Odour Assessment

Riverstone East

Aurecon Australasia Pty Ltd

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North Sydney

Prepared by:

SLR Consulting Australia Pty Ltd

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SLR Project No.: 610.31234.0000

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.2	28 September 2023	Kate Barker	Ali Naghizadeh	Ali Naghizadeh
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1.0	2 August 2023	Kate Barker	Ali Naghizadeh	Ali Naghizadeh

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Aurecon Australasia Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Executive Summary

The New South Wales Department of Planning and Environment (the Department) is progressing investigations into the rezoning of the remaining portion of the Riverstone East Precinct of the North West Growth Area (NWGA), nominally identified as Stage 3, in collaboration with Blacktown City Council (Council) and key stakeholders. SLR Consulting Pty Ltd (SLR) has been engaged to provide a high level Odour Assessment for the Stage 3 Riverstone East Precinct (the Precinct).

This Odour Assessment provides the following:

- Investigates and identifies any sources of odour on or in the vicinity of the Precinct, including from any existing industrial and agricultural operations.
- Develops an understanding of the nature of any odour sources, including odour sources identified.
- Investigates the implications of any existing odours to inform future siting, design and staging of the development of the Precinct.
- Recommends management strategies, where appropriate, to inform development opportunities both under the existing odour situation and into the future, including nominal separation distance between odour sources and urban development.
- Makes high level recommendations for controls for siting, design and planning in proposed residential areas and associated land uses such as schools and open space.
- Provides maps identifying those areas where urban development would encroach into the ‘separation distance’ required between it and any odour sources or odour-producing activities and makes recommendations for any Stage 2 assessments required.

Odour surveys were conducted during varying hours over five days between 26 May 2023 and 9 June 2023 to provide an in-field ambient odour assessment of the impact of odour sources within the Precinct. The field odour surveys included ten sessions of field odour observations performed across the Precinct to assess the odour impacts of the identified odour sources on the surrounding areas.

Separation buffer distances are provided for the two identified odour emission sources (20 Clarke Street poultry farm and AJ Bush and Sons meat rendering facility) based on methodology provided by the *Technical framework: Assessment and management of odour from stationary sources in NSW* and the *Technical notes: Assessment and management of odour from stationary sources in NSW,* as well as recommendations from *The Clean Air Society of Australia and New Zealand (CASANZ) “Draft Odour Separation Distances Guidelines”.*

The outcome of the assessment shows that the observations of odour from 20 Clarke Street do not exceed the identified poultry odour separation buffer (2,107 m), however the observations of odour from AJ Bush and Sons do exceed the identified meat rendering odour separation buffer (1,000 m). Strategic Planning based on the separation buffer distances may be overly conservative for impacts from 20 Clarke Street and insufficient for the impacts from AJ Bush and Sons. A detailed Level 3 Odour assessment with site specific modelling is considered necessary to refine any appropriate separation distances required.

It is noted that the odour surveys provide only a snapshot of the odour for these locations at these times the surveys occurred, and that the odour surveys performed provide an indication of the likely impact under a variety of meteorological conditions but cannot capture all meteorological conditions nor all operating conditions (of the odour generating activities).

In addition the surveyor faced limitations in-field due to access, therefore the snapshot represents only the locations accessible, and the extent of the plumes observed may have been larger.

A risk assessment has been conducted to provide a high level assessment of the risk associated with development in the vicinity of the identified odour sources. The outcomes of this assessment indicate that the odour impacts from AJ Bush and Sons (meat rendering facility) and 20 Clarke Street (poultry farm) are not compatible with land uses that require an ambient odour amenity of 7 ou or below. Redevelopment of land that is in closest proximity to these odour sources may be impacted by this constraint. Locations further away from identified sources may be suitable for development, however a detailed Level 3 Odour assessment would be required to evaluate the suitability.

Given the conservative nature of the Level 1 assessment, detailed recommendations in relation to mitigation options, buffer distances and development staging cannot be provided.

In order to identify mitigation options, establish appropriate buffer distances and identify appropriate areas for proposed land uses, it is recommended that the Department do the following:

1. Conduct a Level 3 Odour Assessment to better understand the extent of impact from the odour sources and investigation of mitigation options. This would involve:
    a. Site odour audit of the odour generating activities.
    b. Development of an odour emission inventory through site specific sampling
    c. Dispersion modelling with multiple scenarios to evaluate level of required control to contain impacts within the boundary of the odour sources.

    A Level 3 Odour Assessment would allow refinement in the understanding of odour impacts in the Precinct form the identified odour sources. It would facilitate the development of a staging plan which could assist in reducing impacts during a transition period while the odour emissions sources implement controls or relocate. AJ Bush and Sons and the poultry farm at 20 Clarke Street currently cause offensive odour impacts beyond their site boundaries and have the potential to impact a large area of the precinct (refer Figure 10). If these sources were to relocate prior to the time of precinct development, a Level 3 Odour Impact Assessment and the recommendations below related to a Level 3 Odour Impact Assessment would not be required.
2. Liaise with odour emission operators to develop mitigation measure implementation strategy.
3. Plan the Precinct to ensure that sensitive land uses are located outside a 2 ou buffer as determined by the recommended Level 3 Assessment.
4. Consider planning of compatible land uses between sensitive land uses and any odour generating activities. These include industrial and agricultural uses as well as uses with transient users. A Level 3 Odour Assessment will assist in identifying times and conditions where impacts are worse and can inform planning decisions.
5. Allow provision for progressive development of non-residential land uses and buffer zones in the event that odour producing activities modify (upgrade) or cease operations (such as developing land to the south of the Precinct as a first stage in the Precinct planning). A Level 3 Odour Assessment will assist in refining the understanding of the full extent of odour impacts and can assist in identifying areas of development to prioritise.

6. For receptors closest to odour sources, design buildings such that air intakes and operable windows are located away odour generating activities where possible (while considering other pollutant sources such as roads, car parks etc).

Recommendation for the facilities to reduce odour is beyond the scope of this assessment. .

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1.0 Introduction

The New South Wales Department of Planning and Environment (the Department) is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct of the North West Growth Area (NWGA), nominally identified as Stage 3, in collaboration with Blacktown City Council (Council) and key stakeholders. SLR Consulting Pty Ltd (SLR) has been engaged to provide a high level Odour Assessment for the Stage 3 Riverstone East Precinct (the Precinct).

1.1 Purpose of this Report

The purpose of this high level Odour Assessment (this Report) is to conduct additional analysis found to be required through the previous Gap Analysis (SLR 2023) conducted by SLR (hereafter the Gap Analysis Report). It will evaluate the current extent of opportunities and constraints pertaining to future development of the Precinct. It will also provide recommendations to inform future development and refinement of the Indicative Layout Plan (ILP).

The objectives of the Odour Assessment are to:

- Investigate and identify any sources of odour on or in the vicinity of the Precinct, including from any existing industrial and agricultural operations.
- Develop an understanding of the nature of any odour sources, including odour sources identified.
- Investigate the implications of any existing odours to inform future siting, design and staging of the development of the Precinct.
- Recommend management strategies, where appropriate, to inform development opportunities both under the existing odour situation and into the future, including nominal separation distance between odour sources and urban development.
- Make high level recommendations for controls for siting, design and planning in proposed residential areas and associated land uses such as schools and open space.
- Provide maps identifying those areas where urban development would encroach into the ‘separation distance’ required between it and any odour sources or odour-producing activities and make recommendations for any Stage 2 assessments required.

1.2 Approach to Assessment

This Report has been prepared using risk-based approaches and strategies for dealing with ongoing odour impacts from existing activities in general accordance with the Department of Environment, Climate Change and Water’s (DECCW) *Technical Framework - Assessment and Management of Odour from Stationary Sources in NSW* (2006) (Technical Framework) (hereafter, “The Odour Technical Framework”) and the associated Technical Notes (hereafter, “The Odour Technical Notes”) .Generally, odour impacts from new or modified activities can be assessed using a Level 1 assessment. A Level 1 assessment is a screening technique that provides a broad estimate of probable odour impacts. In cases where odour impacts from existing facilities are a concern, the application of best management practices and negotiated changes to practice is usually sufficient without the need to undertake odour modelling. However, some may require significant management and control option changes are proposed, it may be appropriate to undertake a level 2 or 3 assessment to better quantify

the extent of measures required to mitigate odour impacts. It is noted that at the time of preparing this Report, detailed information on the existing operational activities of odour emission sources within the Precinct (potential emission rates, etc.) was not available. A large number of assumptions would therefore be required to be used as input to any quantitative (i.e. air dispersion modelling) assessment. The uncertainty associated with the output of such a study means it would be of limited value and would not (in itself) assist with the identification of odour control measures required to actively manage the odour impacts and associated risks.

The risk-based assessment (see **Appendix B** for full methodology) presented in this Report identifies odour sources with a risk of impacting future residential development within the Precinct and identifies appropriate mitigation measure and/or further assessment requirements to inform future development of the Precinct.

The assessment is based on semi-quantitative Level 1 assessment techniques, site visits, meteorological analysis, and odour surveys. Odour surveys were performed as 10 individual odour survey sessions using a ‘dynamic plume method’ and a ‘static odour intensity method’ and completed over five days.

The risk-based assessment methodology takes account of a range of impact descriptors, including the following:

- Nature of Impact: does the impact result in an adverse or beneficial environment?
- Sensitivity: how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- Magnitude: what is the anticipated scale of the impact?

The integration of receptor sensitivity with impact magnitude is used to derive the predicted significance of the impact at the Precinct. This level of this significance provides an assessment of the necessity for mitigation measures. Where the reduction of the risk significance is necessary, high level recommendations can be made for possible mitigation measure or next steps.

2.0 Project Description

2.1 Project Location

The Precinct is located within Blacktown local government area (**Figure 1**) and is generally bound by Windsor Road to the northeast, lands designated for Rouse Hill Regional Park to the east, the developing lands within the Tallawong Station Precinct to the south, the developing Riverstone East Stage 1 and 2 lands to the west, and First Ponds Creek in the northwest. The Project includes Lots 1 and 2 DP 218794 Junction Road to the north-western corner and sites owned by Burns Pet Food and A J Bush and Sons. Riverstone is surrounded by NWGA precincts in the Blacktown, Hills Shire and Hawkesbury local government areas. The Precinct location covers approximately 174 hectares (excluding Rouse Hill Regional Park).

Figure 1 Project Location

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Project Number:	610.31234
Location:	Riverstone, NSW
Other Information:	
Projection:	WGS 84 / UTM Zone 56
Date:	25/07/2023

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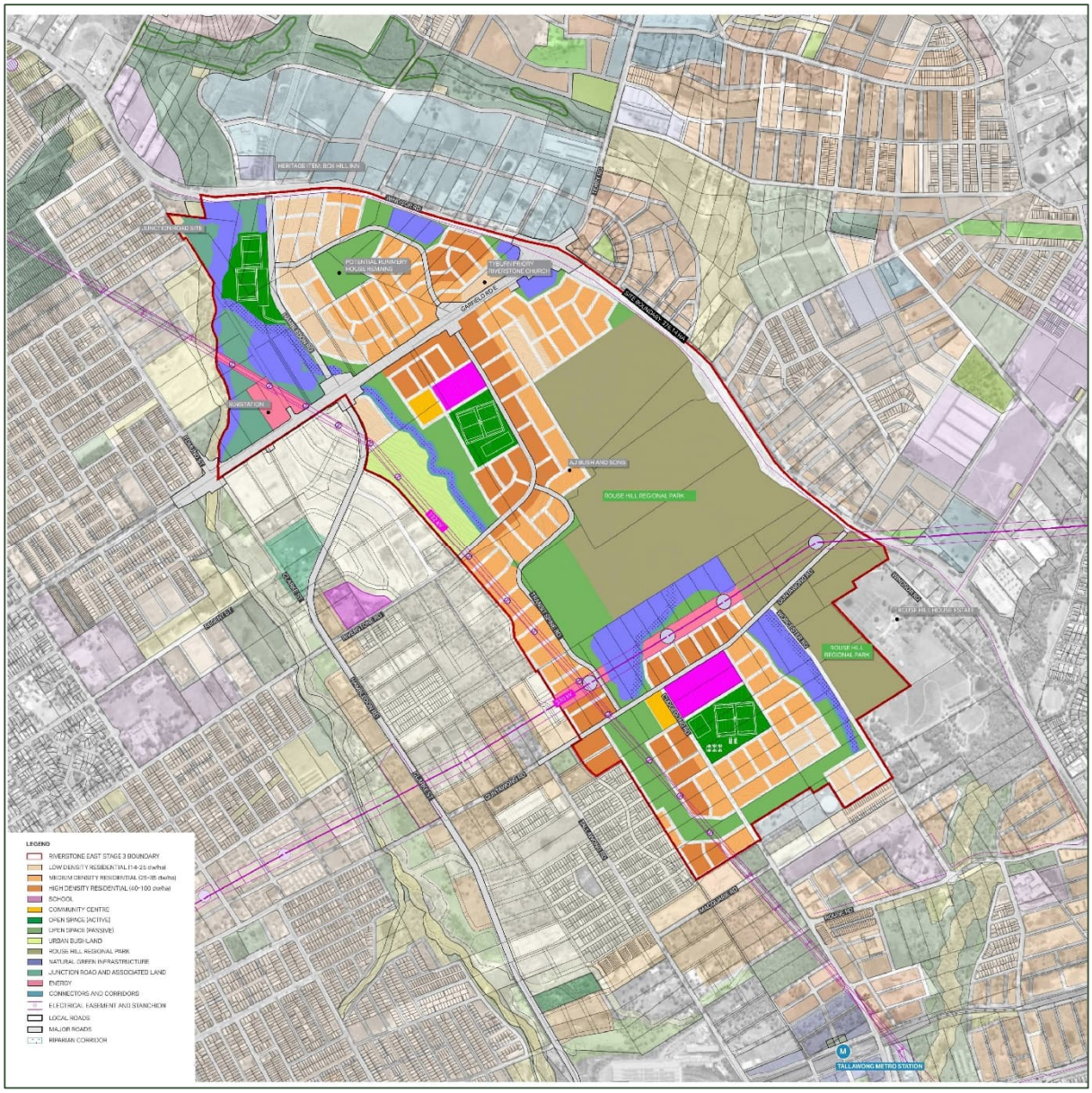
Riverstone East Precinct
Air Quality Assessment

Project Location

2.2 Concept ILP

The Precinct Concept ILP shown in **Figure 2** shows the proposed breakdown of land uses within the boundaries of the Precinct. It includes a variety of land uses including land uses that would be sensitive to odour impacts such as low, medium, and high-density residential areas, schools, active and passive open spaces, environmental conservation land and community centres.

