Final Report

West Schofields Precinct Level 1 Odour Assessment

Document Control Number: AQU-NW-001-20975D

Date: 5 June 2018

Pacific Environment Limited

Technologies Consulting Monitoring

www.pacific-environment.com

Project Name: West Schofields Precinct Level 1 Odour Assessment

Document Control Number: AQU-NW-001-20975D

Prepared For: Department of Planning and Environment

Approved For Release By: Judith Cox

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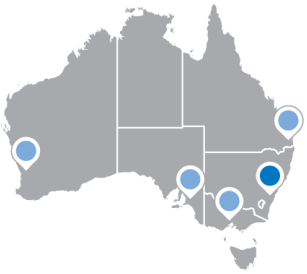
Version	Date	Comment	Prepared by	Reviewed by
01	20/03/2017	Draft 1	Liza McDonough	Francine Manansala / Judith Cox
02	05/06/2018	Final	Liza McDonough/Francine Manansala	Francine Manansala / Judith Cox



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Executive summary

This assessment was completed to determine the potential for odour impacts on the West Schofields Precinct (the Project).

The Project is located in a semi-rural/residential area that currently comprises houses on rural properties. Commercial activities in the Project area include (but are not limited to) brick and paving businesses, plaster lining services, distribution services, drilling contractors, firewood suppliers and pet food and stockfeed suppliers.

Potential odour sources surrounding the Project study area include poultry operations, intensive piggeries, a meat rendering operation, a green waste recycling facility, mushroom farms and sewage treatment plants (STPs).

A Level 1 odour impact assessment has been conducted consistent with the *Technical framework: Assessment and Management of Odour from Stationary Sources in NSW* (**NSW DECC, 2006a**) and the associated Technical Notes (**NSW DECC, 2006b**).

The study has predicted that a small number of poultry operations in the vicinity of the Project study area have potential to individually impact on the proposed development area. When combining the individual poultry operations with greatest influence using the Level 1 assessment, the north, east and western borders of the Project study area are predicted to be affected by poultry farm odour. The study also identified the Northwest Recycling Centre as a source of odour, which is located within the Project boundary. This odour source is identified as predominantly affecting the northern portion of the Project site.

Separation distances for other potential odour sources, such as intensive piggeries, the meat rendering operation and the Quakers Hill and Riverstone STPs have not resulted in encroachment on the Project study area when assessed using the Level 1 assessment methodology, or use of an alternative default buffer distance where Level 1 methods do not exist (i.e. for meat rendering).

In order to increase confidence in the assessment results and to reduce potential areas of influence around odour sources, it is recommended that a Level 2 odour impact assessment be conducted for the sources that were identified as potentially impacting the Project study area.

This report has provided options to control odour impacts from odour generating development on proposed residential development and associated land uses, for potential inclusion in the Development Control Plan for the West Schofields Precinct.

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1. Introduction

Pacific Environment has been commissioned to complete an odour assessment relating to the proposed development of the West Schofields Precinct, located in West Schofields, NSW (the Project). The Department of Planning and Environment NSW (DP&E) is managing the technical studies required for the proposed development.

The West Schofields Precinct is bounded by Eastern and Bells Creeks, Garfield Road West to the north and Railway Terrace, Townson Road and the Colebee subdivision to the south.

1.1 Background

1.1.1 Sydney's North West Growth Area

Sydney's North West Growth Area (NWGA) covers approximately 10,000 hectares, located within the Local Government Area (LGA) boundaries of The Hills, Blacktown and Hawkesbury. It will be supported by a major centre at Rouse Hill and will contain about 90,000 new homes. It is made up of 16 'Precincts', which are areas that will be progressively released over the next 30 years.

1.1.2 Precinct Planning

Precinct Planning is a detailed process which analyses the development potential of each Precinct in the Growth Areas. It will be carried out as a partnership between the NSW Government and the relevant Local Council.

Precinct Planning will involve detailed investigations into appropriate land use options, physical environment constraints (i.e. topography, vegetation, bushfire mapping, mapping of water courses etc.) and infrastructure requirements. The process looks at issues including riparian zones, conservation zones, locations of town centres, the mix and type of housing, and key transport routes. It does this at the Precinct level, saving the need to revisit many issues at Development Application stage.

The analysis will include extensive background studies including Aboriginal and European Heritage, land capability, contamination, noise, odour, transport, biodiversity, bushfire, economics and employment and community facilities and open space.

These studies help to form an Indicative Layout Plan which will be used to test the feasibility of development scenarios with State agencies.

Each Precinct Planning package will include:

- A Precinct Planning report.
- The draft Indicative Layout Plan.
- A draft Amendment to the Growth Centres State Environmental Planning Policy (SEPP) to facilitate rezoning.
- A draft Development Control Plan (DCP).
- Supporting background studies.

Further information about Sydney's Growth Areas and Precinct Planning has been prepared by the Land Release and Strategy team of the DP&E and is available at http://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-and-Precincts.

1.2 Project description

The Project is located in the southern, central section of the NWGA is wholly located within the Blacktown LGA.

The Project currently consists of a mix of urban areas and farming lands.

Figure 1.1 shows the location of the Project site.

Figure 1.1: West Schofields Precinct Project Study Area

1.2.1 Surrounding land use

To the east of the Project area is the Alex Avenue Precinct. The area includes the suburb of West Schofields, a semi-rural area that currently comprises houses on rural properties as well as commercial activities such as livestock. A number of poultry farms are located in this area. To the west is the Marsden Park Precinct, which is a predominantly large, open rural area. To the south is the Colebee Precinct, which is largely open rural area. To the north and north-east of the Project is the Riverstone Precinct which contains a mix of urban areas, semi-rural residential and land uses including poultry farms and a piggery. The densely-populated town of Riverstone also lies to the north.

1.3 Objectives of the study

The study objectives are to:

- Investigate and identify any source or sources of odour on or in the vicinity of the subject land, including from any ongoing agricultural activities on the subject land.
- Investigate the implications of any existing odours for the staging of the development of the land.
- Recommend management strategies to maximise development opportunities under the existing odour situation and into the future.
- Make recommendations for controlling impacts from odour-generating activities in proposed residential areas and associated land uses.
- Develop land use recommendations that provide adequate buffers or transition zones between residential and employment/industrial areas, both proposed and existing.

1.4 Scope of work

The study is to be conducted in two stages. The necessity for Stage 2 (full dispersion modelling assessment) will be determined by the outcomes of Stage 1 (this phase of work), as to whether a more detailed assessment is required. The scope of work required for Stage 1 of the study includes:

- Investigation of any potential sources of odour that may impact on the proposed development, including from existing agricultural activities in the vicinity of the subject land and neighbouring areas.
- Develop an understanding of the nature of any odour producing activities identified.
- Complete a Level 1 Odour Impact Assessment, as outlined in the NSW Office of Environment and Heritage's (OEH) Odour Policy and associated Technical Notes, resulting in recommended separation distances.
- Prepare a report outlining the findings of the Odour Impact Assessment, including maps outlining where urban development would encroach onto the 'separation distances' determined by the study, and make recommendations for any Stage 2 work if required.
- Provide recommendations to control odour impacts from odour generating development on proposed residential development and associated land uses (including open space) as appropriate.

As part of this study an extensive visit of the area was conducted to collect relevant data on odour producing activities, the surrounding areas and meteorological conditions for input to the Level 1 Odour Impact Assessment.

2. Odour legislation and guidelines

2.1 Legislation

The three most important pieces of legislation for preventing and controlling odour are the:

- Environmental Planning and Assessment Act 1979 (EP&A Act).
- Protection of the Environment Operations Act 1997 (POEO Act).
- Local Government Act 1993 (LG Act).

The EP&A Act deals with land-use planning, development, assessment and approvals.

The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act).

The POEO Act includes the concept of “offensive odour” (section 129) and states it is an offence for scheduled activities to emit “offensive odour”.

The LG Act gives local councils the power to deal with public nuisance, including odour emissions.

2.2 Guidelines

Odour is probably the most widespread and complex local air pollution problem in Australia. It accounts for the majority of complaints received by environmental authorities and can be a major source of annoyance and stress in affected communities.

In November 2006, NSW EPA released two guidance documents: *Technical Framework for the Assessment and Management of Odour from Stationary Sources in NSW* and its associated *Technical Notes for the* Assessment *and Management of Odour from Stationary Sources in NSW*. The discussion in this report draws extensively from those documents, which outline the NSW EPA’s proposed approach for the assessment of odour emissions, using a three-level system of odour impact assessment of increasing complexity and detail. Depending on the individual characteristics of a new development and its proposed location, a varying degree of investigation into the potential for odour impacts may be required.

- Level 1 is a screening-level technique based on generic parameters for the type of activity and site. It requires minimal data and uses simple equations to provide a broad estimate of the extent of any odour impact. It may be used to identify the potentially affected zone and site suitability for a proposed facility or new neighbouring development or expansion of an existing facility.
- Level 2 is a screening-level dispersion modelling technique, using worst-case input data (rather than site-specific data). It is more rigorous and more realistic than a Level 1 assessment. It may be used to assess site suitability and odour mitigation measures for new, modified or existing activities.

- Level 3 is a refined-level dispersion modelling technique using site-specific input data. This is the most comprehensive and most realistic level of assessment available. It may be used to assess site suitability and odour mitigation measures for new, modified or existing activities.

This assessment is based on a Level 1 odour impact assessment. In general, a Level 1 assessment is sufficient to broadly identify whether a site is suitable or if further assessment of odour impact is necessary or worthwhile.

For a Level 1 assessment, a “pass” suggests the calculated extent of the odour impact is less than the distance to the nearest (or likely future) receptor. Conversely, a “fail” suggests the site is probably unsuitable but may warrant further, more detailed investigation. Typically, if a proposal fails Level 1 assessment, the following should be considered:

- Adopt better management practices.
- Increase the level of pollution control.
- Relocate the activity to an alternative site.
- Assess the activity using either a Level 2 or 3 assessment.
- Redesign the activity or consider other actions as necessary.

The predominant potential odour producing activities surrounding the Project study area are “diffuse sources”, for example poultry farms and intensive piggeries. Diffuse sources are generally dominated by odour emissions from area sources, which are difficult to control compared to point source emissions. The odour impacts from these sources are most effectively managed through careful site selection, appropriate project design, site layout and sound management practices.

For poultry farms and piggeries, generic procedures for determining the affected areas have been developed and are useful for assessing the potential for odour impacts or the potentially affected area around existing operations.

The Level 1 odour impact assessment for diffuse sources takes into account the following factors:

- Type of operation.
- Size of operation.
- Proposed management practices.
- Density of population likely to be impacted, ranging from a single rural residence to a predominantly urban setting.
- Local topography (flat, undulating, high relief, low relief or drainage flows).
- Surrounding vegetation (none, light or heavy tree cover).
- Local meteorology (high, average or low frequency of winds toward sensitive receptor).
- Possibility of cumulative impacts.

In summary, the Level 1 odour impact assessment for diffuse sources could be used to determine whether the proposed management practices and distance to the nearest sensitive receptor (and likely future receptors) are sufficient to meet environmental outcomes.

2.2.1 Odour impact assessment criteria

Odour impacts are determined by several factors. The most important factors (the so-called **FIDOL** factors) are:

- The Frequency of the exposure.
- The Intensity of the odour.
- The Duration of the odour episodes.
- The Offensiveness of the odour.
- The Location of the source.

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable.

The NSW DECC framework documents include some recommendations for odour criteria. The criteria have been refined by NSW DECC to take account of population density in the area. **Table 2.1** lists the odour criteria, to be exceeded not more than 1% of the time, for different population densities.

