate that bore has capability to meet extraction requirements. If it is not a major project, Water NSW is the appropriate agency to deal with for licencing. They would also consider any works within 40 m of a watercourse.

Water NSW

Simone Tonkin, Water Regulation, phone discussion 26th February 2024 regarding water licencing.

She noted that WAL29034 inked to 80CA715461 (A 164 296) was for irrigation and stock (could add industrial). She noted this WAL was in the name of David Bourke and Susan Bourke

Lot 34 DP754581: 70WA606641, stock and domestic

Lot 2 DP1049163, 2 bores, 70WA609923, S&D and Industrial, 35 ML

Lot 3 70WA606642, S& D

Simone indicated that these issues could be tidied up during the assessment process.

National Resource Access Regulator (NRAR)

Phone call on 27th February 2024 from Julie O’Connell. She advised that NRAR no longer has a role in the EIS process. She referred me to DCCEEW.

Transport NSW (formerly Roads and Maritime Services RMS)

Lindsay Tanner, then Director, South West (now Director Governance and Assurance): tried to call numerous times in February 2020 but the calls were not returned. Emailed 26/2/2020 – no reply.

Cam O’Kane, Development Services Case Officer: message left 26th February 2024. Called again on 7th March 2024. Cam indicated that the assessment needs to follow section 2 of the “Guide to Traffic Generating Developments. However, based on expected relatively low numbers (~1,040 trucks/year including existing movements) a traffic impact statement could be more appropriate. He said that it was necessary to explicitly state numbers currently and expected increase in numbers and point out the small number of vehicles. The biggest concern for him is when they hit Henry Lawson Way. Talk about shoulder treatments. Include photos. He said that it sounds like what is proposed to be provided is on the right track.

Young Local Aboriginal Land Council

Norma Freeman, Chief Executive Officer, Young Local Aboriginal Land Council: Various dates in February, June, September 2020. Site visit undertaken. Report provided by Young LALC on 10th September 2020 (see EIS Appendix).

Consultation Undertaken by Past Traces as part of Aboriginal Cultural Heritage Assessment Report (ACHAR) Preparation

In preparing the ACHAR provided as an Appendix to the EIS, consultation was undertaken with the Young Local Aboriginal Land Council (LALC) and statutory authorities including NSW Heritage on the 8/4/2024. Notification letters were then sent on the 24/4/2024 to the stakeholders identified by NSW Heritage. A public notice was placed in the local newspaper the Young Witness on 11th April 2024 and the Daily Advertiser on the 13th April 2024, seeking registrations of interest from Aboriginal stakeholders. The Registered Aboriginal Groups (RAPs) who registered interest were: Young LALC, Murrabidgee Mullangarri, Didge Ngunawal, Girragirra Murun, Kamilaroi-Yankuntjatjara, Corroboree and Gamila Roi. A Project Pack document was sent to the RAPs on 29th April 2024. This provided details

of the project with the registration letter. A Methodology Pack with the proposed heritage assessment methodology for the proposal was sent to all RAPs on 7th May 2024. The document invited comments regarding the proposed methodology and requested any information regarding known Aboriginal heritage sites or values within the project area. A draft version of the ACHAR was forwarded to the RAPs with a timeframe of 28 days provided to allow for responses to the document.

Appendices to the ACHAR provide full details of the consultation including a copy of the advertisement.

Consultation with Neighbours

November 2019

Preliminary consultation with neighbours.

Jason and Melissa Christie are the closest neighbours. Jason said he had a good relationship with the farm manager and was able to raise any issues. He would prefer that the bund along the front / parallel to the Koorani drive was not used for storing spent bedding due to odour. A commitment was made to use this bund less frequently and not increase use with additional sheds.

Jeremey and Jose Webber.

Dennis and Terry Hambrook.

November 2023

Melissa and Jason Christie (House 1) – provided written information only.

Brian and Penny Nuthall (House 2) – visit.

Steve and Felicity Cavanagh (one of houses at House 3) – phone call.

Matt and Loretta Cavanagh (one of houses at House 3) – visit.

Jeremey and Jose Webber (family live at house 9. Own house 8 which is rented out) – visit.

Dennis and Terry Hambrook (House 5) – visit with Terry.

Richard and Jenny Thakeray (house 4) - visit with son Hugh.

Appendix C – CV for Robyn Tucker

ROBYN TUCKER

Principal Consultant – Livestock Environmental and Planning

QUALIFICATIONS

- Bachelor of Applied Science (Rural Technology) Uni of Qld
- Master of Business Administration (Environmental Management)
- Chartered Agriculturalist
- Certified Professional Soil Scientist (CPSS) Level 2
- EMS Auditor
- National Accreditation: Design Livestock Effluent Systems



CAREER SUMMARY

In July 2014, Robyn commenced as Principal Consultant and Director of Livestock Environmental and Planning. From 1994 to July 2014, she was a Principal Consultant and Director of FSA Consulting. In both these roles Robyn has specialised in environmental management for intensive livestock facilities.

Robyn has prepared EIS, planning permit and EPA works approval applications, environmental management plans and effluent and manure reuse plans for numerous individual enterprises. She has also undertaken a range of industry-funded environmental research and development. Robyn was Project Leader or co-developer for:

- National Environmental Guidelines for Piggeries (editions 1 & 2), National Environmental Guidelines for Indoor Piggeries (editions 3 & 4) (Project Leader)
- National Environmental Guidelines for Rotational Outdoor Piggeries (editions 1 & 2), (Project Leader)
- Piggery Manure and Effluent Management and Reuse Guidelines (Project Leader)
- Environmental Principles for Piggeries training package (Project Leader)
- Environmental Management Plans for Piggeries training package (Project Leader)
- Outdoor Production Awareness Program for outdoor pig producers (Project Leader)
- Environmental Management Plan electronic templates for indoor and rotational outdoor piggeries (Project Leader)
- Australian Pork Ltd (APL) APIQ✓ Free Range Standards (Technical Guidance)
- EMS standards for the pig and meat chicken industries (Project Leader)
- Beef Cattle Feedlots: Waste Management and Utilisation manual (Project Leader, Co-Author)
- Beef Cattle Feedlots: Design and Construction manual (Co-Author)
- Environmental Guidelines for the Australian Egg Industry (Co-Author)
- Guidelines for Victorian Dairy Feedpads and Freestalls (Co-Author)
- Guidelines for the Safe Management of Feedlot Wastes (Co-Author)
- Intensive Animal Industries Regulatory Framework Review (Agriculture Victoria) (Project Leader)
- Development of a Consistent Approach for Determining Separation Distances for Different Animal Production Systems in Victoria (Project Leader)

- Planning for Animal Industries Short Course – development of training materials for planners and delivery of workshops on the 2018 Victorian planning reforms for Agriculture Victoria (Project Leader)
- Technical Guidelines for the Intensive Animal Industries Code of Practice in Victoria for Agriculture Victoria (Project Leader)
- Review of Grazing Animal Production (GAP) and Intensive Animal Production (IAP) Land Use Definitions and Separation Distances Supporting Information for Agriculture Victoria (Project Leader)
- Development of design guidelines for covered feedlots Meat & Livestock Australia (Project Leader)

For several years Robyn was the National Coordinator for the Australian Pork Limited (APL) environmental training program and the Victoria / Tasmania State Coordinator for the APL Environmentally Sustainable Piggeries EMS program. She is an APL EnviroCheck Assessor. From ~12 years (to 2019) she was a member of the APL Specialist Group 5 – Environmental Management which oversaw the direction of piggery environmental research. Since 2021, she has participated on the APL Environmental technical panel.

From 1990 to 1993 Robyn was Beef Husbandry Officer with Queensland Department of Primary Industries (QDPI) Feedlot Services group. She worked on two Meat Research Corporation (MRC) Feedlot Waste Management programs. These major research projects studied the environmental impact of cattle feedlots; implemented changes to improve environmental performance; and provided data to develop feedlot guidelines.

FIELDS OF SPECIAL COMPETENCE

- developing environmental guidelines, codes of practice and standards for intensive livestock industries.
- intensive livestock planning and environmental policy.
- preparing EIS and environmental management plans (EMP) for intensive livestock industries and abattoirs including design of effluent treatment and reuse facilities.
- assessment of environmental performance of intensive livestock facilities.
- developing, organising and delivering agricultural, environmental and planning training.
- undertaking intensive livestock environmental research.

PROFESSIONAL EXPERIENCE

July 2014 to Date: Principal Consultant and Director of Livestock Environmental and Planning.

Experience includes:

- preparing planning applications, EIS, EMPs and environmental monitoring reports for piggeries (indoor and outdoor), dairy freestall barns, beef feedlots, abattoirs and hatcheries
- leading the project to develop the Meat & Livestock Australia (MLA) manual: Beef Cattle Feedlots: Waste Management and Utilisation
- co-authoring the MLA manual: Beef Cattle Feedlots: Design and Construction
- writing a series of best management practice booklets on piggery environmental management for APL
- assisting APL with a review of the Australian pork industry quality assurance APIQ✓ free range standards
- preparing an Evaluation of Reform Options for Victoria's Incorporated Codes for Intensive Animal Industries (2014) and a Review of Regulatory and Non-Regulatory Issues for intensive Dairy Facilities – Scoping Paper (2015) for Department of Economic Development, Jobs, Transport and Resources (DEJTR)

- undertaking an APL: Outdoor Production Awareness project involving the development of fact sheets, conduct of workshops and filming of four videos
- developing training materials and conducting a pilot workshop on “Planning for Piggery Developments”
- undertaking three reviews of the National Environmental Guidelines for Indoor Piggeries and one review of the National Environmental Guidelines for Rotational Outdoor Piggeries for APL
- developing two Explainer clips on planning for piggery developments
- developing and delivering intensive livestock planning guidance: Planning for Animal Industries Short Course Materials, Small Scale Pig and Poultry Planning: Workshop Materials) for DEJRT
- leading a review of the Intensive Animal Industries Regulatory Framework for DEDJTR
- leading a project to develop a consistent approach for determining separation distances for different animal production systems in Victoria for DEDJTR
- developing Technical Guidelines for the Intensive Animal Industries Code of Practice in Victoria for DEDJTR (Project Leader)
- leading a Meat & Livestock Australia project to develop design guidelines for covered feedlots.

