UNDER the Resource Management Act 1991 ("RMA")

IN THE MATTER of Proposed Waikato District Plan (Stage 1) Hearing 25 – Zone Extents

STATEMENT OF EVIDENCE OF ANDREW FERGUSON CURTIS ON BEHALF OF 2SEN LTD AND TUAKAU ESTATES LIMITED

[Submission 299]

AIR QUALITY

1. INTRODUCTION

1.1 My full name is Andrew Ferguson Curtis. I am a Technical Director at Pattle Delamore Partners specialising in Air Quality. I am a Chemical Engineer with over 30 years' experience. I have specialised for over 23 years in air quality, providing advice to clients in New Zealand, Australia and overseas.

Experience

1.2 I have Bachelors Degree in Chemical and Materials Engineering from Auckland University, a Post Graduate Certificate in Sustainable Management from the Open Polytechnic and a Post Graduate Diploma in Toxicology (with Distinction) from RMIT University. I am a Certified Air Quality Professional and an approved Hearing Commissioner.

1.3 I have extensive experience in dealing with the issue of reverse sensitivity as it relates to air quality, with some of my recent experience as follows:

(a) Preparing an assessment of the potential reverse sensitivity effects of a proposed rezoning of rural land on Geraghtys Road in Tuakau as part of this district plan review process.

(b) Preparing an assessment of the potential reverse sensitivity effects of a proposed rezoning of rural land in Pokeno as part of this district plan review process.

(c) Preparing an assessment on reverse sensitivity impacts for Villa Maria in relation to a proposed private plan change in Auckland.

(d) Preparing reports and evidence on the potential reverse sensitivity issues associated with establishing a child care facility adjacent to an industrial area.

(e) Presenting evidence to a council hearing and the environment court on the potential reverse sensitivity issues associated with establishing light industrial units incorporating worker accommodation within an industrial area.

Involvement in the Proposal

1.4 I have been commissioned by 2Sen Ltd and Tuakau Estates Ltd ("**the Submitters**") to prepare this statement of evidence to address matters raised by the Submitters' submission on the proposed Waikato District Plan (Stage 1) ("**PWDP**") seeking the rezoning of the balance of their properties at 48 and 52 Dominion Road, Tuakau to the General Residential Zone ("**Rezoning Request**" and "**Properties**"). In particular, I have been asked to prepare evidence addressing the potential implications for the Rezoning Request in relation to potential incompatibility of residential uses of the Properties with existing industrial activities at Bollard Road to the south of the Properties.

1.5 I was engaged at my previous employer[1] by the Submitters to prepare a report[2] ("**Report**") on the issues identified above as part of the Plan Change 16 (Tuakau Structure Plan) process. While that plan change process was subsequently abandoned by the Waikato District Council ("**WDC**"), the documentation prepared for that process has been incorporated into the wider district plan review.

1.6 I have read all of relevant documents associated with the PWDP, and also considered changes that have occurred in the area since I prepared my

[1] AECOM New Zealand Limited

[2] AECOM New Zealand Limited, Tuakau Air Quality Assessment, August 2016

Report and consider that the findings in it are still appropriate as are the conclusions reached.

1.7 I have appended a copy of my report as **Attachment A**.

1.8 I am familiar with the area and most recently visited it on 6 October 2020.

Code of Conduct

1.9 I confirm that I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing this evidence and agree to comply with it while giving evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

Scope of Evidence

1.10 My evidence will address the following:

(a) What is Reverse Sensitivity

(b) What is the need for Separation

(c) Existing Separation Distances

(d) Council Proposed Separation Distance

(e) My Recommended Separation Distances

(f) Comments on Section 42A Report

(g) Conclusions

2. EXECUTIVE SUMMARY

2.1 I have reviewed the potential for the rezoning of the Properties to result in reverse sensitivity effects on the Bollard Road industrial area.

2.2 It is my opinion that the separation provided within the Rezoning by the proposed "amenity yard", and additional scrutiny of any proposed residential activities within that amenity yard, is sufficient to minimise the potential for air quality related reverse sensitivity effects to arise from the

residual emissions that might arise from the lawful operation of industrial activities within the Bollard Road industrial area.

3. REVERSE SENSITIVITY

3.1 One of the issues identified within the Section 32A -17 report, and also the Tuakau Structure Plan which provides the basis for providing a buffer between the industrial zone and residential zones in the proposed District Plan is to "*reduce reverse sensitivity effects*" for industry.

3.2 There is no definition of reverse sensitivity in the proposed Plan, and as it is one of the keys to the proposed zoning it is important to understand what it means.

3.3 There is a definition[3] in the Franklin section of the Operative Plan which states:

REVERSE SENSITIVITY is used to refer to the effects of the existence of sensitive activities on other activities in the vicinity, particularly by leading to restraints in the carrying on of those other activities. An example of this would be where the establishment of an educational facility in proximity to a long established manufacturing plant caused the closure of the manufacturing plant as a result of the adverse effects of odour and noise.

3.4 This definition is generally acceptable, although I do note the following in terms of my understanding of reverse sensitivity effects:

(a) It is the introduction/intensification of sensitive activities near existing lawfully established effects-generating activities which gives rise to reverse sensitivity effects, rather than the "existence" of the sensitive activities. For example, the establishment of a new industrial activity near existing residential activity, giving rise to complaints from those existing residents, is **not** an example of reverse sensitivity.

(b) The example attached to the definition, while consistent with the above, provides a very black and white picture of the potential results, which I do not consider is always appropriate. Reverse

[3] Operative Waikato District Plan, Franklin Section, Part 50 Definitions

sensitivity effects can include incremental and adverse constraints on effects-generating activities that fall short of requiring the outright cessation of the activity.

3.5 Further, in New Zealand all discharges to air from industrial or trade premises are prohibited by Section 15 (1)(c) of the Resource Management Act 1991 (**RMA**) unless they are expressly allowed by a national environmental standard or rule in a regional plan. Section 15 subsections (2) and (2A) similarly deal with discharges from other sources.

3.6 There is also a definition in the Waikato Regional Policy Statement[4] which states:

Reverse sensitivity – is the vulnerability of a lawfully established activity to a new activity or land use. It arises when a lawfully established activity causes potential, actual or perceived adverse environmental effects on the new activity, to a point where the new activity may seek to restrict the operation or require mitigation of the effects of the established activity"

3.7 Consequently, if an industrial or trade premises had a discharge that was not consented or it was not complying with its resource consent in relation to any air discharges, a requirement to cease or mitigate the effects of the discharge on sensitive activities nearby would also not comprise a reverse sensitivity effect.

4. WHAT IS THE NEED FOR SEPARATION

4.1 As has already been mentioned the intent of some form of separation distance between new residentially zoned land and existing lawfully-established effects-generating activities is to avoid the potential for reverse sensitivity effects. In my experience such effects primarily occur as a result of dust or odour emissions from in this case industrial activities. Chapter 20 in the PWDP sets out the rules for the Industrial zone. It is

[4]Waikato Regional Council Regional Policy Statement for the Waikato Region 4 December 2018

generally permissive for industrial activities, with the exception of waste management facilities which are discretionary.

4.2 However, in addition to PWDP requirements there is also a need in accordance with the RMA for any activity with discharges to air to comply with the Waikato Regional Council's ("**WRC**") Waikato Regional Plan ("**WRP**"). Chapter 6 of the WRP sets out the rules relating to discharges to air.

4.3 Broadly speaking the WRP is also permissive although it does set out in Rule 6.1.9.2 a non-exclusive list of industrial and trade premise activities which are discretionary. Based on my experience, the list includes all of the types of activities that are most likely to experience reverse sensitivity effects due to the types of discharges they emit.

4.4 In addition, all activities, including those specifically identified as being permitted in Rule 6.1.9.1 must meet the standard conditions set out in Section 6.1.8 which are as follows:

a *There shall be no discharge of contaminants beyond the boundary of the subject property that has adverse effects on human health, or the health of flora and fauna.*

b *The discharge shall not result in odour that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the subject property.*

c *There shall be no discharge of particulate matter that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the subject property.*

d *The discharge shall not significantly impair visibility beyond the boundary of the subject property.*

e *The discharge shall not cause accelerated corrosion or accelerated deterioration to structures beyond the boundary of the subject property.*

4.5 Consequently, regardless of whether an activity has an air discharge that is permitted or requires a resource consent, the outcome from an air quality point of view should be broadly the same, which is that there

should be no offensive or objectionable odour or dust effects, and consequently no potential to experience reverse sensitivity effects.

4.6 That having been said there is always some potential for industrial activities to generate some characteristic low level odours that are detectable in close proximity, for example a yeasty odour near a bakery or a pine like odours near sawmills, or low level dust as vehicles move over surfaces.

4.7 Therefore, there is merit in having some separation between these industrial activities and residential activities where practical, to avoid effects from these residual emissions.

5. EXISTING SEPARATION DISTANCES

5.1 Based on the information in my Report, my most recent site visit and the most recent aerial photography, I have looked at the distance between existing residential properties and existing industrial activities located within the area that will be encompassed by the Tuakau/Whangarata industrial area. These range from 140 metres for properties located on Moira Drive to the north, to 350 metres from properties in the new Riverside Grove to the east.

5.2 While the Riverside Grove subdivision has only recently occurred, the Moira Drive Subdivision has been in place for almost 10 years, and has not resulted in any reverse sensitivity effects or complaints in relation to activities within the industrial zone as far as I am aware.[5]

5.3 Given that the Moira Drive subdivision is immediately adjacent to the Submitters' Properties, I consider it represents an appropriate example of

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[5] I have been provided, through counsel, with details of complaints received by WRC in relation to the "Bollard Road industrial area" over the last ten years. Complaints received all relate to the Waste Oil facility at 136 Bollard Road, some 800 metres away from the southern boundary of the Properties, but close to other existing rural residential properties which appear likely to be the key source of complaints. These complaints would appear to indicate that there have been issues of odour management associated with that facility, but there is nothing to suggest that any odour effects are experienced as far away as the Moira Drive subdivision, or might be experienced at the Properties.

a buffer for this location, particularly when considering the difference in elevation between the Submitters land and the Industrial zone.

6. COUNCIL PROPOSED SEPARATION DISTANCES

6.1 The proposal in the PWDP was first put forward in the Tuakau Structure Plan and the now withdrawn Plan Change 16 and proposed an approximate[6] 300 metre buffer between the Bollard Road Industrial area and any proposed residential areas on Dominion Road.

6.2 The basis for selecting this distance is a report prepared for WDC by Tonkin & Taylor[7] which reviewed various international documents, primarily from Australia.

6.3 In Section 2.5 of that document it indicates that the approach it adopted was the VicEpa "urban" method to define what the separation distance was. This approach, as shown in Figure 2.1 of that document (reproduced as Figure 1) requires the activity generating the effect to internalise some of the effects within its property. I consider that this approach is appropriate.

6.4 The Tonkin & Taylor report goes on to state the following:

The measurement approach described above does not take account of the potential for expansion of an industrial activity in the future. However, if the separation distance were measured from the property boundary of the industrial site this would fully externalise the separation distance and could be seen as unnecessarily limiting the use of land outside the industrial site when the likelihood and nature/scale of any future expansion is unknown.

It is also noted that changes to the activity area on industrial site would usually require an amendment to the resource consent for discharges to

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[6] Based on Plan 7.2 Tuakau East in the propose Plan, the separation distance varies between 250 and 350 metres on the Submitters land.

[7] Tonkin & Taylor Ltd, Tuakau Structure Plan – Assessment of Air Quality Effects and Separation Distances, August 2015

air, which would trigger a full re-evaluation of the adequacy of site controls, etc.

In the context of informing decisions about the appropriateness of re-zoning land, the recommended separation distances should be measured from the activity boundary (of the industrial site) to the proposed boundary of the more sensitive zone as this will become the boundary of the nearest sensitive land use.

6.5 Again, I consider that this approach is reasonable, and it is unfortunate that in proposing a separation distance on the Submitters' land WDC does not appear to have adopted the expert advice provided to it. Instead, it has placed the entire separation distance from the northern boundary of the industrial zone on the land of other parties.

6.6 I note that there is no similar separation proposed for the western edge of the Tuakau/Whangarata industrial zone, particularly opposite Coles Road, where it is also proposed to change the zoning of the land from Rural to Residential, or adjacent to the new Riverside Grove residential development where houses will be located less than 60 m from the Industrial zone.

