ATTACHMENTS

Development and Infrastructure Services Committee Meeting

15 March 2023

6.00pm

City of Albany Council Chambers

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ENVIRONMENTAL ASSESSMENT & MANAGEMENT PLAN
OUTDOOR ROTATIONAL PIGGERY – BREEDER FACILITY
LOT 5856 (NO. 1028) YUNGUP ROAD, NAPIER
CITY OF ALBANY

Prepared For:	Milne Agrigroup & Sangarra Southern Pty Ltd atf Sangarra Livestock Trust 27 Roberts Road ROBINSON WA 6330
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LIST OF ABBREVIATIONS

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
APIQ✓™	Australian Pork Industry Quality Assurance Program
APL	Australian Pork Limited
ARVS	Albany Regional Vegetation Survey
ASS	Acid Sulfate Soil
CER	Consultative Environmental Review
DWER	Department of Water and Environmental Regulation
DPIRD	Department of Primary Industries and Regional Development
EPA	Environmental Protection Authority
ha	Hectare
kg	Kilogram
km	Kilometre
K_{SAT}	Co-efficient of Permeability
m	Metre
mS/cm	Millisiemen per centimetre
mg/kg	Milligram per kilogram
mg/L	Milligram per litre
L	Litre
UCL	Unallocated Crown Land
WAPC	Western Australian Planning Commission
^{o}C	Degrees Celsius

EXECUTIVE SUMMARY

This document outlines an environmental assessment and management plan (EAMP) for the operation of a breeder rotational outdoor piggery (ROP) at Lot 5856 (No. 1028) Yungup Road, Napier in the City of Albany (Figure 1). This EAMP has been prepared to demonstrate how the operation will satisfy guidelines, policies and legislation that apply to piggeries of this type.

A development application for a 1000 sow ROP was previously lodged with the City of Albany in 2021. The assessment of this application progressed to a stage of advertising, with input from neighbouring properties, stakeholders and agencies such as the Department of Water and Environmental Regulation (DWER) and Department of Primary Industries and Regional Development (DPIRD).

The 1000 sow ROP proposal received several submissions resulting in the Environmental Assessment and Management plan being updated. The response to submissions is provided in Appendix O.

The application was referred to DWER which advised that the ROP would require assessment under Part V of the *Environmental Protection Act 1986* for a Works Approval and potentially registration. The outcome the assessment process was the approval of a 700 sow ROP with a condition of obtaining the appropriate planning approval from the City of Albany.

This EAMP has been revised and is applicable to the establishment of a 700 sow ROP.

The following matters have been considered in planning for the ROP:

- West Australian statutory framework for the establishment of piggeries;
- Policy framework for the establishment of piggeries generally and outdoor rotational operations specifically;
- Land capability, buffers and sensitive receptors; and
- Process and environmental management of the proposed operation.

The ROP will operate under the National accreditation process of the Australian Pork Industry Quality Assurance Program (APIQ✓™) which sets standards for management, animal welfare, biosecurity, environmental sustainability and transport.

Property details include:

Property Details	Lot 5856 (No. 1028) Yungup Road, Napier, City of Albany. Deposited Plan 116112
Area	304.7289 hectares (ha)
Ownership	Sangarra Southern Pty Ltd atf Sangarra Livestock Trust
City of Albany Local Planning Scheme No. 1 - Zoning	The subject land is zoned 'Priority Agriculture'.

The proposal comprises the following:

Piggery Type:	Free range breeder piggery based on a rotational operation.	The piggery will be certified and operated in accordance with the APIQ✓™ Assurance Program[1]. In addition, the pigs will be compliant with RSPCA Approved Farming Scheme Standards for Pigs (RSPCA, 2018)
Total Number of Pigs:	700 sows and 69 boars. Piglets (suckers) will not be produced until six months after commencement and will be on the property for approximately six weeks prior to being sent to a different location for growing out.	700 Sow Rotational Outdoor Piggery
Rotation	This investigation identifies areas which are suitable for ROPs based on environmental criteria.	Areas have been calculated based on the densities in the *Model Code for Pigs* (2008). Each rotation area will be used for two years and used for intensive cropping (winter and summer) for four years. This assessment concludes that 126.97 ha of suitable land is available for a ROP which provides three rotations based on each rotation comprising at least 42.2 ha.

This assessment concludes that the subject land is suitable for the proposed ROP. Recommendations regarding sustainable management are made in Sections 6 and 7.

The following table summarises compliance with policies, guidelines and planning requirements:

Item	Guideline/ requirement	Comment
Environmental Protection Act 1986 ***Environmental Protection Regulations 1997***		
Category 2	Intensive piggery: premises on which pigs are fed, watered and housed in pens	Not more than 700 sows, being the equivalent herd size of 1342 standard pig units (SPU).
National Environmental Guidelines for Piggeries - Australian Pork Limited (Tucker *et al.*, 2010)		
Buffers requirements	Buffers required: • Public road carrying < 50 vehicles per day – 100 m • Public road carrying > 50 vehicles per day – 200 m • Town – 750 m • Rural residential area – 500 m	The proposed ROP meets buffer requirements. The closest dwellings external to the subject land is on Lot 71 Elliot Road which has a dwelling within 629 m of the nearest possible ROP. The distance exceeds the minimum requirement of 250 m / 300[2] m from any possible ROP unit. All other dwelling external to the property are more than 300 m from the proposed ROP area.

[1] APIQ✓™ Program Outline Australian Pork Limited, 2021: https://www.apiq.com.au/about/program-outline/

[2] A buffer 300m from rural dwellings is recommended in the Department of Agriculture *Guidelines for New and Existing Piggeries* (2000). 250m is considered adequate in Australian Pork Limited *National Guidelines for Rotational Outdoor Piggeries* (2013). In this case, the most conservative distance has been included.

Item	Guideline/ requirement	Comment
	• Rural dwelling – 250 m • Property boundary – 20 m	
Model Code of Practice for the Welfare of Animals – Pigs (Primary Industries Standing Committee, 2008) **Royal Society for the Prevention of Cruelty to Animals (RSPCA) Approved Farming Scheme Standards for Pigs**		
Density of Pigs	Model Code of Practice for the Welfare of Animals – Pigs (COP; Primary Industries Standing Committee, 2008): 20 – 25 dry sows per ha and 9 - 14 lactating sows with piglets per ha. Royal Society for the Prevention of Cruelty to Animals (RSPCA) Approved Farming Scheme Standards for Pigs – 30 adult pigs per ha.	Current calculations have used Model Code of Practice and RSPCA pig densities: Application of buffer requirements indicate that 126.9797 ha is available for the ROP. This includes setbacks from boundaries, roads, and water features, plus removal of some blue gums. There is an adequate area for three rotations for a 700 sow ROP.

Fact Sheet - Design and Management of Outdoor Free-Range Areas for Pigs – Australian Pork Limited (APL, 2011) **Site selection factors:**	**Recommendation**	
Annual rainfall less than 750 mm	730 mm per annum (Weatherzone, 2021)	The subject land meets this site selection requirement.
Mean maximum January temperature less than 28 °C	26.1 °C in January (Weatherzone, 2021)	The subject land meets this site selection requirement.
Mean minimum July temperature exceeding 3 °C	6.1 °C in July (Weatherzone, 2021)	The subject land meets this site selection requirement.
Densities: Based on Model Code densities (which are less dense than RSPCA standards)	Based on Model Code densities, a 700 sow operation will have a minimum of 30.97 ha area per ROP rotation (not including access ways).	If 126.97 ha of the site is usable for the ROP, this would allow for three rotations. For a ROP of 700 sows At least two and preferably three rotation areas are recommended for operation.
Buffer of 800 m between piggery and major water supply storage	There are no major water supply storage areas within 800 m of the subject land.	Proposed ROP meets this site selection requirement.
Buffer of 100 m between piggery and a defined water course	ROP set back at least 100 m from water courses, dams and wetlands. Cleared water gaining areas and depressions are not included as a water course or wetland.	The ROP has been designed to comply with these buffer requirements.
Buffer of 200 m to a public road carrying more than 50 vehicles per day	Yungup Road (presumably) carries more than 50 vehicles per day. A buffer for proposed ROP allows for a 200 m buffer.	Proposed ROP meets this site selection requirement.

Fact Sheet - Design and Management of Outdoor Free-Range Areas for Pigs – Australian Pork Limited (APL, 2011)		
Site selection factors:	**Recommendation**	
	Elliot Road is presumed to carry less than 50 vehicles per day. A buffer of 100 m has been applied.	The Shire of Plantagenet has outlined road upgrades that will be required on Elliot Road.
Buffer of 750 m to a town site.	There are no town sites within 750 m. The closest townsites are Narrikup in the Shire of Plantagenet and Redmond in the City of Albany which are 16 km to the northwest and southwest, respectively.	Proposed ROP meets this site selection requirement.
Buffer of 500 m to a rural residential area.	There are no rural residential areas within 500 m.	Proposed ROP meets this site selection requirement.
Buffer of 250 m to external rural dwelling	The closest dwelling external to the subject land is Lot 71 Elliot Road which has a dwelling within 629 m of the nearest proposed ROP area. The distance exceeds the minimum requirement of 250 m/ 300 m from any possible ROP unit.	No dwellings are within 250 m/ 300 m of the proposed ROP.
Buffer of 20m from a property boundary	All proposed ROP units are at least 20 m from the property boundary.	The ROP complies with this buffer requirements.
Sensitive Agricultural Sites Department of Primary Industries and Regional Development (DPIRD)	Sensitive sites do not preclude other agricultural land uses but highlight the need to consider sensitive agricultural pursuits.	No DPIRD registered sensitive agricultural sites are within 1 km of proposed development. The closest is 10 km to the southwest on Redmond Hay River Road (viticulture; DPIRD, 2021).
Soils: Well drained soils with sufficient capacity to retain nutrients	The ROP sites will ideally be placed in well drained loams with a high Phosphorus Buffering Index (PBI) (e.g. gravelly sands and sandy soils with a cay content at depth).	The subject land meets the drainage site selection requirement. Adsorption of phosphorus will be moderate to extremely low, rather than high. However, drainage management, cropping between rotations and the implementation of buffer zones to waterways will minimise the risk of nutrient export. The regional groundwater is at approximately 80 mAHD which is at least 10 m below the ground surface across the site.
Slopes: Gently sloping land	The site is gently sloping to allow for drainage but not so steep that erosion is likely to occur.	The three rotational areas meet this requirement.
DPIRD (Department of Agriculture and Food, 2000) Environmental Guidelines for New and Existing Piggeries Bulletin 4416		
Buffers	• Townsite boundaries – 1000 m • Special rural areas – 1000 m • Isolated rural dwellings – 300 m • Public roads – 50 m • Neighbouring rural property boundaries – 50 m	The ROP has been designed to comply with these buffer requirements. Rather than a 50 m buffer to neighbouring rural property boundaries a 20 m buffer has been applied, consistent with National Environmental Guidelines for Piggeries -

Fact Sheet - Design and Management of Outdoor Free-Range Areas for Pigs – Australian Pork Limited (APL, 2011)		
Site selection factors:	**Recommendation**	
	• Public Drinking Water Source Area – not permitted • Major water course – 100 m • Minor water course – 50 m • Bores, wells, soaks for private drinking water supply and or stock irrigation water supply – 300 m	Australian Pork Limited (Tucker *et al.*, 2010).
	Water requirements: • Summer: 15 L per dry sow per day to 80 L per lactating sow per day. • Winter: 15 L per weaner per day to 58 L per lactating sow per day. • Water for wallows is also required. • Water quality: short term upper level salinity of 4,500 mg/L of total dissolved solids or 3000 mg/L for long term use.	Not including wallows, approximately 4.81 ML of good quality water will be needed as drinking water per annum. The landowner has advised that water requirements have been considered and that there are adequate resources for the ROP. Water quality is adequate for pigs.
	• Drainage: well drained, level or gently sloping • Slope: Between 1:20 and 1:200 to prevent erosion (if steep) and ponding (if flat). • Groundwater: Maximum 1.5 m below ground level (throughout the year). • Soil Phosphorus Retention Index greater than 10.	The subject land is relatively flat with gentle slopes, with a fall of 10 m over its entirety. Water gaining areas will be avoided to reduce land degradation and nutrient export. Drainage design and management will be key to the successful operation of the ROP. Due to the duplex soils, depth to groundwater exceeds 1.5 m below ground surface. Regional groundwater levels are around 80 mAHD (Smith, 1992) and as determined on site (existing bores). The subject land meets this site selection requirement, with well drained soils although adsorption of phosphorus is likely to be low to moderate rather than high for some areas.
Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses No. 3 June 2005 (Environmental Protection Authority, EPA 2005)		
Buffers	Extensive Piggery – premises on which pigs are fed, watered, and housed in outside paddocks or enclosures – 1000 m	There are no EPA[3] defined sensitive sites within 1 km of proposed ROP.

[3] Noting that in the case of free-range piggeries, a separation of 1000 m to single rural residences is not required – 250 – 300 m separation are the guideline recommendations.

1 INTRODUCTION

Sangarra Southern Pty Ltd as trust for Sangarra Livestock Trust is applying for a planning approval from the City of Albany to establish a breeder rotational outdoor piggery (ROP) at Lot 5856 (No. 1028) Yungup Road, in Napier (Figure).

The proponent has been granted a Works Approval from DWER under Part V of the *Environmental Protection Act 1986* (EP Act) for an operation of 700 sows, pending meeting approval conditions. The Works Approval is subject to obtaining a Planning Consent for the ROP from the City of Albany.

The subject land comprises 304.7289 hectares (ha) and is currently used for broad acre farming including grazing and blue gum plantings. The piggery operation is proposed to complement the existing operations, with the ROP area intended to rotate over some of the current grazing and blue gum plantation areas.

The proposed ROP is a free-range system, not a shedded operation. Shedded operations are more intensive than ROPs, with significant implications for noise, odour and effluent disposal. In free range piggeries, pigs are not closely confined and have access to outdoor areas compared to shedded piggeries where pigs are confined to small stalls or pens in sheds. Outdoor operations offer a higher ability to assimilate nutrients and reduce noise and odour risks.

1.1 PROPERTY AND APPLICANT DETAILS

Property and applicant details are summarised in Table 1.

TABLE 1: PROPERTY AND APPLICANT DETAILS

Property Details	Lot 5856 (No. 1028) Yungup Road, in Napier, City of Albany. Deposited Plan 116112
Area	304.7289 hectares (ha)
Ownership	Sangarra Southern Pty Ltd atf Sangarra Livestock Trust
City of Albany Local Planning Scheme No. 1 - Zoning	The subject land is zoned 'Priority Agriculture'.

1.2 SCOPE OF WORKS

This assessment considers the existing environment of the subject land and requirements for ROPs according to national standards and environmental guidelines, state policies and codes of practice. The document also considers DWERs requirements for a Works Approval and responds to previous advice from DWER and DPIRD for a 1000 sow ROP. City of Albany planning instruments are also considered.

Information gathered during desktop and field surveys in relation to the subject land is considered in the potential impacts of the ROP. This EAMP outlines management strategies to ensure sustainable operation of the piggery.

Preparation of this document has included:

- A desktop review of existing information;
- Site inspection;
- Liaison with government agencies such as CoA, DWER, DPIRD and agronomists.
- Soil assessment and testing; and
- Consideration of applicable standards, guidelines and policies.

2 POLICIES AND PLANNING FRAMEWORK

The following standards, guidelines and policies apply to the operation and management of the ROP.

2.1 NATIONAL GUIDELINES

2.1.1 National Environmental Guidelines for Rotational Outdoor Piggeries

The *National Environmental Guidelines for Rotational Outdoor Piggeries* (Tucker and O'Keefe, 2013) provides guidance with respect to the siting, buffers and operation of piggeries which are free range and operated on a rotational basis. This document provides a useful guide in the form of a planning principles checklist that is applicable to this development. The structure of this EAMP is based on the *National Environmental Guidelines for Piggeries Planning Principles*. A copy of the Planning Principles checklist is included in Appendix A.

2.1.2 APIQ✓™ Standards Manual for Rotational Outdoor Piggeries

Australian Pork Limited (APL) has worked with key stakeholders to develop a *Standards Manual for Rotational Piggeries* (2012), referred to as the *Australian Pork Industry Quality Assurance Program* (APIQ✓™). The program aims to put into place documented procedures and methodologies to carry out key tasks to ensure that high quality pig products can be produced consistently and impacts on the environment and surrounding amenity are reduced and sustainably managed. A number of sections of the APIQ✓™ relate to planning principles which are considered in this EAMP, including (see Appendix B):

- Site selection;
- Environmental impact assessment;
- Proposed environmental management;
- Free range production requirements (including soil monitoring);
- Nutrient management;
- Land and water protection strategies; and
- Other requirements.

This ROP will be registered and operated in accordance with the APIQ✓™ framework.

2.1.3 Fact Sheet, Design and Management of Outdoor Free-Range Areas for Pigs

APL (2011) has produced a fact sheet that summarises the desired site selection characteristics, buffer distances and nutrient management actions specifically for outdoor free-range piggeries. The fact sheet provides a reference for the assessment of the suitability of the site for the development of a free-range piggery, and independent verification of the proposed management practices. A copy of the fact sheet is included in Appendix C.

2.1.4 Piggery Manure and Effluent Management and Reuse Guidelines

The *Piggery Manure and Effluent Management and Reuse Guidelines* (Tucker, 2015) was developed by APL to provide best practice guidelines for the treatment and management of piggery outputs using methodologies such as composting. Outputs such as spent bedding and manure are valuable resources that can help to generate a viable income stream for piggery operators. Sustainable practices are required to ensure that management of these products does not cause nutrient overloading or result in nutrient export to waterways.

2.1.5 Model Code of Practice for the Welfare of Animals – Pigs (Revised)

The Model Code of Practice for the Welfare of Animals – Pigs (Revised) was prepared by the Animal Welfare Working Group (AWWG) within the Primary Industries Ministerial Council (PIMC) committee system in 2007. The document guides the care and management of pigs so that the basic needs of food, water, space, socialisation, accommodation/shelter and health care are of an adequate standard.

2.2 WESTERN AUSTRALIAN STATUTORY FRAMEWORK, POLICIES AND GUIDELINES

2.2.1 Statutory Framework

Until recently, ROPs did not trigger consideration as a prescribed activity under the *Environmental Protection Act 1986* (EP Act) and therefore did not require a works approval, registration or licencing from DWER. However, DWER now considers that outdoor piggeries are 'intensive' and therefore need to be assessed to determine if licensing or registration is required.

2.2.2 Environmental Protection Authority Guidelines

The EPA uses *Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses No. 3* (EPA, 2005). The guidance statement is intended to provide advice on generic separation distances between specific industry and sensitive land uses to avoid or minimise the potential for land use conflict. The distances outlined are not intended to be absolute separation distances, rather they are a default distance for the purposes of:

- Identifying the need for specific separation distance or buffer definition studies; and
- Providing general guidance on separation distances in the absence of site-specific technical studies.

The separation distances in EPA *Guidance Statement No. 3* (EPA, 2005) are intended to be used as a tool, supplemented by other appropriate techniques, to assist in the assessment of:

- New individual industries, infrastructure and estates, in the vicinity of existing/proposed sensitive land uses; and
- New individual sensitive land uses or estates, in the vicinity of existing/proposed industry and infrastructure.

The Guidance states that extensive piggery (premises on which pigs are fed, watered and housed in outside paddocks or enclosures) may need a 1000 m buffer to sensitive land uses (Table 2). Land uses considered by the guidelines to be potentially sensitive to emissions from industry and infrastructure include residential developments, hospitals, hotels, motels, hostels, caravan parks, schools, nursing

homes, child-care facilities, shopping centres, playgrounds, and some public buildings. Some commercial, institutional and industrial land uses which require high levels of amenity or are sensitive to particular emissions may also be considered "sensitive land uses". Examples include some retail outlets, offices and training centres, and some types of storage and manufacturing facilities.

Single rural dwellings are generally not considered to be a sensitive receptor requiring a 1000 m buffer. The EPA Guidance statement refers to Department of Primary Industry and Regional Development (DPIRD) *Guidelines for New and Existing Piggeries* (Latto *et al.* 2000; Table 2 Page 10) which state that a buffer to isolated rural dwellings should be 300 m.

The *National Environmental Guidelines for Rotational Outdoor Piggeries* (Tucker and O'Keefe, 2013) recommends a 250 m buffer to rural residences. This is based on extensive research and experience and has been adopted in New South Wales, Victoria and Queensland. Additional research has been undertaken by the University of Queensland in support of the ROP Guidelines (Banhazi, 2013) for noise, dust and odour.

TABLE 2: EPA GUIDANCE STATEMENT NO. 3 FOR EXTENSIVE PIGGERIES

Industry	Description	DWER Licence or Works Approval Required?	Key Government Agency for Advice	Code of Practice	Impacts	Buffer Distance to defined sensitive land uses
Piggery - Extensive	Premises on which pigs are fed, watered, and housed in outside paddocks or enclosures	Not required	DPIRD, DWER, Local Government Authority	DPIRD Guidelines (Latto *et al.*, 2000)	Dust and odour	1000 m (Guidance defers to DPIRD buffer for isolated rural dwellings of 300m)

2.2.3 Statement of Planning Policy No 2.5 –Rural Planning

The objectives of *State Planning Policy 2.5 Rural Planning* (SPP 2.5; Western Australian Planning Commission (WAPC), 2016) are to protect rural land from incompatible land uses by making land use decisions to support existing and future primary production and protection of priority agricultural land, particularly for the production of food. The policy supports regional development of rural enterprises, seeks to protect and improve environmental and landscape assets and minimise land use conflicts. The policy guides the preparation of planning schemes and other planning decisions.

2.2.4 Department of Primary Industries and Regional Development Western Australia – 'Sensitive Sites'

Sensitive Sites Western Australia is a DPIRD service designed to help identify the location of sensitive agricultural production systems within the agricultural region of WA. This service aims to assist growers in preparing risk assessment and risk mitigation plans for their ongoing production activities

and help protect sensitive agricultural production systems. There are no DPIRD listed 'sensitive sites' within 5 km of the proposed ROP (DPIRD, 2018).

2.3 LOCAL GOVERNMENT AUTHORITY

The City of Albany Local Planning Scheme (LPS) No. 1 defines extensive piggeries as a 'Animal Husbandry - Intensive'. This type of land use is discretionary in 'Priority Agriculture' zones and subject to planning scheme consent by the City of Albany, subject to meeting the requirements of environmental guidelines and other applicable standards. Development for such a purpose requires approval by Council to ensure that siting, operations, and management objectives can be met. Council considers each application based on its merits and likely impacts, to ensure that relevant factors are taken into consideration.

2.4 RESEARCH REGARDING ODOUR, DUST AND NOISE

Studies undertaken by the University of Southern Queensland and National Centre for Engineering in Agriculture (Banhazi, 2013) for representative free-range piggeries suggest that odour, dust and noise related to operations are not likely to be significant issues if National Environmental guidelines are adhered to. Key findings of the 2013 study were:

Odour: The measured odour emission rates were not significantly different between farms (p=0.29) and compared to mean odour emissions measured from beef feedlot pens, the emission rates measured in this study were very low. Therefore, odour reduction strategies other than standard management of manure and bedding are not required.

Dust: Very low dust concentrations were measured on all farms. Most peak dust concentrations were associated with tractor/machinery movements. The high peak concentrations lasted only for a short period of time and the dust settled quickly after these events. It is likely that the low dust concentrations helped maintain low odour concentrations on farms as well. These results would be strongly linked to soil type.

Noise: Very low noise levels were detected on all farms and the results demonstrated that free-range piggeries are quieter places than traditional piggery buildings. Casual observations indicated that many of the noise peaks were related to machinery noise, bird and insect activity. Wind and rain also contributed to general noise levels. Very few vocalisations by pigs were observed during data recording. It was concluded that free-range piggeries would contribute very little to the noise pollution levels of neighbouring areas.

2.5 ENVIRONMENTAL PRACTICE

The Proponent is committed to protecting the environment by reducing the environmental risks of operations. Therefore, the operators and owners voluntarily commit to the following:

1. Sustainable development – Integrate environmental management into planning and decision-making processes, to ensure sustainability and minimal impact on the environment.
2. Pollution prevention – Conduct operations in a manner that prevents pollution, conserves resources, and proactively addresses past environmental contamination (where this is applicable).

3. Legal compliance – Ensure that operations comply with applicable environmental guidelines, regulations, and requirements.
4. Employee involvement – Ensure environmentally responsible stewardship by employees through recycling, conserving resources, reducing waste, and eliminating environmental risks in business operations.
5. Continual improvement – Regularly measure performance and practice continual improvement.
6. Training – Staff will be adequately trained in environmental management.

3 THE PROPOSAL

Table 3 summarises the proposal, which is to establish a breeder ROP where pigs are bred and piglets removed at weaning for grow-out elsewhere. The proposal is for a 700 sow ROP. Notionally, a 700 sow ROP would comprise the number and type of pigs outlined in Table 3, at any one time. A total of approximately 12,303 weaner pigs is likely to be exported from the property each year. The piggery will be certified and operated in accordance with the APIQ✓™ Assurance Program and to RSPCA Standards.

TABLE 3: THE PROPOSAL

Piggery Type:	Free range breeder piggery based on a rotational operation.	The piggery will be certified and operated in accordance with the APIQ✓™ Assurance Program[4]. In addition, the pigs will be compliant with RSPCA Approved Farming Scheme Standards for Pigs (RSPCA, 2018).
Total number of pigs:	700 sows, 69 boars and 1121 suckers at any one time.	700 sows - Piglets are not due to be born until six months after the commencement of operations. The first litters of piglets will comprise 1,121 suckers, which only remain on the property for six weeks before being moved to a grow-out facility. There will be an output of approximately 12,300 weaner pigs per year.
Rotation	This investigation identifies areas which are suitable for ROPs based on environmental criteria.	Areas have been calculated based on the densities in the *Model Code for Pigs* (2008). Each rotation area will be used for two years and used for intensive cropping for four years.

[4] APIQ✓™ Program Outline Australian Pork Limited, 2021: https://www.apiq.com.au/about/program-outline/

4 SITE DESCRIPTION

4.1 LOCATION AND CURRENT LAND USE

The subject land is situated in the locality of Napier (Figure and 2), approximately 6.8 km west of Napier Hall on Chester Pass Road and 16 km east of Redmond and Narrikup townsites. The subject land comprises 304.7289 ha and is zoned 'Priority Agricultural' under the City of Albany LPS No. 1 (Appendix D) and is currently used for grazing and blue gum plantings.

The main access to the proposed ROP area for traffic will be via Settlement Road (bitumen) and Elliot Road (gravel).

The subject land is located in a prime farming area comprising lots between 46 ha and 346 ha, which are largely used for grazing, cereal cropping, blue gum plantations and mixed horticulture.

4.2 SURROUNDING LAND USES AND SENSITIVE RECEPTORS

The property abuts the boundary to the Shire of Plantagenet (immediately to the north and west). Surrounding land is zoned for the following uses (Appendix D):

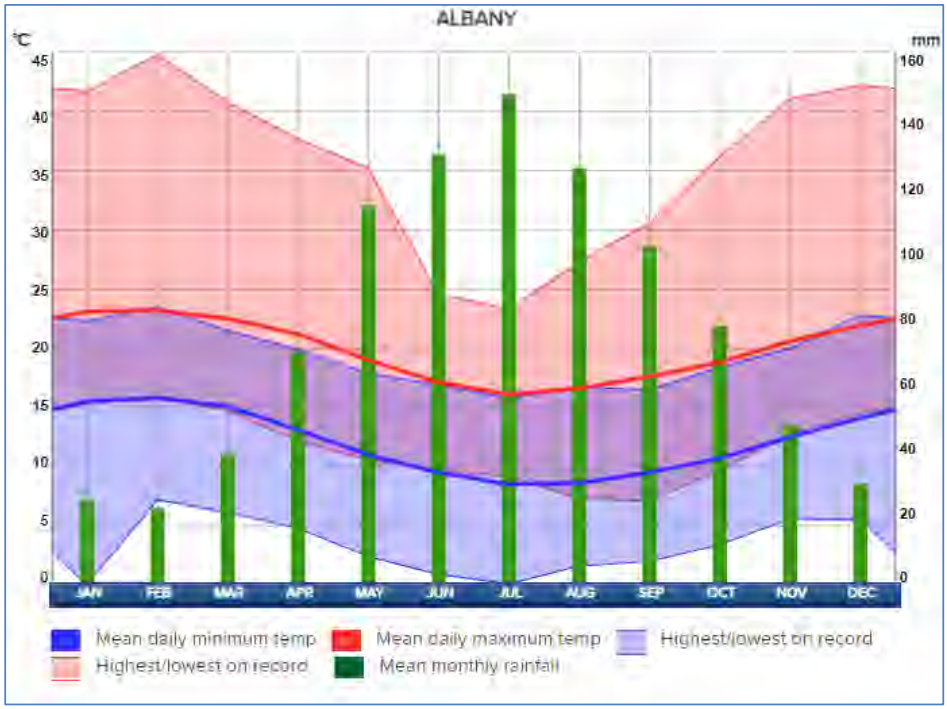
- 'Priority Agriculture' to the east and south (City of Albany Local Planning Scheme No. 1);
- 'Rural' for land to the north and west (Shire of Plantagenet Local Planning Scheme No. 5);
- 'Parks and Recreation' Millbrook Nature Reserve 2 km to the south; and
- Fletcher's Abattoir is 5 km to the west on Settlement Road.

4.3 CLIMATE

Napier has a Mediterranean climate with generally hot summers and cool, wet winters. Proximity to the south coast means that the progression of winds from east through north, west, south and returning to east over periods of several days to a week or more during summer can bring a large variation in weather from fine and mild to hot with thundery showers, to cool and cloudy with drizzle. When the ridge moves north in the cooler months, the moisture-laden westerly winds south of the ridge deliver much of the area's annual rainfall. Atmospheric disturbances embedded in the westerly winds are common in the winter months with sometimes several cold fronts passing through southwest Western Australia in a week.

Climate is summarised in Plate 1 and discussed below. The climate in the region is conducive to the establishment of a ROP as extremes of heat and cold are generally not experienced.

PLATE 1: CLIMATE



Source: Weatherzone, 2021. https://www.weatherzone.com.au/climate/station.jsp?lt=site&lc=9581

Rainfall

The closest rainfall measurement station to the subject land is Kalgan River (Bureau of Meteorology (BOM) Site Number 9559; Plate 1). The Kalgan River's long-term median annual rainfall is 730 mm per annum, although there can be considerable variation in the total rainfall from year to year (BOM, 2021). On average, approximately 50% of the annual rainfall occurs between May and September. Although cold fronts are responsible for much of the recorded rainfall total, a moist onshore flow can occur in any season and bring showers or drizzle. July is the wettest month, with a long-term average of over 107 mm. The driest month is February with a mean of 24.2 mm. Like other parts of south-west WA, winter rainfall has decreased in the region during the latter half of the twentieth century due to natural variability and climate change.

Rainfall levels in the area are conducive for the establishment of a ROP as consistent rain prevents the ROP from becoming too dry. In addition, the proposed ROP area is not too wet, which could contribute to other management issues.

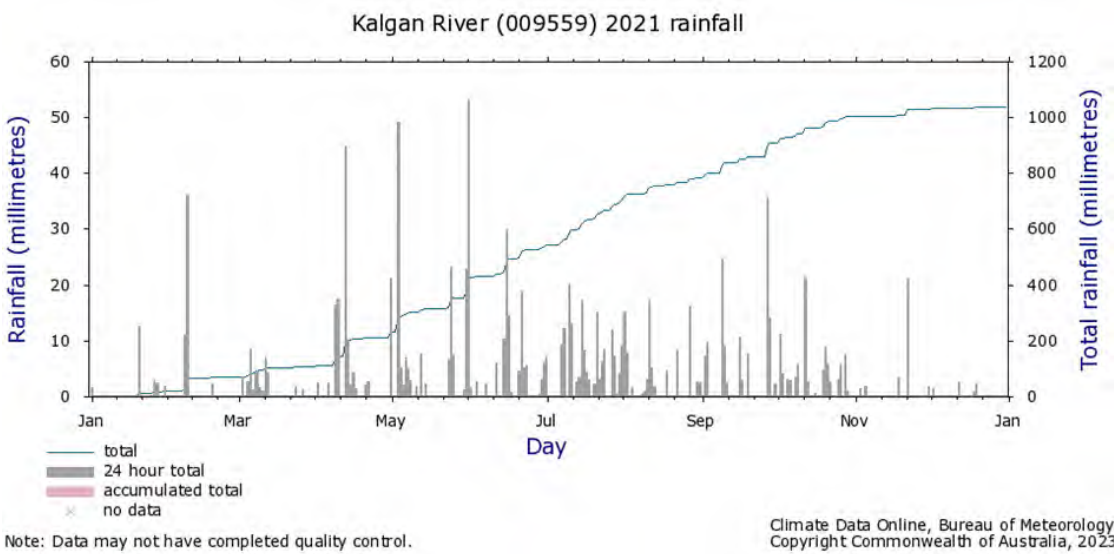
Site selection for outdoor pork production systems (APL, 2011) identifies that an annual rainfall of less than 750 mm per annum is desirable. The proposed site meets this climate requirement with its annual average of 730 mm.