Figure 2 The Precinct: ILP Concept Map



Provided by Aurecon – 01/09/2023

3.0 Existing Environment

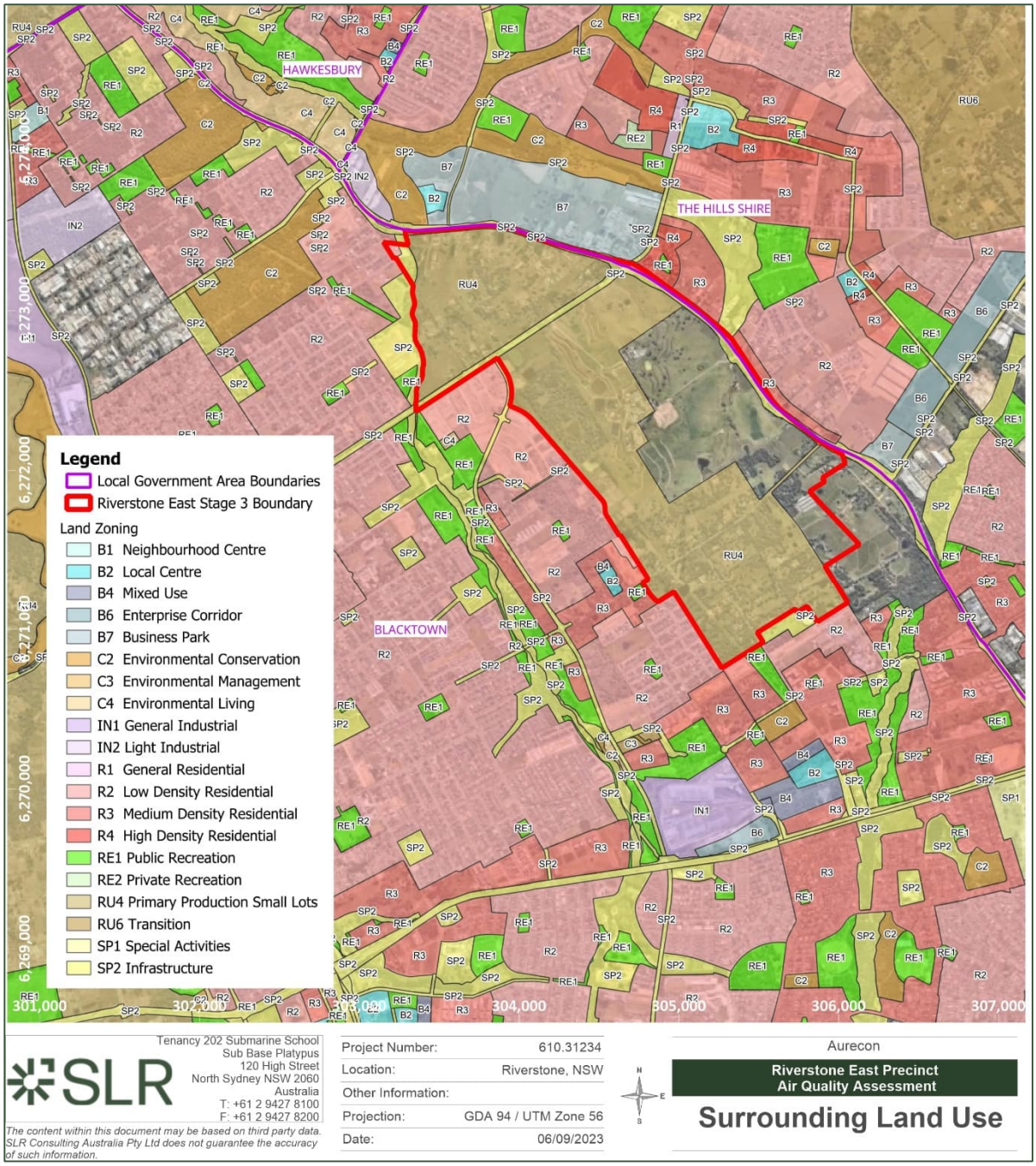
3.1 Surrounding Existing Land Use

The Precinct, being Lots 1 and 2 of DP 2218794, is currently primarily zoned as RU4 – Primary Production Small Lots with a small portion of land to the northwest of the Precinct, the Junction Road Site, currently zoned SP2 Drainage and R2 – Low Density Residential. The RU4 zones in the Precinct are intersected by SP2 - Classified Road zoning, or remain unzoned areas, under the *Blacktown Local Environmental Plan (LEP) 2015* (Blacktown LEP 2015).

The northeastern boundary of the Precinct is bordered by Classified Road (SP2) areas. North of this is captured by the *Hills Local Environmental Plan 2019*, with Business Park (B7) and National Parks & Nature Reserves (C2) zoned areas at the north and a mixture of Low (R2), Medium (R3) and High (R4) residential areas to the northeast. These areas are intermixed with some drainage areas (SP2) and Public Recreation areas (RE1). The areas to the south and west are similar (under the Blacktown LEP 2015), primarily zoned as Low (R2), Medium (R3) and High (R4) residential areas with areas of Classified Road (SP2), Drainage (SP2) and Public Recreation (RE1) zones throughout.

Figure 3 shows the land zoning of the area.

Figure 3 Land Use Zoning of Land Surrounding the Precinct



3.2 Sensitive Receptors

Sensitive receptors are locations where the general population can be adversely impacted by exposure to pollution from the atmospheric emissions. These locations include hospitals, schools, day care facilities and residential housing. For this assessment, all areas within the Precinct boundary are considered potential future sensitive receptors.

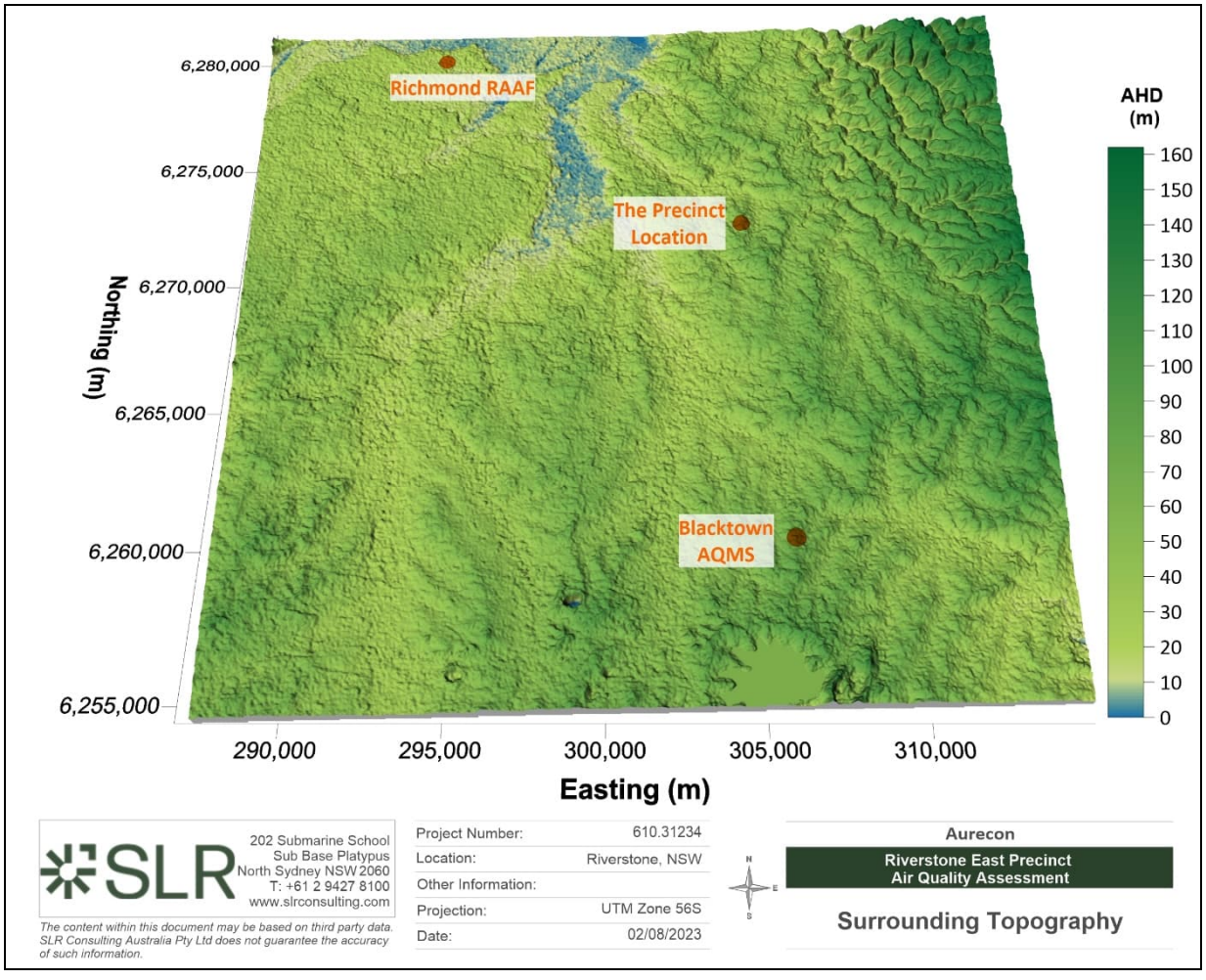
3.3 Topography

Topography can be important in air quality studies as local atmospheric dispersion can be influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies.

A three-dimensional representation of the region is given in **Figure 4**. The topography within the illustrated area ranges up to an approximate elevation of 160 m Australian Height Datum (AHD) to the northwest of the Precinct towards Berowra National Park. The Precinct itself is sloped downhill from the southeast towards the northwest, changing approximately from 70 m AHD to 25 m AHD. There is a small hill in the centre of the Precinct, sloping downhill to the northeast and southwest with the centre of the Precinct at 60 m AHD and decreasing to 25 m AHD in these directions.

Given the AJ Bush and Sons site is located on this hill in the centre of the Precinct, plume dispersion may be impacted with the southeast being less likely to be impacted compared to other directions as it is at a higher elevation that the odour source.

Figure 4 Topography of Area Surrounding the Precinct.



3.4 Meteorology

Local wind speed and direction influence the dispersion of air pollutants. The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest BoM station with relevant data is the Richmond RAAF AWS station. However, considering the distance between the Precinct, this station (approximately 13 km), and the topographical features (refer **Figure 4**), data from this station may not be a good representation of meteorological conditions at the Precinct. Therefore, a site-representative meteorological dataset was generated using the prognostic The Air Pollution Model (TAPM), developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rainwater and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate hourly meteorological observations at user-defined levels within the atmosphere.

Additionally, TAPM may assimilate actual local wind observations so that they can optionally be included in a model solution. The wind speed and direction observations are used to realign the predicted solution towards the observation values. Available observed meteorological data from the nearby weather stations were incorporated into the TAPM setup. The observational datasets were used in TAPM with an appropriate 'radius of influence' ranging from 1 km to 8 km depending on topography.

Table 1 details the parameters used in the TAPM meteorological modelling for this assessment.

Table 1 Meteorological Parameters used for the AQA – TAPM

Parameter	Value
Modelling period	1 January 2018 to 31 December 2022
Centre of analysis	305,084 mE 6,272,366 mS (UTM Coordinates 56S)
Number of grid points	25 × 25 × 25
Number of grids (spacing)	5 (30 km, 10 km, 3 km, 1 km, 0.3 km)
Data assimilation	Richmond RAAF AWS (Station #67105) Penrith Lakes AWS (Station #67113) Horsley Park Equestrian Centre AWS (Station #67119) Terrey Hills AWS (Station # 66059) Badgerys Creek AWS (Station # 67108) Canterbury Racecourse AWS (Station #66194)
Terrain	AUSLIG 9 second DEM

Annual and seasonal wind roses for the years 2018 to 2022 compiled from data from the TAPM model for a location within the Precinct are presented in **Figure 5**.

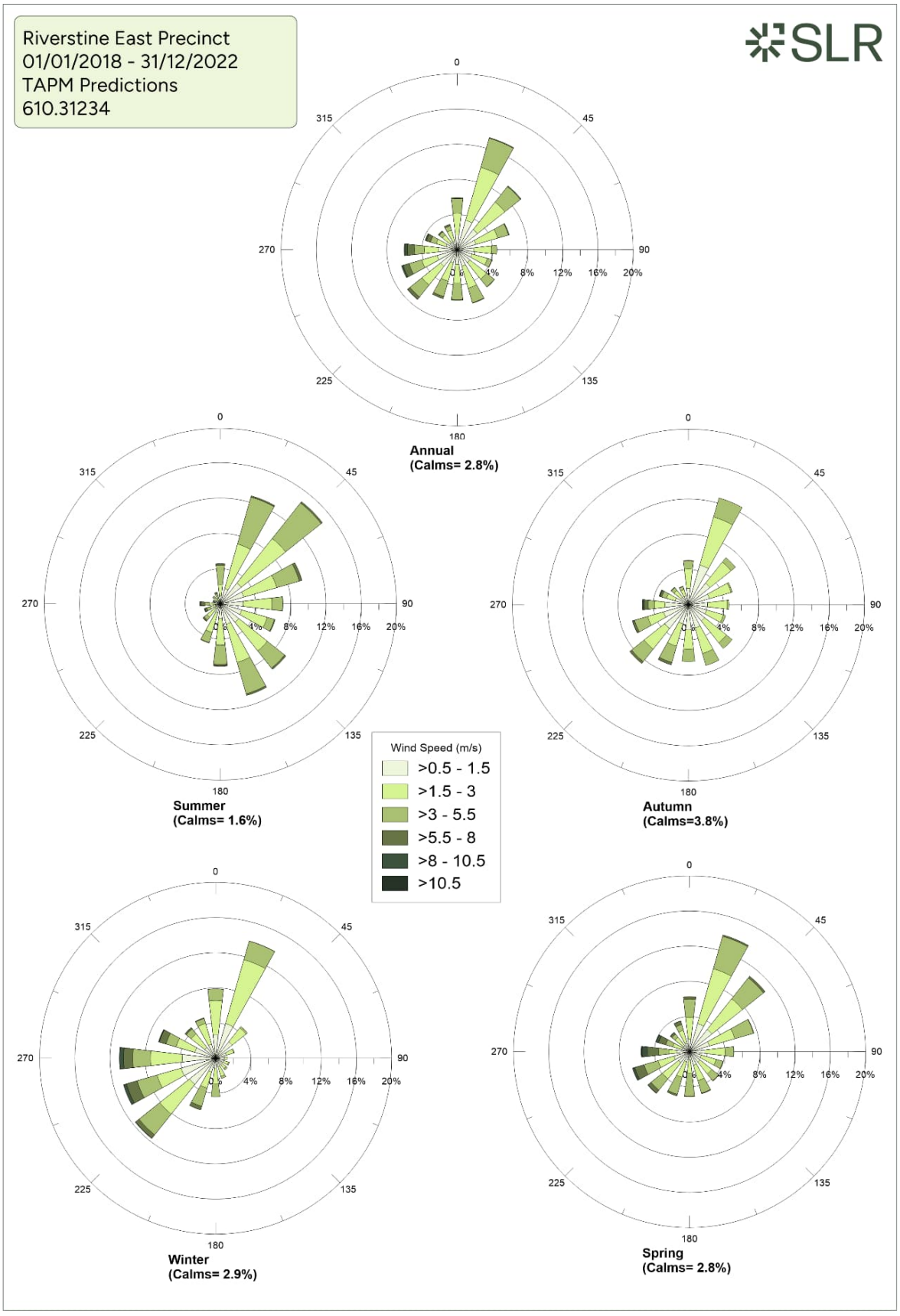
The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on.

The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The annual and seasonal wind roses for the years 2018 to 2022 (**Figure 5**) indicate that the predominant wind directions at the Precinct is north-northeast across all seasons. However, there are seasonal variation in wind conditions at the Precinct. In summer, winds are mostly from the north-northeast to south-southeast directions with very few winds from the southwest and northwest quadrants. In autumn and spring, winds blow mostly from the north-northeast and winds from all other directions are of a relatively similar frequency with higher northeasterlies in during spring. In winter, winds predominantly blow from from the north-northeast direction and the southwest quadrant with very few winds from the southeast quadrant.

The frequency of calm conditions is lowest in the summer at 1.6% and highest in autumn at 3.8% with an annual average calm frequency of approximately 2.8%.

Figure 5 TAPM Prediction Wind Roses (2018-2022)



3.5 Potential odour sources

A Gap Analysis Report prepared by SLR for the Project (SLR 2023) identified the existing environment, existing residential zones and the identified emission sources.

The odour sources were identified through review of aerial maps, the National Pollutant Inventory database, the Environment Protection Authority (EPA) Protection of the Environment Operations (POEO) public register, previous assessments, and experience from odour surveys in the area. The identified odour sources include:

- Riverstone Sewage Treatment Plant (STP)
- Rouse Hill STP
- Meat Rendering Farm at 1106 Windsor Road, Rouse Hill (AJ Bush & Sons)
- Broiler Poultry Farm at 20 Clarke Street, Riverstone
- Layer Poultry Farm at 100 Worcester Road, Rouse Hill
- Layer Poultry Farm at 181 Cudgegong Road, Rouse Hill

Figure 6 illustrates these identified sources. No odour sources were identified on Junction Road. As illustrated, the two STPs and the poultry farm at 20 Clarke Street are located beyond the boundary of the Precinct. It is noted that the land upon which 20 Clark street is located was rezoned in 2016. However, SLR understands that at the time of writing this report an operational poultry farms is present on this land.

Conservative separation distance assessments presented in the Gap Analysis Report found that the risk of odour impacts from the two STPs is very low. This was confirmed through a number of site visits performed by SLR which observed no odours from the STPs beyond the separation distances adopted by the Gap Analysis Report. The site visits and odour surveys also found that the poultry farms at 100 Worcester Road and 181 Cudgegong Road Rouse Hill were not operational. As such, these four sources have not been considered further in this assessment.

