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Addiction - Air Quality Assessment
Addiction Pet Foods NZ Limited
29-Apr-2020
Doc No. R001a

Addiction Pet Foods Air Quality Assessment

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Client: Addiction Pet Foods NZ Limited

ABN: N/A

Prepared by

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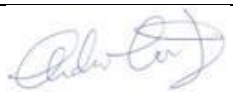
C	29-Apr-2020	Final	Andrew Curtis Technical Reviewer	

Table of Contents

List of Figures

List of Tables

Glossary of Abbreviations

Abbreviations	Descriptions
Addiction Foods	Addiction Foods NZ Limited
AECOM	AECOM New Zealand Limited
AQ	Air Quality
AS/NZS 4323.3:2001	Australian/New Zealand Standard. Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry
AWS	Automatic Weather Station
BOPRC	Bay of Plenty Regional Council
CliFlo	National Climate Database
E	East
Ews	Electronic Weather Station
FIDOL	Frequency, Intensity, Duration, Offensiveness and Location
GPG	Good Practice Guide
GPG Odour	Good Practice Guide for Assessing and Managing Odour
GPG ADM	Good Practice Guide for Atmospheric Dispersion Modelling
MfE	Ministry for the Environment
N	North
NIWA	National Institute of Water and Atmospheric Research
O_3	Ozone
OMP	Odour Management Plan
OU/m^3	Unit of Concentration: Odour Units per cubic metre
PDP	Pattle Delamore Partners Limited
PPM	Parts Per Million
RAP	Regional Air Plan
RMA	Resource Management Act 1991
RNRP (AQ)	Regional Natural Resources Plan (Air Quality)
S	South
UTM	Universal Transverse Mercator
W	West
WBoPD	Western Bay of Plenty District
%	Percentage
km	Unit of distance (kilometre)
mm	Unit of distance (millimetre)
m^3/s	Unit of flow: cubic metres per second
m^3/hr	Unit of flow: cubic metres per hour
m	Unit of distance (metre)
m/s	Unit of speed: metre per second
$OU/m^3/s$	Odour emission rate: Odour units per cubic metre per second

1.0 Introduction

Addiction Foods NZ Limited (Addiction Foods) operates a pet food manufacturing facility located at 240 Jellicoe St, Papamoa Beach, Te Puke 3119, New Zealand. As required by the Bay of Plenty Regional Council (BOPRC) – Regional Natural Resources Plan (Air Quality), Proposed Plan Change 13 (BOPRC – RNRP (AQ)), the activity is now classified as Discretionary and therefore requires a resource consent. Prior to the plan change the activity was not covered by a specific rule and therefore was a permitted activity, providing it met the requirements of the permitted activity rule.

AECOM New Zealand Limited (AECOM) has been engaged by Addiction Foods to prepare an air quality assessment of the potential off-site effects associated with discharges to air, primarily odour, to support a resource consent application triggered by the changes to the BOPRC Regional Natural Resources Plan.

This report should be read in conjunction with the Assessment of Environmental Effects (AEE) report prepared by Pattle Delamore Partners Limited (PDP)[1], which provides background and process information, a planning assessment and a qualitative odour assessment[2]. AECOM's quantitative assessment utilises an atmospheric dispersion model to predict the impacts of odour discharges and assess improvements associated with changes to the plant. For completeness AECOM has also undertaken a FIDOL assessment, similar to that undertaken by PDP.

This report contains an assessment of the potential air quality impacts at the nearest identified receptors resulting from discharges to air from the site. The assessment has been undertaken in accordance with the following Ministry for the Environment (MfE) Good Practice Guides (GPG):

- GPG for Assessing and Managing Odour (GPG AMO)[3]
- GPG for Atmospheric Dispersion Modelling (GPG ADM)[4]

This assessment is set out as follows:

- Section 2 Background Information
- Section 3 Process Description
- Section 4 Existing Environment
- Section 5 Complaints Assessment
- Section 6 Assessment Criteria
- Section 7 Mitigation Measures
- Section 8 Pilot Plant Scrubber Testing Results
- Section 9 Atmospheric Dispersion Modelling Methodology
- Section 10 FIDOL Assessment Methodology
- Section 11 Assessment of Environmental Effects
- Section 12 Conclusions
- Section 13 Limitations

[1] Pattle Delamore Partners Limited, Pet Food Manufacturing, Discharges to Air – Assessment of Environmental Effects. Addiction Foods NZ Limited, 12 September 2019
[2] This qualitative assessment was based on the FIDOL (frequency, intensity, duration, offensiveness and location) assessment tool.
[3] Ministry for the Environment, Good Practice Guide for Assessing and Managing Odour, November 2016
[4] Ministry for the Environment, Good Practice Guide for Atmospheric Dispersion Modelling, 2004

2.0 Background Information

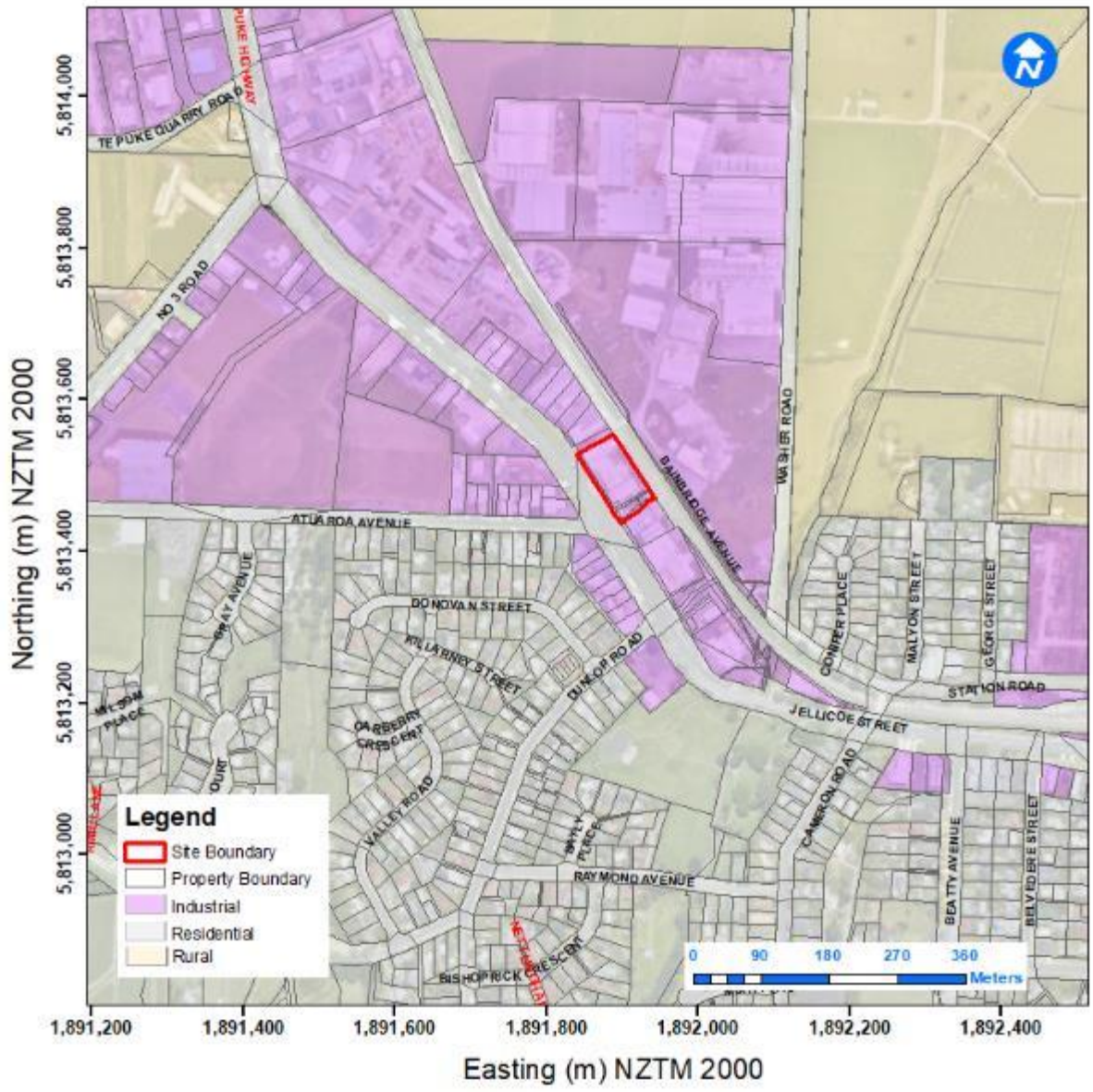
2.1 Site Description

Addiction Foods manufacturing facility (hereby after referred to as “the Site”) is located at 240 Jellicoe Street, Papamoa Beach, Te Puke 3119. It lies within the jurisdiction of Western Bay of Plenty District Council (WBoPD) and the Bay of Plenty Regional Council (BOPRC) and it is legally described as Lot 2 DP436535.

The coordinates of the approximate centre of the Site are New Zealand Transverse Mercator 2000 (NZTM) 1,891,893 m East (E), 5,813,499 m North (N).

The Site is zoned ‘Industry’ under the WBoPD Plan. The location of the Site and the WBoPD Plan zoning is presented in Figure 1.

