

Attachment A: Update to AFTL odour dispersion modelling investigation

Introduction

This document describes details of results of additional odour dispersion modelling of odour emissions from the AFTL at 58 Airport Drive, Bell Block.

Model scenarios

Updated 99.5th percentile odour concentrations have been provided for the following emission scenarios:

- 1 Proposed free range operation at 15 birds/m² stocking density;
- 2 Existing conventional broiler operation operating within the effective operational peak density (35 kg/m²);
- 3 Permitted activity (PA) 30,000 birds housed over sheds 1 and 2 with exhaust via the original horizontal exhaust vents;
- 4 Permitted activity (PA) 30,000 birds housed over sheds 1 and 2 with exhaust via the recently installed vertical 7m exhaust vents.

Model modifications

In order to address matters raised in the hearing and matters discussed with the submitters' air quality experts following the adjournment of the hearing, the following modifications to the model set up have been made:

- **Increased resolution of contour plots and consideration of curtilage receptors:** Revised contour plots have been provided encompassing a more focussed 500 m x 500 m area around the application site (including all submitter locations). As discussed further below, additional receptors have been included to represent exposure within the curtilage of properties. The location of these receptors has generally been based nearest accessible garden or yard areas to the shed discharges rather than any notional boundary.
- **Modelling of exposure of upper storey dwelling receptors:** An elevated (flagpole) receptor has been included (at a height of 6 m above ground level) at the McDonald dwelling at 62 Airport Drive to represent potential exposure at the upper floor of this dwelling.
- **Modifications to represent the impact of shelterbelt vegetation surrounding the site:** As it is not practicable to incorporate vegetation in the building downwash algorithm, as suggested by Mr Van Kekem the land use categorisations for areas lying over the boundary of the site have been modified to Forest Cover to account for the tall shelter belt vegetation. The resolution of the revised CALMET model has been increased from 100 m to 25 m.

Additional receptor details

Additional discrete receptors have been included to represent exposure in curtilage areas of submitter property and the nearest non-submitter properties.

An additional flagpole discrete receptor at a height of 6 m above ground level has been included to represent exposure at the upper floor of the McDonald dwelling at 62 Airport Drive. This receptor has been located at the nearest upper floor window based on photographs provided by Mr Van Kekem. As no multi-storey dwellings are located within 200 m of the exhaust discharges, no further elevated receptors have been included.

The updated discrete receptors are illustrated in the following figure.



Figure 1: Updated discrete model receptor locations. Submitter receptors are denoted in red, non-submitter receptors in cyan. Dwelling receptors are denoted as triangles, curtilage receptors as circles.

Increased CALMET modelling resolution and modifications to land use classifications at application site

The following modifications have been made to the CALMET meteorological model for the local area and the three-dimensional meteorological output has been used in the updated dispersion modelling investigations:

- The spatial resolution of the CALMET meteorological model has been increased from 100 m to 25 m in x and y (north and east) directions. This represents a very fine resolution for CALMET modelling. The scale of the CALMET model has been reduced to 3 km x 3 km to compensate for the increased resolution in terms of file sizes and processing times. The CALMET domain continued to encompass the New Plymouth AWS meteorological stations, surface observation data from which was continued to be incorporated into the updated CALMET model.

- Land use categorisation within each 25 m x 25 m cells across the CALMET model domain has initially been based on the Land Cover Database (LCDB) v5 published by Landcare Research. The land use categorisation of cells within the site and surrounding area has then been manipulated to reflect the impact of tall vegetation. In particular, land use categorisation of cells within and surrounding the site featuring shelterbelt vegetation or other tall trees has been manually classified as Forest Cover, which I consider appropriate to characterise the shelterbelt(s). Within the site, cells occupied by sheds or concrete hardstand have been manually classified as Urban Cover, reflecting the buildings and impervious surfaces consistent with built/urban environments. The land use categorisation of cells in the area surrounding the site has remained as Agricultural. The land use categorisation of the site and surrounding area is illustrated in Figure 2.
- The elevation of terrain within each cell has been derived from New Zealand 8m Digital Elevation Model (2012) data sourced from Land Information New Zealand (LINZ). Likewise the ground/base elevation of emission sources, buildings and receptors has been derived from this source.