6.7 I am not aware of any air quality related reasons why there would be a difference in approach to providing separation between residential properties and industrial activities at these different locations if the intent of WDC is to avoid the potential for reverse sensitivity effects of residential activities on industry. I note that the Tonkin & Taylor report concluded that a "*separation distance of 250m is recommended as a buffer around the Tuakau/Whangarata Industrial area. This will enable future use of this area for a wide range of industrial-type activities within an industrial zone that provides for a reduced level of amenity. The buffer area would be suitable for a range of light industrial and commercial activities that do not require a high level of amenity."*

6.8 The report then went on to say that this buffer distance could be used for a range of activities that did not require a high level of amenity including:

- Agricultural activities;
- Service stations;

- Warehousing and distribution;
- Indoor service-type activities such as veterinary clinics or fitness centres;
- Light engineering; and
- Light industrial or manufacturing activities (excluding activities such as food production that require high air quality amenity) that do not generate appreciable dust or odour emissions.

6.9 While I do not agree that 250 metres is the appropriate distance, I do agree that if a separation distance is required it should apply equally to all sensitive locations, not just in one particular location.

7. RECOMMENDED SEPARATION DISTANCE

7.1 In my Report I recommended a 150 metre buffer between the industrial zone and the residential land. This recommendation was made on the basis of considering the potential for both dust and odour effects, while taking into the account the WRC permitted activity standards discussed in paragraph 4.4.

7.2 My reasons for reaching this recommendation are summarised in the following paragraphs.

7.3 For dust emissions from yards and general site activities, it is generally accepted that for well controlled sites effects should typically only occur within 50 metres. In stronger wind conditions with little mitigation[8] effects could occur out to approximately 100 metres. However, if effects of this type were occurring on a regular basis the sites would not be meeting the requirements of Rule 6.1.8 (c).

7.4 In addition, based on the topography (there is a 10 to 15 metre difference in height) and the meteorology[9] (see Figure 2), it is considered extremely

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[8] For industrial sites mitigation measures would typically include site watering or gravel placement for unsealed yards, and sweeping or washing for sealed yards.

[9] There is only a very small percentage of winds that blow from the south to south east quadrant towards the Submitters land.)

unlikely that dust from the industrial land would be carried towards the Submitters' land.

7.5 This likelihood is further reduced by the presence of vegetation between the two areas.

7.6 Consequently, I remain of the view that with respect to dust a buffer of no greater than 100 metres is required.

7.7 In terms of odour, my staff undertook a number of odour surveys and were unable to detect anything apart from weak odours associated with the industrial activity in the area. This level of odours is consistent with what I would expect from activities that are meeting the requirements of WRP Rule 6.1.8 (b). I see no reason why this situation should change if further industry were to establish in the area.

7.8 We did detect some weak odours approximately 200 metres downwind to the southeast to the existing industry. This makes sense given the topography, and the fact that the katabatic drainage flows (which are most likely to carry odour) will move away from the elevated terrain. It would be extremely unusual for these very light air flows to travel uphill carrying odours with them.

7.9 Consequently, I concluded that a separation distance of approximately 150 metres would be appropriate in this location.

7.10 I note that as part of the Plan Change 16 process I was involved with discussions with Jenny Simpson from Tonkin & Taylor who was assisting WDC at that time, and we discussed the differences in the recommended distances.

7.11 As I have already mentioned in paragraph 6.3 the Tonkin & Taylor approach was based on measurements from the activity area, while ours was on the Submitters' site.

7.12 We realised when we superimposed these two approaches on the same figure that they essentially gave the same level of separation (see Figure 3).

7.13 Consequently, I do not consider that there is any air quality related reason for the buffer distance contained in the proposed Plan, which is

significantly greater than that considered necessary by the air quality experts.

7.14 My advice in relation to the appropriate setback for managing potential air quality effects has now been incorporated into the Submitters' proposal by the insertion of an "amenity yard" setback into the PWDP, within which restricted discretionary resource consent would be required to establish any sensitive activities, with discretion reserved for the Council to consider on-site amenity values, odour concentrations received at the notional boundary of any residential building and the potential for reverse sensitivity effects.

7.15 In any event as I understand it, much of this land would be marginal for residential development in any event, and I therefore consider the approach proposed by the Submitters to be appropriately conservative. It ensures that adequate separation between the residential areas and industry can be required by the Council at subdivision stage, and therefore meets the requirements of the S42A report to avoid the potential for reverse sensitivity effects.

8. COMMENTS ON SECTION 42A REPORT

8.1 I have reviewed the relevant sections of the Framework Report, and consider that with respects to the Request, the separation distance and "amenity yard" mechanism proposed by the Submitters will be suitable to avoid the potential for conflict between what could be considered incompatible activities.

9. CONCLUSION

9.1 I have reviewed the potential for the rezoning of the Properties to result in reverse sensitivity effects on the Bollard Road industrial area.

9.2 It is my opinion that the separation provided within the Rezoning together with the proposed "amenity yard" mechanism is sufficient to avoid the potential for air quality related reverse sensitivity effects to arise from the residual emissions that might arise from the operation of lawful operation of industrial activities within the Bollard Road industrial area.

Andrew Ferguson Curtis

15 February 2021

Figure 1 Measurement of separation distance (excerpt from Vic EPA Guidelines)

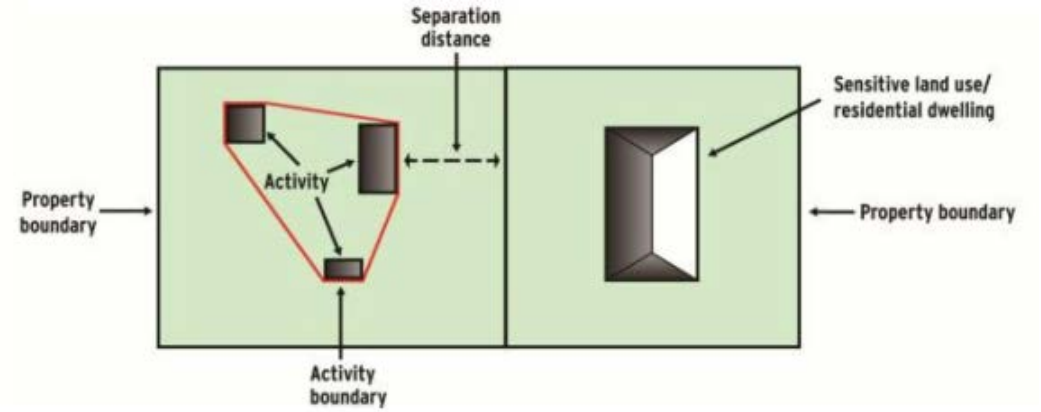


Figure 2 Pukekohe Meteorological Data for the period 1 August 2013 to 31 July 2016

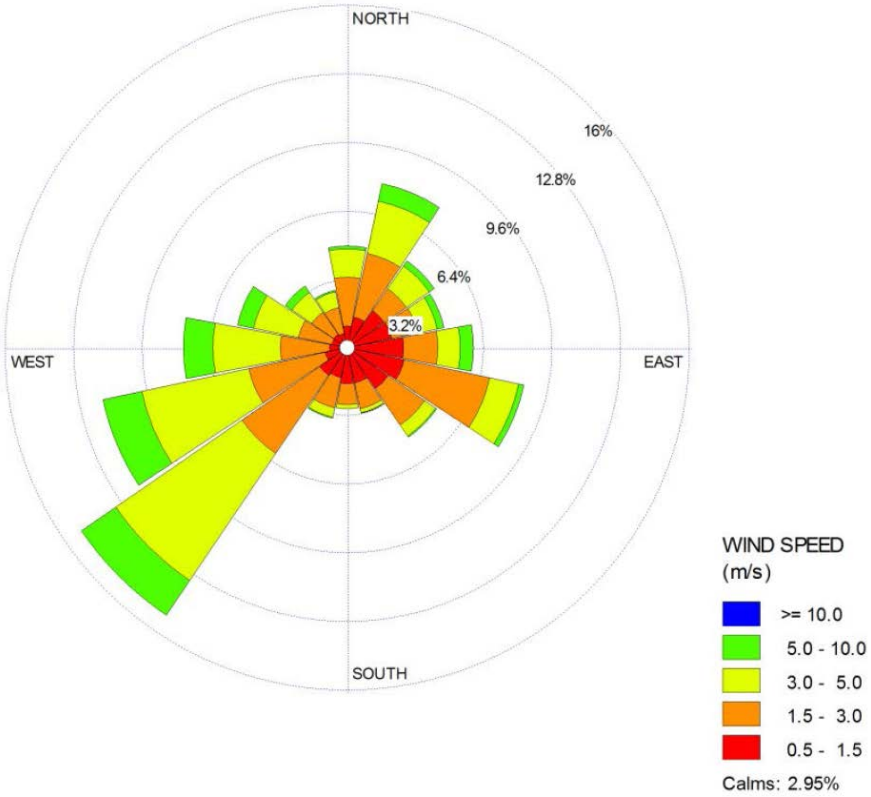
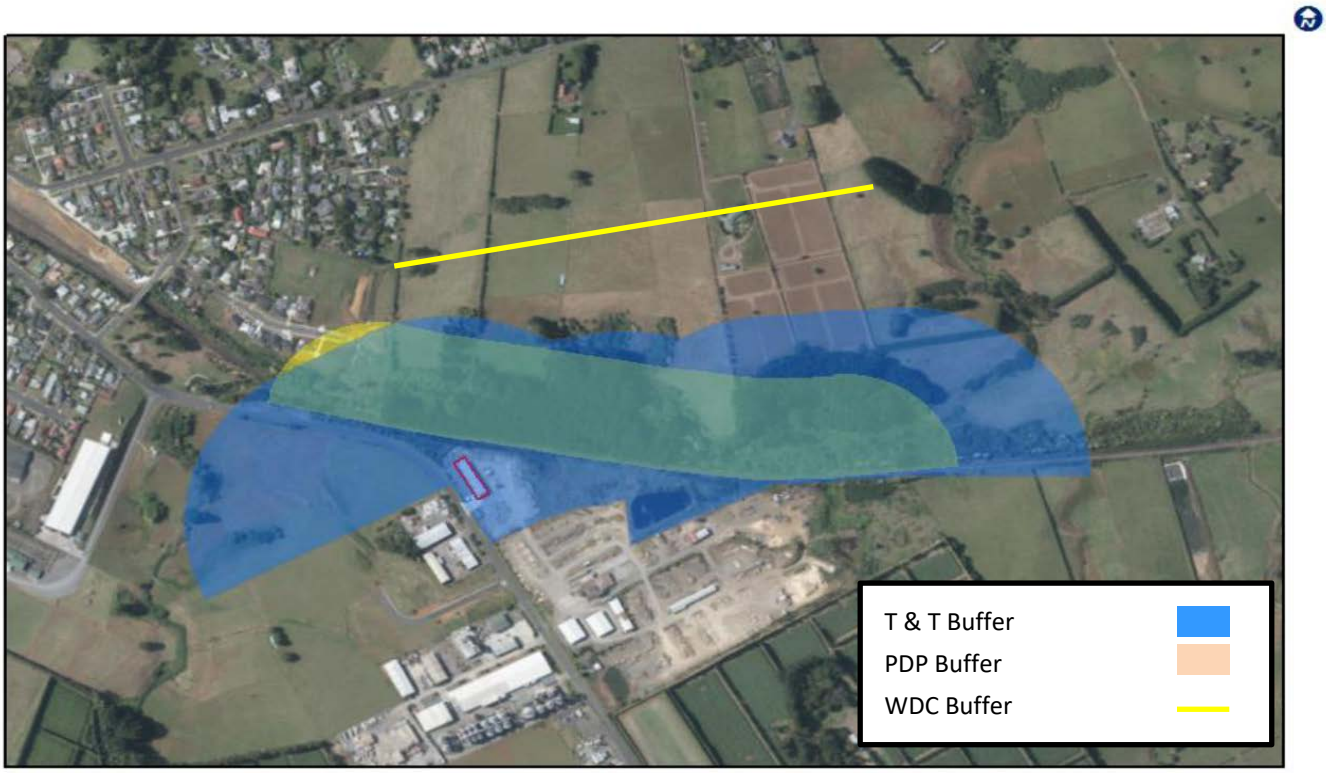


Figure 3 Comparison of Tonkin & Taylor and PDP recommended separation distances.