Figure 1 Site property boundary and zoning



2.2 Surrounding Environment

The Site is located immediately adjacent to two light industrial properties, LRK Trays and Mackie Signs. Within 500 m of the Site are a mixture of light and heavy industrial properties, service stations, depots, infrastructure and network facilities and an open space recreational area. It is important to note that there is also another pet food manufacturing company, Sunday Pets located approximately 130 m northwest of the Site. Except for the open space recreational area (Centennial Park) which is located approximately 176 m west of the Site, the properties located in the Industry zone which are within 500 m from the Site are considered to have moderate to low sensitivity to industrial odour.

Rural areas in Te Puke are generally used for horticulture and pastoral farming. The nearest Rural-zoned property is located approximately 195 m east of the Site. Properties in areas zoned Rural are considered to be less sensitive to odour.

Residential areas are located to the east, south and southwest of the Site, with the nearest residential property situated on Atuaroa Avenue, 60 m southwest of the Site. Apart from residential properties, there is also an open space recreational area, a church and a school located in the Residential zone within 500 m of the Site. People at these locations are considered to have a high sensitivity to odour, as defined in MfE GPG Odour.

3.0 Process Description

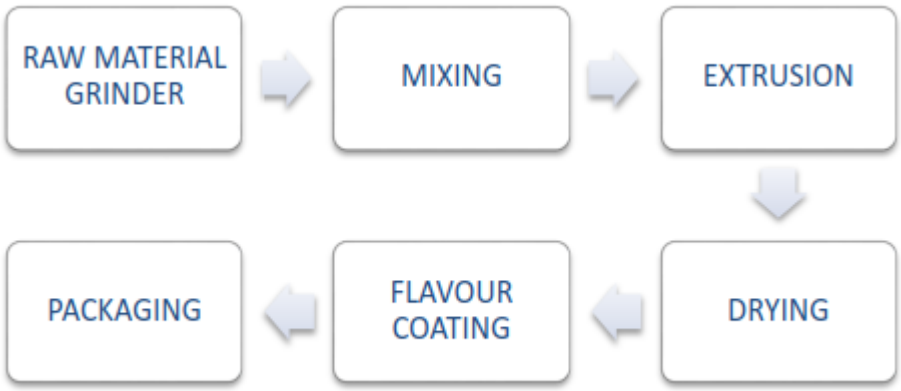
The Site consists of a large 'main production area' where the manufacture of dry pet food takes place and a 'main products storeroom', where products are stored prior to distribution to the market place.

A detailed description of the process is provided in the AEE, however a brief summary is provided below.

Multiple ingredients are used in the production of Addiction Foods products of which can include minced frozen meat and fish meal which are processed to form a paste which is used in the initial stage of the process. The paste is cooked as it moves through an extruder. The product then exits through a shaping die and is cut into small pieces, known as kibbles. The kibbles are then sent to a dryer before being cooled and coated with a flavour enhancer. The product is then packaged and stored onsite in the 'main products storeroom'.

This process is summarised in the following flow diagram which has been reproduced from the AEE.

Figure 2 Process flow diagram



Credit: PPE AEE, dated 12 September 2019

In terms of odour discharges, the extruder and the dryer have the greatest potential to generate odour along with the spray process used to apply the flavour enhancer. These odours are captured by a central process air extraction system and discharged via a stack attached to the northern side of the building which extends to a height 3 m above the main production plant building. The location of the stack is shown in Figure 3 and the stack is shown in Figure 4. Fugitive emissions are controlled by minimising the periods of time that doors are opened and by ensuring that all building penetrations are sealed, such as the roof vents, windows and door frames.

The Site operates 7 days a week, except when undertaking maintenance activities or during other shut down periods. The plant manufactures products during the hours of 4 pm to 8 am to minimise the potential for odour discharges to cause effects, as there is a greater likelihood that nearby residents in the surrounding community will be inside, and/or asleep during this period.

Figure 3 Stack Location

Figure 4 Process Air Discharge Stack

Credit: PPE AEE, dated 12 September 2019

4.0 Existing Environment

The following section describes the surrounding environment as this will influence how odours are dispersed and interact with offsite receptors.

4.1 Topography

The area surrounding the site is essentially flat with no significant terrain features which could influence the dispersion of odour around the plant. The closest terrain features are the Papamoa Ranges which are located 3.5 km to the west of the Site, well beyond the distance that they could influence the dispersion of odour from the plant

4.2 Meteorology

The nearest Electronic Weather Station (Ews), relative to the Project Site is located at the Te Puke Plant and Food Research centre located at 412 No1 Road, approximately 4.8 km south of the Project Site at NZTM 1,892,289 mE, 5,808,651 mN. This was the closest station relative to Addiction Foods that AECOM could obtain validated data, however close enough that the data could be considered representative of conditions at Addition Foods.

The Ews data was downloaded from the National Institute of Water and Atmospheric Research (NIWA) National Climate Database (CliFlo).

Analysis of hourly wind data for the Te Puke Ews for the five-year period 1 January 2014 and 31 December 2018 indicates that winds from all directions are experienced at the monitoring site, however, the predominant winds are from the west, west southwest, north, north northeast and south. The data capture during this monitoring period was excellent at >99%.

The annual average rainfall for the period assessed was 1,855 mm and the average ambient temperature was 14.9 °C.

4.2.1 Analysis of Wind Data

The strongest winds originate from the west and west southwest. The average wind speed recorded was 1.4 m/s and the average frequency of calms was 17.5 percent (%). Note that the term ‘calms’ refers to wind speeds of less than 0.5 m/s.

The wind rose for the Te Puke Ews for the period 1 January 2014 and 31 December 2018 is presented in Figure 5, yearly wind roses in Figure 6, seasonal wind roses in Figure 7 and daytime/night-time wind roses are presented in Figure 8. Figure 6 shows that there is relatively little inter-annual variation in wind direction.

The seasonal wind roses indicate that:

- In summer, the prevailing wind directions are from the west, west southwest, north and north northeast.
- In autumn, the prevailing wind direction is from the west, west southwest and south.
- In winter, the prevailing wind directions are from the west, west southwest and south.
- In spring, the prevailing wind directions are from the west, west southwest, north and south

The daytime/night-time wind roses show that light winds and calm conditions are more prevalent during night-time hours, however winds blowing towards the nearby receptors, to the east, south and southwest of the plant are more common during daylight hours.

Figure 5 Te Puke AWS Windrose – January 2014 to December 2018 (Five-year period)

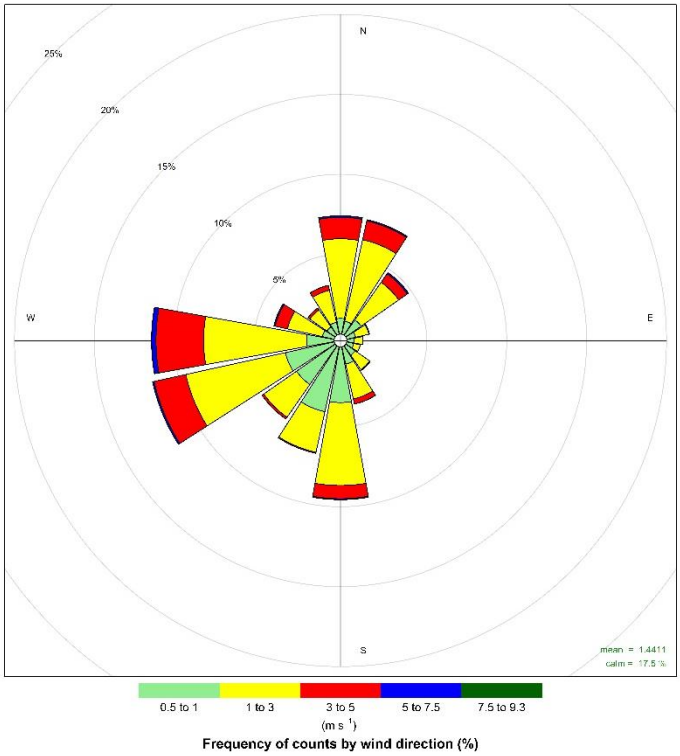


Figure 6 Te Puke AWS Yearly Windrose – January 2014 to December 2018 (Five-year period)

