SETBACK ANALYSIS REPORT

DATE: **31 October 2018**

TOPIC NAME: **Rural**

SCOPE DESCRIPTION: **Setbacks for activities with an air quality component**

TOPIC LEAD: **Robert Love**

PREPARED BY: **Robert Love**

EXECUTIVE SUMMARY

Issue(s)	*When using setbacks as part of the District Plan provisions, an evidential basis is needed to support the quanta used.*
Preferred Option	*To adopt the quanta recommended within this report.*

1.0 Introduction

[1] The purpose of this report is to investigate the appropriate setback quanta between various odour and/ or dust causing activities, and sensitive activities and residential zones.

[2] This report will aim to provide a quantum for each activity and the evidential basis to support the plan provisions as part of the Section 32 report.

[3] District, City, and Regional Plans from around New Zealand were reviewed to determine the ranges and common setback distances in use. Unfortunately Central Government have provided no detailed advice on what appropriate setbacks are. Information from the various Environmental Protection Authorities in Australia was used as most States have their own separation guidance documents. Additionally, industry guidance and research was also used, this guidance tended to be developed by independent third parties and partially funded by the State Government.

[4] Within the Proposed District Plan, setbacks will form part of the planning provisions attempting to control various activities in relation to their proximity to sensitive activities and zones. If a setback is breached it will either trigger resource consent requirements, or a greater level of scrutiny through an activity status escalation.

[5] Additionally these setbacks will make up the basis for reverse sensitivity buffers to protect lawfully established activities from residential encroachment that may lead to the compromising of that activity.

2.0 Summary of Issues

[6] Based on the literature, there is a significant difference between the odour profile of a broiler chicken and a layer chicken. This difference can be as much as 40%, with broilers having a larger odour profile[1]. This is due to the fast growth and high food intake of broiler chickens compared to the slower growth cycle for layer hens. This has a resultant effect on the amount of manure each bird produces. This has implications when setting setback distances within a district plan, and it warrants having separation setbacks for different stock types. This implication needs to be weighed against the need for simplicity within a district plan, which would lean towards including only one setback distance for intensive chicken farms. If the latter approach is adopted the most conservative approach would be appropriate, i.e. the required setback for broilers to apply across all bird types.

[7] While the effects of dust emissions from mining/ quarrying can often be mitigated, they cannot always be avoided. Ideally, all of an activity's effect should be internalised within their own site. However, when complete internalisation cannot be achieved the entire time that the activity is operating then additional mitigation is required. This can be in the form of a setback to reduce the likelihood of adverse effects on sensitive activities. When considering the size of a buffer

[1] McGahan, E. J., & & Galvin, G. (2018). *Odour Review of Layer Farms and Development of S-Factor Formula.* Australia: Australian Eggs Limited.

distance, the consideration should take into account that the operators are taking all reasonable steps to internalise the potential and actual effects of the activity, rather than creating a buffer of a size which results in operators acting without regard to their effects. Plainly, a buffer zone should only be large enough to absorb the small amount of spill over on the odd occasion, rather than be the primary mitigation tool[2]. This approach is consistent with case law, Winstone Aggregates Limited v Papakura District Council (A096/98). Ultimately the purpose of the buffer zones is to reduce the likelihood of incompatible land use establishing near each other, which gives effect to the purpose of the act to promote sustainable management of natural and physical resource.

[8] As already discussed within the Air Quality Report, this option will see the removal of residential permitted development rights where new activities establish. Once an activity is lawfully established a setback buffer will then apply around it and potentially onto the neighbouring properties. These neighbouring properties may not be developed to their maximum potential.

[9] Development rights are already removed in cases where intensive farms are consented, through a 300 metre reverse sensitivity buffer.

[10] This consideration or effect will not be taken into account situations where an intensive farm has setup as a permitted activity due to meeting all of the performance standards. However, this could make up part of the matters of discretion if the activity does trigger consent requirements. Additionally, resource consent will always be required for commercial composting, mushroom farming, and quarrying, so this consideration will occur.

[12] There is a potential issue that if a setback provision is adopted, then existing non-intensive farming activities such as quarrying will automatically have a buffer placed around them and the same applies to existing residential properties, potentially restricting development from either party. However, a potential solution to this issue is to only apply a setback to new or expanding activities establishing post the notification of the proposed District Plan.

[13] An additional issue regarding this topic is how cumulative effects are consider where farms locate in close proximity to one another. The Queensland State department of Agriculture and Fisheries has carried out an assessment on this aspect[3]. This study states an allowance needs to be made in any calculation and that the setback distance should be increased by 50% to allow for cumulative effects. This should occur in cases where calculated setbacks from farms overlap.

3.0 Statement of Operative District Plan approach

[14] The Operative District Plan only contains one setback quantum and that controls the separation of new residential dwellings and existing intensive farms. New dwellings in order to be a permitted activity are required to be at least 300 metres from the intensive farm, if they seek to

[2] CCSG Associates. (2016). *Buffer zone considerations for mining development in proximity to human populations.* Whitehorse.

[3] Department of Agriculture and Fisheries. (2016). *Development of meat chicken farms in Queensland.* Queensland: Queensland State Government.

build within this setback then a resource consent is required, and the intensive farm owner is considered an affected party.

4.0 Summary of setback quanta

4.1 Intensive farming

Authority	Animal/ Activity Type	Setback to residential dwellings/sensitive activities	Setback to residential zones	Reverse sensitive setback-residential to intensive farming
Christchurch City Council	All	200 metres	N/A	200 metres
Ashburton District Council	All	400 metres	1200-1500 metres	400 metres
Waimakariri District Council (depends on stock numbers)	Pigs	200-750 metres	N/A	200-750 metres
	Chickens	300 metres	N/A	300 metres
	Cow Barns	100 metres	N/A	100 metres
Hurunui District Council	All	N/A	N/A	500 metres
Selwyn District Council	All	Restricted Discretionary	N/A	300 metres
Canterbury Regional Council (CARP)	Chickens	200 metres (Restricted Discretionary)	N/A	N/A
	Cow Barns	500 metres (Restricted Discretionary)	1000 metres	N/A
	Pigs	No setback distances included but consent is still required		
General overview of Territorial and Regional Authority RMA Plan Provisions	Buildings used to house animals (intensive farming)	Range 100 – 750 metres, common setback 200-300 metres	Range 1000 – 1500 metres	Range 100 – 750 metres, common setback 300 metres.
Australian Egg Industry Guidance 2008[4] & 2018[5]	Layer Farm	250 metres	500 metres	

[4] McGahan, E., Barker, S., & & Tucker, R. (2008). *Environmental guidelines for the Australian Egg Industry.* Australia: Australian Egg Coporation Limited.

[5] McGahan, E. J., Wiedermann, S., & N., &. G. (2018). *Egg industry environmental guidelines Edition 2.* Australia: Australian Egg Industry Limited.