Attachment A

AECOM

Pacific Engineering Projects Ltd
30-Aug-2016

Tuakau Air Quality Assessment

48 and 52 Dominion Road

Tuakau Air Quality Assessment

48 and 52 Dominion Road

Client: Pacific Engineering Projects Ltd

ABN: N/A

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R01	26-Aug-2016	Draft	Andrew Curtis Technical Director	Andrew Curtis
R02	30-Aug-2016	Final	Andrew Curtis Technical Director	

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1.0 Introduction

AECOM New Zealand Limited (AECOM) has been engaged by Pacific Engineering Projects Ltd (PEP) on behalf of the property owners of 48 and 52 Dominion Road Tuakau to prepare a report which assesses the potential air quality effects associated with local industry on this land, and the use of separation distances between industrial and residential zoned land, to control the potential for reverse sensitivity effects. This assessment will be used to support a submission on the proposed Tuakau Structure Plan Change 16 (PC16) to the Waikato District Plan. PC16 comprises of the rezoning of land around Tuakau for residential and industrial purposes to meet the growth demand, and is based on the 2014 Tuakau Structure Plan developed by the Waikato District Council.

2.0 Background Information

2.1 Site Location

The two properties at 48 (Lot 1 DP 485993) and 52 (Lot 2 DP 371796) Dominion Road (the sites), cover approximately 19 hectares of land. The sites are located approximately 800 m to the east of the Tuakau Town centre. The sites extend from Dominion Road to the north and slope to the south, towards the Bollard Road Industrial Zone. The properties are currently zoned as Rural under the Waikato District Plan. Land directly to the west of the sites is zoned Residential, some of which has houses still in the process of being constructed. The land to the north and east of the sites is zoned as Rural, and is mainly agricultural land with sporadic dwellings spread throughout.

The location of the sites is shown in Figure 1.

Figure 1 General Site Location

Map Source: Open Street Map

2.2 Topography

The sites gently slopes south from Dominion Road toward the Bollard Road Industrial Zone. On the southern boundary of the sites the land drops to create a gully that separates the sites and the Bollard Road Industrial Zone. The gully comprises of pasture, scrub and a large stand of mature pine trees. The sites elevation is approximately 5 m above the Bollard Road Industrial Zone.

2.3 Bollard Road Industrial Zone

The Bollard Road Industrial Zone is directly to the south of the sites. The Bollard Road Industrial Zone is bordered by a railway line to the north and Whangarata Road to the south. Land directly south of the sites is zoned Business (coloured blue in the map below) and this zone is surrounded by Industrial zoning (coloured purple in the map below), with Bollard Road transecting the business park.

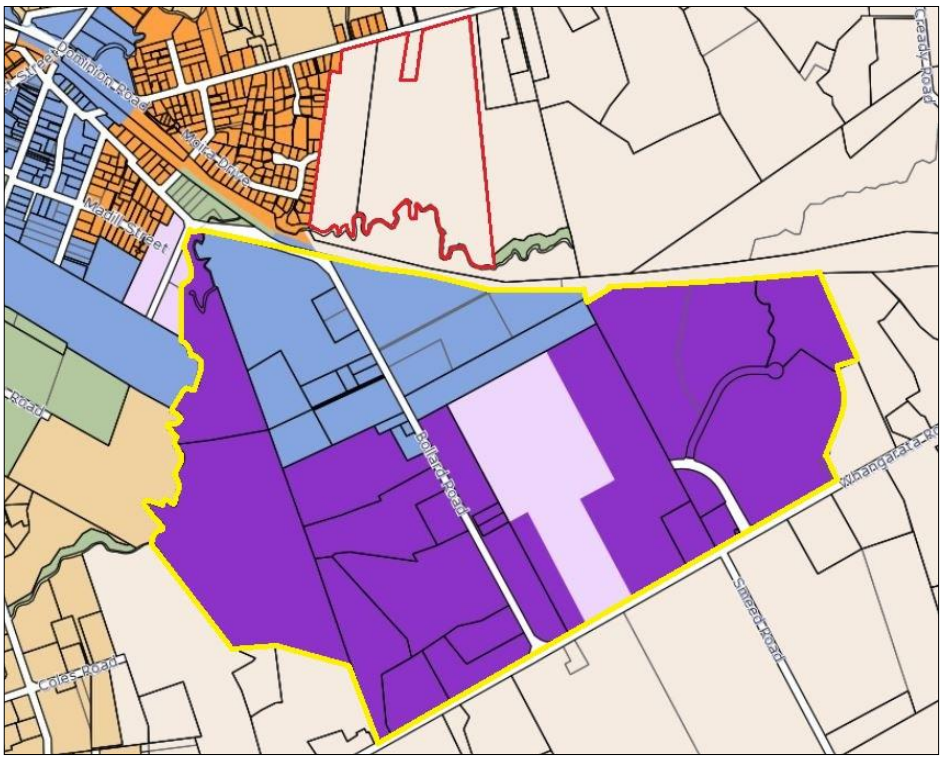
Within the Business and Industrial zoned land there are a number of industrial businesses; Dricon, Tuakau Grain, Fibreglass Tanks and Manufacturing Ltd, Tuakau Timber Treatment and Beams and Timber Direct Ltd (Tuakau Timber).

Currently industries that comply with the Waikato Regional Council Permitted Activity Rules can operate within the Business zone. This could include industries such as; vehicle maintenance, food manufacturing, milk processing, laundering and cleaning facilities. Within the Industrial zone, permitted, controlled and discretionary activities can operate. This could include industries such as; soap manufactures, fertiliser production, and galvanising plants.

Of the industries operating within the Bollard Road Industrial Zone, Dricon and Tuakau Grains have been identified as having resource consents to discharge air containing dust and/or odour. These industries would most likely have conditions imposed upon them, however in addition to these conditions the fundamental requirements of the Resource Management Act (RMA), Regional and District Plans; that no discharge whether odour or dust is objectionable to the extent that it causes an adverse effect at or beyond the boundary.

The current zoning of the sites and the surrounding area is shown in Figure 2. The sites are indicted by the red line; the yellow line indicates the Bollard Road Industrial Zone.

Figure 2 Current zoning around the sites



Map Source: Waikato District Council

2.4 Plan Change 16

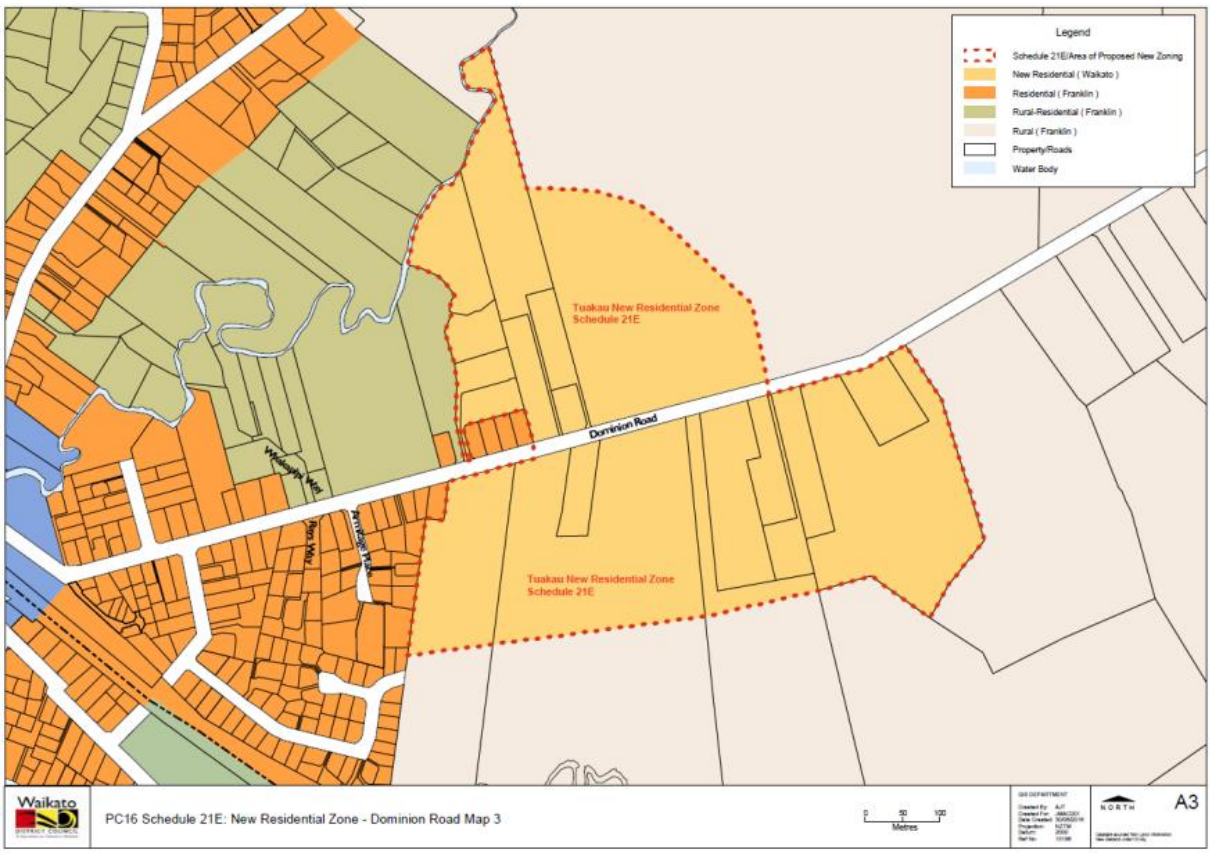
PC16 to the Waikato District Plan (WDP) seeks to change both the Franklin and Waikato Section of the WDP to cater for residential and industrial growth in Tuakau. The under lying document for PC16 is the TSP, which indicates the extent of the structure plan, intended zoning and how development is to be staged between 2016 to 2046.

During the development of this plan, WDC commissioned Tonkin and Taylor (T&T) to provide advice on the air quality effects and separation distance in regards to the TSP. T&T undertook a desktop assessment which considered the local industry, and researched literature both locally and internationally concerning the use of separation distances between industrial sites and residential dwellings. T&T identified a number of industrial sites within Tuakau that have the potential to discharge dust and/or odour. Using Australian guidelines, T&T applied separation distances to each of these industrial activities. Based on the desk top study T&T recommended a separation distance of 250 m around the Bollard Road Industrial Zone. The TSP and subsequently PC16 adopted this recommendation.

Figure 3 and 4 present the proposed zoning for Tuakau. This proposes that part of 48 and 52 Dominion Road would be rezoned from Rural to Residential. A separation zone of at least 300 m between the Bollard Road Industrial Zone and the proposed Residential Zone has been applied. This separation distances comprises of the railway corridor, the gully, and the southern section of the sites. This separation distance is significantly different to other proposed Residential Zones to the west of the existing Industrial Zone, which appears not to have any separation distance.

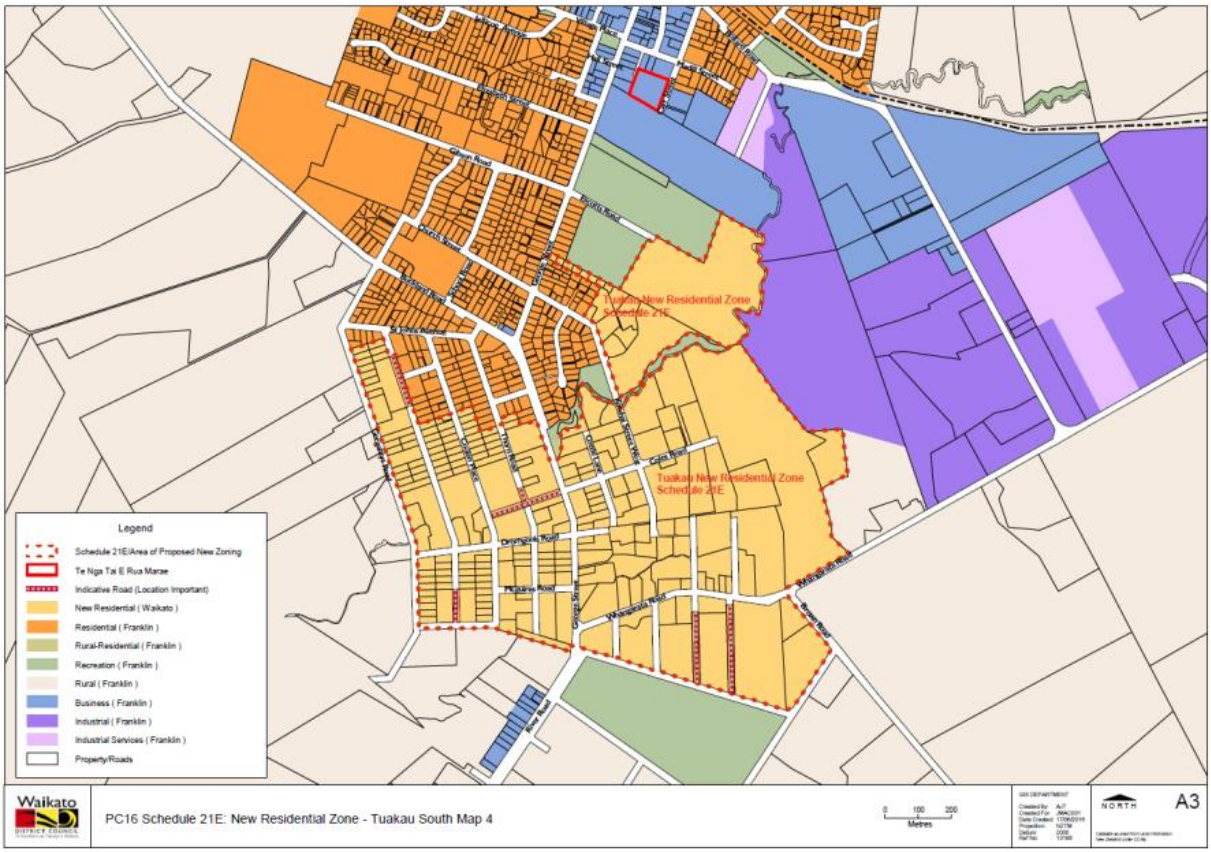
PC16 proposes that the existing Business zoned properties on Bollard Road are included into the industrial zone. This change does not increase the amount of industrial land available, as the existing Business Zone allowed for industrial use provided it was a permitted activity. Currently Tuakau Timber Treatment Limited and other smaller business operate in the Business Zone. This change means that activities that comply with the Waikato Regional Council Discretionary Activity Rules will be able to operate on this land.

