Appendix A: Wind rose analyses

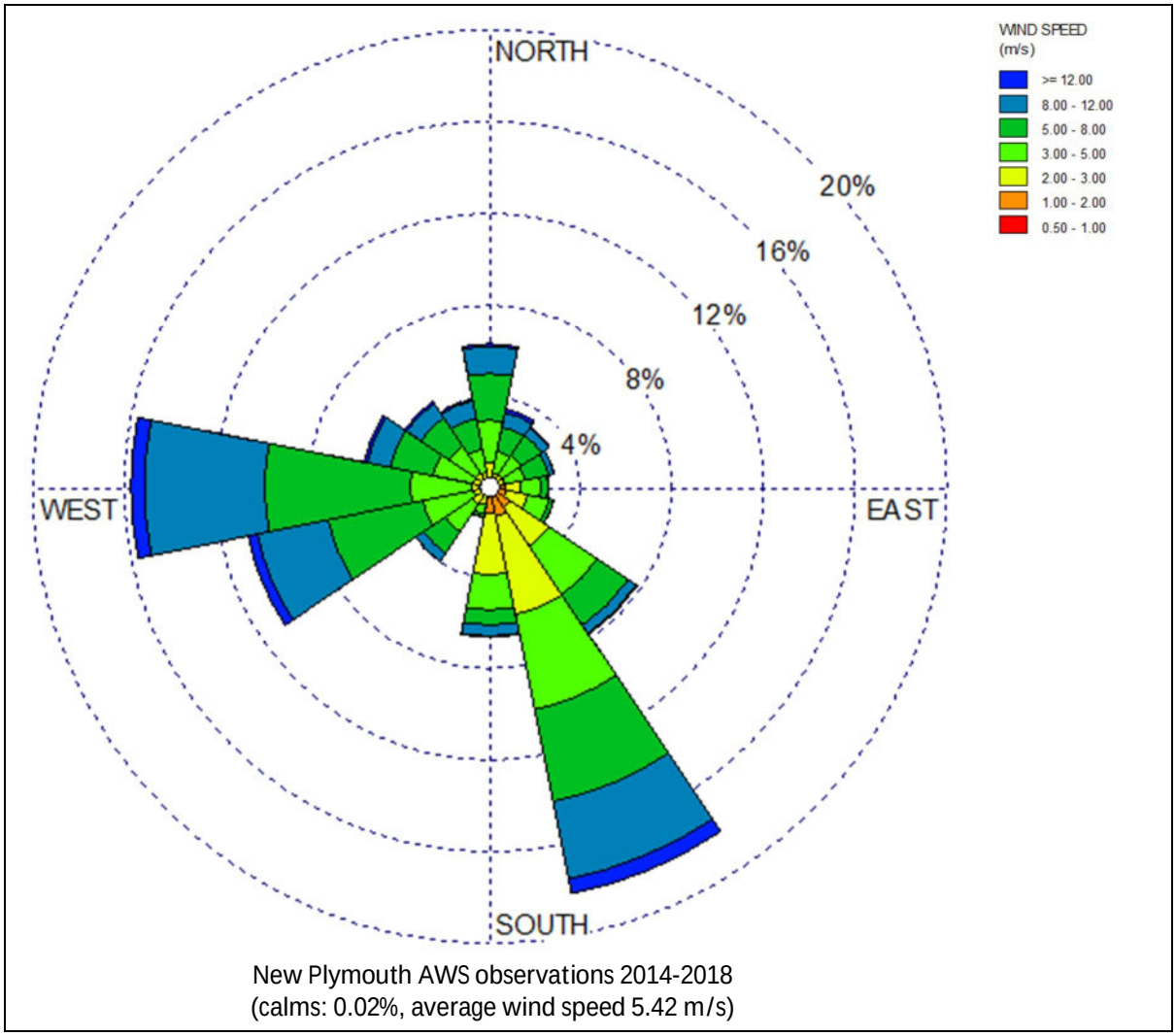

Figure A1: Wind rose frequency analysis of wind speeds and directions observed at the New Plymouth AWS weather station 2014 to 2018, 1-hour average data