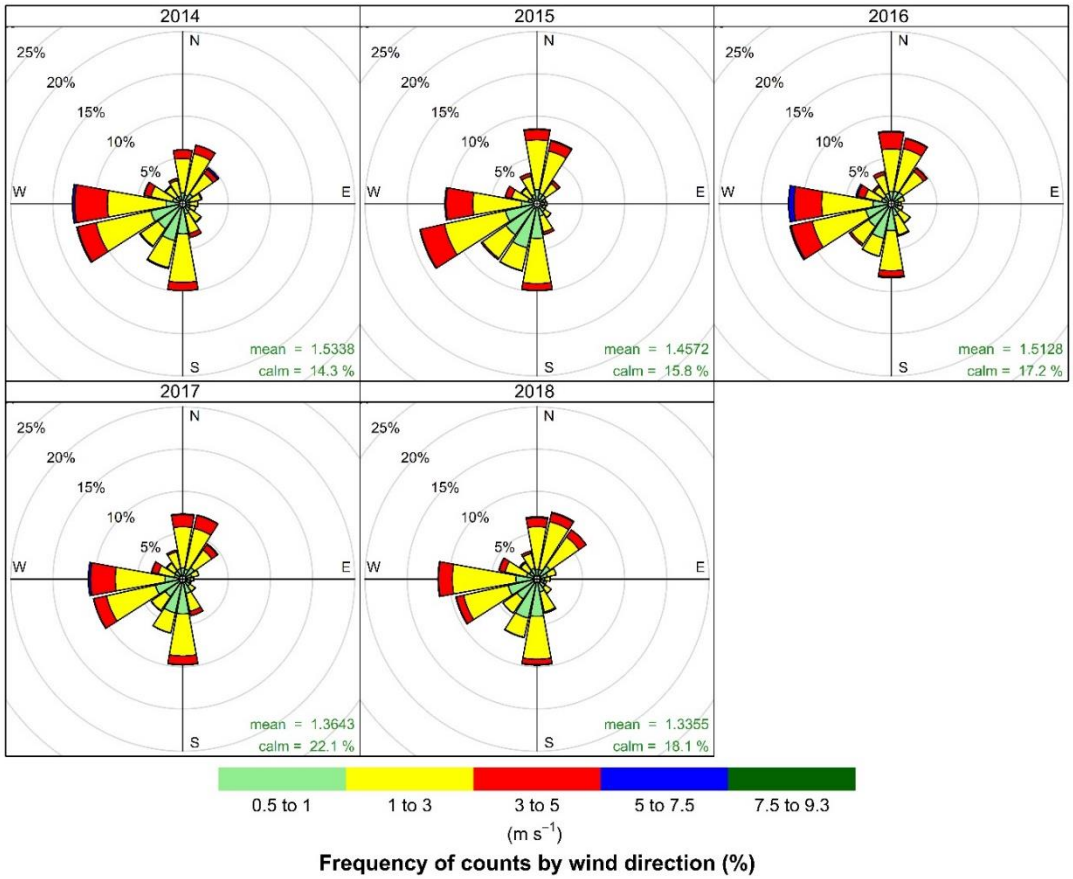


Figure 7 Te Puke AWS Seasonal Windroses – January 2014 to December 2018 (Five-year period)

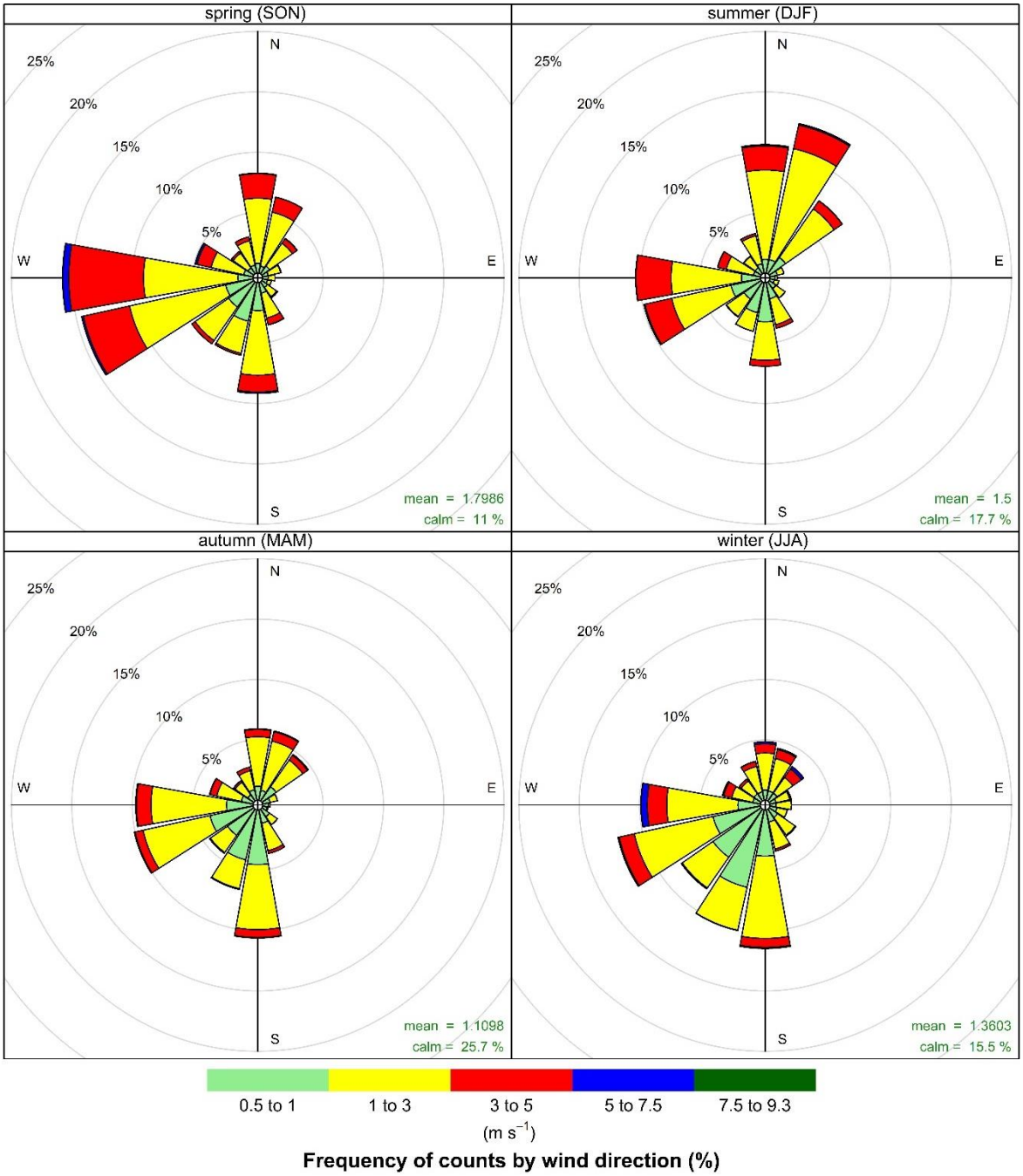
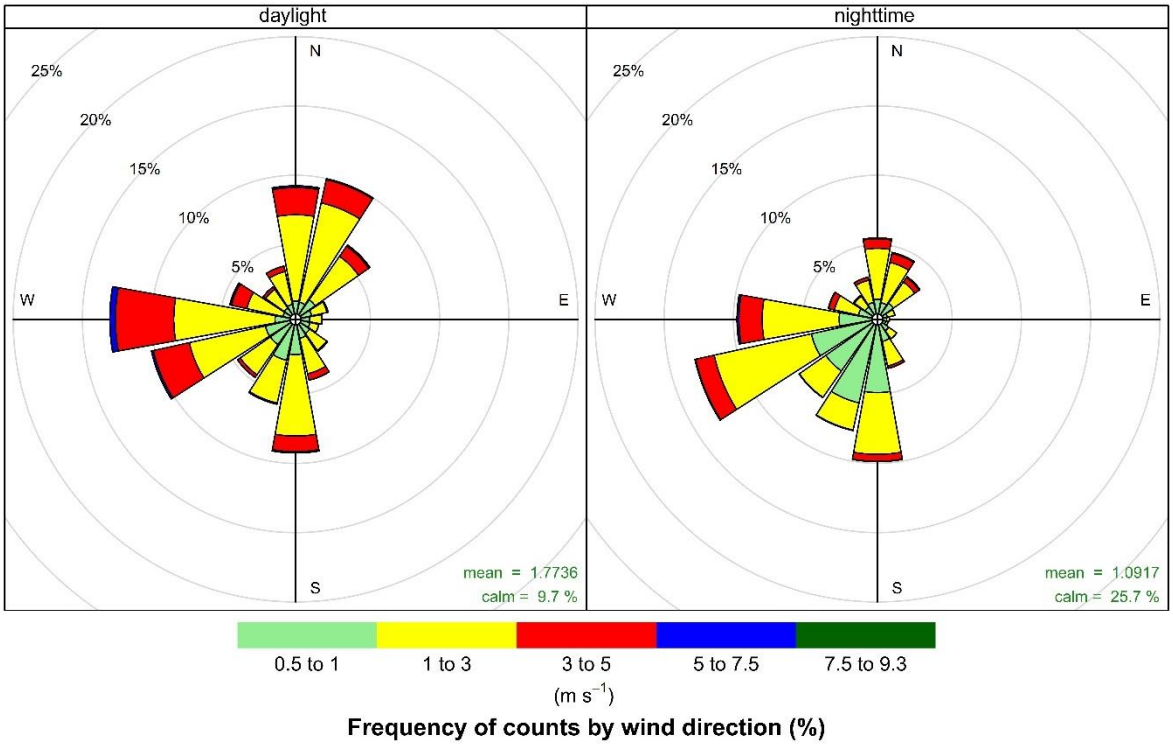


Figure 8 Te Puke AWS Daytime/Night-time Hours Windroses – January 2014 to December 2018 (Five-year period)