Figure 3 Proposed Zoning for the Sites



Map Source: Waikato District Council

Figure 4 Proposed Zoning for Southern Tuakau



Map Source: Waikato District Council

2.5 Existing Separation Distances

Currently within Tuakau, industrial land use does not directly border residential land use. These land uses are separated by a combination of geological features (e.g. gullies), transport routes (roads and rail), and less sensitive land use (e.g. rural, business and light industrial). Under the current District Plan, there are a number of residential properties on Moira Road, Bollard Road and Madill Road that are around 120 to 130 m from land either zoned Business or Industrial in the Bollard Road Industrial Zone. In Figure 4 the proposed new Residential zone to the west of the Bollard Road Industrial Zone appears to be immediately adjacent to the industrial area. This proposed zoning seems to contradict the separation distance planned for the sites. Therefore there appears to be different standards being applied in different areas of Tuakau.

3.0 Assessment of Existing Environment

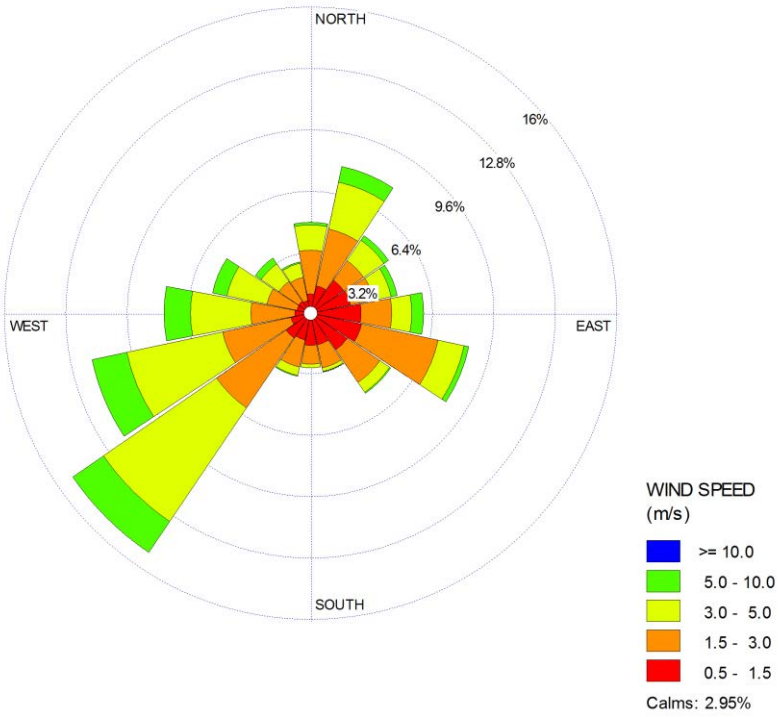
AECOM carried out site investigations to assess actual effects on the sites from the industrial area. The effects on the sites of odour and dust generated by existing activities in the Bollard Road Industrial Zone are discussed in the following sections.

3.1 Local Meteorology

AECOM has reviewed local meteorological data from monitoring stations located close to the proposed site and has used this information to help understand the meteorological conditions in Tuakau. Data from the Pukekohe Weather Station was obtained from the National Institute of Water and Atmospheric Research (NIWA) CliFo data base, a web based system that provides access to New Zealand's national climate database.

The Pukekohe Weather Station is located approximately 10 km northwest of the site, at UTM, Zone 60, 310438m E, 5880300m N. Analysis of the wind data at the Pukekohe Weather Station between 1 August 2013 and 31 July 2016 indicates that the predominant wind directions are from the southwest and west-southwest. Wind data from this station has been presented as a wind rose in Figure 5.

Figure 5 Pukekohe Meteorological Data for the period 1 August 2013 to 31 July 2016



Winds coming from the south-southeast to south would place the sites in a downwind location of the Bollard Road Industrial Zone. Based on the meteorological data, 6.2% of the wind comes from this direction, with no wind from that direction greater than 5 m/s, the wind speed that would be required to carry dust from the Bollard Road Industrial Zone towards the sites. Table 1 presents the distribution frequency of wind speed. The wind sensor at the Pukekohe Weather Station is at 10 m, therefore wind speed at ground level will be lower, due to surface friction effect reducing the wind speed with height decrease. Wind speed of 5 m/s at 10 m would equate to approximately 2.5 m/s at 0.5 m. This means our assessment with respect to wind speeds is conservative.

Table 1 Wind Speed Frequency Distribution

Direction	Wind Speed (m/s)		Total (%)
	0 - 5	>5	
North	4.6	0.1	4.8
North northeast	7.0	0.8	7.8
Northeast	4.7	0.3	4.9
East northeast	4.3	0.3	4.6
East	5.3	0.6	5.9
East southeast	8.2	0.2	8.5
Southeast	5.0	0.1	5.1
South southeast	3.1	0.0	3.2
South	2.9	0.0	2.9
South southwest	3.3	0.0	3.4
South west	13.1	1.9	15.1
West southwest	9.8	1.8	11.7
West	6.3	1.4	7.7
West northwest	4.5	0.8	5.2
Northwest	3.2	0.4	3.5
North northwest	2.7	0.1	2.8

3.2 Odour Observations

Odour observations were undertaken to provide an understanding of existing odours from around the Bollard Road Industrial Zone. Odour observations took place over five days and at different times, to account for different production cycles within in the industrial area and metrological conditions. The findings of the odour observations undertaken on 3, 4, 5, 8 and 9 August 2016 are presented in the following sections.

3.2.1 Methodology

The ambient odour monitoring methodology utilised in this study is a variation of the method described in the German Standard Verein Deutscher Ingenieure (VDI) 3940 “Determination of Odorants in Ambient Air by Field Inspections” (VDI Method). This is the method recommended in the Ministry for the Environment (MFE) Good Practice Guide for Assessing and Managing Odour in New Zealand and is commonly used in Australia and Europe for odour assessment.

3.2.2 Sampling

The modified method used by AECOM involved using a single ‘field odour scout’ to visit a selection of sites and sample the ambient air every 10 seconds for 10 minutes giving a total of 60 samples per location per day. The field odour scout recorded the intensity of the odour (according to a set intensity scale), the odour character (from a list of 40 various odour descriptors), the wind direction, the wind speed, any rainfall, and the time and date for every sample. The intensity scale and odour descriptors are those described in the MFE Good Practice Guide and are listed in Appendix A. The wind direction was determined and recorded by the field odour scout using a compass. Wind speed was recorded according to the Beaufort Force scale.

3.2.3 Field Odour Investigations

AECOM staff carried out site visits on 3, 4, 5, 8 and 9 August 2016. The weather conditions during the site visits are summarised in Table 2. The metrological conditions during the odour investigation were most conducive to detect odour effects, with winds generally below 3 m/s.

Table 2 Summary of Weather Conditions

Sampling Date	Wind Direction	Wind Speed	Wind Strength	Rain
3 August 2016	Northwest	0.3 – 3.5 m/s	Very Light – Moderate Breeze	None
4 August 2016	Northwest	0.4 – 2.3 m/s	Very Light – Gentle Breeze	Sporadic light rain
5 August 2016	Northwest - North	0.9 – 2.2 m/s	Very Light – Gentle Breeze	Sporadic light rain
8 August 2016	Northeast	0.1 – 1.5 m/s	Calm – Gentle Breeze	None
9 August 2016	Northeast - East	0.6 -3.0 m/s	Very Light – Moderate Breeze	None

3.2.4 Field Odour Investigation Locations

The field odour investigation was carried out at various upwind and downwind locations of the sites, sampling locations varied depending on wind direction. The location of the odour surveys are shown in Figures 6 and 7.

3.2.5 Industrial Activity Type

The industrial activities that operate within the Bollard Road Industrial Zone do not appear to have any seasonal or large production variations. Production rates should be steady throughout the year, therefore odours detected during the odour investigations should be similar to odours that would be detected during different times of the year.

Figure 6 Odour Survey Sampling Locations 3 to 5 August 2016

Figure 7 Odour Survey Sampling Locations 8 and 9 August 2016

3.3 Odours Observed

Odours at each site that were observed during the odour investigations are summarised in Figures 8 to 17. Generally the odours observed were either very weak or weak in intensity, and transient in nature. A distinct onion odour was observed at Site 5, based on the intensity scale, this was the most intense odour detected.