EPA – South Australia 2016[6]	Layer and Broiler Farms	250 metres	750 metres	
Australian Pork Ltd - 2013[7]	Outdoor rotational piggery	250 metres	750 metres	
Department of the Environment Western Australia - 2004[8]	Poultry Farm		500 metres	
Mississippi State University - 2018[9]	Poultry (various States)	100 – 300 metres	-	
University of Tennessee[10]	Poultry	150 metres	460 metres	

Table 1: Intensive Farming Setbacks

Pig numbers	To a township	To a rural residential area	To an isolated rural property	To an adjacent farm house
1 - 500	1600	1000	400	300
501 - 2000	2000	1500	500	400
2000	2000	1500	500	400
2500	2500	1875	625	500
3000	3000	2250	750	600
3500	3500	2675	875	700
4000	4000	3000	1000	800
4500	4500	3375	1125	900
5000	5000	3750	1250	1000

Table 2: Piggery Setbacks[11]

[15] Note: these factors for piggery setbacks can be subject to reduction based on ventilation type, effluent collection system, effluent treatment system, noise, power supply reliability, and surveillance intervals. The maximum reduction cannot exceed 40%. The Victorian piggery setback guidance is now somewhat dated (1992), but continues to be referenced by the Victorian EPA recommended separation distances (2013).

4.2 Quarrying

Authority	Zone	Activity	Setback
Christchurch City Council	Rural - Quarry Zone	Crushing and Screening	100m to a Zone Boundary and below ground level
	Rural - Quarry Zone, Quarry Templeton Zone	Stockpiling	50m to a Zone Boundary

[6] Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

[7] Tucker, R. (2013). *National Environmental Guidelines for Rotational Outdoor Piggeries.* Victoria: Australian Pork Limited.

[8] Department of the Environment Western Australia. (2004). *Environmental Code of Practice for Poultry Farms in Western Australia.* Perth: Western Australian State Government.

[9] Tabler, G. T. (2018). *Setback Distance for Poultry Houses.* Starkville: Mississippi State University.

[10] Goan, C. (2011). *Site Selection Factors for New Poulty Facilities.* Knoxville: University of Tennessee.

[11] Environmental Protection Authority Victoria. (1992). *Code of Practice Piggeries.* Melbourne: Environmental Protection Authority Victoria.

	Rural – Quarry Zone, Quarry Templeton Zone	Quarrying (including processing)	20m to a road boundary
	Rural – Quarry Zone	Excavation (depending on visual screening option)	10 - 20m from a zone boundary
	Rural – Quarry Zone	Quarrying (including processing)	6m from an adjoining boundary in the same zone
	Rural - Waimakariri Zone, Urban Fringe Zone,	Quarrying (includes processing)	250m to a Residential or Specific Purpose (School) Zone
	Other Rural Zones	Quarrying (including processing)	No setback – full discretionary
Ashburton District Council	Rural Zone	Quarrying (including processing)	No setback – full discretionary
		Reverse sensitivity	100m to gravel pits
Hurunui District Council	Rural Zone	Quarrying (including processing)	500m from Residential, Business, Open Space Zones
		Reverse Sensitivity	500m to Quarrying
Canterbury Regional Council		Handling of bulk solid materials	200 m to a sensitive activity
		Handling of bulk solid materials that includes blasting	500 m to a sensitive activity
General overview of Territorial and Regional Authority RMA Plan Provisions		Quarrying	Range 100-500 metres to a residential activity
			250-500 metres to a residential zone
		Reverse Sensitivity	Range 100 – 500 metres from a residential unit.
Environmental Protection Authority – Victoria (AUS) - 2013 [12]		Quarrying not including blasting	250 metres to a sensitive activity
		Quarrying including blasting	500 metres to a sensitive activity
		Quarrying of materials containing respirable crystalline silica dust	500 metres to a sensitive activity
EPA – South Australia 2016[13]		Aggregate processing	500 metres to a sensitive activity

Table 3: Quarrying setbacks

4.3 Composting and Mushroom Growing

Source	Activity	Capacity	Setback to sensitive activity

[12] Environmental Protection Authority Victoria. (2013). *Recommended Separation Distance for Industrial Residual Air Emissions.* Melbourne: Environmental Protection Authority Victoria.

[13] Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

EPA – South Australia 2016[14]	Composting	Greater than 200 t/y	1,000 metres
		Between 20 – 200 t/y	300 metres
		Less than 20 t/y	100 metres
EPA – Victoria 2017[15]	Green waste, food organics, and grease trap waste – enclosed aerobic composing with odour capture requirement and open air maturation	1,200 t/y	300 metres
		14,000 t/y	500 metres
		36,000 t/y	800 metres
		55,000 t/y	1,000 metres
		75,000 t/y	1,200 metres
		90,000 t/y	1,400 metres
	Green waste – open windrow and maturation	1,200 t/y	600 metres
		14,000 t/y	1,100 metres
		Greater than 36,000 t/y	2,000 metres
Emission Impossible 2012[16]	Green waste		500 metres
	Animal or human waste		1,500 metres
EPA – Western Australia 2005[17]	Outdoor uncovered, regularly turned windrows – mixed manure and food waste		1,000 metres
	Outdoor uncovered, regularly turned windrows – bio solids		500 metres
	Outdoor uncovered, regularly turned windrows – green waste		150 metres
	Outdoor covered, turned windrows - mixed manure and food waste		750 metres
	Outdoor covered, turned windrows – bio solids		250 metres
	Outdoor covered, turned windrows – green waste		150 metres
	Outdoor covered windrows with continuous aeration - mixed manure and food waste		500 metres
	Outdoor covered windrows with continuous aeration – bio solids		250 metres
	Outdoor covered windrows with continuous aeration – green waste		150 metres
	Enclosed windrows with odour control – mixed manures and food waste		250 metres
	Enclosed windrows with odour control – bio solids		150 metres

[14] Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

[15] Environmental Protection Authority Victoria. (2017). *Designing, Constructing, and Operating Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

[16] Emission Impossible Limited. (2012). *Separation Distances: A Discussion Document.* Auckland: Emission Impossible Limited.

[17] Environmental Protection Authority Western Australia. (2005). *Separation Distances Between Industrial and Sensitive Land Uses.* Perth: Environmental Protection Authority Western Australia.

	In-vessel composting with odour control – mixed manures and food waste		150 metres
	In-vessel composting with odour control – bio solids		
	Mushroom farming (depending on size) with onsite composting		500 – 1000 metres

Table 4: Composting and mushroom growing setbacks

[16] The Environmental Protection Authority of Victoria, Australia have prepared an analysis of the potential risk of harm to human health and the environment from the emission of composting different feedstocks, and composting techniques[18]. These can be found in **Appendix F**

[17] Feedstock such as green garden waste has the lowest risk level, and substances such as organic wastes, meat, and grease have the highest risk to human health and the environment. Sewage has a medium to high risk level.

[18] The various composting techniques have been ranked highest to lowest in their potential to generate odour. Open static windrows have the highest odour potential, with full enclosed facilities or in-vessel units having the lowest[19].

[19] A setback distance formula has been developed also by the Environmental Protection Authority Victoria, Australia to be used for composting sites with quantity less than 36,000 tonne per year (100 tonnes per day)[20]. However, this guidance was issued in 1996, and has limited relevance as it has been superceded by 2017 guidance from the Victoria EPA.

[20] Odour is calculated from the sum of the scale of the operation, the process used, and the material being composted. To determine the appropriate setback, a facility score needs to be calculated (process rating + feedstock rating). Then a value based on the quantity of material being composted is applied to determine an appropriate setback.