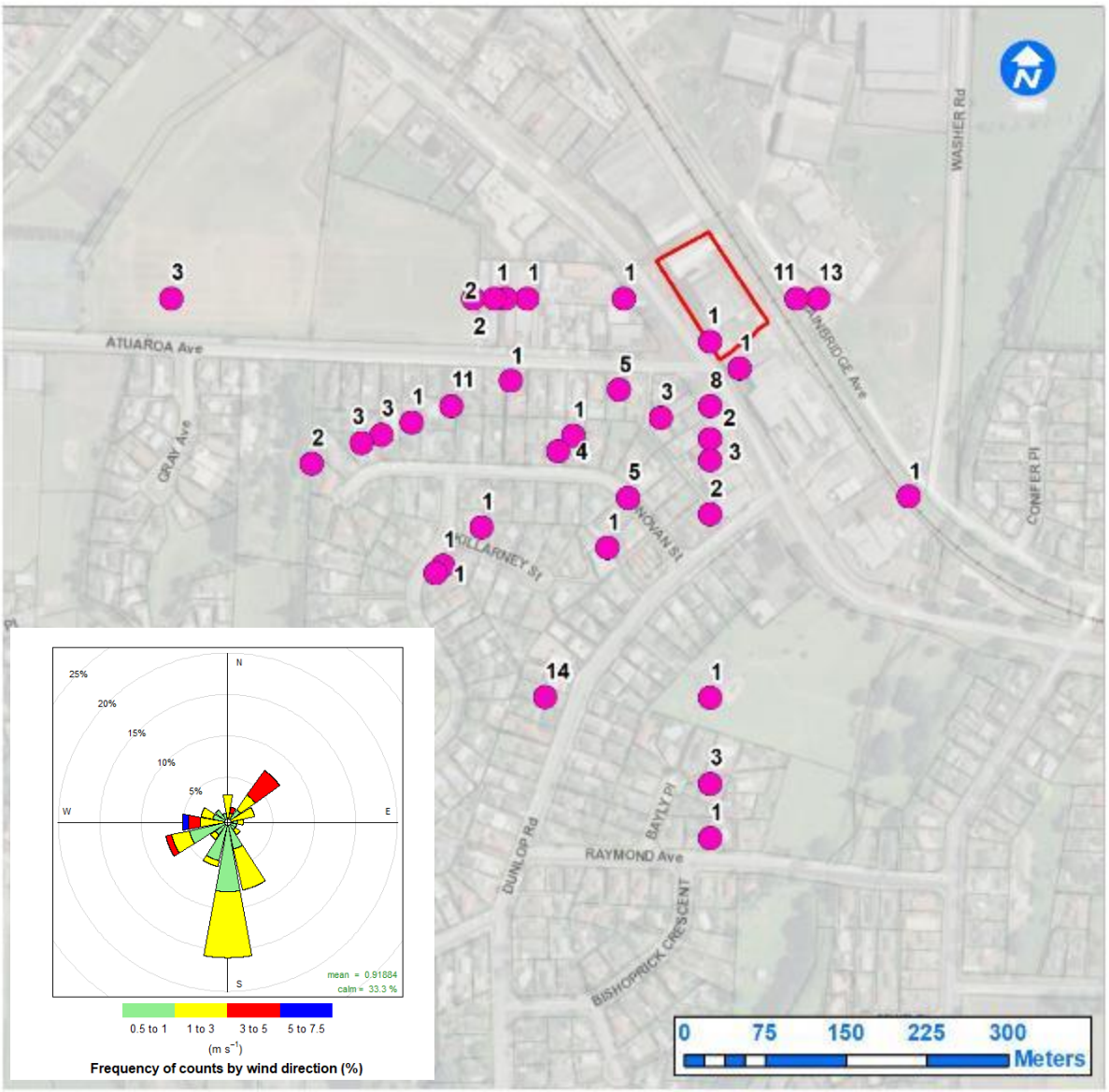


5.0 Complaints Assessment

AECOM has reviewed the BOPRC complaint data for the site for the period 21 June 2017 to 31 July 2019. During this period 158 complaints were made to BOPRC regarding odours assumed to be associated with the plant, however AECOM understands that none of these odour complaints have been verified by BOPRC enforcement officers as being offensive and objectionable.

Figure 9 shows the approximate location of the complainants (where direction and distance was provided in the complaint log) along with the number of complaints made at each location. Figure 9 also includes a wind rose, for the periods of time where complaints have been made, to provide some perspective of the winds associated with the complaints. As can be seen in the Figure nearly all of the complaints occur southwest of the site in the residential area. However, there are a couple of locations close to the plant to the east where a large proportion of the complaints have been recorded.

Figure 9 Odour Complaint Location



AECOM has analysed the wind data at the time of each complaint and has determined the likelihood of the complaint being associated with Addiction Foods i.e. was the complainant downwind of the plant at the time of the complaint. This data is presented in Figure 10 as a pie chart. Each complaint was classified as either “Unlikely”, “Possible”, “Likely” or “Very Likely” depending on how directly downwind of the plant the complainant was at the time of the complaint. These classifications are defined by the following downwind arcs: 0°- 20°(Very Likely), 20°- 45° (Likely), 45°- 90° (Possible) >90° (Unlikely). The data shows that 68% of the complaints were likely attributed to odours generated by Addiction Foods.

The wind data showed that the majority of complaints (89%) occurred during periods where the winds were less than 3 m/s. The data also shows that over 75% of the complaints occurred while the plant was manufacturing products which contained fish meal.

Figure 10 Odour Complaint Location

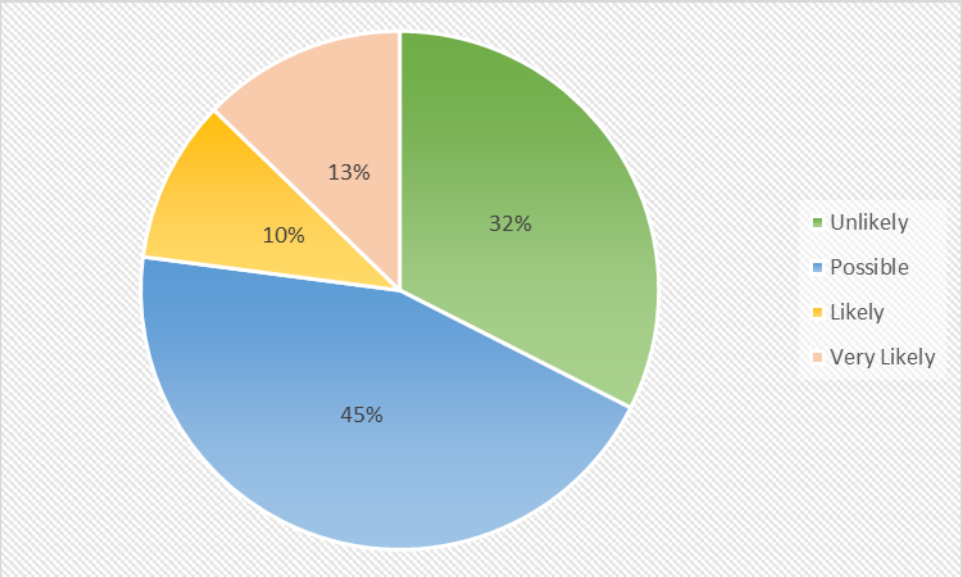
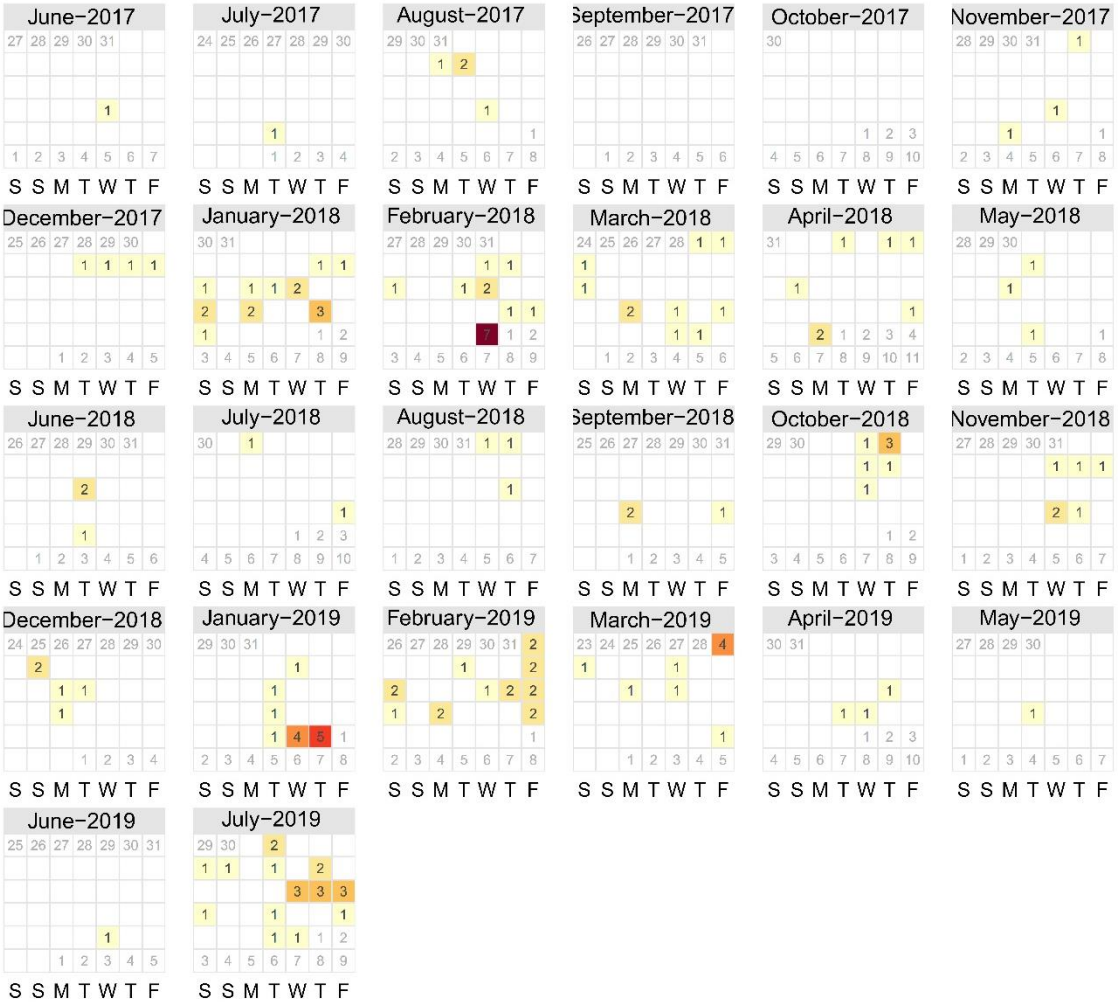