Figure 8 Site 1 Odour Observations

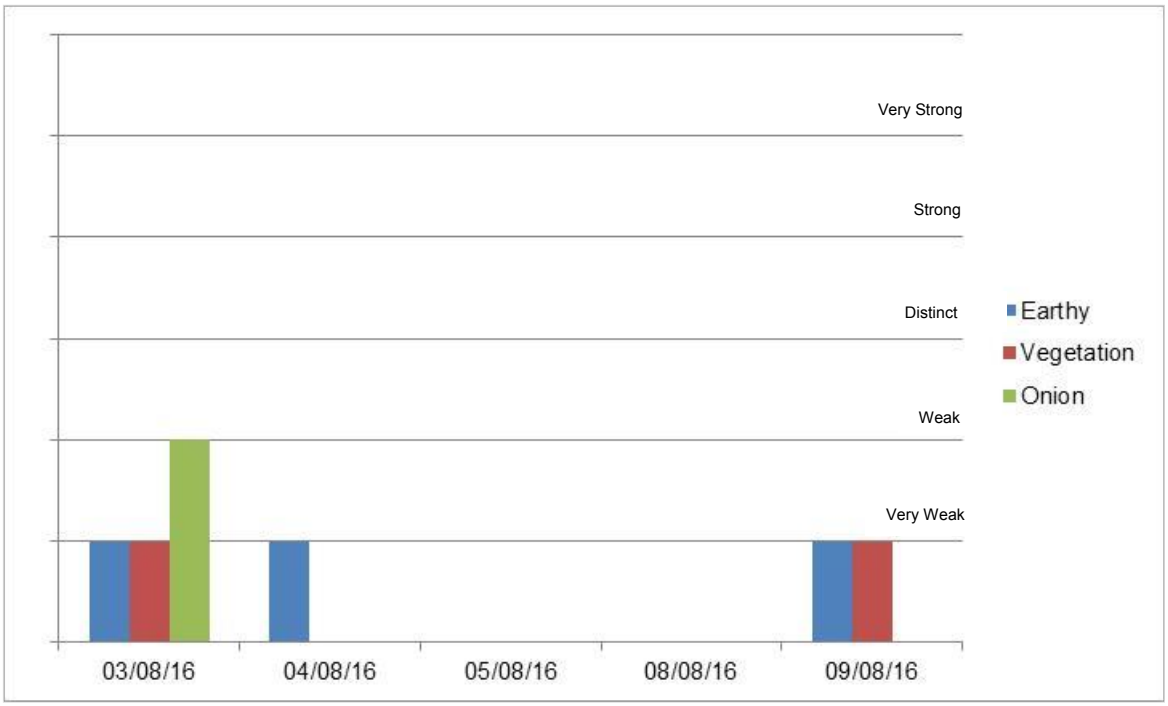


Figure 9 Site 2 Odour Observations

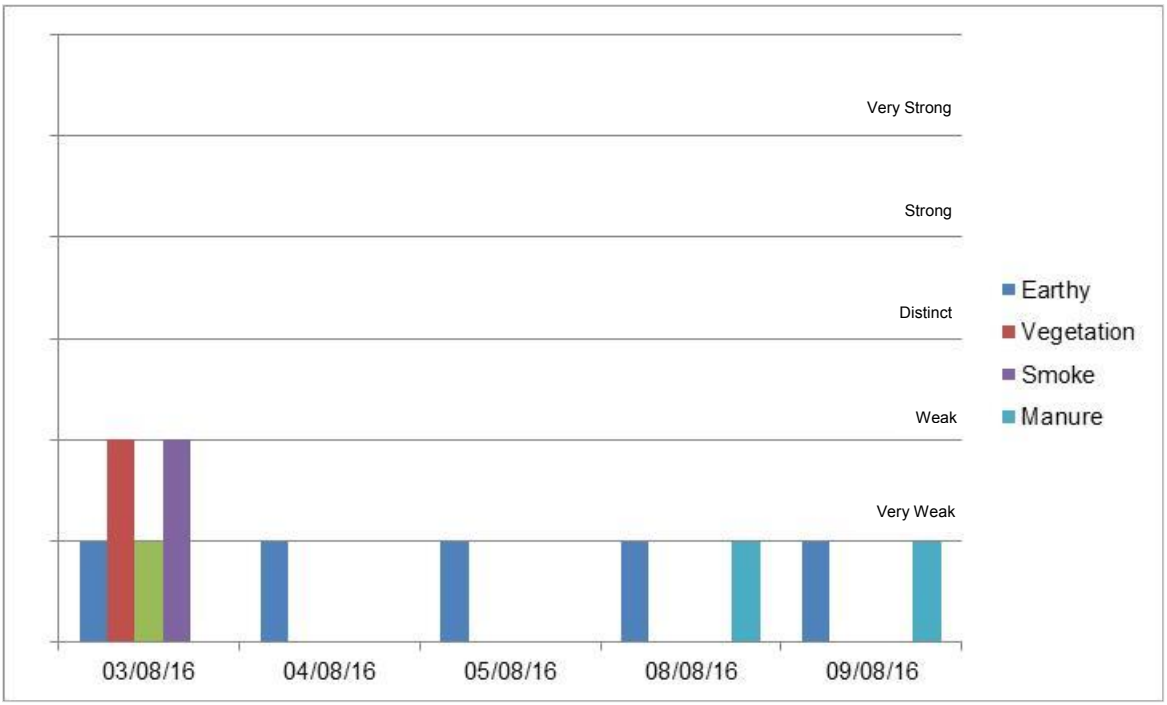


Figure 10 Site 3 Odour Observations

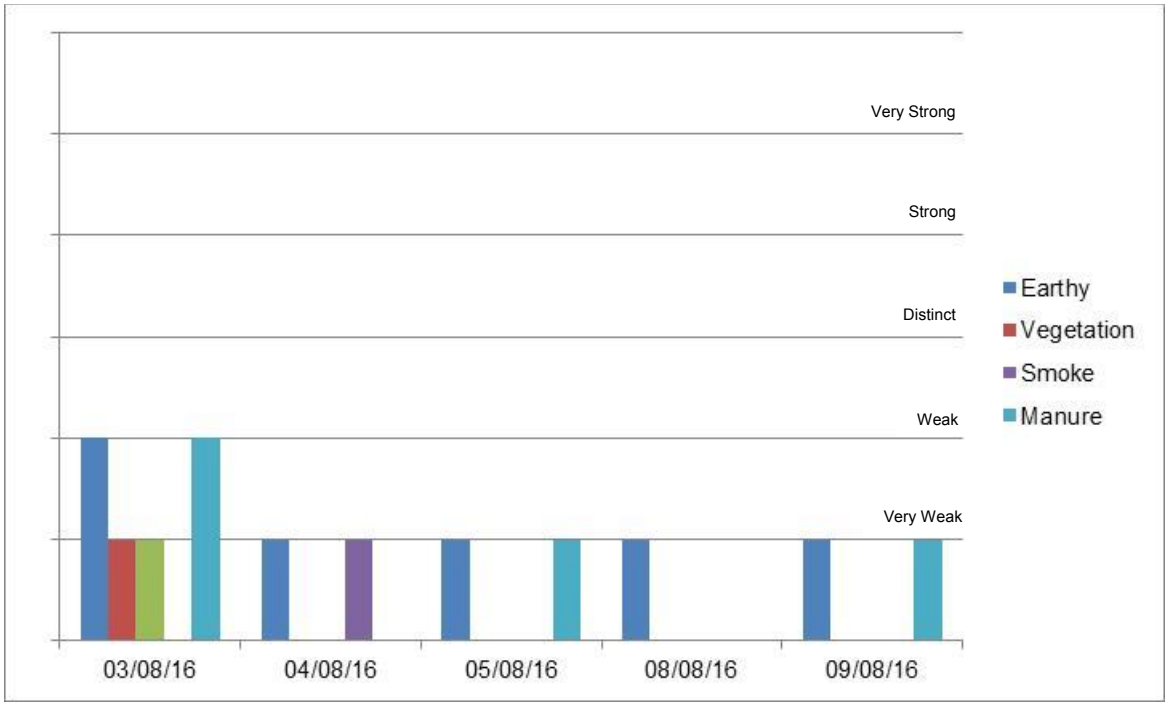


Figure 11 Site 4 Odour Observations

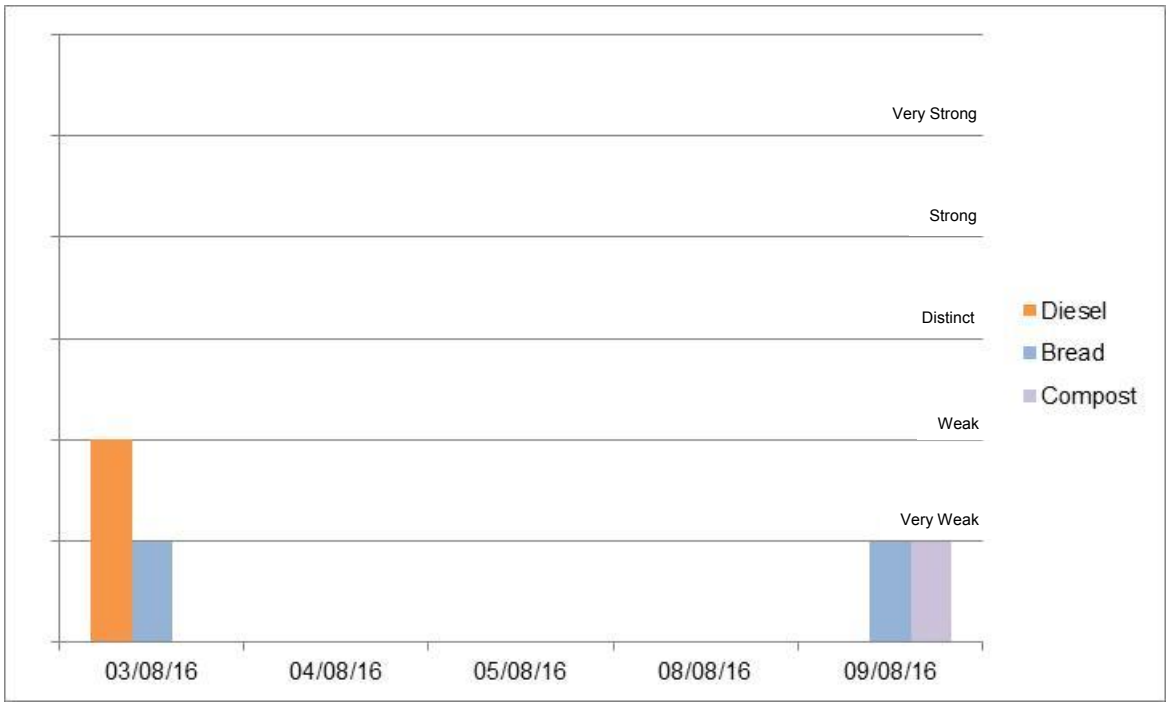


Figure 12 Site 5 Odour Observations

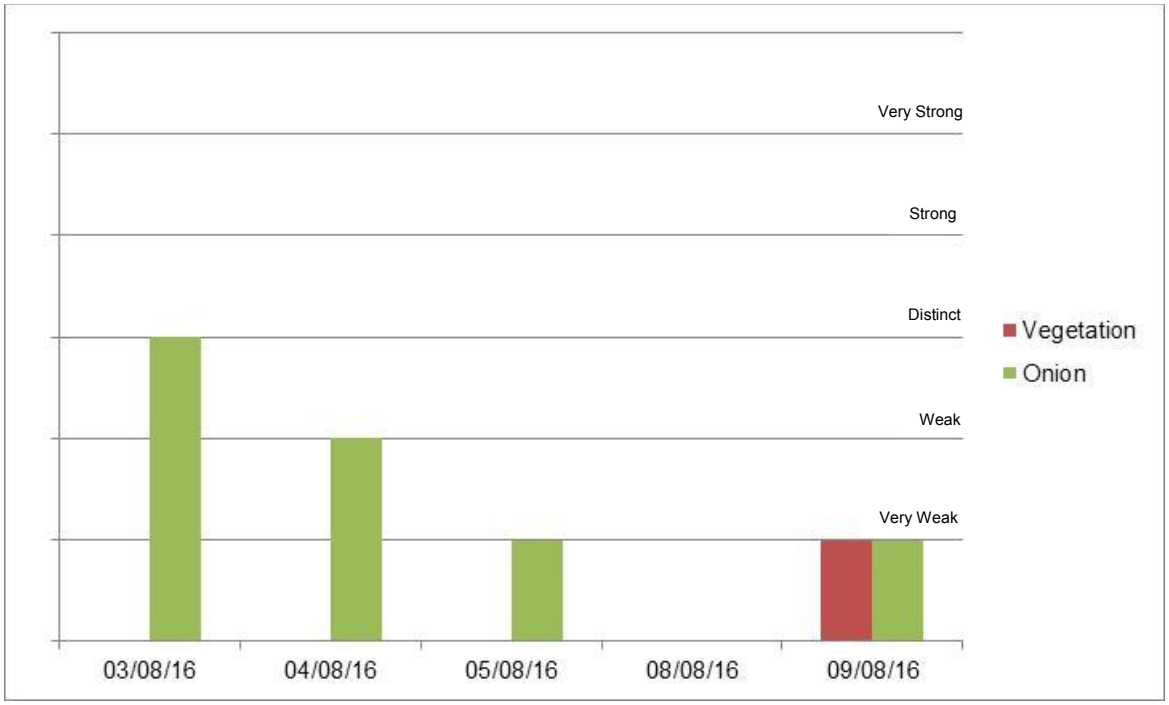


Figure 13 Site 6 Odour Observations

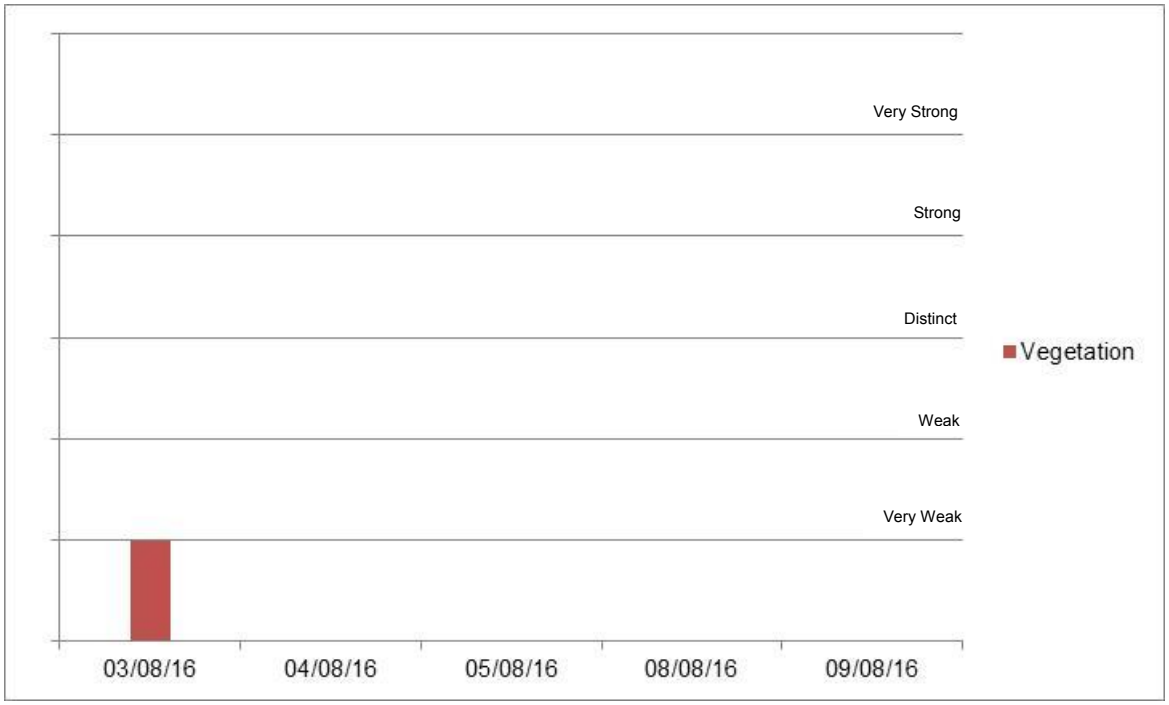


Figure 14 Site 7 Odour Observations

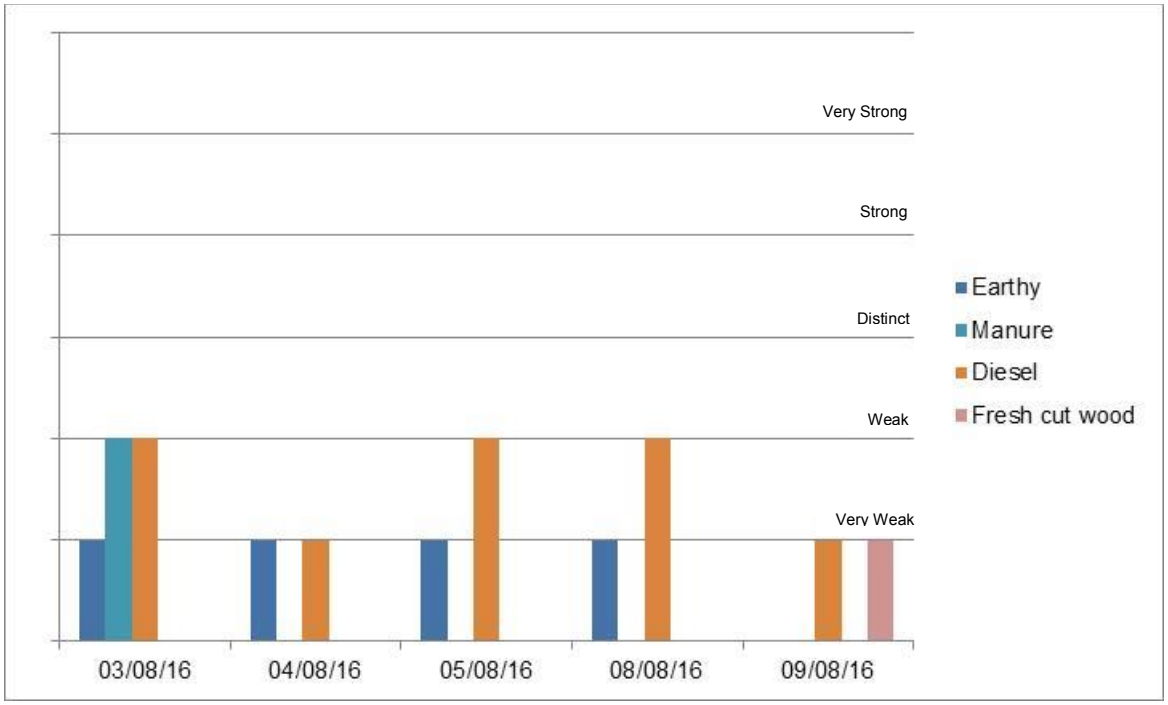


Figure 15 Site 8 Odour Observations

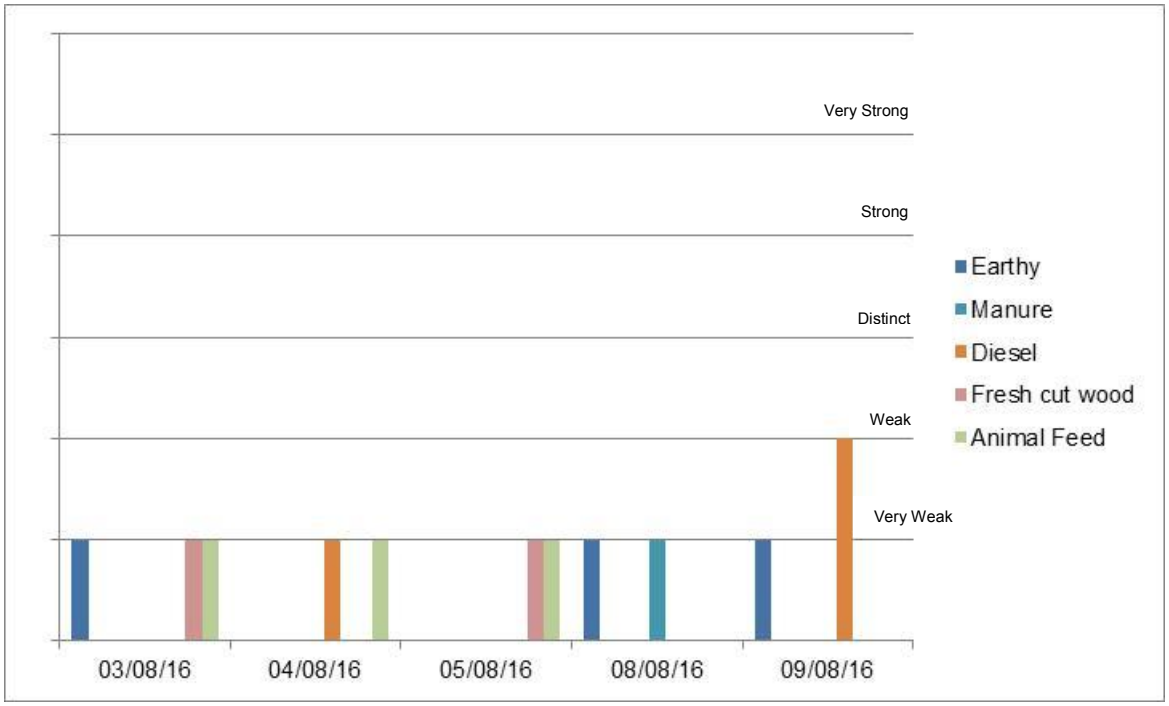


Figure 16 Site 9 Odour Observations

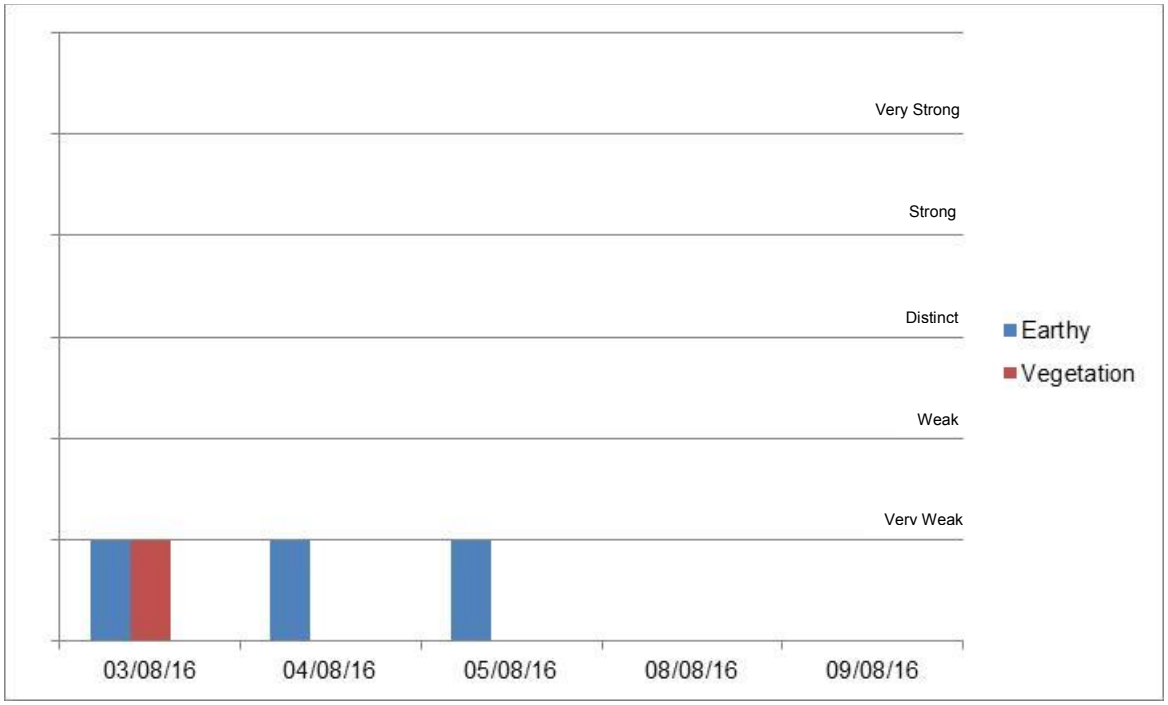