Figure 6 Potential Odour Sources

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Project Number:	610.31234
Location:	Riverstone, NSW
Other Information:	
Projection:	GDA 94 / UTM Zone 56
Date:	06/09/2023

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Air Quality Assessment

Surrounding Odour Sources

4.0 Regulatory Framework

The following regulations and guidelines are relevant to the development:

- *Protection of the Environment Operations Act 1997 No 156* (NSW Parliament Current version 2023)
- *Protection of the Environment Operations (Clean Air) Regulation 2022* (NSW Parliament 2022)
- *Environmental Planning and Assessment Act 1979 No 203* (NSW Parliament Current version 2023)
- *Local Government Act 1993 No 30* (NSW Parliament Current version 2023)
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA 2022), hereafter referred to as the Approved Methods
- *Approved Methods for the Sampling and Analysis of Air Pollutants* (NSW EPA 2022a)
- *Technical framework: Assessment and management of odour from stationary sources in NSW* (NSW DEC 2006a)
- *Technical notes: Assessment and management of odour from stationary sources in NSW* (NSW DEC 2006b)

The key regulations and guidelines have been summarised below.

4.1 Protection of the Environment Operations (POEO) Act 1997 & Amendment Act 2011

The POEO Act (and Amendment Act 2011) is a key piece of environment protection legislation administered by the NSW Department of Planning and Environment's Environment, Energy and Science (EES) group which enables the Government to establish instruments for setting environmental standards, goals, protocols, and guidelines.

The following section of the POEO Act is of general relevance to the Precinct:

Section 128 of the POEO Act states:

1 The occupier of a premises must not carry out any activity or operate any plant in or on the premises in such a manner to cause or permit the emission at any point specified in or determined in accordance with the regulation of air impurities in excess of [the standard of concentration and/or the rate] prescribed by the regulations in respect of any such activity or any such plant.

2 Where neither such a standard nor rate has been so prescribed, the occupier of any premises must carry on activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution.

4.2 Protection of the Environment Operations (Clean Air) Regulation 2022

The POEO (Clean Air) Regulation 2022 (the Regulation) is the core regulatory instrument for air quality issues in NSW. In relation to industry, the Regulation sets maximum limits on emissions from activities and plant for a number of substances. It refers to the state air quality guidelines specified by the NSW EPA, which is the Approved Methods. The Approved Methods lists the statutory methods for modelling and assessing emissions of air

pollutants from stationary sources in NSW, as well as the specific criteria for the emissions are identified in for the pollutants.

4.3 Odour Criteria

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management but are generally not intended to achieve “no odour”.

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the *odour threshold* and defines one odour unit (ou). An odour goal of less than 1 ou would theoretically result in no odour impact being experienced.

In practice, the character of a particular odour can only be judged by the receiver’s reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 ou to 10 ou depending on a combination of the following factors:

- *Odour Quality*: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- *Population sensitivity:* any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- *Background level:* whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- *Source characteristics:* whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily using control equipment than diffuse sources. Point sources tend to be located in urban areas, while diffuse sources are more prevalent in rural locations.
- *Health Effects:* whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

Experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 ou is likely to represent the level below which “offensive” odours should not occur (for an individual with a ‘standard sensitivity’ to odours). Therefore, the *Odour Technical Framework* (DECC, 2006a) recommends that, as design goal, no individual be exposed to ambient odour levels of greater than 7 ou. This is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour assessment criteria need to take into account the range in sensitivities to odours within the community in order to provide additional protection for individuals with a heightened response to odours. This is done in the Odour Technical Framework by setting a range of odour assessment criteria depending on the size of the affected population. In this

way the odour assessment criteria allow for population size, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity.

A summary of odour performance goals for various population densities, as referenced in the Odour Technical Notes is shown in is given in **Table 2**. This table shows that in situations where the population of the affected community is equal to or greater than 2,000 people (or in areas with schools or hospitals), an odour assessment criterion of 2 ou at the nearest residence (existing or any likely future residences) is to be used.

Table 2 NSW DECC Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odours (ou)
Urban area (≥ 2000)	2.0
500 – 2000	3.0
125 – 500	4.0
30 – 125	5.0
10-30	6.0
Single residence (≤ 2)	7.0
Source: The Odour Technical Notes, DECC 2006	

The NSW EPA Air Policy Unit advises that an odour assessment criterion of 2 ou is appropriate for all facilities located in 'Urban Centres' as defined by the Australian Bureau of Statistics, which is an aggregated population of 1,000 persons or more (ABS 2022). Considering the future developments at the Precinct will include low, medium and high density housing, an odour impact assessment criterion of 2 ou is considered appropriate.

5.0 Odour Survey

Odour surveys were conducted during varying hours over five days between 26 May 2023 and 9 June 2023 to provide an in-field ambient odour assessment of the impact of odour sources within the Precinct. The field odour surveys included ten sessions of field odour observations performed across the Precinct to assess the odour impacts of the identified odour sources on the surrounding areas (**Figure 6).** SLR notes that the EPA has confirmed in June 2023 that AJ Bush and & Sons have installed new ducting, and improvements made to the wastewater treatment ponds at the premises, but SLR is unaware of time this works was completed.[1]

The field odour observations rely on odour intensity observations made by an observer using a prescribed format for recording observed odours using the sense of smell (without any apparatus). The SLR odour assessor conducting the odour surveys has successfully undertaken and complies with the odour assessor sensitivity screening protocol in accordance with *AS/NZS 4323.3:2001 Stationary source emissions – Part 3: Determination of odour concentration by dynamic olfactometry*.

It is noted that an odour survey provides only a snapshot of odour at these locations at the time of survey, however, these snapshots repeated over time can provide useful information in assessing odour impact risk. Changes in odour impacts due to seasonal variation can be dependent on multiple factors including temperature, wind direction and wind speed, as well as possible changes to operational intensity at the emission source.

The surveyor faced limitations in-field due to access, therefore the snapshot represents only the locations accessible, and the extent of the plumes observed may have been larger.

5.1 Field Odour Survey Methodology

In order to characterise the area surrounding the identified sources of odour emissions and evaluate the potential exposure from odour plumes arising from the identified odour sources, SLR utilised an odour survey approach of dynamic plume extent observations and static odour intensity observations which are modified approaches based on the following methods for odour surveys:

- British Standard (BS) EN 16841-2:2016 – Ambient Air – Determination of odour in ambient air by using field inspection – Dynamic Plume Method
- German Standard VDI 3882:1992 Part 1 *Olfactometry – Determination of Odour Intensity.*

Currently there are no Australian Standards for determining odour plume extent or rating odour intensity, however these are the most commonly referred to standards by Australian regulatory authorities. Modified approaches of these standards are commonly utilised and accepted for assessments of existing odour impacts.

5.1.1 Plume Extent

This approach is based on the Dynamic Plume Method (EN 16841-2 2016). The plume method determines the presence and intensity or absence of recognizable odours in and around the plume originating from a specific odorant emission source, for a specific emission

[1] https://www.epa.nsw.gov.au/working-together/community-engagement/updates-on-issues/odour-investigations/aj-bush-and-sons-riverstone#:~:text=In%20June%202023%2C%20the%20EPA,the%20intensity%20of%20odours%20generated.

situation and under specific meteorological conditions (i.e., specific wind speed and direction).

In summary, the methodology requires the assessor to conduct a series of measurement cycles which involve successively entering and exiting the plume while moving away from or towards the odour source in order to determine the plume extent. Odour observations are recorded at a given moment and given measurement point. The objective is to obtain an immediate assessment of the presence (including intensity and character where appropriate) of an odour to determine the extent of the odour plume. The unit of measurement is the presence (and intensity) or absence of recognizable odours at a particular location downwind of a source and the extent of the plume is assessed as the transition of absence to presence of recognizable odour. Each observation is less than a minute and considered a discrete single point in time observation.

5.1.2 Odour Intensity

The modified approach for odour intensity surveys adopts a scale for describing odour intensity based on that detailed in the German Standard VDI 3882. To assess the odour intensity at each location for any discernible odours detected, the odour assessor undertaking the survey classified their perception of the odour intensity in accordance with the scale outlined in **Table 3**. This was done for approximately 10-minute periods (static observation), with odour intensity observations recorded at 10 second intervals. This method is not designed to capture the extent of the plume, but rather odour observations over time (as compared to discrete single point in time observations).

Table 3 Summary of Odour Intensity Scale Utilised during the Field Odour Surveys

Odour	Intensity Level
Extremely Strong	6
Very Strong	5
Strong	4
Distinct	3
Weak	2
Very Weak	1
Not perceptible	0

5.1.3 Observation Point Selection

In terms of timing and selection of day for observations, were possible, SLR targeted light winds and stable conditions since these conditions contribute to poor dispersion conditions resulting in higher odour intensities/concentrations. These conditions are common in early morning and late afternoons/evenings or overnight. Due to health and safety concerns overnight surveys were not performed. Further, some surveys were performed during the day to capture the varying emissions from the identified sources, noting that detailed information in relation to the hourly throughout and site activities of the identified sources was available.

5.2 Results

The odour surveys were conducted during varying hours over five days to capture a wide range of ambient weather conditions within the Precinct. The field odour surveys for the Precinct were completed between 26 May 2023 and 9 June 2023. The log sheets for the observation locations are provided as attachments in **Appendix A**.

The general schedule of the odour surveys is provided in **Table 4**.

As outlined above, an odour survey provides only a snapshot of the odour at these locations at these times, and that the odour surveys performed provide an indication of the likely impact under a variety of meteorological conditions but cannot capture all meteorological conditions nor all operating conditions (of the odour generating activities).

Table 4 Odour Survey Schedule Summary

Day	Date	Survey Number	Observation Period	Method	Number of Points/ Observations
Day 1	26-05-2023	1	10:20 AM – 4:00 PM	Dynamic	82
				Static	5
		2	4:00 PM – 7:20 PM	Dynamic	66
				Static	4
Day 2	30-05-2023	3	2:30 PM – 7:00 PM	Dynamic	95
				Static	5
		4	7:00 PM – 9:00 PM	Dynamic	70
				Static	5
Day 3	1-06-2023	5	2:15 PM – 6:00 PM	Dynamic	79
				Static	5
		6	6:00 PM – 9:05 PM	Dynamic	75
				Static	4
Day 4	2-06-2023	7	6:00 AM – 11:00 AM	Dynamic	99
				Static	7
		8	11:00 AM – 3:30 PM	Dynamic	81
				Static	4
Day 5	9-06-2023	9	6:00 AM – 10:30 AM	Dynamic	74
				Static	5
		10	10:30 AM – 3:10 PM	Dynamic	82
				Static	6
Note: Observation period is an approximate guide, exact start and finish times will vary. See **Appendix A.**					

Table 5 summarises the observations from the maximum extent observations of the dynamic odour plume survey approach. It includes character of the perceived odours during the odour surveys conducted, the extent of the plume, and the direction of the plume extent. The observations presented relate to those with an odour intensity of 3 or greater, as odour intensity will generally decrease with increased distance from the source and intensities of 2 and below are generally not distinct enough to characterise. Distances are measured from a centred point within the boundaries of the odour emission source.

Distinct offensive odour emissions from AJ Bush and Sons were observed at distances up to a maximum of 1,380 m from the source. Distinct offensive odour emissions from the poultry farm at 20 Clarke Street were observed at distances up to a maximum of 490 m from the source.

Figure 7 illustrates the dynamic plume observations of an odour intensity of 3 or greater. It is important to note that the extent of the plume surveys is limited by access, and therefore the actual extent of distance or offensive odour may be greater in some directions at the time of the surveys than those illustrated.

Odour intensity survey observation results are summarised below in **Figure 8**. Pie charts are used to show the duration of the intensity during observations for each survey location. The pie charts are plotted on an aerial image at the location they occurred.

These observations show that distinct odours were experienced most of the time during the surveys in close proximity to the odour sources, beyond the boundaries of the facilities.

Detailed figures combining plume extent observations and odour intensity are provided in **Appendix C**. These figures also include wind roses for the monitored meteorological conditions for the time period of the surveys from data collected on site using a Calypso ultrasonic anemometer.

Table 5 Summary of Dynamic Plume Extent Odour Survey Results

Odour source	Survey Number	Odour Character	Direction	Distance (m)
AJ Bush and Sons	1	Offensive, Cooked Chicken	NW	765
	2	Offensive, Cooked Chicken	NE	1,025
	3	Offensive, Cooked Chicken	SE	1,175
	4	Offensive, Cooked Chicken	SW	520
	5	Offensive, Cooked Chicken	SW	530
	6	Offensive, Cooked Chicken	NE	375
	7	Offensive, Cooked Chicken	S	1,160
	8	Offensive, Cooked Chicken	S	1,380
	9	Offensive, Cooked Chicken	SW	1,115
	10	Offensive, Cooked Chicken	SE	1,375
20 Clarke Street	1	Offensive, Manure	NE	480
	2	Offensive, Manure	NE	490
	3	Offensive, Manure	S	270
	4	Offensive, Manure	W	195
	5	Offensive, Manure	W	610
	6	Offensive, Manure	N	215
	7	Offensive, Manure	S	185
	8	Offensive, Manure	S	215
	9	Offensive, Manure	S	465
	10	Offensive, Manure	SE	180