[22] Example:

Hard green waste

Windrow turned

10 t/d

Facility score: 2 + 12 = 14

Distance: 1000 metres

[18] Environmental Protection Authority Victoria. (2017). *Designing, Constructing, and Operating Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

[19] Environmental Protection Authority Victoria. (2012). *Separation Distances for Large Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

[20] Environmental Protection Authority Victoria. (1996). *Environmental Guidelines for Composting and other Organic Recycling Facilities.* Melbourne: Environmental Protection Authority Victoria.

FEEDSTOCK RATINGS

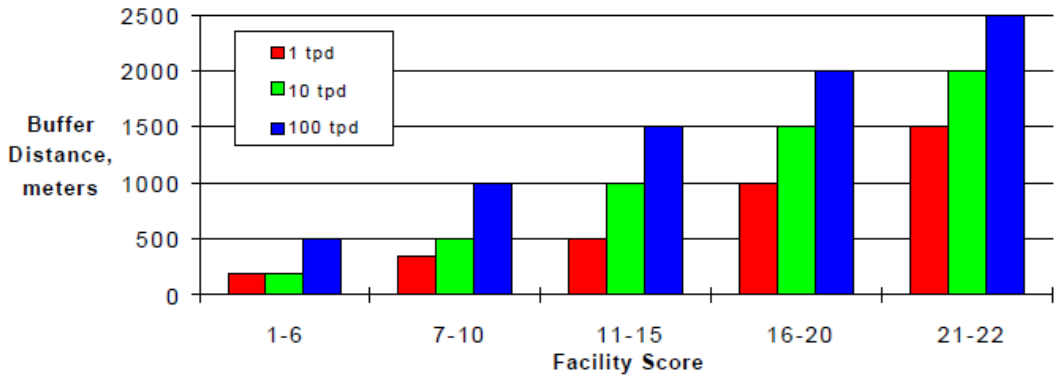
Feedstock composted*	Feedstock Rating
Animal excreta	6
Prescribed waste	5
Food processing waste	4
Municipal solid waste (garbage)	4
Sewage sludge (dewatered)	3
Hard green waste	2
Sewage sludge (> 7 year old)	1

* *Discuss wastes not listed with EPA.*

PROCESS RATINGS

Process type	Process Rating
Static pile /windrow	16
Windrow, turned	12
Vermiculture without pre-composting	9
Windrow, capable of continuous aeration	9
Roofed windrow, turned	9
Vermiculture with pre-composting	6
Roofed windrow, capable of continuous aeration	6
Indoor composting with odour control equipment (o.c.e.)	4
Solid phase anaerobic treatment, in-vessel with o.c.e.	2
In vessel aerobic composting with o.c.e.	1

BUFFER DISTANCES FOR COMPOSTING AT 1, 10, & 100 TONNES PER DAY



4.4 S-Factor Formulas

[23] Separation distance or S-factor empirical formulas have been widely used for siting new or expanding intensive livestock facilities in Australia. The S-factor formula approach has been adopted as a simple method for locating intensive livestock operations in Australia. The formulas can be used as a first step in determining the appropriate location of a new or expanding development. They are designed to provide a low cost, pre-defined method for calculating a conservative separation distance, thereby avoiding the additional cost associated with a low risk proposal having to conduct a more detailed site-specific odour modelling assessment.

Regarding S-Factor Formulas on a whole, such a simple, generalised method also needs to be conservative in order to avoid underestimating required separation distances in any circumstance. Also, with the increasing scale and complexity of operations, a simple formula has limitations and so above a certain farm size it is not recommended to use a generic approach. Hence, although a simple formula is useful, it also has limitations that must be recognised. The S-factor approach is generally considered to be conservative to very conservative, and it is considered that the risk of the formula calculating a less conservative distance than an appropriate modelling based assessment is low.. In other words, dispersion modelling is expected to indicate smaller separation distances than the s-factor[21].

4.4.1 Broilers:

S-Factor Formula 1, Victoria [22]

[24] Recommends a distance of 100 metres between the shed and the property boundary, and for up to 400,000 birds this formula has a set minimum setback of 250 metres to a sensitive activity, and 500 metres to a residential zone, or the calculated value, whichever is greater.

[25] Formula:

Distance = 27 * (stock number/1000) $^{0.54}$

[26] Example (100,000 birds):

Distance = 27 * (100000/1000)$^{0.54}$

Distance = 325 metres

S-Factor Formula 2, New South Wales [23]

[27] This formula is recommended use for up to 250,000 birds, which is the equivalent of 11.4 sheds (each generic shed being 100 metres by 13 metres, with approximately 22,000 chickens). It is recommended that any effluent disposal and storage area should be included in the setback. This formula as seen as the 'gateway' test in New South Wales. If a proposal exceeds the calculated setback distance then odour modelling is not required, and if it does not meet the stated setback then modelling will be required. An allowance for a margin of error should be considered due to risk factors such as katabatic drift, or large populated areas just outside of separation distances. Additionally, consideration of cumulative effects should be made if there are two farms close to each other.

[28] Formula:

D= (N) 0.71 * S1 * S2 * S3 * S4 * S5

N= shed number (assumption one shed = 22,000 birds)

[21] Ormerod, R. (2011). Re*view of Air Quality Assessment Issues for Poultry Operations in Queensland.* Queensland: PAE Holmes.

[22] Victorian Department of Primary Indistries. (2009). *Victorian Code for Broiler Farms.* Melbourne: Victorian Department of Primary Indistries.

[23] New South Wales Department of Environment and Conservation. (2006). *Assessment and Management of Odour from Stationary Sources.* Sydney: New South Wales Department of Environment and Conservation.

S1: Shed Design
S2: Receptor Type
S3: Terrain
S4: Vegetation
S5: Wind Frequency

'S' factor values can be found at **Appendix B**.

[29] Example:

- 88,000 Birds or 4 standard sheds (N)
- Controlled ventilation with barriers (S1)
- Single sensitive activity (S2)
- Flat (S3)
- Few trees, long grass (S4)
- Normal wind conditions (S5)

Distance = (4)0.71* 690* 0.3* 1* 0.9* 1

Distance = 529 metres

S-Factor Formula 3, Queensland[24]

[30] This paper used the work undertaken in a 2011 study by PAE Holmes on behalf of the Queensland Government. It recommended that the formula should be used for broiler farms of up to 300,000 birds, and in conjunction with a minimum separation distance, with the use of the greater value.

[31] Formula:

Distance = $(\text{bird number}/1000)^{0.63} * S1 * S2 * S3$

S1: Sensitive land use factor

S2: Surface roughness factor

S3: Terrain

'S' factor values can be found at **Appendix C**.

[32] Example:

- Birds: 100,000
- Sensitive land use within a rural zone (S1)
- Limited ground cover (S2)
- Flat (S3)

Distance = $(100000/1000)^{0.63} * 30 * 1 * 1$

Distance = 546 metres

[24] Department of Agriculture and Fisheries. (2016). *Development of meat chicken farms in Queensland.* Queensland: Queensland State Government.

4.4.2 Layers:

S-Factor Formula 4[25]

[32] This publication addresses the lack of information around setbacks between layer farms and sensitive activities, taking its S-Factor Formula from a previous report into this matter (McGahan & & Galvin, Odour Review of Layer Farms and Development of S-Factor Formula, 2018). This report states that the separation distance depends on; bird numbers, design, management, surface roughness between the discharge and receptor, terrain, meteorological conditions, and the type of receptor. This formula did not allow for the storage and disposal of manure, or free ranging areas.