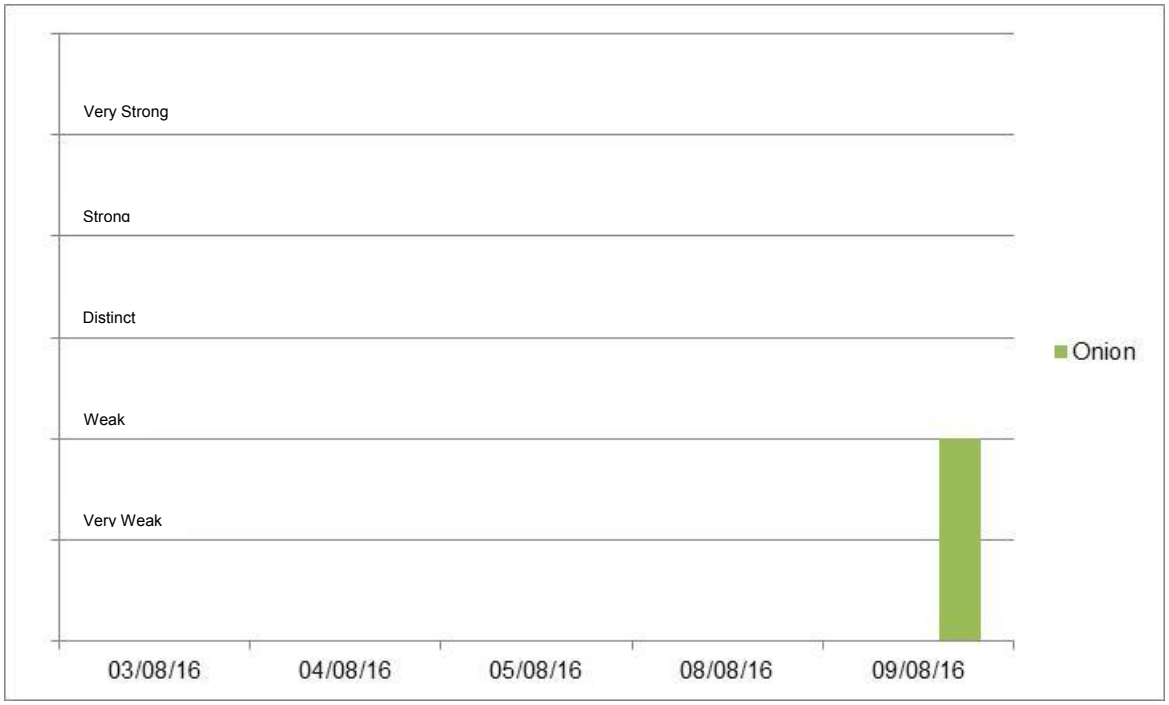


Figure 17 Site 10 Odour Observations



3.4 Summary of Odour Investigations

Based on our observations, odours that can be associated with the industrial zone, were typically described as fresh cut wood and animal feed (grain type odour). These odours can mostly likely be associated with the activity at Tuakau Grains and Tuakau Timber. When detected the odours were classified as being "very weak" and transient in nature, these odours were only observed downwind (approximately 200 m from the site), and within the industrial zone. During the odour survey, no odours were detected that might be considered offensive or objectionable.