Figure 7 Odour Plume Extent for All Days

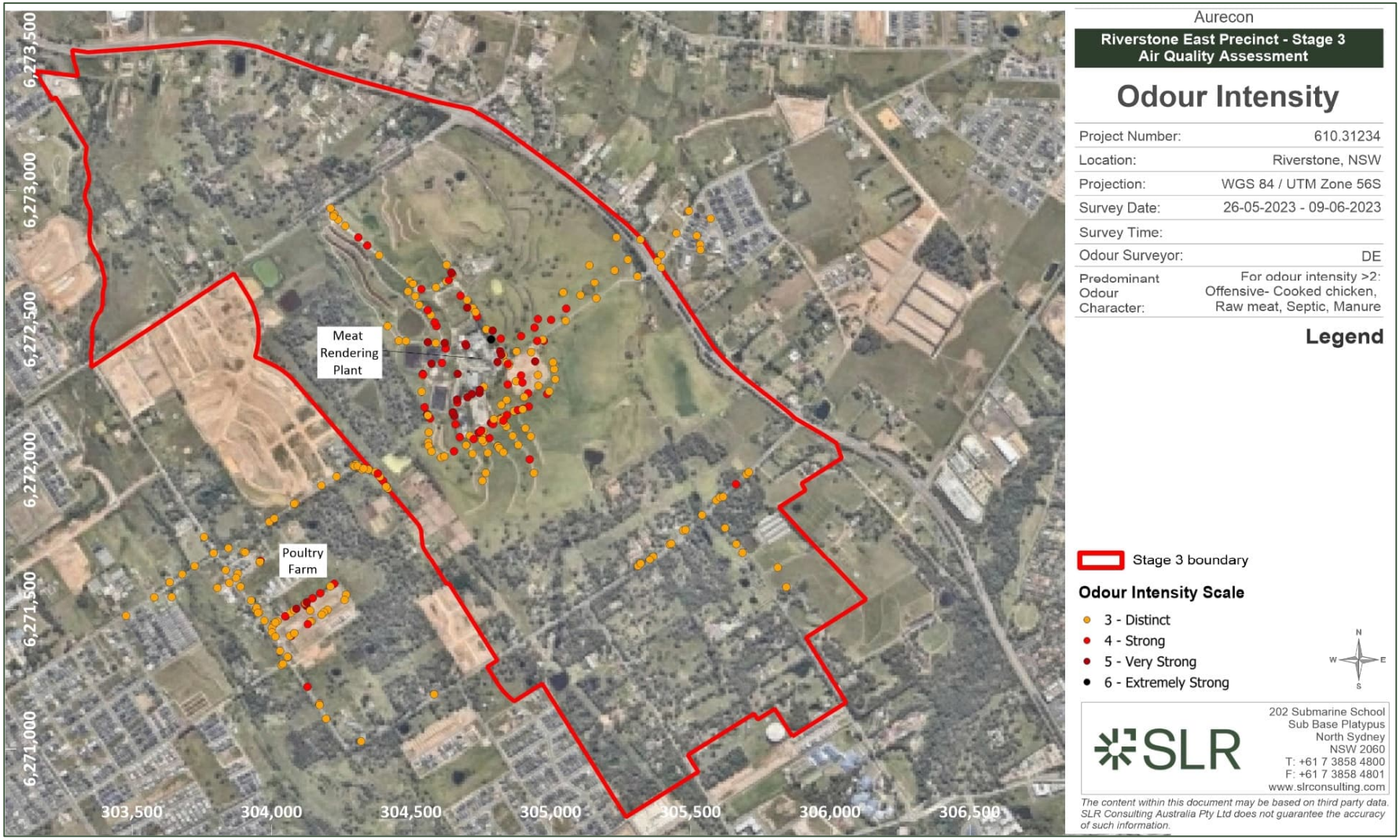
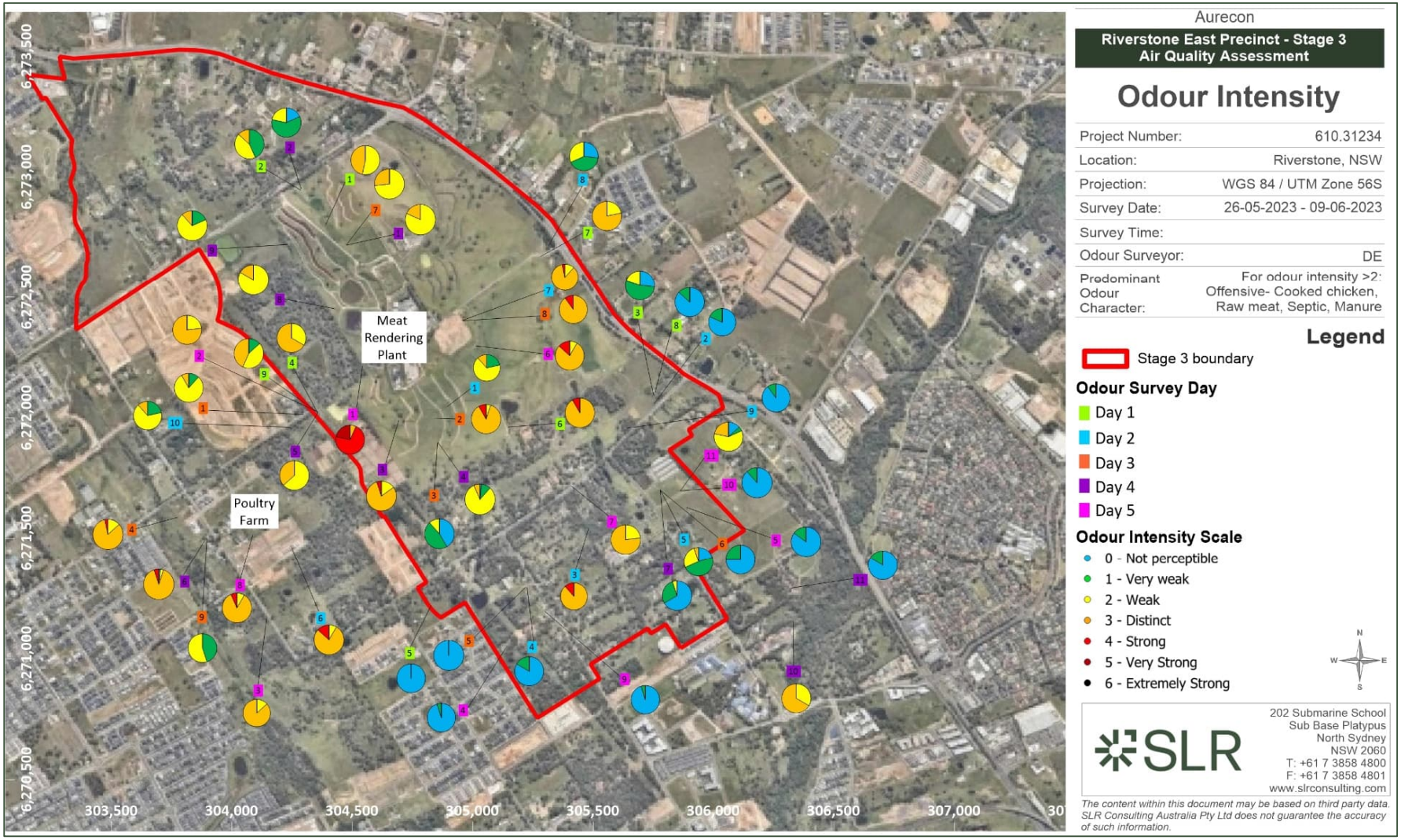


Figure 8 Odour Intensity Survey Results for All Days



6.0 Separation distances

Recommended separation distances and their methodology for the identified odour emission sources are outlined below.

6.1 Level 1 Poultry Odour Separation Buffer

A Level 1 odour impact assessment has been performed as described in the Odour Technical Framework and the associated Odour Technical Notes.

A Level 1 assessment is a simple screening-level technique based on generic parameters for the type of activity and site. The methodology used to calculate separation distances for poultry farms in accordance with Chapter 5 of the Technical Notes uses current standard production technology. The prescribed distances have been found to lead to an acceptable air quality impact on the amenity of the local environment.

To summarise the Level 1 assessment methodology, an equation is used to calculate the minimum separation distance given the number of broiler chicken sheds. The equation requires a composite factor input which depends on site-specific information pertaining to the proposed shed type, receptor, terrain, vegetation, and wind frequency. A detailed methodology is provided **Appendix D**.

Assumptions made for this Level 1 assessment are outlined in **Table 6**. These are generally in line with assumptions made by previous assessments reviewed in the Gap Analysis. At this stage, the recommended separation distance is 2,107 m. This is shown in **Figure 9**.

Table 6 Assumptions used in assessment.

Parameter	Value
Number of Sheds	6
Number of birds across all sheds	70,000
Ventilation Type	Fan ventilated without barriers

Table 7 Assigned values for composite factors.

Factor	Assigned Factor Description	Value
S1 – Shed factor	Controlled fan ventilation without barriers	980
S2 – Receptor Factor	Large towns, greater than 2000 persons	1.05
S3 – Terrain Factor	Flat is regarded as less than 10% upslope, 2% downslope and not in a valley drainage zone.	1.0
S4 – Vegetation Factor	Few trees long grass	0.9
S5 – Wind frequency Factor	Normal wind conditions (between 5% and 60%)	1

6.2 Meat Rendering Odour Separation Buffer

The Odour Technical Framework and Technical Notes (NSW DECC, 2006a, 2006b) do not provide a Level 1 odour impact assessment methodology for meat rendering facilities.

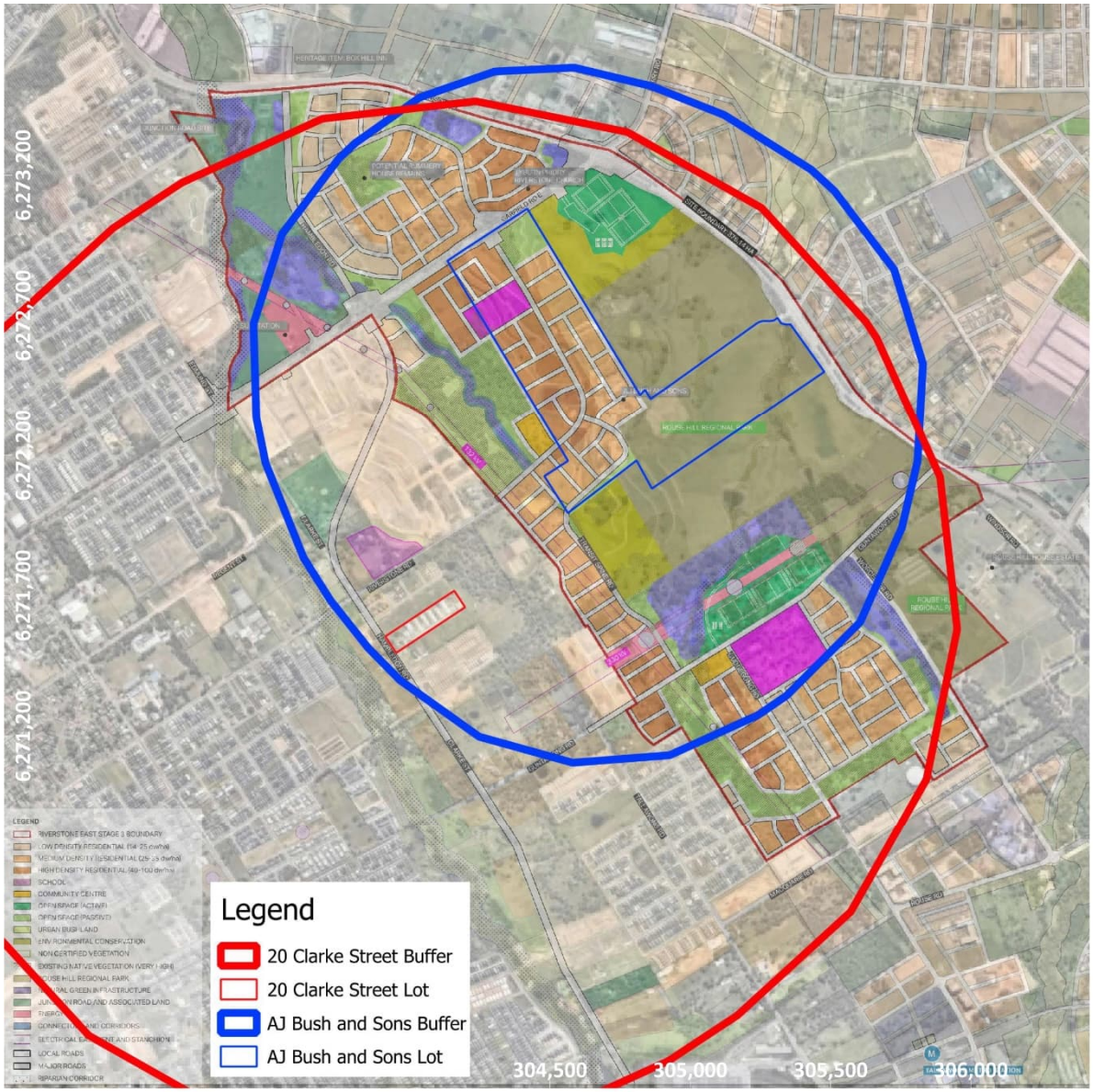
The Clean Air Society of Australia and New Zealand (CASANZ) “Draft Odour Separation Distances Guidelines” (CASANZ, 2008) and VIC EPA publication number 1518,

"Recommended Separation Distances for Industrial Residual Air Emissions" (VIC EPA, 2013) identify a minimum buffer distance from operations of this type to nearest residential areas of 1 km.

Given that the meat rendering plant is within the Precinct boundary, achieving the required separation distance between the sensitive receptors and the facility would result in most of the Precinct area being unsuitable for redevelopment.

At this stage, the minimum buffer separation distance is 1,000 m. This is shown in **Figure 9**.

Figure 9 Separation distances



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Project Number:	610.31234
Location:	Riverstone, NSW
Other Information:	
Projection:	WGS 84 / UTM Zone 56
Date:	01/08/2023

Aurecon

Riverstone East Precinct
Air Quality Assessment

Seperation Buffers

7.0 Risk Assessment

A qualitative assessment is completed for this Report and is a summary presented in this section, with full methodology presented in **Appendix B.**

7.1 Methodology Summary

The risk-based assessment takes account of a range of impact descriptors, including the following:

- **Nature of Impact**: does the impact result in an adverse or beneficial environment?
- **Sensitivity**: how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude**: what is the anticipated scale of the impact?

The integration of receptor sensitivity with impact magnitude is used to derive the predicted **significance** of the impact at the Precinct. Refer to **Appendix B** for detailed methodology.

7.1.1 Nature of Impact

The nature of the impact (odour) is subjective depending on the character, intensity and duration of the odour. Impacts from odorous air contaminants are often nuisance-related rather than health-related. However, nuisance odour can significantly impact a receptors experience of the environment they are in. Pleasant, weak, or infrequent odours may be experienced as beneficial by some, but the same odour may be perceived as offensive, strong and frequent by a different receptor. Due to this variation and potential fluctuation, it is conservative to assume that the nature of odour impacts will be ***adverse***.

7.1.2 Sensitivity

The future sensitive receptors within the Precinct are expected to include urban development such as residential dwellings, schools, open space and community centres. With regard to the methodology outlined in **Appendix B**, the sensitivity of the future area to the existing odour emission sources is classified as ***high***.

7.1.3 Magnitude

The odour survey observations indicate that distinct odours that are offensive in character attributed to the meat rendering plant can be experienced at a distance greater than 1 km from the odour emission source AJ Bush and Sons. Experience gained through odour assessments from proposed and existing facilities in NSW indicates that odours considered to be “offensive” for an individual with a ‘standard sensitivity’ to odours are typically greater than 7 ou in concentration. The results of the odour surveys indicate that if there are no changes to the operations of the identified odour sources, it is likely that land within 1 km of AJ Bush and Sons will be impacted by distinct and potentially offensive odours. These odours would potentially result in impacts greater than 7 ou which is well above the adopted odour assessment criterion of 2 ou. It is unlikely that the odour impacts will cause adverse health impacts, but they will likely impact the amenity of the area to a ***substantial*** scale.

7.2 Outcomes

Given the **high sensitivity** of the potentially affected receptors and the **substantial magnitude** of the potential impacts from the identified odour emission sources, the potential impact significance for the local receptors is concluded to be of ***major/intermediate significance*** for the closest receptors. Based on the limited odour surveys completed it is expected that receptors within approximately 0.5 km of the poultry farm at 20 Clarke Street and 1.4 km of AJ Bush and Sons may potentially be impacted by odours of a Major/Intermediate significance.

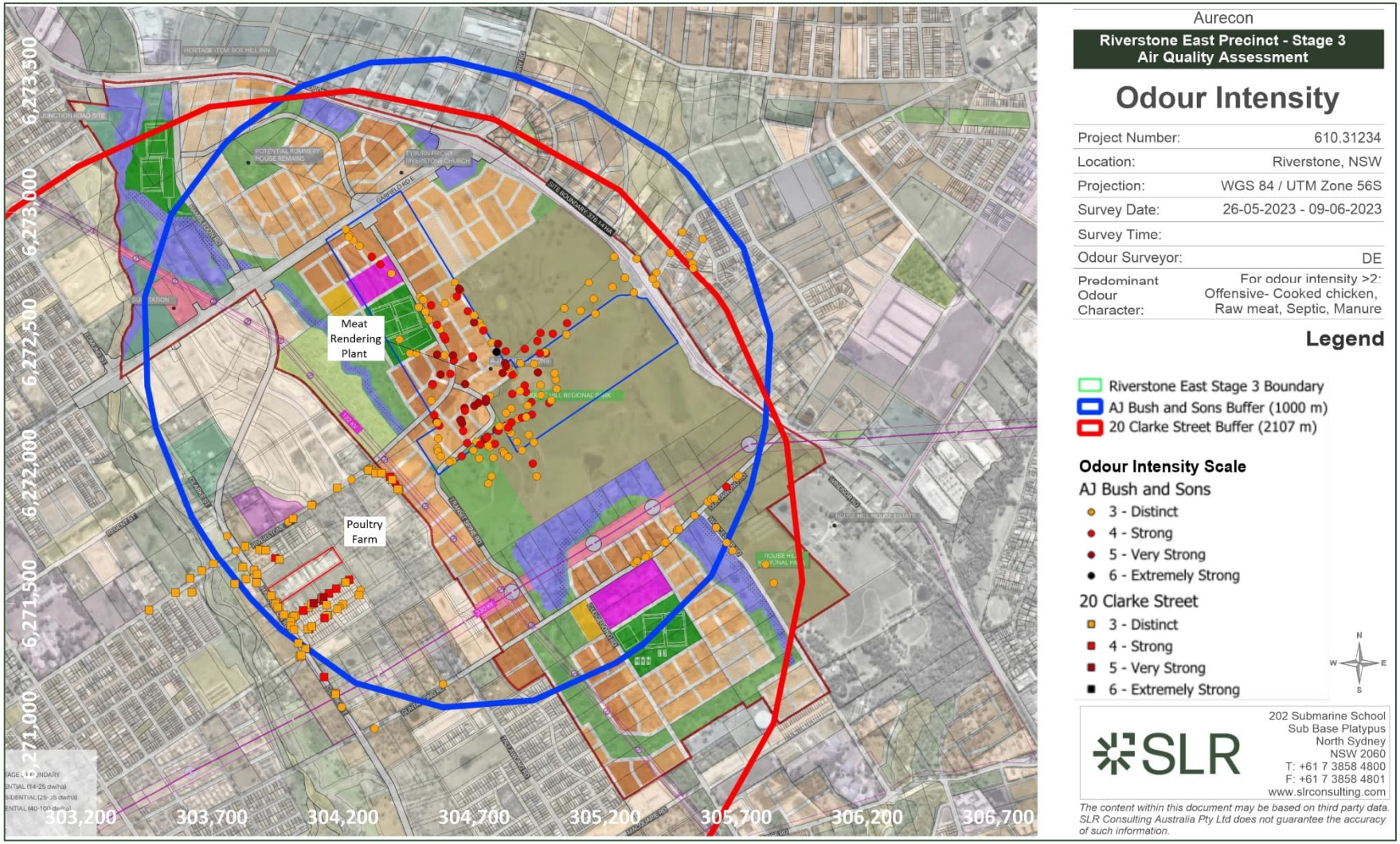
Table 8 Risk Assessment of Impacts from Operations

Magnitude Sensitivity		[Defined by Table B2]			
		Substantial Magnitude	**Moderate Magnitude**	**Slight Magnitude**	**Negligible Magnitude**
[Defined by Table B1]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	**Major/ Intermediate Significance**	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Figure 10 provides an aerial figure which includes the odour intensity results for all five days of surveys as well as the separation buffers. The comparison shows that the observations of odour from 20 Clarke Street do not exceed the identified poultry odour separation buffer (2107 m), however the observations of odour from AJ Bush and Sons do exceed the identified meat rendering odour separation buffer (1000 m). Strategic Planning based on the separation buffer distances may be overly conservative for impacts from 20 Clarke Street and insufficient for the impacts from AJ Bush and Sons. A detailed Level 3 Odour assessment with site specific modelling is considered necessary to refine any appropriate separation distances required.