The difference between odour criteria is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely-populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

The criteria assume that 7 odour units (ou) at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be exposed. The criterion of 2 ou at the 99th percentile is considered to be acceptable for the whole population.

Table 2.1. *Odour assessment performance criteria*

Population of Affected Community	Odour Units
Rural single residence (≤ ~2)	7
~10	6
~30	5
~125	4
~500	3
Urban (~2000) and/or schools and hospitals	2

Source: NSW DECC, 2006a, p.21

3. Odour impact assessment

3.1 Approach

An investigation of the Project study area and the surrounding land was conducted to identify potential sources of odour that may impact future development and to develop an understanding of the nature of any odour producing activities.

Sources of information used to identify potential odour sources included aerial maps, Yellow Pages searches, internet research and previous assessments for Precinct Planning (**Benbow Environmental (BE), 2008a & 2008b; PAEHolmes, 2010; Renzo Tonin & Associates and Todoroski Air Sciences, 2016**). A comprehensive site visit was conducted to gather as much data as possible about the odour sources and other factors required for the assessment (outlined in **Section 3.5**).

The data were used to assess areas of potential odour impact around each identified odour source using the Level 1 odour impact assessment methodology provided by *Technical Notes for the Assessment and Management of Odour from Stationary Sources in NSW* (**NSW DECC, 2006b**). Where Level 1 odour impact assessment methodologies are not published for particular potentially odorous sources, a recommended buffer distance was applied, based on alternative guidance. It should be noted however that the buffer distance approach is generally more limited than the NSW DECC Level 1 assessment as it usually takes no account of local factors or scale of operation.

3.2 Odour sources

Potential odour sources identified as part of the assessment include poultry operations (broiler, breeder and layer chickens and ducks), intensive piggeries, mushroom production, a green waste recycling facility, a meat rendering plant, an abattoir and wastewater treatment plants.

The following sites were investigated as potential odour sources for this study. **Figure 3.1** shows the locations of these sources in relation to the Precinct. Those sources identified as ‘no longer operational’ or further than 5 km away, have not been shown.

Table 3.1. *List of odour sources considered in the assessment*

Poultry Operations	Intensive Piggeries	Other Sources
100 Worcester Rd, Rouse Hill (layer farm)	Gordon Rd, Schofields (piggery) – site visit confirmed that this farm is no longer operational	A J Bush & Son, Riverstone Meat Rendering Operations (meat rendering)
181 Cudgegong Rd, Rouse Hill (layer farm) – site visit confirmed that this farm is no longer operational	101 Hambledon Rd, Schofields (piggery)	920 Richmond Rd, Marsden Park - Marsden Park Landfill
89 Schofields Rd, Rouse Hill (layer farm) – site visit confirmed that this farm is no longer operational	1200 Richmond Rd, Marsden Park (piggery) – this site is no longer operational	Quakers Hill STP (Sewage Treatment Plant)
68 Schofields Farm Rd, Schofields (layer farm) – site visit confirmed that this farm is no longer operational		132 Burfitt Rd, Richmond North West Recycling Centre (green waste recycling facility)
73 Boundary Rd, Schofields (layer farm) – site visit confirmed that this farm is no longer operational		Riverstone STP (Sewage Treatment Plant)
95 Tallowong Rd, Schofields (broiler farm)		Elf Mushroom (mushroom production)
20 Clarke St, Riverstone (broiler farm)		White Prince Mushroom (mushroom production)
16 Clarke St Riverstone (broiler farm)		496 Windsor Rd, Vineyard (mushroom farm)
54 Pelican Rd, Schofields (broiler farm) – site visit confirmed that this farm is no longer operational		Elf Farm Supplies (mushroom composting) – more than 5 km away
2 Pelican Rd, Schofields (broiler farm)		Rouse Hill STP (Water Recycling Plant) – more than 5 km away
93 Hambledon Rd, Schofields (broiler farm)		McGraths Hill STP (Sewage Treatment Plant) – more than 5 km away
98 Hambledon Rd, Schofields (broiler farm) – site visit confirmed that this farm is no longer operational		South Windsor STP (Sewage Treatment Plant) – more than 5km away
96 Hambledon Rd, Schofields (duck farm) – site visit confirmed that this farm is no longer operational		14 Hill View Rd, Kellyville (duck abattoir) – more than 5 km away
25 Schofields Rd, Schofields (broiler farm)		St Mary's STP (Sewage Treatment Plant) - more than 5 km away
26 Schofields Farm Rd, Schofields (broiler farm)		
34-36 Schofields Rd, Schofields (duck farm) – site visit confirmed that this farm is no longer operational		
37-39 Boundary Rd, Schofields (layer farm)		
47 Argowan Rd, Schofields (broiler farm) – site visit confirmed that this farm is no longer operational		
45 Farm Rd, Riverstone (duck farm)		

169 Clifton Rd, Marsden Park (layer farm) – site visit confirmed that this farm is no longer operational
138 Clifton Rd, Marsden Park (broiler farm)
1148 Richmond Rd, Marsden Park (broiler/layer)
264A South St, Marsden Park (broiler farm)
306 South St, Marsden Park (broiler farm)
1132 Richmond Rd, Marsden Park (layer farm)
14 Hillview Rd, Kellyville (duck farm) – more than 5 km away
31-33 Boundary Rd, Box Hill (layer farm) – site visit confirmed this site is no longer operational
466 Windsor Rd, Vineyard (breeder farm)
199 Stahls Rd, Oakville (broiler farm)
472 Windsor Rd, Vineyard (broiler farm)
205 Maguires Rd, Maraylya (breeder farm) – more than 5 km away
115 Wolseley Rd, Oakville (broiler farm) – more than 5 km away
372 Windsor Rd, Vineyard (broiler farm) – more than 5 km away
Dunns Rd, Maraylya (broiler farm) – more than 5 km away
22 Withers Rd, Kellyville (broiler farm) – more than 5 km away
23 Withers Rd, Kellyville (broiler farm) – more than 5 km away
28A Foxall Rd, Kellyville (layer farm) – more than 5 km away
421 - 427 Flushcombe Rd, Blacktown (Red Lea chicken abattoir) – more than 5 km away
291 Fairey Rd, South Windsor – more than 5km away
Pirovic Family Farms (egg layer), 138 Sixth Ave, Llandilo – more than 5 km away

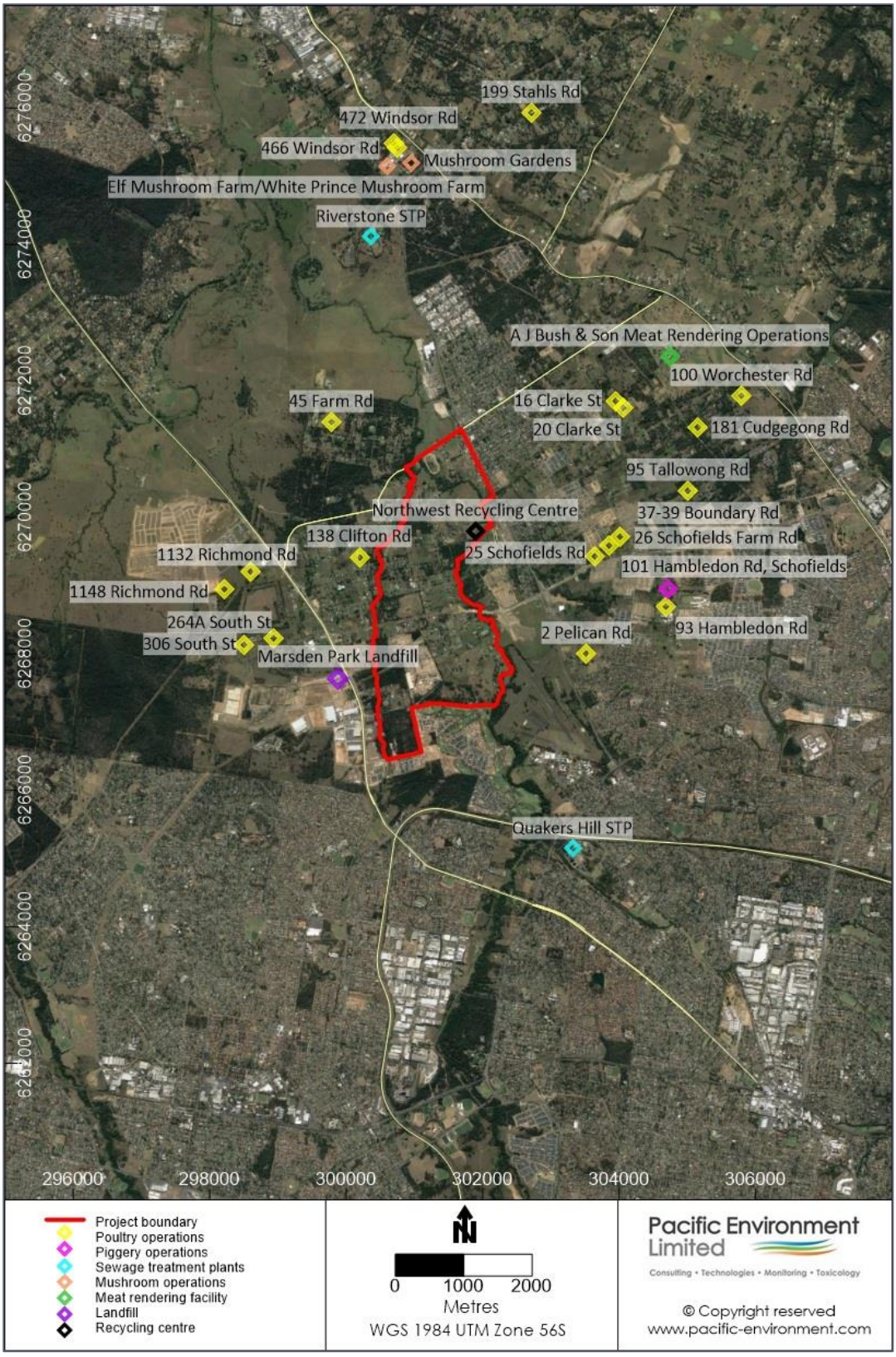

Figure 3.1: Odour Sources in the Vicinity of the Precinct

Investigations have revealed that some operating facilities are located at a significant distance from the Project and are highly unlikely to have any impact. Potential odour sources that were found to be located more than 5 km from the Project area have not been included in the assessment.

Site visits identified that a number of facilities are no longer operating, largely due to extensive development in and around the West Schofields area and surrounds.

3.3 Assessment methodology

3.3.1 Poultry farms

The Level 1 odour impact assessment methodology for broiler chicken farms, as outlined in the Technical Notes (**NSW DECC, 2006b**), is provided below.

All poultry farms that are included in the assessment have been assessed using the broiler farm Level 1 odour assessment methodology (**NSW DECC, 2006b**).

Recommended separation distances for broiler farms are calculated using the following equation:

$$D = (N)^{0.71} \times S$$

Where:

N = Number of standard broiler chicken shed units (SBCSU) (1 SBCSU is equivalent to 22,000 broiler chickens);

D = Separation distance in metres between the closest points of the broiler chicken sheds and the most sensitive receptor or impact location;

S = Composite site factor = S1 x S2 x S3 x S4 x S5. Site factors S1 to S5 relate to shed design, receptor, terrain, vegetation and wind frequency. The value of S depends on site-specific information pertaining to S1 to S5.

It is noted that all shed and chicken numbers for currently operating poultry farms within 5 km of the proposed development area were previously identified as operating in the Schofields Precinct odour study (**PAEHolmes, 2010**). The information on bird and shed numbers were obtained from Blacktown City Council in 2010. Blacktown City Council no longer maintains records of bird and shed numbers for individual farms, thus for the purposes of this assessment it has been assumed that the bird and shed numbers have not changed. For farms where the number of birds was unknown, these were estimated using a calculation based on the shed dimensions (as measured from Google Earth), and a typical bird number per shed (**NSW DECC, 2006b**).