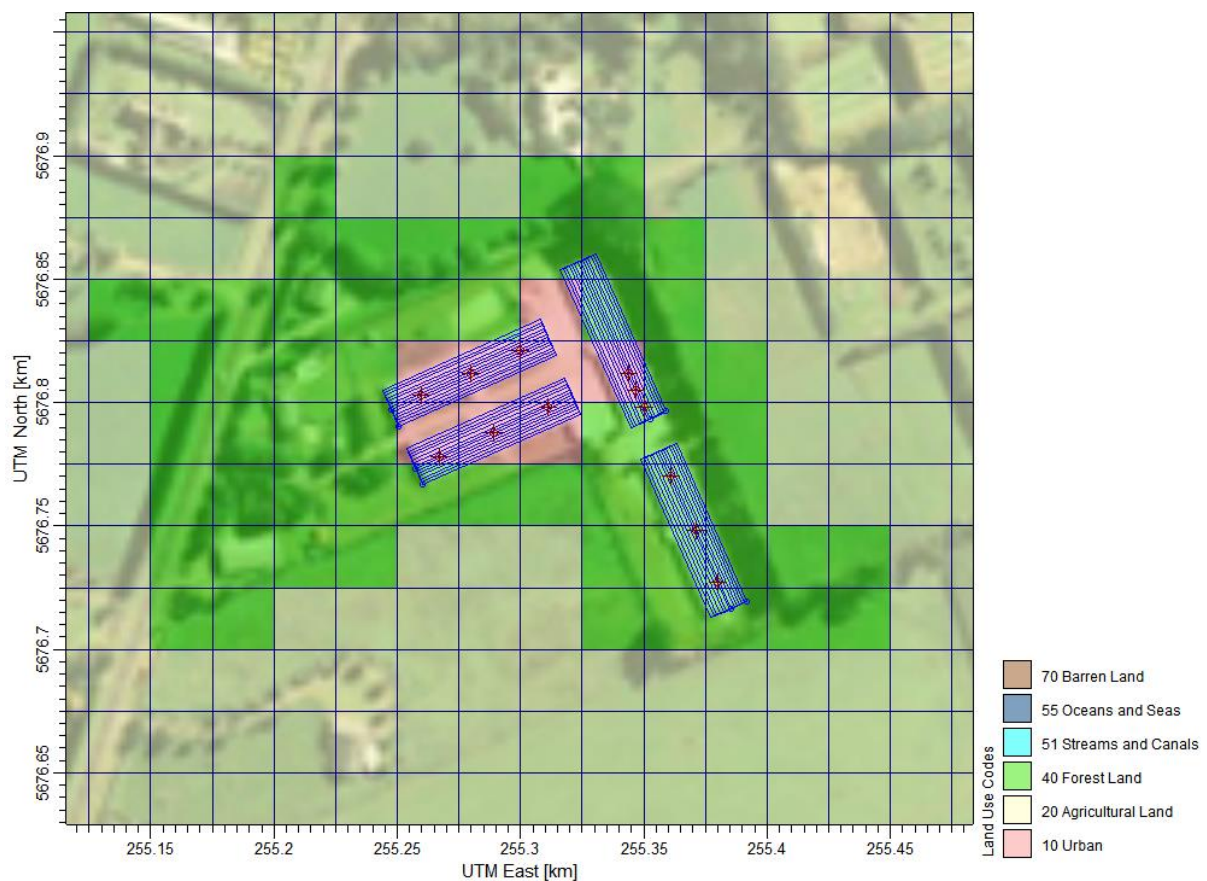


Figure 2: Land use categorisations used in the area surrounding the site in updated CALMET modelling

Model results

The following table provides summarises 99.5th percentile odour concentrations predicted in each scenario (at submitter and non-submitter receptor locations).

Prediction location	Predicted 99.5th percentile 1-hour average odour concentration (OU/m ³)			
	Proposed	Existing effective peak density	PA (horizontal vents)	PA (vertical 7m vents)
Maximum at submitter dwelling (inc. upper floor) or curtilage	3.3	6.9	3.6	2.6
Maximum at other dwelling or curtilage	4.1*	7.0*	3.5*	2.9**
<u>Individual submitter predictions:</u>				
62 Airport Dr (McDonald, inc. curtilage)	3.3	6.9	3.6	2.6
76 Airport Dr (Brown, inc. curtilage)	2.6	4.8	1.8	1.5
47 Airport Dr (Hibell, inc. curtilage)	1.7	3.4	1.5	1.0
40 Airport Dr (Brown, inc. curtilage)	1.6	2.5	1.1	0.9
35 Airport Dr (Poppa's Peppers, inc. curtilage)	1.2	2.1	0.8	0.8