[33] It recommends that a 100 metres buffer exist between the shed and the property boundary. For up to 400,000 birds it stipulates minimum separation distances of 250 metres to a sensitive activity, and 500 metres to a residential zone, or the calculated value, whichever is greater.

[34] Formula:

Distance = (number of birds/1000)$^{0.63}$ * S1 * S2 * S3 * S4

S1 = sensitive land use factor for estimating the relative odour impact potential of a development

S2 = land surface roughness factor for estimating the potential changes to odour dispersion due to changes in the roughness of the land surface

S3 – terrain weighting factor for estimating the potential changes to odour dispersion in situations where metrological conditions may be influence by local terrain features

S4 (optional) - wind frequency factor for estimate the relative odour impact due to the frequency of wind direction for wind speeds less than 3m^3

'S' factor values can be found at **Appendix A**.

[35] Example A:

- 100,000 birds
- To a sensitive activity within a Rural Zone (S1)
- Limited ground cover (S2)
- Flat terrain (S3)

- Distance = (100000/1000)$^{0.63}$ * 20 * 1 * 1
- Distance = 364 metres to a sensitive activity

[36] Example B:

- 100,000 birds
- To a non-rural zone (S1)
- Level wooded country (S2)

[25] McGahan, E. J., Wiedermann, S., & N., &. G. (2018). *Egg industry environmental guidelines Edition 2.* Australia: Australian Egg Industry Limited.

- Downslope receptor is at a gradient over 2% (S3)

- Distance = $(100000/1000)^{0.63} * 30 * 0.85 * 1.2$
- Distance = 557 metres

4.4.3 Either Bird Type

S-Factor Formula 5[26]

[37] This formula recommends its use for up to 500,000 broiler or layer birds, and should be used in conjunction with a minimum separation distance.

[38] Formula:

- $D=(\text{bird number}/1000)^{0.55} * 30 * S1 * S2 * S3 * S4 * S5$
- S1: Type of farm
- S2: Receptor type
- S3: Manure handling
- S4: Surface roughness
- S5: Terrain

'S' factor values can be found at **Appendix D**.

[39] Example A:

- 100,000 birds
- Layers (S1)
- Rural dwelling (S2)
- Manure taken offsite (S3)
- Long grass, few trees (S4)
- Flat (S5)

Distance = $(100000/1000)^{0.55} * 30 * 0.6 * 1 * 1 * 1 * 1$

Distance = 227 metres

[40] Example B:

- 100,000 birds
- Broiler (S1)
- Rural dwelling (S2)
- Manure taken offsite (S3)
- Long grass, few trees (S4)
- Flat (S5)

Distance = $(100000/1000)^{0.55} * 30 * 1 * 1 * 1 * 1 * 1$

Distance = 378 metres

[26] Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

4.4.4 Pigs

S-Factor Formula 6[27]

[41] Formula

Distance = $N^{0.55}$ * S1 * S2 * S3

N= SPU

S1: Design (S1 = effluent removal factor (S1r) * effluent treatment factor (S1t)

S2: Siting (S2 = receptor type (S2r) * surface roughness factor (S2s)

S3: Terrain

'S' factor values and SPUs can be found at **Appendix E**.

[42] Example:

- 1260 SPUs (approximately 1200 pigs depending on type)(N)
- Deep single use litter greater than 7 weeks (S1r)
- Litter removed (S1t)
- Rural dwelling (S2r)
- Long grass few tress (S2s)
- Flat (S3)

Distance = $1260^{0.55}$ * (1*0.5) * (11.5*1) * 1

Distance = 292 metres

5.0 Summary of Options to address Issues

5.1 Stock numbers in Selwyn as derived from Resource Consents

5.1.1 Pigs

[43] Mean: 1,288

[44] Range: 90 – 4,700

[45] Median: 800

5.1.2 Poultry (all types)

[46] Mean: 91,325

[47] Range: 2,000-472,000

[48] Median: 76,500

[27] Tucker, R. (2010). *National Environmental Guidelines for Piggeries.* Victoria: Australian Pork Limited.

5.2 Summary of Formulas

S-Factor Formula 1[28]

[49] Formula:

$$D = 27 * (\text{stock number}/1000)^{0.54}$$

S-Factor Formula 2[29]

[50] Formula:

$$D = (N)\ 0.71 * S1 * S2 * S3 * S4 * S4 * S5$$

S-Factor Formula 3[30]

[51] Formula:

$$D = (\text{bird number}/1000)^{0.63} * S1 * S2 * S3$$

S-Factor Formula 4[31]

[52] Formula:

$$D = (\text{number of birds}/1000)^{0.63} * S1 * S2 * S3 * S4$$

S-Factor Formula 5[32]

[53] Formula:

$$D = (\text{bird number}/1000)^{0.55} * 30 * S1 * S2 * S3 * S4 * S5$$

S-Factor Formula 6[33]

[54] Formula

$$D = N^{0.55} * S1 * S2 * S3$$

5.3 Applying formulas to Selwyn Data

[55] The following table provides a set of distances when applied to a typical scenario in the Selwyn situation across all of the various formula. The attributes used to determine the factors within the formula were that the farm be on flat land, has little significant vegetation cover surrounding it, normal wind conditions, the sensitive activity being a rural dwelling, and that litter would be

[28] Victorian Department of Primary Indistries. (2009). *Victorian Code for Broiler Farms.* Melbourne: Victorian Department of Primary Indistries.

[29] New South Wales Department of Environment and Conservation. (2006). *Assessment and Management of Odour from Stationary Sources.* Sydney: New South Wales Department of Environment and Conservation.

[30] Department of Agriculture and Fisheries. (2016). *Development of meat chicken farms in Queensland.* Queensland: Queensland State Government.

[31] McGahan, E. J., Wiedermann, S., & N., &. G. (2018). *Egg industry environmental guidelines Edition 2.* Australia: Australian Egg Industry Limited.

[32] Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

[33] Tucker, R. (2010). *National Environmental Guidelines for Piggeries.* Victoria: Australian Pork Limited.

taken off site. It should be noted that the calculated setback distances are indicative only because not all of the assumptions made are conservative. In particular, greater setback distances would be calculated where valley drainage or complex terrain effects occur, more sensitive receptors exist (such as residential areas), there is a high frequency of winds blowing from the farm towards the receptor, or where manure is stored or composted on site.

Formula	Stock Type	Mean (m)	Median (m)	Range (m)
1	Broiler	309	281	40 – 750
2	Broiler	529	397	132 – 2777
3	Broiler	516	461	46 – 1451
4	Layer	344	307	31 – 967
5	Layer	216	196	26 – 532
5	Broiler	359	326	44 - 887
6	Pigs	303	233	70 – 618

Table 5: Application of formulas to the Selwyn District[34]

[54] It should be noted that these formulas have been developed for the Australian industry, meaning that they may not be directly relatable to New Zealand situations, but can provide a general indication on what an appropriate setback could be under a typical scenario.

[55] On review of these figures and analysing the setbacks calculated for mean and median sized farms in the district, the S-Factor distances recommended between a typical intensive farm and a rural dwelling are in the order of 200 – 500 metres. Clearly there will be a wide range of calculated setback distances that are a function of the size of the farm, mitigation measures employed and site-specific conditions.