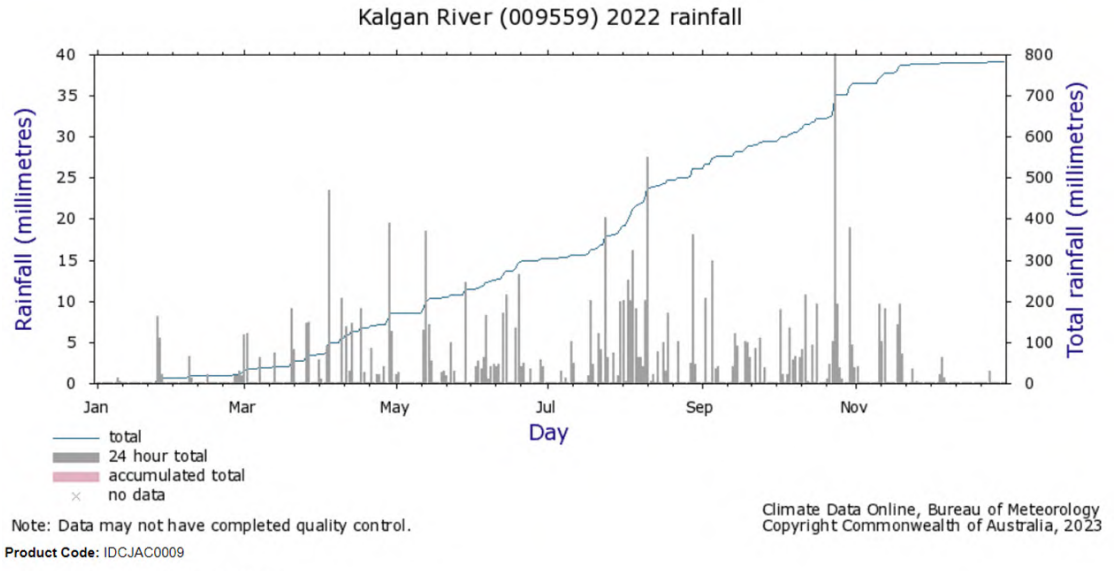
Cumulative rainfall for Kalgan River was used to determine year to date data for 2021[5], which was approximately 790 mm to the end of August 2021 (Plate 2). Significantly higher rainfall was

[5] Data was incomplete for Mount Barker.

experienced in 2021. This indicates that groundwater levels assessed during the site evaluation (11 October 2021) are likely to represent maximum winter levels. The monthly rainfall statistics for 2021 and 2022 are provided in Plate 3.

PLATE 2: CUMULATIVE RAINFALL (2021 AND 2022)





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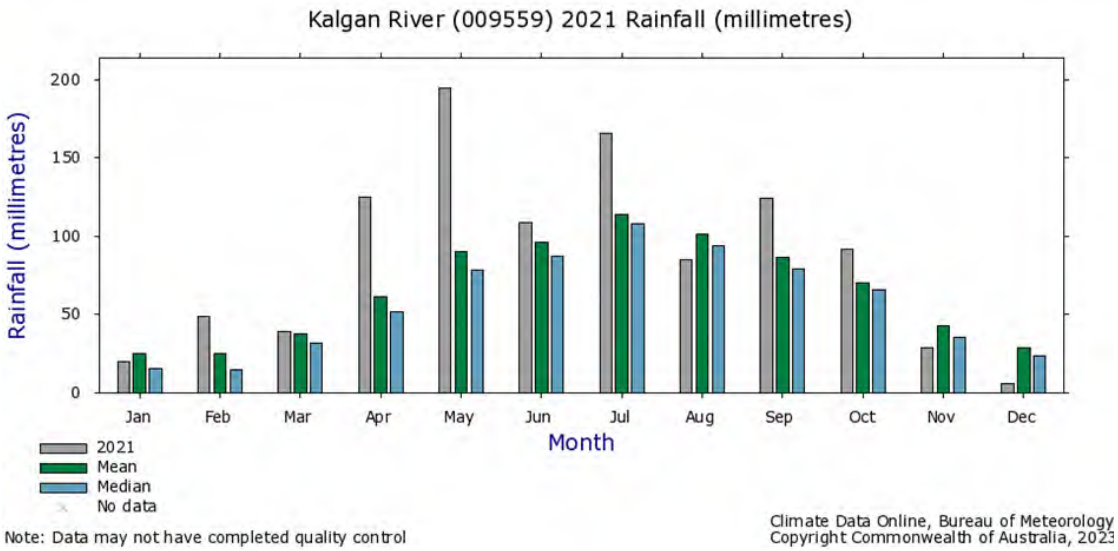
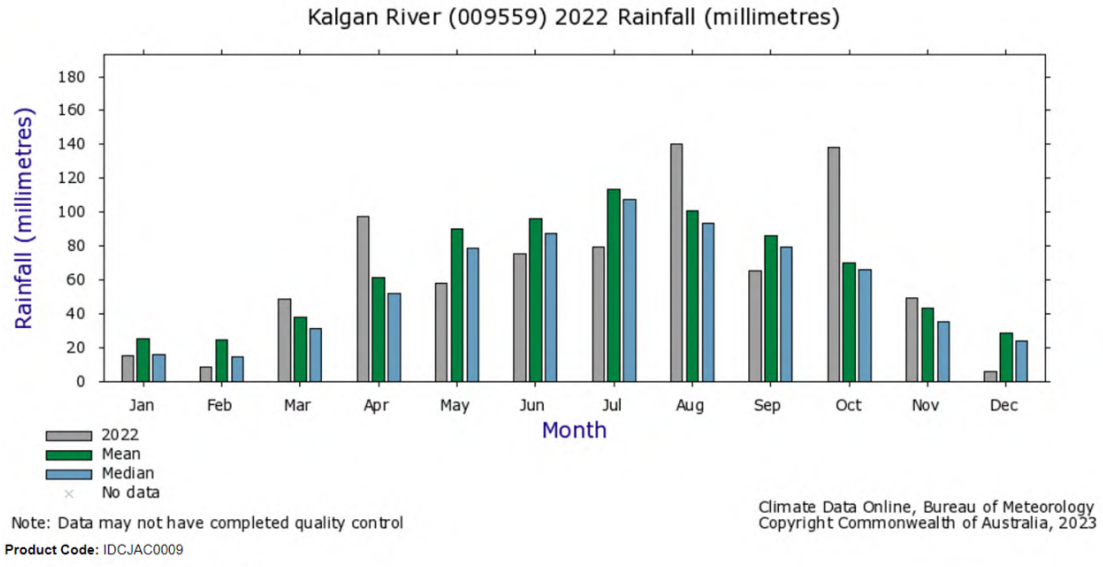
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataDGraph&p_stn_num=009559&p_nccObsCode=136&p_month=13&p_startYear=2021

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataDGraph&p_stn_num=009559&p_nccObsCode=136&p_month=13&p_startYear=2022

PLATE 3: MONTHLY RAINFALL (2021 AND 2022)





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http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataSGraph&p_stn_num=009559&p_nccObsCode=136&p_month=13&p_startYear=2021

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dataSGraph&p_stn_num=009559&p_nccObsCode=136&p_month=13&p_startYear=2022

Temperature

The closest temperature measurement station (with complete data) to the subject land is Albany Airport (BOM site number 9581; Plate 1) which is located approximately 13 km southwest of the subject land. Average maximum temperatures peak in January and February, with monthly means of 26 °C although considerably hotter maximum temperatures (above 35 °C) often occur when hot, dry

northerly winds blow from inland. Overnight average minima peak in February at 13 °C, with frosty conditions sometimes experienced during the winter months (e.g. July 6 °C). Winter daily maximum temperatures drop to around 14 °C in July (Plate 1). Temperatures in the area are conducive to the establishment of a ROP as extremes are generally not experienced or do not occur for extended periods of time.

Site selection for outdoor pork production systems (Australian Pork Limited, 2011) identifies that a mean maximum January temperature of less than 28 °C and a mean minimum July temperature exceeding 3 °C is desirable. The proposed site meets these climate requirements with a mean maximum January temperature of 27 °C and a mean minimum July temperature of 6 °C.

Prevailing Winds

Wind speed and direction can be significant factors in the dispersal and transmission of odours from intensive rural industries. However, odours are usually associated with intensive operations such as indoor/shedded piggeries and poultry farms. Experience and research around Australia have shown that the extensive nature of ROPs means they are not likely to cause odour issues, when adequate buffers to sensitive environments are in place (Banhazi, 2013). In the unlikely event that the ROP activities generate odours, an analysis of wind speed and direction factors has been undertaken as follows.

The nearest weather station to the subject land that records wind direction and speed data is the Albany Airport, which is 13 km to the southwest of the subject land. It is considered that the conditions experienced at the Airport reflect those at the site, although the sea breeze influence may be less pronounced.

The Albany Airport experiences a varied wind climate with a bias toward an easterly wind component in summer and a westerly component in winter. On average, the windiest part of the day during winter is the morning and in summer is the afternoon. Spring and summer afternoon sea breezes are regularly experienced from the southwest through to the east. However, sea breezes from the southeast or east are most common. Summer sea breezes are frequently quite fresh and sometimes reach 25 knots (46 km/h) or more. Late autumn, winter and early spring see regular northwesterly morning winds due to a combination of the sub-tropical ridge being located to the north, with a high centre over the continent, and a land-breeze effect. Cold fronts with winter westerly winds regularly occur during this period and may bring strong to gale force winds.

The wind data for different times of the day, based on the Albany Airport weather information from the Western Australia Bureau of Meteorology, is described below (Table 4) and shown in Appendix E.

TABLE 4: PREVAILING WIND DIRECTIONS DURING DAYTIME FOR THE ALBANY AIRPORT

SEASON	PREVAILING WIND		DETAILS
	9am (% of time)	3pm (% of time)	
Summer (January)	Easterly (24%)	South-easterly (31%)	In Summer mornings, calm conditions occur 6% of the time and the wind blows in an easterly direction 24% of the time (2% at 1-10 km/h, 7% at 10-20 km/h). Wind blows from the southeast 13% of the time (2% at 1-10 km/h, 4.5% at 10-20 km/h). Southerly winds blow 12% of the time (2% at 0-10 km/h and 6.3% at 10-20 km/h). South westerly winds blow 14% of the time (3% at 1-10 km/h and 5% at 10-20 km/h). The most prevalent wind in the afternoon (blowing 31% of the time) is from the southeast (3% at 10-20 km/h and 17% at 20-30 km/h. Winds from the south occur 22% of the time (7.5% at 10-20 km/h and 11% at 20-30 km/h). Southwest winds occur 22% of the time (3% of 10-20 km/h and 12.5% of 20-30 km/h). There are rarely calm conditions at this time of the day in Summer.
Autumn (April)	North-westerly (20%)	South-westerly (15%) to South-easterly (19%)	In Autumn, mornings are calm for 17% of the time. Wind is most prevalent from the northwest at 20% of the time (5% at 0-10 km/h and 8% at 10-20 km/h). Winds from the southwest (4.5%), south (5%) and southeast (4%) are relatively infrequent. Autumn afternoons are calm for 4% of the time, with the most prevalent wind direction being south easterly 19% (2% at 0-10km/h and 7.5% at 10-20 km/hr). Winds from the south occur 15% of the time (2% at 0-10km/h and 9% at 10-20 km/h.
Winter (July)	North-westerly (37%)	Westerly (27%) to North-westerly (24%)	Winter mornings are calm for 13% of the time. The most prevalent wind is from the northwest for 37% and north for 23% of the time. Winds from the southwest (6%), south (2.5%) and southeast (1%) occur relatively infrequently. Winter afternoons have calm conditions 5% of the time with predominant winds coming from a westerly (27%) and north westerly (24%) direction. Winds from the southwest occur 18% (2% 0-10 km/h and 3% 10-20 km/h). Winds from the south (5%) and southeast (3%) occur infrequently.
Spring (October)	Westerly (22%)	South-west (25%), West (18%) to South-easterly (15%)	Spring mornings are calm for 8% of the time. The most prevalent winds are from the west (22%). Winds from the southwest occur 12% of the time (1.5% 0-10 km/h and 4% 10-20km/h). Winds from the south and southeast occur less commonly (7%). Spring afternoons are calm 1% of the time. The most prevalent winds are from the southwest 22% of the time (0.9% at 0-10 km/h and 9% at 10-20 km/h). Winds from the west and the south occur 18% of the time (2% at 0-10 km/h and 10% at 10-2 0km/h). Winds from the southeast occur 15.5% of the time (1% at 0-10 km/h and 4% at 10-20 km/h).

Source: Bureau of Meteorology, 2008. Percentages based on the number of days that wind direction was recorded over the total number of observation days at the Albany Bureau of Meteorology Station between 1965 and 2004.

Should odours be generated by the ROP, they would be unlikely to impact surrounding residences due to the appropriate buffer distances that are in place at the site and as winds from the southeast, south and southwest sectors are typically strong, blowing more than 20 km/h. High velocity winds would have the effect of dissipating any odours through mixing within the air stream. Light winds from the south-west, south and south-east, which would have a greater capacity to transport odours offsite, occur less than 5 % of the time in autumn and spring and less than 10 % of the time in summer. As a result, there is a low risk of odour from the ROP impacting on surrounding residences.

4.4 TOPOGRAPHY AND SLOPES

National Environmental Guidelines for Piggeries (APL, 2010) state that optimal slopes for ROP areas are between 2 - 6% (1 in 50 to 1 in 16 and 1.1° to 3.4°). These slopes assist in optimising drainage without promoting erosion. Ideal slopes depend on soil type, land use, vegetative cover, rainfall intensity, agronomic practices and soil conservation methods.

The subject land comprises a gently undulating plateau which slope into a valley containing Napier Creek, with slopes from a high of 100 mAHD in the north-eastern corner, down to the southwestern portion of the subject land with a low point of approximately 80 mAHD.

The proposed ROP rotational areas are located on the most elevated portions of the subject land between elevations of 90 mAHD and 100 mAHD (approximately 1:70 slope). This slope equates to a 1.5% grade. Recommended slope grades for ROPs are usually between 2% and 6%. As the surface layer of the soil is free draining, the slightly shallower slope is not expected to have negative environmental impacts, such as ponding of water. Seasonal management is likely to be required to place enclosures outside of areas with depressions where water may pond after rainfall.

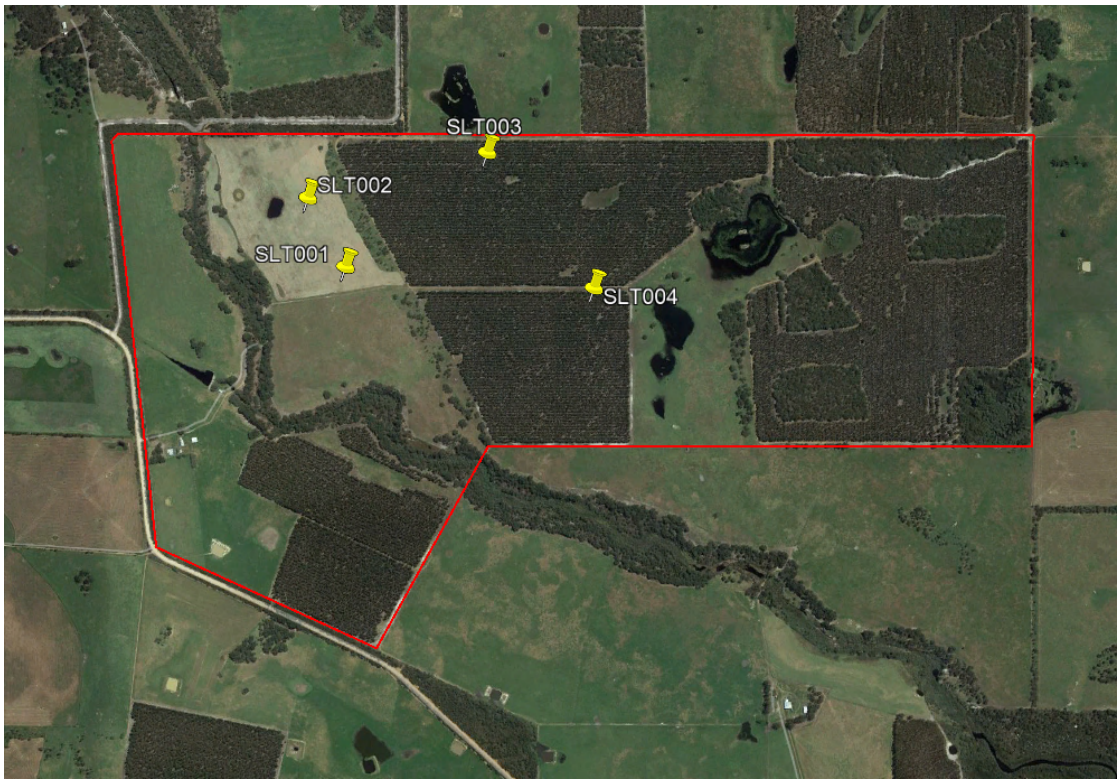
4.5 SITE AND SOIL EVALUATION

During site investigations by Aurora Environmental on 23 September 2021 and 11 October 2021, the following activities were undertaken at sample sites SLT001 – SLT004 (Plate 4):

- Photographs were taken to indicate the ROP areas (Appendix F).
- Excavation of four test pits to determine soil profile characteristics. Results are described in Section 4.6.
- Assessment of groundwater levels.
- Collection of eight soil samples at four sites (samples from near soil surface and subsurface) to test for phosphorus buffering index (PBI). Results are described in Section 4.6.2 with laboratory results in Appendix G.
- Permeability testing at four sites with results described in Section 4.6.3 and Appendix M

After approval, soil testing will be undertaken to determine the baseline levels of nutrients, in line with APIQ✓™ accreditation requirements. The baseline information will be used as a guide to compare nutrient levels after a rotation of the piggery.

PLATE 4: SOIL INVESTIGATION LOCATIONS



4.6 LANDFORM AND SOILS

Landform, soils and vegetation types found on the subject land are listed in Table 5 and shown in Plate 5. Of the two major soil types which occur on the subject land, the soil units which are associated with the ROP rotations comprises:

- 242ReRD: Redmond Subsystem - Broadly undulating plateau; scattered lakes and depressions. Yellow duplex soils and laterite on plains. Marri-Jarrah, - Albany Blackbutt forest. Yellow solonetzic soils in depressions; Paperbark woodland.

PLATE 5: SOIL TYPES

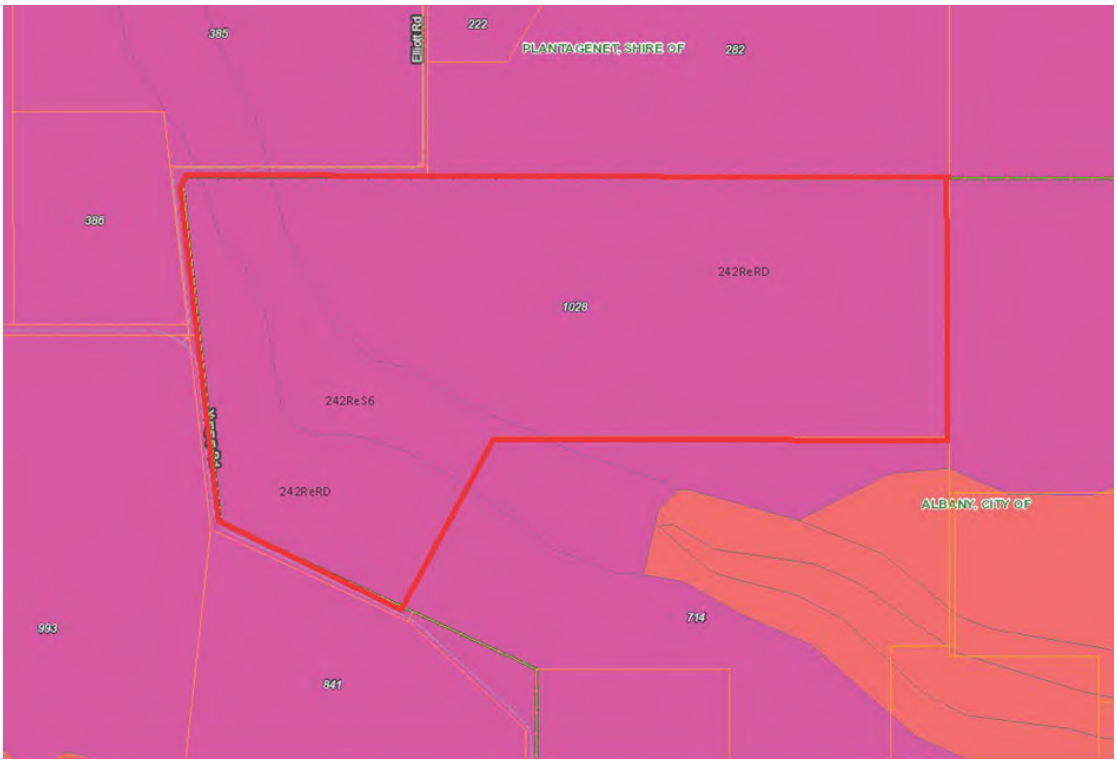


TABLE 5: SOIL UNITS AND LANDFORM

SOIL UNIT	SUMMARY DESCRIPTION	LOCATION AND SUITABILITY
242ReRD	Redmond Subsystem - Broadly undulating plateau; scattered lakes and depressions. Yellow duplex soils and laterite on plains. Yellow solonetzic soils in depressions.	Occurs where ROP compartments are proposed. Considered suitable for ROP.
242ReS6	Minor Valleys 6 Subsystem - Narrow V-shaped valleys, in sedimentary rocks; <10 m relief. Sandy yellow duplex soils on slopes. Deep sands on narrow swampy floor.	Associated with Napier Creek and valley floor. Not suitable for ROP

Source: Landgate, 2021 DPIRD-027

The soil profile varies over the mapped soil type with the profiles described in Table 6.

TABLE 6: SOIL PROFILES BY SAMPLE LOCATION

SAMPLING LOCATION	PROFILE
SLT001	• 0 – 0.2 m: Dark brown, grey gravelly sand • 0.2 – 0.75 m: Sandy yellow clay, becoming dense and stiff at 0.75 m (refusal).
SLT002	• 0 – 0.15 m: Dark brown/grey clayey sand with organic matter • 0.1 – 0.3 m: gravelly clayey sand with refusal at 0.4 m due to gravel.
SLT003	• 0 – 0.1 m: Grey fine sand with organic matter • 0.1 – 0.3 m: Grey to yellow fine sand with small gravel • 0.3 – 1.0 m: Sandy gravel becoming increasingly yellow. Refusal due to gravel at 1 m.
SLT004	• 0 – 0.1 m: Grey fine sand with organic matter • 0.1 – 0.3 m: Grey to yellow fine sand with small gravel • 0.3 – 1.0 m: Sandy clayey gravel. Refusal due to gravel at 1 m.

Phosphorus Buffering Index (PBI)

Phosphorus Buffering Index (PBI) provides an indication of the ability of the soil to absorb phosphorus (BCG, 2014). The classifications for PBI are shown in Table 7.

TABLE 7: PHOPHORUS BUFFERING INDEX CATEGORIES AND CLASSIFICATIONS

CLASSIFICATION	PHOSHORUS BUFFER CAPACITY
Extremely low	<15
Very very low	15-35
Very low	36-70
Low	71-140
Moderate	141-280
High	281-840
Very high	>840

Source: Summit,2021

Soil samples were taken from ground surface (0 – 10 cm) and subsurface (5 to 0.8 mBGL) on 12 October 2021 (See Appendix G) and tested for PBI. PBI results are described in Table 8. Results varied between topsoil (0.1 and 0.2 mBGL) and subsoil (0.4 and 1.0 mBGL) with subsoil generally having a greater PBI capacity. The soil PBI ranged from 'extremely low' to 'moderate'. Liming of areas of the property that present with low pH (based on soil testing) will assist in increasing the phosphorus binding potential.

TABLE 8: PHOSPHORUS BUFFERING INDEX RESULTS

SAMPLING SITE	PBI VALUE	CLASSIFICATION
SLT 001 0.0 – 0.1 m	52.2	Very low
SLT 001 0.3 – 0.4 m	155.2	Moderate
SLT 002 0.0 – 0.2 m	40.4	Very low
SLT 002 0.4 – 0.5 m	60.5	Very low
SLT 003 0.0 – 0.1 m	6.1	Extremely low
SLT 003 0.8 – 1.0 m	19.3	Very very low
SLT 004 0.0 – 0.1 m	18.3	Very very low
SLT 004 0.5 – 0.8 m	32.7	Very very low

See Appendix M - SOIL MONITORING.

Permeability

Soil permeability is a measure of the rate that water flows through a soil profile. It is important for determining land capability as it provides an indication of whether rain and other water will infiltrate readily into the soil, or if it will potentially cause ponding and/or surface runoff.

Infiltration tests were undertaken at four test holes augured at the site to determine the general permeability of the soil types where the ROP is proposed to be located (

Plate 4). A CL26100 well permeameter which is designed to meet the requirements set out in AS/NZS 1547:2012 (Standards Australia, 2012) was used for the investigation. This method is a constant head test, whereby water that infiltrates an unlined test hole is replenished at the same rate from a reservoir, keeping the level of water in the hole constant (i.e., constant head). Field records are taken to measure the loss of water from the reservoir over time, which are then used to calculate the coefficient of permeability (K_{SAT}) for the particular soil profile. The 0.5 m deep test holes were created using a hand auger at each location. The permeability calculations, based on field measurements are detailed in Appendix H. The K_{SAT} results and interpreted soil categories are summarised in Table 9.

High gravel/sand content in the top 0.7 m of soil indicates good drainage across the ROP area, which will also help to minimise surface runoff. In addition, the presence of sandy clay in the subsoil suggests a high ability for the soils to capture and retain nutrients onsite.

TABLE 9: CALULATED K_{SAT} VALUES AND DRAINAGE CLASSIFICATION

LOCATION	K_{SAT} (M/DAY)	SOIL CATEGORY*/ SOIL TEXTURE	SOIL TYPE#	PERMEABILITY^
SLT001	0.01	6, Medium to heavy clay below sandy surface	242ReRD	Low to very low permeability
SLT002	0.14	4, Clay loam, weakly structured		Low permeability
SLT003	0.95	3, Loam, weakly structured or massive		Low permeability
SLT004	0.14	4, Clay loam, weakly structured		Low permeability

* Soil Category as per AS 1547:2012. # Soil type from Landgate – DPIRD-027; Plate 5. ^ Appendix A.

Based on infiltration testing results, calculated K_{SAT} values range from 0.01 m/day to 0.95 m/day which equates to 'very low' to 'low' permeability. Based on field observations and permeability, the soils at sample location SLT001 fall into category 6, heavy clay, SLT002 and SLT004 into category 4, clay loam and SLT003 into category 3, loam (Standards Australia, 2012). These permeability ratings are considered adequate for the ROP, when combined with the gentle slope of the land, which will allow adequate drainage and prevent ponding of water on the surface.

Acid Sulfate Soils

Acid sulfate soils (ASS) are naturally occurring soils and sediments containing iron sulfides, most commonly pyrite. Acid sulfate soils mostly form in coastal wetlands as layers of marine muds and sands which are deposited in protected, low-energy environments such as barrier estuaries and coastal lakes. As long as they are not disturbed, ASS do not present an issue. However, if potential ASS are exposed to oxygen, they undertake a chemical reaction which forms sulphuric acid that can mobilise heavy metals and impact on the environment.

The nearest mapped potential ASS are 5 km to the south and associated with low lying river flats and valleys. Conditions associated with ASS were not detected in the area proposed to be used for the ROP.

4.7 SURFACE AND GROUNDWATER

The subject land is in the Kalgan River catchment, which ultimately discharges into Oyster Harbour. A portion of Napier Creek runs through the subject land and forms a tributary of the Kalgan River.

Other hydrological related information for the subject land includes:

- No Clearing Control Catchments as prescribed under the *Country Area Water Supply Act 1947* within 10 km;
- Nearest Public Drinking Water Source Area (PDWSA) is 13.5 km to southwest – Marbelup Brook Catchment area. However, this PDWSA is in a different catchment; and
- The nearest proclaimed Ground Water Area as prescribed under the *Rights in Water Irrigation Act 1911* is 13 km to the southwest – Albany Groundwater Area (different catchment).

National Environmental Guidelines for Rotational Outdoor Piggeries (Tucker and O'Keefe, 2013) recommends that ROPs are located at least 100 m from a defined water course.

The subject land contains various dams and soaks (Figure). Buffers of 100 m have been established around these features.

Groundwater in the area has been characterised by Smith (1992) as part of the Plantagenet Group – with siltstone, spongelite, minor sandstone, peat and conglomerate. The area is likely to support minor to major aquifers with fresh to saline water. The regional groundwater table is described as standing at approximately 80 mAHD. This has been confirmed from a bore on the subject land, west of the Napier Creek (near the existing residence) with a standing water level of approximately 80 mAHD (Plate 6).

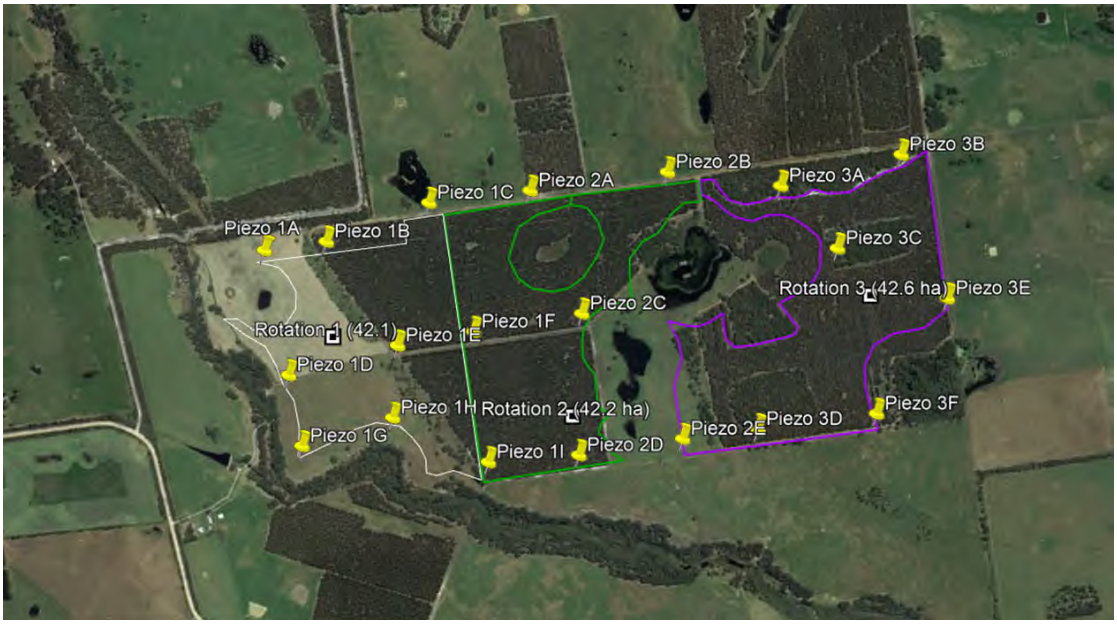
As apart part of the soil investigations in September and October 2021, four augur holes were dug to refusal due to clay or gravel and no groundwater was intercepted. In October 2022, 20 piezometers were installed across the subject land adjacent to the ROP areas. The piezometers were dug to a depth of refusal due to clay or gravel or a depth of approximately 2 m. No groundwater was encountered during the installation of the piezometers. Appendix P contains piezometer soil logs.

Due to the duplex nature of the soil (sand and gravel over clay) it is considered that there is not a groundwater resource within 1.5 m of the ground surface. Water may perch seasonally on clay lenses. However, a 100 m buffer has been applied to these areas.

The proponent has investigated the water supply on the property (the bore near the existing dwelling) this has been tested and will provide adequate water volumes and quality for the ROP.

The subject land is not in a surface or groundwater protection area and licenses are not required for the use of water for stock purposes.

PLATE 6: PIEZOMETERS AND GROUNDWATER PRODUCTION BORE LOCATION



4.8 WETLANDS

The subject land contains seasonally inundated areas, some of which contain native wetland vegetation (tea tree thickets and Melaleuca species). Most of these areas are modified or degraded due to previous grazing and other agricultural activities. Areas prone to inundation will not be used for the ROP (Figure) and a 100 m buffer will be provided to a ROP area.

PLATE 7: WATER GAINING DEPRESSION

The 'South Coast Significant Wetland' dataset (Landgate, 2021; DBCA-18) indicates that wetlands associated with Millbrook Nature Reserve (2 km to the south) are conservation category wetlands. These wetlands are not 'downstream' of the subject land.

There are no RAMSAR Sites (i.e., areas covered by the Convention on Wetlands of International Importance) within 5 km of the subject land (Landgate, 2015).

4.9 VEGETATION

Existing vegetation types (and those previously found on the subject land) are summarised in Table 10 and Plate 8. Most of the subject land has historically been cleared of native vegetation for the establishment of agricultural pursuits. Pockets of native vegetation have been retained as shown in Figure and Plate 6. Remaining vegetation is in a relatively degraded condition due to long term grazing of livestock and weed invasion. No native vegetation is proposed to be cleared for the establishment of the ROP. Some areas of blue gum plantings will be removed to incorporate the ROP (Plate 4).

It is considered unlikely that vegetation on or off the property will be negatively impacted by the ROP.

TABLE 10: INDICATIVE VEGETATION TYPES

SOIL UNIT	SUMMARY DESCRIPTION
242ReRD	Marri-Jarrah - Albany Blackbutt forest with paperbark woodland in depressions.
242ReS6	Jarrah-Marri low forest with sedges and reeds on valley floor.

Source: Landgate, 2021 (DPIRD-027).

PLATE 8: STANDS OF NATIVE VEGETATION

Source: Landgate, 2021. Green areas are native vegetation.

4.10 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas (ESA) are declared in *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, Government Gazette No. 55 and comprise:

- World Heritage properties;
- Areas included on the Register of the National Estate, because of its natural heritage value;
- Ramsar, nationally important and conservation category wetlands and the area within 50 metres of the wetland;
- The area covered by vegetation within 50 metres of Threatened flora;
- The area covered by a threatened ecological community;
- A Bush Forever site;

- A declared World Heritage property;
- An area that is included on the Register of the National Estate (natural heritage value)
- Areas covered by the Environmental Protection (Gnangara Mound Crown Land) Policy 1992;
- Areas covered by the Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002; or
- Protected wetlands in the *Environmental Protection (Southwest Agricultural Zone Wetlands) Policy 1998*.

There are no ESA's listed on the subject land. The nearest ESA is approximately 2 km to the south of the subject site, an area of remnant vegetation with Threatened flora.

4.11 ABORIGINAL AND EUROPEAN HERITAGE

Cultural heritage places in Western Australia are recorded under several different heritage listings which can be sourced via the Western Australian Heritage Council InHerit database. The categories in Table 11 were investigated to determine the status of the subject land. No heritage places are indicated to occur on the subject land. The closest listed site is the Napier Hall (Place Id 19554) which is listed in the City of Albany's Local Heritage Survey. The Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System indicates that there are no registered Aboriginal sites or other heritage places known to occur on the subject land. Development proposed at the subject land is relatively low key and aims to disturb the land and vegetation as little as possible. Should the construction phase reveal the presence of artefacts, the DPLH will be notified.