* Predicted to occur at 69 Airport Drive

** Predicted to occur at 52 Airport Drive

The following contour plots illustrate the spatial distribution of 99.5th percentile 1-hour average odour concentrations associated with each of the four emission scenarios described above:

- Odour concentration contours are plotted increments of 1 OU/m³ (yellow contours), and 5 OU/m³ (orange contours) between 1 OU/m³ and 10 OU/m³.
- Submitter receptors are illustrated in red and non-submitter receptors as cyan.
- Dwelling receptors are illustrated as triangles, curtilage receptors as circles.

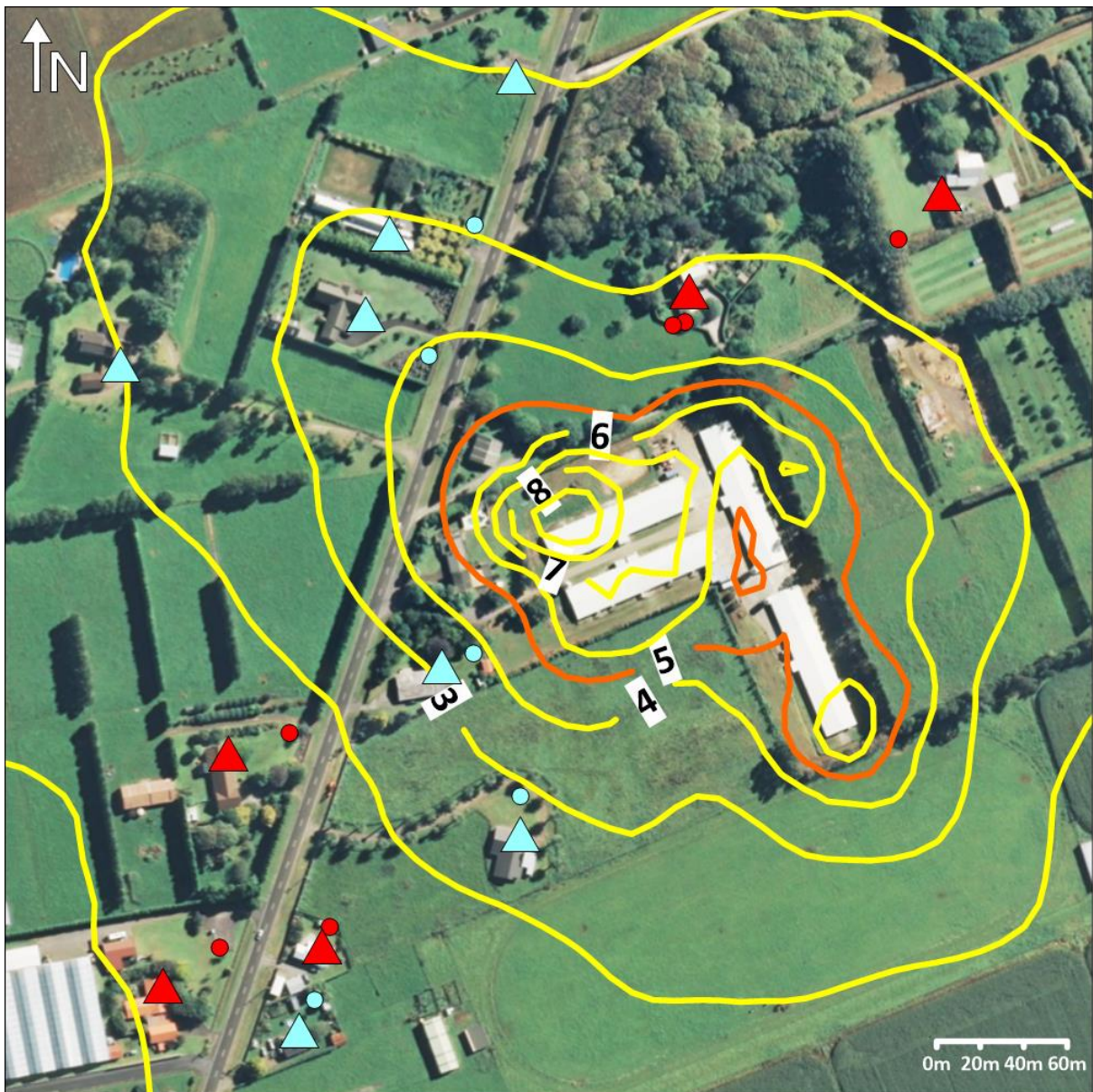


Figure 3: Proposed free range operation. Spatial distribution of 99.5th percentile 1-hour average odour concentrations associated with the proposed operation (including change to free range configuration and installation of roof vents). - 1 OU/m³ increments denoted in yellow, 5 OU/m³ increments denoted in orange