February 1994 to June 2014: Principal Consultant and Director of FSA Consulting.

Experience includes:

- preparing planning applications, EIS and / or EMPs for:
 - beef feedlots (up to 80,000 head capacity)
 - dairy feedlots (up to 4,000 head capacity)
 - piggeries (up to 142,000 standard pig units capacity)
 - lamb feedlots (up to 10,000 lambs capacity)
 - barn-based goat dairy (8000 milking does)
 - abattoirs and other industries.
- designing effluent treatment and reuse plans for intensive livestock facilities, abattoirs and sewage treatment plants using MEDLI and other computer models.
- initiating and undertaking industry funded environmental research e.g.
 - investigating efficacy of piggery solids separators
 - trials comparing different composting regimes for spent bedding from deep litter piggeries
 - developing indicators of environmental sustainability for beef cattle feedlots and piggeries
 - developing NRM indicators for red meat supply chain LCAs
 - investigating the potential to treat feedlot effluent for reuse as stock drinking water
 - examining the relationship between feedlot manure management and pathogen transfer.
 - reviewing on-farm food safety best practice for the beef industry
 - providing guidance into the management of microbial and chemical contaminants in feedlot wastes
 - nutrient extraction from piggery spent bedding and pond sludge
 - estimating the quantities of nutrients in various organic waste streams nationally and mapping the location of these nutrients as part of a wastes to fertilisers project.

- co-developing APL Environmental Principles for Piggeries and Environmental Management Plans for Piggeries training packages and National Coordinator for these (Jan 2000 to June 2005). She is an APL Technical Expert / Facilitator for APL environmental training and has conducted numerous workshops throughout Australia. She trained NSW DECC staff in the environmental initiatives of the pig industry.
- developing EMS standards for pig and meat chicken industries and APIQ✓ FR standards for the pig industry. Training APL State Coordinators and Auditors in piggery ESP EMS and APIQ✓ FR standards.
- Project Leader: APL National Environmental Guidelines for Piggeries.
- Project Leader: APL National Environmental Guidelines for Rotational Outdoor Piggeries
- Project Leader: revision of Victorian Code of Practice Piggeries.
- Project Leader: draft Australian Pork Industry National Environmental Sustainability Strategy 2010-2015
- Co-developer of APL's EnviroCheck. EnviroCheck is used to assess the performance of existing piggeries against the National Environmental Guidelines for Piggeries.
- Project Leader: Intensive Animal Industries Regulatory Framework Review (DEDJTR)
- Project Leader: MLA Beef Cattle Feedlots: Waste Management and Utilisation manual
- Co-author: MLA Beef Cattle Feedlots: Waste Management and Utilisation manual
- Project Leader: APL Piggery Manure and Effluent Guidelines

January 1990 - January 1994: Beef Feedlot Husbandry Officer for QDPI.

Robyn worked in a multi-disciplinary team undertaking two MRC "Feedlot Waste Management" research projects.

Robyn investigated the:

- size, distribution and environmental management of Australian feedlots
- effect of diet type on cattle performance and faeces characteristics. This data was developed into a feedlot nutrient minimisation strategy.
- factors influencing odour generation from feedlot pads. These trials showed the importance of time since wetting, diet, pad temperature and pad pH on odour.
- nutrient dynamics in feedlots. This led to the development of a phosphorus mass balance model and the Beefbal model that predicts feedlot nutrient output.
- water intake patterns of cattle in Queensland feedlots.

Robyn participated in three major feedlot committees:

- DPI Feedlot Liaison Committee - focussed on animal health and production.
- DPI Queensland Feedlot Management Program - aimed to improve the profitability and operation of feedlots
- Australian Lot Feeders' Association (ALFA) / DPI "Designing Better Feedlots" Workshop Committee

Robyn co-ordinated training and presented information for:

- DPI Queensland Feedlot Management Program Seminar Series. Nine venues.

- DPI Feedlot Services "Workshop on Agricultural Odours".
- DPI-CES Feedlot Hand Training Course.
- DPI Feedlot Services "Odour Update '92".
- ALFA/DPI "Designing Better Feedlots" (September 1993). ALFA AGM, two-day workshop (three overseas speakers), two-day feedlot tour. Committee secretary.

Overseas Experience

- 1994: South Africa and Botswana consultancy visiting feedlot and helping to develop a feedlot layout and costing.
- 2006: USA study tour meeting feedlot environmental researchers and visiting feedlots.
- 2010: New Zealand study tour on biogas collection from piggery ponds and GHG research.
- 2019-20: consulting to various piggeries in New Zealand

PUBLICATIONS

Books & Manuals

O’Keefe M, Chamberlain P, Chaplin S, Davison T, Green J & **Tucker RW**, 2010, *Guidelines for Victorian dairy feedpads and freestalls – first edition*, Department of Primary Industries, Victoria.

Tucker RW, 2018, *National Environmental Guidelines for Indoor Piggeries: Third Edition*, project no. 2015/2221, Australian Pork Limited, Canberra.

Tucker RW, 2015, *Piggery Manure and Effluent Management and Reuse Guidelines*, Australian Pork Ltd Project 2012/1028, Australian Pork Ltd, Canberra.

Tucker RW, 2015, *Piggery Manure and Effluent Reuse: Glovebox Guide*, Australian Pork Ltd Project 2012/1028, Australian Pork Ltd, Canberra.

Tucker RW, Davis RJ, McGahan EJ & Lawrence RL, 2023, “Feedlot Covered Housing Systems: Best Practice Design and Management Manual”, Meat and Livestock Australia, North Sydney,

Tucker RW, Lott SC, Watts PJ & Jukes PD 1991, *Lot feeding in Australia - a Survey of the Australian Lot Feeding Industry*, Department of Primary Industries Information Series QI91019, Brisbane.

Tucker RW, McDonald S, O’Keefe MF, Craddock A & Galloway JL, 2015, *Beef Cattle Feedlots: Waste Management and Utilisation*, Meat & Livestock Australia, North Sydney.

Tucker RW, McGahan EJ, Galloway JL & O’Keefe MF 2010, *National Environmental Guidelines for Piggeries: Second Edition*, project no. 2231, Australian Pork Limited, Canberra.

Tucker RW, McGahan EJ, Watts PJ, Nicholas PJ & Howard MR 2004, *National Environmental Guidelines for Piggeries: first edition*, project no. 1832, Australian Pork Limited, Canberra

Tucker RW & Price J, 2024, *National Environmental Guidelines for Rotational Outdoor Piggeries: Second Edition*, project no. 2023/0033, Australian Pork Limited, Canberra. *In press*

Tucker RW, Price J & Tait S, 2024, *National Environmental Guidelines for Indoor Piggeries: Fourth Edition*, project no. 2023/0033, Australian Pork Limited, Canberra. *In press*

Watts PJ, Davis RJ, Keane OB, Luttrell MM, **Tucker RW**, Stafford R & Janke S, 2015, *Beef Cattle Feedlots: Design and Construction*, Meat & Livestock Australia, North Sydney.

Watts PJ & **Tucker RW** (eds) 1994, *Designing Better Feedlots*, Conference and Workshop Series QC94002, Department of Primary Industries, Brisbane, Queensland.

Journal Papers

Coleman HM, Trinh T, Le-Minh N, Klein M, Roser DJ, **Tucker RW**, Stuetz RM, Peters G & Khan SJ, 2013, ‘Occurrence of Ectoparasitocides in Australian Beef Feedlot Wastes’, *Environmental Pollution*, 174: 265-272.

- Khan SJ, Roser DJ, Ashbolt NJ, Davies CM, Peters G, Stuetz R & **Tucker R**, 2008, 'Chemical Contaminants in Feedlot Wastes: Concentrations, Effects and Attenuation', *Environment International*, 34 (6): 839-859.
- Klein M, Brown L, **Tucker RW**, Ashbolt NJ, Stuetz RJ & Roser DJ, 2010, 'Diversity and Abundance of Zoonotic Pathogens and Faecal Indicators in Cattle Feedlot Manures', *Applied and Environmental Microbiology*, 76 (20): 6947-6950.
- Mehta C, Tucker R, Poad G, Davis R, McGahan E, Galloway J, O'Keefe M, Trigger R & Batstone D, 2016, 'Nutrients in Australian agro-industrial residues: production, characteristics and mapping', *Australasian Journal of Environmental Management*, Vol 23 (2), pp.206-222.
- Paper won Eric Anderson award for the best article of 2016 in the Australasian Journal of Environmental Management*
- Peters GM, Rowley HV, Wiedemann SG, **Tucker RW**, Short M & Schulz M, 2010, 'Red Meat Production in Australia – A Life Cycle Assessment and Comparison with Other Nations', *Environmental Science and Technology*, 44: 1327-1332.
- Peters GM, Wiedemann SG, Rowley HV & **Tucker RW**, 2010, 'Accounting for Water Use in Australian Red Meat Production', *International Journal of Life Cycle Assessment* 15(3):311-320, DOI:10.1007/s11367-010-0161-x.
- Peters GM, Wiedemann SG, Rowley HV, **Tucker RW**, Feitz AJ & Schulz M, 2011, 'Assessing Agricultural Soil Acidification and Nutrient Management in Life Cycle Assessment', *International Journal of Life Cycle Assessment* 16: 431-441.
- Tucker RW** & WATTS PJ, 1993. 'Waste Minimisation at Feedlots by Ration Modification', *Trans. ASAE* 36 (5):1461-1466.
- Watts PJ, Jones M, Lott SC, **Tucker RW** & Smith RJ, 1993, 'Feedlot Odor Emissions Following Heavy Rainfall', *Trans. ASAE*, 37 (2): 629-636.