TABLE 11: HERITAGE LISTING SEARCH

STATUTORY LISTINGS			
TYPE	**ORGANISATION**	**LEGISLATION**	**WHAT IS LISTED**
State Register	Heritage Council (assisted by the State Heritage Office)	*Heritage of Western Australia Act 1990*	Places of State significance included in the State Register of Heritage Places
Conservation Order	Heritage Council (assisted by the State Heritage Office)	*Heritage of Western Australia Act 1990*	Places of State significance or potential State significance (special cases)
Heritage Agreement	Heritage Council (assisted by the State Heritage Office)	*Heritage of Western Australia Act 1990*	Places protected by long-term agreement between the parties
Heritage List	Local Government	*Planning and Development Act (2005)*; Local Planning Schemes	Places of local heritage significance
National Heritage List	Australian Heritage Council	*Environment Protection & Biodiversity Conservation Act (1999)*	Places of national significance

STATUTORY LISTINGS			
Local Government Inventory (Municipal Inventory)	Local Government	Mandated under the *Heritage of Western Australia Act 1990,* administered by Local Government	Places of local significance
List of Classified Places	The National Trust of Australia (WA)	*The National Trust of Australia (WA) Act (1964)*	Places of local, state or national significance

Source: Heritage Council – State Heritage Office (2016) http://inherit.stateheritage.wa.gov.au/

5 DESCRIPTION OF PROPOSED OPERATION

5.1 ROTATIONAL OUTDOOR PIGGERY – BREEDER AND GROW OUT

The proposed operation will breed and raise pigs using an accredited free-range system. The ROP will allow the pigs to be raised outdoors with shelter from the elements. The operation consists of outdoor paddocks which allow for rooting and foraging areas and huts with bedding for shelter. The huts allow the pigs to shelter from environmental extremes and can be moved for rotational purposes.

Free range systems such as this provide enough space for the land to assimilate nutrients which are generated through pig manure, as long as suitable soil types and slopes are chosen, stocking rates are consistent with recommendations and rotations occur after two years of use by piggery. Outdoor operations reduce the levels of odour build up (in comparison to shed based piggeries).

5.1.1 Density of Pigs

Densities of pig housing are guided by the *Code of Practice for Animal Welfare–Pigs* (Animal Welfare Working Group; AWWG, 2007) and the RSPCA Approved Farming Scheme Standards for Pigs[6] (RSPCA, 2011) as shown in Table 12. Through all phases of the production cycle, the stocking rate will be compliant with the RSPCA standards and Code of Practice (for lactating sows with piglets).

Boars, gilts and gestating sows will be kept in paddocks at 30 pigs per hectare. Farrowing sows with piglets will be in shared paddocks at 14 sows per hectare.

TABLE 12: ROTATIONAL OUTDOOR PIGGERY DENSITIES

GUIDELINE	MAXIMUM STOCKING DENSITY
Model Code of Practice for the Welfare of Animals	Sows kept in groups - 300m^2 per sow (20 - 25 sows per ha) Lactating sows with piglets – 9 - 14 sows per ha
RSPCA Approved Farming Scheme Standards for Pigs	Boars, lactating and gestating sows - 30 adult pigs per ha

Source: Code of Practice (AWWG, 2007); RSPCA Approved Farming Scheme Standards for Pigs (RSPCA, 2011).

5.1.2 Number of Pigs and ROP Rotational Areas

When comparing pig numbers and impacts, it is useful to consider standard pig units (SPU). SPU is a theoretical unit for defining piggery capacity, inputs and outputs and for comparing outputs between ages, sizes and stages in a pig's life. SPU conversion factors are summarised in Table 13. When fully operational, the proposed ROP's will support the 11,343 SPU at any one time (see

Table 13). For a period of 6 weeks there will be an additional 1,121 suckers which will be removed from the property to be grown out elsewhere.

[6] This ROP operation is not intending to be accredited with the RSPCA Approved Farming Scheme Standards for Pigs.

TABLE 13: COMPOSITIONS OF PIGS IN ROP (AND STANDARD PIG UNITS – SPU)

Pig Type	700 sows	SPU
Boar (1 = 1.6 SPU)	69	110.4
Gestating (1 = 1.6 SPU)	560	896
Lactating (1 = 2.5 SPU)	140	350
Suckers (1 = 0.1 SPU) After first 6 months	1121	112.1
Total (at any one time)		**1,343**

Note: The number of adult pigs is greater than 700 SPU due to boar and gilt numbers.

Each rotational area will comprise at least 42.1 ha (plus alley ways and access) based on the densities required by the RSPCA and the Code of Practice as shown in Table 12.

TABLE 14: AREA (HA) ON ROTATION FOR TWO YEARS

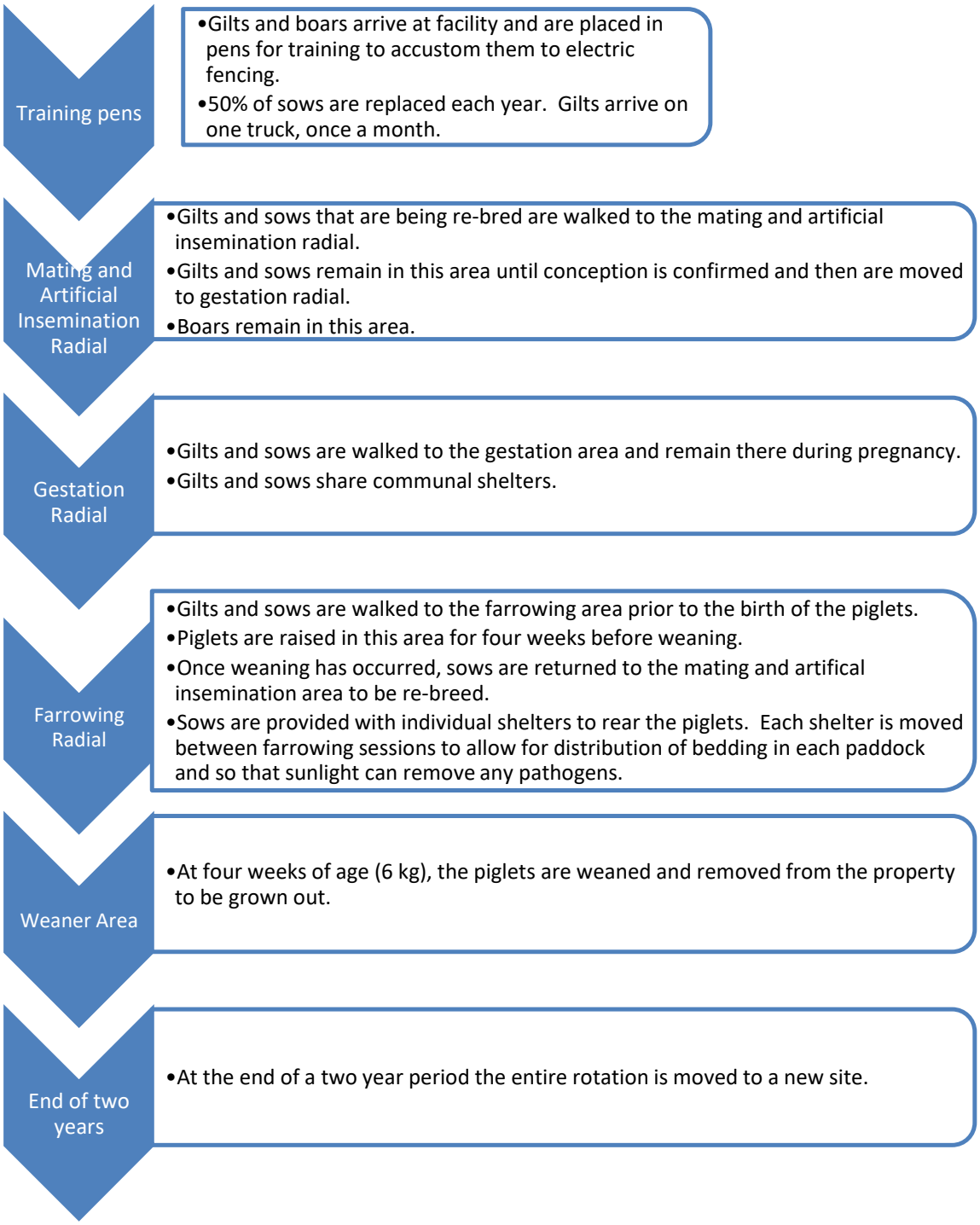
Pig Type, Minimum and Proposed Rotational Area							
RSPCA: 30 Dry sows (and boars) per ha	if	560 gestating sows and 69 boars	629	Pigs over	Minimum 20.97 ha	ha	plus alleys and access
COP: 14 lactating sows per ha		140 sows lactating at any one time	140		Minimum 10.0 ha		
				MINIMUM ROTATION	**3030.97 ha**		
				PROPOSED ROTATION	**42.0 ha**		
The subject land has 126.97 ha suitable for use as an ROP. This equates to 3 rotations, each of a minimum size of 42.0 ha (which will cater for a 700 sow operation). Operationally ROP's shall be just over 42 ha, that is ROP 1, 42.1 ha, ROP 2 42.2 ha and ROP 3 42.67.							

5.1.3 Rotation Description

Each rotation is proposed to be a minimum of approximately 42.1 ha. Approximately 126.97 ha is proposed for the ROP which will allow for 3 rotations (Figure). Rotating the use of active pig areas will be undertaken on a minimum two-year cycle, to allow utilisation of nutrients through cropping for a four year period. Rotation reduces the risk of land degradation and disease. For example, if Rotational Area 1 is used for two years, it will be four years after leaving Rotational Area 1 that pig operations will recommence (that is, in year 7 of the overall operation).

Each rotation follows the process outlined in Plate 9. Photographs of the rotation areas are included in Appendix F.

PLATE 9: BREEDING ROP PROCESS



5.2 BUFFERS AND SEPARATION

One of the criteria for establishment of an outdoor pork production system is the availability of a sufficient area of land to operate a sustainable rotational system. The subject land provides an adequate area of land with sufficient buffers to accommodate the outdoor piggery system. 126.97 ha of suitable land has been identified as meeting buffer and other requirements, which will allow for three rotations.

Buffers have been applied, consistent with either the DPIRD buffer guidelines (Department of Agriculture and Food Western Australia, 2000) and *Environmental Guidelines for Rotational Outdoor Piggeries* (Tucker and O'Keefe, 2013) as summarised in Table 15. The areas that meet buffer requirements are shown in Figure and Appendix I.

There are six rural dwellings located within 1 km of the subject land's boundaries as shown Figure . The closest residence to any of the proposed ROP cells is located at Lot 71 Elliot Road and is 629 m from the nearest proposed ROP. Other dwellings within 1 km of the proposed ROP, vary between 785 m and 805 m from the nearest proposed ROP area.

No enterprises such as tourist venues or tourist accommodation are known to exist within 1 km of the proposed ROP rotational areas.

TABLE 15: BUFFER AND SEPARATION DISTANCES

Item	Guideline/ Requirement	Comment
National Environmental Guidelines for Piggeries - Australian Pork Limited (Tucker *et al.*, 2010)		
Buffers requirements	Buffers required: • Public road carrying < 50 vehicles per day – 100 m. • Public road carrying > 50 vehicles per day – 200 m • Town – 750 m • Rural residential area – 500 m • Rural dwelling – 250 m • Property boundary – 20 m	The proposed ROP meets buffer requirements. The closest dwellings external to the subject land is Lot 71 Elliot Road which has a dwelling within 629 m of the nearest possible ROP. The distance exceeds the minimum requirement of 250 m/ 300[7] m from any possible ROP unit. All other dwellings external to the property are in excess of 300 m to the nearest proposed ROP.

[7] A buffer 300 m from rural dwellings is recommended in the Department of Agriculture *Guidelines for New and Existing Piggeries* (2000). 250 m is considered adequate in Australian Pork Limited *National Guidelines for Rotational Outdoor Piggeries* (2013). In this case, the most conservative distance has been included.

Model Code of Practice for the Welfare of Animals – Pigs (Primary Industries Standing Committee, 2008) **Royal Society for the Prevention of Cruelty to Animals (RSPCA) Approved Farming Scheme Standards for Pigs**		
Density of Pigs	Model Code of Practice for the Welfare of Animals – Pigs (COP; Primary Industries Standing Committee, 2008): 20 – 25 dry sows/hectare (ha) and 9 - 14 lactating sows with piglets per ha. Royal Society for the Prevention of Cruelty to Animals (RSPCA) Approved Farming Scheme Standards for Pigs – 30 adult pigs/ha.	Current calculations have used Model Code of Practice and RSPCA pig densities: Application of buffer requirements indicate that 126.97126.97 ha is available for ROP. This includes setbacks from boundaries, roads and water features, plus removal of some of the blue gums. There is room for three rotations for a 700 sow ROP.
Fact Sheet - Design and Management of Outdoor -Free-Range Areas for Pigs – Australian Pork Limited (APL, 2011)		
Site selection factors:	**Recommendation**	**Comment**
Annual rainfall less than 750 mm	730 mm per annum (Weatherzone, 2021)	The subject land meets this site selection requirement.
Mean maximum January temperature less than 28 ^{o}C	26.1 °C in January (Weatherzone, 2021)	The subject land meets this site selection requirement.
Mean minimum July temperature exceeding 3^{o}C	6.1 °C in July (Weatherzone, 2021)	The subject land meets this site selection requirement.
Densities: Based on Model Code densities (which are less dense than RSPCA standards)	Based on Model Code densities, the 700 sow operation will have minimum of 42.142.1 ha area per ROP rotation (not including access ways).	126.97 ha of the site is usable for the ROP, which allows for three rotations.
Buffer of 800 m between piggery and major water supply storage	There are no major water supply storage areas within 800 m of the subject land.	Proposed ROP meets this site selection requirement.

Site selection factors:	Recommendation	Comment
Buffer of 100 m between piggery and a defined water course	ROP set back at least 100 m from water courses, dams and wetlands.	The ROP has been designed to comply with these buffer requirements.
Buffer of 200 m to a public road carrying more than 50 vehicles per day	Yungup Road (presumably) carries more than 50 vehicles per day. A buffer for proposed ROP allows for a 200 m buffer. Elliot Road is presumed to carry less than 50 vehicles per day. A buffer of 100 m has been applied	Proposed ROP meets this site selection requirement.
Buffer of 750 m to a town site.	There are no town sites within 750 m. The closest townsites are Narrikup and Redmond which are 16 km to the northwest and south west, respectively.	Proposed ROP meets this site selection requirement.
Buffer of 500 m to a rural residential area.	There are no rural residential areas within 500 m.	Proposed ROP meets this site selection requirement.
Buffer of 250 m to external rural dwelling	The closest dwelling external to the subject land is Lot 71 Elliot Road which has a dwelling within 629 m of the nearest proposed ROP area. The distance exceeds the minimum requirement of 250 m/ 300 m from any possible ROP unit.	No dwellings are within 250 m/ 300 m of the proposed ROP.
Buffer of 20 m from a property boundary	All proposed ROP units are at least 20 m from the property boundary.	The ROP can be designed to comply with this buffer requirements.
Sensitive Agricultural Sites (DAFWA)	Sensitive sites do not preclude other agricultural land uses but highlight the need to consider sensitive agricultural pursuits.	No DPIRD registered sensitive agricultural sites are within 1 km of proposed development. The closest is 10 km to the southwest on Redmond Hay River Road (viticulture; DPIRD, 2021).
Soils: Well drained soils with sufficient capacity to retain nutrients	The ROP sites will ideally be placed in well drained loams with a high PBI (e.g., gravelly sands and sandy soils with a clay content at depth).	The subject land meets this site selection requirement, with well drained soils although adsorption of phosphorus is likely to be low to moderate rather than high for some areas.
Slopes: Gently sloping land	The site is gently sloping to allow for drainage but not so steep that erosion is likely to occur.	The subject land meets with this requirement for most areas and should be acceptable if sufficient drainage measures are implemented to manage surface runoff.

DPIRD (Department of Agriculture and Food, 2000) Environmental Guidelines for New and Existing Piggeries Bulletin 4416		
Buffers	• Townsite boundaries – 1000 m • Special rural areas – 1000 m • Isolated rural dwellings – 300 m • Public roads – 50 m • Neighbouring rural property boundaries – 50 m • Public Drinking Water Source Area – not permitted • Major water course – 100 m • Minor water course – 50 m • Bores, wells, soaks for private drinking water supply and or stock irrigation water supply – 300 m	The ROP has been designed to comply with these buffer requirements, except for the buffer distance to neighbouring rural property where National Environmental Guidelines for Piggeries indicate that 250 m is required as a separation to dwellings external to the ROP property.
Water Supply requirements:	• Summer: 15 L per dry sow per day to 80 L per lactating sow per day. • Winter: 15 L per weaner per day to 58 L per lactating sow per day. • Water for wallows is also required. and • Water quality: Short term upper level salinity of 4,500 mg/L of total dissolved solids or 3000 mg/L for long term use.	Not including wallows, approximately 47.73 ML of good quality water will be needed as drinking water per annum. The landowner has advised that water requirements have been considered and that there are adequate resources for the ROP. Water quality is adequate for pigs.
Soil and Topography requirements	• Drainage: well drained, level or gently sloping • Slope: Between 1:20 and 1:200 to prevent erosion (if steep) and ponding (if flat). • Groundwater: Maximum 1.5 m below ground level (throughout the year). and • Soil phosphorus retention index greater than 10.	The subject land is relatively flat with gentle slopes, with a fall of 10 m over its entirety. Water gaining areas will be avoided to reduce land degradation and nutrient export. Drainage design and management will be key to the successful operation of the ROP. Due to the duplex soils, depth to groundwater exceeds 1.5 m below ground surface. Regional groundwater levels are around 80 mAHD (Smith, 1992; and measured at bore on the property). There is approximately 10 m from ground surface to regional groundwater. The Phosphorus Buffering Index for soil tested at the site indicates the soils have an extremely low to moderate ability to sorb phosphorus

Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses No. 3 June 2005 (EPA 2005)		
Buffers	Extensive Piggery – premises on which pigs are fed, watered and housed in outside paddocks or enclosures – 1000 m	There are no EPA[8] defined sensitive sites within 1 km of proposed ROP.

[8] Noting that in the case of free range piggeries, a separation of 1000 m to single rural residences is not required – 250 – 300 m separation are the guideline recommendations.

5.3 HOUSING

Communal shelters for the pigs will comprise skid mounted structures that can be moved after each batch of pigs. The number of enclosures is dependent on the number of pigs associated with a particular rotational cycle.

Shelters will be constructed from galvanised steel with a covering of either white polypropylene based polyfabric or colourbond (or similar material).

Dry sow paddocks will comprise of up to 5 radial units, each with 10 paddocks with 8 x 5 m shelters. At full capacity there will be 46 dry sow shelters.

Farrowing huts (2.4 m x 2.4 m) are designed to house a single sow and her litter of piglets. These shelters will be constructed from marine ply (or similar) and will be a timber or dark colour. There will be 140 of these huts when the ROP is at full capacity.

5.4 FENCING AND WATER SUPPLY

Pigs are contained and protected from predators such as foxes by providing shelters and using secure fencing and electrification (where necessary). Other pest control methods, such as exclusion fencing are also used to reduce risk (e.g. from foxes). All pigs are securely enclosed and are unlikely to escape from the pens.

Adult pigs introduced to the ROP are put into a ring lock paddock with an electric outrigger to allow the pigs to become used to electric fence systems. Once trained, a single strand electric wire is used to contain adult pigs.

Drinking water for the pigs will be provided from a bore and several dams on the property. Water will be provided to the pens via pipework that sits on the surface of the ground at the perimeter fence so that it can be relocated as required.

5.5 INFRASTRUCTURE AND OTHER FEATURES

Infrastructure and other features associated with the operation of the ROP includes:

- Water pipes and pumps to transport water from dams or bores;
- Silo/s for food storage. Silos will be approximately 6m in height with a capacity of storing 60 tonnes of food; and
- Storage area for straw for bedding.

5.6 TRANSPORT AND OPERATIONS

The processes and operations for pig breeding, rearing and transport will be in line with the Model Code of Practice for the Welfare of Animals-Pigs (Revised) (AWWG, 2007).

- Feed for the pigs will be transported to the site using a road train which will visit the property approximately four times per week. Feed comprises pellets which will be stored in silos. Feed will be provided to the farrowing pigs in 1.5 tonne feeder bins. Other pigs have food blown into the pens from the perimeter to ensure it is distributed widely. This allows the pigs to forage, reduces competition, and prevents hotspots of nutrient build up.

- Straw is used for bedding in communal shelters and weather protection at the end of the shelters. Straw will partially be sourced from the subject land or imported periodically. Straw will be kept at two locations central to ROP activities, in an open area to reduce fire risk.
- Incoming pigs (gilts and boars) will be transported using a road train. Initially, animals will be brought in every week, until the operation is at capacity. Subsequently, replacement animals will be brought in every month.
- Weanlings will be transported to a grower/ finisher facility in a small truck on a weekly basis;
- Spent bedding may be removed via up to two truck visits weekly or spread on non-piggery areas in place of synthetic fertilisers; and
- Any fuel storage area will be bunded to contain any spills. The location of the proposed fuel storage area will between the Piezometers 1A and 1B (Plate 6) and consist of a 3000L diesel above ground tank. Upto 200L of unleaded fuel will be stored in this area also.

All traffic accessing the site will enter from Settlement and Elliot Road. It is expected that there will be 11 truck movements (i.e. arriving and departing) per week, plus occasional movements for straw delivery.

5.7 BIOSECURITY

Australian agriculture is free from many of the more devastating diseases that exist in other countries around the world. The introduction of exotic diseases and those that already occur in Australia could have a large impact on the livestock industry, including pig production. Adequate biosecurity is required on a pig farm to maintain sanitation, disease control and vermin management and is integral to the health of the pigs and quality of the product. This means that access to the ROP will be limited to authorised personnel with a high standard of hygiene at all times.

The proponent will ensure that effective contingency plans are in place and that staff are adequately trained to respond to disease risk and other emergency situations. The Australian Veterinary Emergency Plan (AUSVETPLAN; Animal Health Australia, 2021) is a coordinated national response for the control and eradication of high impact animal diseases. In addition, APL and affiliated operators are party to the Animal Health Australia Cost Sharing Deed of Agreement on Emergency Animal Disease Response (Animal Health Australia, 2001).

The proponents will implement the following:

- Signage installed to inform visitors they cannot enter the Farm without permission as per Plate 10;
- Visiting vehicles are not permitted to drive over alleyways used to walk pigs from pen to pen. Visiting vehicles, including trucks that visit other pig properties are only allowed access to a quarantined area;
- Visitors must not have been in contact with pigs in the 24 hours prior to visiting the ROP. This includes contact with pigs at agricultural shows, farm stays, transport vehicles, abattoirs and pig processing. Exemptions may apply if the pig contact is within production group and visitation is approved by the Livestock Manager or the consultant veterinarian;

- Visitors must not be experiencing any cold or flu like symptoms;
- Visitors must not have been on an aircraft in the preceding 72 hours;
- Visitors must sign the visitors book and provide relevant details;
- Visitors must wear the protective clothing and footwear provided; and
- Visitors must not feed food scraps to the pigs.

PLATE 10: PROPERTY ENTRY SIGNAGE

5.8 ACCIDENTS AND EMERGENCY RESPONSE

Emergency responses in the pig industry sector are guided by AUSVETPLAN Enterprise Manual-Pig Industry (Animal Health Australia, 2011) and the Australian Pork Industry Biosecurity Program (APL, 2003). AUSVETPLAN is a series of technical response plans that describe the proposed Australian approach to an emergency animal disease incident. APL (2003) outlines a code of practice for dealing with emergency pig disease responses in accordance with Clause 14 of the Government and Livestock Industry Cost Sharing Agreement. The documents provide guidance based on recent analysis of risks, linking policy, strategies, implementation, coordination and emergency management plans.

Mass pig deaths due to factors such as abnormal heat stress or disease rarely occur. However, a plan is required for disposal of the pigs should mass deaths occur and management of the issue should the cause be an infectious disease. When disease is the cause of death, the farm owner will obtain a veterinary report and immediately contact the Emergency Disease Watch Hotline (1800 675 888), City of Albany Environmental Health Officer (EHO), DPIRD and Department of Health (DOH), where applicable. These agencies will provide guidance to the landowner on disease control and hygiene, transport and disposal of diseased and/or dead pigs.

Harsh chemicals such as disinfectants will not be used in this piggery operation. However, as for any farming operation, any person storing, handling or transporting dangerous goods (including agricultural chemicals) is required to report spills and other dangerous events to a dangerous goods officer within the Department of Mines, Industry Regulation and Safety as soon as practicable. Where an agricultural chemical spill is likely to cause pollution or environmental harm, the occupier of the land on which the discharge occurred is required to inform DWER (Albany Office).

5.9 FIRE RISK MANAGEMENT

Each rotational area will have a 4 m firebreak around its boundary and the property will have a fast attack unit to respond to a fire on the property, should the situation arise. The subject site has dams and a bore where water can be drawn for firefighting purposes. Fire risk within each rotational area will be minimised by storing flammable material such as straw bedding in a single section of the operational area.

The subject land is in the Napier Volunteer Bush Fire Brigade area.

5.10 PUBLIC RELATIONS AND TRAINING

The proponent wishes to promote good relations with neighbours and the general public to reduce the risk of complaints based on lack of adequate information of farm operations or fears based on misconceptions. All complaints received directly will be recorded in a logbook and dealt with in a professional and sensitive manner. Where issues cannot be resolved easily, the proponent will liaise with the City of Albany Environmental Health Officer and/or Planning Officer.

A piggery manager will primarily be responsible for the operation of the ROP, including transport of pigs to, from and within with property, unloading and loading, feeding and general management and maintenance. Staff will be adequately trained in best practice methodology for management of the ROP.

6 ROTATIONAL OUTDOOR PIGGERY – PROPOSED MANAGEMENT

Free range piggeries, when adequately located and managed, present few management issues. The main management considerations for any piggery are odour, dust, noise, waste, fly breeding, pest management, nutrient management and visual management. The magnitude of possible impacts is closely related to the size of the operation, density of pigs, management and type of operation being carried out. Generally, the more intensive the operation, the more risk there is of generating impacts on-site and off-site. This ROP will operate within the recommended density of pigs on a site which has suitable characteristics to support sustained operation. It is important to note that free range piggeries with rotational components are less intensive operations compared to shedded operations where odour, dust and effluent disposal issues require larger buffers. The buffers outlined in this EAMP are consistent with national and other standards, which indicates that the ROP impacts can be adequately managed.

6.1 ODOUR

ROPs are not required to meet site-specific separation distances but should meet the minimum separation distances set out in the *National Environmental Guidelines for Piggeries* (Tucker *et al*., 2010). The ROP areas proposed in this EAMP meet all separation distances outlined. ROPs pose a low risk of causing significant off-site odour impacts, provided they are designed and managed according to sustainable nutrient loading rate criteria (Tucker and O'Keefe, 2013). Measures that assist in keeping odour to acceptable levels include:

- Keeping pig densities at recommended levels;
- Ensuring that there is adequate infiltration of water and drainage of pens;
- The existing screens of mature vegetation and proposed tree planting adjacent to all ROP cells will assist in creating turbulent airflow, which will help to disperse any odour generated on the site; and
- Dead animals will be immediately collected and placed in dedicated burial trenches. The animals will be covered with a minimum of 0.5 m of clean fill within 3 hours of disposal.

Research by University of Southern Queensland and National Centre for Engineering in Agriculture (Banhazi, 2013) indicates that risk associated with ROPs from odour is low.

6.2 DUST

Dust from ROP operations can be generated from traffic movements, dry conditions when pens have dry soil exposed or from associated farm operations such as feeding. The proposed setbacks from roads and property boundaries, plus existing shelter belts and vegetation buffers will ensure that impact from dust is minimal. Dust generation will be minimised through:

- Placement of pens in suitable soil types (i.e. coarse sand/loamy soils with clay and laterite elements); and
- Vehicle movements on access roads to be restricted to moderate speeds, and minimise distances travelled on gravel or sand.

Research by University of Southern Queensland and National Centre for Engineering in Agriculture (Banhazi, 2013) indicates that risks associated with ROPs from dust is low.

6.3 NOISE

A low level of noise is likely to be generated by the pigs and use of associated equipment. Noise risk in ROPs is generally not an issue due to setbacks and that the low density of pigs reduces noise related to aggression and competition for food. Noise associated with loading and unloading the pigs will be limited to daylight hours. In the event of adversely high daytime temperatures, loading and unloading will be undertaken during early morning and evening. It is also considered that noise impacts are unlikely to be a problem given the distances to nearby rural residences, the nearest of which will be a minimum of 785 m to the west of the nearest rotational area. In addition, noise generated will be of a volume generally associated with farming activities in a rural area.

Research by University of Southern Queensland and National Centre for Engineering in Agriculture (Banhazi, 2013) indicates that risk associated with ROPs from noise is low.

6.4 WASTE MANAGEMENT

The ROP will generate waste products including pig manure mixed with straw bedding. The nutrients present in these materials including nitrogen (N), phosphorus (P) and potassium (K) will be managed to reduce the risk of export from the property. Design and management factors which will be applied to this ROP (in accordance with *National Environmental Guidelines for Rotational Outdoor Piggeries*; Tucker and O'Keefe, 2013) include:

- **Nutrient Budgeting:** While N, P and K accumulate in soils of ROPs, the nutrient accumulation rate is generally not high unless an area has been stocked continuously for more than two years (APL, 2011). Consequently, rotations will be planned so that pigs are not continuously stocked on an area for longer than two years. Following the pig stocking phase, winter crops for hay (or cereals) and summer crops of sorghum or millet will be grown to utilise accumulated N, P and K. Nutrient budgeting is described in Section 6.5;
- **Facilitating Even Spreading of Manure Nutrients:** In ROPs, manure and consequently nutrients, are not spread evenly across the paddocks. This increases the risk of nutrient overloading a specific location, through leaching and/or runoff. Moving pig shelters and feeding facilities regularly during the stocked phase will help spread nutrients more evenly. Feed is blown into the enclosures and spread over a relatively large area and in a variety of locations. Numerous water access points will also be available within each enclosure. These practices assist in evenly distributing the nutrients within the ROP paddock areas;
- **Minimising Uncontrolled Movement of Sediment and Nutrients from ROP Paddocks:** This will be achieved through regular spelling from pig production, with a plant growth and harvest phase to remove the nutrients added through the stocked phase. The pig growing areas will be rested for at least two years before reuse. APIQ✓™ accreditation requires that soil testing be undertaken prior to reuse of a previous rotational area. Nutrient levels must be returned to acceptable levels before a new pig phase can begin.

  Roll-over drains, interceptor drains and vegetated strips will be incorporated into the ROP as described in *Western Australian Guidelines for Biosolids Management* (Department of

Environment and Conservation, 2012). In addition, water management and sediment trapping devices will be located along the downstream side of all ROPs should any surface runoff be observed. This will slow the rate of runoff and capture any sediment that may be transported from the ROP.

- **Providing and maintaining wallows:** Wallows will be monitored, and locations changed to prevent excessive impacts on a single site. Wallows will be remediated at the end of each rotation by ripping, refilling, and levelling.
- **Monitoring and Surveillance:** Routine environmental monitoring of soil and surveillance of drainage lines will be undertaken during the pig growing phase and following the cropping phase of the rotation. Soil sampling will be undertaken in accordance with the APIQ✓™ guidelines, include samples collected prior to the pig phase commencing on a site, and then again prior to reusing an area as an ROP. This will be undertaken to ensure that the nutrient levels have returned to satisfactory levels prior to reusing an area as an ROP.
- **Removal and Treatment of Waste Products:** The ROP will produce more nutrients than can be spread on the property over an extended period of time. To manage this, a proportion of manure and bedding will be collected and stored and/or composted and exported from the property.

Details for these strategies are summarised below.

6.5 NUTRIENT MANAGEMENT

APL (2012) outlines a methodology for developing a nutrient management plan for outdoor piggeries (Appendix K) which includes:

- Defining the operation;
- Preparing a nutrient budget;
- Developing strategies for even spread of manure and spend bedding as required;
- Defining nutrient loss pathways; and
- Undertaking regular soil monitoring.

The management of nutrients during and following the pig growing phase is an important part of the operation of the facility. Bedding with manure from shelters may be collected each time a shelter is moved (e.g. after each batch of pigs) and either removed from the property immediately or spread on cattle grazing areas to replace application of synthetic fertilisers.

Promotion of even distribution of manure and spend bedding will be enabled, using strategies such as moving relocatable structures and wallows (Appendix L).

Table 16 provides estimates of the total nutrients applied from a range of pig classes.

Based on the average stocking rate for the ROP and nutrients per pig class, Table 17 presents the total annual nutrients produced. Half the manure and straw bedding may be collected and removed from the property (via composting or as spent bedding). For the remaining bedding and manure, nutrients will be assimilated in the subsequent cropping phase.

Due to the nature of nitrogen in fresh pig manure, a significant portion will be lost through ammonia volatilisation and nitrous oxide emissions (estimated at 30%). It should also be noted that not all nitrogen, phosphorus and potassium in manure and spent bedding are in a form that is readily available for uptake by plants. This is a result of manure being in a relatively insoluble form, which means it has a slow-release effect that will continually release bioavailable nutrients over a longer timeframe than synthetic fertilisers.

Depth to groundwater on the subject land is not considered a risk for nutrient migration, as winter groundwater level monitoring indicated that groundwater was not present within 1.5 m of the ground surface. Regional groundwater is at around 80 mAHD which is 10 m below the ground level in the nominated rotational areas. Water gaining/retaining areas will not be used for pig areas during winter months.

The main risk of nutrient export would be via erosion, sedimentation and overland water flow. Controls to prevent this are described in Section 6.6. Soil monitoring is described in Section 6.13.

TABLE 16 PREDICTED NUTRIENT OUTPUT BY CLASS OF PIG AND BEDDING MATERIAL (KG/HEAD/YEAR)

PIG CLASS	TOTAL SOLIDS	VOLATILE SOLIDS	ASH	NITROGEN	PHOSPHORUS	POTASSIUM
Gilt	197	162	35	12..0	4.6	4.0
Boar	186	151	35	15.0	5.3	3.8
Gestating sow	186	151	35	13.9	5.2	3.7
Lactating sow	310	215	95	27.1	8.8	9.8
Sucker	11.2	11.0	0.2	2.3	0.4	0.1
Sow and litter	422	325	97	50.0	13.0	11.0
Weaner pigs	54	47	7	3.9	1.1	1.1
Grower pigs	108	90	18	9.2	3.0	2.4
Finisher pigs	181	149	32	15.8	5.1	4.1
Wheat straw	89	-	-	0.58	0.41	0.51

Source: *National Environmental Guidelines for Piggeries* (Tucker *et al.*, 2010). Highlighted rows indicate pig classes proposed for this operation.