3.3.1.1 Shed factor (S1)

The shed factor (S1) depends on how the shed is ventilated. Factors for S1 are shown in **Table 3.2.**

Table 3.2. *Shed Factor (S1)*

Shed Type	Value
Controlled fan ventilation without barriers [a]	980
Controlled fan ventilation with barriers	690
Natural ventilation	690

Source: NSW DECC 2006b, p.21

a. *Barriers defined as walls, berms and other structures designed to mitigate emissions from controlled fan ventilated sheds.*

The majority of poultry sheds investigated in this study operate under natural ventilation. An exception is the broiler chicken farm at 20 Clarke St, which is a tunnel ventilated operation. The shed factor for 20 Clarke St is 980.

3.3.1.2 Receptor factor (S2)

The receptor factor (S2) varies depending on the likely impact area. It is determined based on criteria shown in **Table 3.3**.

Table 3.3. *Receptor factor (S2)*

Receptor Type	Value
Large towns, greater than 2000 persons	1.05
Medium towns, 500–2000 persons	0.75
Medium towns, 125–500 persons	0.55
Small towns, 30–125 persons	0.45
Small towns, 10–30 persons	0.35
Single rural residence	0.30
Public area (occasional use)	0.05 a

Source: NSW DECC 2006b, p.21

a. *The value for public areas would apply to areas subject to occasional use. Higher values may be appropriate for public areas used frequently or sensitive in nature, such as frequently used halls and recreation areas. These should be assessed individually.*

The impact area being considered may be a neighbour's house, small town or large town that may be affected by odour generated at the broiler chicken sheds. Any likely future receptor locations should also be considered.

For a town, the distance is measured from the closest point of the town boundary. For a rural farm residence, the distance is the closest part of the residence itself, excluding any yards.

Proposals for the future development of the Project are to consider capacity for greater than 2,000 people. The receptor factor for this assessment is therefore set to 1.05.

3.3.1.3 Terrain factor (S3)

The terrain factor (S3) varies according to topography and its ability to disperse odours and is determined from **Table 3.4**.

Table 3.4.*Terrain factor (S3)*

Terrain	Value
Valley drainage zone	2.0
Low relief	1.2
Flat	1.0
Undulating country between broiler chicken farm and receptor	0.9
High relief or significant hills and valleys between broiler chicken farm and receptor	0.7

Source: NSW DECC 2006b, p.22

Flat is regarded as less than 10% upslope, 2% downslope and not in a valley drainage zone.

High relief is regarded as upslope terrain or a hill that projects above the 10% rising slope from the broiler chicken sheds. Thus the receptor location will be either uphill from the broiler chicken sheds, behind a significant obstruction or have significant hills and valleys between the sheds and the receptor.

Low relief is regarded as terrain which is generally below the 2% falling slope from the broiler chicken sheds. Thus the receptor will be downhill from the broiler chicken sheds.

Undulating hills comprise topography of continuous rolling, generally low level hills and valleys with minimal vegetation cover, but without sharply defined ranges, ridges or escarpments.

A valley drainage zone has topography at low relief with significant confining sidewalls.

Topographical features at the selected site may adversely affect the odour impact under certain circumstances. During the early evening or night time, under low wind speed conditions, population centres located in a valley at a lower elevation than a broiler chicken farm may be subject to higher odour concentrations as a result of down-valley wind or the occurrence of low-level inversions. Unless site-specific information has been gathered under conditions dominated by low wind speeds, the value for the factor S3 should apply.

Some of the poultry farms under investigation as part of this study were located on the other side of a low-level ridge line from the Project study area, and were therefore assigned a terrain factor of 0.9 for undulating terrain. For others, the assigned factor was 1.0 representing flat terrain.

3.3.1.4 Vegetation factor (S4)

The vegetation factor (S4) varies according to vegetation density, as shown in **Table 3.5**. The vegetation density is assessed by the effectiveness with which the vegetation will reduce odour by dispersion. Tree cover should be maintained, as far as practicable, for the life of broiler chicken sheds.

Table 3.5. *Vegetation factor (S4)*

Vegetation	Value
Crops only, no tree cover	1.0
Few trees, long grass	0.9
Wooded country	0.7
Heavy timber	0.6
Heavy forest (both upper and lower storey)	0.5

Source: NSW DECC 2006b, p.23

Few trees, with long grass is regarded as open country with a permanent covering of grass or pasture of around 1 m or more in height and with a light scattering of timber which is distributed continuously across the buffer area. Topography would be predominantly flat to slightly undulating. Isolated clumps of trees would not be sufficient to attract this concession. Land being actively cropped would not attract this concession because of the extended periods when it is bare or carrying only very low ground cover.

Wooded country is regarded as open forest country with tree density not sufficient to provide a continuous canopy, but sufficiently dense to influence air movement. There would be little or no lower storey vegetation. The density needs to be such that the vegetation can be considered as a contiguous belt and isolated clumps would not attract this concession. The minimum tree height is 4 m and the minimum extent in the direction of the receptor is 400 m.

Heavy timber is regarded as tall forest areas with dense timber stands providing a continuous canopy.

There is limited understorey vegetation, mainly associated with regrowth. The minimum tree height is 4 m and the minimum extent in the direction of the receptor is 400 m.

Heavy forest, upper and lower storey is regarded as dense layers of taller timber with an interlocking canopy and with extensive amounts of lower storey vegetation of various species resulting in almost complete ground cover and a dense upper canopy. Examples are uncleared brigalow areas and dense eucalypt forests where little or no clearing or harvesting have occurred. The minimum tree height is 4 m and the minimum extent in the direction of the receptor is 400 m.

The values suggested for S4 should be used with care. No concession should be given for an intention to plant a barrier.

To improve visual amenity and odour dispersion, premises should be encouraged to plant and maintain upper- and lower-storey vegetation that would not cast shadows on the broiler chicken sheds.

The poultry operations considered in this study were assigned a factor of 1.0, representing no tree cover. There is some tree cover in the area, so this assumption provides a conservative approach.

3.3.1.5 Wind frequency factor (S5)

The wind frequency factor (S5) is determined from **Table 3.6**.

Table 3.6. *Wind frequency factor (S5)*

Wind frequency	Value
High frequency towards receptor (greater than 60%)	1.5
Normal wind conditions	1.0
Low frequency towards receptor (less than 5%)	0.7

Source: NSW DECC 2006b, p.23

Wind speed and direction varies annually and diurnally (that is by the season and by the hour of the day). Although there is generally one direction that is the most frequently observed (prevailing wind), the wind direction usually blows from all directions at some time.

The wind can be classed as high frequency towards the receptor if the wind is blowing towards the receptor (± 40 degrees) with a frequency of at least 60% of the time for all hours over a whole year.

The wind can be classed as low frequency towards the receptor if the wind is blowing towards the receptor (± 40 degrees) with a frequency of less than 5% of the time for all hours over a whole year.

Local meteorology has been assessed (see **Section 3.4**) and winds are considered to be normal. All sites were assigned a wind frequency factor of 1.0.

3.3.2 Intensive piggeries

The Level 1 odour impact assessment methodology for intensive piggeries, as outlined in the Technical Notes (**NSW DECC, 2006b**), is provided below. Recommended separation distances for intensive piggeries are calculated using the following equation:

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

Where:

N = Number of standard pig units (SPU). A standard pig unit is defined as a grower pig of 26–60 kilograms live weight. **Table 3.7** shows factors for converting other types and weights of pig to SPU.

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

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

3.3.2.1 Standard pig units (SPUs)

Piggeries either have a range of pigs, from farrowing to finisher, or only one type of pig (e.g. growers). Larger pigs usually produce more manure and hence have a greater potential for odour production. For a piggery growing from farrowing to finishers, the number of standard pig units (SPU) can be estimated by multiplying the total number of sows by ten. **Table 3.7** can be used for more refined calculations.

Table 3.7. *Standard pig units conversion table*

Type of pig approximate weight range (kg)	Number of standard pig units (SPU)
Lactating sows 160–250	2.5
Gestating sow 160–250	1.8
Gilt 100–160	1.8
Heavy finisher 100-125	1.8
Boar 100–250	1.6
Finisher 61–100 (75)	1.6
Grower 26–60 (40)	1.0
Weaners 8–25 (16)	0.5
Suckers/early weaners 1.4–8	0.1

Source: NSW DECC 2006b, p. 30

Two piggeries were identified at 101 Hambledon Road, Schofield and 1200 Richmond Road, Marsden Park. At time of final reporting, it was found that 1200 Richmond Road was no longer operational.

SPUs were calculated for 101 Hambledon Road from data collected by Benbow Environmental (**BE, 2008a**). That study found that piggeries at 21 Gordon Rd, Schofields (no longer operating) and 101 Hambledon Rd each held lactating sows, gestating sows, and suckers.

Final pig numbers at 101 Hambledon Road, Schofields have been calculated in **PAEHolmes (2010)** from **Table 3.8** using the approximate live weight and type. Total standard pig numbers were calculated by multiplying the number of pigs in each class by the above conversion factors and then adding the totals.

The ratio of total shed size between 101 Hambledon Road, Schofields and 1200 Richmond Road, Marsden Park was used to calculate SPUs at 1200 Richmond Road. Shed sizes were identified based on aerial images and a ratio between shed sizes at the two sites was calculated.

The value of S to apply in the equation depends on site-specific information pertaining to the proposed shed design, maintenance schedule, receptor, terrain, vegetation and wind frequency. These are detailed below.

3.3.2.2 Odour potential factor (S1)

The odour potential factor (S1) for each class of piggery, varies with the shed design and maintenance schedule. It can be determined from **Table 3.8** by multiplying the factors together i.e. A x B x C x D x E. The S1 factor can be no lower than 0.5.

The reduction factor could be adjusted if there is a new technology that can be demonstrated and quantified to reduce the odour.

The odour potential factor S1 for this assessment is based on the data collected by Benbow Environmental (**BE, 2008a**). This study found that piggeries at 21 Gordon Rd (no longer operational) and 101 Hambledon Rd each held lactating sows, gestating sows, and suckers. One farm also had growers. Both farms had slatted floors with deep pits, limited ventilation by ridge and side-ventilator, anaerobic lagoons, and used conventional feeding.

Table 3.8. *Odour potential factor (S1)*

	Odour potential factors	Value
A	**Type of building**	
	1 Slatted floor and deep pit	1.0
	2 Partly slatted floor and shallow pit or open drain with regular flushing	0.9
	3 Partly slatted floor and sloping floor and regular flushing	0.8
	4 Partly slatted floor and 'pull plug' and recharge system	0.6
B	**Ventilation of buildings**	
	1 Limited ridge and side-ventilators (or side only) or limited forced (fan) ventilation	1.0
	2 Ridge ventilators which are at least 90% of the roof length and are at least 10% of the roof width and side ventilators are at least 90% of the length of the two long sides of the building and at least 30% of the side wall height, with roof and walls insulated	0.9
	3 Fan forced ventilated shed with well-designed uniform ventilation throughout shed	0.9
C	**Effluent collection frequency within all pig buildings**	
	1 Faeces, urine and other biological material removed from the confines of the buildings every 24 hours or less often	1.0
	2 Faeces, urine and other biological material removed from the confines of the buildings while essentially aerobic but in no case less often than 24 hours	0.9
D	**Effluent treatment system (within the piggery compound)**	
	1 Anaerobic lagoon(s) (including all inlet pipes/channels)	1.0
	2 Series lagoons anaerobic/aerobic (or facultative) and evaporation lagoons	1.0
	3 Facultative lagoon(s) (including all inlet pipes/channels)	0.95
	4 Aerated lagoon(s) (aerobic surface layer over entire lagoon)	0.75
	5 Aerobic lagoon(s)	0.6
	6 No effluent storage within at least 500 m of the piggery	0.6
E	**Feeding**	
	1 Conventional feeding	1.0

Odour potential factors	Value
2 Phase feeding	0.9
3 Phase feeding with optimal protein	0.8

Source: NSW DECC 2006b, p.31

3.3.2.3 Receptor factor (S2)

The receptor factor (S2) varies depending on the likely impact area. The receptor factor for intensive piggeries is determined in the same way as for broiler farms and outlined above in **Section 3.3.1.2**, although the factors are different as shown in **Table 3.9**.