Conference and Workshop Papers

- Casey KD, Lunney CL, Watts PJ & **Tucker RW**, 1997, 'Odour emissions from feedlot retention ponds following heavy rainfall', *National Workshop of Odour Measurement Standardisation*, Sydney, New South Wales, pp. 20-22.
- Coleman HM, Trinh T, Le-Minh N, Klein M, Roser DJ, **Tucker RW**, Stuetz RM, Peters G & Khan, SJ, 2012, 'Occurrence of ecoparasitocides in Australian Beef Cattle Feedlot Wastes', *3rd International Conference on Waste Management*, Greece, September, 2012.
- Gardner, EA, Watts, PJ, **Tucker, RW** & Moody, P, 1994, 'Sizing ecologically sustainable land disposal areas for feedlots', Section 7.2 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Hart, D & **Tucker, RW**, 1998, 'Greening your piggery: Managing for sustainable outcomes', *National Pig Environmental Conference*, Gold Coast, Queensland.

- Jones, M, Watts, PJ, Lott, SC, **Tucker RW**, & Smith, RJ 1992, 'A mobile dynamic olfactometer for feedlot odor studies', *The Winter Meeting of ASAE*, ASAE, Nashville, Tennessee.
- McGahan EJ & Tucker RW, 2005, 'Implementing EMS to Meet Community Expectations'. In Proceedings of the 13th Australian Poultry Convention – Climate Change., 09-12 October 2005, Gold Coast, Australia. pp 33-36.
- Rinehart, D & **Tucker RW**, 1994, 'Shade structures', Section 3.4 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Spence MG, **Tucker RW** & Tranter MW, 1998, 'Environmental codes of practice: noose or lifeline?', *The Pacific Air and Environment Workshop*, Environmental Codes of Practice, Brisbane, Queensland.
- Tucker RW**, 2000, 'Environmental training package for piggery managers: delivering environmental awareness', *2nd National Pig Environmental Conference*, University of Queensland, Gatton, Queensland.
- Tucker RW**, 1992, 'Odour identification test results', In PJ Watts (ed.), *Odour Update '92 - Proceedings of a Workshop on Agricultural Odours*, MRC report no. 64/24, Department of Primary Industries Feedlot Services Group, Toowoomba, Queensland.
- Tucker RW**, 1992, 'Odour measurements from simulated feedlot pads', In PJ Watts (ed.), *Odour Update '92 - Proceedings of a Workshop on Agricultural Odours*, MRC Report No. 64/24, Department of Primary Industries Feedlot Services Group, Toowoomba, Queensland.
- Tucker RW** & Watts PJ, 1994, 'Disposal of carcasses', Section 6.3 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Tucker RW** & Watts PJ, 1994, 'Feeding systems', Section 4.5 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Watts PJ & **Tucker RW**, 1994, 'Feedlot site layout' Section 2.2 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Tucker RW** & Watts PJ, 1994, 'Fences, Gates and Lanes', Section 3.3 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Watts PJ, Gardner EA, **Tucker RW** & Casey KD, 1994, 'Mass-balance approach to design of nutrient management systems at cattle feedlots', *Proceedings of the Great Plains Animal Waste Conference on Confined Animal Production and Water Quality*, Denver, Colorado, GPAC Publication 151, 27-33.
- Watts PJ, Gardner EA, **Tucker RW**, Moody PW & Gilbert M, 1992, 'Phosphorus balance for cattle feedlots', *Conference on Engineering in Agriculture*, The Institution of Engineers, Albury, New South Wales, Publication No. 92/11, pp. 153-158.

- Watts PJ, Jones M, Lott SC, **Tucker RW** & Smith RJ, 1992, 'Odor measurements at a Queensland feedlot', Nashville, Tennessee, ASAE paper no. 92-4516.
- Watts PJ & **Tucker RW**, 1993, 'Feedlot site layout', *Designing Better Feedlots Workshop*, Maroochydore, Queensland.
- Watts PJ & **Tucker RW**, 1993, 'The creation and reduction of odour at feedlots', *Proceedings of the Agricultural Odours Workshop*, Clean Air Society of Australia and New Zealand and Australian Water and Wastewater Association, Dubbo, New South Wales.
- Watts PJ & **Tucker RW**, 1993, 'The effect of ration on waste management and odour control in feedlots', *Proceedings of Recent Advances in Animal Nutrition in Australia*, University of New England, Armidale, New South Wales, pp. 117-129.
- Watts PJ, **Tucker RW** & Casey KD, 1994, 'Water system design', Section 4.6 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Watts PJ, **Tucker RW**, Gardner EA, Casey KD & Lott SC, 1994, 'Characteristics of feedlot waste', Section 7.1 in Watts, PJ and Tucker, RW (eds.) *Designing Better Feedlots*, State of Qld Dept Primary Industries Publications Conference and Workshop Series No. QC94002, Department of Primary Industries, Brisbane.
- Selected Reports**
- Davis RJ, Watts PJ & **Tucker RW**, 2006. "Environmental sustainability assessment of the Australian feedlot industry: part E – review of lot fed cattle water consumption", Meat & Livestock Australia Project FLOT.328, Meat & Livestock Australia, North Sydney.
- Galvin G, McGahan EJ, Tucker RW & Todoroski A, 2018, "Development of a consistent approach for determining separation distances for different animal production systems in Victoria: Stage 1 Options Paper", Livestock Environmental and Planning, Horsham, VIC, 3400.
- Galvin G, McGahan EJ, Tucker RW & Todoroski A, 2019, "Development of a consistent approach for determining separation distances for different animal production systems in Victoria: Stage 2 Further Development", Livestock Environmental and Planning, Horsham, VIC, 3400.
- Green SL, **Tucker RW**, McGahan EJ & Wiedemann SG, 2007, *Reviewing composting practices in the pig industry*, Project No 2140, Australian Pork Limited, Canberra.
- Green SL, **Tucker RW**, McGahan EJ & Wiedemann, SG 2007, *Composting of Piggery Manure and Mortalities – Milestone Report – Reviewing Composting Practices in the Pig Industry*, APL Project No. 2140, Australian Pork Limited, Canberra.
- Lott SC, Watts, PJ, **Tucker, RW**, Jones, M & Round, PJ 1990, *Procedural arrangements and design requirements for feedlot licensing*, AMLRDC report no. DAQ64/5, Department of Primary Industries, Brisbane.

- Lott SC, Watts, PJ, **Tucker, RW**, Jones, M & Round, PJ 1990, *Feedlots in North America. Procedural arrangements and design requirements for feedlot licensing in United States and Canada*, AMLRDC report no. DAQ64/4, Department of Primary Industries, Brisbane.
- McGahan EJ, Barker SJ & **Tucker RW**, 2008, *Environmental Guidelines for the Australian Egg Industry*, A report for the Australian Egg Corporation Limited as part of the DAFF EMS Pathways to Sustainable Agriculture Program, AECL Publication No. 08/01, AECL Project No. EM01, Australian Egg Corporation, North Sydney.
- McGahan EJ, Barker SJ, **Tucker RW**, Green S & Wiedemann S, 2007, *Assessment of Nutrient Balance Calculators for Piggeries – Final Report*, Australian Pork Ltd Project No 2137, Australian Pork Limited, Canberra.
- McGahan EJ & **Tucker RW**, 2002, *Manure production and spent litter composition*, Meat Chicken Technical Environmental Note 2, Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ & **Tucker RW**, 2002, *National environmental management system for the meat chicken industry*, A Final Report for the Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ & **Tucker RW**, 2002, *National environmental management system for the meat chicken industry: part D – environmental risk assessment workbook for the meat chicken industry*, Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ & **Tucker RW**, 2003, *EMS for meat chicken farms: facilitators training manual*, Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ & **Tucker RW**, 2003, *EMS for meat chicken farms: participants training manual*, Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ & **Tucker RW** (principal authors), 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.
- McGahan EJ & **Tucker RW** (principal authors), 2003, *Summary document 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.
- McGahan EJ, **Tucker RW**, Barker SJ, Green SL, Wiedemann SG, Chinivasagam N, Blackall P, Hudson N, Duperouzel, D and Clayton C 2007, *Composting of piggery manure and mortalities, Final Report Project No 2140*, Australian Pork Limited, Canberra.
- McGahan EJ, **Tucker RW**, Chinivasagam N, Blackall P, Barker SJ, Green S, Wiedemann S, Hudson N, Duperouzel D & Clayton C, 2007. *Composting of Piggery Manure and Mortalities*, Final Report, APL Project No 2140, Australian Pork Limited, Canberra.
- McGahan EJ, **Tucker RW** & Hewitt SC 2005, *Australian piggeries environmental management system implementation manual, Level 1*, Australian Pork Limited, Canberra.
- McGahan EJ, **Tucker RW** & Hewitt, SC 2005, *Australian piggeries environmental management system implementation manual, Level 2*, Australian Pork Limited, Canberra.