6.0 Preferred Option

[56] The Project Team recommends that the following:

Activity Type		Sensitive Activity (m)	Residential Zone (m)
Quarrying (includes processing)	No blasting	200	500
	Blasting	500	500
Poultry	Broiler	300	1,000
	Layer	300	1,000
Pigs		300	1,000

Table 6: Preferred Option Setbacks

[57] The same setback quanta are also recommended as those used for the reverse sensitivity buffers between sensitive activities/ residential zone and the listed activities.

[58] These distances have been developed and recommended on the principle raised within the issues section, that of a setback not being the primary mitigation tool to control odour and/or dust discharges, but rather as a method of catering for any periodic overspill of effects, and as a way of separating incompatible land uses. Under the Canterbury Regional Council's Air Plan, discharges

[34] Note the figures in this Table have not been adjusted to include s-factor minimums

should be self-contained within their own sites, but where an effect does occur it should be of a degree less than offensive and objectionable.

[59] It should be noted that these setbacks have not been developed in regard to the potential health effects of these activities, as this function sits within the regional planning framework. They are to address spill over effects where they may affect amenity values. Furthermore, the presense of setbacks should not indicate affected parties, but only the need for further assessment in regards to the discharge.

6.1 Quarrying

[60] The setback values recommended for this activity are derived from other district and regional plans from around New Zealand, include the new Canterbury Air Regional Plan (CARP). In addition to this other guidance was reviewed where available, this being in most cases Environmental Protection Authority requirements from Australia. The 200 metre setback value for quarrying (no blasting) to a sensitive activity was primarily derived from the values for bulk handling within the CARP. The CARP is a relatively new plan, which should have incorporated the latest research and guidance in this field, and also is a statutory plan for the Canterbury Region which the Selwyn District falls under. Regarding this latter point, it is ideal to have consistency between the district and regional planning frameworks.

[61] While the CARP does not stipulate a setback value for residential zones, other sources recommend a distance of 500 metres, which is considered appropriate as there is a need for more caution to be taken in regard to areas with large numbers of sensitive sites in close proximity to one another (a township), rather than a lone sensitive activity within the rural zone where some dust discharge is expected.

[62] It is recommended that the setback used for quarrying involving blasting be 500 metres for both residential zones and sensitive activities. While blasting is very rare within the Selwyn District, an extra setback allowance within the District Plan is appropriate given the potential for any blasting to intensify any potential effect (dust, noise, and vibration) from the quarrying. Additionally a 500 metre value is used within the CARP, so therefore it is appropriate to be consistent with this value.

6.2 Intensive farming

[63] While various animal types, and management techniques result in different intensities of odour profiles, for the sake of user friendliness of the plan, one value has been recommended to cover all of the different stock types of intensive farming.

[64] Based on all of the guidance, research, S-factor Formulas, and other district and regional plan content, it is recommended that the setback for sensitive activities be 300 metres, and one kilometre for residential zones. The recommended setback quanta are based on an approximate mean of all of the values contained within the aforementioned sources, and rounded to square numbers for the sake of plan clarity. Another aspect which helps to support the 300 metre figure is that it is the current figure used within the Operative District Plan, which appears to be working without significant issues. Most guidance contained separate values for residential zones, usually much larger than that used just for a single sensitive activity. This is to help reflect the density of sensitive activities, and the increased likelihood of an effect and/or reverse sensitivity.

Furthermore, as with quarrying, some odour and dust is expected within the rural zone, and thus the thresholds controlling this activity in regard to sensitive activities within the rural zone should reflect this.

6.3 Composting

[65] On review of the studies and guidance provided for compost manufacture it is recommended that setbacks are not used within the district plan for this activity type. The reasoning behind this is that composting can be widely variable from the type of feedstock to the method of composting, all with different effects on the overall odour profile of the activity. Therefore, it is appropriate to render this activity as a discretionary activity and allow the activity to be treated on its merits. Additionally, given the small number of composting manufacturers in the Selwyn District, and the low probability that there will be a proliferation of them in the future, this stance would not be to unduly restrictive.

6.4 Mushroom growing

[66] Regarding mushroom growing, there is a lack of any evidence to point towards what an appropriate setback would be for this activity type. Effects are related to the use of compost on the site and the nature of the mitigation measures applied. Therefore, no setback should be used within the district plan for this activity type, as any setback within a district plan needs to have an evidential basis to support it. It is recommended, as for the composting manufacturing activity, that the commercial growing of mushrooms be a discretionary activity. Given the small number of mushroom growers within the district this approach would not be too unduly restrictive.

[67] No reverse sensitivity buffer would also exist for composting and mushroom growing given the unclear nature of what an appropriate setback would be.

7.0 References

CCSG Associates. (2016). *Buffer zone considerations for mining development in proximity to human populations.* Whitehorse.

Department of Agriculture and Fisheries. (2016). *Development of meat chicken farms in Queensland.* Queensland: Queensland State Government.

Department of the Environment Western Australia. (2004). *Environmental Code of Practice for Poultry Farms in Western Australia.* Perth: Western Australian State Government.

Emission Impossible Limited. (2012). *Separation Distances: A Discussion Document.* Auckland: Emission Impossible Limited.

Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

Environmental Protection Authority Victoria. (1992). *Code of Practice Piggeries.* Melbourne: Environmental Protection Authority Victoria.

Environmental Protection Authority Victoria. (1996). *Environmental Guidelines for Composting an other Organic Recycling Facilities.* Melbourne: Environmental Protection Authority Victoria.

Environmental Protection Authority Victoria. (2012). *Separation Distances for Large Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

Environmental Protection Authority Victoria. (2013). *Recommended Separation Distance for Industrial Residual Air Emissions.* Melbourne: Environmental Protection Authority Victoria.

Environmental Protection Authority Victoria. (2017). *Designing, Constructing, and Operating Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

Environmental Protection Authority Western Australia. (2005). *Separation Distances Between Industrial and Sensitive Land Uses.* Perth: Environmental Protection Authority Western Australia.

Goan, C. (2011). *Site Selection Factors for New Poulty Facilities.* Knoxville: University of Tennessee.

McGahan, E. J., & & Galvin, G. (2018). *Odour Review of Layer Farms and Development of S-Factor Formula.* Australia: Australian Eggs Limited.

McGahan, E. J., Wiedermann, S., & N., &. G. (2018). *Egg industry environmental guidelines Edition 2.* Australia: Australian Egg Industry Limited.

McGahan, E., Barker, S., & & Tucker, R. (2008). *Environmental guidelines for the Australian Egg Industry.* Australia: Australian Egg Coporation Limited.

New South Wales Department of Environment and Conservation. (2006). *Assessment and Management of Odour from Stationary Sources.* Sydney: New South Wales Department of Environment and Conservation.

Ormerod, R. (2011). *Review of Air Quality Assessment Issues for Poultry Operations in Queensland.* Queensland: PAE Holmes.

Tabler, G. T. (2018). *Setback Distance for Poultry Houses.* Starkville: Mississippi State University.

Tucker, R. (2010). *National Environmental Guidelines for Piggeries.* Victoria: Australian Pork Limited.

Tucker, R. (2013). *National Environmental Guidelines for Rotational Outdoor Piggeries.* Victoria: Australian Pork Limited.

Victorian Department of Primary Indistries. (2009). *Victorian Code for Broiler Farms.* Melbourne: Victorian Department of Primary Indistries.