Table 3.9. *Receptor factor (S2)*

Receptor type	Value
Large towns, greater than 2000 persons	1.6
Medium towns, 500–2000 persons	1.2
Medium towns, 125–500 persons	1.1
Small towns, 30–125 persons	1.0
Small towns, 10–30 persons	0.6
Single rural residence	0.3
Public area (occasional use)	0.05 [a]

Source: NSW DECC 2006b, p.33

a. *The value for public areas would apply to areas subject to occasional use. Higher values may be appropriate for public areas used frequently or sensitive in nature, such as frequently used halls and recreation areas. These should be assessed individually.*

The Project will house more than 2,000 people and therefore a factor of 1.6 has been used for S2 for piggeries.

3.3.2.4 Other site factors (S3, S4 and S5)

The other site factors, i.e. terrain factor (S3), vegetation factor (S4) and wind frequency factor (S5), are assessed in the same way for intensive piggeries as for broiler chicken sheds (see **Sections 3.3.1.3** to **3.3.1.5**).

For this assessment, the terrain factor S3 was set at 1.0 to represent flat terrain between the piggeries and the Project study area. S4 was set at 0.9 since the piggeries were located with a few trees between them and the proposed development area. S5 was set to 1.0 for normal meteorological conditions as noted in **Section 3.3.1.5**.

3.3.3 Two odour sources in close proximity

Where two similar operations are located near each other, for example two broiler farms or two piggeries, the area of influence may need to be modified.

Where the operations are considered as separate entities, a 20% increase in separation distance may apply to the area that is predicted to be influenced by both. The two sources are assessed by adding 20% to the required separation distance of each operation and determining whether the two zones overlap. If the zones overlap, the added 20% applies to the separation distance. If the zones don't overlap, the normal separation distance applies.

3.3.4 A J Bush & Son, Riverstone - Meat rendering operations

There is no Level 1 odour impact assessment methodology for meat rending operations outlined by the Technical notes (**NSW DECC, 2006b**). However, NSW DECC has published recommended separation distances for these operations, as outlined below.

A minimum buffer distance to the nearest residence or residential area of 1,000 m is recommended downwind of a rendering plant. This depends on the prevailing winds and may need to be increased if effective and reliable odour control equipment is not installed (**NSW DECC, 2008**).

For the Level 1 assessment, a buffer zone of 1,000 m has been applied to the A J Bush & Son meat rendering operations.

3.3.5 Sewage treatment plants

There is no Level 1 odour impact assessment methodology for sewage treatment plants outlined by the Technical notes (**NSW DECC, 2006b**). However, Sydney Water and the Department of Urban Affairs and Planning (DUAP, now the Department of Planning) have published guidance on recommended separation distances for these operations, as outlined below.

DUAP issued Circular No E3 (**DUAP, 1989**) which outlined a guideline for buffer areas about sewage treatment plants. This guideline states that:

"Ideally, buffer areas should be created through local environment plans, and be at least 400 metres wide, but this may vary to suit local conditions. Meteorological advice should be obtained to work out the most likely movement of air flows so that the widest buffer areas can be established in that direction.

To obtain the most efficient use of land possible, buffer zone areas should also be used for compatible purposes. Possibilities include: flora and fauna reserves; grazing; agricultural use; forestry; commercial plant nurseries; recreation; effluent disposal; or public road reserves."

Sydney Water also has prepared a Sewage Treatment Plant Buffer Zone Policy (**Sydney Water, 1997**) that is intended to assist Sydney Water personnel as well as Councils and developers in assessing the suitability of land for different types of developments. Within this policy document the following discussion is made on the subject of the width of buffer zones:

> *"It is generally agreed that the buffer width should be measured from the existing plant boundary. However, in many cases, adjoining development already encroaches on the 400 metre zone, if measured from the plant boundary. Several STPs have residential development, which was*

permitted prior to current policy standards, within 400 metres of their boundaries. The Corporation needs to avoid further encroachment into STP buffer zones to the extent possible."

The buffer zone is an area defined by DUAP and Sydney Water in which development is subject to additional controls. The logic behind this is that this area has the potential to be exposed to the additional risks of exposure to releases of chlorine from chlorination facilities, odour, noise and light from the normal and abnormal operation of the facility and dust from the handling of solids on the site. This potential for exposure to any or all of the noted agents makes 24 hour per day use of this area by the public for, for example, residential or entertainment uses unsuitable.

The 400 m buffer zone has been applied to the nearby sewage treatment plants in this assessment to indicate whether there is any conflict between the proposed development land and the separation distance as recommended above.

3.3.6 Mushroom Farms

There is no Level 1 odour impact assessment methodology for mushroom production outlined by the Technical notes (**DECC, 2006b**). Further to this, New South Wales does not currently offer advice on separation distances for mushroom farms. Further research was then conducted to determine a suitable separation distance for this source.

Griffith Local Environmental Plan 2002 recommends buffer distances for agricultural activities. It recommends 500 m for a composting facility and recommends that Council specify a buffer zone for mushroom farms. In gathering such data, Council were unable to provide such recommendation.

The Western Australia Environmental Protection Authority (WA EPA) has published the "*Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986): Separation Distances between Industrial and Sensitive Land Uses*". This document recommends a separation distance of 500-1,000 m dependant on the size of the mushroom farm (**WA EPA, 2005**).

Therefore, for the Level 1 odour impact assessment, a conservative buffer zone of 1,000 m has been applied to the Elf Mushrooms/White Prince Mushroom farm and the Mushroom Gardens farm.

3.3.7 Green waste facilities

Whilst the NSW EPA does not provide specific odour buffer guidance for green waste recycling facilities, the Victorian EPA does provide some information on recommended separation distances based on the type of facility and the size of the plant. This guidance is shown in **Table 3.10** and **Table 3.11**.

Table 3.10. *Recommended separation distances for green waste recycling facilities – reference facility 1*

Types of feedstock	Technology being used	Size of the plant	Recommended separation distances (m)
Green Waste	Open air receival	1,200 tonnes per annum	>300
Vegetable organics	Enclosed aerobic composting with	14,000 tonnes per annum	>500

Grease inceptor trap waste	secondary odour capture and treatment equipment	36,000 tonnes per annum	>800
	Open air maturation	55,000 tonnes per annum	>1,000
		75,000 tonnes per annum	>1,200
		90,000 tonnes per annum	>1,400

Source: EPA VIC (2015).

Table 3.11. *Recommended separation distances for green waste recycling facilities- reference facility 2*

Types of feedstock	Technology being used	Size of the plant	Recommended separation distances (m)
Green Wastes	Open air receival Open turned windrow Open air maturation	1,200 tonnes per annum	>600
		14,000 tonnes per annum	>1,100
		36,000 tonnes per annum	>2,000
		50,000 tonnes per annum	>2,000

Source: EPA VIC (2015).

The buffer distances used in this assessment for green waste recycling facilities have been based on the facility type, and plant size.

3.4 Meteorology

Odour impacts in the Project study area will be influenced by local meteorology. Meteorological conditions, such as wind speed, wind direction and atmospheric turbulence, affect how often receptors are likely to be downwind of an odour source as well as how well the odour disperses in the atmosphere.

The closest meteorological station to the site is at the Riverstone STP, off Bandon Road, Vineyard. The Vineyard site was commissioned in February 1994 and is maintained by the Office of Environment and Heritage (OEH). The following meteorological variables are measured at Vineyard:

- Wind speed, wind direction and sigma theta.
- Ambient temperature.
- Relative humidity.

Figure 3.2 presents the annual and seasonal windroses prepared using data collected from Vineyard in 2015.

On an annual basis, the winds are predominantly from the south south-west to south south-east and north north-west to north north-east. This persists throughout the year with winds predominantly from these directions in autumn, winter and spring. In the summer the wind directions are more frequently mixed from the south south-east, east north-east and north.

Annually, the lower strength winds (0.5 to 1.5 m/s) were most commonly from the north and south south-west.

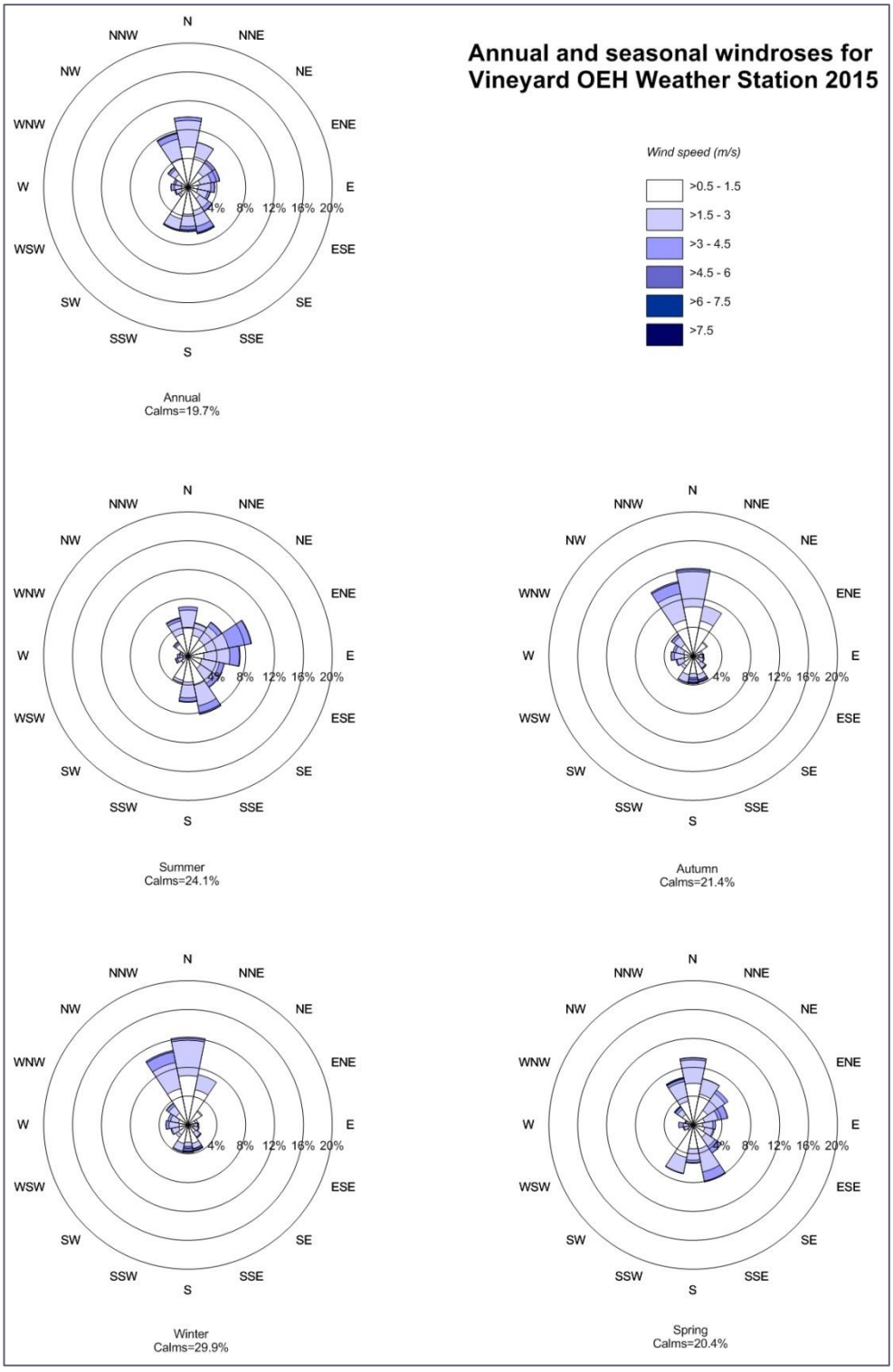

Figure 3.2: *Annual and seasonal windroses for Vineyard (2015)*

3.5 Level 1 assessment results

3.5.1 Poultry farms

A number of the poultry farms identified within in the vicinity of the Project study area, as outlined in **Section 3.2**, were discounted from the assessment due to distance from the study area. Any operations that were determined to have ceased or were more than 5 km from the study area, were excluded.