- McGahan EJ, **Tucker RW** & Hewitt SC 2005, *Australian piggeries environmental management system standard, Level 1*, Australian Pork Limited, Canberra.
- McGahan EJ, **Tucker RW** & Hewitt SC 2005, *Australian piggeries environmental management system standard, Level 2*, Australian Pork Limited, Canberra.
- McGahan EJ, **Tucker RW** & Robinson, S 2002, 'National environmental management system for the meat chicken industry: part B – environmental management plan example and explanatory notes for the meat chicken industry', Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ, **Tucker RW** & Robinson S 2002, 'National environmental management system for the meat chicken industry: part C – generic environmental management plan for the meat chicken industry', Rural Industries Research & Development Corporation, Canberra.
- McGahan EJ, **Tucker RW**, Zadow EN, Wiedemann SG & Poad GD, 2011, *National EMS for the Meat Chicken Industry Version 2. Part A – Manual of Good Environmental Practice*, Project No. PRJ-005765, December 2011, Rural Industries Research and Development Corporation, Canberra.
- Nicholas PJ, Redding M, Devereux J, Kelsey G, McGahan EJ, **Tucker RW** & Heinrich NA, 2006, *Developing guidelines for use of spent deep litter bedding – final report*. Australian Pork Ltd Project No. 1969, Australian Pork Limited, Canberra.
- O'Keefe MF, McDonald SA, Yan M, Davis RJ, McGahan EJ & **Tucker RW**, 2013, *Sludge handling and management*, Project No. 2012/1029, Australian Pork Limited, Canberra.
- Peters G, Rowley H, **Tucker R**, Wiedemann S & Feitz A, 2008, *Life Cycle Analysis of the Australian Red Meat Industry – Final Report*. Project No. COMP.094, Meat and Livestock Australia, North Sydney.
- Peters G, Rowley H, **Tucker RW**, Wiedemann SG, Short M & Schulz M, 2009, *Southern Red Meat Production - Life Cycle Assessment*, Project COMP.094 Final Report, Meat and Livestock Australia Ltd, North Sydney.
- Peters G, Wiedemann SG, Rowley HV & **Tucker RW**, 2009, *Red Meat Production in Southern Australia - LCA Water Use Analysis*, Project COMP.094 Milestone Technical Report, Meat and Livestock Australia Ltd, North Sydney.
- Roser DJ, **Tucker RW**, Khan SJ, Klein M, Coleman HM, Brown L, Davies C, Trinh T, Wang S, Peters G, Stuetz R, Ashbolt N, Baker KM, Burger M & Davis RJ, 2011, *"Managing the Contaminants in Feedlot Wastes: Development of Realistic Guidelines – Final Report"*, Meat & Livestock Australia project FLOT.333, Meat & Livestock Australia Ltd, North Sydney.
- Roser DJ, **Tucker RW**, Khan SJ, Klein M, Coleman HM, Brown L, Davies C, Trinh T, Wang S, Peters G, Stuetz R, Ashbolt N, Baker KM, Burger M & Davis RJ, 2012, *Microbiological and Chemical Human Health Risks Arising from Cattle Feedlot Wastes: Their Characterization and Management*, Meat & Livestock Australia project FLOT.333, Meat & Livestock Australia Ltd, North Sydney.
- Sanders PR, Lott SC, Watts PJ, **Tucker RW**, Casey KD & Lyndon K, 1994, *Lot fed cattle water consumption*, Report 12.A. Meat Research Corporation Project No. DAQ.079, Queensland Department of Primary Industries & Feedlot Services Australia, Toowoomba.
- Spence M & **Tucker RW**, 2001, *Environmental management program manual*, Pig Research and Development Corporation, Canberra.

- Spence M & **Tucker RW** 2001, *Environmental management plan package for small and medium piggeries*, Pig Research and Development Corporation, Canberra.
- Spence M & **Tucker RW**, 2001, *Environmental management systems*, Pig Research and Development Corporation, Canberra.
- Tucker RW**, 2014, *Evaluation of Reform Options for Victoria's Incorporated Codes for Intensive Animal Industries*, Department of Economic Development, Jobs, Transport and Resources, Melbourne.
- Tucker RW**, 2015, *Review of Regulatory and Non-Regulatory Issues for intensive Dairy Facilities – Scoping Paper*, Department of Economic Development, Jobs, Transport and Resources, Melbourne.
- Tucker RW** & Baker KM, 2006, *Overview of Feedlot Waste Management and Pathways for Contaminant Transfer*, Centre for Water and Waste Technology, Sydney.
- Tucker RW**, Gernjak W, Davis RJ, Scobie MJ, Watts PJ, Trigger RZ, Poat GD, O'Keefe MF and Bonner SL, 2011, *Treatment Technologies for Feedlot Effluent Reuse*, Meat & Livestock Australia Project B.FLT.0348, Meat & Livestock Australia, North Sydney.
- Tucker RW**, Keane OB, Galloway JL, 2013, *Intensive Animal Industries Regulatory Frameworks Review*, FSA Consulting Report 8092/3, FSA Consulting, Toowoomba, QLD 4350.
- Tucker RW** & Klepper K, 2005, *Review of on-farm food safety best practice*. MLA project no. PRMS.075, Meat and Livestock Australia, North Sydney.
- Tucker RW**, McGahan EJ & Price J, 2021, *Technical Guidelines for the Intensive Animal Industries Code of Practice in Victoria: Final Report*, prepared for Agriculture Victoria, Melbourne
- Tucker RW**, O'Keefe M, McGahan E, Jensen P & Batsone D, 2012, *Nutrient Extraction from Spent Bedding and Pond Sludge*. Australian Pork Ltd Project 2011/10115.399. Canberra, ACT: Australian Pork Limited.
- Tucker RW**, Price J and McGahan EJ, 2022, *Review of Grazing Animal Production (GAP) and Intensive Animal Production (IAP) Land Use Definitions and Separation Distances Supporting Information*, for Agriculture Victoria, Melbourne
- Tucker RW**, Roser DJ, Klein M & Khan SJ, 2011, *Guidelines for the Safe Management of Feedlot Wastes*, Meat & Livestock Australia project FLOT.333, Meat & Livestock Australia Ltd, North Sydney. Meat & Livestock Australia Ltd, North Sydney.
- Watts PJ, Davis RJ & **Tucker RW**, 2006, *Review of lot fed water consumption*, MLA project no. DAQ.079, Final Report FLOT.328 Part E, Meat & Livestock Australia Ltd, North Sydney.
- Watts PJ, Jones M, **Tucker RW**, Lott SC & Fennell SJ, 1992, *The FARMFEST experiment - an evaluation of the ability of the population to identify agricultural odours*, Meat Research Corporation report no. DAQ64/10, Department of Primary Industries, Brisbane.
- Watts PJ, Smith JN, Smith RJ, Jones M, Lott SC & **Tucker RW** 1992, *The offensiveness of odours from cattle feedlots*, MRC report no. DAQ64/20, Department of Primary Industries, Brisbane.
- Watts PJ, **Tucker RW**, Pittaway PA, McGahan EJ, Kruger IR & Lott SC, 2002, *Low cost alternatives for reducing odour generation – Part B – Case studies of solids separation systems*, Milestone No 5 of project no. 1629, Australian Pork Limited, Canberra.

Watts PJ, **Tucker RW**, Pittaway PA & McGahan EJ, 2002, *Low cost alternatives for reducing odour generation – Part A – Literature review and recommendations*, Milestone No 5 of Project No. 1629, Part A Report, Australian Pork Limited, Canberra.

Watts PJ, Tucker RW, Pittaway PA & McGahan EJ, 2001, *Low cost alternatives for reducing odour generation – Final Report*, Australian Pork Ltd Project No. 1629, Australian Pork Limited, Canberra.

Wiedemann SG, **Tucker RW**, Rowley HV & Peters GM, 2006, *Natural resource management issues*. Research paper for COMP.094 workshop, Meat and Livestock Australia, North Sydney.

Zadow EN, **Tucker RW**, McGahan EJ, O’Keefe MF & Wiedemann SG, 2010, *Caring for our Country - Nutrient management plan development (Summary Report)*, Final report prepared for Australian Pork Ltd Project No. 2262.02, Australian Pork Limited, Canberra.

Extension Material

McGahan EJ & **Tucker RW** 2002, *Composting carcasses in open bays and piles*, Meat Chicken Technical Environmental Note 5, Rural Industries Research & Development Corporation, Canberra.

McGahan EJ & **Tucker RW** 2002, *Composting and pasteurising spent litter*, Meat Chicken Technical Environmental Note 3, Rural Industries Research & Development Corporation, Canberra.

McGahan EJ & **Tucker RW** 2002, *Land application of spent litter*, Meat Chicken Technical Environmental Note 4, Rural Industries Research & Development Corporation, Canberra.

McGahan EJ & **Tucker RW** 2002, *Litter clean-out*, Meat Chicken Technical Environmental Note 1, Rural Industries Research & Development Corporation, Canberra.

McGahan EJ & **Tucker RW** 2003, *EMS for meat chicken farms: example environmental management plan*, Meat Chicken Technical Environmental Note 4, Rural Industries Research & Development Corporation, Canberra.

National Centre for Engineering in Agriculture-Pig Research and Development Corporation, 1998, *Environmental Management Training for Piggery Managers*, **Tucker RW**, content development, Pig Research and Development Corporation, Canberra.

National Centre for Engineering in Agriculture – Australian Pork Limited 2001, *Environmental Principles for Piggeries*, **Tucker RW**, content development. **Tucker RW** & Kruger IR: Course review, Australian Pork Limited, Canberra.

Nicholas PJ, McGahan EJ & **Tucker RW**, 2006, *Producer guidelines for use of spent bedding*, Australian Pork Ltd project no. 1969, Australian Pork Limited, Canberra.

O’Keefe MF and **Tucker RW**, 2010, *Lamb Lot Feeding: Opportunities in the Wimmera Mallee Pipeline Region*, Department of Primary Industries, Melbourne

Tucker RW, 1992, ‘Beef cattle feedlot - animal welfare’, In *Feedlotting notes - a collection of farmnotes*. Information Series Q191032, Department of Primary Industries, Brisbane, pp. 67-69. (Also published as Farmnote BE9111003 F47/May91 Agdex 420/17).