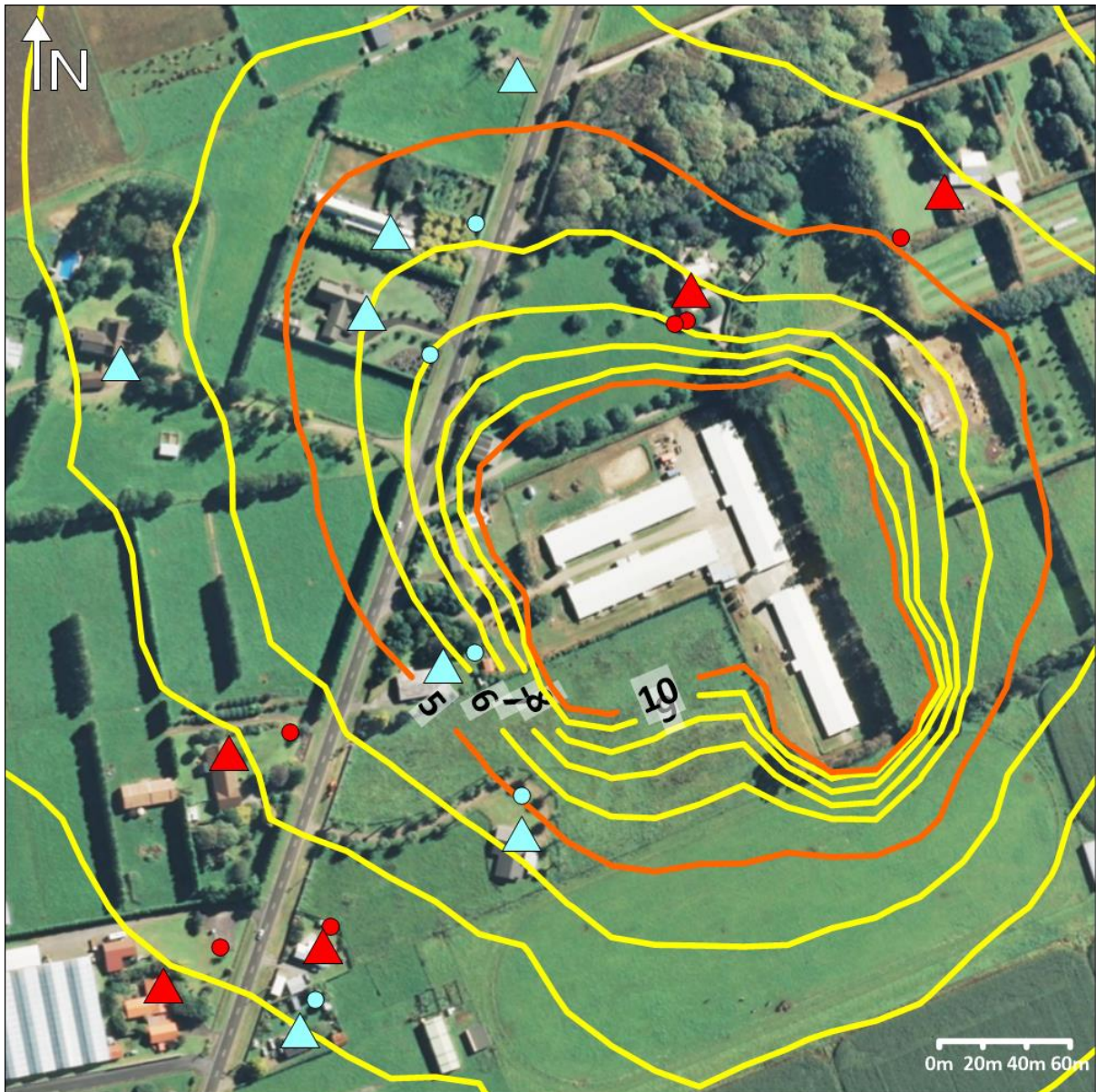


Figure 4: Existing conventional broiler operation at effective operational peak mass density (35 kg/m^2). Spatial distribution of 99.5th percentile 1-hour average odour concentrations. - 1 OU/m^3 increments denoted in yellow, 5 OU/m^3 increments denoted in orange