Figure 11 presents a calendar plot which shows the days of the year where odour complaints were made to BOPRC. The Figure shows that 29% of complaints occurred during the summer, 39% during autumn, 21% during spring and 6% during winter. There were 58 complaints made in the period 01 August 2017 to 31 July 2018, which compares with the latest 12 months of data 01 August 2018 to 31 July 2019 where 89 complaints were made. This data suggests that odours from the site have become more noticeable with time which may be attributed to a small increase in production.

Overall, based on the complaint data, the current operation of the plant has the potential to create odour nuisance on occasions with these most likely being attributed to the product being manufactured, poor dispersive conditions or a combination of the two.

Figure 11 Calendar Plot of Complaints



6.0 Assessment Criteria

The assessment contained in this report has considered the matters outlined in the following statutory documents:

- Resource Management Act 1991 (RMA); and
- Regional Natural Resources Plan (Air Quality), Proposed Plan Change 13 (BOPRC – RNRP (AQ))

6.1 Resource Management Act

Section 5(1) sets out the purpose of the RMA, which is "to promote the sustainable management of natural and physical resources".

Section 5(2)(c) provides for this to occur while "avoiding, remedying, or mitigating any adverse effects of activities on the environment".

Section 2 of the RMA defines 'environment' and 'amenity values' as follows:

"Environment

includes –

a. Ecosystems and their constituent parts, including people and communities; and

b. All natural and physical resources; and

c. Amenity values; and

d. The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters.

Amenity values

those natural or physical qualities and characteristics of an area that contribute to people's appreciation of tis pleasantness, aesthetic coherence, and cultural and recreation attributes."

Since offensive odours can be considered to cause effects on amenity values, people and communities, they need to be managed under the RMA. Since the compounds that cause odour effects are air contaminants, their discharge is therefore controlled under section 15 of the RMA. Under section 15(1) of the RMA, discharges from industrial or trade premises are only allowed if they are authorised by a rule in a regional plan, a resource consent, or regulations. If the activity is prohibited under the plan, then no resource consent can be obtained.

6.2 Regional Assessment Criteria

6.2.1 BOPRC – Regional Natural Resources Plan (Air Quality)

The Site falls under the jurisdiction of the BOPRC and the policies, objectives and rules contained within BOPRC – RNRP (AQ).

Reference should be made to the PDP report for a complete statutory assessment, however the rules applicable to this Application are provided below.

AQ R18 – Fuel Burning Equipment (Boilers) – Permitted

The site uses natural gas to provide heat to the drier, however the total heat generation is less than 1 MW, therefore it is covered by the following permitted activity rule providing it can meet the following criteria.

(1) General discharges from fuel burning equipment[5]

All discharges of contaminants to air from fuel burning equipment under any part of this rule must comply with all of the following conditions:

a. The discharge must be an unimpeded vertical discharge from an emission stack.

b. The fuel burning equipment and any emission control equipment must be maintained in accordance with the manufacturer's specifications at least once every year by a person competent in the maintenance of that equipment.

c. The sulphur content of any fuel burnt must be less than 1% by weight.

d. The discharge of smoke or water vapour must not adversely affect vehicle safety, aircraft safety, or ship safety.

e. The discharge must not be noxious or dangerous, offensive or objectionable

(2) Equipment installed before 27 February 2018

b. For fuel burning equipment generating a gross heat energy output within the combustion chamber:

   B. Between 40 kW up to 1 MW from the combustion of natural or liquefied petroleum gas

The discharge stack meets the requirements of the above criterion, therefore the discharge is covered by the permitted activity rule.

AQ R21 - Specific Activities

The discharge of *contaminants* into air from any of the following activities is a discretionally activity:

(r) Pet food manufacture by the application of heat.

The air discharges from Addiction Foods are considered to be a discretionary activity which requires a resource consent.

[5] Fuel burning Equipment means a device used for the combustion of fuel within an enclosed combustion chamber in which heat is transferred from the products of combustion directly for the production of useful heat or power. For clarity this excludes vehicles, rail vehicles, ships, aircraft, solid fuel burners, diesel fuelled generators, and enclosed incineration

In determining whether there is the potential for nuisance to occur, the BOPRC – RNRP (AQ) provides the following guidance on what should be assessed. This assessment involved reviewing the following:

- The nature of the activity being undertaken;
- How long the activities are likely to occur;
- The nature of the material being discharged;
- Whether mitigation measures can be implemented to control the potential for effects;
- How close receptors are to the activities;
- The nature of the receptors and their sensitivity to odour; and
- The prevailing meteorological conditions.

The qualitative assessment is discussed in detail in Section 10.0.

6.3 Odour Guidelines

The land of the Project Site is zoned for heavy industry and, based on this zoning, the guideline recommended by MfE GPC odour of 5 OU/m³ for a Low Sensitivity Receiving Environment would typically be deemed appropriate; however for this assessment, due to the location of the sensitive receptors, the guideline value of 2 OU/m³ for a High Sensitivity Receiving Environment has been used. Table 1 presents the MfE odour guidelines.

Table 1 MfE Odour Guidelines

Sensitivity of the Receiving Environment	Concentration	Percentile
High (worst-case impacts during unstable to semi-unstable conditions)	1 OU/m³	0.1 and 0.5%
High (worst-case impacts during neutral to stable conditions)	2 OU/m³	0.1 and 0.5%
Moderate (all conditions)	5 OU/m³	0.1 and 0.5%
Low (all conditions)	5-10 OU/m³	0.5%

7.0 Mitigation Measures

7.1 Current Mitigation Measures

The primary form of mitigation utilised by Addiction Foods to control odour is to minimise fugitive emissions, by ensuring the building is sealed and minimising periods of time where doors are open (installation of rapid rise doors). Addiction Foods has 'smoke-tested' the building to check that there are no significant pathways for odour to escape the building envelope.

Process air from the production line passes through a filtration system to remove any particles in the air prior to treatment using an ozone system. The system doses the air with ozone molecules which have been found to reduce some types of odours. A water spray system was recently installed to reduce the flue gas temperature and improve the efficacy of the ozone treatment system which has been found to reduce some of the odour.

The residual odour is discharging to air via a 23 m high stack which, due to its height, dilutes the concentration of odour at off-site locations.

Addiction Foods has also identified products which have the highest odour potential and is in the process of reformulating these products so that they generate less odour; in the interim these products are not being manufactured.

7.2 Proposed Mitigation Measures

Given that the plant has been identified to be the cause of some odour complaints, Addiction Foods engaged a specialist emission control company to provide options for the treatment of odours from process emissions. Various options have been considered including: enzyme sprays, deodorisers biofilters and wet scrubbing. A bark bed biofilter was not recommended by the specialist emission control company due to the limited space available onsite and the temperature of the discharge. A wet scrubber was the recommended option and a small pilot plant was consequently installed to evaluate its performance at reducing odour. The results of this evaluation are presented in Section 8.0.

Based on the results from the trials on the wet scrubber, together with atmospheric dispersion modelling, a staged approach to mitigation has been proposed, whereby improvements are implemented followed by a period of evaluation and confirmation of effectiveness at the completion of each stage prior to progressing to the next phase. AECOM proposes that the monitoring and evaluation of the effectiveness of the mitigation measures is incorporated into consent conditions for the site, with the requirement to undertake regular odour scouting around the plant.

The proposed phases of plant upgrades are as follows:

Phase 1: Dilute air odour prior to discharge and stack height extension

Phase 1 will involve installing a large fan to combine fresh air with discharges from the plant. The current volumetric flowrate associated with the process is 12,600 m^3/hr (3.5 m^3/s) which is discharged via the main stack with no dilution. For this phase it is proposed to introduce 50,400 m^3/hr of fresh air into the discharge to provide a total volumetric flow rate of 63,000 m^3/hr. This will result in the odour discharge concentration reducing by a factor of 5 i.e. one part odour to four parts fresh air.

Furthermore, the results of atmospheric dispersion modelling indicate that the current stack has the potential to be affected by the downwash created by the building. It is therefore proposed that the stack is extended by 10 m to a final height 13.4 m above the level of the roof to minimise downwash effects.

Phase 2: Wet Scrubbing

Phase 2 will involve the installation of a wet scrubber to reduce the concentrations of odour prior to discharge. The scrubber will be oversized to allow the site to increase production capacity to meet changes in market demand, if required.