Table 3.12 provides the Level 1 assessment calculations for poultry farms relevant to the study. The distance of each farm from the study area and recommended separation distances are also presented. The recommended separation distances for the small number of poultry farms predicted to encroach on the Project study area are shown in bold.

The poultry farms identified as potentially encroaching on the Project study area are:

- 2 Pelican Road, Schofields
- 25 Schofields Road, Schofields
- 138 Clifton Rd, Marsden Park
- 264A South Street, Marsden Park
- 306 South St, Marsden Park
- 20 Clarke St, Riverstone
- 45 Farm Road, Riverstone

The recommended individual separation distances for these seven poultry farms which have the greatest potential influence on the Project study area are shown in **Figure 3.3** to **Figure 3.9**. The yellow circles indicate the recommended buffer distances for individual farms and the orange circles the buffer distances plus 20%, indicating when two farms influence the same area.

Figure 3.10 provides a prediction for the combined area of influence of all poultry farms in the region (within 5 km) around the Project study area. It can be seen from **Figure 3.10** that only a small portion of the Project area is predicted to be influenced by odour, all of which originate from the seven poultry farms identified above.

The Level 1 separation distances of the majority of the poultry operations outlined in **Table 3.12** do not encroach on the Project study area.

3.5.2 Intensive piggeries

The operational piggeries in the surrounding region are not predicted to influence the Project study area.

Table 3.12 provides the calculations and **Figure 3.11** presents the recommended separation distances for the assessed intensive piggeries.

3.5.3 A J Bush & Son meat rendering operations

The recommended 1,000 m separation distance (**DECC, 2008**) has been applied to the AJ Bush & Son, Riverstone meat rendering operation, as shown in **Table 3.14** and **Figure 3.12**.

The suggested separation distance indicates that odour from the meat rendering operations is not predicted to influence the Project study area.

It should be noted that the recommended 1,000 m separation distance for meat rendering plants is a default buffer that does not account for site-specific data such as emission rates and control technologies, meteorology, terrain etc. It is acknowledged that the 1,000 m buffer is used in Australia as an acceptable default separation distance; however anecdotal evidence also suggests that some meat rendering plants can have odour impacts beyond this distance.

3.5.4 Landfill operations

A search of NSW EPA Environment Protection Licences (EPLs) in the Schofields area and surrounds identified a potential odour source at the Marsden Park Landfill (EPL 11497). During a visit to the site, no waste could be observed on site and no odour was detected at the roadside. The facility was contacted on 18th March 2016 and it was confirmed that no odorous wastes are accepted, including food or chemical wastes. The landfill is therefore not considered a potential odour source and has not been assessed any further.

3.5.5 Sewage treatment plants

The Quakers Hill STP and Riverstone STP are located approximately 2,300 m and 3,200 m from the Project boundary respectively. Two further STPs (Saint Mary's and Rouse Hill) are located in the vicinity of the Project, however these are located greater than 5 km from the boundary and have not been considered further.

3.5.6 Green waste recycling facilities

One green waste recycling facility, the Northwest Recycling Centre, was identified within the Project boundary, located at 132 Burfitt Road, Riverstone. The Centre's EPL (11620) allows for 0 - 5,000 tonnes of organics to be received. For the purposes of this assessment, it is assumed that the facility can be categorised as reference facility 2 shown in **Table 3.11**. The buffer distance selected for use in the assessment is 1,100 m which assumes a highly conservative plant size of 14,000 tonnes per annum.

Table 3.12. *Recommended separation distances from poultry farms (Level 1 assessment method)*

Address	Bird Type	Sheds	Total Birds	SBCSU	S1	S2	S3	S4	S5	Separation Distance (m)	(+20%)	Distance from the Project (m)
100 Worchester Rd, Rouse Hill	Layer	4	32,000	1.45	690	1.05	0.9	1	1	851	1,021	4,100
95 Tallowong Rd, Schofields	Broiler	5	92,000	4.18	690	1.05	0.9	1	1	1,801	2,161	2,900
20 Clarke St, Riverstone	**Broiler**	**5**	**70,000**	**3.18**	**980**	**1.05**	**0.9**	**1**	**1**	**2,106**	**2,528**	**2,386**
16 Clarke St, Riverstone	Broiler	2	10,000	0.45	690	1.05	0.9	1	1	373	447	2,360
2 Pelican Rd, Schofields	**Broiler**	**2**	**39,422**	**1.79**	**690**	**1.05**	**1**	**1**	**1**	**1,096**	**1,315**	**1,130**
93 Hambledon Rd, Schofields	Broiler	3	53,000	2.41	690	1.05	1	1	1	1,353	1,623	2,400
25 Schofields Rd, Schofields	**Broiler**	**3**	**75,000**	**3.41**	**690**	**1.05**	**1**	**1**	**1**	**1,731**	**2,077**	**1,600**
26 Schofields Farm Rd, Schofields	Broiler	4	42,837	1.95	690	1.05	1	1	1	1,163	1,395	1,800
37-39 Boundary Rd, Schofields	Layer	1	8,000	0.36	690	1.05	1	1	1	353	424	1,930
45 Farm Rd, Riverstone	**Duck Farm**	**6**	**75,000**	**3.41**	**690**	**1.05**	**1**	**1**	**1**	**1,731**	**2,077**	**1,240**
138 Clifton Rd, Marsden Park	**Layer**	**4**	**52,683**	**2.39**	**690**	**1.05**	**1**	**1**	**1**	**1,347**	**1,616**	**200**
1148 Richmond Rd, Marsden Park	Broiler/Layer	7	60,000	2.73	690	1.05	1	1	1	1,477	1,773	1,800

Address	Bird Type	Sheds	Total Birds	SBCSU	S1	S2	S3	S4	S5	Separation Distance (m)	(+20%)	Distance from the Project (m)
264A South St, Marsden Park	**Broiler**	**3**	**75,000**	**3.41**	**690**	**1.05**	**1**	**1**	**1**	**1,731**	**2,077**	**1,400**
306 South St, Marsden Park	**Broiler**	**5**	**142,571**	**6.48**	**690**	**1.05**	**1**	**1**	**1**	**2,731**	**3,277**	**1,800**
1132 Richmond Rd, Marsden Park	Layer	4	60,000	2.73	690	1.05	1	1	1	1,477	1,773	1,800
472 Windsor Rd, Vineyard	Broiler	3	10,245	0.47	690	1.05	1	1	1	421	505	4,200
466 Windsor Road, Vineyard	Broiler and Layer	3	10,502	0.48	690	1.05	1	1	1	429	514	4,219
199 Stahls Road, Oakville	Layer	5	28,615	1.30	690	1.05	0.9	1	1	786	943	4,743

Table 3.13. *Recommended separation distances from piggeries (Level 1 assessment method)*

Address	Operation	Sheds	SPU[a]	S1[a]	S2	S3	S4	S5	Separation Distance (m)	(+20%)	Distance from the Project (m)
101 Hambledon Rd	Piggery	8	403	1	1.6	1	1	1	1,606	1,927	2,550

a) Based on BE (2008a).

Table 3.14. *Recommended separation distances from other sources*

Address	Operation	Buffer Distance (m)	Distance from the Project (m)
1106 Windsor Rd, Riverstone	A J Bush & Son Meat Rendering Ops	1,000	3,000
Quakers Road, Marayong	Quakers Hill Sewage Treatment Plant	400	2,300
132 Burfitt Rd Riverstone	Northwest Recycling Centre	1,100	0 (within project boundary)
Bandon Road, Riverstone	Riverstone Sewage Treatment Plant	400	3021
61 Wallace Road, Vineyard	Elf Mushroom Farm	1000	3988
61 Wallace Road, Vineyard	White Prince Mushroom Farm	1000	3988
496 Windsor Road, Vineyard	Mushroom Gardens Mushroom Farm	1000	4001

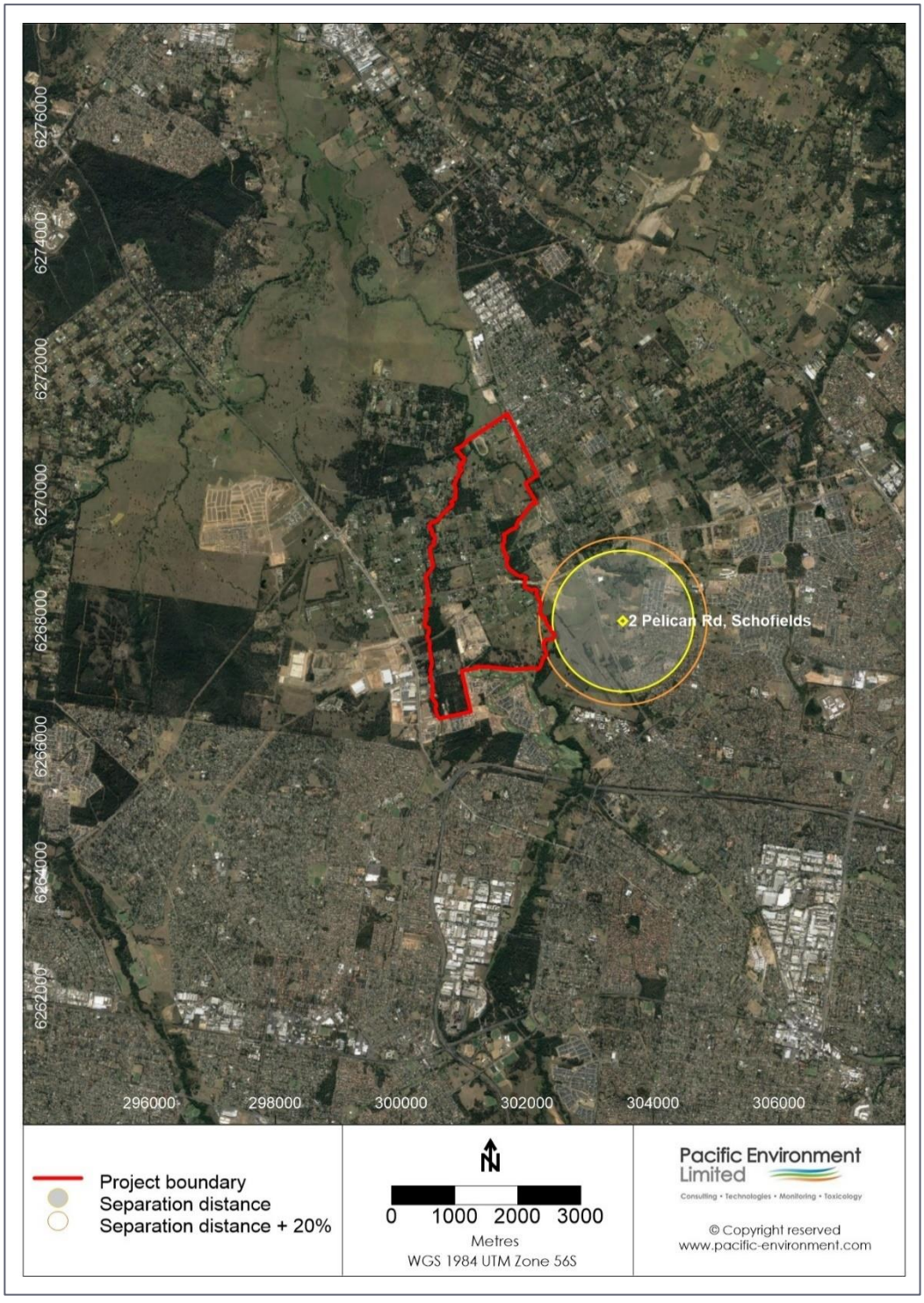

Figure 3.3: Level *1 separation distance for broiler farm at 2 Pelican Road, Schofields*