TABLE 17: PREDICTED SOLID AND NUTRIENT OUTPUT FOR CLASSES OF PIGS

PIG CLASS	TOTAL SOLIDS (kg/head/year)	700700 Sow Operation tonnes/ solids/ year	SOLIDS (kg/head/year)	700700 Sow Operation tonnes/year	ASH (kg/head/year)	700700 Sow Operation tonnes/year	NITROGEN (kg/head/year)	700700 Sow Operation tonnes/year	PHOSPHORUS (kg/head/year)	700700 Sow Operation tonnes/year	POTASSIUM (kg/head/year)	700700 Sow Operation tonnes/year
Gilt	197.0	0.0	162.0	0.0	35.0	0.0	12.0	0.0	4.6	0.0	4.0	0.0
Boar	186.0	12.8	151.0	21.0	35.0	5.4	15.0	22.3	5.3	0.88	3.8	0.66
Gestating sow	186.0	104.22	151.0	170.88	35.0	43.66	13.9	17.36	5.2	6.55	3.7	4.66
Lactating sow	310.0	43.44	215.0	60.88	95.0	29.66	27.1	8.4	8.8	2.77	9.8	3.00
Sucker	11.2	12.66	11.0	24.99	0.2	0.55	2.3	5.7	0.4	1.0	0.1	0.2
Straw Bedding tonnes/year)		407.44						2.55		0.33		8.77
kg/year			528.0		165.2		58.3		19.7		17.4	
tonnes/year		368.2		277.6		79.98		36.3		11.23		17.28
Tonnes/year/ ha (43 ha rotation area)		8.563		6.5		1.84		0.84		0.26		0.40
Tonnes/ha/ year entire farm		1.208		0.91		0.26		0.12		0.037		0.06

Source: Tucker *et al.*, 2010. Assumptions: Area for all rotations: 126.97. Total area of farm: 304.7 ha. Single rotational area (minimum size): 43 42.1 ha. Bedding straw: 0.76 kg/SPU/day or 407.5407.5 tonnes/ year

Ratios	700 Sow Operation	SPU ratio	SPU
Gilt	0	1.8	0
Boar	69	1.6	110.41
Gestating	560	1.6	896
Lactating	140	2.5	350
Suckers	1121	0.1	112.1
		Total SPU	1468.5

TABLE 18: TYOICAL NUTRIENT REMOVAL THROUGH CROPPING

	AVERAGE YIELD	NITROGEN		PHOSPHORUS		POTASSIUM	
	tonnes/ha	kg/ tonne	kg/ ha	kg/ tonne	kg/ha	kg/ tonne	kg/ha
Hay	6	20	120	2	12	25	150
Wheat	3.5	23	80.5	3	10.5	4	14
Barley	3.5	20	70	2.9	10.15	4.4	15.4
Canola	1.8	40	72	6.5	11.7	9.2	16.6

*Source: Summit Fertiliser Nutrient Removal Tables (2015).

Following the pig phase, the rotational area will be used for cropping. The net result of cropping is the removal of nutrients from the soil, and the export of these offsite. Typical data for cropping suggests that nutrient removal rates provided in Table 19 would be applicable for to the site.

Livestock producers in the Albany, Napier, Narrikup, Denmark and Manypeaks area routinely sow winter and summer crops in rotation to fill feed gaps and allow high production (Bee, 2022). A limiting factor for these enterprises is not having the numbers of livestock to utilise the feed. Pasture trials conducted in 2020 in the Albany area using improved ryegrass, clover and forage cereal varieties measured an average of 14 tonnes matter of dry matter per hectare with the best plots achieving in excess of 15 tonnes matter over three cuts (Bee, 2022). DPIRD also considers that a 17 tonnes of dry matter per hectare per year is achievable with good management (Coffey, 2022).

CSBP data on nutrient removal by crop types have determined that 4.0 kg per tonne of phosphorus is removed via silage (clover/ryegrass). Drawing on the 2020 pasture trials, kilograms of phosphorus removed ranged from 44.8 kg – 65.1 kg. per hectare per year. Table 19 details the amount of Phosphorus removal calculated using the 2020 pasture trials conducted in the Albany area.

TABLE 19: BIOMASS CUTS ALBANY PASTURE DEMONSTRATION

Variety	Total (kg)	Calculated Kilogram of Phosphorus removed per hectare per year*
Elders Maximum Hay Mix & Oats	15141	65.1
Elders Gazamax Mix	12568	54
Elders Baleburster Mix	13469	58.7
Atomic tetraploid rye	15003	64.5
Elders Superstar Mix	13130	56.5
Elders Perennial Manypeaks Mix	12027	51.7
Elders Mile High Mix	10426	44.8
Elders Whoosh Plus Mix	15369	66.1

Variety	Total (kg)	Calculated Kilogram of Phosphorus removed per hectare per year*
Graza 85 Forage Oats	15385	66.2
Shotgun Mix	16629	71.2

Source: Bee 2022. *Calculated using CSPB data

Both the *National Environmental Guidelines for Rotational Outdoor Piggeries* (Tucker and O'Keefe, 2013) and the APIQ✓™ guidelines have a heavy emphasis on the sustainable management of nutrients.

A nutrient budget has been calculated using the APL nutrient calculator (APL, 2022; https://australianpork.com.au/sites/default/files/2021-11/Nutrient-Balance-Outdoor.xlsx). Local factors such as tonnes of dry matter per hectare per year have been used and CSBP rate of P removal have been used in the model. Data for the proposed ROP based on winter (e.g. oaten hay) and summer (sorghum or millet) cropping is included in Appendix K.

The budget indicates that both potassium and nitrogen are in deficit after two years of cropping. Phosphorus will decline from 182 kg/ha at the end of the first year of cropping to 117 kg/ha at the end of the second year of cropping, to 53 kg/ha at the end of the third year of cropping and be in deficit in the fourth year of cropping. A summary of the nutrient surplus at the end of each year is shown in Table 20.

TABLE 20: NUTRIENT SURPLUS / DEFICIT AT THE END OF EACH CROPPING YEAR (KG/YR)

	Nitrogen (N)	Phosphorus (P)	Potassium (K)
Year 1: Cropping	352	182	254
Year 2: Cropping	12	117	-18
Year 3: Cropping	-328	53	-290
Year 4: Cropping	-668	-12	-562
Year 5: Return to pig phase	-668	-12	-562

Modelling indicates that there will be no residual nutrients in the area of the rotation prior to the next pig phase. It should also be noted that advice from APL indicates that the model is conservative and represents the upper limit of nutrient and does not fully take into account the removal or reuse of spend bedding.

In addition, the phosphorus present from the manure and spent bedding is in mineral and organic forms, not all of which is mobile or available for plant growth or export via water. As the ROP will be part of the APIQ accreditation scheme, soil testing will be undertaken prior to the pig phase and then prior to the pig phase returning to the original area. One of the tests is for phosphorus available for plant uptake (Colwell, Olsen or Bray Phosphorus). The suggested levels to trigger investigation of phosphorus in topsoil are between 31 and 85 mg/kg Colwell Phosphorus (noting that highly productive agricultural systems often have levels greater than this). The nutrient levels are considered

manageable due to the integrated implementation of manure and bedding management, control of any overland flow of stormwater and planting of high nutrient requirement crops such as oaten hay, sorghum and/or millet.

The proponent is committed to undertaking APIQ✓™ standard soil monitoring to ensure that nutrient limits have returned to acceptable levels prior to reusing an area for ROP operation. When approvals have been secured, soil testing will be undertaken to determine baseline data which will be lodged with APIQ✓™ for approval to maintain accreditation.

These management measures, having room for up to three rotations and on-site operations will ensure that nutrients are appropriately managed to maximise reuse and minimise potential impacts on the environment.

6.6 RUNOFF AND DRAINAGE MANAGEMENT

APL (2012) has prepared a guideline for *Land and Water Protection Measures for Rotational Outdoor Piggeries* (Appendix N) which recommends the following:

- Prevention of erosion;
- Installation of secondary control measures;
- Monitoring; and
- Site remediation.

The APIQ✓™ Standards Manual (Australian Pork Limited, 2012) provides guidelines for the management of nutrients on-site.

Land and Water Protection Standard

The removal of nutrients in stormwater runoff will be minimised by:

- Maintaining groundcover over paddocks throughout both the pig and the crop, forage or pasture phases; and/or
- Maintaining a continuous resilient vegetative buffer strip ideally consisting of a runner developing, non-clump forming grass species at least 10 m wide immediately downslope of the entire paddock area/s (e.g. Kikuyu); and/or
- Installing terminal ponds associated with roll over and/ or cut off drains, sized and located to catch the first 12 mm of runoff from the piggery paddocks and other land within the same local catchment area.

Due to the proximity of the proposed ROP to Napier Creek (noting there will be a 100 m grassed buffer), careful management will be implemented to ensure there is no uncontrolled loss of nutrients from the ROP. A number of management measures are proposed to be implemented in each rotational area prior to the commencement of each pig phase.

To ensure that no soil leaves the dedicated pig areas, several tiers of erosion control measures will be used:

- Construction of roll over drains down gradient of rotational areas (where appropriate);
- Use of secondary control measures where needed (sediment traps and diversions);

- Retention of existing pasture or blue gums (at least 10 m wide) and/or establish vegetation strips adjacent to internal waterways.

Rollover drains will be constructed along the contour in each ROP area to intercept and infiltrate surface water flow. This system is proposed to allow for trafficable access during the cropping stage of the operation. Design of the rollover drains is shown in Appendix N.

The rollover drains will detain and treat water, with any excess water stored in permeable basins for infiltration. Sizing of the basins (if required) will be based on the volume of the rollover drain and to allow for detention of runoff from a minimum of a 15 mm 1 hour rain event (which equates to 95% of rainfall overall). The drain and basic system will be sized to accommodate run-off from each rotational area (e.g. rotation area 1 is 42.2 ha).

The runoff coefficient used for the runoff calculation is 0.15. This is within the range of recommended runoff coefficients from the Australian Rainfall and Runoff for a Park, Garden and Meadow environment for a rainfall intensity of 35 mm/hr. This coefficient is considered conservative as the calculation is only sizing the drain system for a 15 mm rainfall event.

For example, in Rotation Area 1, comprising approximately 42.1 ha of operational area the rollover drain would need to accommodate 675 m^3 (based on runoff coefficient of 0.15 with 50% of water flowing into the rollover drain system).

These treatments will ensure that any surface water flow is slowed, and sediment is captured before potentially leaving the ROP areas. The use of sand and silt trapping devices (e.g., silt trapping fences) and vegetated filter strips also satisfies APIQ✓™ recommendations for land management. Specifications for drainage management are shown in Appendix N.

Retention of strips of blue gums and maintenance of cattle grazing areas with kikuyu around the ROP will create nutrient filtering areas.

6.7 DISPOSAL OF DEAD PIGS

A mortality rate of less than 5% of pigs per year is generally accepted in breeder and grower facilities. This means that of the 1890 pigs (output per annum of 1121 weaners and herd of 700 sows), up to 94 pigs may die. However, this number is expected to be significantly lower in a well operated free-range piggery. Most of the pigs that die will be piglets (less than 10 kg).

The most practical way to dispose of dead pigs at this site is by placing them in a purpose dug trench. Burial trenches will be designed, constructed and maintained in accordance with the *National Environmental Guidelines for Rotational Outdoor Piggeries* (2nd edition; Tucker and O'Keefe, 2013). Lime will be added and the trench will be backfilled as required. It should be noted that mass pig deaths will be dealt with as outlined in Section 5.6.

The following will apply to burial trenches:

- Large carcasses should be split to minimise bloating.
- The pit bases must be at least 2 m above the water table at all times.
- Pits should be situated on low permeability soils and/or low risk sites.
- Mortalities need to be well covered with soil or other suitable material each day to avoid scavenging by feral animals and to prevent odour.

- Further clay should be compacted over filled pits.
- Earth should be mounded over filled pits to promote shedding of stormwater. The mounds should be grassed over but trees should not be planted at the site as the roots allow water to move through the pit.

Each trench will be approximately 2 m wide and 1.5 m deep with length depending on the location chosen. Due to the duplex soils in the area, digging into the clay will create a relatively impermeable floor and walls to the trench. Testing of the soil will be undertaken as part of the Works Approval.

Material dug to create the trench will be used to backfill, ensuring that at least 0.5 m of soil covers the carcases. Nominated locations of the burial trenches are shown in Appendix I.

6.8 FLY BREEDING AND PEST MANAGEMENT

Fly breeding will be minimised by undertaking the following:

- Manure and bedding will be spread as thinly as possible and not left to accumulate to reduce the risk of fly breeding conditions;
- Spoilt feed around feed troughs will be regularly removed; and
- Dead pigs will be disposed of as quickly as possible.

Free range operations are at risk of attracting rodents and predators such as foxes. Best practice management of pig paddocks and feeding will help to minimise pests. Strategic baiting and trapping may be used if pests are identified.

6.9 WEED MANAGEMENT

As for any agricultural enterprise, monitoring for weeds and pests is an important priority for ROP management. General monitoring and treatment of weeds will be undertaken seasonally.

6.10 VISUAL

The visual impacts of the ROP will be minimal due to the existing vegetation that screens the ROP areas from all external vantage points. Some areas of blue gums will also be retained on the periphery of the property.

6.11 TRANSPORT AND ACCESS

The ROP will rely on vehicle movements to bring pig feed, straw bedding, deliver breeding pigs and transport weaners from the site. The subject land will be serviced via Settlement Road (bitumen) and Elliot Road (gravel). Access within the property comprises a well-formed gravel road and other stable tracks.

Heavy vehicle use associated with the operation will be limited to the operation of road trains on Yungup Road.

Transport impacts will be minimised by:

- Ensuring that loads are appropriately sized, secured and coordinated to reduce movements;
- Keeping traffic speed on internal access road low (20 km/h); and
- Not moving pigs during the night.

As outlined in Section 5.5 it is expected that there will be 11 truck movements (i.e. coming and going from the subject land) each week, with occasional deliveries of straw.

6.12 CHEMICALS AND FUELS

ROPs use far fewer chemicals than many other farming enterprises (e.g. no disinfectants). However, from time to time the use of pesticides, vaccines and other pharmaceutical products may be required. These materials will be stored in the farm sheds on the subject land according to manufacturer instructions and legislative requirements (where applicable). This applies to any rural activity where chemicals are required. In this instance, chemicals will be stored in an enclosed shed with a concrete floor. All pesticides will be stored, applied, transported and disposed of in accordance with the *Health (Pesticides) Regulations 1956*. Medications such as vaccines will be stored in a refrigerator solely for that purpose.

6.13 MONITORING AND EVALUATION

The Australian Pork Industry Quality Assurance Program (APIQ✓™) is an on-farm quality assurance program designed by the pork growing industry in consultation with producers, key customers and government. APIQ✓™enables pig producers to demonstrate that their on-farm practices reflect good agricultural practices for management, food safety, animal welfare, biosecurity and traceability. Part of the APIQ✓™ program involves soil testing for nutrients, firstly to determine baseline nutrient levels and prior to reuse of rotational areas to ensure that nutrient levels continue to be managed sustainably. Soil testing must be undertaken as part of the accreditation process as described in **Error! Reference source not found.**, Appendix M and parameters stated in Table 22.

Ground water monitoring will occur according to the schedule outlined in Table 21 as per Condition 13 of the Works Approval.

TABLE 21: GROUNDWATER MONITORING REQUIREMENTS

Monitoring point and reference	Parameter	Unit	Averaging period	Monitoring frequency
Piezo 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I	Standing water level[1]	m (AHD) m (BGL)	Spot sample (in-field)	Biannual
Piezo 2A, 2B, 2C, 2D, 2E	pH[1]	-		
	Electrical conductivity @ 25 °C[1]	µS/cm	Spot sample (laboratory determined)	
Piezo 3A, 3B, 3C, 3D, 3E, 3F	Total nitrogen, Ammonia nitrogen	mg/L		
	Total phosphorus			
	Total dissolved solids			
	Biological oxygen demand			
	Na, K, Ca, Mg, Cl, SO4, HCO3			

TABLE 22: SOIL TESTING REQUIREMENTS

Soil sampling locations	Soil profile	Parameter	Units	Frequency
At least one sample made up of at least three individual cores for each pig paddock[1]	0 – 10 cm; 10 – 20 cm; 20 – 30 cm;	pH	CaCl2	Annual[2]
		Electrical conductivity	mS/cm	
		Moisture content	%	
		Total nitrogen, ammonium-nitrogen, nitrate-nitrogen	mg/kg	
		Total phosphorus		
		Phosphorus retention index (PRI)	-	
		Phosphorus buffering index (PBI)	-	
		Aluminium	CaCl2 extract	

7 SUMMARY AND COMMITMENTS

Suppliers of pigs are required to meet exacting standards to ensure that the end product meets processor and market expectations. This ROP will meet the standards set by the APIQ✓™ Accreditation System and the *Model Code of Practice for the Welfare of Animals-Pigs* (Revised) (AWWG, 2007).

Examination of environmental factors, guidelines and policy requirements indicates that the proposed ROP can be managed to meet desired objectives for its operations without impacting on the surrounding environment or the health or amenity of surrounding property owners and the wider public.

The following commitments are made by the proponent in support of this EAMP (Table 23).

TABLE 23 PROPONENT COMMITMENTS

	COMMITMENT	TIMING/RESPONSIBILITY
1	ROP areas will only be established within the boundaries shown in Figure and Appendix I.	Proponent.
2	The ROP areas identified will be used for two years and cropped for four years prior to reuse (and pending results of APIQ✓™ nutrient testing).	Two years use, four years of cropping prior to return to first rotational area. Proponent.
3	Density of pigs will meet Model Code of Practice Guidelines.	Proponent.
4	Surface water flow from the ROP rotation areas will be monitored and controlled through the installation of cut off or roll over drains and basins. In addition, vegetated buffers (pasture and/or blue gums) and temporary structures such as water/sediment control devices will be used.	Proponent.
5	Apply *National Environmental Guidelines for Rotational Outdoor Piggeries* (Tucker and O'Keefe, 2013), *Model Code of Practice for the Welfare of Animals – Pigs (Revised)* (AWWG, 2007) and RSPCA *Approved Farming Scheme Standards for Pigs* (RSPCA, 2011) to operations of the ROP.	Proponent.
6	After use, each ROP rotational area will be planted to a suitable harvestable crop (e.g. oaten hay, sorghum, millet) for four years to utilise nutrients.	Minimum four years. Proponent.
7	Testing for nutrient levels prior to re-use of ROP area for pigs (as per APIQ✓™ program).	Proponent.
8	Biosecurity measures will comply with the *Australian Pork Industry Biosecurity Program* (APL, 2003) and AUSVETPLAN (Animal Health Australia, 2021).	Proponent.
9	Pigs that die on the property will be placed in a designated burial trench and immediately covered with soil (as per Tucker *et al.*, 2010). This does not apply where mass deaths or disease occurs.	Proponent – immediately following pig deaths.

	COMMITMENT	TIMING/RESPONSIBILITY
10	Vehicle speed on internal tracks will be limited to 20 km/hour.	Proponent and suppliers.
11	Signage will be installed at entry to ROP compartments with information regarding biosecurity.	Proponent.
12	Operations such as delivering and removal of pigs from the property will be undertaken during daylight hours.	Proponent.
13	Any complaints will initially be dealt with by the Proponent, with advice and assistance from the City of Albany Environmental Health and/or Planning Officer, where necessary. A register of complaints will be kept.	Proponent and City of Albany
14	Application of lime to ROP areas and locations where litter is spread, to aid in the retention of phosphorus.	Proponent.
15	Drainage and run-off management measures will be implemented as rotational areas are developed. Erosion will be managed by use of suitable management devices (Appendix N).	Proponent.

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FIGURE 1 - REGIONAL LOCATION

SLT2021-001_EMP_002_mp-l01.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

Aurora environmental
ASSESS • ADVISE • APPLY

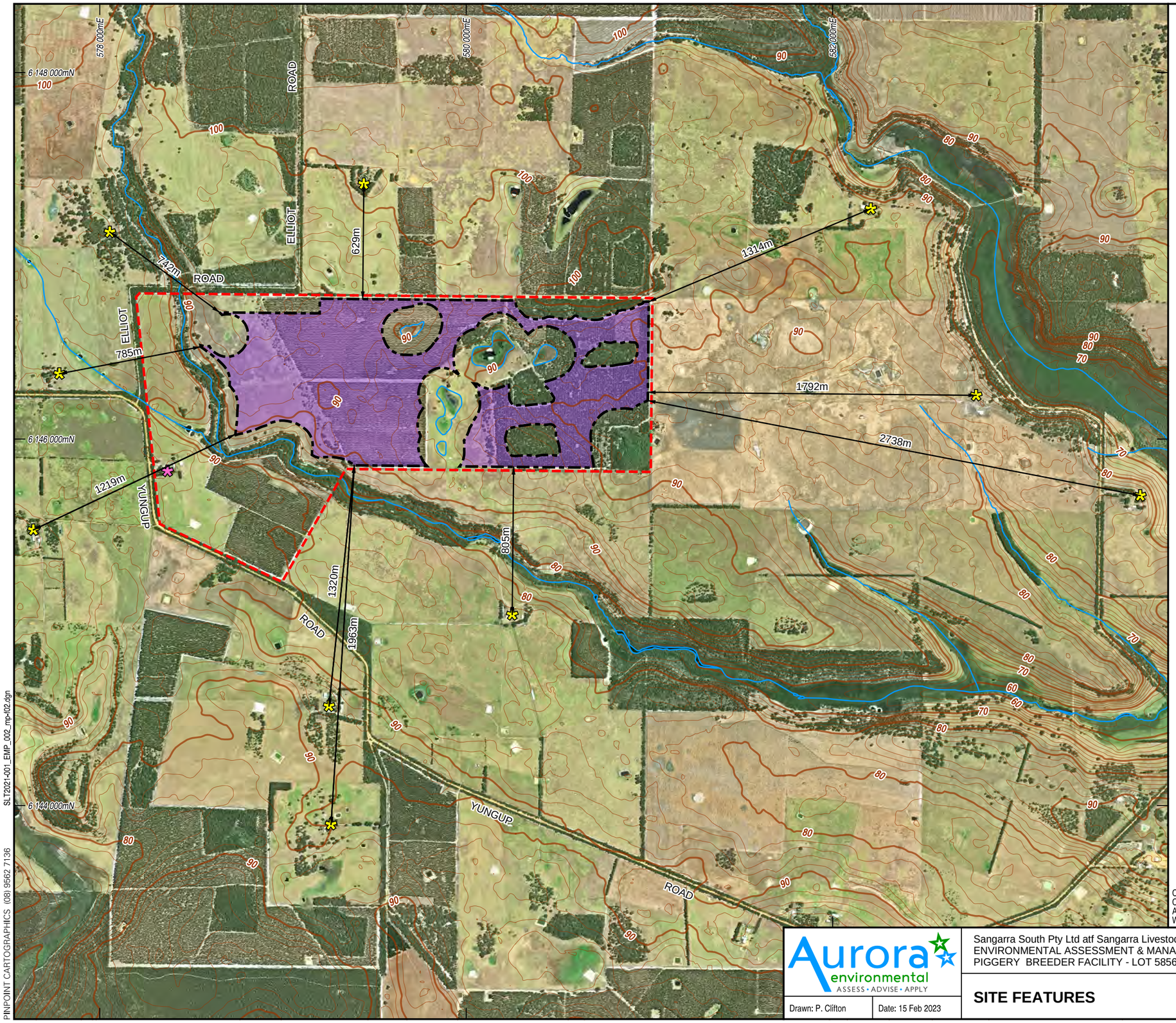
Sangarra South Pty Ltd atf Sangarra Livestock Trust
ENVIRONMENTAL ASSESSMENT & MANAGEMENT PLAN - OUTDOOR ROTATIONAL PIGGERY BREEDER FACILITY - LOT 5856 (NO. 1028) YUNGUP ROAD, NARRIKUP

Figure 1

REGIONAL LOCATION

Drawn: M. Price | Date: 12 Oct 2021 | Job: SLT2021-001

FIGURE 2 - SITE FEATURES



N

0 200 400 600 800 1000m

SCALE 1 : 20 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Topographic Contour
- Watercourse
- Rural Dwelling
- Dwelling Within Subject Land
- Combined Buffer
- Land to be Used as Rotational Outdoor Piggery (ROP)

Buffers required:

National Environmental Guidelines for Piggeries (Australian Pork Limited (Tucker et al., 2010))
- Public road carrying < 50 vehicles per day 100m
- Public road carrying > 50 vehicles per day 200m
- Property boundary 20m

Department of Agriculture and Food (2000) Environmental Guidelines for New and Existing Piggeries Bulletin 4416
- Isolated rural dwellings 300 m
- Neighbouring rural property boundaries 50 m
- Major water course 100 m
- Minor water course 50 m

CONTOUR SOURCE: Dept. of Agriculture, 2000.
CADASTRAL SOURCE: Landgate, October 2021.
AERIAL PHOTOGRAPH SOURCE: ESRI, January 2020.
WATERCOURSE SOURCE: Landgate 1:50 000 topographic mapping.

PINPOINT CARTOGRAPHICS (08) 9562 7136 SLT2021-001_EMP_002_mp-f02.dgn

Aurora environmental ASSESS • ADVISE • APPLY

Drawn: P. Clifton | Date: 15 Feb 2023

Sangarra South Pty Ltd atf Sangarra Livestock Trust
ENVIRONMENTAL ASSESSMENT & MANAGEMENT PLAN - OUTDOOR ROTATIONAL PIGGERY BREEDER FACILITY - LOT 5856 (NO. 1028) YUNGUP ROAD, NARRIKUP

SITE FEATURES

Figure 2

Job: SLT2021-001

APPENDIX A - PLANNING PRINCIPLES CHECKLIST

2 Planning Principles

The following planning principles can apply to new developments, expansions or changes in material use at piggeries. The first step in planning involves the identification of any land use or zoning issues from local government, and the state government agencies responsible for piggery licensing and approval, water licensing, soil conservation and vegetation clearing. Consultation with the relevant agencies, ideally through a pre-lodgement, on-site meeting, helps to determine if the site is suitable, and the major issues to be addressed in an application. These issues are listed below in a checklist.

The next step is to gather and compile the information. As the National Guidelines provide recommended siting, design and management information, they can be used to assemble the supporting information for a piggery development application. Submission of application forms and supporting information, advertising the development and formal assessment, will follow. For large or complex applications, professional assistance may be necessary.

ISSUES	CHECK
Applicant details	
Site description (including plans) and assessment	
Real property description	
- Land tenure	
- Land area	
- Cadastral plan	
Land zoning, and zoning of the surrounding land	
Climatic data	
- Median annual rainfall	
- Average monthly rainfall	
- Rainfall intensity data (1-in-20-year design storm, 1-in-20-year 24-hour storm)	
- Average monthly evaporation	
- Monthly maximum and minimum temperatures	
- Wind speed and direction	
Soil description for the piggery complex site (including analysis of basic physical properties) and reuse areas (including analysis of basic chemical and physical properties)	
Description of groundwater resources and geology of the site	
- Details of any bores on the subject property	

PLANNING PRINCIPLES (continued)

ISSUES	CHECK
- Analysis of the chemical properties of groundwater for use in piggery	
- Details of any licenses held	
Description of surface water resources on the property or in the vicinity of property	
- Analysis of the chemical properties of surface waters for use in piggery.	
- Details of any licenses held	
Description of the current vegetation of the site and the extent of any proposed clearing	
Identification of any items, sites or places that may have cultural heritage significance	
Description of the proposed piggery operation	
Total pig or standard pig unit (SPU) numbers	
- herd composition	
- numbers and weights of incoming and outgoing stock	
- sources of stock	
Description of housing and layout plans	
Water requirements for drinking, cooling, cleaning and shandying with effluent, and water sources and quality	
Bedding requirements and bedding sources	
Feed requirements, sources and storage areas	
Staff numbers	
Hygiene practices	
Prediction of manure production and mass balance estimate of the nutrient content of solid and liquid by-products	
Design of effluent collection, pre-treatment and treatment system, including plans	
Sizing and proposed management of the reuse areas, including location, area, method, frequency and general management of spreading/irrigation activities	
Description of carcass management or disposal, including plan for mass mortalities	
Calculation of traffic numbers and consideration of access and road safety. There is also a need to negotiate with state or territory and local governments regarding road upgrading and maintenance responsibilities	

PLANNING PRINCIPLES (continued)

ISSUES	CHECK
Environmental impact assessment	
Community amenity impacts - particularly odour, dust, noise, traffic Calculate separation distances to sensitive receptors	
Surface water impacts – quality and availability for other potential users	
Groundwater impacts – quality and availability for other potential users	
Vegetation impacts – effects of clearing on rare and threatened species and communities	
Impacts on items, sites or places of cultural heritage significance	
Impacts to soils of reuse areas	
Summary of design and management features to minimise adverse environmental impacts	
Proposed environmental monitoring and reporting	
Environmental Management Plan (EMP) - An EMP focuses on the general management of the whole farm, taking into account the environment and associated risks. It should document design features and management practices; identify risks and mitigation strategies; include ongoing monitoring to ensure impacts are minimised; and processes for continual review and improvement	
Plans including:	
Topographic plan - showing watercourses and drainage lines; flood lines, protected land; and location of nearby residences	
Recent aerial photograph	
Farm plan – showing current land uses; proposed piggery complex location; proposed carcass composting or burial site; proposed reuse areas; on-farm roads; location of on-farm bores; and location of any soil conservation or drainage works	
Piggery complex layout plan - including location of by-products treatment and storage facilities	
Effluent treatment ponds plan - (if applicable)	
Separation and buffer distances plan - showing location of piggery complex (including feed storage; and by-products storage and treatment facilities) and reuse areas; and distances to sensitive land uses e.g. houses and towns, as well as buffers around sensitive natural resources	

APPENDIX B - AUSTRALIAN PORK INDUSTRY QUALITY ASSURANCE PROGRAM (APIQ™)

1.2 Free Range Production Requirements

Standard	The piggery production system complies with the APIQ✓® definition and standards for 'Free Range' (FR).

Performance indicators:

A. Weaners and growers and the sows from which they were bred have access to paddocks at all times for their entire life.

Where pigs are confined temporarily for vaccinations, mating or under veterinary advice, systems are in place which support the need for confinement.

B. Shelter is available to provide protection from the elements at all times.

Steps are taken to minimise the risks to pigs from predators.

All pigs are able to move freely in and out of shelter provided.

Bedding is provided in the shelters.

C. Suitable paddocks with rooting and/or foraging areas are available to pigs at all times.

Wallows are provided where state regulations and the season permits.

D. Shelter provided for weaners and growers meets the space allowance standards of the *Model Code*, 3rd edition, 2007, Appendix 3, Table 5.

E. Shelter for dry sows in groups, lactating sows with piglets and boars meet the space allowance in the *Model Code,* 3rd edition, 2007, Appendix 3, Table 8.

1.2.1 Soil Monitoring Standard

Standard	**Sampling and analysis of soils is either:** - **Done in accordance with the conditions of a licence, approval or consent that requires specific soil monitoring but at least every two years; OR** - **Done before pigs move onto that land if the pig phase is expected to exceed 24 months in length; AND** - **At the end of any 24 month period in which pigs are stocked on an area for any length of time and at the end of each subsequent 24 months that includes a pig phase; AND** - **Samples are collected from the expected nutrient-rich area of each block of paddocks.**

Performance indicators:

A. Soil sampling produces a set of samples that is representative of the expected nutrient-rich area of each block of paddocks[1] by:

- drilling at least ten holes from dispersed locations between the shelter/s and the feeding and watering points from a block of paddocks; **AND**
- bulking the samples of soils collected from common depths to produce a single composite sample for each depth from all blocks of paddocks sampled (i.e. a bulked top soil, subsoil and profile sample).

B. Soil sampling occurs

- before the commencement of each pig phase that is expected to exceed 24 months in length; **AND**
- at the end of any 24 month period in which pigs are stocked on an area for any length of time; **AND**
- at the end of any subsequent 24 month period that includes a pig phase.

C. Soil sampling depths and analysis parameters are either in accordance with the conditions of a planning or development consent, approval, permit or licence; **OR**

if not stipulated, in accordance with the following:

Soil test parameter	Depth
pH	0-0.1 m 0.3-0.6 m OR bottom 0.3 m of soil profile OR 0.3 m to base of root zone
Electrical conductivity	0-0.1 m 0.3-0.6 m OR bottom 0.3 m of soil profile OR 0.3 m to base of root zone
Nitrate-nitrogen	0-0.1 m 0.3-0.6 m OR bottom 0.3 m of soil profile OR 0.3 m to base of root zone
Available phosphorus	0-0.1 m 0.3-0.6 m OR bottom 0.3 m of soil profile OR 0.3 m to base of root zone
Phosphorus buffer capacity or phosphorus sorption index	0-0.6 m OR 0 m to base of soil profile OR 0 m to base of root zone
Potassium	0-0.1 m 0.3-0.6 m OR bottom 0.3 m of soil profile OR 0.3 m to base of root zone
Organic carbon	0-0.1 m
Exchangeable cations and CEC	0-0.1 m 0.3-0.6 m OR bottom 0.3 m of soil profile OR 0.3 m to base of root zone

1 A block of paddocks is defined as a group of adjacent paddocks used simultaneously to run pigs. For piggeries that operate with a radial paddock system, one radial would constitute a block of paddocks. Similarly, if a piggery uses eight adjacent rectangular paddocks at a time this would constitute a block of paddocks.

1.2.2 Nutrient Management Standard

Standard	**If the pig phase is expected to last for 24 months or longer, the results of soil testing show that soil nutrients are at suitable levels before the pigs move onto a land area; AND** **The results of soil testing undertaken at the end of any 24 month period that includes a pig phase show that soil nutrients are at suitable levels for the area to be used for ongoing or subsequent pig phases.**

Performance indicators[2]:

A. Before the commencement of a pig phase expected to exceed 24 months in length, the results of soil testing show that:

- the soil properties are below the trigger values suggested as indicators of sustainability in section 17.5.4 of the *APL National Environmental Guidelines for Piggeries*, Second Edition (Revised) Published in 2011; **OR**
- the soil properties are similar to; i.e. no more than 30% greater[3] than those of a representative background plot[4]; **OR**
- the soil properties are satisfactory to the licensing authority or an independent soil scientist or agronomist[5].