As outlined previously, the odour surveys provide only a snapshot of the odour for these locations at these times the surveys occurred, and that the odour surveys performed provide an indication of the likely impact under a variety of meteorological conditions but cannot capture all meteorological conditions nor all operating conditions (of the odour generating activities). In addition the surveyor faced limitations in-field due to access, therefore the snapshot represents only the locations accessible, and the extent of the plumes observed may have been larger.

Figure 10 Odour Intensity Survey Results for All Days with Separation Distances



To reduce the impact significance, additional measures may be put in place to reduce or remove these impacts. The level of residual risk will be dependent on the level of measure put in place. The hierarchy of controls can be used to describe potential areas where mitigation areas may be appropriate. **Table 9** outlines possible measures that could be applied to reduce odour impacts.

Table 9 Possible Measures to Reduce Odour Impacts

Control Level	Controls at operator (Nature of impact)	Controls at receptor (Sensitivity)	Planning controls (Magnitude)
1. Elimination	Remove facility	No development changes	Planning measures to support relocation
2. Substitution	None	Less sensitive land uses (e.g. industrial, agricultural)	None
3. Engineering Controls	Extensive upgrades to facility	For future receptors closest to existing odour source, design buildings such that air intakes and operable windows are located away odour generating activities where possible (while considering other pollutant sources such as roads, car parks etc'.	None
4. Administrative controls	Operational Changes	None	Progressive development in stages and buffer zones

8.0 Recommendations

The outcomes of this assessment indicate that the re-development of the land in proximity to AJ Bush and Sons (meat rendering facility) and 20 Clarke Street (poultry farm) is not compatible with the current odour impacts.

Given the conservative nature of the Level 1 assessment, detailed recommendations in relation to mitigation options, buffer distances and development staging cannot be provided.

Applying the highest level of control (elimination) would resolve odour impacts due to the conflicting uses. Either removing the facility or no redevelopment of the Precinct would remove the conflict.

No development is an undesirable outcome for the Precinct, therefore, should the odour emission sources continue to operate, and urban development continues, it is recommended that the Department do the following:

1. Conduct a Level 3 Odour Assessment as part of the Stage 2 Assessment to better understand the extent of impact from the odour sources and investigation of mitigation options. This would involve:
   a) Site odour audit of the odour generating activities.
   b) Development of an odour emission inventory through site specific sampling
   c) Dispersion modelling with multiple scenarios to evaluate level of required control to contain impacts within the boundary of the odour sources.

   A Level 3 Odour Assessment would allow refinement in the understanding of odour impacts in the Precinct form the identified odour sources. It would facilitate the development of a staging plan which could assist in reducing impacts during a transition period while the odour emissions sources implement controls or relocate. AJ Bush and Sons and the poultry farm at 20 Clarke Street currently cause offensive odour impacts beyond their site boundaries and have the potential to impact a large area of the precinct (refer Figure 10). If these sources were to relocate prior to the time of precinct development, a Level 3 Odour Impact Assessment and the recommendations below related to a Level 3 Odour Impact Assessment would not be required.
2. Liaise with odour emission operators to develop mitigation measure implementation strategy.
3. Plan the Precinct to ensure that sensitive land uses are located outside a 2 ou buffer as determined by the recommended Level 3 Assessment.
4. Consider planning of compatible land uses between sensitive land uses and any odour generating activities. These include industrial and agricultural uses as well as uses with transient users. A Level 3 Odour Assessment will assist in identifying times and conditions where impacts are worse and can inform planning decisions.
5. Allow provision for progressive development of non-residential land uses and buffer zones in the event that odour producing activities modify (upgrade) or cease operations (such as developing land to the south of the Precinct as a first stage in the Precinct planning). A Level 3 Odour Assessment will assist in refining the understanding of the full extent of odour impacts and can assist in identifying areas of development to prioritise.
6. For future receptors closest to existing odour source, design buildings such that air intakes and operable windows are located away odour generating activities where possible (while considering other pollutant sources such as roads, car parks etc).

Recommendation for the facilities to reduce odour is beyond the scope of this assessment.

9.0 Closure

The Department of Planning and Environment (the Department) is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct of the North West Growth Area (NWGA), nominally identified as Stage 3, in collaboration with Blacktown City Council (Council). SLR Consulting Pty Ltd (SLR) was engaged to provide a qualitative Odour Assessment for the Precinct.

The purpose of this Odour Assessment is to conduct additional analysis found to be required through the previous Gap Analysis (SLR 2023) conducted by SLR. It evaluates the current extent of opportunities and constraints. It will also provide recommendations to inform future development and refinement of the ILP.

The outcomes of this assessment indicate that the odour impacts from AJ Bush and Sons (meat rendering facility) and 20 Clarke Street (poultry farm) are not compatible with land uses that require an ambient odour amenity of 7 ou or below. Redevelopment of land that is in closest proximity to these odour sources may be impacted by this constraint. Locations further away from identified sources may be suitable for development, however a detailed Level 3 Odour assessment would be required to evaluate the suitability.

To reduce the impact significance, additional measures may be put in place to reduce or remove these impacts. The level of residual risk will be dependent on the level of measure put in place. It is recommended that the should the odour emission sources continue to operate, and the Precinct development continues, a Level 3 Odour Impact Assessment with site specific emission data be conducted to determine the level of controls required to reduce the risk of odour impacts.

AJ Bush and Sons and the poultry farm at 20 Clarke Street currently cause offensive odour impacts beyond their site boundaries and have the potential to impact a large area of the precinct (refer Figure 10). If these sources were to relocate prior to the time of precinct development, a Level 3 Odour Impact Assessment and the recommendations below related to a Level 3 Odour Impact Assessment would not be required.

10.0 References

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11.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time, and we will make a $10 donation to our 2023 Charity Partner - Lifeline, for every completed form.

Appendix A Odour Survey Log sheets

Odour Assessment

Riverstone East

Aurecon Australasia Pty Ltd

SLR Project No.: 610.31234.0000

28 September 2023

Appendix B Risk Assesment Methodology

Odour Assessment

Riverstone East

Aurecon Australasia Pty Ltd

SLR Project No.: 610.31234.0000

28 September 2023

Operational Risk Assessment Methodology

The risk-based assessment takes account of a range of impact descriptors, including the following:

- **Nature of Impact**: does the impact result in an adverse or beneficial environment?
- **Sensitivity**: how sensitive is the receiving environment to the anticipated impacts? This may be applied to the sensitivity of the environment in a regional context or specific receptor locations.
- **Magnitude**: what is the anticipated scale of the impact?

The integration of receptor sensitivity with impact magnitude is used to derive the predicted **significance** of that change.

Nature of Impact

Predicted impacts may be described in terms of the overall effect upon the environment:

- **Beneficial**: the predicted impact will cause a beneficial effect on the receiving environment.
- **Neutral**: the predicted impact will cause neither a beneficial nor adverse effect.
- **Adverse**: the predicted impact will cause an adverse effect on the receiving environment.

Receptor Sensitivity

Sensitivity may vary with the anticipated impact or effect. A receptor may be determined to have varying sensitivity to different environmental changes, for example, a high sensitivity to changes in air quality, but low sensitivity to noise impacts. Sensitivity may also be derived from statutory designation which is designed to protect the receptor from such impacts.

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with the broad categories outlined below, which has been used in this assessment to define the sensitivity of receptors to air quality impacts.

Table B 1 Methodology for Assessing Sensitivity of a Receptor to Air Quality Impacts

Sensitivity	Criteria
Very High	Receptors of very high sensitivity to air pollution (e.g. dust or odour) such as: hospitals and clinics, retirement homes, painting and furnishing businesses, hi-tech industries and food processing.
High	Receptors of high sensitivity to air pollution, such as: schools, residential areas, food retailers, glasshouses and nurseries, horticultural land and offices.
Medium	Receptors of medium sensitivity to air pollution, such as: farms, outdoor storage, light and heavy industry.
Low	All other air quality sensitive receptors not identified above.

Magnitude of Impact

Magnitude describes the anticipated scale of the anticipated environmental change in terms of how that impact may cause a change to baseline conditions. The following table outlines

the methodology used in this assessment to define the magnitude of the identified potential air quality impacts.

Table B 2 Methodology for Assessing Magnitude of Impacts

Magnitude	Description
Substantial	Impact is predicted to cause significant consequences on the receiving environment (may be adverse or beneficial)
Moderate	Impact is predicted to possibly cause statutory objectives/standards to be exceeded (may be adverse)
Slight	Predicted impact may be tolerated.
Negligible	Impact is predicted to cause no significant consequences.

Significance of Impact

The risk-based matrix provided below illustrates how the definition of the sensitivity and magnitude interact to produce impact significance.

Table B 3 Impact Significance Matrix

Magnitude Sensitivity		[Defined by Table B2]			
		Substantial Magnitude	Moderate Magnitude	Slight Magnitude	Negligible Magnitude
[Defined by Table B1]	Very High Sensitivity	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

Appendix C Odour Survey Results

Odour Assessment

Operational Risk Assessment Methodology

Aurecon Australasia Pty Ltd

SLR Project No.: 610.31234.0000

28 September 2023

Odour survey results

Table C1 summarises all results from the odour intensity surveys which are shown as pie charts on **Figure C1** to **Figure C10.** For presentation of the dynamic plume observation results, all observation points are shown, and the plotted colours show odour intensity. For all static odour intensity observation results are presented as pie charts showing the duration of the intensity during observations for each location and are plotted on the aerial image at the location they occurred. A Calypso Wind Sensor was used by the surveyor onsite to monitor wind direction and speed. The figures also include wind roses for the monitored meteorological conditions for the time period of the surveys. This provides an overview of the observation results summarising where odour was observed as well as the level of odour and the frequency of different odour intensities observed.

Table C1 Summary of Odour Intensity Survey Results

Odour Source	Observation Point	Date	Start Time	Finish Time	Wind Direction	Odour intensity percentage of time (%)						
						0	1	2	3	4	5	6
AJ Bush and Sons	1	26-05-2023	11:29 AM	11:39 AM	SE	-	-	53	47	-	-	-
AJ Bush and Sons	2	26-05-2023	11:50 AM	12:00 PM	SE	-	43	43	13	-	-	-
Unknown	3	26-05-2023	1:32 PM	1:42 PM	S	27	53	20	-	-	-	-
20 Clarke Street	4	26-05-2023	2:45 PM	2:55 PM	S	-	-	33	67	-	-	-
Unknown	5	26-05-2023	3:25 PM	3:35 PM	S	100	-	-	-	-	-	-
AJ Bush and Sons	6	26-05-2023	4:32 PM	4:42 PM	S	-	-	-	92	8	-	-
AJ Bush and Sons	7	26-05-2023	5:11 PM	5:21 PM	S	-	-	22	78	-	-	-
Unknown	8	26-05-2023	5:45 PM	5:55 PM	S	87	13	-	-	-	-	-
20 Clarke Street	9	26-05-2023	6: 28 PM	6: 38 PM	S	-	13	43	43	-	-	-
AJ Bush and Sons	1	30-05-2023	3:27 PM	3:37 PM	Calm – WNW	-	-	-	77	23	-	-
AJ Bush and Sons	2	30-05-2023	4:07 PM	4:17 PM	NW	49	11	-	-	-	-	-
AJ Bush and Sons	3	30-05-2023	4:28 PM	4:38 PM	NW	-	-	-	88	12	-	-
Unknown	4	30-05-2023	4:44 PM	4:54 PM	NW	83	17	-	-	-	-	-
Unknown	5	30-05-2023	5:15 PM	5:25 PM	NW	20	48	57	5	-	-	-
20 Clarke Street	6	30-05-2023	6:23 PM	6:33 PM	W	-	-	8	78	13	-	-

Odour Source	Observation Point	Date	Start Time	Finish Time	Wind Direction	Odour intensity percentage of time (%)						
						0	1	2	3	4	5	6
AJ Bush and Sons	7	30-05-2023	7:34 PM	7:44 PM	SW	-	-	12	85	3	-	-
AJ Bush and Sons	8	30-05-2023	7:48 PM	7:58 PM	SW	27	42	32	-	-	-	-
Unknown	9	30-05-2023	8:25 PM	8:35 PM	Calm	90	10	-	-	-	-	-
20 Clarke Street	10	30-05-2023	8:41 PM	8:51 PM	Calm	-	22	67	12	-	-	-
AJ Bush and Sons	1	01-06-2023	2:27 PM	2:37 PM	NE to S and W	-	12	80	8	-	-	-
AJ Bush and Sons	2	01-06-2023	2:59 PM	3:09 PM	NNW	-	-	5	87	5	-	-
AJ Bush and Sons	3	01-06-2023	3:42 PM	3:52 PM	NNW	42	47	12	-	-	-	-
20 Clarke Street	4	01-06-2023	4:32 PM	4:42 PM	NE	-	-	13	83	3	-	-
Unknown	5	01-06-2023	5:42 PM	5:52 PM	From N - S to NW to SE	100	-	-	-	-	-	-
Unknown	6	01-06-2023	6:02 PM	6:12 PM	N to S	75	25	-	-	-	-	-
AJ Bush and Sons	7	01-06-2023	6:33 PM	6:43 PM	E	-	-	73	27	-	-	-
AJ Bush and Sons	8	01-06-2023	7:07 PM	7:17 PM	E	-	-	-	90	10	-	-
20 Clarke Street	9	01-06-2023	7:32 PM	7:42 PM	Calm	-	45	55	-	-	-	-
AJ Bush and Sons	1	02-06-2023	7:03 AM	7:13 AM	Calm	-	-	82	18	-	-	-
AJ Bush and Sons	2	02-06-2023	7:18 AM	7:28 AM	Calm	13	60	22	-	-	-	-
AJ Bush and Sons	3	02-06-2023	7:58 AM	8:08 AM	Calm	-	-	15	80	5	-	-
AJ Bush and Sons	4	02-06-2023	8:11 AM	8:21 AM	Calm	2	10	82	7	-	-	-
20 Clarke Street and AJ Bush and Sons	5	02-06-2023	8:25 AM	8:35 AM	Calm	-	-	63	37	-	-	-
AJ Bush and Sons	6	02-06-2023	10:11 AM	10:21 AM	SE	2	-	3	90	5	-	-
Unknown	7	02-06-2023	10:24 AM	10:34 AM	Calm	67	28	5	-	-	-	-
AJ Bush and Sons	8	02-06-2023	11:08 AM	11:18 AM	Calm	-	-	83	17	-	-	-
AJ Bush and Sons	9	02-06-2023	11:20 AM	11:30 AM	Calm	-	11	42	7	-	-	-