- Tucker RW**, 1992, 'Feedlot waste management series no. 9 - fly control', In *Feedlotting notes - a collection of farmnotes*. Information Series Q191032, Department of Primary Industries, Brisbane, pp. 59-62. (Also published as Farmnote BE9116003 F51/May91 Agdex 420/17).
- Tucker RW**, 1993, 'Leadership and small farmer groups', In *Agricultural Extension: Book of Readings*, University of Southern Qld, Toowoomba, pp. 1-11.
- Tucker RW**, 2012, 'Developing a nutrient management plan for a rotational outdoor piggery', Australian Pork Ltd Outdoor Piggery Fact Sheet Series, May 2012, Australian Pork Ltd, Canberra.
- Tucker RW**, 2012, 'Land and water protection measures for rotational outdoor piggeries', Australian Pork Ltd Outdoor Piggery Fact Sheet Series, May 2012, Australian Pork Ltd, Canberra.
- Tucker RW**, 2012, 'Promoting more even distribution of manure nutrients in rotational outdoor piggeries', Australian Pork Ltd Outdoor Piggery Fact Sheet Series, May 2012, Australian Pork Ltd, Canberra.
- Tucker RW**, 2012, 'Soil monitoring for rotational outdoor piggeries', Australian Pork Ltd Outdoor Piggery Fact Sheet Series, May 2012, Australian Pork Ltd, Canberra.
- Tucker RW**, 2015, 'Getting the best value from manure nutrients', Australian Pork Ltd Project 2013/031, Australian Pork Ltd, Canberra.
- Tucker RW**, 2015, 'Minimising odour from piggeries', Australian Pork Ltd Project 2013/031, Australian Pork Ltd, Canberra.
- Tucker RW & Tait S**, 2015, 'New design guidelines for anaerobic ponds', Australian Pork Ltd Project 2013/031, Australian Pork Ltd, Canberra.
- Tucker RW**, 2015, 'Reducing energy costs in piggeries', Australian Pork Ltd Project 2013/031, Australian Pork Ltd, Canberra.
- Tucker RW**, 2015, 'SEPS: sedimentation and evaporation pond systems', Australian Pork Ltd Project 2013/031, Australian Pork Ltd, Canberra.
- Tucker RW & Kruger IR**, 2002, *Environmental Management Plans for Piggeries*, Australian Pork Limited, Canberra.
- Tucker RW & McGahan EJ**, 2005, *EnviroCheck: A template for assessing the performance of existing piggeries against the national environmental guidelines for piggeries*. Australian Pork Ltd, project no. 1972.08, Australian Pork Limited, Canberra.
- Tucker RW & Price J**, 2018, "Planning for Animal Industries Short Course Materials", Department of Economic Development, Jobs, Transport and Resources, Melbourne.
- Tucker RW & Price J**, 2019, "Small Scale Pig and Poultry Planning: Workshop Materials", Department of Economic Development, Jobs, Transport and Resources, Melbourne.
- Tucker RW & Svensson R**, 1992, 'Feedlot waste management series no. 9 - disposal of carcasses', In *Feedlotting notes - a collection of farmnotes*. Information Series Q191032, Department of Primary Industries, Brisbane, pp. 67-69. (Also published as Farmnote BE9111003 F47/May91 Agdex 420/17).

- Tucker RW & Watts PJ**, 1992, 'Feedlot waste management series - no. 4 - design concepts to aid cleaning', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 43-46.
- Tucker RW & Watts PJ**, 1992, 'Feedlot waste management series - no. 5 - mounding in yards', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 47-48.
- Tucker RW & Watts PJ**, 1992, 'Feedlot waste management series - no. 6 - attention to detail', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 49-52.
- Tucker RW & Watts PJ**, 1992, 'Feedlot waste management series - no. 7 - manure removal and stockpiling', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 53-54.
- Tucker RW & Wiedemann SG**, 2016, "Outdoor Production Awareness Program", workshop PowerPoint presentations and workbook, Australian Pork Ltd Project 2015/054, Australian Pork Ltd, Canberra.
- Watts PJ & **Tucker RW**, 1992, 'Feedlot waste management series - no. 2 - the feedlot pad', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 36-38.
- Watts PJ & **Tucker RW**, 1992, 'Feedlot waste management series - no. 3 - pen cleaning (manure harvesting)', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 39-42.
- Watts PJ & **Tucker RW**, 1992, 'Feedlot waste management series - no. 2 - the feedlot pad', In *Feedlotting notes - a collection of farmnotes*, Information series QI91032, Department of Primary Industries, Brisbane, pp. 36-38.

Models & Tools

- McGahan EJ, Casey KD, Van Sliedregt H, Gardner EA, Watts PJ & **Tucker RW**, 2003, "Beefbal: A Nutrient Balance Model for Beef Cattle Feedlots", Queensland Department of Primary Industries, Toowoomba
- McGahan EJ, **Tucker RW** & Skerman AJ, 2021, "Separation Distance Calculators for the Intensive Animal Industries in Victoria", prepared for Agriculture Victoria, Melbourne
- Tucker RW** & Yan M, 2014, "EMP Template: Conventional Piggeries", prepared for Australian Pork Ltd, Barton.
- Tucker RW** & Yan M, 2014, "EMP Template: Rotational Outdoor Piggeries", prepared for Australian Pork Ltd, Barton.
- Tucker RW** & Yan M, 2015, "Nutrient Balance Calculator: Rotational Outdoor Piggeries", prepared for Australian Pork Ltd, Barton.

Explainers & Video Clips

Tucker RW, 2018, "Indoor Piggeries: A Guide for Planners", Explainer Clip prepared as part of Australian Pork Ltd Project 2016/093, Explainer Videos: Piggery Planning Requirements, Australian Pork Ltd, Canberra.

Tucker RW, 2018, "Outdoor Piggeries: A Guide for Planners", Explainer Clip prepared as part of Australian Pork Ltd Project 2016/093, Explainer Videos: Piggery Planning Requirements, Australian Pork Ltd, Canberra.

Tucker RW & Weidemann SG, 2018, "Rotational Outdoor Piggeries: Land Protection", Video Clip prepared as part of Australian Pork Ltd Project 2015/054, Australian Pork Ltd, Canberra.

Tucker RW & Weidemann SG, 2018, "Rotational Outdoor Piggeries: Promoting Even Nutrient Distribution", Video Clip prepared as part of Australian Pork Ltd Project 2015/054, Australian Pork Ltd, Canberra.

Tucker RW & Weidemann SG, 2018, "Rotational Outdoor Piggeries: Selecting a Good Site", Video Clip prepared as part of Australian Pork Ltd Project 2015/054, Australian Pork Ltd, Canberra.

Tucker RW & Weidemann SG, 2018, "Rotational Outdoor Piggeries: Soil Testing", Video Clip prepared as part of Australian Pork Ltd Project 2015/054, Australian Pork Ltd, Canberra.

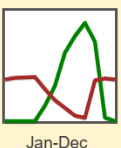
Appendix D – PigBal Output

Provided as separate document.

Appendix E – Watbal Output

Primary and Storage Pond design Koorani (17916 SPUs) at Koorani

Growing Winter reduced till C (50ha) on Average sandy loam PAWC 80 at YOUNG POST OFFICE

1 Analysis Setup	2 Pond Catchment	3 Flushing System	4 Pull Plug	5 Static Pit	6 Solids Management	7a Primary Pond	7b Storage Pond	8 Effluent Irrigation
Name  Koorani Farm  Koorani Setup  Primary & Storage Location  YOUNG POST OFFICE Soil type  Average sandy loam PAWC 80 Crop type  Winter reduced till C Years  1900 to present Notes   Crop Cover Jan-Dec								

1 Analysis Setup	2 Pond Catchment	3 Flushing System	4 Pull Plug	5 Static Pit	6 Solids Management	7a Primary Pond	7b Storage Pond	8 Effluent Irrigation
Concrete catchment  0 m2 Earth catchment  310 m2 Hard catchment  3820 m2 Grass (veg) catchment  24000 m2 Roof catchment  0 m2								

1 Analysis Setup	2 Pond Catchment	3 Flushing System	4 Pull Plug	5 Static Pit	6 Solids Management	7a Primary Pond	7b Storage Pond	8 Effluent Irrigation
Flushing shed SPUs  - 17916 + Flushing interval  1 days/flush Fresh water flushing vol  0 L/flush Recycled effluent flushing vol  0 L/flush Hosing interval  1 days Hosing volume  20000 L/hosing								

- 1
Analysis
Setup
- 2
Pond
Catchment
- 3
Flushing
System
- 4
Pull
Plug
- 5
Static
Pit
- 6
Solids
Management
- 7a
Primary
Pond
- 7b
Storage
Pond
- 8
Effluent
Irrigation

Total solids (TS) from sheds ⓘ 800 kg TS/day ▾ Volatile solids (VS) from sheds ⓘ 500 kg VS/day ▾

Solids separation ⓘ None ▾

- 1
Analysis
Setup
- 2
Pond
Catchment
- 3
Flushing
System
- 4
Pull
Plug
- 5
Static
Pit
- 6
Solids
Management
- 7a
Primary
Pond
- 7b
Storage
Pond
- 8
Effluent
Irrigation

Pond design philosophy ⓘ Heavily loaded anaerobic (H) ▾ Desludging interval ⓘ 1 years ▾

Total pond volume ⓘ 14500 m3 ▾ Pond storage depth ⓘ 1 m ▾

Batter - lengthwise ⓘ 1 (V) : 3 (H) ▾ Batter - breadthwise ⓘ 1 (V) : 3 (H) ▾

Length (at embankment crest) ⓘ 420 m ▾ Freeboard ⓘ 0.5 m ▾

Cover anchorage allowance ⓘ 0 m ▾ Dam factor (kdam = Pond evap / ... ⓘ 1 ▾

- 1
Analysis
Setup
- 2
Pond
Catchment
- 3
Flushing
System
- 4
Pull
Plug
- 5
Static
Pit
- 6
Solids
Management
- 7a
Primary
Pond
- 7b
Storage
Pond
- 8
Effluent
Irrigation

Total storage capacity ⓘ 13200 m3 ▾ Total storage depth ⓘ 2 m ▾

Residual storage depth ⓘ 0.2 m ▾ Length (at embankment crest) ⓘ 87 m ▾

Batter - lengthwise ⓘ 1 (V) : 2(H) ▾ Batter - breadthwise ⓘ 1 (V) : 2(H) ▾

Freeboard ⓘ 0.5 m ▾

- 1
Analysis
Setup
- 2
Pond
Catchment
- 3
Flushing
System
- 4
Pull
Plug
- 5
Static
Pit
- 6
Solids
Management
- 7a
Primary
Pond
- 7b
Storage
Pond
- 8
Effluent
Irrigation

Irrig method ⓘ Low Press Travelling ▾ Irrigation triggers (Change all) ⓘ

Effluent irrig area ⓘ 50 ha ▾ Jan 10 mm ▾ Feb 10 mm ▾ Mar 10 mm ▾ Apr 10 mm ▾ May 10 mm ▾ Jun 10 mm ▾

Pump capacity ⓘ 1 ML/day ▾ Jul 10 mm ▾ Aug 10 mm ▾ Sep 10 mm ▾ Oct 10 mm ▾ Nov 10 mm ▾ Dec 10 mm ▾

Rain to cancel irrig ⓘ 5 mm ▾

Effluent dilution ... ⓘ 100 % ▾



Primary and Storage Pond design Koorani (17916 SPUs) at Koorani

Growing Winter reduced till C (50ha) on Average sandy loam PAWC 80 at YOUNG POST OFFICE