B. The results of soil testing undertaken on areas that have included a pig phase over any part of any 24 month period show that:

- the soil properties are below the trigger values suggested as indicators of sustainability in section 17.5.4 of the *APL National Environmental Guidelines for Piggeries*, Second Edition (Revised) Published in 2011; **OR**
- the soil properties are similar to; i.e. no more than 30% greater[3] than those of a representative background plot; **OR**
- the soil properties are satisfactory to the licensing authority or an independent soil scientist or agronomist.

2 A Nutrient Management Plan (NMP) is not specifically included as a Performance Indicator. However, it is valuable to develop and implement a NMP to ensure the soil nutrient properties required by the Performance Indicators can be achieved.

3 APIQ✓® FR and OB Standards Guide for Producers and Auditors.

4 A representative background plot is an area of land that has a similar soil type and is physically close to the land being monitored, that is sampled and analysed at the same time, to provide a basis for comparison when interpreting soil test results. It should not have been used for outdoor pig production, irrigated with effluent or spread with manure, or recently had fertiliser applied. It is recognised that it is not always easy to find a suitable background plot. The location of the representative background plot should be carefully noted as samples should be collected from the same location each time.

5 It is the farm's responsibility to ensure that their business complies with the permit/licensing arrangements required by their state authority/local council.

1.2.3 Promoting Even Nutrient Distribution Standard

Standard	Facilities and practices are actively managed to promote dispersal of manure nutrients over the paddock area.

Performance indicators:

A. For breeder paddocks:

- readily movable structures that could include shelters, shade, feeding points, waterers, wallows and spray or drip cooling facilities are moved within the paddock at least every six months to promote more even manure deposition over the land; **OR**
- feed is always delivered right along the length of a paddock perimeter fence line or dispersed over a significant part of the paddock area and feeding areas are well separated from shelters; **OR**
- when the length of the pig phase is less than six months, readily movable structures that could include either shelters, shade, feeding points, waterers, wallows and spray or drip cooling facilities are located in different positions before the return of pigs to the area.

B. For grower paddocks:

- readily movable structures that could include shelters, shade, feeding points, waterers, wallows and spray or drip cooling facilities are moved within the paddocks at least every three months to promote more even manure deposition over the land; **OR**
- feed is always delivered right along the length of a paddock perimeter fence line or dispersed over a significant part of the paddock area and feeding areas are well separated from shelters or these feeding areas are moved to a new location at least every three months; **OR**
- before the return of pigs to the area and when the length of the pig phase is less than three months, readily movable structures that could include shelters, shade, feeding points, waterers, wallows and spray or drip cooling facilities are moved to different positions within the paddock.

C. If significant quantities of spent bedding are produced from shelters, this material is:

- dispersed over land within the pig paddocks that is not within the expected nutrition rich areas that are bounded by the shelters, shade, feeding points, waterers, wallows and spray or drip coolers; **OR**
- removed from the pig paddocks for spreading on other parts of the farm or for reuse off-farm.

1.2.4 Land and Water Protection Standard

Standard	**Land and water are protected by minimising soil erosion throughout both the pig and the crop, forage or pasture phases of the rotation; by rehabilitating the site after the pig phase; by using water protection measures; and by properly constructing and managing wallows.**

Performance indicators:

A. Land is managed to minimise soil erosion by:

- selecting sites with a flat to gentle slope; **AND**
- maintaining sufficient groundcover[6] over paddocks as much as practical throughout both the pig and the crop, forage or pasture phases to minimise erosion; **AND / OR**
- installing and maintaining properly designed shelter belts and / or filter strips and / or contour banks in blocks of paddocks.

B. Each block of paddocks is examined:

- on completion of the pig phase; **OR**
- where the pig phase exceeds 24 months in length the paddocks are examined at least every 24 months; **AND**
- any soil erosion or structural issues that need addressing are identified; **AND**
- a plan to address these is developed and implemented within three months of the completion of the examination.

C. Where significant soil compaction has resulted from the pig phase, the site is remediated by:

- only cultivating the soil when the moisture content is between wilting point and field capacity; **AND / OR**
- growing pasture ley crops (ungrazed); **AND / OR**
- deep ripping the soil (if this is a suitable measure for the soil type); **AND / OR**
- applying gypsum to the soil (if this is a suitable measure for the soil type).

D. Removal of nutrients in stormwater runoff is minimised by:

- maintaining groundcover over paddocks throughout both the pig and the crop, forage or pasture phases; **AND / OR**
- maintaining a continuous resilient vegetative buffer strip ideally consisting of a runner developing, non-clump forming grass species at least 10 m wide immediately downslope of the entire paddock area/s; **OR**
- installing terminal ponds sized and located to catch the first 12 mm of runoff from the piggery paddocks and other land within the same local catchment area.

E. Sites selected for wallows have loam to clay soils or the base of the wallow is lined with compacted clay.

6 Groundcover is any material on or near the soil surface that provides protection for the soil against the erosive action of rainfall runoff or wind. It may include plant material (alive or dead), spent bedding and other cover materials providing these will not be carried away in rainfall runoff or blown away by the wind. Since attached plant material is more effective than dead plant material or other light matter lying on the soil surface it is recommended that it make up the majority of the groundcover.

F. Wallows are remediated when they are replaced and if needed within three months of completion of the pig phase by:

- deep ripping the soil; **AND / OR**
- applying gypsum to the soil (if these are suitable measures for the soil type); **AND**
- filling with soil; **AND**
- levelling to match the slope of the immediately surrounding land.

G. A forage crop or pasture is given time to establish before the commencement of a pig phase.

NOTE: Only producers who meet the full set of APIQ✓® FR Standards will be APIQ✓® FR certified. Those producers who meet Standards 1.2A to 1.2E and are able to demonstrate that they are in the process of addressing Standards 1.2.1 to 1.2.4, will be certified as Conditional APIQ✓® FR. A producer with Conditional APIQ✓® FR certification has until close of business (COB) 30 April 2014 to comply with all APIQ✓® FR Standards at which time APIQ✓® Certification Policy 9 (CP9), Producer APIQ✓® Certification Status and non compliance to APIQ✓® Standards, comes into effect.

1.3 Outdoor Bred Production Requirements

Standard	The piggery production system complies with the APIQ✓® definition and standards for 'Outdoor Bred' production. Production is carried-out according to accepted Good Agricultural Practices (GAP) for the production of Outdoor Bred pigs.

Performance indicators:

Sows and piglets are managed as per Free Range Standards until weaning (see 1.2 B – E)

A. The piglets up until weaning and the sows from which they are bred have access to paddocks at all times.

   Where pigs are confined temporarily for vaccinations, mating or under veterinary advice systems are in place which support the need for confinement.

B. At weaning piglets are transferred to deep litter housing, intensive indoor housing, or feedlot outdoor pens for growing and/or finishing.

Note: Additional standards for outdoor bred piggeries are being developed and will be available once approved.

APPENDIX C - APIQ™ STANDARDS SITE SELECTION CHARACTERISTICS

7 Site Selection

Environmental Outcome: Protection of natural resources and the community through good piggery siting.

Environmental advisers can provide guidance on the suitability of a proposed site for an outdoor piggery. The main factors to consider include:

- statutory land use planning restrictions
- availability of suitable land area
- suitable road access
- availability of a reliable water supply
- climate
- the site's natural resources
- possible effects on community amenity or cultural heritage
- any possible future expansion plans.

Each of these factors is discussed below.

7.1 Planning Restrictions

The suitability of a farm for a rotational outdoor piggery depends on its land use, zoning and any legal constraints. The current and future land zoning of the property and surrounding land should be discussed with the local government authority to confirm the long-term suitability of the zoning. Environmental advisers can identify state and territory department planning controls.

7.2 Available Land Area

The farm must be large enough to accommodate all of the paddocks and related facilities needed for the pig phase. Generally, there will need to be sufficient space for future pig phases although some herds move from one farm to the next on completion of the pig phase. Owning land around the piggery complex prevents encroachment by nearby developments and offers options for providing separation distances and buffers to sensitive areas or features. The shape of the property and other physical constraints also influence both the piggery layout and the separation distances and buffers to nearby sensitive land uses and features.

7.3 Suitable Road Access

Piggery roads must provide all-weather access for trucks. It is very important to consider safety when selecting and designing property access points. Farm access points should provide good visibility in both directions and allow for safe entry and exit by vehicles. Where alternative routes are available, consider those that avoid passing nearby houses and other sensitive locations like schools, bus pick-up points, halls and community areas. Selecting routes with sealed roads may reduce the impact of dust at nearby houses and have lower maintenance requirements.

7.4 Availability of a Suitable Water Supply

Rotational outdoor piggeries need water for stock consumption, wallows and possibly for spray or drip cooling and dust control.

Water licensing and allocation conditions vary between states and territories, and regions within them. It is essential to confirm that water can legally be used in a piggery. The holding of a water allocation may not guarantee the supply of that volume. Pump testing of bores is recommended.

Water quality influences herd health and performance. Potential water sources should be analysed to identify suitable supplies. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000) provide specific guidance on water quality for stock drinking and irrigation purposes. A pig husbandry or veterinary consultant can also advise on drinking water suitability.

7.5 Climate

Temperature and rainfall should be considered when selecting a site for an outdoor piggery.

In general, outdoor piggeries are better suited to temperate climates. The risk of the heat wave conditions linked to summer infertility is lower if the mean maximum summer temperatures are less than 28°C. A location in which the mean minimum winter temperatures exceed 3°C has a lower likelihood of water pipelines freezing and provides a more comfortable environment for stock and staff. Sites with an annual rainfall of less than 760 mm are generally preferable (McGugan & Fahy n.d.).

Based on these climatic constraints, ideal locations for outdoor piggeries are limited to the south coast of New South Wales; northern Gippsland and south-western Victoria, the Eyre Peninsula and south-eastern South Australia; and parts of the lower south-west, great southern and south-eastern regions of Western Australia (see Figure 1). However, outdoor piggeries can operate in other climates with good design and management. Consult pig production experts about design and husbandry recommendations for other locations.

FIGURE 1 **Ideal climatic locations for outdoor piggeries**

Source: McGugan & Fahy (n.d.)

7.6 Natural Resources

7.6.1 Topography

Gently sloping or undulating sites promote good drainage in outdoor piggeries. Flat sites may be subject to localised flooding or waterlogging. Sites with a steeper slope may promote soil erosion and nutrient loss through both erosion and stormwater runoff. The ideal slope depends on soil type, the amount of vegetative cover it is possible to continuously maintain and soil conservation measures.

Topographical barriers (hills, ridges etc) between the piggery and sensitive locations are desirable. For some, the sight of a piggery is not aesthetically pleasing. For others, it is a reminder of the presence of a piggery, which may trigger complaints. Undesirable sites are often elevated and cleared providing a clear line of sight between nearby roads or neighbouring houses and the piggery.

7.6.2 Soils

Suitable soils provide acceptable paddock conditions for stock in wet weather, can be formed into all-weather roads, can grow pastures, forage or crops that can be harvested and removed from the site, have low erosivity and have a reasonable water holding capacity. Heavy clays are often unsuitable as they tend to stay wet and get puggy after wet weather. They may also be prone to compaction. Very sandy soils are also unsuitable as they drain rapidly which may move nutrients below the root zone of future crops, posing a risk to groundwater.

7.6.3 Water

The piggery site should be well separated from watercourses and other surface waters to protect water quality. However, buffers alone are insufficient and good nutrient management is also needed to ensure surface waters are protected.

Rotational outdoor piggeries should be sited above the 1 in 100 year flood line since flooding may not only harm the operation, but also cause surface water contamination. Information on land submerged by a 1 in 100-year flood is available from the local government authorities, or state water resources agencies.

Consider groundwater vulnerability when selecting a site for a rotational outdoor piggery. Ideally groundwater should be reasonably deep and stored within a confined aquifer or well protected by a clay layer. Avoid sandy soils, particularly if there is shallow groundwater. Good nutrient management is also necessary to protect groundwater quality.

7.6.4 Flora and Fauna

Avoid areas of remnant vegetation, wildlife habitats and natural wetlands for rotational outdoor piggeries. Pigs can quickly destroy trees, shrubs and other vegetation by chewing, rooting, soil compaction and nutrient deposition. Tree guards can reduce physical damage. Consult relevant local, state and territory authorities to determine specific restrictions on tree clearing.

7.7 Community Amenity

Good site selection is fundamental to minimising community amenity impacts. Fortunately, APL-funded research has shown that rotational outdoor piggeries produce very low levels of odour, dust and noise. Providing appropriate separation distances between FR or OB piggeries and nearby sensitive land uses offers additional protection. Section 8.2 provides information on recommended separation distances.

However, appropriate layout, design, management and a good communication strategy are also necessary to prevent conflicts with neighbours. Conflicts arising from amenity issues are often very emotive, and the people involved sometimes experience great personal stress. Hence, it is important to prevent and quickly resolve conflicts.

Since the public sometimes perceives piggeries negatively, it is desirable to screen the piggery complex from public view. This can be challenging given that rotational outdoor piggeries can cover large areas. Take advantage of the topography and existing vegetation where possible.

Landscaping can improve the aesthetics of FR or OB piggeries. It can also conceal the piggery from nearby roads or sensitive land uses. If the piggery is clearly visible from nearby houses or roads, consider planting groves of indigenous trees and shrubs along property boundary fences and waterways.

7.8 Cultural Heritage

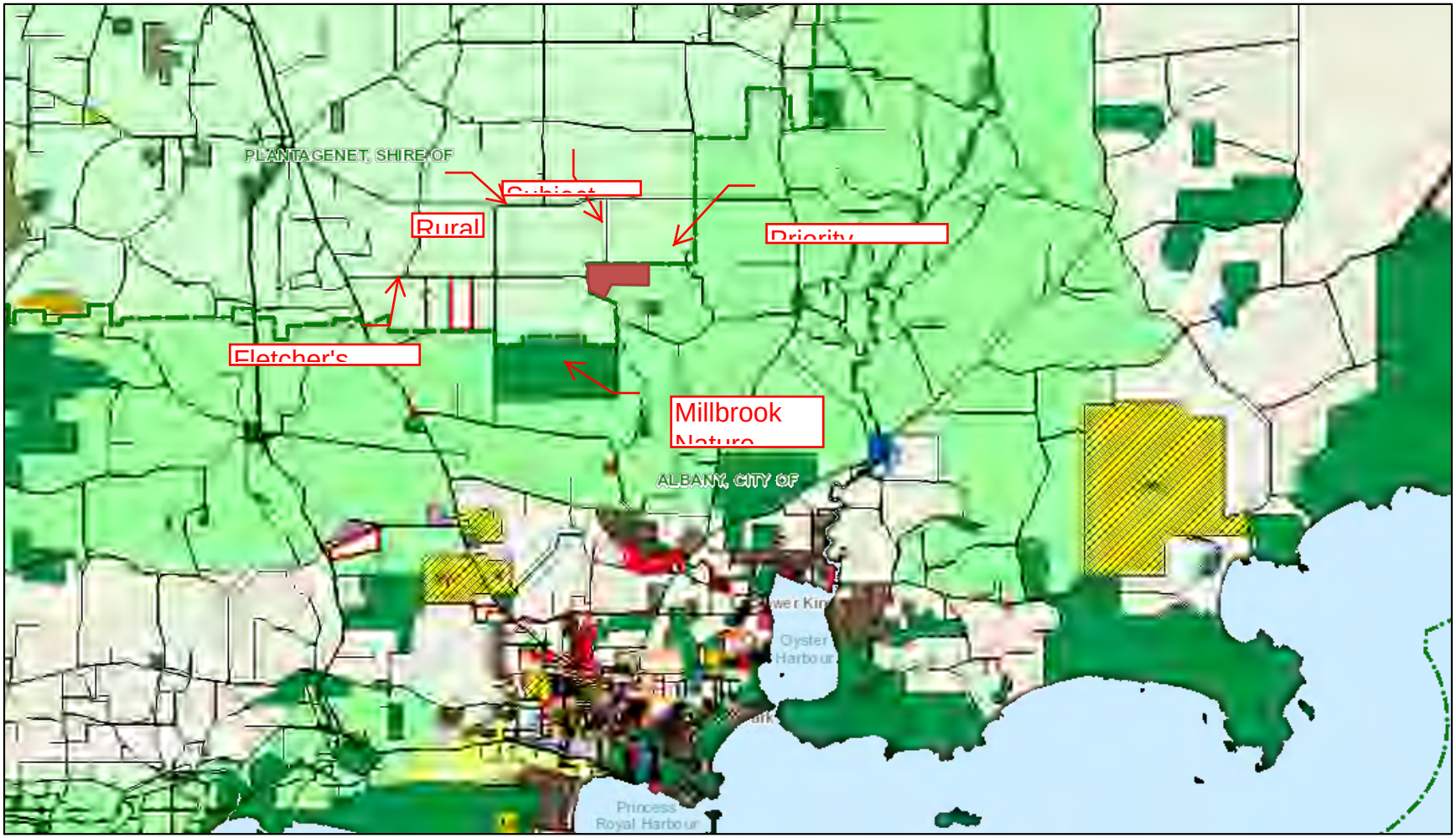
Items, sites or places of Aboriginal or European cultural significance must be considered when selecting a piggery site. If artefacts are found consult the appropriate bodies, including the traditional land owners, to determine the most suitable course of action. The issue may be resolved by properly recording, preserving or relocating special objects to allow development to proceed, or, in rare cases, permanently sectioning off parts of the property to prevent any potential detrimental effects.

7.9 Future Expansion Plans

During the site selection process, consider any possible future expansion plans. In particular, take into account the land area needed for additional paddocks, and for buffers and separation distances to sensitive land uses.

APPENDIX D - ZONING

Local Planning Schemes



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0 3.25 6.5 13 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community, SLIP/LANDGATE, SLIP/Landgate

Aurora Environmental

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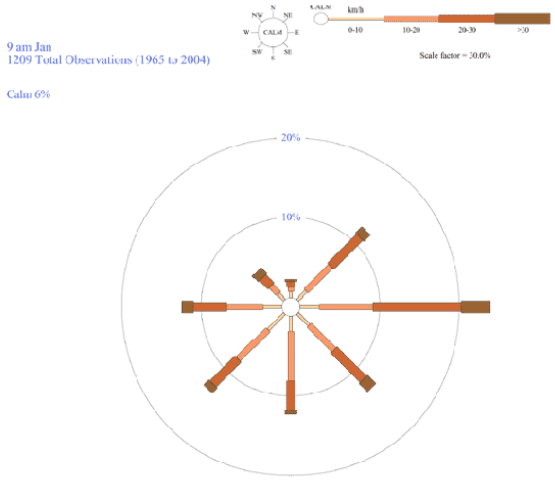
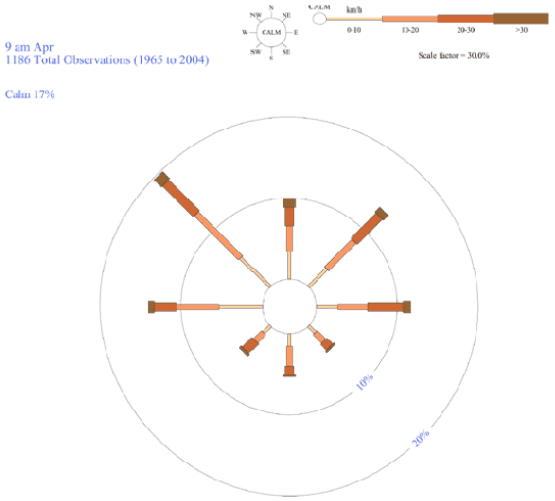
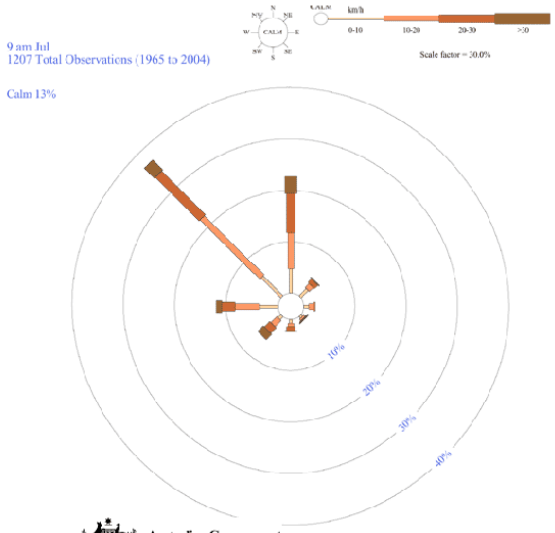
APPENDIX E – WIND ROSES (ALBANY) – BUREAU OF METEOROLOGY

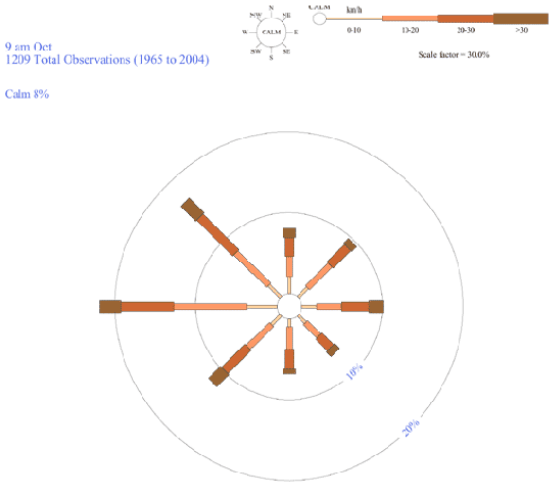
Appendix C: Albany Wind Roses

Wind Roses for Albany Airport at 9am



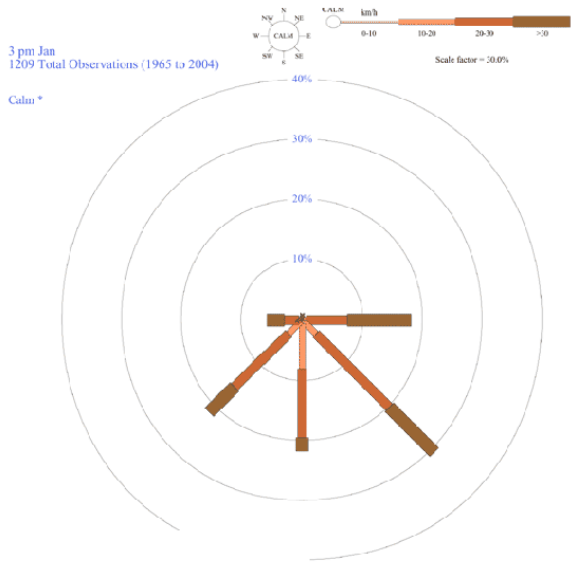


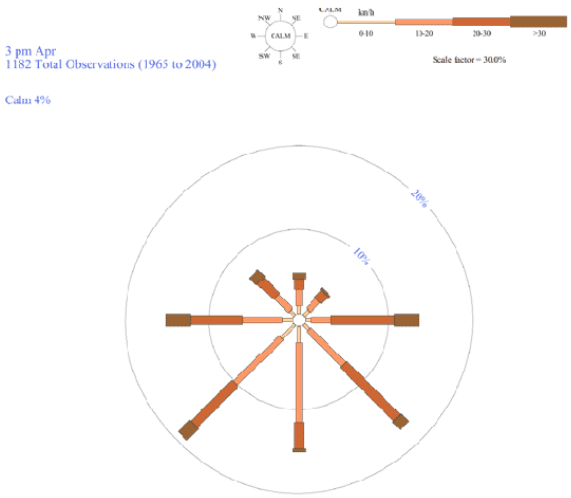


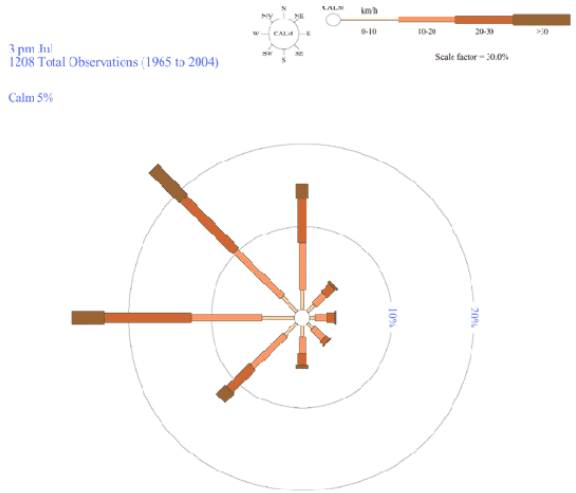


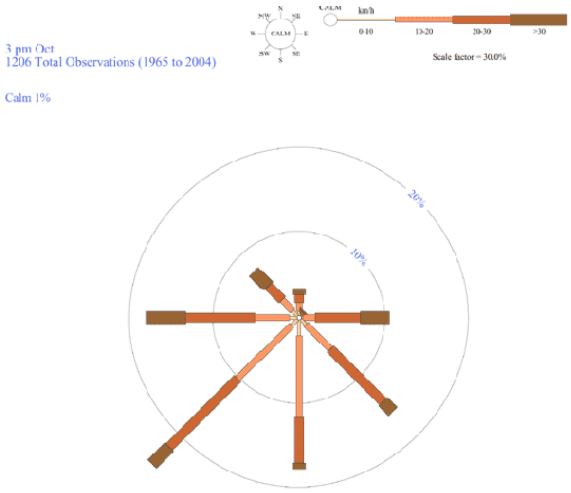
Australian Government
Bureau of Meteorology

Wind Roses for Albany Airport at 3pm









Australian Government
Bureau of Meteorology

APPENDIX F – SITE PHOTOGRAPHS

Photo 1:

Location of Sampling Site SLT001

Photo 2:

Soil profile of SLT001

Environmental Assessment and Management Plan - Outdoor Rotational Piggery – Breeder Facility -Lot 5856 (No. 1028) Yungup Road, Napier - City of Albany	Aurora environmental

Photo 3

Location of Sample SLT002

Photograph 4

Soil profile SLT002

Photograph 3

Location SLT003

Photograph 6

Profile SLT003

Photograph 7

Location SLT004

Photograph 8

Profile SLT004

Photograph 9

Dam to the west of SLT002. The dam has been incorporated into a buffer of 100m

Photograph 10

Lateritic pavement associated with Dam west of SLT002

APPENDIX G - PHOSPHORUS BUFFERING INDEX

Analysis Results

CSBP Soil and Plant Laboratory

86486
Aurora Environmental (Albany)

		Lab No	5SS21096	5SS21103	5SS21104	5SS21105	5SS21106	5SS21107	5SS21108	5SS21109
		Name	SLT001	SLT001	SLT002	SLT002	SLT003	SLT003	SLT004	SLT004
		Code	14/10/21	14/10/21	14/10/21	14/10/21	14/10/21	14/10/21	14/10/21	14/10/21
		Customer	Aurora Environmental	Aurora Environmental	Aurora Environmental	Aurora Environmental	Aurora Environmental	Aurora Environmental	Aurora Environmental	Aurora Environmental
		Depth	0-10	30-40	0-20	40-50	0-10	80-100	0-10	50-80
Phosphorus Colwell	mg/kg		10	3	10	4	8	2	< 2	3
Potassium Colwell	mg/kg		48	278	58	30	50	22	67	27
PBI			52.2	155.2	40.4	60.5	6.1	19.3	18.3	32.7

CSBP Lab. Extract Value.

APPENDIX H - PERMEABILITY RESULTS

Job No.: SLT2021-001
Lot 5856 (No. 1028) Yungup Road,
Site: Narrikup **Zone:** 50H
Location ID: SLT001 **Northing:** 6146343
Operator: MP **Easting:** 578897
Date: 12/10/2021 **Slope:** Flat, gently undulating
Elevation approximately 90 m AHD
Vegetation: Pasture
Soil structure:

Depth	**Soil Description**
0 - 0.2 m:	Dark brown grey gravelly sand
0.2 – 0.75	Sandy yellow clay, becoming dense and stiff at 0.75 m (refusal).

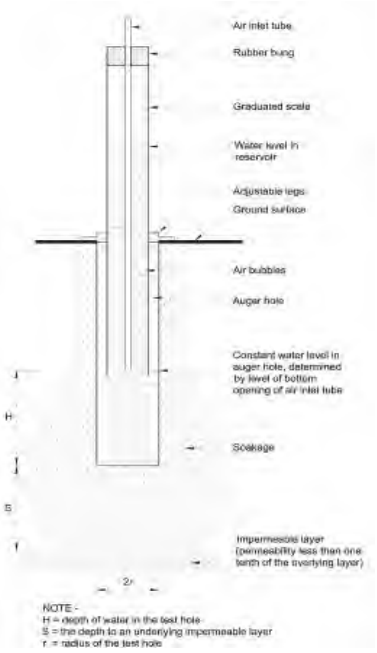
Average time to fall 10cm:	5500.00	sec
Depth of water in hole:	50	cm
Diameter of test hole:	8	cm
Depth to impermeable layer:	0	cm
Diameter of water reservoir:	6	cm
Diameter of air inlet tube:	0.8	cm

The method of calculation is taken from AS 1547:2000 On-site Domestic Wastewater Management

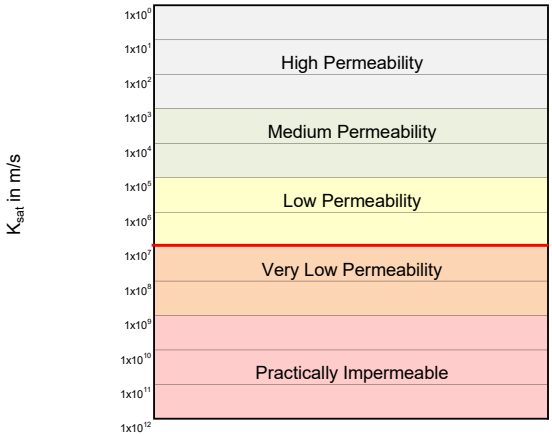
$$K_{sat} = \frac{4.4Q\left[0.5\sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\left(\frac{r}{H^2}\right) + 0.25\right\}} + \frac{r}{H}\right]}{2\pi H^2}$$

where

K_{sat} = saturated hydraulic conductivity of the soil in cm/min
4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation
Q = rate of loss of water from the reservoir in cm^3/min
H = depth of water in the test hole in cm
r = radius of the test hole in cm



Rate of water loss		**Saturated hydraulic conductivity**	
Q=	0.0001 L/sec	K_{sat}=	0.00 cm/min
Q=	3.0 cm^3/min	K_{sat}=	0.01 m/day
		K_{sat}=	1.19E-07 m/sec



Job No.: SLT2021-001

Site: Lot 5856 (No. 1028) Yungup Road, Narrikup

Location ID: SLT002

Operator: MP

Date: 12/10/2021

Zone: 50H

Northing: 6146554

Easting: 578784

Slope: Flat, gently undulating

Elevation approximately 90 m AHD

Vegetation: Pasture

Soil structure:

Depth	Soil Description
0-0.15 m:	Dark brown/grey clayey sand with organic matter
0.1 – 0.3 m	Gravelly clayey sand with refusal at 0.4m due to gravel

Average time to fall 10cm:	392.86	sec
Depth of water in hole:	50	cm
Diameter of test hole:	8	cm
Depth to impermeable layer:	0	cm
Diameter of water reservoir:	6	cm
Diameter of air inlet tube:	0.8	cm

The method of calculation is taken from AS 1547:2000 On-site Domestic Wastewater Management

$$K_{sat} = \frac{4.4Q\left[0.5\sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\left(\frac{r}{H^2}\right)+0.25\right\}} + \frac{r}{H}\right]}{2\pi H^2}$$

where

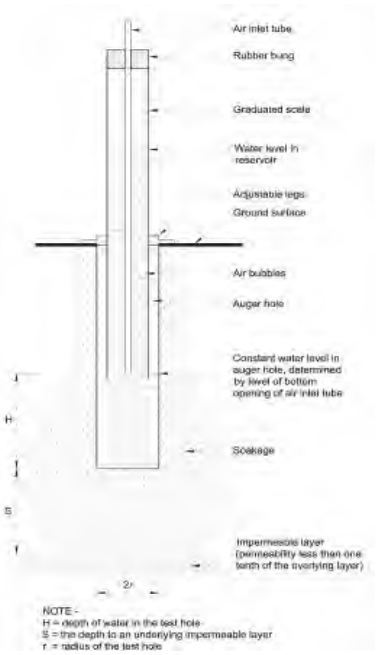
K_{sat} = saturated hydraulic conductivity of the soil in cm/min

4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation

Q = rate of loss of water from the reservoir in cm^3/min

H = depth of water in the test hole in cm

r = radius of the test hole in cm



Rate of water loss

Q= 0.0007 L/sec

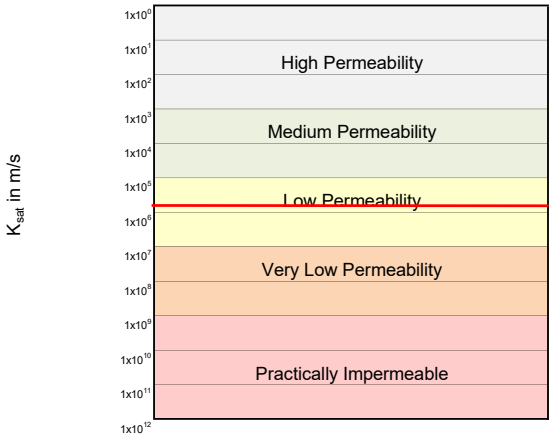
Q= 42.4 cm^3/min

Saturated hydraulic conductivity

K_{sat}= 0.01 cm/min

K_{sat}= 0.14 m/day

K_{sat}= 1.67E-06 m/sec



Job No.: SLT2021-001

Lot 5856 (No. 1028) Yungup Road,

Site: Narrikup **Zone:** 50H

Location ID: SLT003 **Northing:** 6146687

Operator: MP **Easting:** 579334

Date: 12/10/2021 **Slope:** Flat, gently undulating

Elevation approximately 90 m AHD

Vegetation: Bluegum Plantation

Soil structure:

Depth	Soil Description
0 – 0.1 m	Grey fine sand with organic matter
0.1 – 0.3 m	Grey to yellow fine sand with small gravel
0.3- 1.0 m	Sandy gravel becoming increasingly yellow. Refusal due to gravel at 1 m.