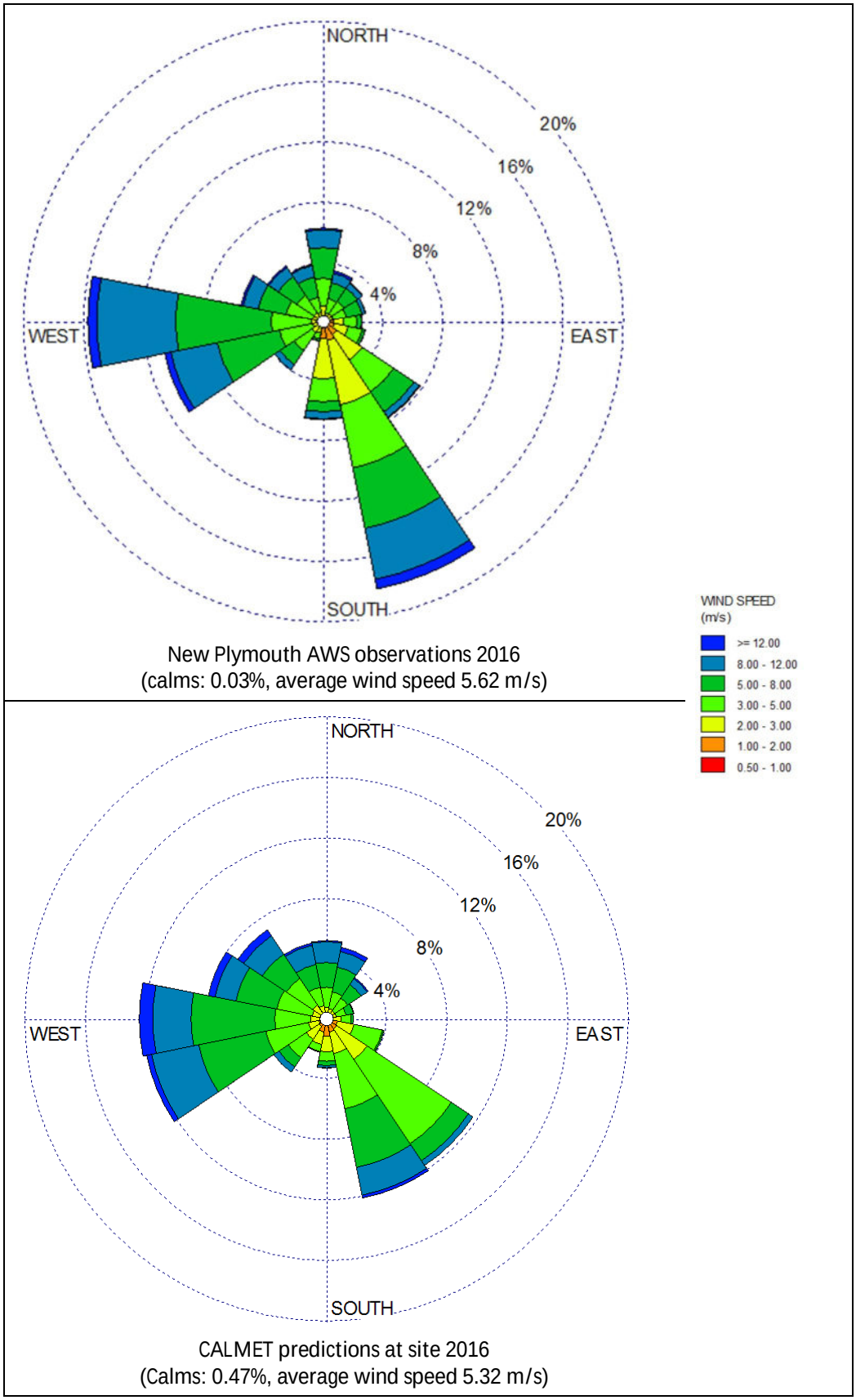

Figure 1: Comparison of wind rose frequency analyses of predicted and observed wind speeds and directions, 2016, 1-hour average data

Tonkin+Taylor

Job No: 1015638
28 January 2022

Airport Farm Trustee Limited
58 Airport Drive
New Plymouth

Attention: Ed Whiting

Dear Ed

Summary of Airport Farm field odour observations, September 2021

1 Introduction

Airport Farm Trustee Ltd (AFTL) operates a four shed poultry broiler farm at 58 Airport Drive, Bell Block, Taranaki.

AFTL holds a number of resource consents for the site including resource consent R2/5262-2.1 to *discharge emissions into the air from a poultry farming operation and associated activities including waste management activities*. Consent R2/5262-2.1 expires on 31 May 2026.