- | | | | | | | | | |
|------------------------|------------------------|-------------------------|-------------------|--------------------|---------------------------|-----------------------|-----------------------|-----------------------------|
| 1
Analysis
Setup | 2
Pond
Catchment | 3
Flushing
System | 4
Pull
Plug | 5
Static
Pit | 6
Solids
Management | 7a
Primary
Pond | 7b
Storage
Pond | 8
Effluent
Irrigation |
|------------------------|------------------------|-------------------------|-------------------|--------------------|---------------------------|-----------------------|-----------------------|-----------------------------|

Irrig method **i** Low Press Travel **v**

Effluent irrig area **i** 50 ha **v**

Pump capacity **i** 1 ML/day **v**

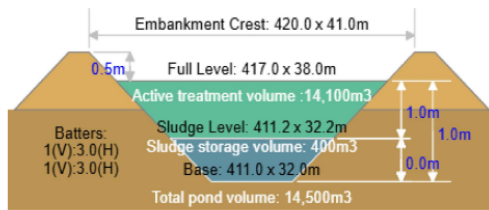
Rain to cancel i... **i** 5 mm **v**

Effluent dilution... **i** 100 % **v**

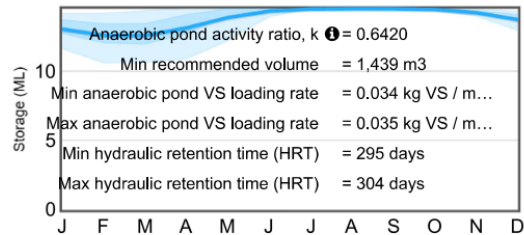
Irrigation triggers (Change all) **i**

Jan	Feb	Mar	Apr	May	Jun
10 mi v	10 mi v	10 mi v	10 mi v	10 mi v	10 mi v
Jul	Aug	Sep	Oct	Nov	Dec
10 mi v	10 mi v	10 mi v	10 mi v	10 mi v	10 mi v

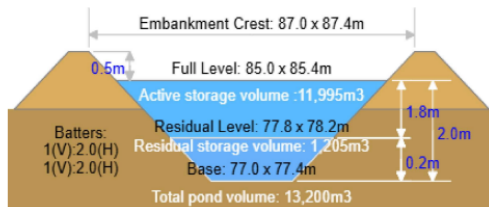
Primary Pond



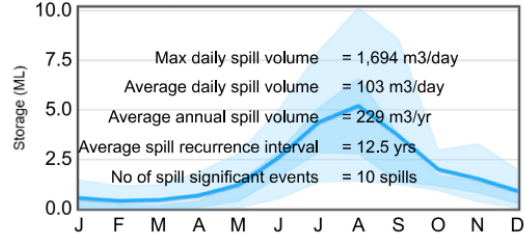
Primary pond active volume



Storage Pond



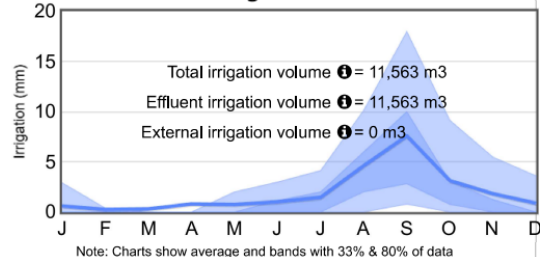
Storage Pond active volume



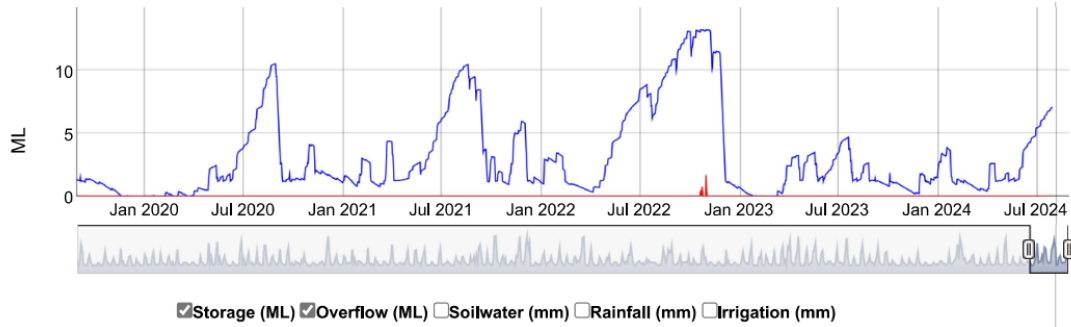
Storage Pond Water balance

Output	m ³ /yr
Inflow from Primary Pond	12,178
Inflow from Pond Rainfall	4,969
Outflow from Recycling	24
Outflow from Irrigation	11,563
Outflow from Pond Evaporation	5,461
Outflow from Overtopping	229

Irrigation

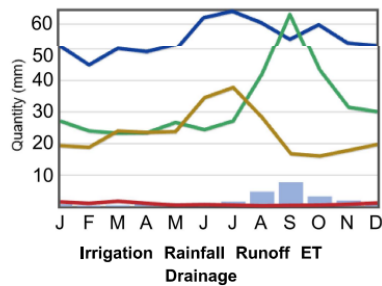


Note: Charts show average and bands with 33% & 80% of data



Paddock Summary

Paddock water-balance



Key time-series outputs

Output	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Irrig(Total)	1	0	0	1	1	1	1	5	8	3	2	1	23
Irrig(Pond)	1	0	0	1	1	1	1	5	8	3	2	1	23
Irrig(Clean)	0	0	0	0	0	0	0	0	0	0	0	0	0
Rainfall	51	45	50	49	51	62	64	60	55	60	54	53	65
Runoff	2	1	2	1	1	1	1	0	0	1	1	1	11
ET	27	24	23	23	27	24	27	42	63	43	31	30	38
Drainage	19	19	24	24	24	34	38	28	17	16	18	20	28

Farm Detailed Outputs

Primary Pond Detailed Outputs

Storage Pond Detailed Outputs

Top Spill Events

Disclaimer

This product has been prepared by the State of Queensland as an information - only source. The State of Queensland makes no statements, representations, or warranties about the accuracy or completeness of, and you should not rely on, any information contained in this product. Any reference to any specific organisation, product or service does not constitute or imply its endorsement or recommendation by the State of Queensland. The Queensland Government disclaims all responsibility and all liability (including, without limitation, liability in negligence) for all expenses, losses, damages and costs you might incur as a result of the information being inaccurate or incomplete in any way, and for any reason, © The State of Queensland, Department of Agriculture and Fisheries 2017.

Copyright protects this material, inquiries should be addressed to DAFFcopyright@daf.qld.gov.au.



Appendix F – Duty of Care Statement: Spent Bedding and Compost (sourced from APL Piggery Manure and Effluent Management and Reuse Guidelines)

Duty of Care Statement: Spent Bedding and Compost

Aged spent bedding and bedding compost from piggeries are great sources of nutrients for plant growth and carbon for building soil structure. However, like inorganic fertilisers, they need to be spread on suitable areas and applied at sustainable rates to ensure the environment is protected. Those utilising spent bedding or compost must take all reasonable and practical steps to prevent harm to the environment and to areas of cultural heritage sensitivity. Each state has its own Acts detailing duty of care provisions. These typically require:

- Sustainable use of natural resources
- Conservation of biological diversity
- Avoidance of harm to Indigenous cultural heritage.

In particular, spreading of spent bedding or compost needs to be managed to avoid:

- Land degradation (e.g. soil erosion, decline in soil structure, nutrient overloading)
- Odour and dust nuisance
- Surface water and groundwater pollution with nutrients and sediment
- Increased weeds
- Noise nuisance.

To minimise the likelihood of these potential impacts:

- Minimise the risk of spent bedding or compost spillage during transportation by not overfilling the truck and by covering the load
- Where practical, avoid transport routes with a large number of houses close to the road
- Spent bedding and compost should not be stored or spread on areas that are flood-prone. Nor should they be stored or spread on areas where they will pose a significant risk of nutrient transfer to watercourses (e.g. sloping land immediately abutting a watercourse)
- Check the weather forecast before spreading spent bedding or compost and delay spreading if heavy rain is expected or the soil is still very wet following heavy rain. Also check the wind speed and direction to ensure the prevailing wind is not blowing directly towards nearby residences
- Plan to spread spent bedding or compost from mid-morning to early-afternoon when good odour dispersion is likely. Avoid spreading from mid-afternoon to evening. Avoid spreading just before weekends or during holiday periods, particularly if close to a public area
- Determine a suitable spreading rate based on the N, P and K content of the spent bedding or compost, soil properties and the intended land use of the reuse area. The rate should be consistent with the ability of soils and plants grown on the area to sustainably use the applied nutrients, salts and carbon in the spent bedding or compost

- Calibrate the spreader to spread at the target rate
- Monitor reuse areas for weeds and control these if necessary. Although the aging and composting processes can destroy most weed seeds, some seeds may remain viable
- Avoid spreading spent bedding or compost close to sensitive neighbours at night when noise may create nuisance
- Do not allow grazing stock to access stored manure or reuse areas for at least three weeks after spreading.

A recent "typical analysis" sheet for the manure or compost should also be provided to the recipient.

Appendix G – Biodiversity Assessment Report

Provided as separate document.

Appendix H – Biosecurity Procedure



WINDRIDGE FARMS SOP 11: BIOSECURITY PROCEDURE



Purpose

To minimise the risk of disease transmission accompanying people, vehicle and equipment movement and by restricting the access of domestic pigs to other animals, particularly feral pigs.