Odour Source	Observation Point	Date	Start Time	Finish Time	Wind Direction	Odour intensity percentage of time (%)						
						0	1	2	3	4	5	6
20 Clarke Street	10	02-06-2023	12:35 PM	12:45 PM	NE	-	-	33	67	-	-	-
Unknown	11	02-06-2023	2:42 PM	2:52 PM	NE	50	10	-	-	-	-	-
AJ Bush and Sons	1	09-06-2023	7:08 AM	7:18 AM	NNE	-	-	-	7	72	22	-
AJ Bush and Sons	2	09-06-2023	7:23 AM	7:33 AM	NNE	-	-	23	77	-	-	-
20 Clarke Street	3	09-06-2023	8:08 AM	8:18 AM	N	-	-	13	87	-	-	-
Unknown	4	09-06-2023	9:25 AM	9:35 AM	N	95	5	-	-	-	-	-
Unknown	5	09-06-2023	10:12 AM	10:22 AM	NW	85	15	-	-	-	-	-
AJ Bush and Sons	6	09-06-2023	11:15 AM	11:25 AM	NNW	-	-	8	78	13	-	-
AJ Bush and Sons	7	09-06-2023	12:24 PM	12:34 PM	NW	-	-	23	77	-	-	-
20 Clarke Street	8	09-06-2023	12:54 PM	1:04 PM	NW	-	-	8	85	7	-	-
Unknown	9	09-06-2023	1:41 PM	1:51 PM	NW	95	5	-	-	-	-	-
Unknown	10	09-06-2023	2:56 PM	3:06 PM	NA	88	12	-	-	-	-	-
AJ Bush and Sons	11	09-06-2023	2:56 PM	3:06 PM	NA	13	5	60	22	-	-	-