AFTL proposes to modify the nature of the operation from conventional (i.e. non-free range) broiler poultry configuration to free range configuration. AFTL has lodged an application with the Taranaki Regional Council (TRC) to authorise the discharges to air from the modified operation and to replace resource consent R2/5262-2.1.

Tonkin & Taylor Ltd (T+T) prepared the following report describing an assessment of odour effects of the proposed discharges to air to inform the consent application:

- "*Airport Drive Free Range Poultry Farm Odour Assessment*", June 2021

To provide further assessment of the effects of odour emitted from the existing operation in response to concerns raised in submissions on the application, AFTL has commissioned T+T[1] to carry out observational assessments of ambient odour levels in the area surrounding the current operation. Observations encompassed both normal shed operation and the catch process (when birds are removed).

This document summarises the methodology, results and findings of the observational odour investigation.

[1] In accordance with our engagement dated 24 September 2020 and variation dated 25 May 2021.

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2 Methodology

Potential odour nuisance effects associated with the operation of poultry farms in New Zealand are typically assessed in accordance with the *'Good Practice Guide for Assessing and Managing Odour'* (Ministry for the Environment, 2016).

To investigate odour impacts in the area surrounding AFTL, T+T undertook field odour observations in a manner consistent with MfE (2016). This involved noting the intensity and character of odour observed at chosen observation locations every 10-seconds for a period of 10-minutes. The scales of the intensity and hedonic tone scores used in the investigation are as shown in Table 1 and Table 2.

Table 1: Scale of intensity for field odour observations

Odour intensity	Description	Explanation of field staff
0	No odour	No odour.
1	Very weak	Odour is detected but the character and tone cannot be recognised.
2	Weak	Character and odour can just be recognised but you may need to think about it carefully, the odour is weak.
3	Distinct	Character and tone are immediately recognisable, but the odour is not strong.
4	Strong	Character and tone are immediately recognisable, and the odour is strong.
5	Very strong	Character and tone are immediately recognisable, and the odour is very strong.
6	Extremely strong	Character and tone are immediately recognisable, and the odour is extremely strong.

Table 2: Scale of hedonic tone for field odour observations

Scale of hedonic tone	Description of hedonic tone
-4	Extremely unpleasant
-3	
-2	
-1	
0	Neutral
+1	
+2	
+3	
+4	Extremely pleasant

3 Summary of observations

The location of the observations is shown in Figure 1. The observations were conducted during normal shed operation and during the catch process. The distance to the nearest shed is approximately 320 m. The wind velocity during the normal operation observation was a moderate to fresh breeze according to the Land Beaufort Wind Scale and during the catch observation the wind speed was a light to gentle breeze, and it was raining. In all observations the wind was coming from a northerly direction (from the site).