Records

Visitor movement record

Personal Bio-security Declaration

Also relates to APIQ✓ Standards 4.1, 4.2, 4.3 and the APIQ✓ *Food Safety and Bio-security Controls*, Table 3

Action

Manager

- To ensure that Windridge has a barrier to the entry of disease to our sites by following and having good bio-security procedures.
- No livestock, including other domestic of feral pigs, can enter or come into direct contact with pigs.
- Sheep are allowed to graze around pig sheds, their movement is controlled so they can easily be mustered and removed in the event of a disease outbreak.
- establish the biosecurity conditions under which access for staff and visitors, and their vehicles and equipment, is permitted. Only essential visitors are allowed access to sheds.
- entry gates and shed doors are secured and warning signs are displayed to discourage unauthorised entry.
- provide sufficient protective clothing and boots for a range of sizes. Provide facilities for hand and equipment washing.
- maintain a visitor entry record. Outside the sheds are dirty inside are clean areas. The load-out and silo area is designated 'dirty'.

All Staff and Visitors

- The Feedmill will be out of bounds to all Production and Maintenance staff
- The production sheds are out of bounds to all Mill staff and feed delivery drivers.
- There is to be one night down for all production staff who may move around sites and who enter sheds.

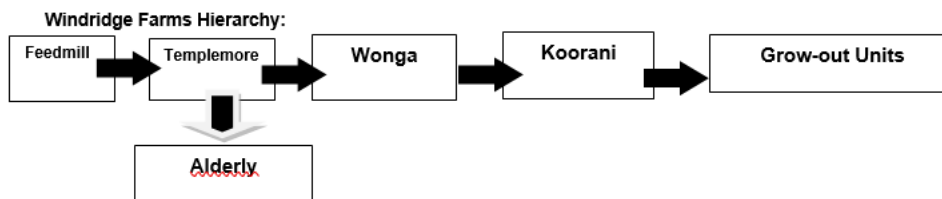


WINDRIDGE FARMS

SOP 11: BIOSECURITY PROCEDURE



- Senior members of staff can visit all sites in one day if site clothing and footwear is used at each site. This group would include vets and specialists who need to visit the production areas, and follow the following hierarchy for Windridge Farms.



- Entry of staff or visitors into pig sheds is not allowed if they have entered sheds or handled pigs on another piggery, there is to be no contact with pigs 4 nights prior to visit.
- If staff travel overseas for their holidays they must have 4 nights away from the pig sheds if they have travelled to a low risk country. If they travel to a high risk country they must have 6 nights down. The high and low risk countries will be determined at the time by management and will be subject to change.
- Clothing and shoes worn outside of Australia will need to be laundered and never worn on a Windridge farm.
- There is a controlled entrance to the 'clean' area where staff and visitors are provided with facilities for hand and equipment washing.
- Zero Pork products are to be consumed or brought onto any Windridge site, (this would include in any vehicles or live haul trucks).
- No food products are to be discarded in anything other than a sealed bin.
- No Pet food is to be brought on site under any circumstances, including in vehicles.
- Hands must be washed before entering the work place (before starting work and after breaks).
- Food is to be consumed in the break room, by staff and all visitors to the site the only exception being drivers can consume food in the vehicle cab or in the lunch room.
- If exceptions are made, a shower is required before entry, unless agreed otherwise by management.
- There is a controlled entrance and shower and change rooms where staff and visitors are provided with facilities for hand and equipment washing.
- Before entering sheds, paddocks and other facilities, staff and visitors must remove street clothes in the designated 'dirty' area, change into protective boots and clothing and wash hands and any equipment before moving into the 'clean' area. Any equipment taken into sheds must be visibly clean, and the exterior treated by 'wet' disinfection (alcohol/methylated spirits), or water and detergent or other disinfectant.
- Biosecurity conditions are displayed at the piggery entrance and all visitors must read and agree to these conditions. All visitors must complete and sign the *Visitor Record*, as well as the person who has authorised their entry.
- Alderly Isolation shed is out of bounds to all non-essential staff.



WINDRIDGE FARMS

SOP 11: BIOSECURITY PROCEDURE



Bio-security Procedure:

All staff must sign the *Personnel Biosecurity Declaration* form and comply with the requirements outlined on that form. In addition, they must inform management if they were, or plan to be, involved in wild pig or goat hunting, so that appropriate quarantine arrangements can be made.

Vehicles:

Vehicles are not allowed into 'clean' areas unless necessary and authorised. If so, they should be parked as far away from pigs sheds as practical. At silos and loading areas within the perimeter, drivers remain outside the sheds.

Vehicles must be washed after visits to contract growers or any other non-company pig site before returning to a Windridge location.

GRAZING SHEEP WITHIN PIGGERY COMPOUND

This procedure is aimed at controlling the situation when sheep are grazed within the piggery compound. It will ensure that there is no potential for sheep grazing within the piggery compound to access pig feed.

Risk Area	Risk Mitigation	Procedural Mitigation
Beneath feed silos – feed may have spilled		All silo areas to be checked prior to sheep being given access to piggery compound. Spilled feed to be removed.
Beneath and around silo breather tube bags	Access to bags on breather tubes to be fenced off with sheep mesh	All bags and breather tube areas to be checked prior to sheep being given access to piggery compound. Spilled feed to be removed
Bagged feed storage	Bagged feed kept inside	Bagged feed area checked prior to sheep access being granted. Any spilled feed to be cleaned up and removed.
General shed area	Sheep do not have access to the feed areas in the pig sheds themselves	All areas around sheds to be checked prior to sheep being given access to piggery compound.

**WINDRIDGE FARMS****SOP 11: BIOSECURITY PROCEDURE**

The procedure to control the grazing of sheep within the piggery compound will be as follows:

- Requirement to graze within the piggery compound is recognized by either the Piggery Manager, or the Pastoral Manager.
- The planned date of the piggery grazing will be communicated to the Piggery Manager in writing by the Pastoral Manager, with a minimum of one weeks notice.
- The Piggery Manager will complete the Sheep Grazing [checklist](#), and rectify any areas which are required.
- Once the checklist has been completed, and all rectification works have been completed, the Piggery Manager will sign the Sheep Grazing checklist, and inform the Pastoral Manager.
- The Sheep will be given access to the piggery compound.
- All risk areas will be checked daily and noted on the Sheep Grazing Checklist during the period the sheep have access to the piggery compound.
- The date of sheep removal will be noted, and the sheep grazing will be signed off by the Piggery Manager

In the event that an employee's comes into contact with pigs outside of the workplace they are to contact their manager immediately before coming to work and a quarantine period will be imposed after consultation with your manager.

Appendix I – Traffic Impact Statement

Provided as separate document.

Appendix J – Young Aboriginal Land Council Report



YOUNG LOCAL
ABORIGINAL LAND COUNCIL

247 BOOROWA STREET
YOUNG NSW
2594

TEL 02 6382-5669
FAX 02 6382-2522

younglalc62@gmail.com

Koorani Grower Unit Expansion



Aboriginal Cultural Heritage Assessment and Survey Report

Prepared for Robyn Tucker on 8th Sept 2020

By Young Local Aboriginal Land Council Cultural and Heritage Consultants *'working to preserve our culture and heritage for our future generations'*

247 Boorowa Street

YOUNG NSW 2594

Ph: 02.63825669

CEO Norma Freeman

Importance of our Cultural and Heritage Sites Officers

In accordance with OEH's Aboriginal cultural heritage consultation requirements for proponents 2010, we can perform 'decision making' as our sites officers continue to maintain a deep respect for our ancestral belief system, traditional lore and customs by passing down our knowledge from elders to children.

Our Cultural Sites Officers have many years of knowledge and some are elders in our community who have worked extensively passing down knowledge and training all our site's officers in all aspects of our culture.

We recognize our responsibilities and obligations to protect and conserve our culture and heritage and care for our traditional lands and country. We take great pride in our country and want to see that as much of our culture is saved for future generations as possible.

Our sites officers are extremely well respected in our community and have the trust of our community, knowledge and understanding of our culture and permission to speak about it.

Wiradjuri Cultural and Heritage Sites Officers

Keith Freeman and Norma Freeman

"We, the Wiradjuri Cultural and Heritage sites officers and members of Young Local Aboriginal Land Council welcome and acknowledge our relationship with Andree Rowntree about the land management along with the protection of Aboriginal Heritage and values. Being on country in Young, we acknowledge this to be Wiradjuri Culture and Heritage belonging to the Burrowmunditory Clan of the Wiradjuri Nation."