Odours detected at the sites were generally described as earthy, vegetation, manure and smoke. The earthy, vegetation and manure type odours can be associated with the agricultural activities on the sites. The smoke odours can be attributed to the domestic home heating from residential properties on Dominion Road and Armitage Place. Other odours of interest that were experience during the survey were diesel and onion odours. The diesel odours were from passing traffic, mainly large trucks. Onions type odours were observed at the sites once, and routinely at Site 5. The origin of the onion type odour at the sites could not be identified, but a likely source could be onion weed. The onion odour at Site 5 can be attributed to the NZ Growers Ltd pack house on Tuakau Saleyards Road.

Even though no odours from the Bollard Road Industrial Zone were observed at the sites, this is due to unfavourable wind direction during the field visits. Observations downwind of the Bollard Road Industrial Zone at similar distances to that of the sites, had either no discernible odours or very weak and intermitted odours. Based on the field observation and considering the topography and the large stand of tree between the Bollard Road Industrial Zone and sites, it is highly unlikely any offensive or objectionable odour would be detected on the sites.

3.5 Dust Emissions

AECOM has reviewed existing industries and undertook site investigations of activities at the Bollard Road Industrial Zone, and consider the most significant source of dust is generated from vehicle movements on unsealed yards around the Tuakau Timber site. From the site investigations dust was observed within the site on dry days.

There are four main factors that are important to understand when determining whether any nuisance is caused by dust emissions from unsealed yards.

These are:

- Particle size;
- Particle density;
- Wind speed; and
- Wind direction.

These factors are all interrelated, and it is how they combine that determines the potential for an effect to occur.

In general, however, it is possible to make the following statements:

- Heavier and larger particles require more wind (speed) to become airborne;
- Large particles will deposit faster than small particles (of a similar density);
- More dense particles will deposit more rapidly than less dense particles (of a similar size); and
- Particles will travel further before depositing with a strong wind blowing than with a light wind blowing.

Despite this range of variables, the MfE Good Practice Guide[1] states that dust nuisance effects are generally only experienced within 300 m of unmitigated dust sources. As operations at Tuakau Timbers must comply with Waikato Regional Council's Permitted Activity Rule it is not considered to have unmitigated dust discharges.

AECOM considers that the most common type of materials that has the potential to generate dust emissions from the Tuakau Timber site are soil, clay and gravel from unpaved surfaces. Figure 18 depicts the distance travelled by dust particles of these types of materials for a range of wind speeds.

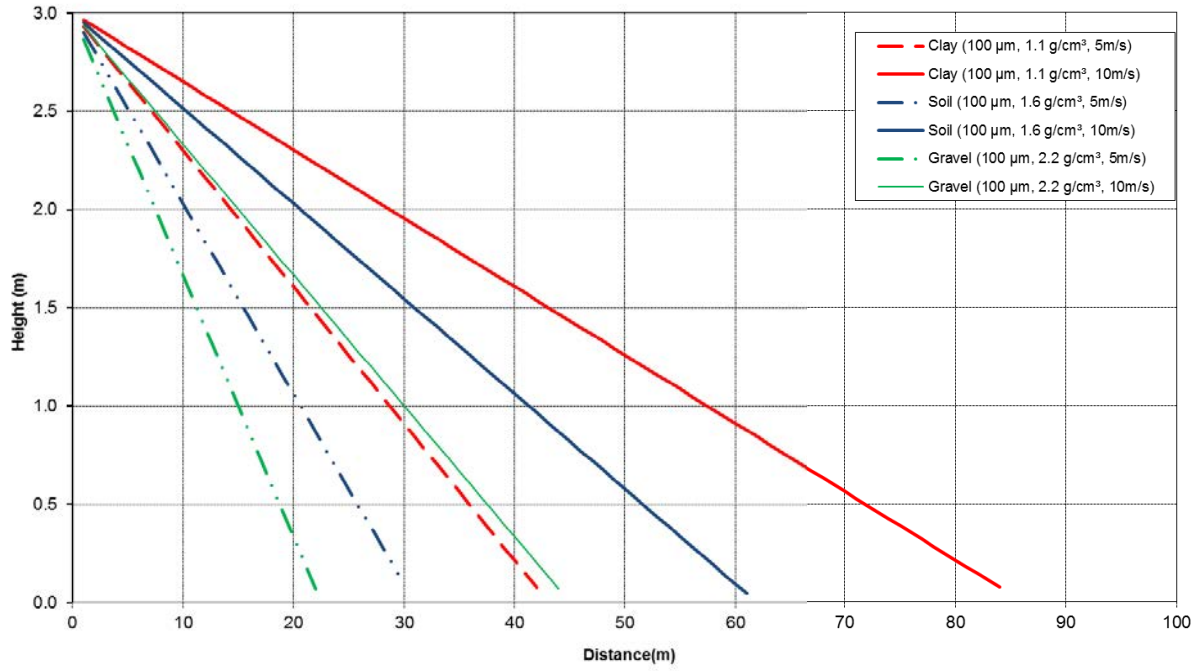
[1] MfE Good Practice Guide for Assessing and managing the environmental effects of dust emissions, September 2001.

Figure 18 shows that the density of the particle affects the distance it travels, with lighter particles travelling further than heavier ones. The density of clay, soil and gravel is 1.12, 1.6 and 2.2 g/cm³, respectively.

Typically nuisance dusts have a diameter of between 20 µm and 250 µm. In Figure 18 it has been assumed that the average particle diameter is 100 µm.

AECOM considers that there is some potential for dust affects within 84 m of Tuakau Timber during normal meteorological conditions (wind speeds ~5 m/s), if no form of mitigation is used. This value is based on flat land with no obstructions. However the sites are elevated by a gully and separated by a large stand of trees, therefore it is unlikely that the dust could travel this distance. Additionally metrological data indicates that there are typically very low wind speeds from the south-southeast and south direction that are strong enough to carry dust towards the sites, that exceed the required 5 m/s to carry dust. Coupled with the fact that the metrological data is at 10 m, wind speed would have to be between 9-10 m/s to reach 5 m/s at ground level. Also based on guidance provided in US EPA technical documents[3], with mitigation in place it is likely that effects will only occur within 50 m of sources that are located at ground level.

Figure 18 Difference in Particle Travel with Wind Speed



[2] http://www.aqua-calc.com/page/density-table/substance/Clay-coma-and-blank-dry-blank-excavated
[3] AP 42, Fifth Edition, Volume I Chapter 13 Miscellaneous Sources, Section 2.4 - Aggregate Handling and Storage Piles

4.0 Separation Distances

4.1 Reasons for Separation Distances

Separation distances, also known as buffer zones, are a management tool to avoid conflict between industrial and sensitive land uses. These buffer zones are used to shield existing industrial activities from encroachment of sensitive activities and reverse sensitivity effects, and to reduce potential effects on sensitive activities from the encroachment of industry.

Separation distances are typically based on the consideration of typical emissions that may affect nearby sensitive land uses. These include:

- Dust;
- Odour;
- Combustion emissions; and,
- Other pollutants.

4.1.1 Dust

Particulate matter in the environment generally falls into two categories: suspended and deposited particulate.

Suspended particulate matter is dust or aerosol which stays suspended in the atmosphere for significant periods of time. Its exact definition is dependent on the monitoring procedure adopted. The term Total Suspended Particulate is commonly used to describe the total amount of suspended particulate in the atmosphere at any one time.

Deposited particulate matter is dust or aerosol which because of its aerodynamic diameter and density, falls from the air. In general terms deposited particulate has a diameter of greater than about 10 or 20 µm. It is generally associated with nuisance effects such as soiling.

Suspended and deposited particulate arise from many natural and man-made sources. The most important sources globally are volcanoes and wind-blown dust, whilst on a local level, stationary and mobile combustion sources, road dust, wind-blown soil, pollen, and emissions from industrial processes are important.

Section 15(1)(c) of the Resource Management Act 1991 (RMA) states that any discharge from an industrial or trade premise into air requires a Resource Consent unless that discharge is expressly allowed by a rule in a Proposed Regional Plan, Regional Plan, or a regulation.

Industries located within the Bollard Road Industrial Zone fall within the jurisdiction Waikato Regional Council and Waikato District Council. Some of the industries bordering the sites do not hold an air discharge consent, therefore onsite activities are covered by the Permitted Activity Rule 6.1.8(c), which for dust states:

> *There shall be no discharge of particulate matter that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the subject property.*

For industries to comply with Regional and District rules, emission control equipment might need to be installed. During the site investigations, it was observed that Tuakau Timber, Tuakau Grains and Dricon used baghouses and cyclones to control dust emissions. AECOM does not have information regarding specifically to these sites, but based on past experience resource consents have specific conditions regarding the operation of emission control equipment. These conditions usually relate to regular maintenance schedules to avoid failures, and continual monitoring of these devises, so any failure is identified and appropriate action can be undertaken.

The rule of no objectionable dust at or beyond the property, applies to activities within the Bollard Road Industrial Zone regardless of the zoning of the adjoining land. Therefore any future industrial activities within the Bollard Road Industrial Zone, whether on an existing site or a new activity will also have to comply with this rule.

4.1.2 Odour

Odour is defined by The Ministry for the Environment (MfE) as:

> *"Odour is perceived by our brains in response to chemicals present in the air we breathe. Odour is the effect that those chemicals have upon us. Humans have sensitive senses of smell and they can detect odour even when chemicals are present in very low concentrations.*
>
> *Most odours are a mixture of many chemicals that interact to produce what we detect as an odour. Fresh air is usually perceived as being air that contains no chemicals or contaminants that could cause harm, or air that smells "clean". Fresh air may contain some odour, but these odours will usually be pleasant in character or below the human detection limit.*
>
> *Different life experiences and natural variation in the population can result in different sensations and emotional responses by individuals to the same odorous compounds. Because the response to odour is synthesised in our brains, other senses such as sight and taste, and even our upbringing, can influence our perception of odour and whether we find it acceptable, objectionable or offensive."*

The difficulty when assessing odours is the fact that the same odour has the potential to cause an effect that may be considered "acceptable", "objectionable" or "offensive" depending on the context, of the sensitivity of the receiving environment and the person carrying out the assessment. An "objectionable" or "offensive" effect may occur where an odorous compound is present in a sample of air in very low concentrations, usually far less than the concentration that could cause adverse effects on the physical health of humans or impacts on any other part of the environment.

Typical odour effects reported by people include the following: nausea; headaches; retching; difficulty breathing; frustration; annoyance; depression, stress; tearfulness; reduced appetite; sleep deprivation; and embarrassment in front of visitors. Odour effects, such as those described above, contribute to a reduced quality of life for the individuals who are exposed to the odour.

Under the RMA, the main concern with odour is its ability to cause an effect that could be considered "objectionable" or "offensive" beyond the boundary of the sites. Whether an odour has an objectionable or offensive effect will depend on the factors described below and the decision as to whether an odour nuisance has occurred will depend on the judgement of the local authority who will investigate the potential for nuisance in response to complaints from the public.

Industries located within the Bollard Road Industrial Zone fall within the jurisdiction Waikato Regional Council and Waikato District Council. Even if industries operating within the Bollard Road Industrial Zone do not hold an air discharge consent, therefore onsite activities are covered by the 'Permitted Activity Rule 6.1.8(b), which for odour states:

> *There shall be no discharge of odour that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the subject property.*

Any future industrial activity to the Bollard Road Industrial Zone will also have to comply with this rule.

4.1.3 Combustion emissions

Combustion products are those compounds that arise as a result of combustion processes. The most common combustion products are particulate matter with an aerodynamic diameter <10 µm (PM_{10}), nitrogen oxides (NO_x)[4], carbon monoxide (CO), and sulphur dioxide (SO_2). NO_x and CO arise from virtually all combustion processes. SO_2 only occurs from those combustion processes where the fuel (e.g. diesel and coal) contains sulphur.

Combustion emissions are regulated through resource consents, and the National Environmental Standards (NES)[5]. The MfE promulgated the NES on 6 September 2004 as regulations under the Resource Management Act 1991. The NES standards apply to five air pollutants: nitrogen dioxide (NO_2); CO; PM_{10}; SO_2; and ozone (O_3). The MfE has also produced ambient air quality guidelines (NZAAQG)[6] for a similar list of contaminants for other averaging periods.

The NES standards for pollutants were primarily designed to ensure that air quality within a defined airshed is maintained at acceptable levels. AECOM has assessed the different industries within the Bollard Road Industrial Zone, and has identified a small number of sources, used on a small scale and relatively long distance away from the sites. Tuakau Timber operates a small boiler used to steam logs, this located approximately 350 m from the sites. AECOM has therefore concluded that emissions from combustion source to be insignificant and no further investigation is required.