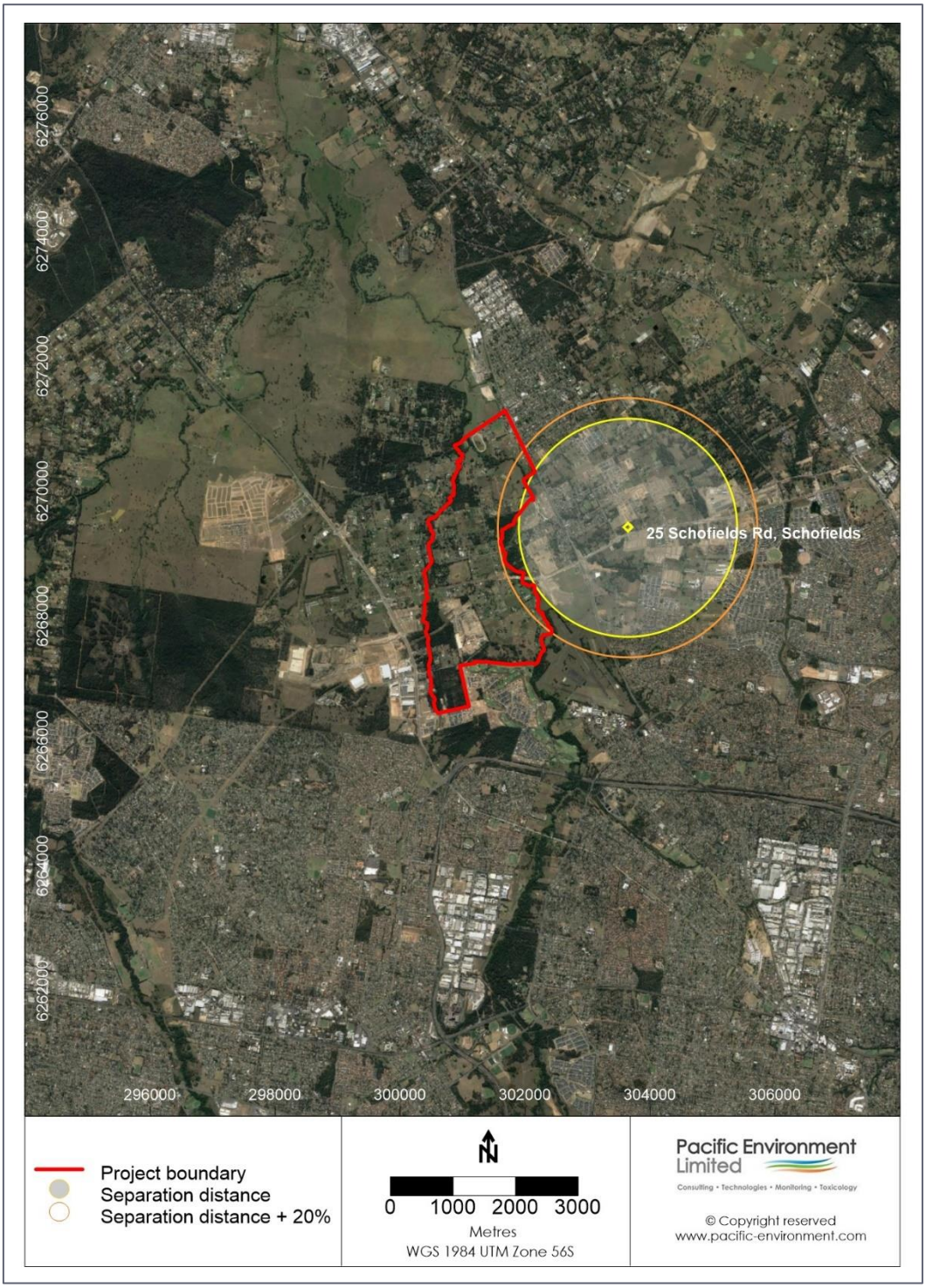

Figure 3.4: Level 1 separation distance for broiler farm at 25 Schofields Road, Schofields

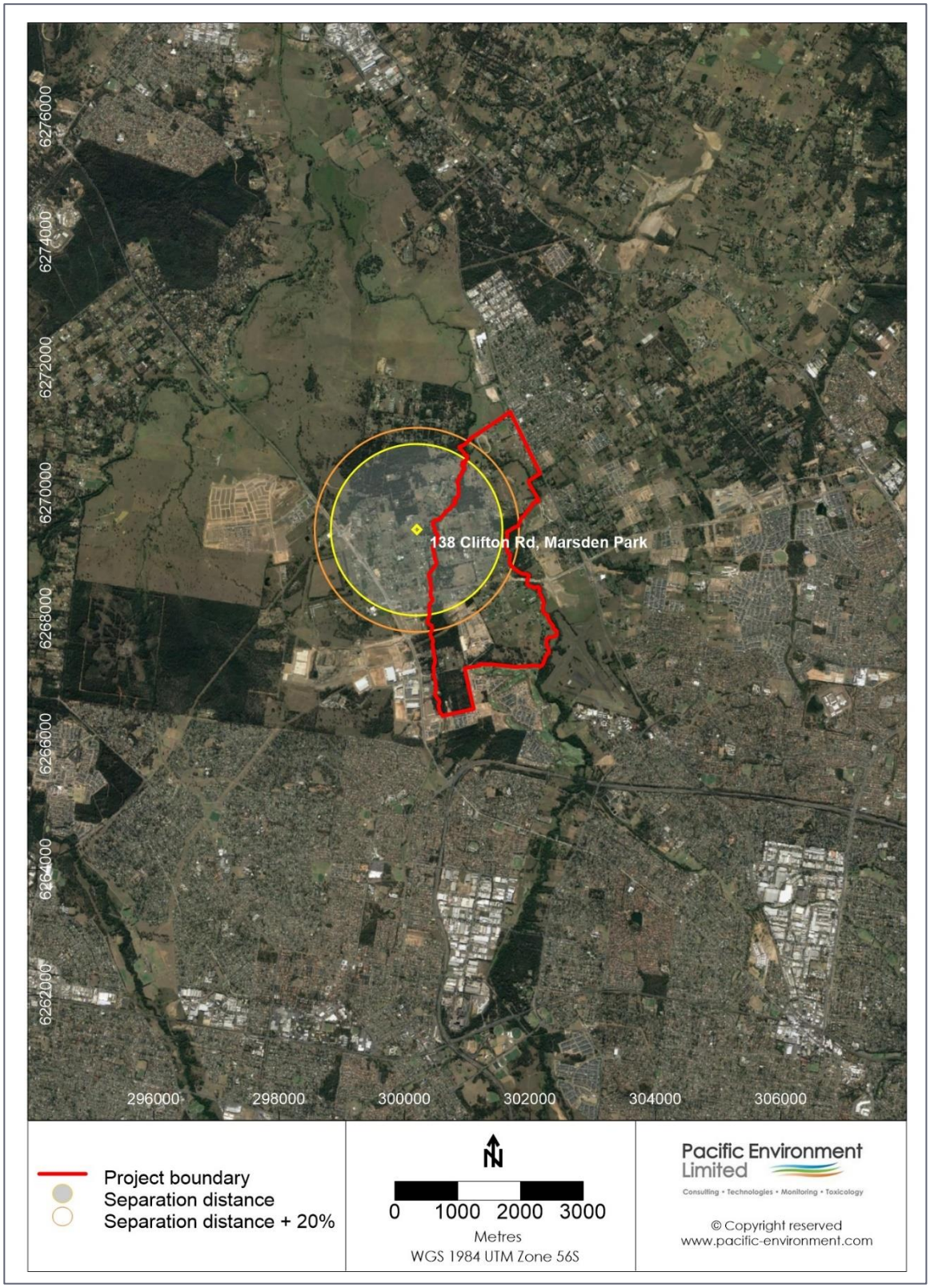

Figure 3.5: Level 1 separation distance for broiler farm at 138 Clifton Road, Marsden Park

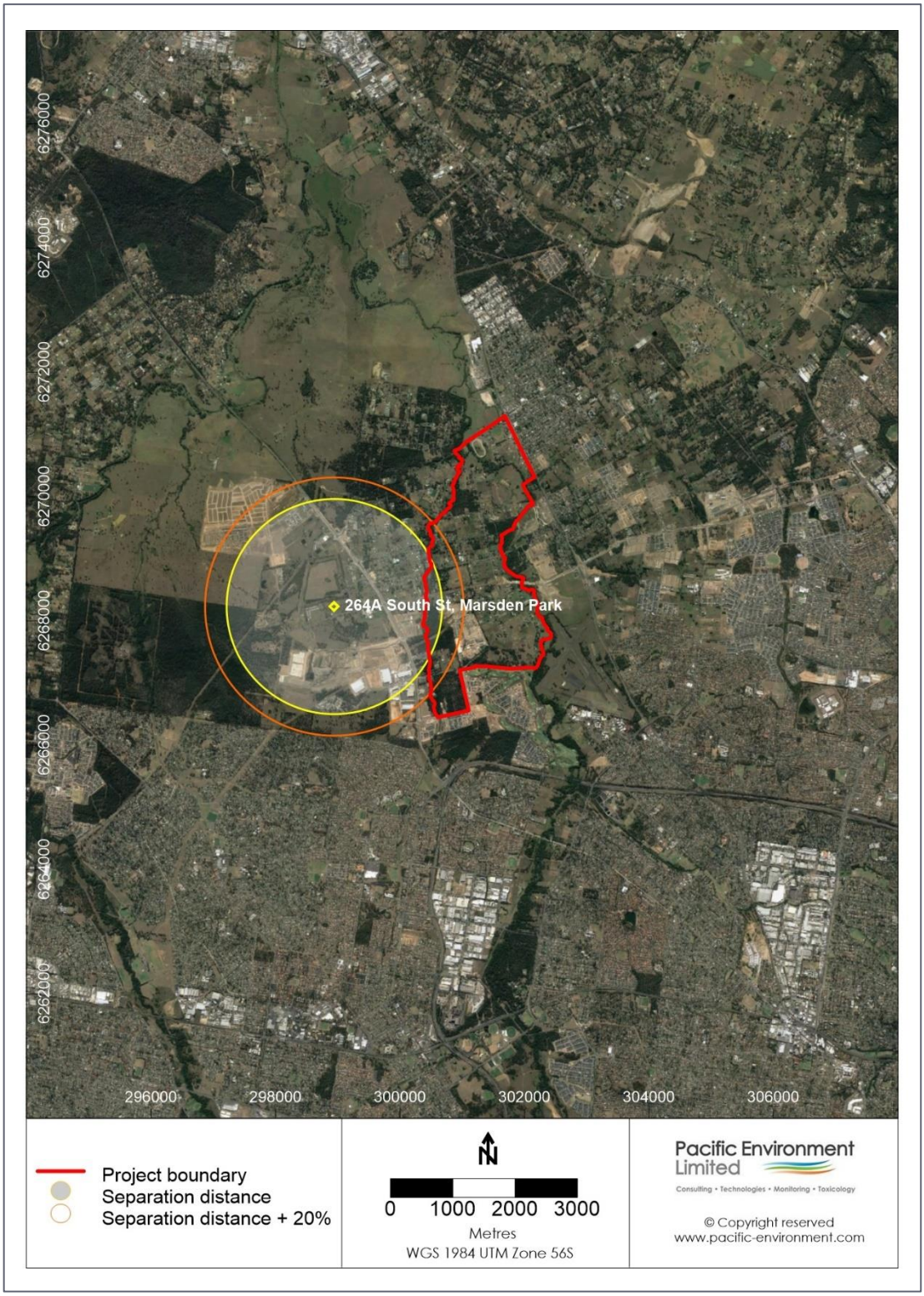

Figure 3.6: Level 1 separation distance for broiler farm at 264A South Street, Marsden Park