Based on the results of the trial on the pilot plant scrubber (see Section 8), concentrations of odour are unlikely to exceed 2,000 OU/m^3 at the outlet of the plant. The dilution air injection system proposed as part of Phase 1 may be removed depending on the effectiveness of the scrubber. This will be decided after a period of evaluation through regular odour scouting surveys.

For the purposes of this assessment the stack height has been assumed to be 33.4 m above ground level, however the final height may be determined based on structural constraints. In order to demonstrate compliance with the odour assessment criteria, should the final height be less than modelled, the revised stack height will be remodelled using the dispersion model and the results presented to BOPRC. AECOM recommend that this requirement is included as a resource consent condition.

8.0 Pilot Plant Scrubber Testing Results

As previously mentioned, Addiction Foods engaged a specialist emission control company to install a small pilot plant to assess the suitability of a wet scrubber as a treatment option. The plant was installed during April 2019 and was still operational at the time of preparing this report.

The scrubber was configured to take a small portion of the flow from the main plant discharge and passes this through two packed tower scrubbers. Figure 12 presents a picture of the pilot plant scrubber.

Figure 12 Pilot Plant Scrubber

During a period of 5 months, Addiction Foods has undertaken a significant amount of in-house testing to better understand how effective the scrubber is at reducing odour from a wide range of products that the plant can manufacture. This in-house testing is subjective as it requires staff to collect samples and then observe the odour and provide a rating using a system that Addiction Foods has developed. To support the findings of this in-house analysis, Addiction Foods engaged AECOM to undertake independent odour testing. This consisted of collecting samples in general accordance with Australian New Zealand Standard 4323.3:2001 from the inlet and outlet of the scrubber into tedlar bags and then undertaking analysis of the samples using AECOM's olfactometer.

The results from this analysis are presented in Table 2. The results show that the odour associated with the process ranged between 2,317 OU/m^3 and 41,224 OU/m^3. For the purposes of modelling AECOM has excluded the highest measured concentration as this product is no longer manufactured and conservatively used 6,000 OU/m^3 as the basis for the existing scenario – the current operation of the plant.

The results also showed that the scrubber has the potential to reduce concentrations to below 2,000 OU/m^3. The quantitative results from this testing have been found to be consistent with the in-house testing undertaken by Addiction Foods. AECOM therefore has confidence that the scrubber will provide a significant reduction in off-site odour once an appropriately sized scrubber has been commissioned. Based on the testing results AECOM has conservatively based its atmospheric dispersion modelling for the Phase 2 scenario on an outlet concentration of 2,000 OU/m^3.

Table 2 Pilot Scrubber Test Results (2 September 2019)

Sample	Sample Location	Odour Concentration (OU/m^3)	Odour Character
1	Pilot Plant Inlet	2,317	Moderate Meaty Odour
2	Pilot Plant Outlet	911	Moderate Chemical Odour
3	Pilot Plant Inlet	41,224	Very Strong Fishy Odour
4	Pilot Plant Outlet	1,750	Moderate Chemical Odour with a slight fish odour
5	Pilot Plant Inlet	4,784	Strong Meaty Odour
6	Pilot Plant Outlet	1,414	Moderate Chemical Odour

9.0 Atmospheric Dispersion Modelling Methodology

Using a CALMET meteorological data set provided by BOPRC for the three-year period 1 January 2014 to 31 December 2016 off-site concentrations of odour associated with main process emission stack were predicted using the atmospheric dispersion model CALPUFF.

9.1 Modelled Scenarios

Three scenarios have been developed which are based on: the existing plant configuration and Phases 1 and 2, as discussed in Section 7.0 and summarised below.

- **Existing Scenario**– Current Plant Configuration – No dilution air and stack height of 23.4 m above ground level.
- **Phase 1 Scenario** – Introduction of dilution air at a ratio of 4 parts fresh air to 1 part process air and an increase in the height of the stack to 33.4 m above ground level. The stack discharge point will also be fitted with a taper to increase the discharge velocity to 20 m/s.
- **Phase 2 Scenario** – Installation of a wet scrubber to reduce odour to a concentration less than 2,000 OU/m^3. The discharge stack will be the same as Phase 1, however no dilution air is added. This scenario also accounts for increased production and assumes a maximum airflow of 40,000 m^3/hr.

The discharge parameters incorporated into the modelling assessment are presented in Table 3.

Table 3 Assessment Scenario Model Parameters

Scenario Description	Existing	Phase 1	Phase 2
Stack Height (m)	23.4	33.4	33.4
Stack Discharge Flow Rate (m^3/s)	3.5	17.5	11.1
Oven Flow Rate m^3/hr	12,600	12,600	40,000
Dilution Flow Rate m^3/hr	0	50,400	0
Flow Rate (m^3/hr)	12,600	63,000	40,000
Oven Odour Concentration (OU/m^3)	6,000	6,000	2,000
Discharge Odour Concentration (OU/m^3)	6,000	1,500	2,000
Velocity (m/s)	12.4	20	20
Stack Area (m^2)	0.283	0.866	0.554
Stack Discharge Diameter	0.600	1.050	0.840
Odour Emission Rate (OU/s)	21,000	21,000	22,222

9.2 Atmospheric Dispersion Modelling

CALPUFF (Version 7) has been used extensively in New Zealand and Australia and is a recommended model in the MfE GPG ADM particularly for sites surrounded by complex terrain and where sea-breeze conditions are likely to occur. CALPUFF is a United States Protection Agency (US EPA) approved atmospheric dispersion model and is a recommended model in the MfE GPG. CALPUFF has been used extensively in New Zealand and Australia, particularly in complex topographical situations and/or in coastal settings.

The CALPUFF model was set up in accordance with the guidance contained in MfE GPG ADM.

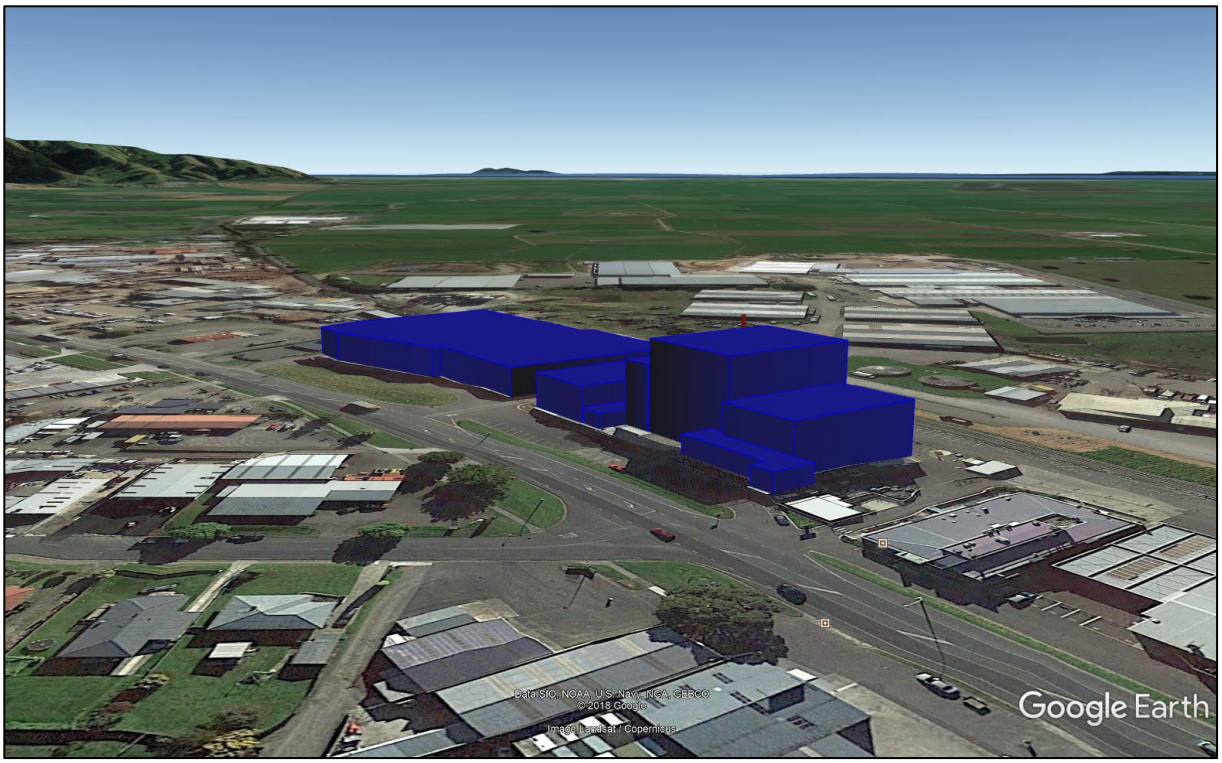
The CALPUFF model is designed to simulate the continuous discharges (characterised as a series of puffs) emitted from a source into the ambient wind flow. As wind flow changes hourly (in both speed and direction), the path each puff takes follows the new wind flow direction. Puff diffusion follows a normal (Gaussian) distribution, and concentrations are based on the contributions of each puff as it passes over or near a receptor point.

CALPUFF is a non-steady state Lagrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. In other words, the model can simulate the effects of time and space-varying meteorological conditions on contaminant transport, transformation and removal.

The meteorological data required by CALPUFF was provided by BOPRC and covered the period 1 January 2014 to 31 December 2016. No alterations or adjustment to the dataset have been made.