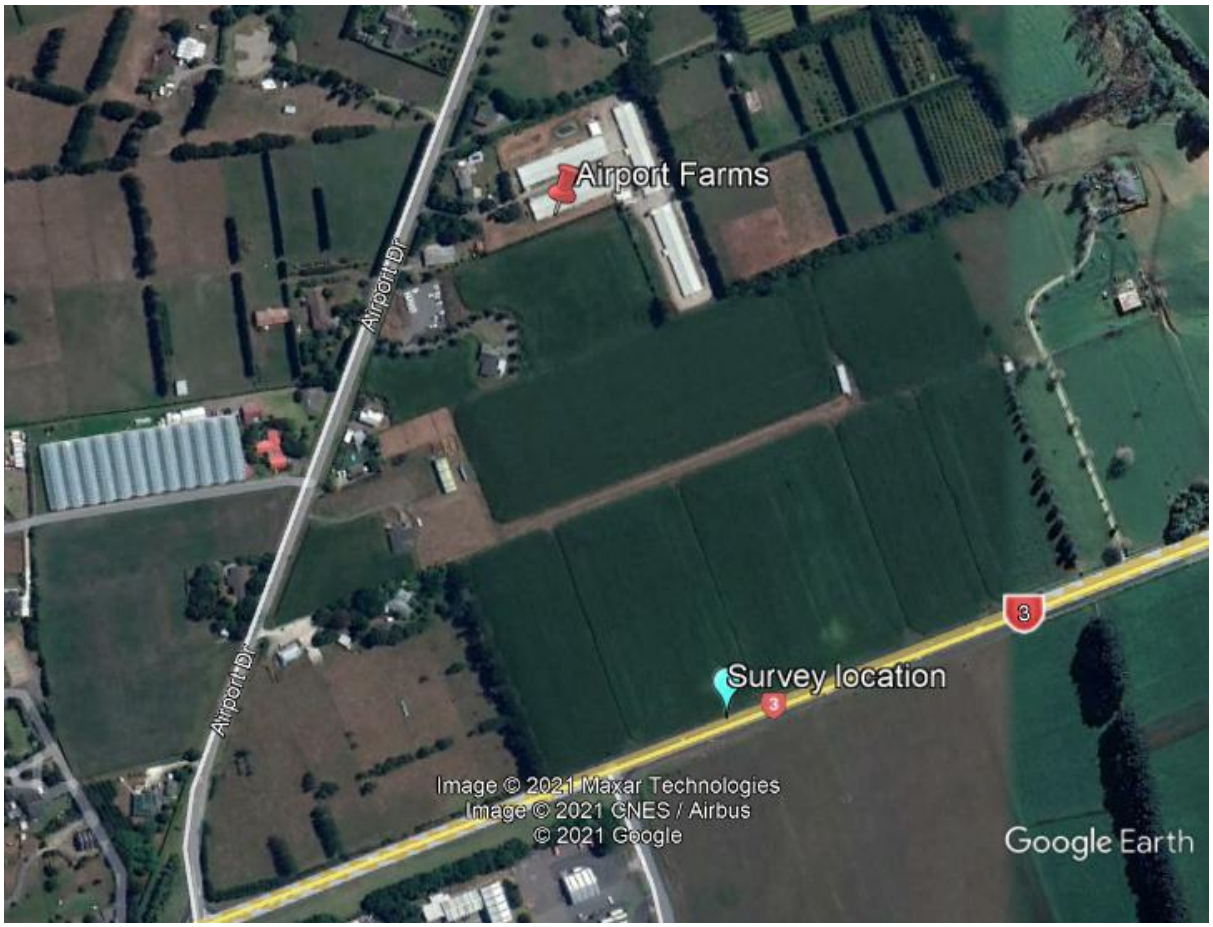

Figure 1. Observation location and wind direction during background and catch observations

Table 3. Summary of odour observations

Date and time	Activity	Intensity (0 – 6)	Character	Hedonic tone*
21/09/2021 10:57 a.m.	Business as usual	93% - 0 (no odour) 5% - 1 (very weak) 2% - 2 (weak)	Sour	-2
22/09/2021 1:48 a.m.	Catching	92% - 0 (no odour) 7% - 1 (very weak) 2% - 2 (weak)	Manure, Grain	-2
22/09/2021 2:16 a.m.	Catching	87% - 0 (no odour) 7% - 1 (very weak) 7% - 2 (weak)	Chicken shed	-2

* -4 = extremely unpleasant, 0 = neutral, + 4 = extremely pleasant)

The observations show that on this occasion there was minimal difference in observed ambient odour levels during the catch process and normal operation. Observations during the catch process were undertaken in lighter winds and during the night. This differs from the normal operation observations, which were undertaken in stronger winds, during the day. The normal operation observations were therefore likely subject to a higher degree of turbulent mixing due to the less stable atmospheric conditions during daytime compared to night-time and the higher winds speeds occurring during the observations.

4 Applicability

This report has been prepared for the exclusive use of our client Airport Farm Trustee Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Taranaki Regional Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
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Michele Dyer	p.p. Jenny Simpson
Senior Environmental Engineer	Project Director

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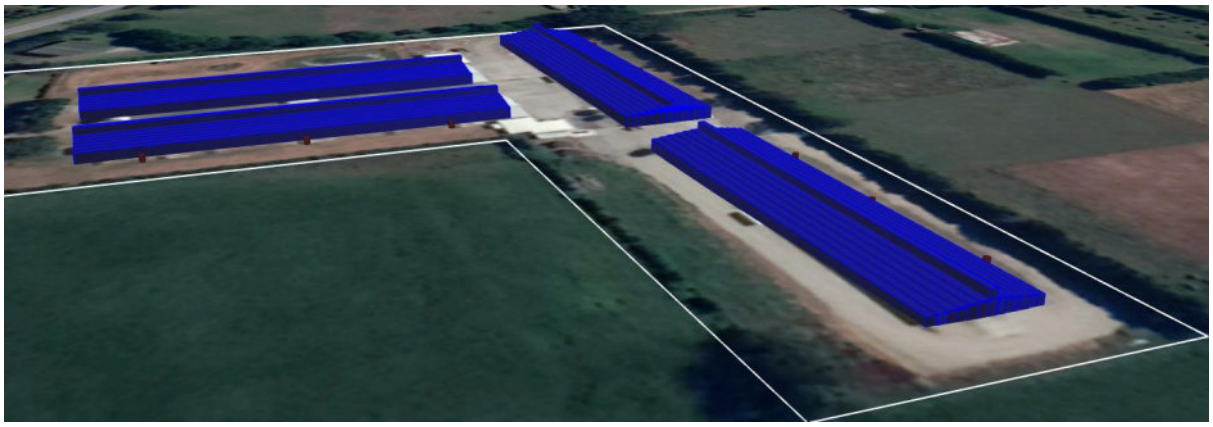
Appendix C: Dispersion modelling method