7.0 Appendices

7.1 Appendix A[35]

Table 4 Summary of S-factors

Factor Description		Factor
S1 – Sensitive Land Use Factor		
Receptor Type		
Sensitive land use (within a rural zone)		20
Non-rural zone (closest boundary of the non-rural zone)		30
S2 – Surface Roughness Factor		
Surface Roughness Features		
Limited groundcover/short/grass/cropland, few trees		1.00
Undulating hills		0.93
Level wooded country		0.85
Heavy timber		0.77
Significant hills and valleys		0.68
S3 Factor – Terrain Weighting Factor		
Terrain	**Weighting Factor**	
	Downslope of site	Upslope of site
Flat – <2% from source to receptor	1.0	1.0
Valley drainage zone – Broad valley >10 km and/or a valley or gully with low side walls, where the average slope from centre of valley/gully to confining ridgeline is <2%*	1.2	1.0
Valley drainage zone – Average slope from centre of valley/gully to confining ridgeline is 2-5%*	1.5	1.0
Valley drainage zone – Average slope from centre of valley/gully to confining ridgeline is >5%*	2.0	1.0
Low relief at >2% from farm site – Not in a valley drainage zone, but the source lies above the receptor at an average grade of more than 2%*	1.2	N/A
All other situations*	1.0	1.0

**If there is an associated risk of katabatic drainage*

[35] McGahan, E. J., & & Galvin, G. (2018). *Odour Review of Layer Farms and Development of S-Factor Formula.* Australia: Australian Eggs Limited.

7.2 Appendix B[36]

Table 1 Summary of S-factors – NSW formula

Factor Description	Value
S1 Factor – Shed Factor	
Shed Type	
Controlled fan ventilation without barriers	980
Controlled fan ventilation with barriers	690
Natural ventilation	690
S2 Factor – Receptor Factor	
Receptor Type	
Large towns, greater than 2,000 persons	1.05
Medium towns, 500–2,000 persons	0.75
Medium towns, 125–500 persons	0.55
Small towns, 30–125 persons	0.45
Small towns, 10–30 persons	0.35
Single rural residence	0.30
Public area (occasional use)	0.05
S3 Factor – Terrain	
Terrain Features	
Valley drainage zone	2.0
Low relief	1.2
Flat	1.0
Undulating country	0.9
High relief or significant hills and valleys between meat chicken farm and receptor	0.7
S4 Factor - Vegetation Factor	
Vegetation	
Crops only, no tree cover	1.0
Few trees, long grass	0.9
Wooded country	0.7
Heavy timber	0.6
Heavy forest (both upper and lower storey)	0.5
S5 Factor – Wind Frequency Factor	
Wind frequency	
High frequency towards receptor	1.5
Normal wind conditions	1.0
Low frequency towards receptor	0.7

[36] New South Wales Department of Environment and Conservation. (2006). *Assessment and Management of Odour from Stationary Sources.* Sydney: New South Wales Department of Environment and Conservation.

7.3 Appendix C[37]

Table 2 Summary of S-factors – Qld formula

Factor Description	Value
S1 – Sensitive land use factor	
Receptor Type	
Sensitive Land Use (within a rural zone)	30
Non-rural zone (closest boundary of the non-rural zone)	50
S2 - Surface roughness factor	
Surface Roughness Features	
Limited ground cover / short grass	1.00
Undulating hills	0.93
Level wooded country	0.85
Heavy timber	0.77
Significant hills and valleys	0.68

S3 Factor – Terrain Weighting Factor		
Terrain	**Weighting Factor**	
	Downslope of site	Upslope of site
Flat (<0.1% in all directions)	1.0	1.0
Valley drainage zone – (Broad valley >10 km and/or a valley or gully with low side walls, where the average slope from centre of valley/gully to confining ridgeline is <2%)	1.2	1.0
Valley drainage zone – (Average slope from centre of valley/gully to confining ridgeline is 2–5%)	1.5	1.0
Valley drainage zone – (Average slope from centre of valley/gully to confining ridgeline is >5%)	2.0	1.0
Low relief at >2% from farm site (Not in a valley drainage zone, but the source lies above the receptor at an average grade of more than 2%)	1.2	-
All other situations	1.0	1.0

[37] Department of Agriculture and Fisheries. (2016). *Development of meat chicken farms in Queensland.* Queensland: Queensland State Government.

7.4 Appendix D[38]

Table 4 Summary of S-factors – SA formula

Factor Description	Value
S1 Factor – Type of poultry farm factor	
Production system	
Broiler meat chicken production	1.0
Broiler meat chicken production (free range)	0.85
Egg production	0.6
S2 Factor – Receptor type factor	
Receptor Type	
Town	2.0
Rural residential	1.5
Rural dwelling	1.0
S3 Factor – Litter manure handling factor	
Litter manure handling	
Used litter/manure taken off site	1.0
Litter/manure on site > 3 days and < 2 weeks	1.15
Litter/manure stored/composted on site > 2 weeks	1.3
S4 Factor – Surface Roughness Factor	
Surface Roughness	
Settled areas – Metropolitan area or continuous residential, commercial and/or industrial areas.	1.0
Long grass, few trees – Open country with few or scattered trees. Topography would be predominantly flat to slightly undulating.	1.0
Undulating hills - Situations where topography consists of continuous rolling, generally low level hills and valleys, but without sharply defined ranges, ridges or escarpments. Assumes minimal vegetation.	0.93
Level Wooded country - Open forest country with tree density not sufficient to provide a continuous canopy but sufficiently dense to influence air movement. There would be little or no lower storey vegetation. The density is such that the vegetation can be considered as a continuous belt	0.85
Heavy timber - Generally tall forests with dense timber stands, providing a continuous canopy. There is limited understorey vegetation mainly associated with regrowth.	0.77
Significant hills and valleys - Where one or more lines of hills are sufficiently large enough to influence air movement between the receptor and the activity	0.68
S5 Factor – Terrain Weighting factor	
Terrain Features	

Terrain	Weighting Factor	
	Downslope of site	Upslope of site
Broad valley/Drainage (0.1-1%)	1.6	1.0
Sloping terrain (1-2%)	1.5	1.0
Flat (<0.1% in all directions)	1.0	1.0
Hilltop (>4%)	1.2	N/A
Narrow valley (1-2%)	1.2	0.5

[38] Environmental Protection Authority South Australia. (2016). *Evaluation distance for effective air quality and noise management.* Adelaide: Environmental Protection Authority South Australia.

7.5 Appendix E[39]

TABLE 4.1 SPU conversion factors

Pig Class	Mass Range (kg)	Age Range (weeks)	SPU Factor	Pig Numbers (and SPU) for typical 100-sow farrow-to-finish (26 weeks) piggery
Gilt	100 – 160	24 – 30	1.8	5 (9)
Boar	100 – 300	24 – 128	1.6	5 (8)
Gestating sow	160 – 230	-	1.6	83 (133)
Lactating sow	160 – 230	-	2.5	17 (43)
Sucker	1.4 – 8	0 – 4	0.1	177 (18)
Weaner	8 – 25	4 – 10	0.5	253 (127)
Grower	24 – 55	10 – 16	1.0	249 (249)
Finisher	55 – 100	16 – 24	1.6	330 (528)
Heavy finisher	100 – 130	24 – 30	1.8	82[a] (148)
			TOTAL	**1201 (1263)**

[39] Tucker, R. (2010). *National Environmental Guidelines for Piggeries.* Victoria: Australian Pork Limited.