The terrain elevation data was extracted from the CALMET data set and incorporated into the model. Figure 13 presents a 3D model of the buildings incorporated in the CALPUFF model.

Figure 13 3D model of the buildings and stacks incorporated into the CALPUFF Model



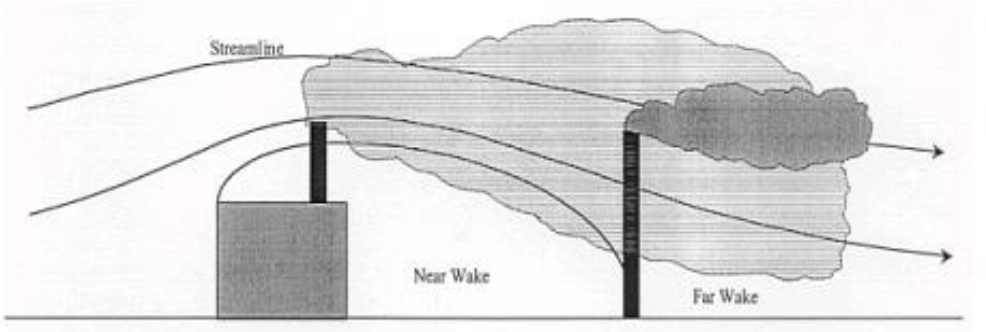
9.2.1 Building Downwash Explanation

To determine the effects of building downwash, building dimensions were entered into the Building Profile Input Program (BPIP) Plume Rise Model Enhancements (PRIME) model incorporated within CALPUFF. BPIP-PRIME was used to simulate the building downwash effects in accordance with the requirements of the MfE GPG ADM.

"Airflow around buildings is - short stacks in the wake of a building can result in much higher ground-level concentrations close to the source than the model would otherwise predict." MfE GPG ADM

This is illustrated in Figure 14.

Figure 14 Building Downwash Turbulence Zones



Source: Schulman et al., 2000

9.3 CALPUFF Model Domain

A summary of the computational and receptor grids used in the modelling assessment are provided in Table 4.

Table 4 CALPUFF Computational and Discrete Receptor Grids

Grid	Center Coordinates (NZTM)		Grid Spacing (m)	Grid Extent X by Y (km)
	X (m)	Y(m)		
Computational Grid	1,889,605	5,816,750	180	18 x 18
Receptor Grid	1,891,891	5,813,520	100	3 x 3

10.0 FIDOL Assessment Methodology

A qualitative assessment of the potential effects associated with the proposed activities is required to determine the potential for the activities to generate odour that might affect the neighbouring community. This is undertaken in accordance with the MfE GPG Odour and BOPRC – RNRP (AQ) using the Frequency, Intensity, Duration, Offensiveness and Location (**FIDOL**) assessment tool. These factors are explained in detail below:

- Frequency; relates to how often an individual is exposed to the odour. To determine the frequency, three parameters need to be established:
    1. the direction of sensitive receptors - relative to the odour discharging activities;
    2. the frequency at which the wind blows in this direction with sufficient strength that odour can be carried; and
    3. the frequency of odour discharges. AECOM considers that the significance of occurrence frequency for wind conditions which may cause odour to be low when the frequency is between 0% and 5%; moderate when the frequency is between 5% and 10% and high when the frequency is above 10%.
- Intensity: is the strength of the odour that is likely to be experienced at any potential receptor.
- Duration: is the amount of time that a receptor is exposed to odour. Combined with frequency, this indicates the exposure to odour. The duration of odour emissions, like its frequency, is related to the source type and discharge characteristics, meteorology and location. The longer the odour detection persists in an individual location, the greater the level of complaints that may be expected.
- Offensiveness: is a subjective rating of the unpleasantness of the effects of nuisance odour.
- Location: is the type of land use and the nature of human activities in the vicinity of odour source. The same process in a different location may produce more or less odour depending on local topography and meteorological conditions.

11.0 Assessment of Environmental Effects

11.1 Atmospheric Dispersion Modelling Assessment

AECOM has modelled odour discharges for the three scenarios presented in Section 9.1 and compared predicted off-site concentrations with the odour assessment criteria of 2 OU/m³. The results from the modelling assessment are presented in the following section.

The maximum predicted 99.5%ile and 99.9%ile 1-hour mean odour concentrations for the three scenarios are presented in Table 5, and are compared with the relevant assessment criteria of 2 OU/m³. A graphical presentation of the maximum predicted 99.5 %ile 1-hour mean odour concentrations associated each scenario are presented in Appendix A Figures 1 to 3.

Table 5 Predicted Off-site odour concentrations for the various scenarios assessed

Scenario Description	Existing	Phase 1	Phase 2
Maximum Off-site 99.5%ile Odour Concentration	4.0	0.4	0.5
Maximum Off-site 99.9%ile Odour Concentration	4.1	0.5	0.7
Maximum 99.5%ile Odour Concentration at a Residential Receptor	2.0	0.3	0.5
Maximum 99.9%ile Odour Concentration at a Residential Receptor	2.2	0.4	0.7

The results from the existing scenario show that the plant has the potential to create off-site odour nuisance, particularly if the plant was to produce the fish-based product, which produced odour concentrations seven times higher than what is considered typical.

The results of modelling show that the implementation of Phases 1 and 2 will make a substantial difference to the 99.5%ile off-site odour concentration. With Phase 1 and Phase 2 providing an approximate 90% reduction in off-site odour and an 80% reduction in odour at the nearest residential locations.

Based on the results of atmospheric dispersion modelling and providing the odour discharge rates are in general accordance with the values input into the model there is limited potential for odour discharges to cause off-site odour nuisance once the mitigation measures are implemented.

AECOM has been advised that Addiction Foods is currently considering the feasibility of expediating the implementation of Phase 2 and forgoing Phase 1. If this is the case, AECOM consider that it will make no difference from an assessment perspective as both options are predicted to provide off-site odour concentrations below the assessment criteria.

11.2 Odour Assessment of Addiction Foods - FIDOL assessment

It is generally accepted that odours associated with pet food manufacturing are considered unpleasant by the general population, and therefore the manufacturing plant and odour treatment systems need to be operated appropriately in order to minimise any air discharges.

However, it is AECOM's experience that even with all appropriate mitigation measures in place there is the potential that from time to time odours may be detectable off-site. Consequently, AECOM considers that it is appropriate to use the FIDOL assessment tool to determine whether there is the potential for these odours to be considered offensive and objectionable.

This assessment is based on the implementation of the mitigation measures described in Section 7.0, namely Phase 2. The results of atmospheric dispersion modelling suggest that off-site concentrations post implementation of Phase 1 will be similar to Phase 2, with any difference in off-site odour unlikely to be significant.

11.2.1 Frequency

Frequency relates to how often odours will be experienced at an off-site receptor. In terms of odour from the operations at Addiction Foods, odour emissions are dependent on the type of product being manufactured, with some products generating more odour than others. Therefore, the frequency at which odour could be detected at the neighbouring property will be a combination of the odour from the Site and certain meteorological conditions, such as those which produce poor dispersion conditions.

Fugitive odours can often be experienced off-site when wind speeds are less than 3 m/s. Odours discharged from stacks have the potential to be experienced off-site during any wind speeds, however the complaint data shows that approximately 90% of complaints were made during periods when the wind speed was less than 3 m/s. Based on the meteorological data presented in Section 4.2 the prevailing winds are from the west, west southwest, north, north northeast and south. The occurrence of poor dispersion conditions (wind speed less than 3 m/s) for prevailing winds from these directions occur at 8.5, 9.6, 5.8, 5.9 and 8.9 % of the time, respectively. This indicates that the frequency of poor dispersion conditions which could cause off-site sensitive receptors to experience odour from the Site is considered to be moderate to high, when calm conditions are also considered.

11.2.2 Intensity

Intensity relates to the strength of odour that is likely to be experienced at any potential receptor. Odour associated with the production of pet food can have a strong intensity and can be considered offensive and objectionable, if undiluted. The intensity is also related to the wind conditions and the resulting level of dilution that occurs between the source and the receptor. In essence, the stronger the wind, the more dilution will occur and the greater the distance between the odour source and receptor the less likely the receptor will experience undiluted odour.

The odours are discharged via a single stack which due to its height and the proposed mitigation measures, such as injection of dilution air, increased stack height to mitigate downwash effects and the installation of a wet scrubber, will reduce the odour to a level where it is unlikely to be of sufficient strength at off-site receptor locations that it would be considered offensive or objectionable.

Based on AECOM's experience and the complaint data, receptors located beyond 500 m from the odour source are unlikely to experience significant odour from the Site.

11.2.3 Duration

Duration relates to the length of time that odour discharges are likely to occur. The potential for odour to be experience off-site, that could be considered offensive or objectionable, is therefore related to periods of time where there is a malfunction in the systems used to control odour discharges, namely the dilution fan or operation of the wet scrubber.

AECOM would therefore expect Addiction Foods to install the necessary monitoring equipment and alarm systems to be immediately notified should a failure occur and therefore remedy the failure in a timely manner. In AECOM's experience, assuming appropriate control systems and alarms it should take no longer that 1 hour to identify and respond to an issue with the system. Should the equipment not be able to be repaired within a reasonable amount of time, AECOM would expect that Addiction Foods would stop production and not restart until the system has been remedied.