Figure 3.7: Level *1 separation distance for broiler farm at 306 South Street, Marsden Park*

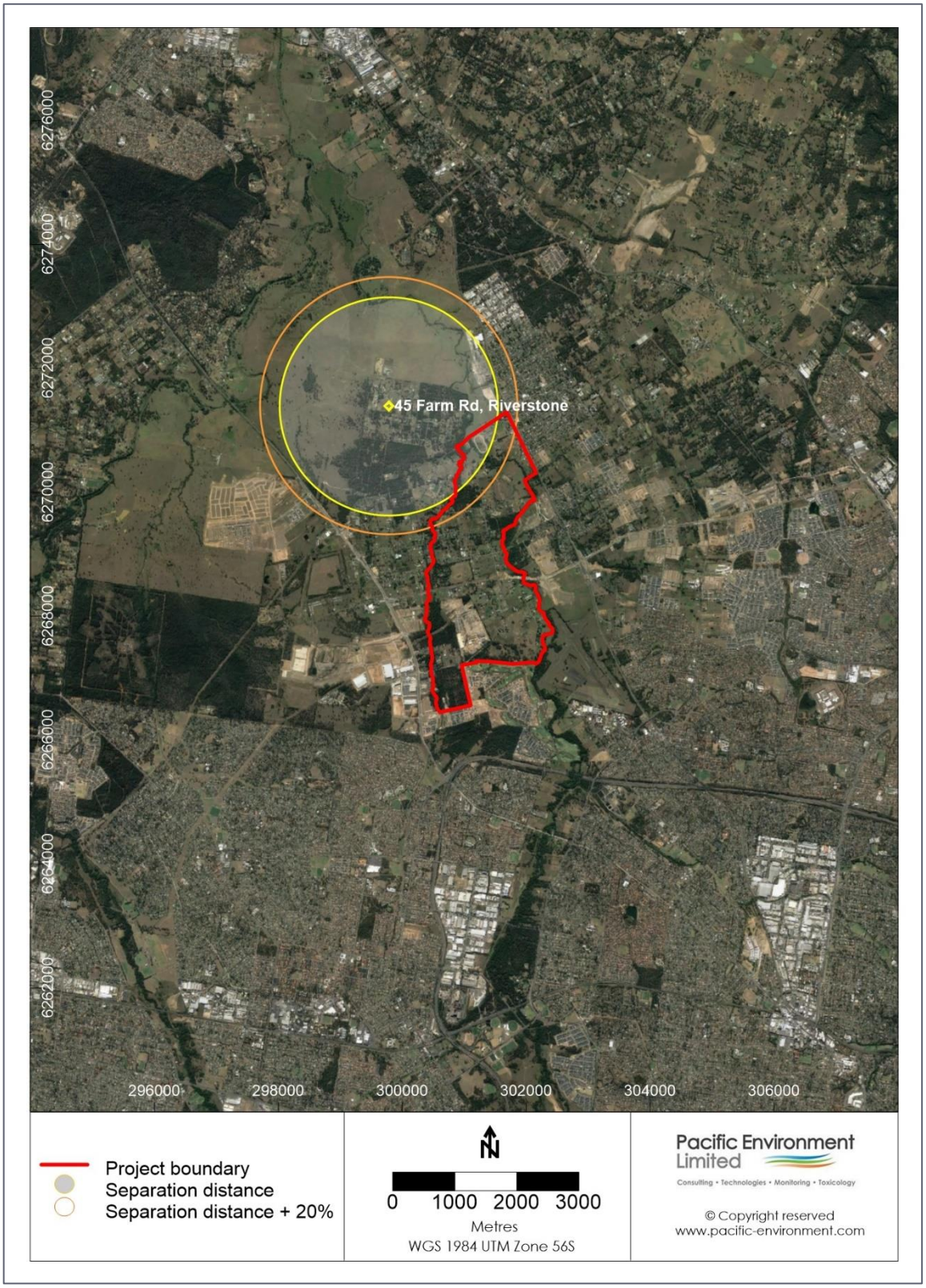

Figure 3.8: Level *1 separation distance for broiler farm at 45 Farm Road, Riverstone*

Figure 3.9: Level *1 separation distance for broiler farm at 20 Clarke Street, Riverstone*

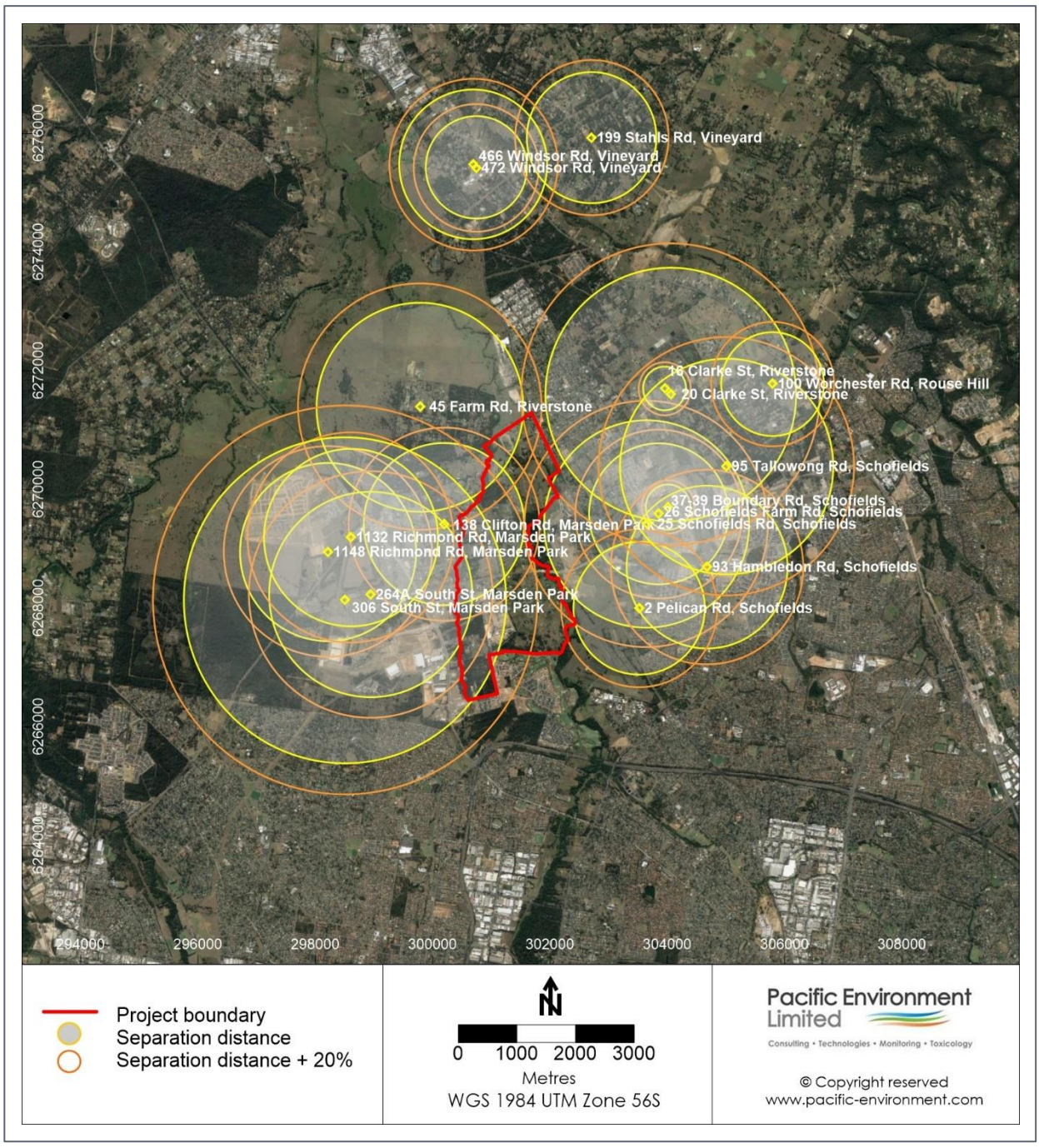

Figure 3.10: Combined Level 1 separation areas for poultry farms around the Project study area