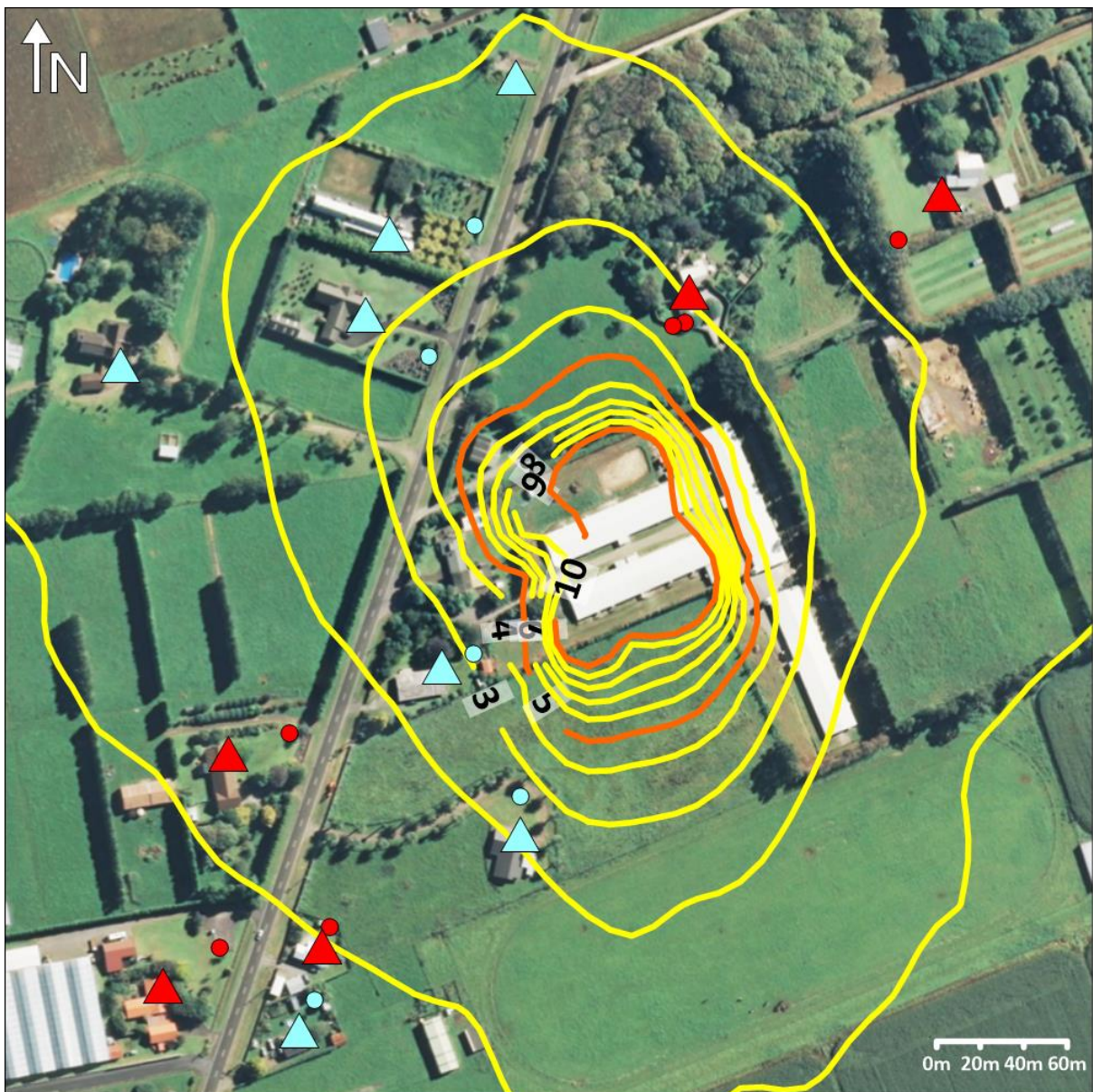


Figure 5: Permitted activity (PA) 30,000 birds housed in Sheds 1 and 2 with exhaust via horizontal exhaust vents. Spatial distribution of 99.5th percentile 1-hour average odour concentrations. - 1 OU/m³ increments denoted in yellow, 5 OU/m³ increments denoted in orange.