11.2.4 Offensiveness

If strong undiluted odours were experienced off-site, they could be considered as offensive by a member of the public. AECOM considers that odour emissions from the process have limited potential to result in offensive and objectionable odour off-site, providing that the mitigation measures identified in Section 7.2 are implemented. This is demonstrated by the results of atmospheric dispersion modelling which shows that off-site concentrations once the proposed mitigation measures are implemented are predicted to be well below the relevant odour assessment criteria.

11.2.5 Location

To a large extent the location of the source in proximity to sensitive receptors is possibly the most important of the FIDOL factors. In this instance due to the fact that even if odours are generated there is the potential for adverse effects as a number of receptors are located close to The Site.

In this case, there are sensitive receptors in most directions, with the closest sensitive receptors located to the southwest and less than 100 m from The Site. Given the close proximity of the nearest sensitive receptors and the frequency of winds that have the potential to blow undiluted odours towards these receptors it is imperative that the odour mitigation measures are implemented and should there be a failure in the control equipment that this be remedy as quickly as possible, or if it is not able to be repaired immediately the plant is shutdown.

11.2.6 FIDOL Conclusion

Taking all the factors into account, it is unlikely that odours from Addiction Foods will have the potential to be considered offensive or objectionable, once the proposed mitigation is implemented.

Based on the number of complaints it is clear that there is often a low level of odour associated with The Site in the surrounding environment, however this odour is seldom considered to be offensive or objectionable. Given that the proposed mitigation measures will reduce off-site odour concentrations at nearby receptor locations by up to 80% any odours experience off-site will be significantly lower that currently experienced. Furthermore, the results of dispersion modelling predict that off-site concentrations will be well less that the MfE GPG Odour assessment criteria and therefore offensive or objectionable off-site odour is unlikely to occur.

11.3 Cumulative Effects

There is the potential for cumulative effects to occur if significant odour from Sunday Pets during north westerly winds, the plumes combined with those from Addiction Foods. However, given that Sunday Pets is 450 m from the receptors to the west of Addiction Foods and considering that off-site odour from Addiction Foods, post implementation of odour control measures is predicted to be low. AECOM therefore considers that the potential for cumulative effects is likely to be low.

12.0 Conclusion

The existing operation of Addiction Foods manufacturing plant has the potential to cause odour complaints on occasions, depending on the coincidence of certain products being manufactured and/or the occurrence of worst-case meteorological conditions. It has therefore been determined that the odour treatment system needs to be upgraded. Given the lead-time to install a wet scrubber, Addiction Foods intends to install additional mitigation measures progressively with the first phase consisting of increasing the stack height and installing a dilution air injection system on the roof. The second phase will consist of installing a large wet scrubber which will be designed to treat the full air flow from the existing process and any increases in production, should this occur in the future.

AECOM undertook a round of testing on the pilot plant scrubber currently being evaluated and concluded that the technology can significantly, and reliability reduce odour discharge concentrations for a range of pet food products

AECOM has assessed the potential for odour effects to occur from the operation of Addiction Foods manufacturing plant using both quantitative and qualitative odour assessment tools and has determined that once the proposed odour mitigation measured are implemented there is limited potential for offensive and objectionable off-site odour. This assessment is supported by the results of atmospheric dispersion modelling which predict maximum offsite odour to reduce by 80 to 90%, with predicted 99.5%ile concentrations approximately a quarter of the odour assessment criteria.

The proposed installation of a wet scrubber is considered to be the most appropriate odour control technology given the site constraints, and represents best practice in terms of controlling pet food odours. The proposed system will provide Addiction Foods with a high degree of control over odour emissions and when implemented will significantly reduce the potential for complaints to occur.

Once the mitigation measures are implemented, AECOM considers that the effects from the manufacturing plant will be less than minor.

13.0 Limitations

AECOM New Zealand (AECOM) has prepared this Assessment of Effects Report on discharges to air in accordance with the usual care and thoroughness of the consulting profession of Addiction Foods NZ Limited for the use in a statutory process from the Bay of Plenty Regional Council under the Resource Management Act 1991 for activities undertaken at 240 Jellicoe St, Papamoa Beach, Te Puke 3119, New Zealand.

Except as specifically stated in this section, AECOM does not authorise the use of this Report by any third party except as provided by the Resource Management Act 1991.

Nor does AECOM accept any liability for any loss, damage, cost or expenses suffered by any third party using this Report for any purpose other than that stated above.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated July 2019.

Where this Report indicates that information has be provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in this Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared during November 2019 and is based on the conditions encountered and information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

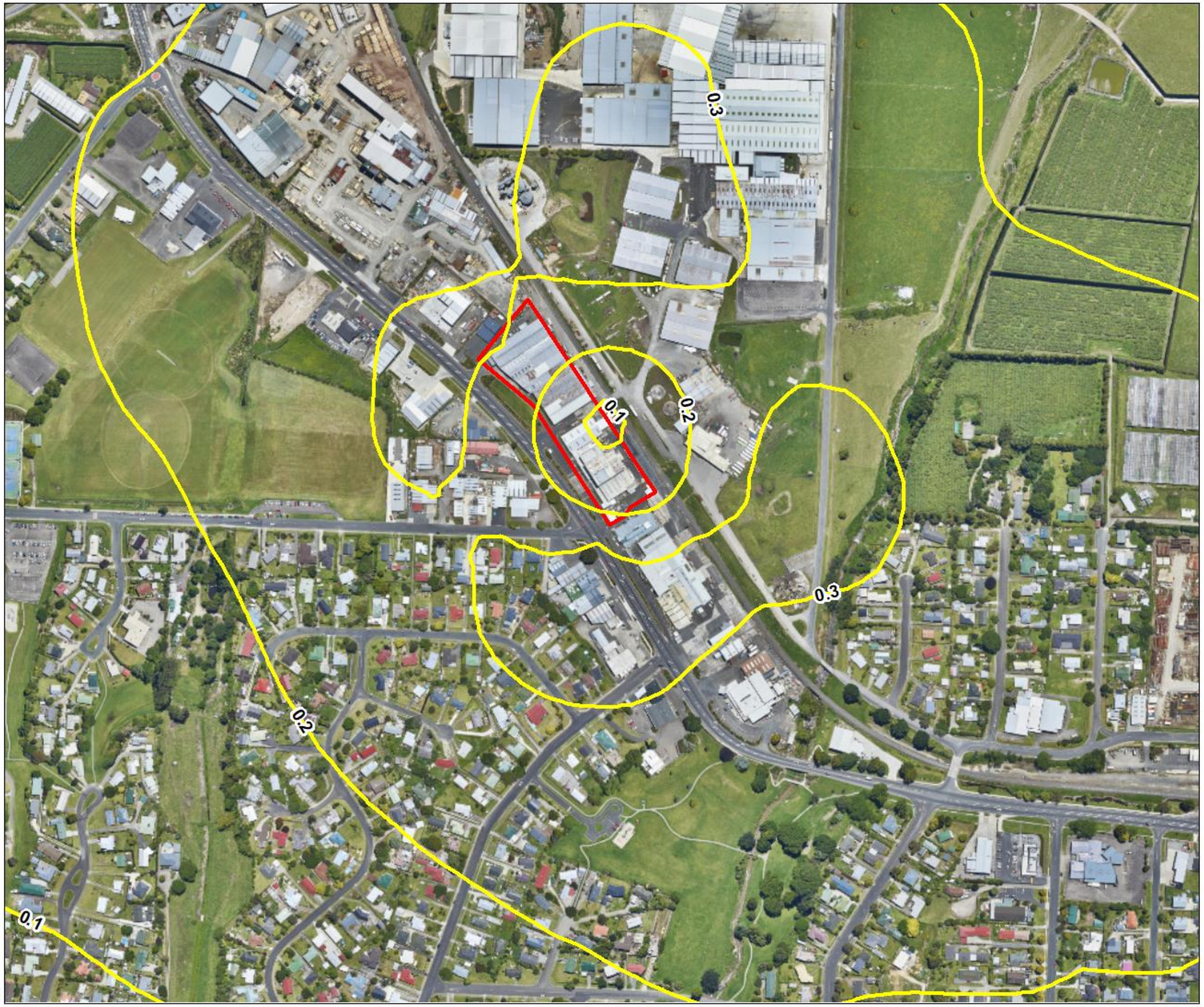
Appendix A

Odour Contour Plots

Figure 1: Existing Scenario – 99.5%ile 1-hour average Odour Contour Plot

Figure 2: Phase 1 Scenario – 99.5%ile 1-hour average Odour Contour Plot

ISO A3 297mm x 420mm



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AECOM

PROJECT
Addiction Foods - Air Quality Assessment

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SPATIAL REFERENCE
Scale: 1:3,625 (A3 size)

0 20 40 80 120 160 m

Map features depicted in terms of NZTM projection.

Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2016

PROJECT MANAGEMENT

Approved	AFC	Date	5/11/2019
Checked	PWS	Date	5/11/2019
Designed	CYS	Date	5/11/2019
Drawn	CYS	Date	5/11/2019

ISSUE/REVISION

Rev	Date	Description
A	5/11/2019	Final

KEY PLAN

PROJECT NUMBER
60611298

SHEET TITLE
Phase 1 Scenario
99.5%ile Odour Contour Plot

MAP NUMBER
2

Figure 3: Phase 2 Scenario – 99.5%ile 1-hour average Odour Contour Plot