Average time to fall 10cm:	59.46	sec
Depth of water in hole:	50	cm
Diameter of test hole:	8	cm
Depth to impermeable layer:	0	cm
Diameter of water reservoir:	6	cm
Diameter of air inlet tube:	0.8	cm

The method of calculation is taken from AS 1547:2000 On-site Domestic Wastewater Management

$$K_{sat} = \frac{4.4Q\left[0.5\sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\left(\frac{r}{H^2}\right)+0.25\right\}} + \frac{r}{H}\right]}{2\pi H^2}$$

where

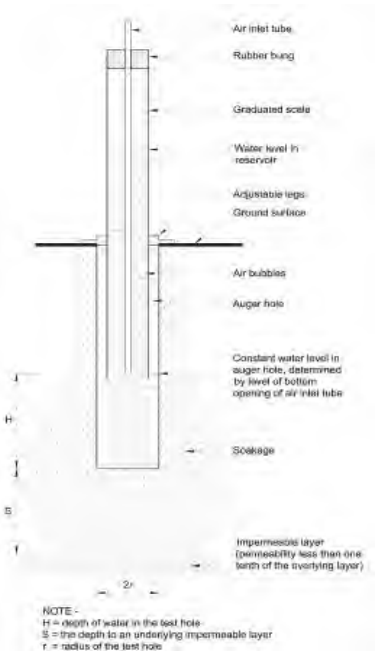
K_{sat} = saturated hydraulic conductivity of the soil in cm/min

4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation

Q = rate of loss of water from the reservoir in cm^3/min

H = depth of water in the test hole in cm

r = radius of the test hole in cm



Rate of water loss

Q= 0.0047 L/sec

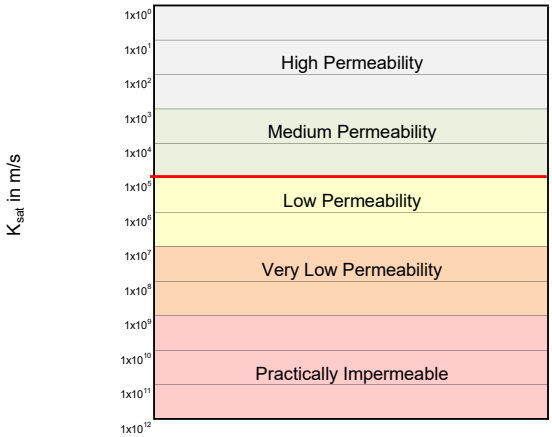
Q= 280.2 cm^3/min

Saturated hydraulic conductivity

K_{sat}= 0.07 cm/min

K_{sat}= 0.95 m/day

K_{sat}= 1.10E-05 m/sec



Job No.: SLT2021-001

Site: Lot 5856 (No. 1028) Yungup Road, Narrikup

Location ID: SLT004

Operator: MP

Date: 12/10/2021

Zone: 50H

Northing: 6146272

Easting: 579657

Slope: Flat, gently undulating

Elevation approximately 90 m AHD

Vegetation: Bluegum Plantation

Soil structure:

Depth	Soil Description
0 – 0.1 m	Grey fine sand with organic matter
0.1 – 0.3 m	Grey to yellow fine sand with small gravel
0.3- 1.0 m	Sandy gravel becoming increasingly yellow. Refusal due to gravel at 1 m.

Average time to fall 10cm:	407.41	sec
Depth of water in hole:	50	cm
Diameter of test hole:	8	cm
Depth to impermeable layer:	0	cm
Diameter of water reservoir:	6	cm
Diameter of air inlet tube:	0.8	cm

The method of calculation is taken from AS 1547:2000 On-site Domestic Wastewater Management

$$K_{sat} = \frac{4.4Q\left[0.5\sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\left(\frac{r}{H^2}\right) + 0.25\right\}} + \frac{r}{H}\right]}{2\pi H^2}$$

where

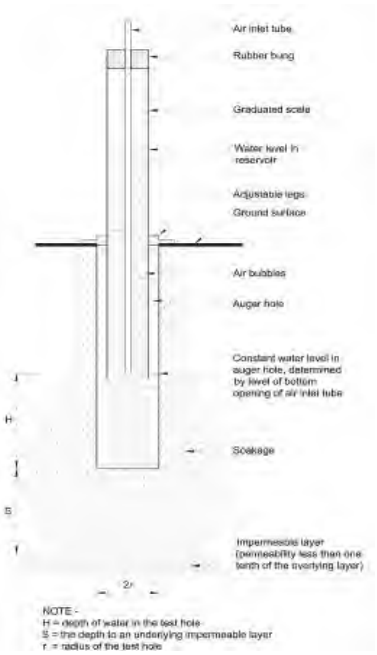
K_{sat} = saturated hydraulic conductivity of the soil in cm/min

4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation

Q = rate of loss of water from the reservoir in cm^3/min

H = depth of water in the test hole in cm

r = radius of the test hole in cm

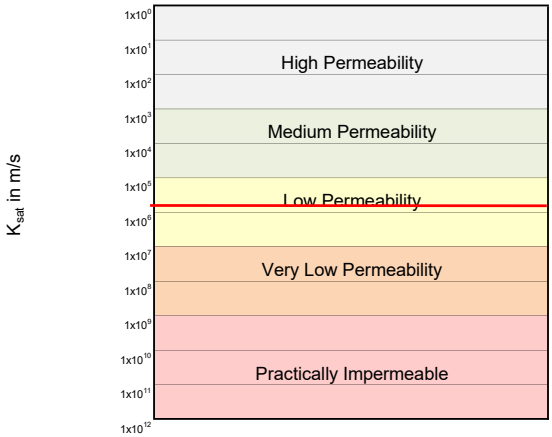


Rate of water loss

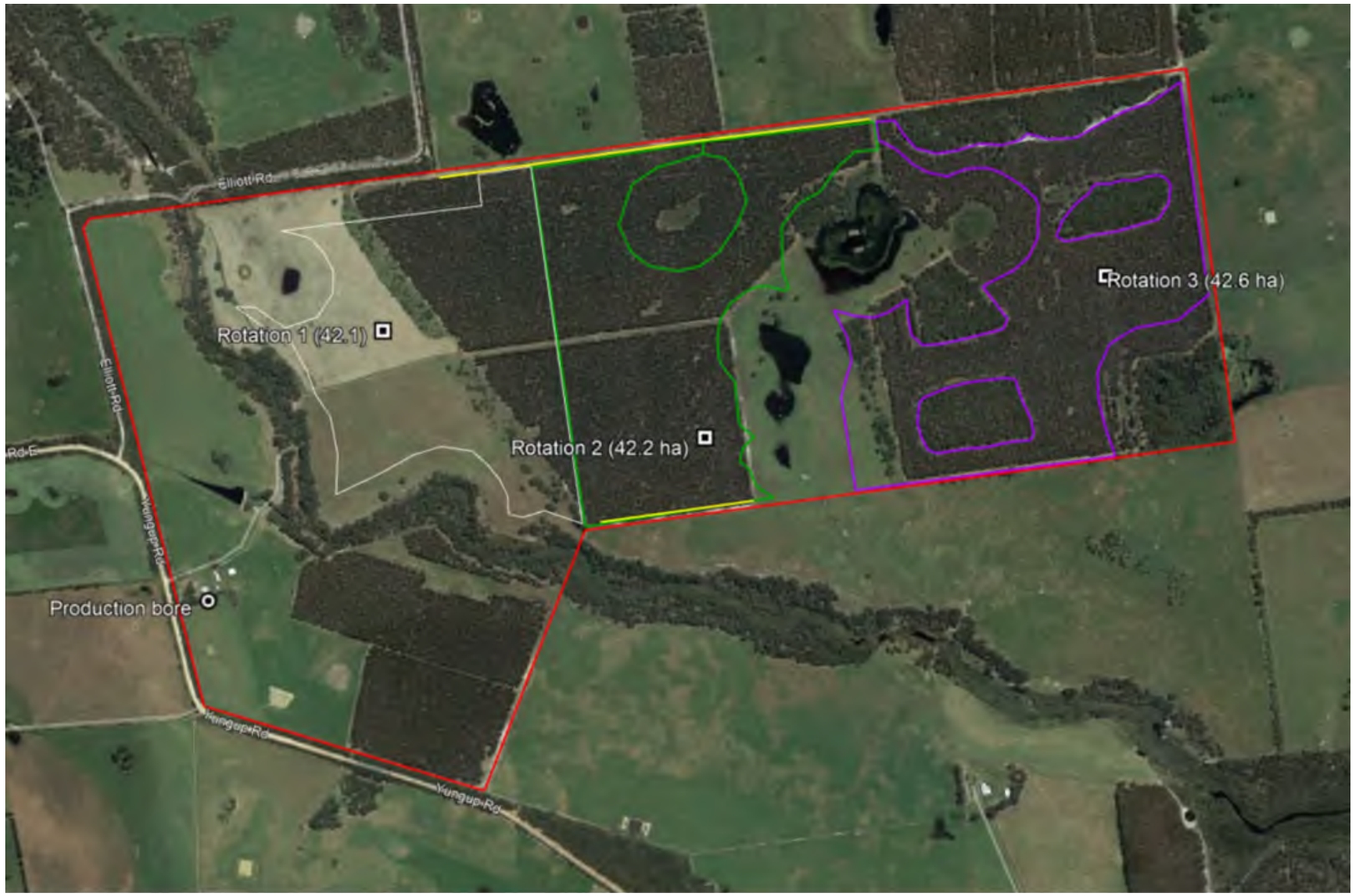
Q=	0.0007	L/sec
Q=	40.9	cm^3/min

Saturated hydraulic conductivity

K_{sat}=	0.01	cm/min
K_{sat}=	0.14	m/day
K_{sat}=	1.61E-06	m/sec



APPENDIX I– ROTATION AREAS AND MANAGEMENT



Notes:

- The Rotational Outdoor Breeding Piggery will comprise three rotations (Rotation 1: 42.1 ha, Rotation 2: 42.2 ha, Rotation 3: 42.6 ha).
- Each rotation will be for two years with cropping for four years of cropping prior to next pig phase.
- The production bore is located near the existing on site dwelling (west of Napier Creek). An additional bore exists on the eastern side of Napier Creek.
- Native vegetation will be retained.
- Setbacks, in line with State and Australian Guidelines have been included in the design.
- Bluegums (two rows) will be retained or replanted in areas marked in yellow as a visual and drainage control.

APPENDIX J – DEVELOPING A NUTRIENT MANAGEMENT PLAN

FACT SHEET

Outdoor Piggery Fact Sheet Series
May 2012

DEVELOPING A NUTRIENT MANAGEMENT PLAN FOR A ROTATIONAL OUTDOOR PIGGERY

Nutrients can accumulate quickly in rotational outdoor piggeries. Without active management, manure nutrients are not evenly spread over the paddocks, which can result in unsustainable levels over the areas between the shelters and the feeding, watering and wallowing areas. This poses an increased risk of soil degradation and nutrient transfer to any nearby surface waters and groundwater. It also provides a challenge for future crop production on that land.

A nutrient management plan (NMP) can assist operators of rotational outdoor piggeries to:

- document the existing operation
- develop a nutrient budget for the farm including nutrient application rates during the pig phase and nutrient removal rates during the crop / pasture / forage phase
- evaluate how evenly manure nutrients are spread
- identify potential nutrient loss pathways
- develop and implement an action plan for managing the risk.

Documenting Existing Operation

It is useful to include a description of the size, type and history of the operation.

The piggery operated from 2000-2005 as a 500 sow breeder unit. Since 2006 it has operated as a 1000 sow breeder unit. It is a rotational outdoor system with a rotation including two years of pigs followed by one year of pasture (baled, 2 t DM/ha) and three years of barley (grain only, 3 t DM/ha). Dry sows are accommodated in paddocks set out in a radial with bedded group shelters. The average stocking density is 15 sows/ha (667 m^2/sow). Farrowing sows are accommodated in rectangular paddocks with individual bedded shelters. The average stocking density of these paddocks is 10 sows/ha (1000 m^2/sow). Piglets are weaned at 28 days and leave the site for rearing in deep litter shelters. The typical herd composition is: 830 dry sows, 170 farrowing sows, 50 boars, 55 gilts, 1725 suckers. The paddocks are largely denuded of vegetation about six months after the commencement of the pig phase.

Also describe the land, soil, groundwater and surface water resources.

The site has a gentle slope of about 2% to the north. The soil across the site is a clay loam suitable for crop production. Groundwater is approximately 30 m below ground level. It is the water source for the piggery. A creek forms the northern boundary of the property. The boundaries of the pig paddocks are always at least 50 m from the creek. This buffer zone is kept well vegetated. There are no other significant waterways or dams on the farm.

Preparing a Nutrient Budget

Rotational outdoor piggeries are net accumulators of nutrients since nutrients imported as pigs, feed and bedding are not matched by removals through pigs and gaseous losses. The balance remains as manure and spent bedding (unless this is removed from the paddocks). Surplus nutrients can be removed by growing and harvesting crops, forage or pastures after the pig phase.

A nutrient budget is needed for the pig phase and for the entire rotation. The PIGBAL model (DPI 2006) is a very useful tool to use for the pig phase. However, data provided in the National Environmental Guidelines for Piggeries (2010) can be used to prepare an approximate budget, bearing in mind that the data provided are derived from intensive conventional piggeries and may under-estimate nutrients added to outdoor rotational piggery systems. The steps in preparing a nutrient budget are provided overleaf.

The nutrient budget (overleaf) identified that the mass of nutrients added by the pig phase is not being matched by the crop / forage pasture phase. For example, there is an average nitrogen surplus in the dry sow area of 181 kg/ha at the end of the rotation. For the farrowing area there is an average nitrogen surplus of 637 kg/ha.

Evaluating How Evenly Manure Nutrients are Spread

Research has confirmed that manure nutrients are not evenly distributed across the paddocks of outdoor rotational piggeries.

Rather they are concentrated in the area between the shelter and the feeding area and other installations.

Active site management is needed to promote even manure excretion. This involves regularly relocating moveable installations around the paddock (e.g. shelters and feeding points). If this does not occur, the nutrient-rich hot-spots that result pose an increased risk of nitrate-nitrogen leaching during both the pig phase and the cropping phase that follows.

There is also an increased risk of nutrient removal in runoff or as eroded soil.

Paddock installations are not regularly moved in the dry sow paddocks. Wallows are replaced if they become too deep. Spent bedding is spread evenly over the paddocks.
It is likely that manure nutrients are concentrating in the areas between the shelters and the feeding area and other installations.
In the farrowing paddocks shelters are relocated after each litter is weaned. The spent bedding is spread in the paddock or removed. Wallows are replaced if they become too deep.

Providing shelters are moved over the majority of the paddock, better manure nutrient dispersal might be expected in the farrowing paddocks. However, regular movement of the feeding area and possibly other installations would enhance this dispersal.

Potential Nutrient Loss Pathways

This section should evaluate the detail contained in the previous sections, along with any soil analysis results, and identify areas where there is a significant risk of nutrient losses.

In both the dry sow and the farrowing paddocks there is a significant surplus of nutrients, with the farrowing paddocks being of particular concern. It is also likely that nutrients are not being distributed evenly in the paddocks, particularly in the dry sow paddocks. Although there is no shallow groundwater, there is a significant risk of nitrate leaching during both the pig and pasture / cropping phases due to the level of nitrogen surplus. This may eventually contaminate the groundwater.
The stocking rate is such that the paddocks are denuded about six months into the pig phase. This increases the erosion risk. Because the soils have high nutrient levels a significant nutrient load will be carried in the eroded soil. The vegetated filter strip between the paddocks and the creek offers some protection but is only a secondary measure.

Mortalities Management

Good mortalities management is needed to prevent nutrient movement to groundwater and surface waters; odour nuisance; spread of diseases; and vermin breeding.

Rendering and composting pose a lower environmental risk than burial or incineration. This section should describe the routine mortalities management and the plan for managing a mass mortalities event.

To prevent water impacts, carcass composting should be undertaken within a bunded area with a compacted base that sits at least 2 m above the water table.

Each carcass should be surrounded with at least 300 mm of sawdust, spent litter or similar to promote low odour aerobic composting. Keeping carcasses well covered reduces the interest from vermin and the disease transfer risk. The finished compost is suitable for spreading on land at sustainable rates. Grazing stock should be excluded from land for three weeks after the compost is spread to minimise disease transfer risks.

Burial may be an option if composting and rendering are not feasible. To prevent water impacts, burial pits should be situated on low permeability soils and / or low risk sites. The base of the pits should sit at least 2 m above the highest water table. Carcasses need to be well-covered with soil or other suitable material each day to avoid scavenging and to prevent odour.

An effective response to a mass mortalities event requires planning. It is important to identify a suitable disposal site and have a contingency plan in place. State government veterinary officers have the main responsibility and resources to combat an exotic disease outbreak and should be contacted regarding the selection of a site and disposal method but also in the event of a suspected disease outbreak. AUSVETPLAN (2007) provides useful information for managing a mass mortalities event.

Regular Soil Monitoring

Regular soil monitoring can confirm that nutrients are maintained at levels that pose an acceptable ecological risk. Ideally this should occur before a pig phase commences to ensure that the soil has suitable properties for use by pigs. This will also provide benchmark data for comparison with future analysis results. Thereafter soil monitoring should usually be undertaken at the end of any two year period that includes a pig phase. For more heavily stocked paddocks, annual soil monitoring is recommended. Samples should be collected from areas that are expected to be nutrient-rich (i.e. between the shelters and the feeding area).
If interpretation of the results confirms that soil nutrients are at suitable levels the area can be used for ongoing or subsequent pig phases.

If they do not, action must be taken to reduce soil nutrients to acceptable levels.

This will generally involve destocking the land and growing and harvesting plant material from the area.

Action Plan for Managing the Risk

This section needs to provide targeted action to reduce the likelihood of nutrients losses. When planning rotations, it is important to aim for a balanced nutrient budget.

In the example provided in this Fact Sheet, there is a need to reduce nutrient inputs (e.g. by reducing the stocking density or shortening the length of the pig phase) and / or increase nutrient removals (e.g. by growing crops that remove more nutrients when harvested like hay or silage crops; or by lengthening the cropping phase). Where a significant nutrient surplus exists, the length of the pig phase should not exceed two years. There is also a need to promote even nutrient distribution over the paddocks to minimise the risk of nutrient hot-spots.

Reducing the stocking density and / or shortening the length of the pig phase will also help to retain groundcover which is the primary protection against soil erosion.

Good mortalities management is important to prevent transfer of nutrients to groundwater or surface waters.

Regular soil monitoring can confirm that nutrients are maintained at suitable levels or identify risks.

An action plan for the example used in this Fact Sheet follows:

From 1 July 2012 Promote more heterogeneous nutrient distribution over the paddocks by moving shelters and self-feeders around the paddocks at least quarterly.

By 1 Jan 2013 Design future pig and crop / forage / pasture rotations that will achieve a balanced nutrient budget. This must involve a 50% reduction in stocking density and / or shortening of the pig phase to retain groundcover for longer. It may also involve extending the length of the crop / forage / pasture phase and / or growing different crops.

By 1 Mar 2013 Implement regular two-yearly soil monitoring across the farm. Undertake baseline soil monitoring for new area and sampling of the nutrient-rich areas of the existing pig paddocks.

Other Fact Sheets in this Series

- Land and Water Protection Measures for Rotational Outdoor Piggeries
- Promoting More Even Distribution of Manure Nutrients in Rotational Outdoor Piggeries
- Soil Monitoring for Rotational Outdoor Piggeries

References and Further Reading

Australian Pork Ltd 2010 National Environmental Guidelines for Piggeries 2nd Edition (revised), Australian Pork Ltd, Deakin.

AUSVETPLAN 2007, Operational Procedures Manual: Disposal – Version 3, Animal Health Australia, Canberra.

Casey, K, McGahan, E, Atzeni, M, Gardner, E and Frizzo, R 1996, PIGBAL: A Nutrient Mass Balance Model for Intensive Piggeries, Department of Primary Industries, Brisbane.

Preparing a Nutrient Budget

The nutrient budget for the pig phase involves the following steps:

1. Estimate nutrient inputs to paddocks:
   Example calculations for nitrogen only are provided below. The calculations would need to be repeated for phosphorus and potassium.

   - Table 9.1 of the National Environmental Guidelines for Piggeries (2010) (revised) (NEGP) provides generic nutrient outputs for different classes of pigs. These can be used to estimate the manure nutrient output for the entire dry sow area and for the entire farrowing area. e.g.

     <u>Dry sow area:</u>
     Nitrogen added:
     830 dry sows X 13.9 kg N/hd/yr = 11,537 kg N/yr
     50 boars X 15 kg N/hd/yr = 750 kg N/yr
     55 gilts X 12 kg N/hd/yr = 660 kg N/yr

     Total nitrogen added as manure = 12,950 kg/yr

     <u>Farrowing area:</u>
     Nitrogen added:
     170 lactating sows X 27.1 kg N/hd/yr = 4607 kg N/yr
     1725 suckers X 2.3 kg/hd/yr = 3968 kg N/yr

     Total nitrogen added as manure = 8575 kg N/yr
   - Nutrients also enter the paddocks as bedding. Table 9.2 of NEGP provides typical total solids and nutrient content data for clean bedding materials.

Assuming each adult pig uses 400 kg/yr of barley straw for bedding, the nitrogen added as bedding is:

Dry sow area:
Nitrogen added:
935 pigs X 400 kg straw X (91/100) (total solids content of straw) X (0.69/100) (N content of dry matter in straw) = 2350 kg N/yr

Farrowing area:
Nitrogen added:
170 sows X 400 kg straw X (91/100) (total solids content of straw) X (0.69/100) (N content of dry matter in straw) = 430 kg N/yr

- The nutrients in the manure and bedding are then summed to get an estimate of the total nutrients added to the soil. e.g.
  Dry sow area:
  Nitrogen added:
  Manure N (12,950 kg N/yr) + bedding N (2350 kg N/yr) = 15,300 kg N/yr

  Farrowing area:
  Nitrogen added:
  Manure N (8575 kg N/yr) + bedding N (430 kg N/yr) = 9005 kg N/yr

- These total nutrient quantities then need to be converted to application rates (kg/ha) by dividing the mass by the total area of land e.g.

  Dry sow area:
  15,300 kg N/yr / 62.4 ha = 245 kg N/ha/yr.

  In the case of nitrogen only, some volatilisation losses will occur. Assuming these are 20%, the net nitrogen application rate is:

  245 kg N/ha/yr X (1-(20/100) = 196 kg/ha/yr.

  The length of the pig phase is 2 years so the net application rate needs to be multiplied by 2. Hence, the nitrogen application rate for the pig phase is 392 kg N/ha.

  Farrowing area:
  The land area is calculated by multiplying the total number of pigs by the area per pig (ha). E.g.
  170 sows x (1/10 ha/sow) = 17 ha.

  Then the mass of nutrient is divided by the area e.g.

  9005 kg N/yr / 17 ha = 530 kg N/ha/yr.

  In the case of nitrogen only, some volatilisation losses will occur. Assuming these are 20%, the net nitrogen application rate is:

  530 kg N/ha/yr X (1-(20/100) = 424 kg/ha/yr.

  The length of the pig phase is 2 years. Hence, the net nitrogen application rate for the pig phase is 848 kg N/ha.

2. Estimate nutrient removals from paddocks as plant harvest. Table 14.4 of NEGP provides nutrient removal rates for a range of crops, forages and pastures. Example calculations for nitrogen only are provided below. The calculations would need to be repeated for phosphorus and potassium.

   - Following the pig phase, pasture yielding 2 t DM/ha) is grown on the area for one year followed by three years of barley (3 t DM/ha).

     Pasture
     The harvested yield is 2 t DM/ha so the nutrient removal rate is:
     2 t DM/ha X 20 kg/t = 40 kg/ha

     Barley
     The harvested yield is 3 t DM/ha so the nutrient removal rate is:
     3 t DM/ha X 19 kg/t = 57 kg/ha

     Total Nutrient Removal
     One year of pasture and three years of barley are grown and harvested.

     40 kg/ha = (3 X 57 kg/ha) = 211 kg/ha

     Note: This assumes no fertiliser is applied to the pasture or barley. If fertiliser is applied this needs to be subtracted from the total nutrient removal rate. E.g. if 20 kg N/ha were applied each year, a total of 80 kg N/ha would need to be subtracted leaving a net nitrogen removal rate of 131 kg N/ha.

3. Determine Nutrient Budget. The nutrient budget is the nutrient application rate less the nutrient removal rate. *Example calculations for nitrogen only are provided below.*

The calculations would need to be repeated for phosphorus and potassium.

E.g.

Dry sow area:
392 kg N/ha - 211 kg N/ha = 181 kg N/ha

Farrowing area:
848 kg N/ha – 211 kg N/ha = 637 kg N/ha

In both cases there is a significant surplus of nitrogen, with the surplus for the farrowing area being of particular concern.

FSA Consulting has taken all reasonable steps to ensure that the information contained in this fact sheet is accurate at the time of production. FSA Consulting and APL maintain no responsibility for the accuracy or reliability of information supplied in this fact sheet and accept no responsibility due to the incorrect use of this information.

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APPENDIX K - NUTRIENT BALANCE CALCULATIONS

APL
LOGO

Nutrient Balance Calculator - Rotational Outdoor Piggeries

Introduction

This calculator is designed to allow piggery operators to easily estimate the amount of nutrients added to the paddocks of rotational outdoor piggeries as manure nutrients, and the quantities removed by the crop / forage / pasture phase.

It is important to recognise that manure nutrients are unlikely to be spread evenly across the paddocks. Levels in the area between the shelters and the feeders may be many times higher than in other parts of the paddock. Consequently, it is important to test the soils of areas that could be expected to be nutrient-rich, and to use the results to guide decisions about when to end the pig phase.

It is important to note that grazing of pastures by stock of any kind removes nutrients very slowly since most are returned to the soil as manure. The digestive system of pigs is not designed for a grass-based diet, so "grazing" by pigs removes almost no nutrients at all.

Instructions

This simple calculator uses a colour coded system for data entry, data selection and calculations.

White cells require data entry. Enter data specific to your piggery where possible.
Blue cells include a selection of pull-down data to choose from.
Green cells provide the results of calculations.
A triangle in the top right corner of a cell indicates that guidance information is available. Hover the mouse over the triangle for help.

Disclaimer

While Australian Pork Ltd (APL) has no reason to believe the output of this calculator will be inaccurate, APL is unable to guarantee the accuracy of this information and, subject to any terms implied by law which cannot be excluded, accepts no responsibility for loss suffered as a result of any party's reliance on the accuracy or currency of the outputs of this tool.

PIGGERY DESCRIPTION		
Name of paddock area e.g. dry sows	All	
Total paddock (m2)	420000	42 ha
Length of pig phase on area (months)	24	
Bedding type	Wheat straw	
Total bedding use for type of paddock (t/yr)	573.5	
Bedding management	Dispersed over paddock	

PIG CLASS	No. of Pigs	No. of SPU
Gilt	0	0
Boars	69	110.4
Gestating sows	560	896
Lactating sows	140	350
Suckers	1121	112.1
Weaners	0	0
Growers	0	0
Finishers	0	0
Total	1890	1468.5

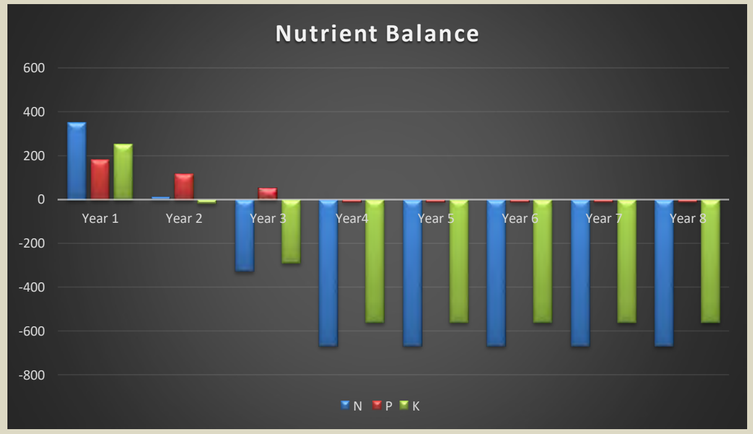
PADDOCK MANAGEMENT - PIG PHASE (* excludes suckers)	
Total number of pigs in paddock*	1890
Stocking density (pig/ha)*	45
Stocking density (SPU/ha)	35

NUTRIENTS ADDED OVER PIG PHASE	Nitrogen (kg)	Phosphorus (kg)	Potassium (kg)
Manure	30383	9916	7637
Bedding	5964	459	14452
Sub-Total	36347	10375	22089
Losses through bedding management (kg)	0	0	0
Remaining after losses by bedding management (kg)	36347	10375	22089
Losses through volatilisation (20%)	7269	0	0
Total after volatilisation losses (kg)	29078	10375	22089
Nutrient addition rate (kg/ha)	692	247	526

PADDOCK MANAGEMENT Crop / Forage / Pasture Phase	Crop Grown	Grain Yield (t DM/ha)	Hay / Straw / Silage (t DM/ha)
Year 1	Winter cereal hay	0	17
Year 2	Winter cereal hay	0	17
Year 3	Winter cereal hay	0	17
Year 4	Winter cereal hay	0	17
Year 5	-	0	
Year 6	-	0	
Year 7	-	0	0
Year 8	-	0	0

NUTRIENT BALANCE Nutrient removal by crop harvest (kg/ha)	N	P	K
Year 1	340	65	272
Year 2	340	65	272
Year 3	340	65	272
Year4	340	65	272
Year 5	0	0	0
Year 6	0	0	0
Year 7	0	0	0
Year 8	0	0	0

Nutrient Surplus / Deficit at End of Year (kg/ha)		
N	P	K
352	182	254
12	117	-18
-328	53	-290
-668	-12	-562
-668	-12	-562
-668	-12	-562
-668	-12	-562
-668	-12	-562



APPENDIX L - MANAGEMENT OF MANURE AND SPENT BEDDING

FACT SHEET

Outdoor Piggery Fact Sheet Series
May 2012

PROMOTING MORE EVEN DISTRIBUTION OF MANURE NUTRIENTS IN ROTATIONAL OUTDOOR PIGGERIES

Australian and international research shows that manure nutrients are not distributed evenly across the paddocks of rotational outdoor piggeries. Rather, the nutrients are concentrated around the shelter; and in the area bounded by the shelter, the feeding facilities, the waterers and the wallow.

APL research has used electromagnetic (EM) induction survey technology, coupled with soil sampling and testing, to map the distribution of nutrients in rotational outdoor piggery paddocks. Figure 1 and Figure 2 below show the distribution of nitrate-nitrogen and Colwell phosphorus respectively across one of the surveyed paddocks in relation to the shed, wallow and feeding area.

Figure 1. Predicted Nitrate-N Distribution Map

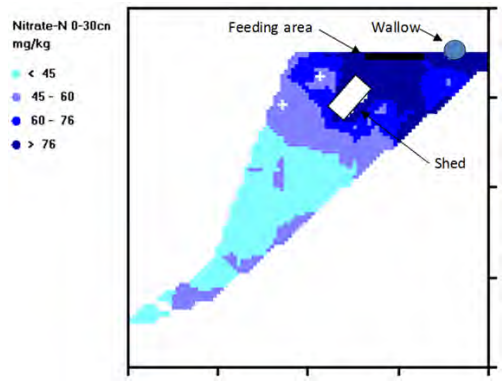
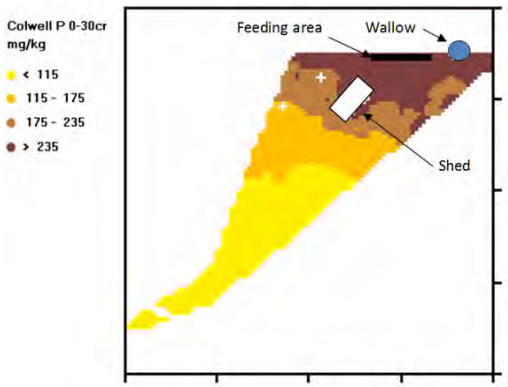


Figure 2. Predicted Colwell Phosphorus Distribution Map



Rotational outdoor piggeries will always accumulate nutrients in the soil because of the quantities of nutrients brought in as feed. If these nutrients are not evenly spread, soil nutrient concentrations in parts of the paddock may quickly reach levels that pose a risk to the environment. The potential for nitrate-nitrogen leaching from these hot-spots is of particular concern. There are also implications for crops grown on the land after the pig phase, in particular uneven crop growth and reduced nitrogen use efficiency.

To promote more even nutrient distribution across the paddock area it is necessary to change the excretory behaviour of the pigs. European researchers have identified that pigs mainly defecate and urinate as they move between the shelter and the feeding area, although they also excrete as they move between other installations. The researchers also demonstrated that regularly moving facilities around the paddock (e.g. every 3-4 weeks) was effective in modifying excretory patterns and in achieving more homogeneous nutrient distribution across the paddock (Quintern & Sundrum (2006) and Eriksen et al. (2006)). Using appropriate nutrient inputs will also help to reduce the ecological risks of nutrient accumulation and leaching.

Regularly relocating movable structures that could include shelters, shade, feeding points, waterers, wallows and spray or drip cooling facilities within the paddocks promotes more even manure deposition. It is recommended that this occur at least every six months for the breeding herd paddocks and at least every three months for grower paddocks. Position the shelters so that they are well separated from the feeding facilities. For piggeries that ground-feed, delivering the feed either right along the length of a paddock perimeter fence or dispersing it over a significant part of the paddock area encourage more heterogeneous spread of manure.

Other Fact Sheets in this Series

- Developing a Nutrient Management Plan for a Rotational Outdoor Piggery
- Land and Water Protection Measures for Rotational Outdoor Piggeries
- Soil Monitoring for Rotational Outdoor Piggeries.

Example of movable farrowing hut

Example of movable dry sow or grower shelters

Example of movable self-feeder

Example of wallow water supply that is readily movable

References and Further Reading

Australian Pork Ltd 2011, The use of EM technology to determine nutrient distribution in free range pig areas, Australian Pork Ltd Fact Sheet, Australian Pork Ltd, Deakin.

Benfalk, C, Lindgren, C and Rundgren, M 2005. Mobile and Stationary Systems for Organic Pigs – Animal Behaviours in Outdoor Pens, accessed from http://orgprints.org/4313/

Eriksen, J, Hermansen, JE, Strudsholm, K and Kristensen, K 2006. 'Potential loss of nutrients from different rearing strategies for fattening pigs on pasture', *Soil Use and Management*, vol. 22, pp. 256-266.