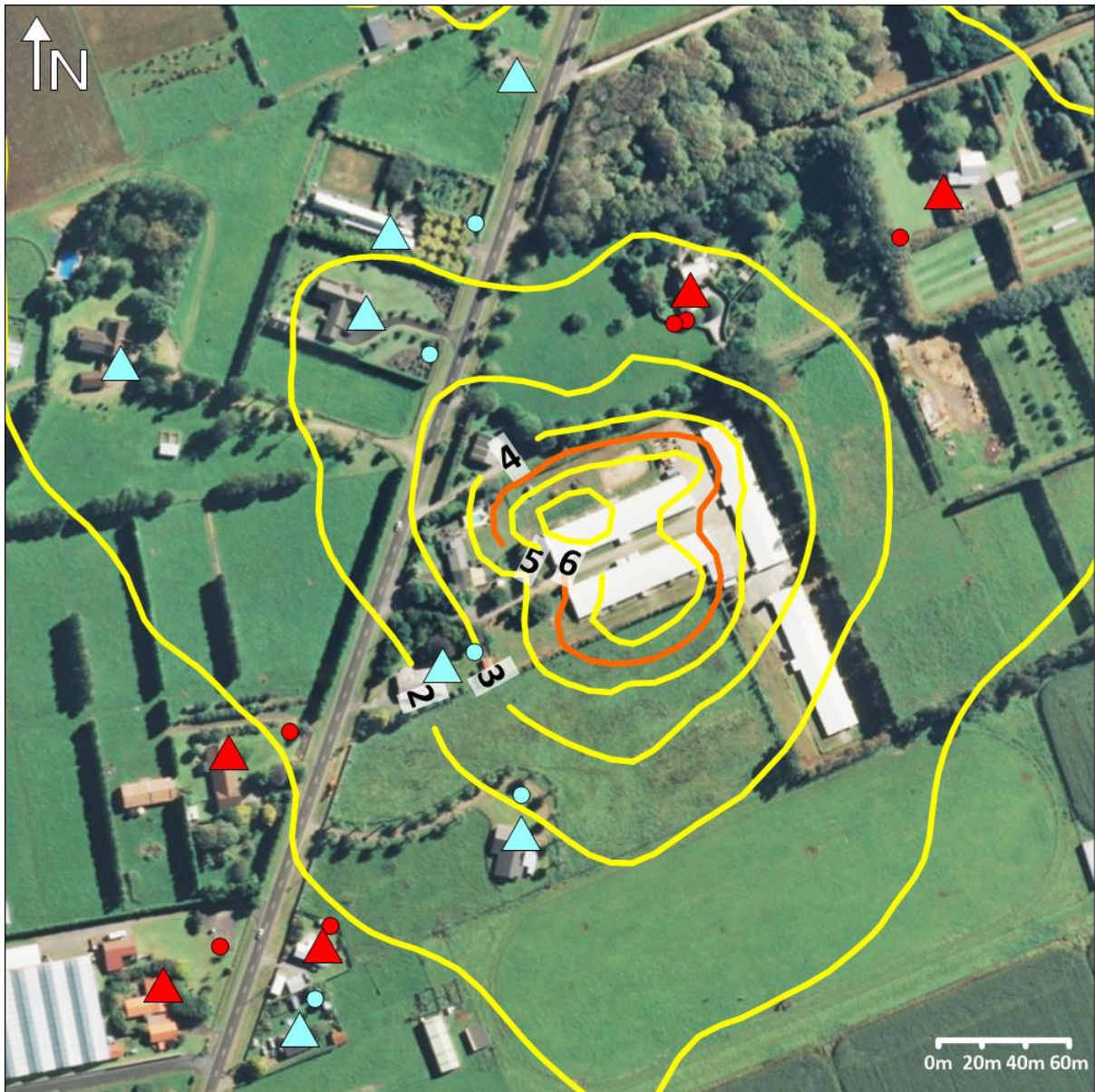


Figure 6: Permitted activity (PA) 30,000 birds housed in Sheds 1 and 2 with exhaust via vertical 7m exhaust vents. Spatial distribution of 99.5th percentile 1-hour average odour concentrations. - 1 OU/m³ increments denoted in yellow, 5 OU/m³ increments denoted in orange