Industries that produce emissions from combustion source within the Bollard Road Industrial Zone would have to comply with the Waikato Regional Council's air discharge rules 6.1.8(a) and 6.1.8(d):

> *There shall be no discharge of contaminants beyond the boundary of the subject property that has adverse effects on human health, or the health of flora and fauna.*
>
> *The discharge shall not significantly impair visibility beyond the boundary of the subject property.*

Any combustion process that does not comply with the Permitted Activity Rules would require consent, and further conditions would be imposed.

4.1.4 Other Pollutants

There is a range of industrial processes that have the potential to be discharge into the air. These can include, but not limited to; volatile organic compounds (VOC), polycyclic aromatic hydrocarbon (PAH), dioxins, silica, acidic gases, ozone and asbestos. These substances have the potential to cause adverse health effects if not managed properly. Any future industry to the Bollard Road Industrial Zone will have to comply with the Waikato Regional Council's air discharge rule 6.1.8(a):

> *There shall be no discharge of contaminants beyond the boundary of the subject property that has adverse effects on human health, or the health of flora and fauna.*

Most of the compounds list above would not comply with the Permitted Activity Rules and therefore would require consent with strict conditions.

4.2 Complaints from Existing Industry

AECOM contacted the Waikato Regional Council regarding any past air quality complaints that have arisen from the existing industrial activities at the Bollard Road Industrial Zone and the surrounding area. AECOM has found no evidence of complaints made to the Waikato Regional Council; therefore it can be assumed that there are minimal effects on air quality around the existing residential properties.

[4] Primarily a mixture of nitrogen oxide (NO) and nitrogen dioxide (NO_2).
[5] Ministry for the Environment, Resource Management (National Environmental Standards for Air Quality) Regulations, 2004
[6] Ministry for the Environment, Ambient Air Quality Guidelines (2002 update)

4.3 Separation Distances from other Jurisdictions

There is no buffer distance criteria promulgated by New Zealand regulatory authorities, other than the general requirements under the RMA. However some regulatory authorities and air quality consultants in New Zealand have adopted buffer distances set out by the South Australia Environmental Protection Authority (SA EPA), Environmental Protection Authority Victoria (EPA Vic), Western Australia Environmental Protection Authority (WA EPA) and the Tasmania EPA in the following documents:

- Guidelines for Separation Distances (SA EPA 2007)
- Environmental Protection Authority Victoria, Guideline, Recommended Separation Distances for Industrial Residual Air Emissions (EPA Victoria 2013)
- Guidance for the Assessment of Environmental Factors, Separation Distances between Industrial and Sensitive Land Uses (WA EPA, 2005)
- Attenuation Distances and Air Quality Code (Tasmania EPA, 2011)

Based on the industries in the Bollard Road Industrial Zone, AECOM has reviewed the above documents and considers the SA EPA and the EPA Vic guidelines to be the most appropriate for this situation. The SA EPA and the EPA Vic guidelines are summarised them in Table 3.

Table 3 Separation Distances

Industry	South Australia EPA	Victoria EPA
Cement Bagging	100 m	100 m
Grain Storage/Drying	100 m	250 m
Manufacture of Fibreglass Products	300 m	250 m
Sawmill	100 m	250 m
Timber Treatment	100 m	100 m

Based on the on the separation distance proposed by the SA EPA and the EPA Vic the sites is beyond the guidelines, with the exception of the EPA Vic sawmill distance of 250 m. The closest distance between the sites and Tuakau Timber is approximately 200 m, however the sawmill itself is approximately 350 m from the sites.

Future industries that operate out of the Bollard Road Industrial Zone might fall under difference categories, therefore have different separation distances from the above guidelines. AECOM has considered the potential type of industries that might occupy the Bollard Road Industrial Zone in the future, and have summarised them in Table 4 based on the above guidelines.

Table 4 Separation Distance of Potential Industry in Tuakau

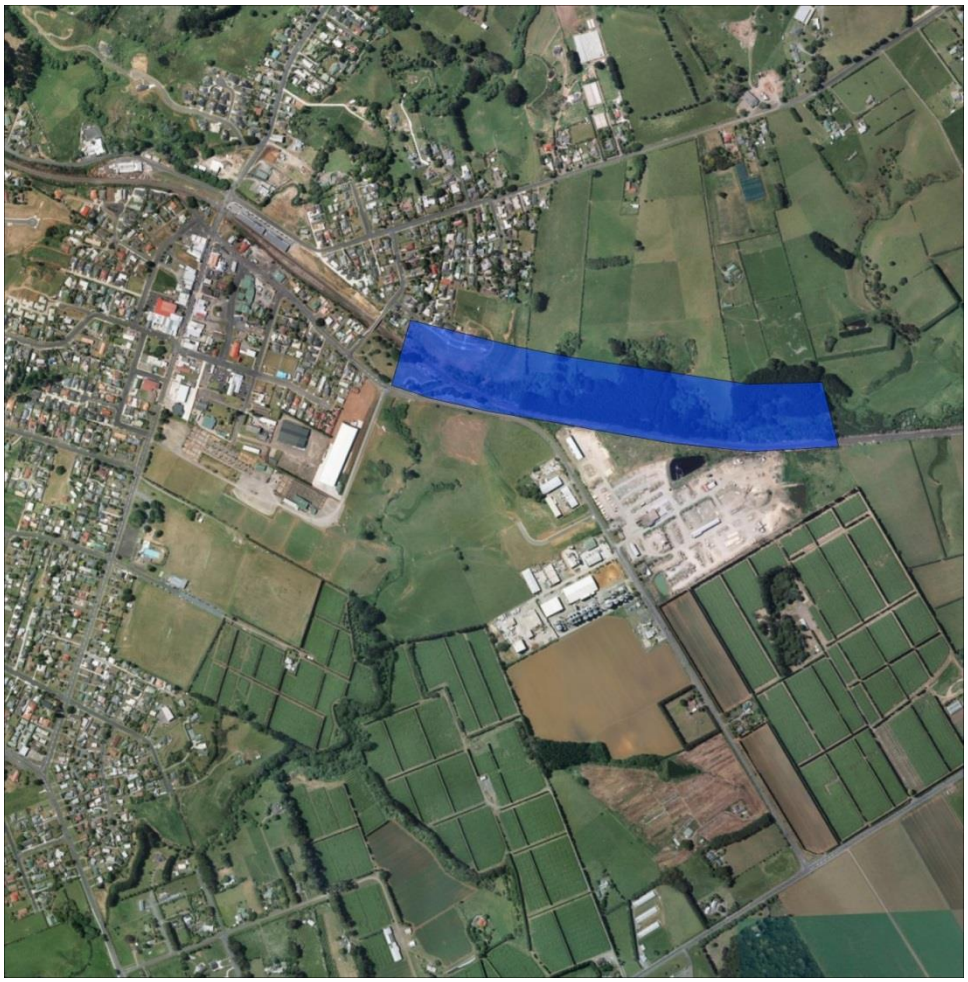
Industry	Typical Separation Distance
Food Manufacturing	100 – 300 m
Galvanising	100 m
Automotive spray painting	200 m
Chemical Processes	500 m
Fibre reinforced plastics manufacturing	300 m

The above are only guidelines, and in some instance the appropriate separation distance may vary from that recommended as a result of site specific operational or environmental conditions. These guidelines are based on the worst case emission, and don't take into account the use of good control measures. Even though New Zealand doesn't have guidelines specific to separation distances, the underlying requirements of the RMA, Regional and District Plans require that no discharge whether odour, dust or gaseous pollutant is objectionable to the extent that it causes an adverse effect at or beyond the boundary. This in effect protects the surrounding environments whether is sensitive or industrial. The above industrial activities would likely require a resource consent, which would limit any air pollutants to the site boundary, which would mean minimal off site effects.

4.4 Recommend Separation Distance

AECOM considers that separation distances are an important tool to manager the future effects of industry on sensitive land uses, and control the potential for reverse sensitivity effects. Based on observations, investigations, and the potential for an uncontrolled discharge, AECOM considers a separation distance of 150 m distance, would protect future growth within the two proposed zones, and the effect of new housing on the current industrial clients of the Bollard Road Industrial Zone. AECOM's recommended separation distance is shown in Figure 19.

Figure 19 AECOM's Recommended Air Quality Buffer Zone



5.0 Summary

AECOM has investigated existing odour and dust at and around the sites to observe any effects from the Bollard Road Industrial Zone. AECOM has also assessed the potential for odour, dust and other air quality pollutants, current zoning and separation distances, other jurisdictions separation distance and what could the future industrial make of the Bollard Road Industrial Zone.

Odour Observations

There was no objectionable or offensive odour detected at any stage of the odour survey. During the odour investigation the sites was never down wind of the sites, however sites downwind of the Bollard Road Industrial Zone that would be of a comparable distance to that of the sites either had no detectable odour or a very weak fresh cut wood or animal feed odour that was very transient in nature. The sites down wind of the Bollard Road Industrial Zone where odour was detect, had no obstruction in anyway, therefore it would highly likely that the sites would experience similar odours, possibly a reduction in odour as the mature stand of trees and natural gully would impede air flow to the sites.

Dust Investigations

There was no objectionable dust observed at the sites during the site visits. During the site visits it was observed that the vehicles at Tuakau Timber created dust onsite during dry days due to unpaved surfaces. No other dust was observed on any other site. AECOM also undertook a desktop study of all the industries and deem dust from the unpaved surfaces at Tuakau Timber to be the only significant source of dust that had the potential to affect the sites. Based on the assumed make-up of the substrate, with wind speeds of 5 m/s there is a possibility that the dust could travel 84 m based on particle settling velocities. This is a conservative figure as the calculation is based on flat terrain; it does not take into account that the sites are elevated above the Bollard Road Industrial Zone and the stand of mature trees which would impede air flow.

Metrological Data

Winds coming from the south-southeast and south would place the sites in a downwind location of the Bollard Road Industrial Zone. From the meteorological data, 6.2% of the wind comes from this direction, with no wind from that direction is greater than 5 m/s. Due to the low frequency of winds from this direction, coupled with low wind speeds from this direction, the likely hood of dust and odour reaching the site is low.

Future use of Industrial Land

As well as assessing the current situation in and around the Bollard Road Industrial Zone, AECOM has also considered the future growth within the Bollard Road Industrial Zone. Even though it is hard to predict what industries might occupy the Bollard Road Industrial Zone in the future, any future industries will need to comply with the underlying requirements of the RMA, Regional and District Plans that no discharge whether odour, dust or gaseous is objectionable to the extent that it causes an adverse effect at or beyond the boundary. .

Recommended Separation Zone

Following the review of all the information AECOM considers 150 m separation distance between the sites and the Bollard Road Industrial Zone appropriate, rather than the 300 m proposed in PC16. AECOM's proposed separation distance is also consistent with the current separation distances between existing residences. Considering that under PC16 there is no separation distance between the proposed residential properties and the western boundary of the Bollard Road Industrial Zone, this proposed zoning seems to contradict the separation distance planned for the sites.

6.0 Limitations

AECOM New Zealand Limited (AECOM) has prepared this Assessment of Environmental Effects Report in accordance with the usual care and thoroughness of the consulting profession for Pacific Engineering Projects Limited for use in submission on the proposed Tuakau Structure Plan Change undertaken at 48 and 52 Dominion Road Tuakau.

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

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 2016.

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Appendix A

Odour Character Descriptors			
1	Fragrant	21	Like blood, raw meat
2	Perfumy	22	Rubbish
3	Sweet	23	Compost
4	Fruity	24	Silage
5	Bakery (fresh bread)	25	Sickening
6	Coffee-like	26	Musty, earthy, mouldy
7	Spicy	27	Sharp, pungent, acid
8	Meaty (cooked, good)	28	Metallic
9	Sea/marine	29	Tar-like
10	Herbal, green, cut grass	30	Oily, fatty
11	Bark-like, birch bark	31	Like gasoline, solvent
12	Woody, resinous	32	Fishy
13	Medicinal	33	Putrid, foul, decayed
14	Burnt, smoky	34	Paint-like
15	Soapy	35	Rancid
16	Garlic, onion	36	Sulphidic
17	Cooked vegetables	37	Dead animal
18	Chemical	38	Faecal (like manure)
19	Etherish, anaesthetic	39	Sewer odour
20	Sour, acrid, vinegar	40	Other

Intensity Level	Odour Intensity
0	No odour
1	Very Weak
2	Weak
3	Distinct
4	Strong
5	Very strong
6	Extremely Strong