Quintern, M and Sundrum, A 2006, 'Ecological Risks of Outdoor Pig Fattening in Organic Farming and Strategies for Their Reduction—Results of a Field Experiment in the Centre of Germany', *Agriculture, Ecosystems and Environment*, vol. 117, pp. 238–250

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APPENDIX M - SOIL MONITORING

FACT SHEET

Outdoor Piggery Fact Sheet Series
May 2012

SOIL MONITORING FOR ROTATIONAL OUTDOOR PIGGERIES

Rotational outdoor piggeries can sometimes pose a risk to the environment through unsustainable soil nutrient levels and poor land protection measures.

Nutrients are brought into rotational outdoor piggeries as feed. Depending on stocking density and herd composition, nutrients can quickly accumulate in the soil to high levels. Unless the site is actively managed to promote even manure excretion, nutrients will also be unevenly distributed across the paddocks creating nutrient-rich hot-spots. Although the land areas involved may be relatively small there is an increased likelihood of nitrate-nitrogen leaching from these hot-spots during both the pig phase and the cropping phase that follows. There is also a risk of nutrient removal in runoff or as eroded soil. This risk can be reduced by promoting good land protection.

A Nutrient Management Plan (NMP) is a useful tool for planning a suitable stocking density, length of pig phase and cropping rotation for a rotational outdoor piggery. However, it needs to be supported by regular soil monitoring to confirm that nutrients are maintained at levels that pose an acceptable ecological risk.

Ideally collect and analyse soil samples before a pig phase commences. This can help to confirm that the soil has suitable properties for use by pigs (refer to chapter 17 of the National Environmental Guidelines for Piggeries second edition, (2010) revised). It also provides benchmark data for comparison with future analysis results.

Australian research has identified that although nitrogen, phosphorus and potassium build up in the soils of rotational outdoor piggeries, the amounts accumulated are generally not high except when pigs were stocked on an area for more than two years (Rate 2000). Consequently, in most cases it is appropriate to undertake soil sampling and analysis at the end of any two year period that includes a pig phase. For more heavily stocked paddocks, annual soil monitoring is recommended. Collecting samples from areas that are expected to be nutrient-rich (i.e. between the shelters and the feeding area) provides the best guide to environmental risk.

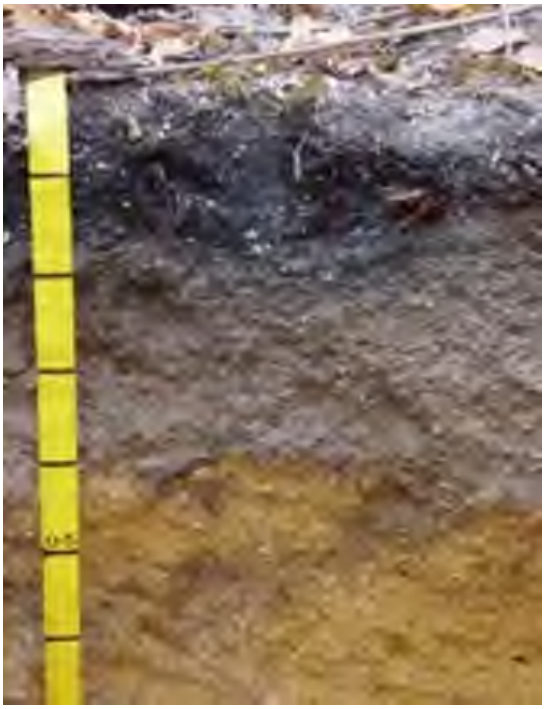
Soil sampling with hand auger

Collect one set of composite (bulked) soil samples for each block of paddocks. A block of paddocks is a group of adjacent paddocks used simultaneously to run pigs. For piggeries that operate with a radial paddock system, one radial would constitute a block of paddocks. Similarly, if a piggery uses eight adjacent rectangular paddocks at a time this would constitute a block of paddocks. For each block of paddocks compile a composite soil sample from soil from at least ten holes distributed across the nutrient-rich land areas.

Soil sampling with soil rig

Sampling a representative background plot at the same time will provide baseline data for interpreting analysis results. A representative background plot is a 20 m diameter area located on land that has a similar soil type and is physically close to the land being monitored. Sampling the representative background plot at the same time as the pig paddocks provides a basis for comparison when interpreting soil test results. Representative background plots should be on land that has not been used for outdoor pig production, irrigated with effluent or spread with manure, or recently had fertiliser applied. Carefully note the location of the representative background plot so samples can be collected from the same location each time. For each representative background plot, compile samples for each sampling depth from soil from ten holes.

Example soil profile



For both the block of paddocks and any representative background plot, sampling depths should be in accordance with the conditions of any planning or development consent, approval, permit or licence. If these do not apply, a single composite sample can be compiled for each of the following depth ranges:

- 0 to 0.1 m
- 0.3-0.6 m or 0.3 m to the base of either the root zone or the base of the soil profile (if less than 0.6 m in depth)
- whole soil profile from surface to a depth of 0.6 m or to the base of the root zone or the base of the soil profile.

It is important that soil analysis parameters meet the conditions of any planning or development consent, approval, permit or licence. If this does not apply, use the soil analysis parameters specified in the National Environmental Guidelines for Piggeries:

Parameter	Depth		
	0-0.1 m	0.3-0.6 m (or to base of root zone)	0-0.6 m (or to base of root zone)
pH	✓	✓	-
Electrical conductivity	✓	✓	-
Nitrate-nitrogen	✓	✓	-
Available phosphorus	✓	✓	-
Phosphorus buffer capacity or phosphorus sorption index	-	-	✓
Potassium	✓	✓	-
Organic carbon	✓	-	-
Exchangeable cations and CEC	✓	✓	-

An agronomist or soil scientist can assist in interpreting soil analysis results. Trigger levels for further investigation for some key parameters are given below:

- Salinity (EC) rating of moderate or higher: ECSE exceeding 3.8 dS/m
- Nitrate-nitrogen concentration in the subsoil exceeding:

Sand	1.2 mg NO3N/kg
Sandy-loam	1.5 mg NO3N/kg
Loam	1.7 mg NO3N/kg
Clay-loam	2.0 mg NO3N/kg
Medium clay	3.5 mg NO3N/kg
Self-mulching clay	4.5 mg NO3N/kg

- Available phosphorus for different methods: *Colwell P*

Clay <30%, pH <7	31 mg P/kg
Clay <30%, pH >7	59 mg P/kg
Clay >30%, pH <7	75 mg P/kg

Clay >30%, pH >7 85 mg P/kg

Olsen P exceeding 25 mg P/kg
Bray P exceeding 20 mg P/kg
BSES P
<30% clay 31 mg P/kg
>30% clay 131 mg P/kg

- Exchangeable sodium % (ESP) 6%

Results can be evaluated by comparison with these triggers for further investigation or with the results for a representative background plot.

If the analysis results interpretation confirms that soil nutrients are at suitable levels the area can be used for ongoing or subsequent pig phases. If they do not, take action to reduce soil nutrients to acceptable levels. This will generally involve destocking the land and growing and harvesting plant material from the area.

References and Further Reading

Australian Pork Ltd 2010 National Environmental Guidelines for Piggeries 2nd Edition (revised), Australian Pork Ltd, Deakin.

Rate, AW 2000, Effects of outdoor pig production on nutrient accumulation and movement in soils, Final Report prepared for the Pig Research and Development Corporation, Report no. UWA 28/1119, University of Western Australia, Nedlands, WA.

Other Fact Sheets in this Series

- Developing a Nutrient Management Plan for a Rotational Outdoor Piggery
- Land and Water Protection Measures for Rotational Outdoor Piggeries
- Promoting More Even Distribution of Manure Nutrients in Rotational Outdoor Piggeries.

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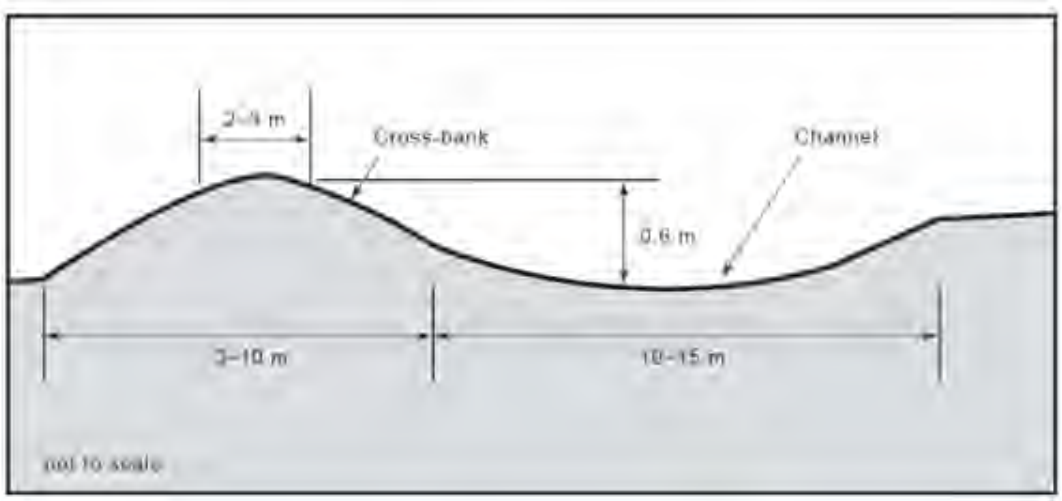
APPENDIX N - DRAINAGE MANAGEMENT

Rollover Drains

Description

A rollover drain is an earth bank with an upstream channel used to direct water flow across the road to discharge onto a stable surface (Figure 1).

FIGURE 1: ROLLOVER DRAIN DIMENSIONS



Operational guidance

- As the grade increases increase the height of rollovers with a relative increase in length.
- The depth of a rollover should not exceed 600 mm as it may become untrafficable.
- Enough loose earth should be used to give the required dimensions after shaping and compaction is completed (aim for a consolidated effective bank height of 300–600 mm). ·
- A long, shallow excavation for the bank is better than a short, deep excavation so as to allow vehicle passage while effectively collecting and diverting runoff.
- Ensure the channel is deep enough to prevent runoff from breaching the bank. ·
- Track- or wheel-roll the entire length of the bank to get maximum compaction and a smooth, even surface. ·
- Adequate compaction will minimise the risk of banks breaching and maintain their capacity for vehicle use. ·
- Any loose earth or other material that may block water flow off the road should be removed from the excavation.

Ongoing maintenance

- Increase the bank height or decrease the spacing between rollovers if they are being overtopped or breached.
- Repair any damage to the integrity of the bank; maintain an effective consolidated height of at least 300 mm.
- Ensure the cross-bank channel is clear of debris and/or sediment.
- If there is erosion at the outlet stabilise the rollover drain.

FACT SHEET

Outdoor Piggery Fact Sheet Series
May 2012

LAND AND WATER PROTECTION MEASURES FOR ROTATIONAL OUTDOOR PIGGERIES

Adopting good land protection measures helps to preserve or enhance the productive qualities of the soil and prevent off-site impacts. Rotational outdoor piggeries can sometimes pose a risk to the environment through unsustainable soil nutrient levels, soil structural decline and poor land protection measures. Suitable siting, planning and design; dynamic management; and a commitment to site remediation reduce the risk of land degradation and related surface water contamination.

Soil Erosion

It is important to prevent soil erosion throughout both the pig and the crop, forage or pasture phases of the rotation. Erosion reduces land productivity by removing the nutrient-rich topsoil. It may also cause increased turbidity and nutrient levels in nearby surface water resources. Erosion is difficult to remedy and prevention is imperative.

Good site selection is important in minimising erosion from rotational outdoor piggeries. Erosion risk increases with higher slope; soil erosivity; and rainfall or wind intensity. Sites with a steep slope are generally unsuitable for rotational outdoor piggeries. Land with a flat to gentle slope is preferable. Sites with dispersible or light soils are also erosion-prone. Locations with higher rainfall intensities also have higher water erosion rates.

Maintaining groundcover over the land is the critical management strategy for minimising erosion. Groundcover is any material on or near the soil surface that provides protection for the soil against the erosive action of rainfall runoff or wind. It may include plant material (alive or dead), spent bedding and other cover materials providing these will not be carried away in rainfall runoff or blown away by the wind. Since attached plant material is more effective than dead plant material or other light matter lying on the soil surface it is recommended that it make up the majority of the groundcover. Groundcover prevents erosion by leaving soil less exposed to wind and rainfall runoff, promoting soil properties that increase rainfall absorption, and intercepting runoff preventing it from becoming erosive. Maintaining groundcover in pig paddocks year-round is challenging and dependent on selecting a suitable stocking density for the locality and soil type.

Secondary Erosion Control Measures

On sloping sites, contour banks can be constructed to slow the flow of water across the paddock, thereby reducing erosion.

Other structures can reduce the risk of eroded soil reaching waterways. Vegetated filter strips (VFS) or buffers below piggery paddocks can effectively prevent eroded soil and nutrients from reaching waterways. VFS's are continuous vegetated buffer strips at least 10 m wide that are located immediately downslope of the entire paddock area. Ideally these consist of a runner-developing, non-clump forming grass species. VFSs reduce the nutrient concentration of runoff by trapping soil particles and by slowing the water flow rate which increases infiltration. Generally, wider VFS's can trap greater quantities of eroded soil. For sites with greater slope, higher rainfall intensities or erosive soils wider VFS's are recommended.

As an additional control, or where there is high risk of waterway contamination, terminal ponds sized and located to catch the first 12 mm of runoff from the piggery paddocks and other land within the same catchment area can effectively minimise nutrient contamination of surface water resources. These work primarily by capturing the runoff containing the most nutrients. However, they also slow the flow velocity, promoting settling of suspended soil from the runoff. Runoff caught in terminal ponds needs to be irrigated on land not in use as pig paddocks.

Monitoring

Regularly monitoring paddocks for signs of soil erosion or structural decline allows corrective action to be taken as needed. Depending on the location, soil properties and facility management, soil compaction can be an issue. This can have serious implications for the growth of future crops and also contributes to erosion.

Site Remediation

On completion of the pig phase, site remediation helps to prepare the land for the crop, forage or pasture phase. This generally involves removal of fencing, shelters, feeders and other paddock installations; remediation of compacted or eroded land; and wallows remediation.

If the soil is compacted or eroded, growing an ungrazed ley pasture crop on the area is recommended. The soil should only be cultivated when the moisture content is between wilting point and field capacity. Other soil compaction remedies will depend on the soil type and may include deep ripping and spreading gypsum. Badly eroded areas may need to be fenced off and excluded from agricultural uses.

Wallows tend to be fairly nutrient-rich areas of the pig paddocks. Locating them on areas with loam to clay soils or lining them with compacted clay reduces the risk of groundwater contamination. Wallows remediation typically occurs when they are decommissioned (e.g. for relocation) and on completion of the pig phase to allow for crop or forage production. This may involve discing or deep ripping the base and possibly applying gypsum; filling in the wallow with soil; and levelling to match the slope of the immediately surrounding land.

A forage crop or pasture should be given time to establish before commencement of the next pig phase.

References and Further Reading

Australian Pork Ltd, 2010. National Environmental Guidelines for Piggeries, 2nd Edition (revised), Australian Pork Ltd, Deakin.

Redding M and Phillips I, 2005. Land Application of Effluent Phosphorus, Australian Pork Ltd Project 1354, Australian Pork Ltd, Deakin.

Other Fact Sheets in this Series

- Developing a Nutrient Management Plan for a Rotational Outdoor Piggery
- Promoting More Even Distribution of Manure Nutrients in Rotational Outdoor Piggeries
- Soil Monitoring for Rotational Outdoor Piggeries

FSA Consulting has taken all reasonable steps to ensure that the information contained in this fact sheet is accurate at the time of production. FSA Consulting and APL maintain no responsibility for the accuracy or reliability of information supplied in this fact sheet and accept no responsibility due to the incorrect use of this information.

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Maintaining good groundcover levels effectively prevents erosion

Vegetated Filter Strips (VFS) protect watercourses

Wallows need to be remediated after the pig phase to prepare the land for the crop / pasture / forage phase

Fact Sheet 1

Site - Planning

The overall principle is to stop both erosion and sediment leaving your site. However, this requires careful planning and forethought. The way you run your building site can have a large impact on the amount of pollution in stormwater run-off.

When planning the site layout, building location and earthworks, it is possible to make sure control devices don't interfere with the building process. Your council will have guidelines for your DA submission.

- ✔ Avoid stripping and excavating until ready to build.
- ✔ Minimise the reshaping of the land, any fill needs to be well compacted.
- ✔ Allow stormwater to flow around the building area and any disturbed areas.
- ✔ In new estates, temporary revegetation may be required.
- ✔ Allow room for a sediment barrier (e.g. sediment fence) to be located along the lower end of the disturbance.
- ✔ Ensure that stockpiles are stored within the sediment fence.
- ✔ Avoid long, steep, unstable driveways.
- ✔ Limit the amount of material on site to what is required at any one time.
- ✔ Ensure all material is immediately removed from the site at the completion of work.
- ✔ Instruct site workers on the need to prevent materials from washing or blowing into the stormwater system.
- ✔ Ensure all materials are immediately removed from site when work is completed.

Fact Sheet 3

Fact Sheet 3

Sediment Fencing

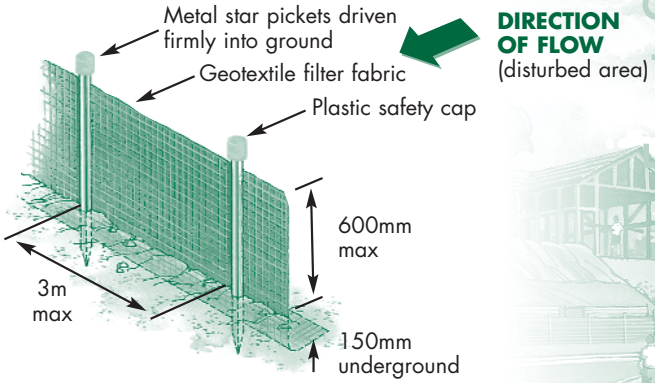
The most efficient and widely accepted sediment barrier for construction sites is a specially manufactured geotextile sediment fence. Sediment fences act like dams - trapping the sediment while allowing water to leave the site. They are effective in retaining suspended solids coarser than 0.02 mm. They are simple to construct, relatively inexpensive and easily moved as development proceeds.

When using a sediment fence, keep in mind that it will be effective within the following parameters:

- It is generally not designed to filter concentrated flows and therefore needs to be placed following the contours whenever possible.
- It should last for up to six months but requires regular maintenance and weekly checks are needed. The performance of a sediment fence diminishes considerably when crushed by delivery of building materials. It must remain vertical and keyed into the soil.
- Where the sediment fence is not installed correctly water will inevitably flow through the point of least resistance. Damaged fences must be repaired promptly.
- Sediment fences need to be trenched in at least 150 mm and buried so the water flows through and not underneath.
- Soil on both sides of the fence must be compacted to avoid seepage under the barrier.

On a typical residential building block (approx. 700sq.m), a sediment fence should work well providing it is situated on the low side of the block. If there needs to be a break in the fence for any reason (say, an access point) a contour bank/diversion bank or bund needs to be constructed to direct water back to the fence. The sediment fence must have uphill returns at either end to prevent sediment flowing around it.

Advantages. It is a simple strategy that is easily installed, shifted or removed. Sediment fences work well and, if maintained, will last for the duration of the construction stage.



Construction Notes

1. Construct sediment fences as close as possible to follow the contours of the site.
2. Drive 1.5 metre long posts into ground, maximum 3 metres apart.
3. Staple to 40 mm square hardwood posts or wire tied to steel posts.
4. Dig a 150 mm deep trench along the up-slope line of the fence for the bottom of the fabric to be entrenched.
5. Backfill trench over base of fabric and compact on both sides.

Fact Sheet 4

Fact Sheet 4

Straw Bale Filter

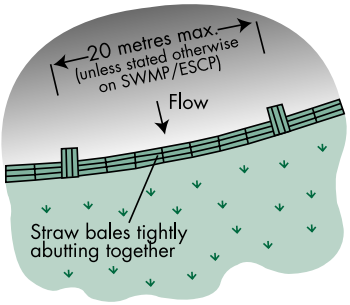
Straw bales are suitable for low flows of water. It is only recommended that these are used in limited applications such as reducing the flow velocity.

The return of straw bales every 20 metres is recommended to ensure some stability for this style of barrier. Please note that they need to be embedded in the ground and held firmly in place with star pickets.

The minimum number of bales to be used is four. If only two bales are used during a storm event, the water will simply hit the bales and flow around, increasing erosion. The bales must dam the run off and allow the sediment to settle behind the bales.

Please note straw bales do not filter sediment-laden waters. They will only hold back water if installed correctly.

Plan



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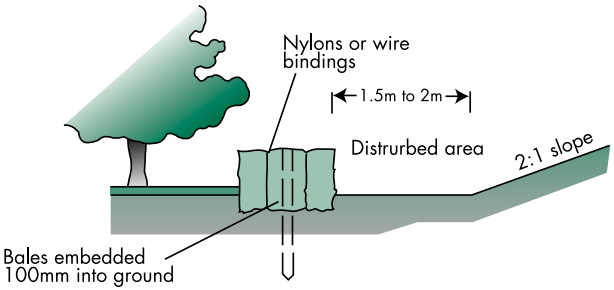


Fact Sheet 7

Grass Filter Strips

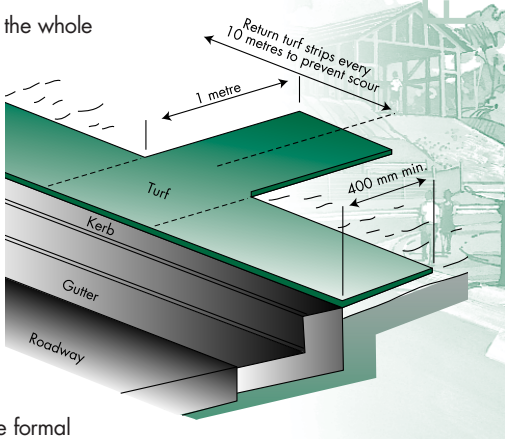
Strips of vegetation left or planted down-slope from earthworks provide a simple method of trapping coarse sediment.

The flatter and wider the filter strips are, the more effective they become. Grass filter strips have little effect in a storm, but form an important part of a sediment control program.

A 400 mm wide grass strip can be installed next to a kerb to stabilise the area between the kerb and footpath. It is also valuable for trapping sediment in very small storm events.

For best results it is advised that the whole footpath is planted.

Grass strips will stabilise a disturbed site quickly and easily and act as an excellent erosion & sediment control device.



Advantages. Grass filter strips can be very effective in removing coarse sediment upstream from detention basins or infiltration structures. They prevent sediment travelling from bare soil areas towards the formal drainage system.

Remember that grass filter strips are only suitable on low grades.

Construction Notes

1. Install minimum 400 mm wide roll of turf on the footpath adjacent to the kerb and at the same level as the top of the kerb.
2. Lay 1.5 metre long turf strips (at 90 degrees) every 10 metres.
3. Rehabilitate disturbed soil behind the turf strip in accordance with the ESCP/SWMP.

Maintenance of Control Measures

Proper maintenance of erosion and sediment controls is vital to their success. After a storm event the effectiveness of the established controls can be assessed. The site manager should check the operation of all erosion and sediment controls each day and initiate repair or maintenance as required.

An effective maintenance program should include ongoing modification to plans as development progresses. These plans are usually based on a specific landform, but as development proceeds changes occur in slope gradients and drainage paths.

Best practice includes anticipating potential risks as well as being prepared for abnormal circumstances and emergencies. This could include storing extra sediment fence fabric and posts on-site to facilitate emergency repairs, or ensuring that the sediment control contractor's phone number is available on site.

- ✔ The entry/exit pad will require reapplication of aggregate if excessive sediment build-up occurs.
- ✔ Clean any catch drains.
- ✔ Erosion in drainage channels should be repaired with rock, turf or erosion control matting.
- ✔ Sediment fences should be replaced if the fabric is ripped or otherwise damaged. Retrenching may also be needed. Sediment fences work well if they are maintained on a weekly basis and/or after every storm event.
- ✔ Keep an eye on the weather.

APPENDIX O – RESPONSE TO SUBMISSIONS

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8 March 2022

Chief Executive Officer
City of Albany
PO Box 484
ALBANY WA 6331

Attention: Jessica Anderson, Senior Planning Officer

RE: RESPONSE TO SUBMISSIONS – PROPOSED ROTATIONAL OUTDOOR PIGGERY 1028 YUNGUP ROAD, NAPIER, CITY OF ALBANY

Thank you for your email dated 7 February 2022, providing a summary of public submissions regarding the proposal to establish a Rotational Outdoor Piggery (ROP) (Breeding) at 1028 Yungup Road, Napier in the City of Albany. Aurora Environmental and the proponent have prepared responses to the submissions which are outlined in Attachment 1.

We will update the Environmental Assessment and Management Plan when responses have been discussed and an agreed position has been established.

We are confident that the responses clarify that the management measures proposed will ensure that the ROP impacts are managed, with negligible risk to surrounding landowners and the environment.

If you have any queries regarding this response, please contact the undersigned on 0447 446 343 or melanie.price@auroraenvironmental.com.au.

For and on behalf of Aurora Environmental

Melanie Price

Principal Environmental Scientist (Director)

Attachments

Attachment 1: Response to Submissions

Attachment 2: Banhazi T. (2013) Data Collection to Underpin the Quantitative Assessment of Odour, Dust and Noise Emission from Free Range Piggeries. Final Report. APL Project 2011/1015.417. March 2013. University of Southern Queensland and National Centre for Engineering in Agriculture.

Attachment 3: Erosion Fact Sheet

Attachment 4: Northampton County Conservation District (Undated) A Color Catalogue of Best Management Practice for Erosion and Sediment Control.

Attachment 5: United States Environmental Protection Agency (2012) Stormwater Best Management Practices – Silt Fences.

Attachment 6: Proposed EMP Updates

Attachment 7: DWER ROP Advice – Prescribed Premises

Attachment 8: APL Nutrient Balance

ATTACHMENT 1

RESPONSE TO SUBMISSIONS

RESPONSE TO SUBMISSIONS – DEVELOPMENT APPLICATION – FREE RANGE (ROTATIONAL OUTDOOR) PIGGERY – LOT 5856 (1028) YUNGUP ROAD, NAPIER

To clarify, some definitions from Encyclopaedia Britannica:

- **Extensive agriculture is distinguished from intensive agriculture in that the latter, employing large amounts of labour and capital, enables one to apply fertilisers, insecticides, fungicides, and herbicides and to plant, cultivate, and often harvest mechanically.**
- **Free range: Animals that are not closely confined and have some access to the outdoors (RSPCA, 2013a).**
- **Sensitive land use as defined in Environmental Protection Authority (2005): Land uses sensitive to emissions include residential developments, hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, shopping centres, playgrounds, and some public buildings. Some commercial, institutional and industrial land uses which require high levels of amenity or are sensitive to particular emissions may also be considered "sensitive land uses". Examples include some retail outlets, offices and training centres, and some types of storage and manufacturing facilities (EPA, 2005). A single rural dwelling is not included in the definition of 'sensitive land use'.**

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
Amenity – Noise and Odour:	Concerns that the proposal would result in distress and nuisance from noise and odour from manure and food waste decomposing.	Separation distances to receptors such as rural dwellings have been applied to the rotational outdoor piggery, consistent with *National Environmental Guidelines for Piggeries - Australian Pork Limited as Revised* (Tucker, RW and O'Keefe, MF, Project 2011/1039 (2013) which recommends a separation of 250 m for a ROP to reduce the risk associated with noise and odour. The nearest rural dwelling is 629 m to the north of the proposed ROP. Also note that no human food waste will be fed to pigs. They will be fed a specifically formulated pelletised food. A more specific response cannot be provided as the location of the person making this submission has not been provided.	No change to EMP.
	Currently experience bad odour from the cattle feedlot at Settlement Road which is located 6km's away	A Breeder ROP is a different operation from a cattle feed lot as it is less intensive. Separation distances to receptors such as rural dwellings have been applied to the rotational outdoor piggery, consistent with *National Environmental Guidelines for Piggeries as revised- Australian Pork Limited* (Tucker et al., 2013). ROPs do not generate significant odours as outlined in a study by Banhazi, 2013; Attachment 2).	No change to EMP.
	House is only 785m from the piggery. Odour carried by easterly winds will impact on people's ability to run their own businesses in the future which could include tourism or accommodation.	As above.	No change to EMP.
Environmental Impact – Waterways , dust and air pollution.	Concerned that animal waste will contaminate the waterways adversely affecting fish and species as well as impacting water quality available that our livestock drink.	Setbacks from wetlands, water gaining depressions and water have been applied to the proposed ROP in accordance with consistent with *National Environmental Guidelines for Piggeries - Australian*	No change to EMP.

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	Napier Creek is a main waterway which feeds the Kalgan River, part of the Oyster Harbour Catchment. In a year as wet as the year we have had, the animal waste would leach into these water catchments and creek beds. Currently lease property on the south side for cattle farming enterprise and have noticed an increase in salt content in the Kalgan River. Piggery will require large volumes of water to the detriment of supply and quality downstream. Concerned about run-off from the area affecting a swamp that straddles the boundary. Not convinced that there are enough measures explicitly explained as to how this will be managed and would suggest a meeting between ourselves, the proponent and a hydrologist to arrive at suitable set of measures to deal with the issue. If this is done will withdraw objection – Note to applicant Please contact Michael Carmody on 0427186357 should you want to meet onsite as per his request. Environmental impact of pig farming is mainly driven by the spread of faeces and waste to surrounding areas, polluting air and water with toxic waste particles. Waste from pig farms can carry pathogens, bacteria that are often antibiotic-resistant, and heavy metals that can be toxic when ingested. The rainfall of 2021 in Napier was 1000+mm and would be a concern for the escape of pathogens, toxins and the like from an extensive piggery near a flowing watercourse. The rainfall in the year 2010, the year we	*Pork Limited as Revised* (Tucker, RW and O'Keefe, MF, Project 2011/1039 (2013)) which recommends a separation of 100 m for a ROP to a watercourse to reduce the risk associated with nutrient export. The 100 m zone will comprise pasture vegetation and act as a vegetated filter strip as described in Australian Pork Limited (2012) *Outdoor Piggery Fact Sheet – Land and Water Protection Measures for Rotational Outdoor Piggeries.* In addition, drainage management features such as roll over drains and terminal basins will be incorporated. Drainage systems will be determined based on the needs of each rotation. Design guides are included in Attachments 3, 4 and 5, noting that the farm must incorporate structures that are compatible with the cropping phase of the ROP cycle. It is proposed to remove excess bedding and manure from areas where it is likely to build up (shelters and farrowing huts) when they are moved. This material will be provided to a suitably licenced operation for composting and use as a soil conditioner. It is difficult to address the concerns about pollution such as pathogens and heavy metals as no references have been provided. However, a properly managed ROP will not pollute the environment if appropriate measures are in place to manage runoff. No materials containing heavy metals will be used in the operation.	

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	mentioned earlier, was of even greater concern. Here we explain why. In 2010 there was a 900+mm for the year, less than the recent 1000+mm, however in 2010 we recorded 183mm of rainfall in a 26hr period. The effect of this rain flooded the ground with a visible sheet of water of considerable depth. In that rain event, the rainfall in Napier was higher than in Denmark and many other areas in WA. In such a rain event at an intensive piggery set up close to watercourse/s, we would be very surprised if a severe leakage would be contained. And even *if* the spill were to be policed---it would be too late.	There are several Breeder ROP's in the municipalities of Albany and Plantagenet that are operating and not contributing to negative environmental outputs. High rainfall years may happen from time to time, which is why conservative separation distances to boundaries and water courses, wetlands and water gaining areas are provided. The ROP systems are monitored via the APIQ accreditation system (https://www.apiq.com.au/) which is required by ROPs that supply Plantagenet Pork and Milne operations (as this operation will).	
	Water quality of Napier Creek – any underground aquifers (Kalgan River and Oyster Harbour) needs to be studied further by an independent body and any preliminary water testing done prior to ensure there is no environmental impact. 2021 annual rainfall was 937mm – well above the recommended annual rainfall of less than 750mm for an intensive piggery – and significant, prolonged flooding was a result. Proposed location is subject to inundation. It was completely saturated from May until October 2021. This proves the risk is too high for contamination of the natural water course.	DWER has undertaken studies of the Albany Hinterland and Water Allocation Plan Area which is the subject of a water allocation planning process (https://www.water.wa.gov.au/planning-for-the-future/allocation-plans/south-coast-region/albany-and-hinterlands). However, no allocation planning has been determined for the Napier area to date. The rainfall in 2021 was not typical. Separation distances to water courses, wetlands and water gaining areas will prevent use of areas prone to inundation. The proposed ROP is not prone to inundation. Areas prone to inundation have been excluded from the ROP areas.	No change to EMP.