TABLE A.2 Summary of S factors for use with Level 1 calculations

Factor Description	Value
S1 Factor = Effluent Removal System Factor, $S1_R$ * Effluent Treatment Factor, $S1_T$	
Effluent Removal System	
Conventional shed – static pit, pull plug or flushing system	1.00
Deep litter system, pigs on single batch of litter ≤ 7 weeks	0.63
Deep litter system, pigs on single batch of litter > 7 weeks	1.00
Effluent Treatment	
Pond with >40% separation of volatile solids before pond	0.80
Pond with 25 – 40% separation of volatile solids before pond	0.90
Pond with <25% separation of volatile solids before pond	1.00
Permeable pond cover – preliminary factor, subject to change	0.63
Impermeable pond cover	0.50
Deep litter system – spent bedding stockpiled / composted on-site	0.63
No manure treatment or storage on-site – effluent / litter removed from site	0.50
S2 Factor = Receptor Type Factor, S2R x Surface Roughness Features Factor, S2S	
Receptor Type	
Town	25
Rural Residential	15
Rural Dwelling	11.5
Surface Roughness Features	
Limited ground cover / short grass	1.00
Undulating hills	0.93
Level wooded country	0.85
Heavy timber	0.77
Significant hills and valleys	0.68

S3 Factor – Terrain Weighting Factor		
Terrain	**New Weighting Factor**	
	Downslope of site	**Upslope of site**
Narrow valley (1-2%)	1.2	0.5
Sloping terrain (1-2%)	1.5	1
Flat (<0.1% in all directions)	1	1
Broad valley/Drainage (0.1-1%)	1.6	1
Hilltop (>4%)	1.2	N/A

Notes: S1 factors for an outdoor piggery would need to be negotiated with the relevant approved authority.

7.6 Appendix F [40] [41]

5.1. Feedstock categories

The categorisation approach adopted by EPA ranks feedstock into four categories from lowest to highest potential risk of harm to human health and the environment.

Table 4 – feedstock categories

Category	Risk level	Waste types	Definitions and examples
1	Lowest	Garden and landscaping organics	Grass, leaves, plants, branches, tree trunks and tree stumps
		Untreated timber	Sawdust, shavings, timber offcuts, crates, pallets, wood packaging
		Natural organic fibrous organics	Peat, seed hulls/husks, straw, bagasse and other natural organic fibrous organics
2	Medium	Municipal source separated kerbside garden waste	Grass, leaves, plants, branches, tree trunks and tree stumps
		Biosolids and aged manure	Biosolids that meet treatment grades T1 to T3[5]. Aged manure that has a dry matter greater than 35%
3	Medium to high	Dewatered sewage sludge and fresh manures	Dewatered sewage sludge (does not meet the T1 to T3 standards), animal manure and mixtures of animal manure and animal bedding organics
		Other natural or processed vegetable organics	Vegetables, fruits and seeds and processing wastes, winery, brewery and distillery wastes, food organics excluding organics in category 4
		Mixed source separated kerbside (Garden waste/food waste – FOGO)	Grass, leaves, plants, branches, tree trunks and stumps, vegetables, fruit and meat
		Grease interceptor trap wastes	Grease trap waste with less than 10% solids
4	Highest	Liquid organic wastes (excluding grease interceptor trap waste with less than 10% solids)	Liquid food waste and liquid food processing wastes (including sludges), liquid animal wastes (blood) and paunch (sludge), grease trap with greater than 10% solids
		Meat, fish and fatty foods	Animal mortalities, parts of carcasses, bone, fish and fatty processing or food

Process type	Potential for odour generation
Open, static pile/windrow	**Highest**
Open, turned windrow (Reference facility 2)	↓
Open, aerated, static pile/windrow, capable of continuous aeration	
Vermiculture	
Covered, aerated, static pile/windrow, capable of continuous aeration and moisture control, open-air maturation	
Housed/indoor composting with odour-control equipment and open-air maturation	
Covered process for active and maturation phase with odour-control equipment	
In-vessel (tunnel or drum) aerobic composting with odour-control equipment and open air maturation (Reference facility 1)	
Fully enclosed facility with enclosed receipts and enclosed maturation phase with best-practice odour-control technology[1]	**Lowest**

1 Best-practice odour-control technology will be assessed based on the proposal and the best available technology would be expected. Consideration of international practices may also be relevant.

[40] Environmental Protection Authority Victoria. (2017). *Designing, Constructing, and Operating Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

[41] Environmental Protection Authority Victoria. (2012). *Separation Distances for Large Composting Facilities.* Melbourne: Environmental Protection Authority Victoria.

7.7 Appendix G: Peer Review Report

SES
Specialist Environmental Services Ltd

15 Fort Pl, R.D.2 Wanaka 9382 Ph. 027 437 9044

19th December 2018

Selwyn District Council

PO Box 90

Rolleston 7643

Attention: Mr Robert Love

Strategy and Policy Planner

Dear Robert

Re: Review of the Setback Analysis Report for Activities with an Air Quality Component

Specialist Environmental Services Limited (SES) has been engaged by the Selwyn District Council (SDC) to undertake a review of the Setback Analysis Report (the report) prepared by SDC as part of consideration of rural activities under the District Plan Review. The report has carried out an assessment and provided recommendations on the potential setbacks between various activities and sensitive activities. The activities discharging odour and dust that are considered in the report are:

- Intensive farming;
- Quarrying;
- Compost manufacture; and
- Mushroom growing.

This review will assess the recommendations in the report and examine the methodology and evidence used to support those recommendations. The review will also note if any particular gaps of knowledge or evidence are identified in the report.

Specific review comments relating to any substantive matters are addressed below. In addition, a Word version of the report will be provided by email that has been marked with tracked changes and comments that connect the review points to relevant sections of the report. There are a number of minor tracked changes suggested in the report, for grammatical reasons or to assist clarity, that are not specifically discussed in this review.

Review comments are listed in relation to each section of the report.

Sections 1 and 2 - Introduction and Summary of Issues

The Ministry for the Environment's Good Practice Guide for Assessing and Managing Odour[42] provides a useful summary of the application of separation distances to odour management (Section 5.1.2, p55-56 of the Guide). That information could be used to provide an introduction to the "summary of issues" section that may provide additional background and context for the reader. Note that Section 3.2.4, p27-28 of the Good Practice Guide also provides information regarding reverse sensitivity.

Para 11 – Explanation of the reason for consents always being required for commercial composting, mushroom farming and quarrying would be helpful to the reader. It is noted that from an air quality perspective alone, some quarries could be classified as permitted activities subject to appropriate setback and conditions.

Para 12 – It is noted that the Queensland allowance for 50% increase to the recommended setback to account for cumulative effects is somewhat simplistic. The degree of any cumulative effect will depend on the location of the individual emission sources in relation to each other, the prevailing wind conditions and the location of sensitive receptors. Nevertheless, it is accepted that some degree of conservatism to allow for cumulative effects is appropriate.