Figure C1 Odour Survey 1 – Plume extent and odour intensity

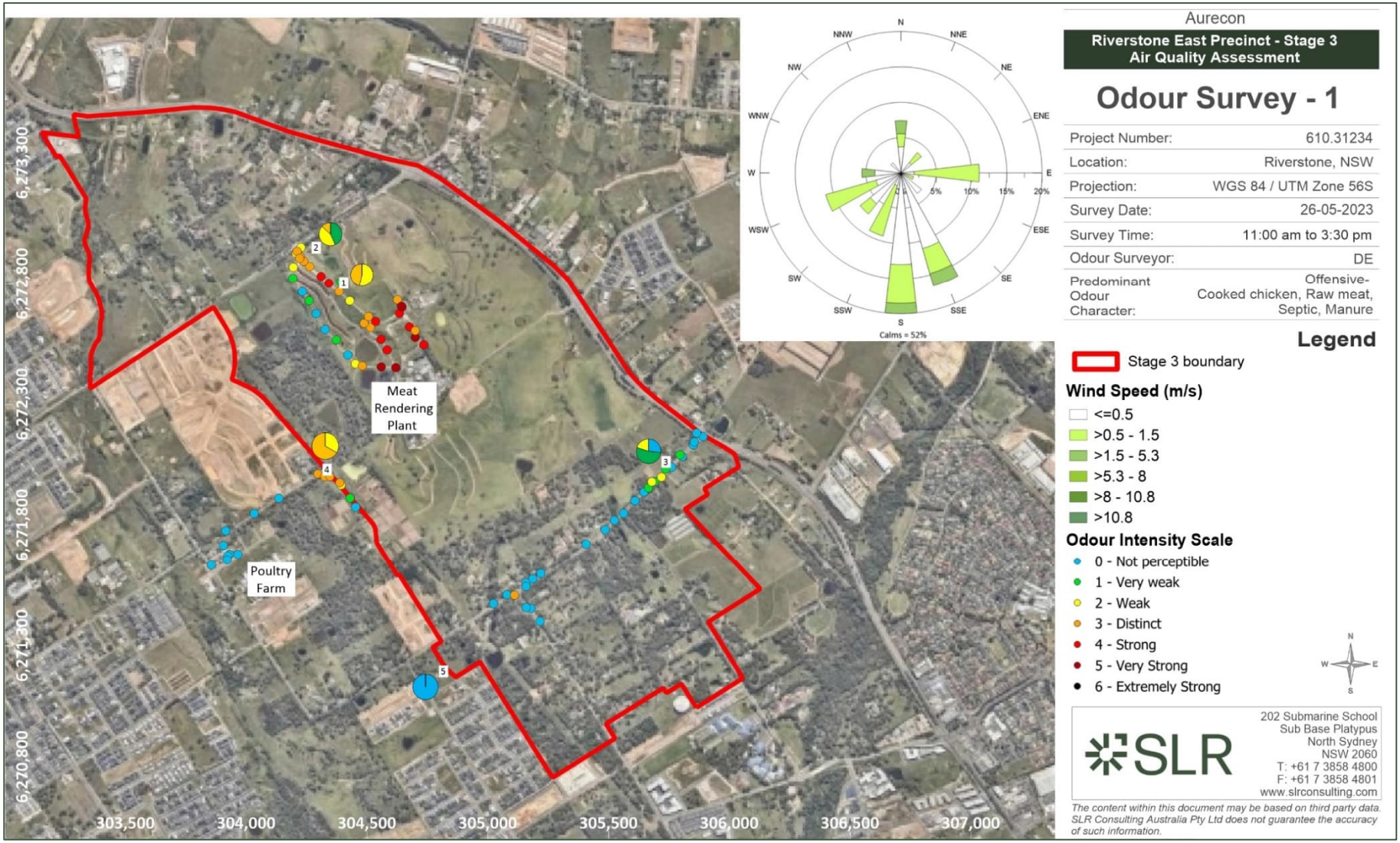


Figure C2 Odour Survey 2 – Plume extent and odour intensity

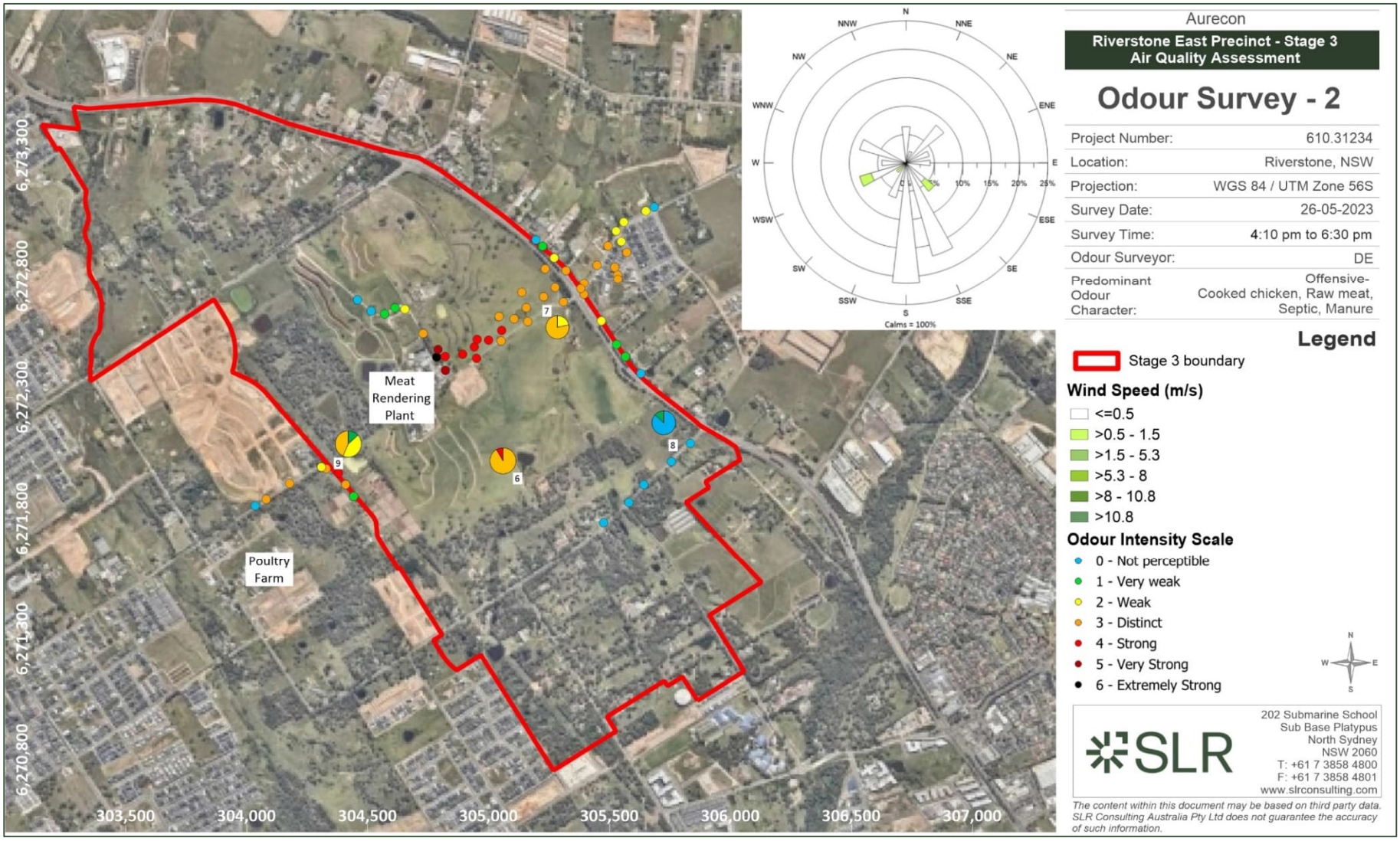


Figure C3 Odour Survey 3 – Plume extent and odour intensity

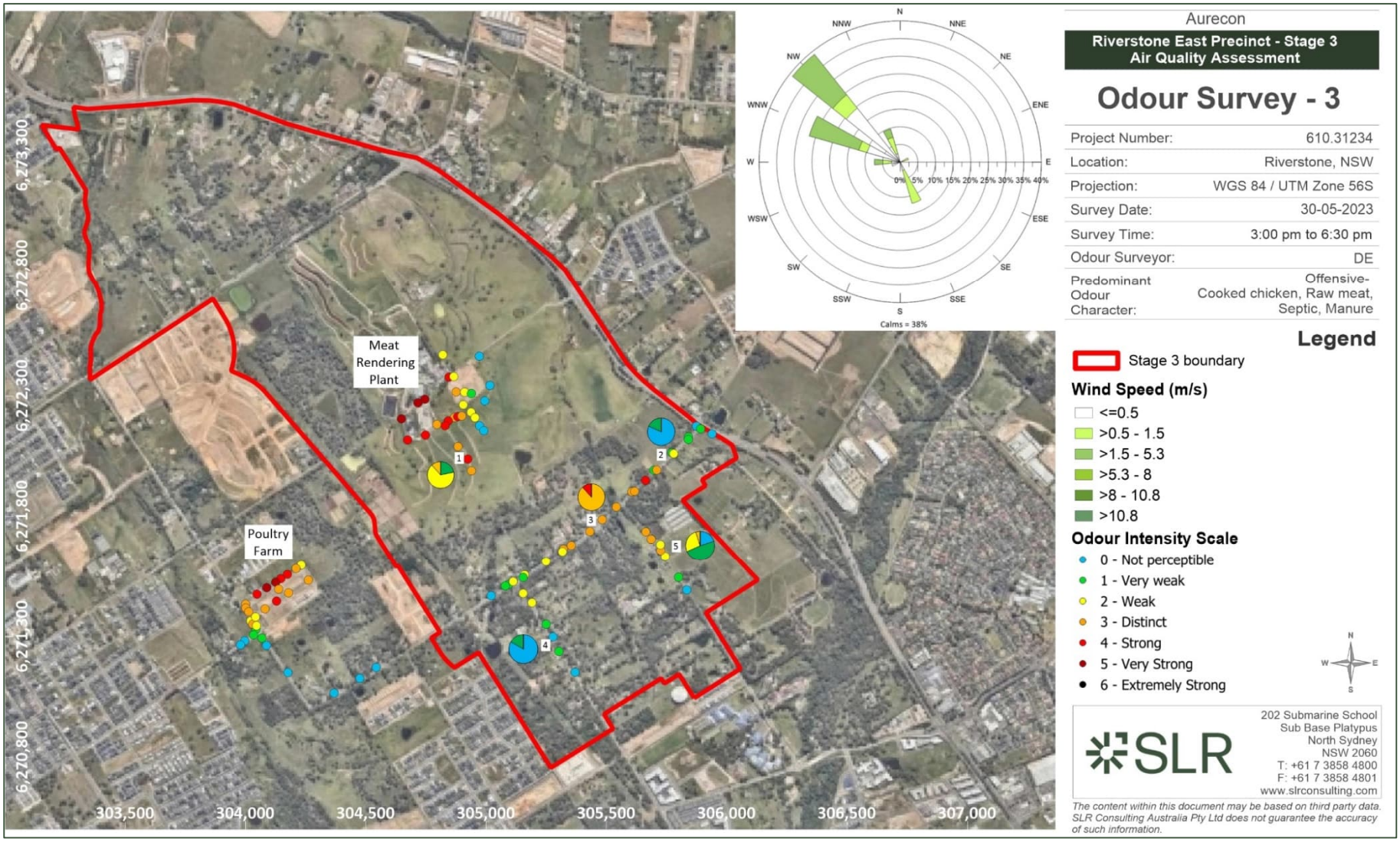


Figure C4 Odour Survey 4 – Plume extent and odour intensity

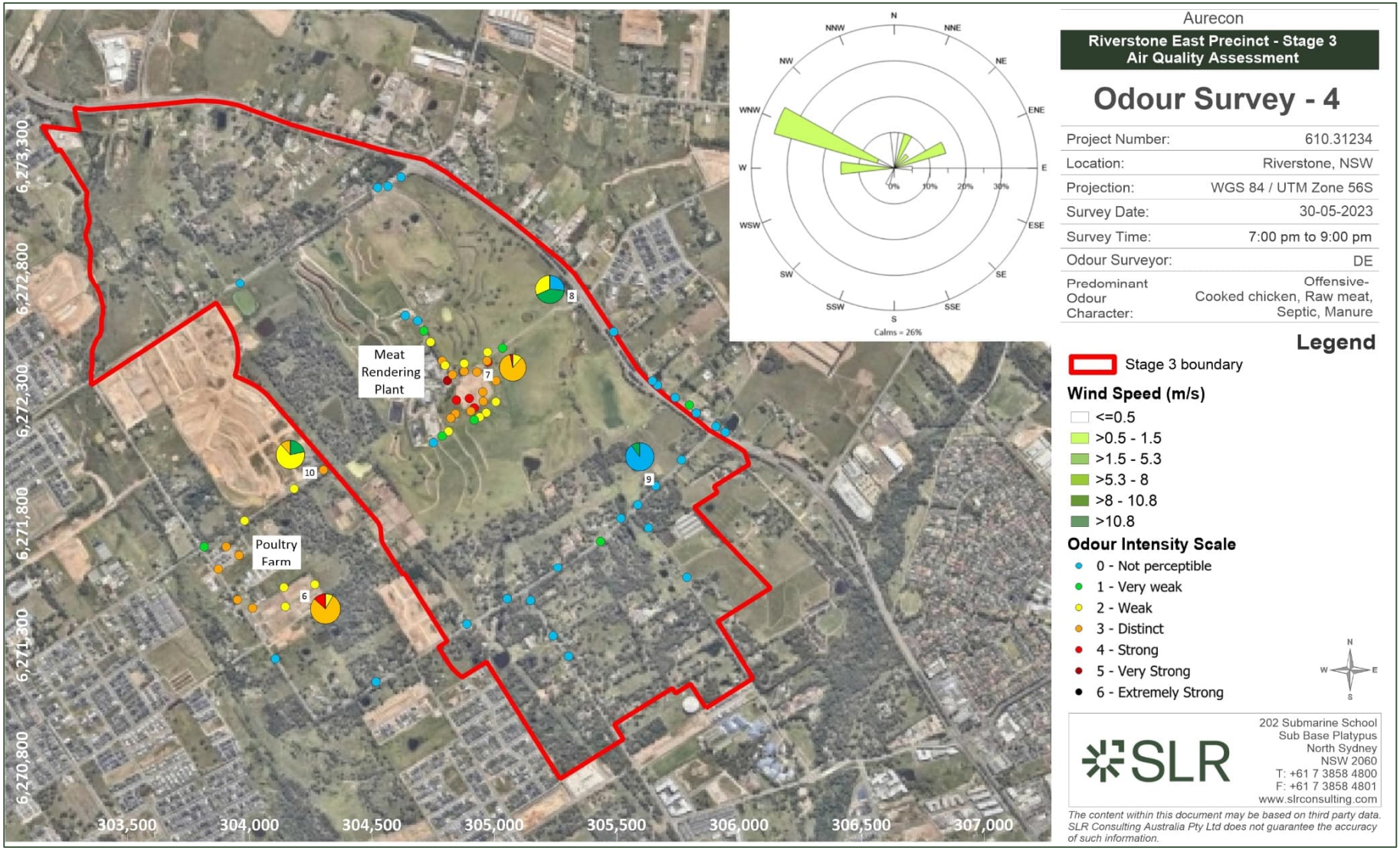


Figure C5 Odour Survey 5 – Plume extent and odour intensity

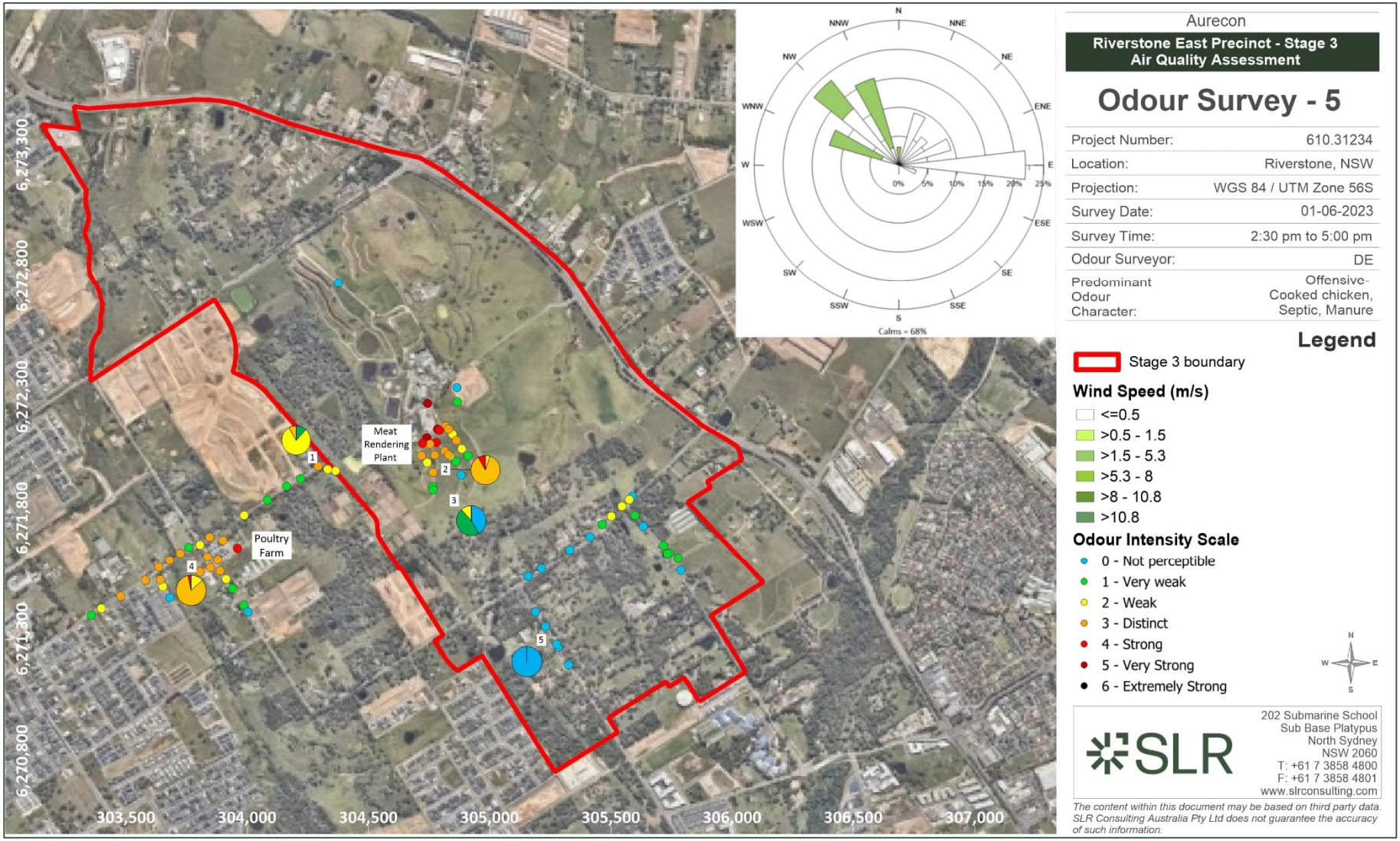


Figure C6 Odour Survey 6 – Plume extent and odour intensity

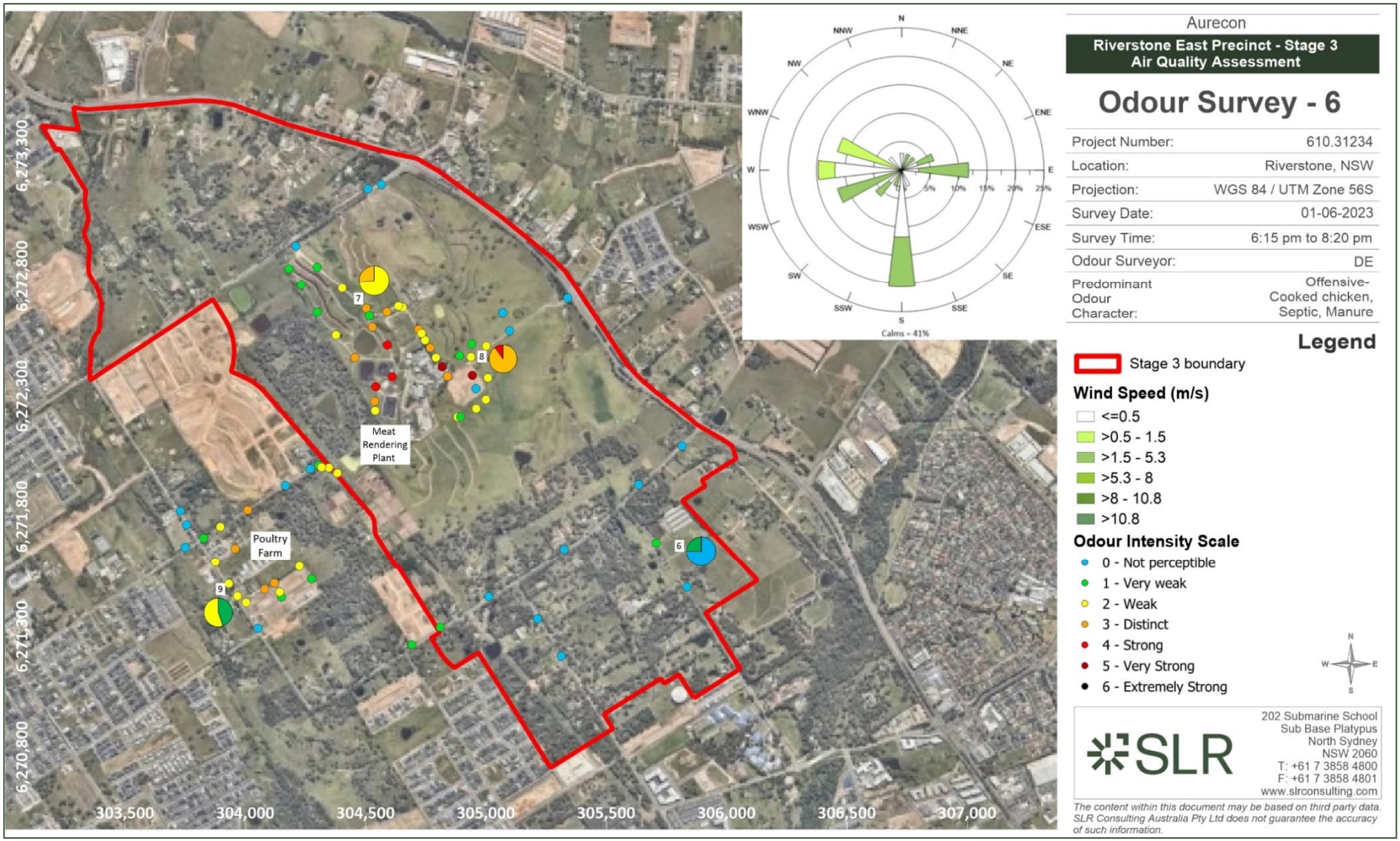


Figure C7 Odour Survey 7 – Plume extent and odour intensity

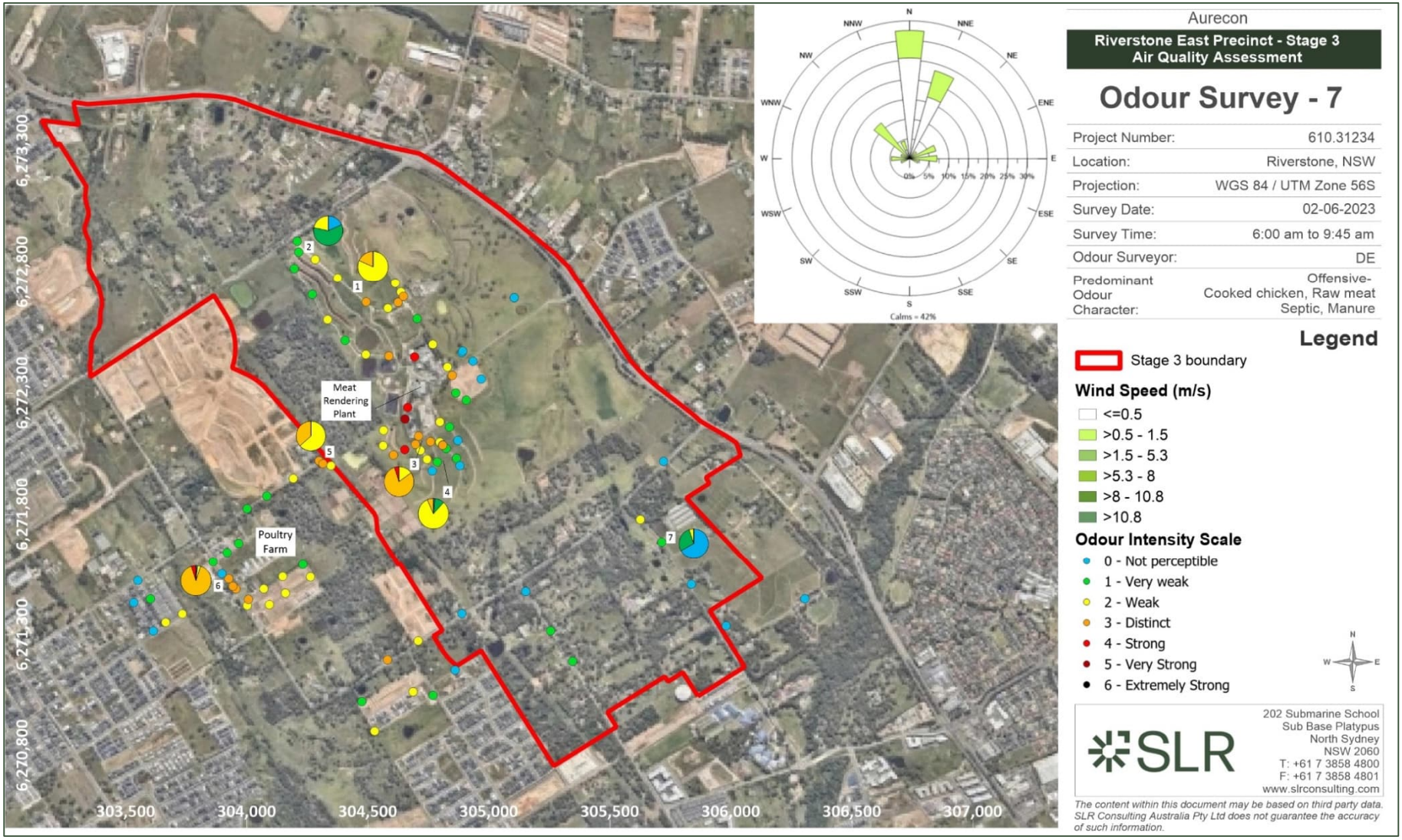


Figure C8 Odour Survey 8 – Plume extent and odour intensity

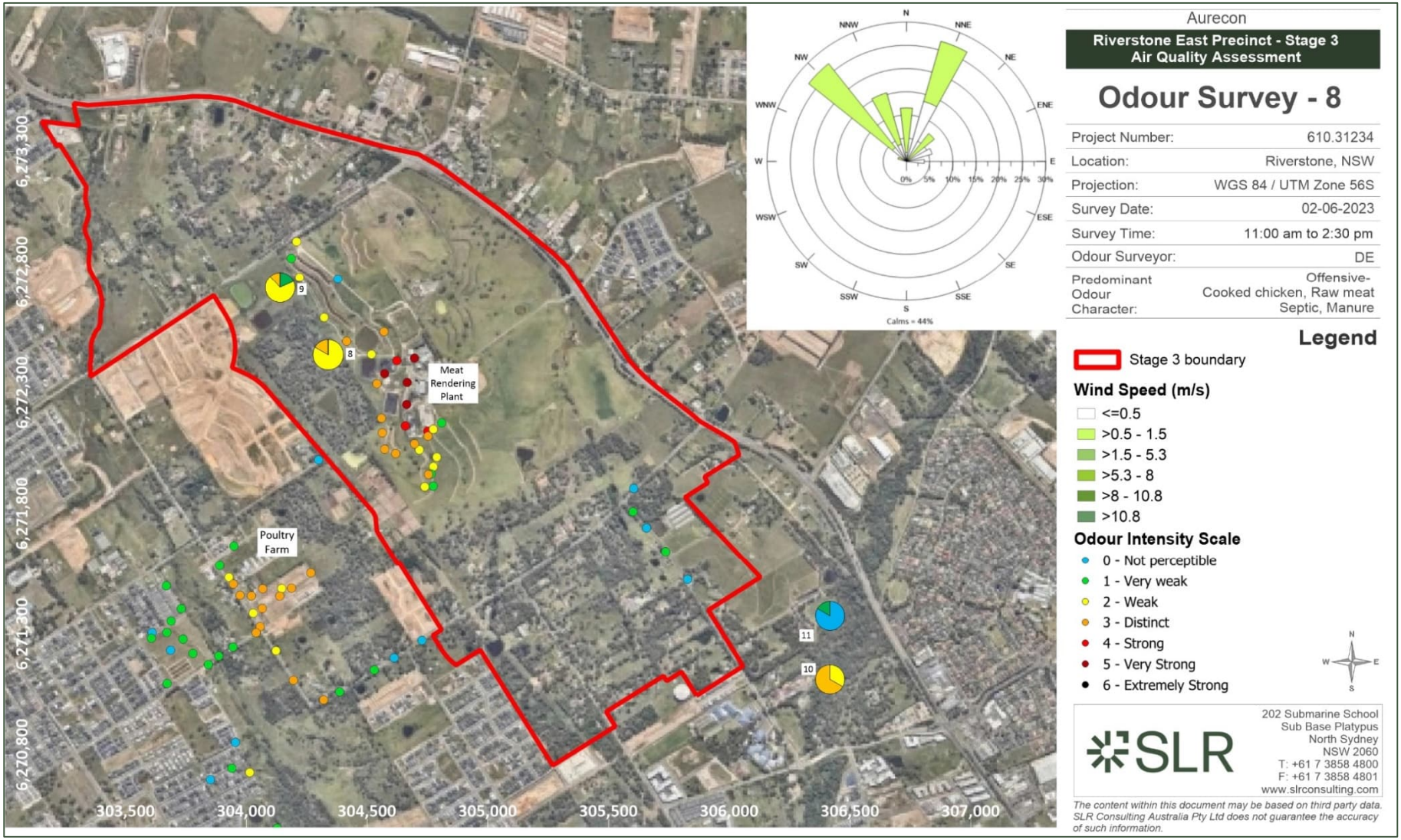


Figure C9 Odour Survey 9 – Plume extent and odour intensity

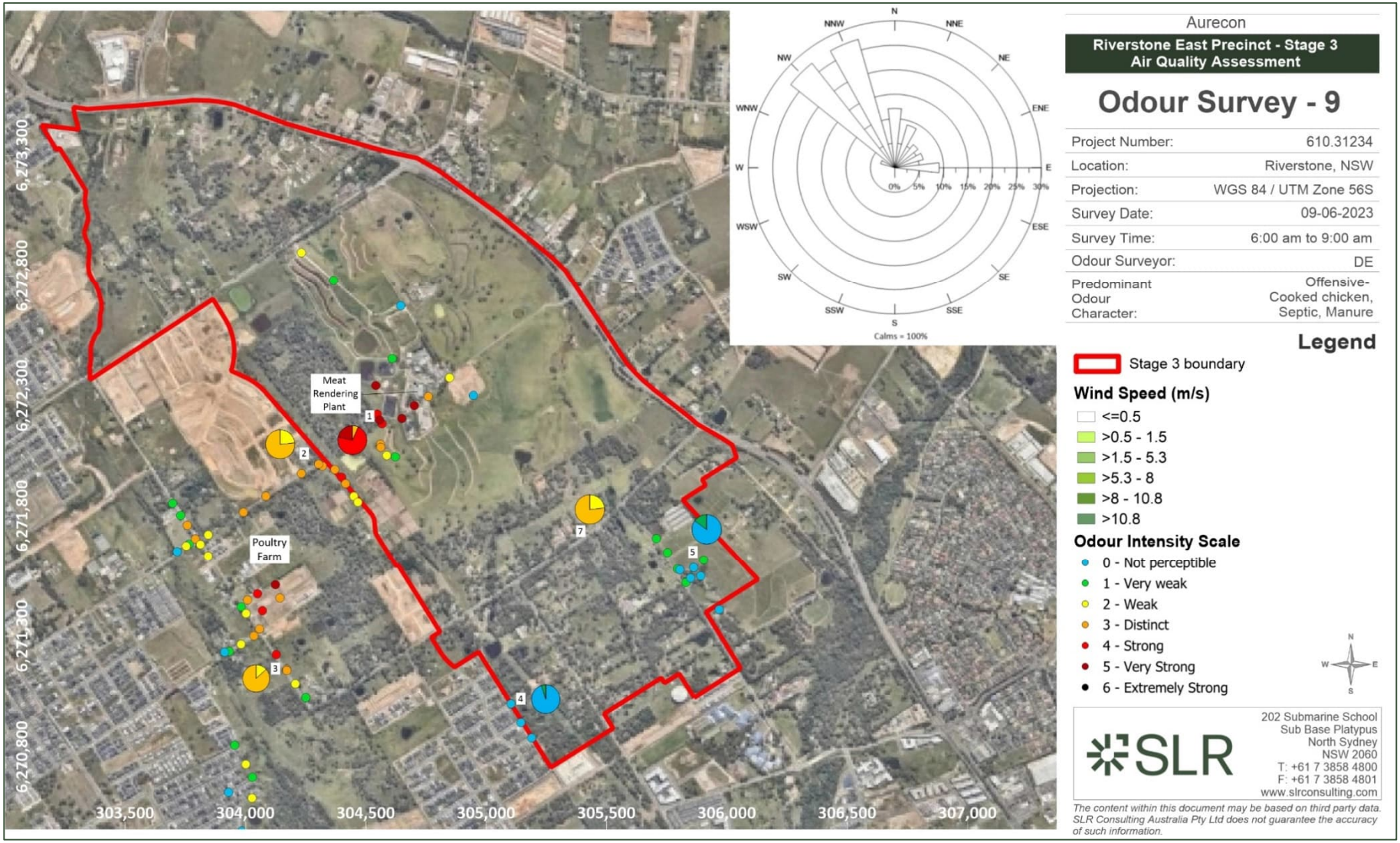
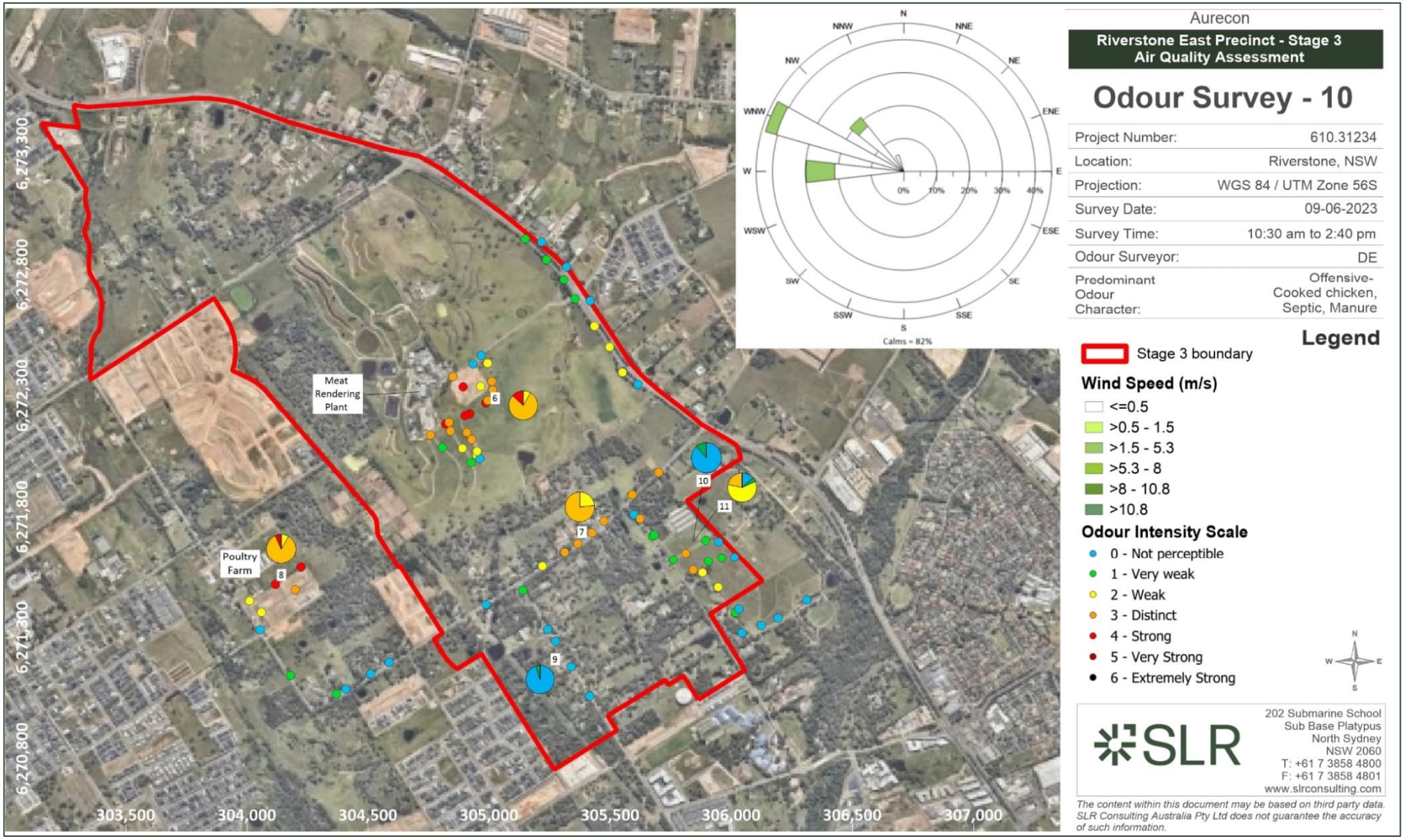


Figure C10 **Odour Survey 10 – Plume extent and odour intensity**



Appendix D Level 1 Methodology

Odour Assessment

Odour survey results

Aurecon Australasia Pty Ltd

SLR Project No.: 610.31234.0000

28 September 2023

D.1 Broiler Chicken Farms - -Level 1 Odour Assessment Methodology

A Level 1 assessment is a simple screening-level technique based on generic parameters for the type of activity and site. The methodology used to calculate separation distances for poultry farms in accordance with Chapter 5 of the Technical Notes uses current standard production technology. The prescribed distances have been found to lead to an acceptable air quality impact on the amenity of the local environment.

D.1.1 Calculation of Minimum Separation Distances

Variable separation distances are measured from the closest point of the poultry farm to the closest point of a receptor and are based on the dispersion of odours from their source. They are used to determine the maximum allowable number of poultry sheds and the management practices necessary to satisfy air quality objectives. A weighting factor allows for different types of premises.

The composite factor used to develop the separation distance for the 20 Clarke St poultry farm site assumes natural ventilation.

Equation D1 below is specified for calculating the minimum separation distance for a given number of poultry sheds.

$D = (N)^{0.71} \times S$ **Equation D1**

where:

N = Number of poultry sheds

D = Separation distance in metres between the closest points of the poultry 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, S2, S3, S4 and S5 relate to shed design, receptor, terrain, vegetation and wind frequency as outlined below.

D.1.2 Composite Factor

The value of S to apply in **Equation D1** depends on site-specific information pertaining to the shed type, receptor, terrain, vegetation and wind frequency, as set out in the following tables. Site factors adopted for the purpose of this assessment are selected from the options outlined in the following sections.

D.1.3 Shed Factor, S1

The shed factor, S1, depends on how the shed is ventilated and is determined from **Table D1**. At any given site, some sheds may have controlled ventilation, and some may have natural ventilation, hence S1 is calculated proportionally based on the numbers of each type of shed. For all operations identified in this assessment it has been assumed that all sheds are naturally ventilated. This represents the most conservative assumption.