Keith Freeman

Wiradjuri Elder, Knowledge Holder & Member Young LALC

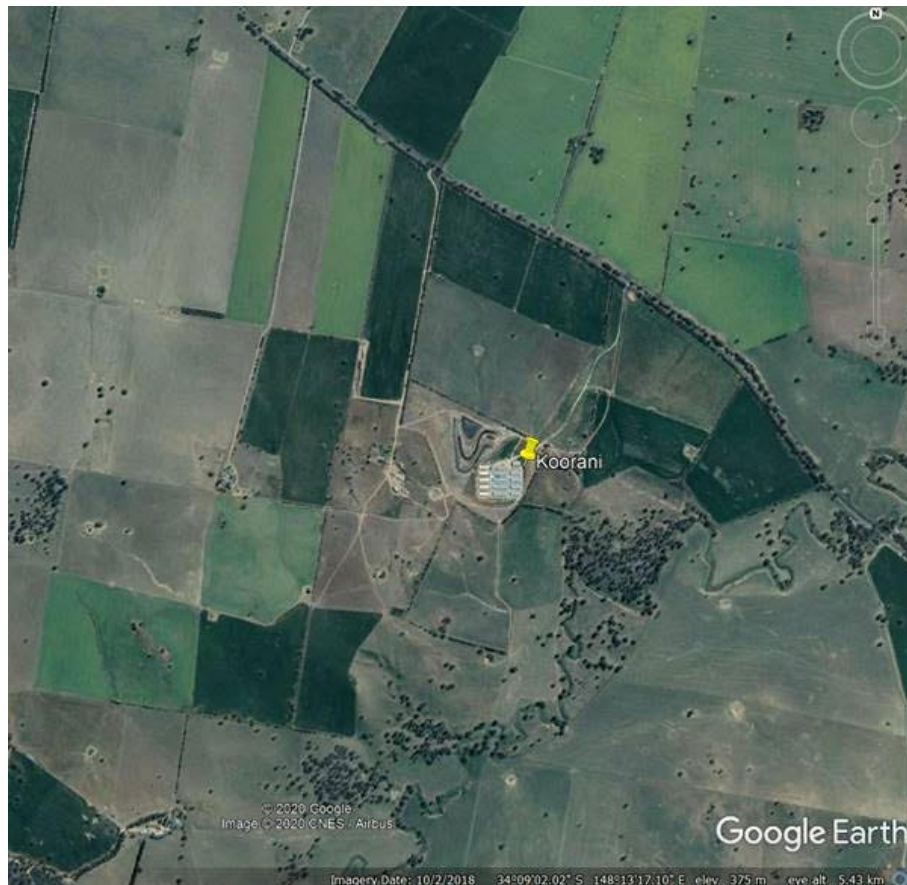
Summary

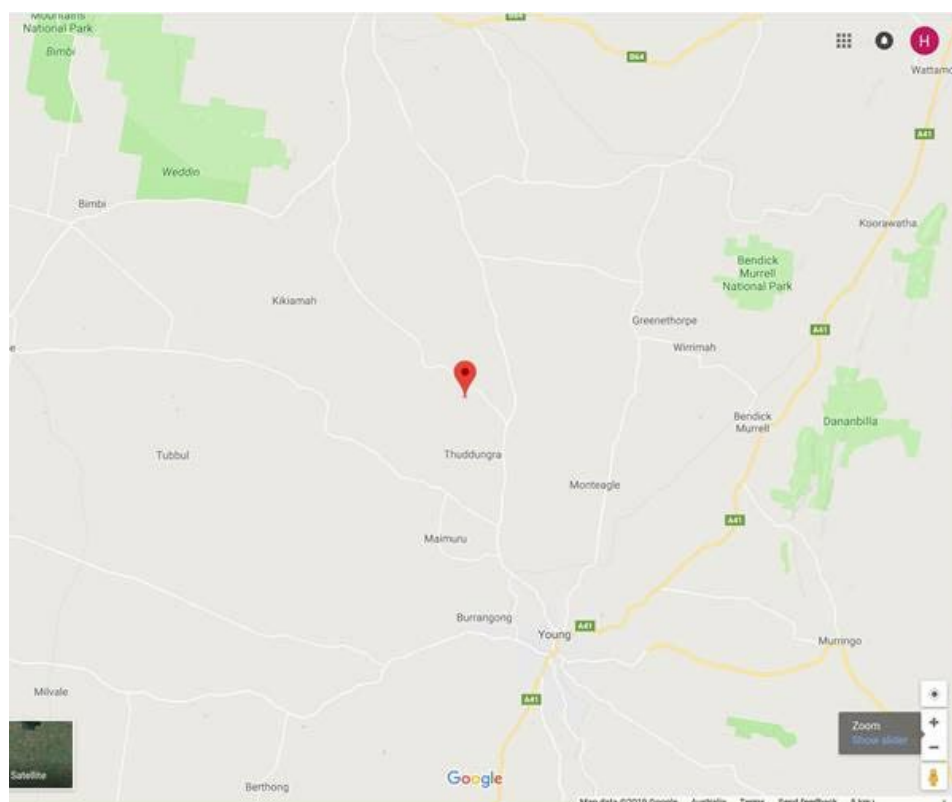
Robyn Tucker of Windridge Farms Pty Ltd engaged Young Local Aboriginal Land Council to prepare an Aboriginal Cultural and Heritage assessment and survey report for Aboriginal heritage within the proposal area.

This survey and report have been prepared in accordance with Young Local Aboriginal Land Council and New South Wales Aboriginal Land Council Cultural and Heritage guidelines.

Background

Robyn Tucker and Andree Rowntree of Koorani Piggery Windridge Farms Pty Ltd propose to Expand Koorani Grower Unit over the land shown by Yellow thumb tack on the attached Diagram.





Koorani Piggery - survey

Disturbed Area

Nil visibility ground coverage. Thick grass coverage.

1 artefact found. 1 Chert which is used for Knives/spear heads.

Towards the ploughed area.

This artefact was removed from the area that was going to be disturbed and put in a safe tree line close to where it was found, for safety.

1 possible artefact- Grinding stone which was used for sharpening tools. This was left in place along the fence line.



Recommendation

Due to the nil visibility and thick ground coverage on the day of survey, Young LALC recommends that when the earth/soil is to be dug up/ disturbed then our 2 site officers are to be in attendance in case anything is disturbed or found.

This is the policy of Young LALC that “if any earth/soil is to be disturbed then our Site Officers for that Project are to in attendance at all time/s. If for any reason we can’t have the Officers who carried out the survey be in attendance, then Young LALC will supply other Site Officers. (same contract agreement will need to be signed before further works are carried out.

We would like to acknowledge and thank the people involved in this survey who shared their knowledge and took great pride in caring for country.

Appendix K – ACHAR

Provided as separate document.

Appendix L – Draft Environmental Management Plan

Provided as separate document.

Appendix M – Summary of Mitigation Measures

Quality assurance

- APIQ✓® quality assurance will be maintained. APIQ✓® includes a module on animal welfare.

Waste minimisation

- low waste feeders
- phase feeding with optimal protein
- buy feedstuffs in bulk to minimise packaging waste
- rubbish segregation with recycling where practical
- flaring of GHG from effluent treatment
- beneficial reuse of effluent, manure and mortalities compost as cropping system inputs in place of fertiliser

Cleaning and hygiene

- smooth surfaces within housing that are easy to clean
- regular pressure washing of conventional sheds
- regular emptying of the effluent pits in series to keep a consistent flow of effluent to the CAL)
- using plenty of bedding in deep litter shelters
- replacing bedding frequently and regularly

Pests and weeds

- inspection and monitoring for pests and weeds
- slashing grass surrounding piggery
- feed storage silos, bins and feed lines designed to prevent access by rodents and birds.
- prompt clean up of spilt feed.
- control as needed (strategic baiting of flies and rodents and insects, herbicide and / or physical control of weeds)

Amenity (odour, visual, dust, noise, traffic)

- separation distances to sensitive land uses
- deep litter sheds and modern conventional sheds for housing
- good shed cleaning and hygiene (see separate section)
- suitably sized and designed effluent treatment system
- covering of anaerobic pond
- regular sludge removal from CAL
- good manure and effluent reuse practices (see separate section)
- tree screens maintained for visual amenity protection
- handling of dry spent bedding avoided, particularly under windy conditions
- reuse of dry manure near houses avoided
- construction work generally undertaken during the day
- operational work generally undertaken during the day
- traffic scheduled for day where practical property entry well separated from houses.
- property entry provides for safe entry / exit.

Public health

- where practical, spent bedding will be stockpiled for at least three months prior to reuse.
- handling and turning of spent bedding will be avoided under windy conditions.
- reuse will not occur within 250 m of a receptor house.
- a low-pressure travelling spray irrigator will be used.
- reuse will be avoided under very stable atmospheric conditions (e.g. early in the morning, evening). Effluent irrigation will generally not occur on weekends or public holidays.
- reuse will cease when wind speeds are expected to exceed 6 km/hr.
- reuse will be avoided under low relative humidity conditions.

Manure and effluent reuse practices for odour minimisation

- consider weather (wind speed and direction, cloud cover, imminent rain) when scheduling reuse
- spread frequently to minimise the likelihood of large, odour generation events
- distribute evenly over the land being irrigated / spread
- spread close to the ground
- incorporate into the soil (manure).

Effluent, spent bedding and mortalities compost reuse will be avoided:

- when the wind is blowing directly towards a nearby house or public area
- when the material (spent bedding and mortalities compost) is very dry and dusty and spreading could result in dust being carried to nearby houses or public areas
- under heavy, overcast conditions
- if significant rain is expected later that day
- early in the morning and late in the afternoon
- close to nearby houses or public areas

Effluent and manure nutrient management for soil health

- using sustainable nutrient application rates based on nutrient content of effluent and manure and expected crop nutrient removal rates.
- spreading manure and effluent evenly over land.
- applying manure and effluent when the nutrients can be taken up by growing crops.
- monitoring nutrients and salts in soils.
- providing off-site users with guidance on sustainable reuse.

Groundwater protection

- efficient groundwater use (within limits of WALs)
- buffers to bores
- good reuse practices (refer to Effluent and manure nutrient management for soil health)
- groundwater quality monitoring

Surface water protection

- piggery designed to exclude extraneous stormwater and to prevent effluent, manure and potentially contaminated stormwater from inadvertently leaving the site.

- monitoring of banks, bunds and the volume of water in the recycle dam regularly and after rainfall events.
- buffers between reuse areas and watercourses
- good reuse practices (refer to Effluent and manure nutrient management for soil health)

Biodiversity protection

- Minimal clearing
- Buffers
- Refer to Biodiversity Assessment Report included as an appendix to EIS.

Aboriginal cultural heritage

- Young LALC representatives present during the soil excavation for construction.
- Refer to ACHAR included as an appendix to EIS

Biosecurity

- Refer to the biosecurity protocol provided as an appendix to the EIS.

GHG mitigation

- deep litter housing
- CAL with GHG flaring
- efficient production and minimising feed use and wastage.

Chemical

- chemicals will be stored and used in accordance with the packaging directions or veterinary advice.
- MSDS for each hazardous chemical will be prominently located near the chemical.
- spill containment equipment will be kept in or near the chemical storages.
- details of all chemical purchases, usage and disposal will be recorded.

Complaints management

A complaints management process will be implemented at the piggery, whereby complaints will be managed by:

- talking with the complainant about the issue with the aim of finding out what the problem is, what date and time it occurred, how long the nuisance lasted, whether the complainant can help identify the cause and any other useful information.
- investigating possible causes by considering what activities were being undertaken (including where and when) and the weather conditions at the time the nuisance occurred.
- gathering evidence and identifying and implementing strategies to remedy the problem and prevent it from happening again.
- talking with the complainant about the identified cause and the corrective and / or preventative actions taken recording all details of the complaint, the investigation, actions taken and the communication with neighbours.
- monitoring the effectiveness of the implemented strategies on an ongoing basis and adjusting if necessary

Should odour issues arise, liaison with the affected party, Hilltops Shire Council and EPA will be important in reaching a resolution.