Section 4 - Summary of Setback Quanta

Intensive Farming

Table 1 provides a useful summary of setbacks for intensive farming stipulated in various plans and recommended by other authorities in Australia and internationally. Guidance provided by the Australian EPAs for various activities is commonly considered in the New Zealand context, although it is subject to limitations. Some minor adjustments to the range of values shown in the table for NZ plans are suggested in the emailed tracked change version so that the range accurately reflects the quanta in the preceding columns.

Para 15 – The piggery setbacks in Table 2 are based on 1992 guidance from the Victoria EPA. A qualifying statement at the end of para 15 is suggested as follows:

"The Victorian piggery setback guidance is now somewhat dated (1992), but continues to be referenced by the Victorian EPA recommended separation distances (2013)."

Quarrying

Table 3 provides a good summary of the range of setbacks for sensitive receptors from quarrying that are applied in New Zealand and Australia. Note also that the Good Practice Guide for Assessing and Managing Dust[43] at p53 references the Auckland Air, Land and Water Plan that classifies quarries less than 200m from dwellings as controlled activities, providing an example of where setbacks are used to determine activity status.

The setback of 500m from quarrying of materials containing respirable crystalline silica (RCS) recommended by the Victoria EPA relates to potential health effects, rather than nuisance effects. Minor

[42] Ministry for the Environment. 2016. Good Practice Guide for Assessing and Managing Odour. Wellington.
[43] Ministry for the Environment. 2016. Good Practice Guide for Assessing and Managing Dust. Wellington.

adjustment of the summary range of quarry setback distances is suggested in the tracked change version to accurately reflect data in the preceding rows of the table.

Composting and Mushroom Growing

Table 4 provides a useful summary of the wide range of setbacks recommended in Australia and New Zealand for composting of various feedstocks.

Para 19 – The 1996 Victoria EPA guidance is dated. Given the inclusion of the Victoria EPA 2017 guidance distances in the table, reference to the 1996 formula approach adds limited value and could be deleted. If it is retained, it is suggested that the final sentence of para 11 be amended to read:

"However, this guidance was issued in 1996, and has limited relevance as it has been superseded by 2017 guidance from the Victoria EPA."

S-Factor Formulas

There are limitations to the use of S-Factor formulas and it is recommended that a summary regarding their application be included at the beginning of Section 4.4 as follows:

"Separation distance or S-factor empirical formulas have been widely used for siting new or expanding intensive livestock facilities in Australia. The S-factor formula approach has been adopted as a simple method for locating intensive livestock operations in Australia. The formulas can be used as a first step in determining the appropriate location of a new or expanding development. They are designed to provide a low cost, pre-defined method for calculating a conservative separation distance, thereby avoiding the additional cost associated with a low risk proposal having to conduct a more detailed site-specific odour modelling assessment."

It is expected that S-Factor formulas are likely to be particularly conservative when applied to very large intensive farms in the New Zealand context. In these cases, the farm is likely to be required to obtain consent to discharge contaminants to air (from the regional council) and application of best practice mitigation measures could result in a significantly reduced separation distance being assessed.

Section 5 – Summary of Options to Address Issues

5.1 – Reference for the source of the Selwyn District stock data should be included. Because of the very wide range of pig and poultry farm sizes in the district, there is a degree of risk that adopting a single setback distance could result in an excessive buffer for the smallest farms and insufficient separation for the largest intensive farms. This matter is discussed further in relation to the preferred options.

Para 55 – Given the significant limitations of applying S-Factor formulas without site-specific information, it is recommended that a qualifier be added to the end of para 55 as follows:

"It should be noted that the calculated setback distances are indicative only because not all of the assumptions made are conservative. In particular, greater setback distances would be calculated where valley drainage or complex terrain effects occur, more sensitive receptors exist (such as residential areas), there is a high frequency of winds blowing from the farm towards the receptor, or where manure is stored or composted on site."

Table 5 - The data in Table 5 should be adjusted to include the minimum recommended separation distances for the S-Factor formulas. For example, Formulas 1 and 4 specify a minimum setback of 250m. This will affect the range and the mean/median values in the Table.

There is a broad range of calculated setback distances for intensive farms in the Selwyn District and it is recommended that the final para of Section 5 be amended to read as follows:

"On review of these figures and analysing the setbacks calculated for mean and median sized farms in the district, the S-Factor distances recommended between a typical intensive farm and a rural dwelling are in the order of 200 – 500 metres. Clearly there will be a wide range of calculated setback distances that are a function of the size of the farm, mitigation measures employed and site-specific conditions."

Section 6 – Preferred Options

Quarrying

Based on analysis of the setback quanta, the recommended setback of 200m from a sensitive activity (such as a rural dwelling) for quarrying without blasting is considered to be reasonable. Quarrying in the Selwyn District typically involves extraction of aggregate below ground level. Provided good practice mitigation measures are in place, significant dust nuisance effects are not expected beyond 200m from the source. The report correctly recognises that setbacks for district planning purposes are based on nuisance effects, not potential health effects associated with RCS.

The recommended setback of 500m for quarrying with blasting is considered to be appropriate. The recommended setback of 500m from residential zones is relatively large when applied to gravel extraction without aggregate processing or screening. It is suggested that from an air quality perspective a lesser setback (in the order of 200-300m) could be applied from residential zones in circumstances where blasting or processing (including crushing and screening of aggregate) does not occur.

Intensive Farms

The 300m recommended setback for intensive farms from sensitive activities has value for reasons of simplicity and consistency with the existing planning framework. However, it is noted that the data in Table 5 indicate a wide range of calculated setback distances for the various poultry farms (2000-472,000 birds) and piggeries (90-4700 pigs) in the district. Consequently, there is an issue that a single setback distance of 300m is likely to be excessive for very small farms and insufficient for the largest farms. This issue could potentially be addressed by setting a scale limit with a lesser setback applying to the smallest farms, and also by specifying different setback distances based on animal type.

In terms of setting a scale limit, it is recognised that a lesser setback for the smallest farms would not allow for potential expansion of farms in future. Therefore, such an approach has limitations, particularly if applied in relation to reverse sensitivity. In other words, allowing dwellings to establish nearby very small farms could result in odour nuisance in future if the farm subsequently expands. On balance, and having reviewed the data in Tables 1, 2 and 5 of the report, it is considered that a setback of 300m from rural dwellings is appropriate for all intensive farms. While this setback may be insufficient for very large farms, new developments of this type are likely to require consent to discharge contaminants to air from the regional council with site-specific assessment based on the mitigation proposed.

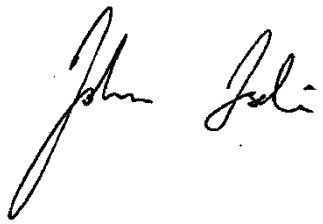
The recommended separation distance from residential zones of 1000m is relatively conservative and has implications from a planning perspective, being a significant change from the current plan requirements. Consideration could be given to setting a lesser setback specifically for layer farms in the order of 500m. Such a setback would be in line with Australian Egg Industry Guidance (2018) shown in Table 1 of the report.

Composting and Mushroom Growing

It is agreed that it is appropriate not to specify setbacks for these activities in the plan, given the small number of activities and the difficulty in determining an appropriate setback distance. It is expected that mushroom growing and composting would require discharge permits from the regional council whereby a site-specific assessment of effects is undertaken.

Please contact the author if you require any clarification of the above matters.

Yours sincerely



John Iseli

Principal Air Quality Consultant