The dispersion model selection and configuration may be summarised as follows:

- Dispersion modelling of odour emissions from the poultry sheds was conducted using the CALPUFF suite of modelling software.
- A three-dimensional meteorological model of the local area (over a 5 km x 5 km domain) for the 2016 calendar year was developed using CALMET (v6.5) software. The meteorological model incorporated surface meteorological observations from the New Plymouth EWS meteorological station and, as an initial guess input, a 3-D prognostic meteorological input over a 50 km x 50 km domain with 1 km resolution developed using the WRF model.
- Odour concentrations resulting from the proposed poultry sheds have been predicted using CALPUFF (v7.2.1) software.
- Emissions were modelled in three separate scenarios:
  - the proposed free-range configuration (with a stocking density of 15 birds/m^2);
  - the existing broiler configuration operating at the currently consented stocking density limit (38 kg/m^2); and
  - the existing broiler configuration stocked at the operational peak stocking density (35 kg/m2).
- Emissions from the sheds have been modelled as occurring via point emission sources as follows:
  - Side wall vents in the existing configuration scenarios were represented by three point emission sources per shed. The vertical momentum of each modelled vents was set to zero to reflect to the horizontal nature of the side vent discharges. The location of each modelled vent was set at a distance of 2 m from the shed wall to reflect the initial horizontal momentum of the discharge, as follows:



  - Roof-mounted chimney vents in the proposed scenario were represented by three point emission sources located on the roof of each shed with full vertical momentum to reflect the vertical orientation of the vents, as follows:.

- Modelled odour emissions have varied on an hourly basis over the model year at the rates illustrated in section Figure 2 above. Exhaust temperature have assumed to be constant at an end of cycle target temperature of 22 C, the lowest temperature.
- The downwash effects of the poultry sheds on the dispersion of emissions was incorporated using the BPIP-Prime algorithm.
- Ground level odour concentrations resulting from the emissions from the shed vents have been predicted at the dwellings within 300 m of the site and over a series of nested grids around the site:
  - 2 km × 2 km cartesian grid of receptors at 100 m spacing.
  - 400 m × 400 m cartesian grid of receptors at 50 m spacing.
  - 200 m × 200 m cartesian grid of receptors at 25 m spacing.
- Physical discharge parameters for the proposed scenario roof vents and existing scenario side wall vents are summarised in Table C1 and C2, respectively.

Table C1: Modelled discharge parameters – proposed scenario

Parameter	Value	Derivation
Stack vents per shed	3	Actual
Chimney vent discharge height	7 m	Actual
Chimney vent diameter	0.9 m	Actual
Stack exhaust temperature	22°C	Lower end of cycle target temperature (will be higher early in cycle)
Stack exhaust velocity	Variable 3.65 to 7.3 m/s	Variable based on 50% to 100% of maximum ventilation flow
Stack locations	Roof mounted at locations proposed	
Vertical momentum	Full	Vertical unimpeded discharge
Building downwash	PRIME	

TableC2: Modelled discharge parameters – existing scenarios

Parameter	Value	Derivation
Stack vents per shed	3	Assumed based on current partial operation of fans
Chimney vent discharge height	1.2 m	Actual
Chimney vent diameter	0.9 m	Corresponding to proposed scenario vents for ventilation rate equivalence
Stack exhaust velocity	Variable 3.65 to 7.3 m/s	
Stack exhaust temperature	22°C	Lower (end of cycle) target temperature (temperature and thermal buoyancy will be higher early in cycle)
Stack locations	2 m distant from actual wall mounted locations	To account for horizontal momentum of exhaust from side wall vents
Vertical momentum	Nil	Horizontal discharge
Building downwash	PRIME	