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Buffer from Water bore on adjoining lot	Water bore location – we are currently waiting on a contractor to drill a bore in our eastern paddock for stock water. The buffer between a bore and SOP is 300m, therefore this buffer should be applied. Subject lot 385 Elliott Rd	Lot 385 Elliot Road is upstream from the ROP and will not affect groundwater or bore water at 385 Elliot Road.	No change to EMP.
Buffer from future dwelling	Plan to build a retirement dwelling at 385 Elliott Rd therefore request a 500m buffer from this property so that their future plans are not impacted in terms of where they can locate their dwelling.	A proposal to build a dwelling does not constitute a 'development' or 'sensitive receptor' in the planning approval process.	No change to EMP.
Aboriginal Place	Yarrenyungrip is a place of significance therefore a greater buffer should be required. Please note I am just clarifying this with DPLH to see if this is actually the case.	There are no 'Registered Aboriginal Sites' or 'Other Heritage Places' listed under the *Aboriginal Heritage Act 1972* on the subject land or within 7.5 km. The closest registered site is Morande Lake (Id 4455) which is 7.5 km to the north east.	No change to EMP.
Anaerobic pond	Unlikely that any uncovered anaerobic treatment process will be completely odour-free or leakproof	There are no effluent treatment ponds proposed for the ROP.	No change to EMP.
Animal welfare concerns	Free range pork standards have come under scrutiny and many free range piggeries are only meeting the minimum rules only giving pigs a few metres of straw an limited space.	Cannot address this unless references are provided. The proposed ROP intends to operate in compliance with Model Code of Practice for the Welfare of Animals-Pigs (Revised) (AWWG, 2007).	No change to EMP.
Proximity to properties	Currently bluegums on property, however once harvested the buffer zone will be removed causing visual impact.	The landowner is willing to retain blue gums on the periphery of the property to prevent visual impacts. See Attachment 6.	Update EMP
	In the future will be building a house on the adjoining lot.	Not specified where this property is. A possible future development does not constitute a development/ sensitive land use in planning.	No change to EMP
	Buffer zone of 50m is insufficient taking into account the need for a firebreak and it is not stated the buffer	The buffer zone of 50 m is outlined by NGROP (2013) and has worked successfully for other ROP.	Update EMP

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	zone would be vegetated. We would suggest the bluegums be allowed to re-shoot after being harvested and at the same time a number of local species of other trees and understorey being seeded. (this will mitigate their concern in relation to buffer)	Blue gums have been nominated for retention on the boundary of the ROP. See Attachment 6.	
Value of land:	Concerns regarding the impact on surrounding land value	Land values are not a planning consideration.	No change to EMP
Access	Elliott Rd is a local traffic only road and maintained by the Shire of Plantagenet. The road is sand in most parts and only one vehicle wide.	Noted. Shire of Plantagenet have provided advice about upgrades to the road requiring approval. See next comment.	No change to EMP
Shire of Plantagenet advice:	*Elliott Road is under the care, control and management of the Shire of Plantagenet, who has advised that Elliott Road will require the applicants to contribute to the upgrade of this road to a standard suitable for increased light and heavy vehicles access.* *Any proposed use of this road by Restricted Access vehicles is subject to approval by the Shire of Plantagenet.*	Noted.	No change to EMP
Prescribed Premises	DPIRD suggests that, based on the information supplied, the facility would qualify as a prescribed premise, and would therefore require a works approval from the Department of Water and Environmental Regulation (DWER)	Caron Goodbourne (Manager, Process Industries, Regulatory Services, DWER) has provided advice that operations of this nature do not require a Works Approval or Licence under the Environmental Protection Act. See Attachment 7.	No change to EMP
Indication of Rotation Areas	A plan for the rotations that clearly identifies the three proposed Rotational Outdoor Piggery (ROP) areas on a map should be provided. The frequency for the	See attached plan (Attachment 6). Infrastructure will be moved as a rotation every two years. Within each rotation, shelters will be moved at least every six months within paddocks. Farrowing huts will be	Can be added to EMP

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	movement of infrastructure should also be included in this plan.	moved after every gestion period is completed (every 1.5 months)	
Groundwater	The provided depth to groundwater information is very basic and only states that it is very likely that there is no groundwater resource within 1.5 m of the surface. Detailed and site-specific information is required to ensure groundwater resources are adequately protected.	As stated in the EMP, *National Environmental Guidelines for Piggeries - Australian Pork Limited as Revised* (Tucker, RW and O'Keefe, MF, Project 2011/1039 (2013) recommends that maximum groundwater should be at least 1.5 m below ground surface in ROP areas. Sufficient auger holes (4) were installed to characterise the ROP, indicating that even in a high rainfall winter, groundwater was not within 1.5 m of the ground surface. Smith (1992) indicates that regional groundwater is at approximately 80 mAHD. The majority of the ROP is at 90 mAHD or above, indicating that there is likely to be up to 10 m separation to groundwater.	No change to EMP
Dedicated Nutrient Budget	While information is provided on the likely nutrient outputs of the pigs and the typical uptake rates of crops, a dedicated nutrient budget is not provided. Nutrient budgets outlay the addition of nutrients to the land and calculates crop removal of nutrients for each year of the rotation. This is necessary to show the cumulative effect on the land and the adequacy of the crop rotation to strip excess nutrients from the landscape. DPIRD recommends the use of the nutrient budget calculator for Rotational Outdoor Piggeries developed by Australian Pork Limited.	The nutrient calculator provided by APL with data for the proposed ROP is included in Attachment 8. It indicates that nitrogen is in deficit in year three of cropping. Potassium is in deficit in year two of cropping. Phosphorus will decline from 271 kg/ha at the end of the two year rotation to 121 kg/ha at the end of year six of cropping. This represents phosphorus in mineral and organic forms, not all of which is mobile or available for plant growth or export via water. As the ROP will be part of the APIQ accreditation scheme, soil testing will be undertaken prior to the pig phase and then prior to the pig phase returning to the original area. One of the tests is for phosphorus available for plant uptake (Colwell, Olsen or Bray Phosphorus). The suggested levels to trigger investigation of phosphorus in	Add additional nutrient budget to EMP

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		topsoil are between 31 and 85 mg/kg Colwell Phosphorus (noting that highly productive agricultural systems often have levels greater than this). The nutrient levels are considered to be manageable due to the integrated implementation of manure and bedding removal, control of any overland flow of stormwater and planting of high nutrient requirement crops such as oaten hay.	
Burial Trenches	The proposal notes that burial trenches will be constructed in accordance with the National Environmental Guidelines for Rotational Outdoor Piggeries (2013), but no design specifications for these trenches were provided. DPIRD expects that burial pits are lined to achieve a permeability of at least 1x10-9 m/s. The location of these trenches should also be clearly indicated on a farm map.	The following will apply to burial trenches: • large carcasses should be split to minimise bloating • the pit bases must be at least 2 m above the water table at all times • pits should be situated on low permeability soils and/or low risk sites • mortalities need to be well covered with soil or other suitable material each day to avoid scavenging by feral animals and to prevent odour • further clay should be compacted over filled pits • earth should be mounded over filled pits to promote shedding of stormwater. The mounds should be grassed over but trees should not be planted at the site as the roots allow water to move through the pit. Each trench will be approximately 2 m wide and 1.5 m deep with length depending on location chosen. Due to the duplex soils in the area, digging into the clay will create a relatively impermeable floor and walls to the trench. Material dug to create the trench will be used to backfill, ensuring that at least 0.5 m of soil covers the carcases. Nominated	Update EMP

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		locations of the burial trenches are shown on Attachment 6.	
Terminal Basins	Limited information on the design specifications of terminal basins is provided. It is imperative that wastewater containment infrastructure is constructed to meet acceptable industry standards. Wastewater containment infrastructure is expected to be lined to achieve a permeability of at least 1x10-9 m/s, which is most commonly achieved by compacting 2 layers of 150mm of suitable clay.	The ground surface of each Rotation Area will include one or more contour banks which will act to retard surface flows and encourage infiltration in the more permeable surface layer of soil. A cut off drain will be installed on the down gradient side of each Rotation area to intercept any surface runoff and direct it to either a series of basins or a terminal basin that will be conservatively sized to retain the runoff from a minimum of a 15 mm 1 hour rain event (which equates to 95% of rainfall). The basin will be sized on the basis that run-off from the entire 430,000 m^2 of the site will be captured in either a basin or a drain before any over flow occurs from the terminal basin. The Runoff coefficient used for the runoff calculation is 0.15. This is within the range of recommended runoff coefficients from the Australian Rainfall and Runoff for a Parks, Garden and Meadow environment for a rainfall intensity of 35 mm/hr. This coefficient is considered conservative as the calculation is only sizing the basin for a 15 mm rainfall event and the provision of contour drains will act to slow overland flows, reduce sediment transport and increase infiltration and prevent run-off. For example, in Rotation area 1, comprising approximately 43 ha of operational area, a series of basins, or a terminal basin would need to	Update EMP

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
		accommodate 675 m^3 (based on runoff coefficient of 0.15 with 50% of water reporting to basins).	
Interceptor Drains	Design specifications for interceptor drains are not provided.	The design of the drains will be determined on ground when each rotation is set up. The interceptor drains will be shallow to allow vehicle access in the cropping phase.	
Compliance with National Guidelines	The application will need to demonstrate compliance with the National Environmental Guidelines for Piggeries 2010 and 2018 and the National Environmental guidelines for Rotational Outdoor Piggies 2013 prepared by Australian Pork Limited.	Compliance has been outlined in detail in Section 5 of the EMP. The ROP meets the requirements for setbacks from water courses, boundaries, roads, residences. Recommended distances to groundwater are also met.	No change to EMP
Extensive vs Intensive Piggery	Outdoor piggeries are only considered to be extensive piggeries (and therefore not prescribed) if it can be demonstrated by the applicant through the submission of a Nutrient Management Plan (nutrient budget), that the piggery: • does not trigger the definition for 'intensive agriculture' and 'intensive pig farming'; • nutrients generated during the pig phase is balanced by the nutrient removal rates during the crop phase; and • if operated as an ROP, must be operated as a true rotation operation with all animals and shelters being continuously rotated with a crop for a minimum 2-year animal exclusion rotation period.	Caron Goodbourne (Manager, Process Industries, Regulatory Services, DWER) has advised that ROPs such as this one are rotational and therefore do not meet the definition of a prescribed premises under the Environmental Protection Act (Attachment 7). The ROP will operate as a proper rotational system.	No change to EMP
Additional Water Bodies	DWER's hydrographic mapping identifies two additional potential waterbodies (soaks/dams) which are not shown within the ROP exclusion areas. The waterbodies are located within blue gum plantation and are not visible from any access track into the property. Further information should be provided on	A site inspection indicates that these depressions are not water bodies.	No change to EMP

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	why these waterbodies haven't been incorporated within buffers.		
Rights in Water and Irrigation Act	Part of the western portion of the property is located within the Albany Hinterland Prospective Groundwater Resources Area. Proposed ROP areas to the west are likely to fall within or close to the boundary as shown on the groundwater resource area mapping based on the proponent's site map. The proponent is advised: a) to contact the DWER's South Coast Water Licensing Branch on 9841 0101 regarding the requirements under the *Rights in Water and Irrigation Act 1914* on matters related to: .i) the construction of bores and taking of groundwater within the groundwater resource area. (Artesian bores will require a licence for construction) ii) any proposed interference with the bed and banks of a watercourse	Information on the DWER website [1] states: *The Albany and hinterland water allocation plan area :Groundwater use in this plan area is mainly for:* • *public water supply for Lower Great Southern towns and the City of Albany* • *irrigation of public open space and sporting grounds* • *irrigated commercial horticulture* • *stock watering and domestic gardens.* *All these above uses are licensed, except stock watering and domestic garden use.* As the use of water for the proposed ROP is for watering stock, licensing is not required. No artesian bores are proposed. No modification of beds or banks is proposed.	No changes to EMP
DWER Recommendations	Should the City grant approval for the proposed piggery on Lot 5856 it is recommended that the following conditions be considered: ・ Require the applicant to apply for a works approval to establish for the proposed piggery operations and a licence to operate it. ・ Limiting operations to a free-range breeder operation only	The ROP does not meet the definition of a prescribes premises and therefore is not required to be licensed under Part V of the EPAct. Other conditions noted and will be complied with. Treatment of pigs should a mass death occur would be addressed depending on the cause of mortality as advised by DPIRD.	No change to EMP

[1] https://www.water.wa.gov.au/planning-for-the-future/allocation-plans/south-coast-region/albany-and-hinterlands#:~:text=The%20Albany%20hinterland%20groundwater%20resource,River%2C%20Manypeaks%20and%20Nanarup%20zones.&text=Groundwater%20use%20in%20this%20plan,open%20space%20and%20sporting%20grounds

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	• Limit total stock numbers to a 1000 sow breeder piggery with a maximum SPU of 2,067 SPU at any time, as has been applied for. • Operated as a rotational piggery with a minimum 2-year pig exclusion rotational cycle where a harvestable crop shall be planted to export nutrient from the site. • Applicant should prepare a mass pig death disposal plan to the satisfaction of the City of Albany.		
Manure and Bedding	The EMP proposes to store and/or compost manure and bedding pending off-site sale or disposal but does not provide detail on the waste storage/composting infrastructure proposed, its management and how leachate will be managed.	No waste storage or composting is proposed on site. Spent bedding will be removed from the property when shelter infrastructure is moved.	No change to EMP
Composting	If composting is proposed to occur on-site then the details of the composting area, its location and how leachate is proposed to be managed must be provided.	No composting is proposed	No change to EMP
Depth to Groundwater	There is no site-specific comment about the depth to the shallowest groundwater table, critical for determining any potential for groundwater contamination. The statement that no groundwater was found to be present within 1.5 m of the ground surface is not substantiated as to where and when this study was carried or whether this is the highest winter water table. This is not considered evidence that a minimum 1.5 separation to groundwater in accordance with the NEGP guidelines can be met. Further investigation is required to determine depth to groundwater across the site to a depth of 3m.	Regional groundwater is mapped as being at approximately 80 m AHD which is 10 m lower than most of the ROP. The soils are duplex which means that there are clayey sands above the regional groundwater. Sampling of the ROP area occurred during the wettest period of 2021 which was a higher than average rainfall year. Water was not perching on the clay layer during that time.	No change to EMP

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
Drainage Management	Construction detail and location is needed for the cut-off or roll-over drains and terminal ponds proposed to be installed. Pond sizing calculations are also needed. It is expected that wastewater containment infrastructure is constructed to meet industry standards. Wastewater containment infrastructure is expected to be lined to achieve a permeability of at least 1x10-9 m/s, which is most commonly achieved by compacting 2 layers of 150mm of suitable clay. The specification of the cut-off drains and dams are not provided.	As stated previously, the location and design of the cut-off and rollover drains needs to be determined based on the local topography foreach Rotational unit. Consistent with API guidance, the drainage system will be sized to capture at least the first 15 mm of rainfall. This detail cannot be determined until the location and layout of a particular Rotational Unit is determined. It is suggested that a generic design is developed and submitted to the City of Albany for discussion and agreement so that the design principles can be confirmed. As the proposal is for an ROP, no waste water infrastructure is proposed and so the comments on lining specifications, while accurate, are not relevant.	
	No justification as to how groundcover over paddocks will be maintained throughout the pig phases.	Maintenance of grass cover in pig production areas during summer months may be difficult. However, pasture strips and retention of blue gums surrounding each of the three ROP areas will create biofiltration zones and break points in surface drainage.	Add detail regarding biofilter zones and retention of blue gum strips to EMP.
Disposal of Dead Pigs	The National Environmental Guidelines for Piggeries states that burial should only be used where rendering or composting is not feasible, and it is not the preferred method. More details regarding disposal pits are provided in the guidelines. In addition, AUSVETPLAN (Edition 3 p29) states that where the burial site is not located on soil with low permeability,	Rendering is not available and composting has its own management issues. The soil type associated with the ROP is suited for burial as it is duplex with sand and sandy clays over clay.	Add detail regarding burial to the EMP

SUBJECT	CONCERN/ QUERY	PROPONENT RESPONSE	RECOMMENDED CHANGE TO EMP
	strong consideration must be given to lining the pits to reduce the likelihood of contamination of the water table by leachate.		

References:

Aurora Environmental (2021) Environmental Assessment and Management Plan – Outdoor Rotational Piggery – Breeder Facility – Lot 5856 (No. 1028) Yungup Road, Napier, City of Albany. Prepared for Sangarra South Pty Ltd atf Sangarra Livestock Trust. Report AA2013/051 Version 2. 4 November 2021. Albany, Western Australia.

EPA, Environmental Protection Authority (2005) Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986). Separation Distances between Industrial and Sensitive Land Uses. Guidance No. 3. Perth, Western Australia.

Latto, A., Noonan J.D., Taylor, R.J. (2000) Environmental Guidelines for New and Existing Piggeries. Bulletin 4416. Agriculture Western Australia, Department of Environmental Protection, Water and Rivers Commission, West Australian Pork Producers' Association, Department of Health.

Tucker R.W. and O'Keefe M.F. (2013) Environmental Guidelines for Rotational Outdoor Piggeries. FSA Consulting Report 7634/2. FSA Consulting, Horsham.

Tucker, RW and O'Keefe, MF (2011) National Environmental Guidelines for Rotational Outdoor Piggeries, Project 2011/1039 (2013), Australian Pork Ltd, Barton, ACT, 2600 (revised)

APPENDIX A - PEIZOMETER SOIL LOGS

Soil Sampling (Validation) Field Log

Sheet 1 of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1A	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 0.4
QA/QC Sample IDs:

Depth to Water (mbgl):
Not encountered.

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine damp dark grey sand		0 - 0.1				
Orange mottled red/brown mottle clay		0.35 - 0.4				
Clay moist between approx 0.36 - 0.36 -0.4						
Clay dry		0.4 -				

SKETCH

E: 578626.9
N: 6146782

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1B	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	-
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 1.1
QA/QC Sample IDs:

Depth to Water (mbgl):
No groundwater evident

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey Sand		0 - 0.15				
Fine white sand		0.15 - 0.8				
Fine light orange sand		0.8 - 1.1				
no groundwater evident.						

SKETCH

E: 117.8626
N: -34.8183

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1C	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.45	Depth to Water (mbgl):	Not encountered
QA/QC Sample IDs:			

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey sand with some residual road base		0 - 0.15				
Fine white sand		0.15 - 0.45				
Disturbed area graded firebreak ex road in close prosimity to the adjacent blud gum plantation.						
Road has been moved to be located against the property boundary.						

SKETCH

E: 579221.29
N: 6146771.18

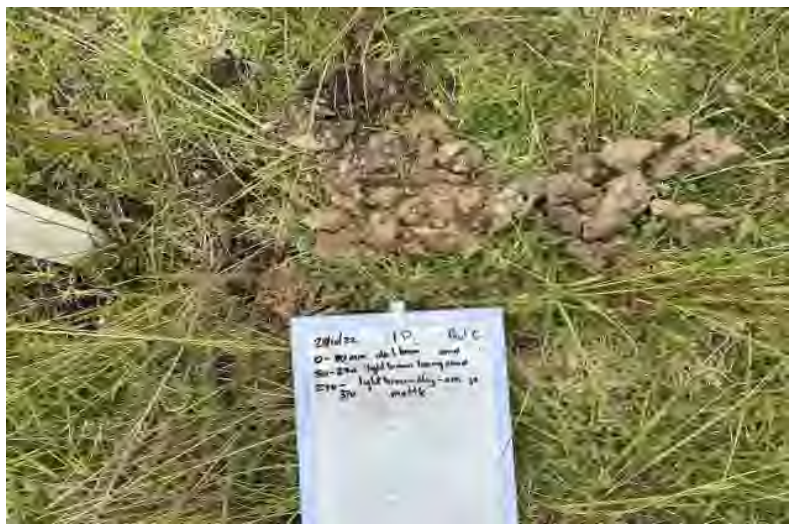
Soil Sampling (Validation) Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1D	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.33	Depth to Water (mbgl):	No groundwater encountered
QA/QC Sample IDs:			

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Dark brown sand		0.0 - 0.08				
Light brown loamy sand		0.08 - 0.27				
Light brown clay orange mottle		0.27 - 0.33				

SKETCH



E: 578707.78
N: 6146298.70

Soil Sampling (Validation) Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1E	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.26	Depth to Water (mbgl):	No groundwater encountered
QA/QC Sample IDs:			

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Damp dark grey sand		0 - 0.15				
Gravelly brown clay		0.15 - 0.26				

SKETCH

E: 579131.49
N: 6146328.55

Soil Sampling (Validation) Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1F	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	1.4	Depth to Water (mbgl):	No groundwater encountered
QA/QC Sample IDs:			

SOIL PROFILE / **SOIL DATA**

DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey sands		0 - 0.15				
White fine sand		0.15 - 1.4				

SKETCH

E: 579477.18
N: 6146325.34

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1G	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.31	Depth to Water (mbgl):	
QA/QC Sample IDs:		No groundwater encountered	

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Brown loamy sand		0 - 0.1				
Light brown loam		0.1 - 0.25				
Gravel (Refusal)		0.25 - 0.31				

SKETCH

E: 578705.83

N: 6146071.36

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1H	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.6	Depth to Water (mbgl):	No groundwater encountered
QA/QC Sample IDs:			

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Darkbrown fribale sand		0 - 0.050				
Fine grey sand		0.05 - 0.13				
White sand		0.13 - 0.6				
Mottled orange brown light clay		0.6 -				

SKETCH

E: 578990.87
N: 6146035.64

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	1I	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 0.23

QA/QC Sample IDs:

Depth to Water (mbgl):

No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Grey Sand		0 - 0.05				
Mottle white sand		0.05 - 0.23				
Refusal		0.23 -				

SKETCH

E: 578990.92

N: 6146041.18

Soil Sampling (Validation) Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	2A	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	-
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.9m	Depth to Water (mbgl):	Not encountered
QA/QC Sample IDs:			

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey powdery sand		0 - 0.1				
Light grey fine sand		0.1 - 0.4				
Light orange fine sand		0.4 - 0.55				
Fine orange sandy loam		0.55 - 0.7				
Fine orange sandy loam with small pebbles/stones		0.7 - 0.9				

SKETCH

E:

N:

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	2B	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 0.3
QA/QC Sample IDs:

Depth to Water (mbgl):
No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Dark grey sand damp		0 - 0.250				
Mottled orange brown clay damp		0.25 - 0.3				
Beige clay		0.3 -				

SKETCH

E:
N:

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	2C	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 0.33

QA/QC Sample IDs:

Depth to Water (mbgl):

No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey sands		0 - 0.12				
Light brown sand loam		0.12 - 0.33				
Gravelly sand - compacted		0.33 -				

SKETCH

E: 579755.17

N: 6146319.60

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	2D	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.75	Depth to Water (mbgl):	
QA/QC Sample IDs:		No groundwater encountered	

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Damp grey sand		0 - 0.2				
Brown sand loam		0.2 - 0.4				
Orange brown sand loam		0.4 - 0.5				
Yellow sand (0.65 - 0.75 wet)		0.5 - 0.75				
Refusal (gravel)		0.75 -				

SKETCH

E: 579674.05
N: 6145825.66

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	2E	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 0.5
QA/QC Sample IDs:

Depth to Water (mbgl):
No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Dark grey fine sand (wet)		0 - 0.1				
Light grey / white fine sand (saturated)		0.1 - 0.45				
Orange, grey clay		0.45 - 0.5				

SKETCH

E: 579849.70
N: 6145831.90

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:		WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	1.7	Depth to Water (mbgl):	
QA/QC Sample IDs:			No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey sands		0 - 0.1				
Fine grey sand		0.1 - 0.4				
Fine white sand		0.4 - 1.6				
White sand with some mottling (orange) and small pebbles/stones		0.6 - 1.7				

SKETCH

E: 580487.95
N: 6146654.79

Soil Sampling (Validation) Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	3B	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	1.7	Depth to Water (mbgl):	No groundwater encountered
QA/QC Sample IDs:			

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Grey sand		0 - 0.1				
White fine sand		0.1 - 0.9				
Orange sandy Loam		0.9 - 1.7				

SKETCH

E: 580892.70
N: 6146710.01

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	3C	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	2.2	Depth to Water (mbgl):	
QA/QC Sample IDs:			No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Grey sand		0 - 0.8				
Gravelly light brown sand		0.8 - 2.2				
White loamy clay, with red/orange mottling		2.2 -				

SKETCH

E:
N:

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	3D	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.3	Depth to Water (mbgl):	
QA/QC Sample IDs:			No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey sands		0 - 0.08				
Light brown gravelly loam		0.08 - 0.2				
Orange gravelly sand		0.2 - 0.3				
Refusal		0.3 -				

SKETCH

E: 580282.34
N: 6145839.22

Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:	3E	WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.

Total Depth of Hole (m): 0.2
QA/QC Sample IDs:

Depth to Water (mbgl):
No groundwater encountered

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Fine grey sand		0 - 0.05				
Brown gravelly loam with stones		0.05 - 0.2				
Refusal		0.2 -				

SKETCH

E: 581010.67
N: 6146293.07

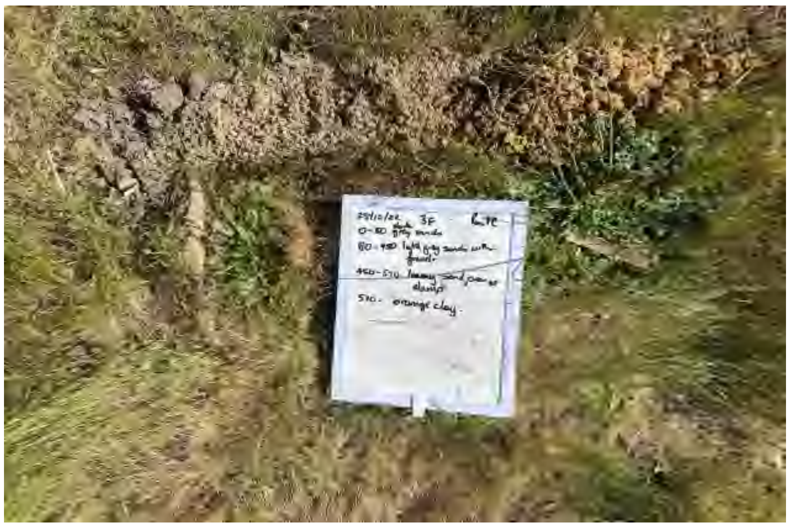
Soil Sampling (Validation)
Field Log

Sheet of

CLIENT:	Sangarra Southern / Milne Agriculture	DATE:	28/10/2022
PROJECT/PHASE:	Piezoemeter Installation - Works Approval Application	METHOD:	Hand Auger
LOCATION:		WEATHER:	Fine & sunny
JOB NUMBER:	MAG2022-011	STORAGE:	
LANDSCAPE:	Lot 1028 Yungup Road, Napier, City of Albany	SCIENTIST:	Paul C.
Total Depth of Hole (m):	0.52	Depth to Water (mbgl):	
QA/QC Sample IDs:		No groundwater encountered	

SOIL PROFILE			SOIL DATA			
DESCRIPTION (Colour, texture, Soil Type)	LOCATION (wall/floor)	DEPTH (mbgl)	SAMPLE ID	PID ppm	Staining (Y/N)	Odour (Y/N)
Dark grey fine sand		0 - 0.08				
Light grey fine sand with gravelly stones		0.08 - 0.45				
Orange sandy loam		0.45 - 0.52				
Orange clay		0.52 -				

SKETCH



E: 580616.00
N: 6145821.87

CITY OF ALBANY LOCAL PLANNING SCHEME No. 1

Animal Husbandry – Intensive (Piggery) – 1028 Yungup Rd, Napier WA 6330 P2210668

SCHEDULE OF PUBLIC SUBMISSIONS

Note: This is a broad summary of the submissions only.

Summary of submission.	Officer Comment
Impacts on amenity & the environment • Concerns that the proposal would result in distress and nuisance from noise and odour from manure and food waste decomposing. • Currently experience bad odour from the cattle feedlot at Settlement Road which is located 6km's away • House is only 785m from the piggery. Odour carried by easterly winds will impact on peoples ability to run their own businesses in the future which could include tourism or accommodation. • Concerned that animal waste will contaminate the waterways adversely affecting fish and species as well as impacting water quality available that our livestock drink. • Napier Creek is a main waterway which feeds the Kalgan River, part of the Oyster Harbour Catchment. In a year as wet as the year we have had, the animal waste would leach into these water catchments and creek beds. • Piggery will require large volumes of water to the detriment of supply and quality downstream. • Environmental impact of pig farming is mainly driven by the spread of faeces and waste to surrounding areas, polluting air and water with toxic waste particles. Waste from pig farms can carry pathogens, bacteria that are often antibiotic-resistant, and heavy metals that can be toxic when ingested. • The rainfall of 2021 in Napier was 1000+mm and would be a concern for the escape of pathogens, toxins and the like from an extensive piggery near a flowing watercourse. The rainfall in the year 2010, the year we mentioned earlier, was of even greater concern. Here we explain why. • In 2010 there was a 900+mm for the year, less than the recent 1000+mm, however in 2010 we recorded 183mm of rainfall in a 26hr period. The effect of this rain flooded the ground with a visible sheet of water of considerable depth. In that rain event, the	Refer to Council Report (18-27)

CITY OF ALBANY LOCAL PLANNING SCHEME No. 1

Animal Husbandry – Intensive (Piggery) – 1028 Yungup Rd, Napier WA 6330 P2210668

SCHEDULE OF PUBLIC SUBMISSIONS

Note: This is a broad summary of the submissions only.

Summary of submission.	Officer Comment
rainfall in Napier was higher than in Denmark and many other areas in WA. In such a rain event at an intensive piggery set up close to watercourse/s, we would be very surprised if a severe leakage would be contained. And even *if* the spill were to be policed---it would be too late. • Land subject to inundation • Visual impact • Impact on future development on adjoining sites, including future dwellings and bore location	
Access not suitable for additional traffic • Elliott Rd is a local traffic only road and maintained by the Shire of Plantagenet. The road is sand in most parts and only one vehicle wide. • Access is not sufficient for additional traffic	Refer to Council Report (28-30)
Aboriginal Place • Concerns were raised that it will impact an Aboriginal place of significance	Refer to Council Report (31-32)
Anaerobic pond • Concerns that any anaerobic pond will not be completely odour-free or leakproof	Refer to Council Report (33-34)
Animal welfare concerns: • Concerns were raised about animal welfare.	Refer to Council Report (33-35)
Value of property: • Concerns regarding the impact on surrounding land value	Refer to Council Report (33-36)

Proposed road excision and closures affecting Reserve 24258 Torndirrup National Park
Frenchman Bay Road & Quaranup Road

SCALE @ A4: Date Printed: 17/11/2022

MXD: X:\Planning_&_Development\Lands\Torndirrup Roads\R24258\R24258.aprx

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Proposed road excision and closures affecting Reserve 24258 Torndirrup National Park
Frenchman Bay Road
between Quaranup Road & The Gap Road

SCALE @ A4: Date Printed: 17/11/2022

MXD: X:\Planning_&_Development\Lands\Torndirrup Roads\R24258\R24258.aprx

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Proposed road excision and closures affecting Reserve 24258 Torndirrup National Park
Salmon Hole Road

SCALE @ A4: Date Printed: 13/12/2022

MXD: X:\Planning_&_Development\Lands\Torndirrup Roads\R24258\R24258.aprx

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Proposed road excision and closures affecting Reserve 24258 Torndirrup National Park
Frenchman Bay Road
between The Gap Road & Blowholes Road

SCALE @ A4: Date Printed: 17/11/2022

MXD: X:\Planning_&_Development\Lands\Torndirrup Roads\R24258\R24258.aprx

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Proposed road excision and closures affecting Reserve 24258 Torndirrup National Park
Blowholes Road

SCALE @ A4: Date Printed: 17/11/2022

MXD: X:\Planning_&_Development\Lands\Torndirrup Roads\R24258\R24258.aprx

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Proposed road excision and closures affecting Reserve 24258 Torndirrup National Park
Salmon Hole Road

SCALE @ A4: Date Printed: 17/11/2022

MXD: X:\Planning_&_Development\Lands\Torndirrup Roads\R24258\R24258.aprx

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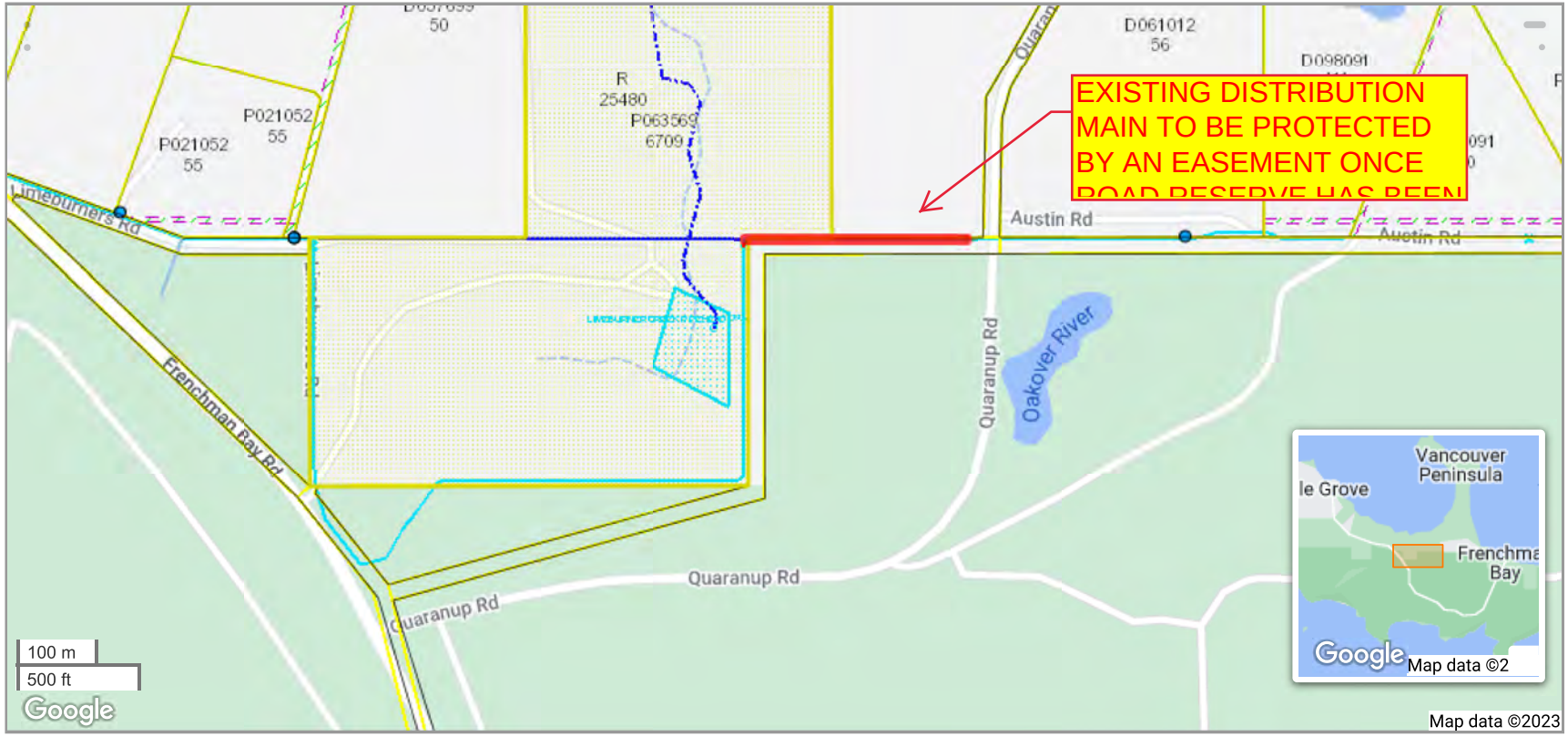

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