Table D1 Level 1 odour Assessment – Shed Factor

Shed Type	Value
Controlled fan ventilation without barriers*	980
Controlled fan ventilation with barriers	690
Natural ventilation	690

* Barriers – e.g. walls or hedges designed to mitigate dust and odour emissions from controlled fan ventilated sheds.

D.1.4 Receptor Factor, S2

The receptor factor, S2, varies depending on the likely impact area and is determined from **Table D2** (e.g. for a town, the distance is measured from the closest point of the proclaimed town boundary).

Table D2 Level 1 Odour Assessment - Receptor Factor, S2

Receptor Type	Value
Large towns, greater than 2,000 persons	1.05
Medium towns, 500—2,000 persons	0.75
Medium towns, 125—500 persons	0.55
Small towns, 30—125 persons	0.45
Small towns, 10—30 persons	0.35
Rural residence	0.30
Public area (occasional use) *	0.05

* The value for a public area 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.

D.1.5 Terrain Factor, S3

The terrain factor, S3, varies according to topography and its ability to disperse odours and is determined from **Table D3**.

- **Flat** is regarded as 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 poultry sheds. Thus, the receptor location will be either uphill from the poultry sheds, behind a significant obstruction or have significant hills and valleys between the sheds and the receptor.
- **Low relief** is regarded as terrain that is generally below a 2% falling slope from the poultry sheds. Thus, the receptor will be downhill from the poultry sheds.
- **Undulating hills** is regarded as terrain where the topography consists of continuous rolling, general low level hills and valleys with minimal vegetation, but without sharply defined ranges, ridges or escarpments.
- **A valley drainage zone** has topography at low relief (as above) with significant confining sidewalls.

Topographical features between the poultry sheds and the Precinct 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

poultry farm may be subject to higher odour concentrations as a result of down-valley wind or the occurrence of low-level inversions.

Table D3 Level 1 Odour Assessment - Terrain Factor, S3

Terrain	Value
Valley drainage zone	2.0
Low relief (greater than 2% downslope from site)	1.2
Flat (less than 10% upslope, 2% downslope and not in valley drainage zone)	1.0
Undulating country between poultry farm and receptor	0.9
High relief (greater than 10% upslope from site) or significant hills and valleys between poultry farm and receptor	0.7

D.1.6 Vegetation Factor, S4

The vegetation factor, S4, varies according to vegetation density and is determined from **Table D4.** The vegetation density is assessed by the effectiveness with which the vegetation stand will reduce odour by dispersion.

Table D4 Level 1 Odour Assessment - 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

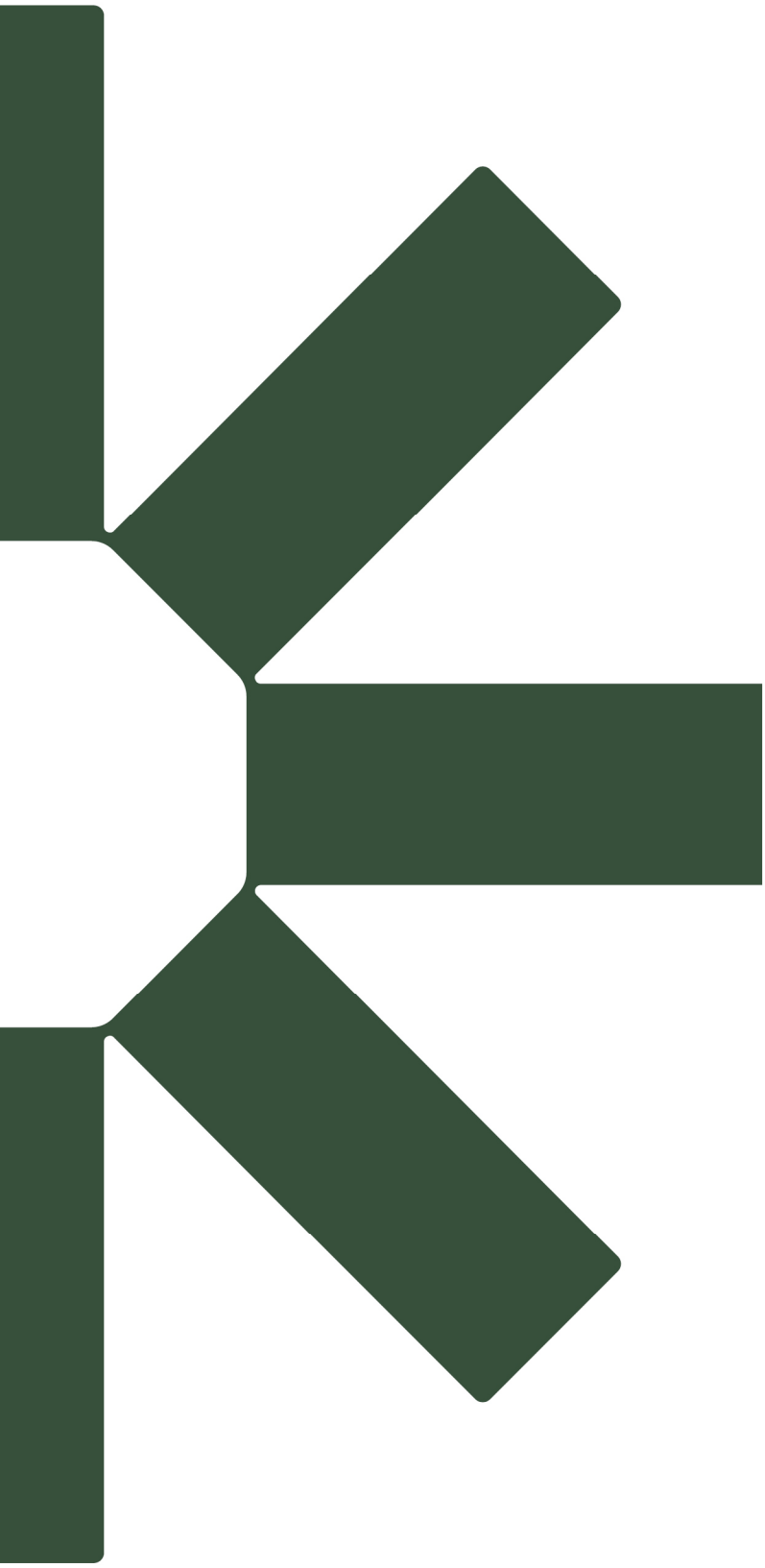
D.1.7 Wind Frequency Factor, S5

The wind frequency factor, S5 is determined from **Table D5**. The wind speed and direction vary 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 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.

Table D5 Level 1 Odour Assessment - Wind Factor, S5

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



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