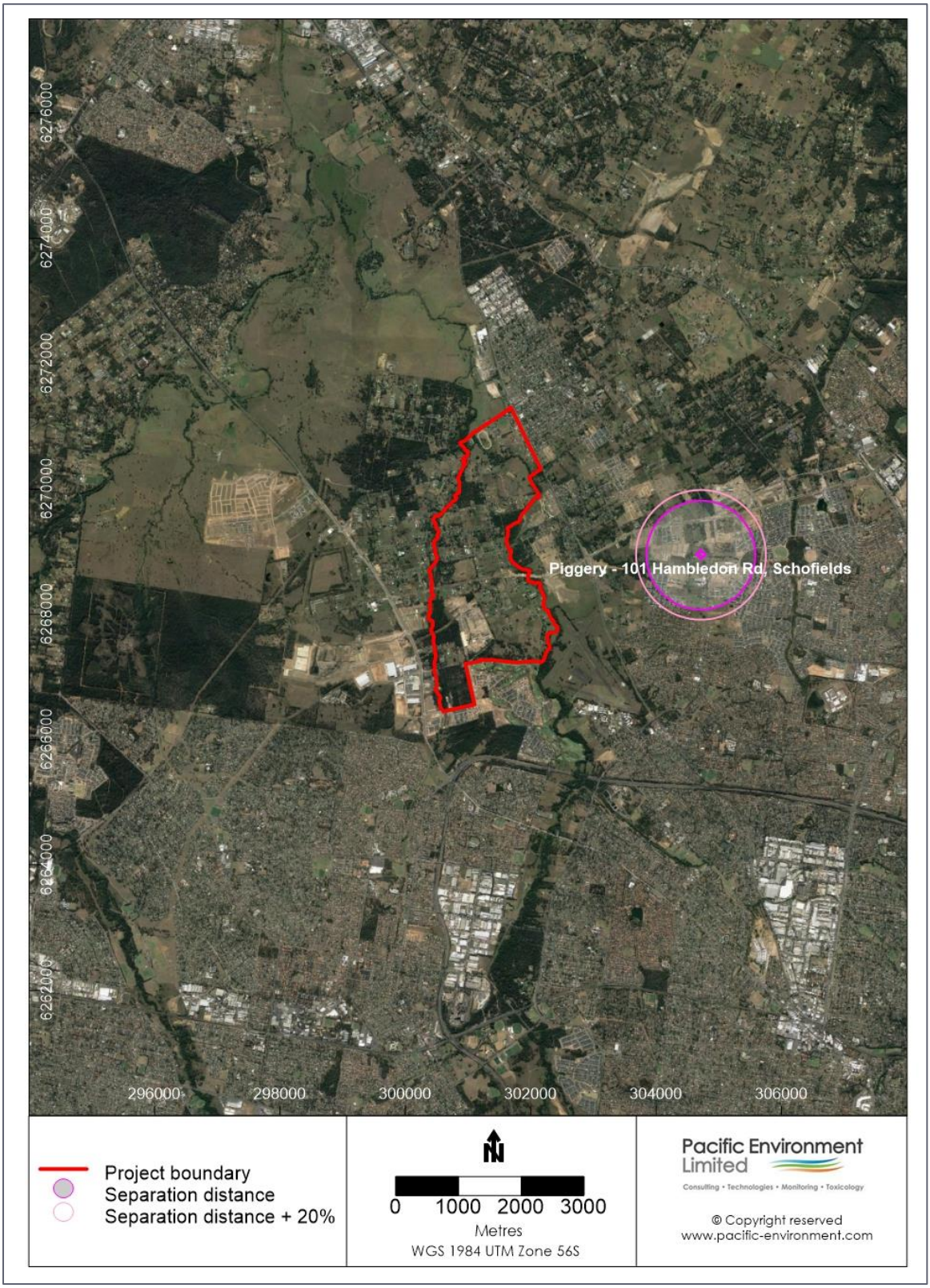

Figure 3.11: Level 1 separation distances for intensive piggeries in proximity to the Project study area

Figure 3.12: Recommended buffer distance for meat rendering operation in proximity to the Project study area

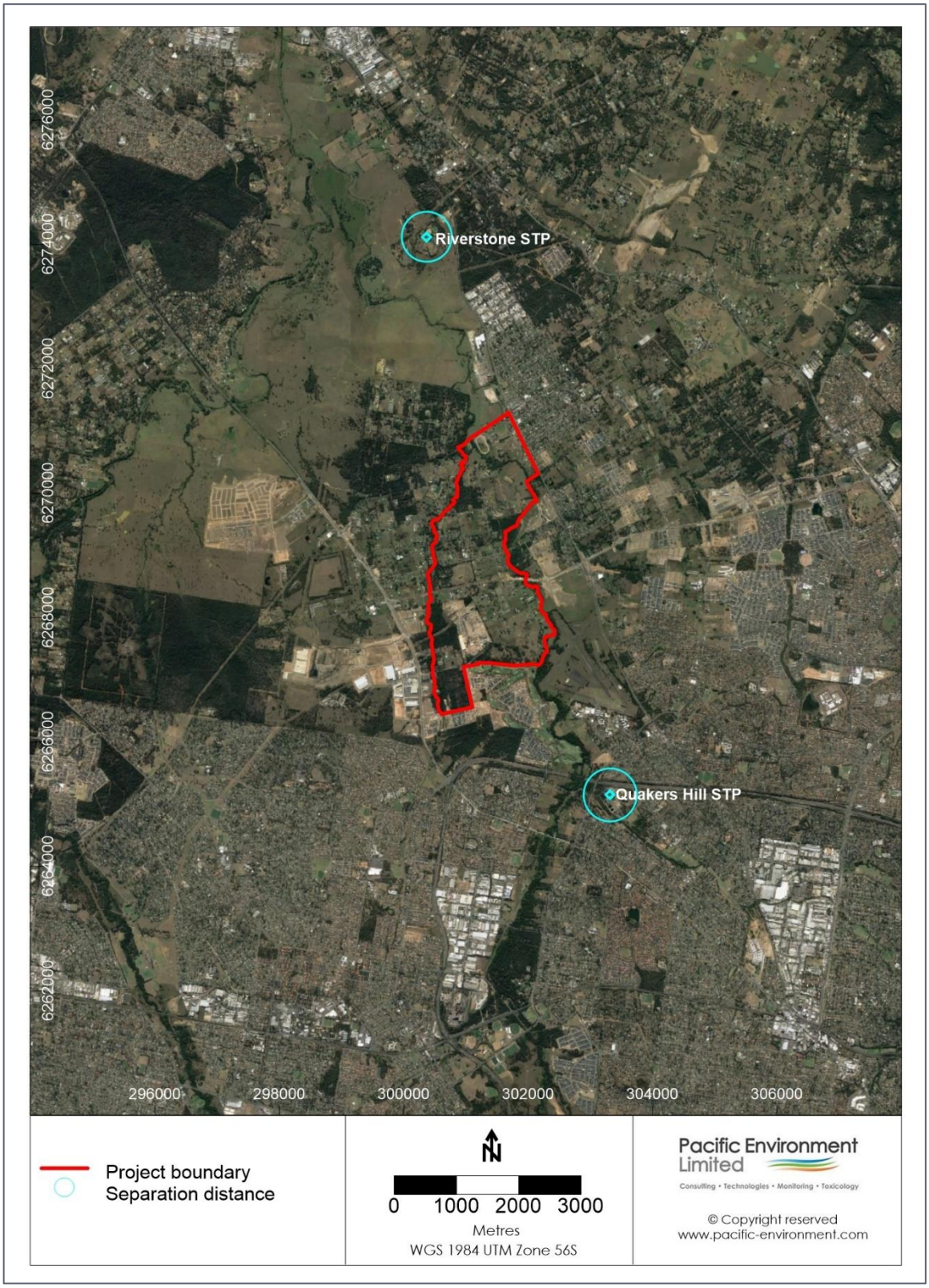

Figure 3.13: Recommended buffer distances for sewage treatment plant operations in proximity to the Project study area

Figure 3.14: Recommended buffer distances for green waste recycling operations (132 Burfitt Road, Riverstone) in proximity to the Project study area

4. Outcomes and recommendations

4.1 Assessment

The Level 1 assessment has produced conservative results, particularly for the cumulative area of influence due to poultry farms, which make up the majority of the sources of odour determined to potentially impact the site. The other odour source identified as potentially affecting the Precinct is the Northwest Recycling Centre which is located within the Project site boundary. The results indicate that even with the use of conservative buffer distances, only small portions around the border of the West Schofields Precinct would potentially affected by odour.

It is likely that the predicted separation distances for all odour sources would be reduced if assessed using the Level 3 odour assessment methodology, as outlined by the Technical Notes (**DECC, 2006b**). While Level 1 assessment is a screening-level technique based on generic parameters for the type of activity and site, Level 3 assessment is a refined-level dispersion modelling technique using site-specific input data, including terrain and meteorological data. This is the most comprehensive and realistic level of assessment available. The predicted separation distances will vary in different directions around an odour source when based on a Level 3 assessment, as opposed to the uniform circle centred on the source provided by Level 1. The Level 3 assessment may be used to assess site suitability and odour mitigation measures for new, modified or existing activities and would provide a better understanding of the locations within the Project study area that are likely to be most affected by odour. Extra focus on odour mitigation measures should be provided where sensitive land use is planned for such locations.

Where the Level 1 method has identified odour sources that encroach on the study area or are in proximity to its boundary, it is recommended that a level 3 assessment be completed. The CALPUFF dispersion model should be used to predict odour concentrations and incorporate terrain, meteorology and any additional refined data on odour emissions as available.

4.2 Potential Development Control Plan provisions

It is recommended that development controls be implemented to manage odour impacts in future development of the study area. Potential provisions are listed below:

- Plan a transition of land use zones that locates sensitive uses in areas that are not adjacent to odour generating activities.
- Consider introducing specific zoning categories for odour-generating activities, e.g. agriculture, intensive agriculture, minerals/metal processing, waste industries.
- Ensure that sensitive uses are located outside the 2 odour unit buffer.
- Plan compatible land uses in areas closest to odour sources, e.g. car parks, commercial areas. Residential areas should be away from odour sources.
- Orientate buildings to provide adequate air flow, i.e. no dead end courtyards, long narrow spaces, or areas where air may stagnate. Design buildings to encourage air flow.

- Ensure that air intake to buildings is not from the direction of odour sources.
- Consider ventilation and air conditioning and design buildings so that people do not live or work in areas of buildings facing odorous sources.
- Build continuous dense landscaping around local odour sources or Precinct boundaries to assist in reducing odour by increasing dispersion.
- Consider removing development restrictions if an odour source ceases operation and has no prospect of reviving.
- Revise buffer zones where reduced separation distances can be determined for some odour sources, either with or without changing the operation of the source, for example, through further study.
- Evaluate whether the nature of a development is compatible with odour affected lands and if odour nuisance will be detrimental to the successful long-term function of the completed development.
- Purchase or long-term lease of neighbouring properties to provide a secure buffer zone around a facility and increase the separation distance between the site of the odour emissions and existing or potentially sensitive use.

When odour assessment criteria are being exceeded at receptors despite avoidance and mitigation measures at the source or in the pathway, consideration could be given to measures that would manage the reaction of the receptors and increase their willingness to accept the odour levels.

These types of approaches may also be appropriate before an activity begins operation if there is some degree of uncertainty about whether the proposed odour avoidance and mitigation strategies will achieve the required odour levels at receptors.

- Establish a communication strategy so that affected neighbours are kept informed about the operation of odour generating facilities and are consulted about aspects of these operations likely to result in odour.
- Investigate the feasibility of facilities entering into an agreement with neighbours regarding their acceptance of the odour impacts. Negotiated outcomes would need to be documented in licence conditions, particularly in relation to the ‘offensive odour’ provisions of the POEO Act. Negotiated outcomes would not normally transfer to any new neighbours (should properties be sold) or apply in relation to any new land uses; as a result, such an arrangement would not provide a secure long-term mitigation strategy.
- Investigate the practicality of providing the most affected receptors with air-conditioning or other measures to reduce the impacts of emissions. This option would normally only be considered in exceptional circumstances.

Council should also consider new odour sources in the future development of the Precinct. Commercial businesses that produce odour will need to be controlled if they have potential to affect sensitive zones or nearby businesses and residences.

5. Conclusions

An investigation has been conducted to identify and develop an understanding of potential sources of odour that may impact the future development of the West Schofields Precinct.

A Level 1 odour impact assessment has been completed for the West Schofields Precinct consistent with the Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (**DECC, 2006a**) and its associated Technical Notes (**DECC, 2006b**). The impact assessment has identified potential sources of odour that may impact on future development in the Project area, recommended separation distances for nearby odour sources have been presented.

The study has predicted that a small number of poultry operations in the vicinity of the Project study area have potential to individually impact on the proposed development area. When combining the individual poultry operations with greatest influence using the Level 1 assessment, the north, east and western borders of the Project study area are predicted to be affected by poultry farm odour. The study also identified the Northwest Recycling Centre as a source of odour, which is located within the Project boundary. This odour source is identified as predominantly affecting the northern portion of the Project site.

Separation distances for other potential odour sources, such as intensive piggeries, the meat rendering operation and the Quakers Hill and Riverstone STPs have not resulted in encroachment on the Project study area when assessed using the Level 1 assessment methodology, or use of an alternative default buffer distance where Level 1 methods do not exist (i.e. for meat rendering).

In order to increase confidence in the assessment results and to potentially reduce the areas of influence around odour sources, it is recommended that a Level 2/3 odour impact assessment be conducted for the sources that were identified as potentially impacting the Project study area.

This report has provided options to control odour impacts from odour generating development on proposed residential development and associated land uses, for potential inclusion in a development control plan.

6. References

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