MARSHALL DAY Acoustics

AUCKLAND REGIONAL LANDFILL ASSESSMENT OF ENVIRONMENTAL NOISE EFFECTS

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1.0 INTRODUCTION

Marshall Day Acoustics (MDA) has been engaged by Waste Management New Zealand (WMNZ) to prepare an assessment of environmental noise effects related to the initial construction and ongoing development and operation of a new waste disposal site at Wayby Valley. This new landfill site would replace the Redvale Landfill site which is expected to have reached the end of its operational life around 2026 – 2028. As such, a replacement site would be required to service Auckland and WMNZ has identified Wayby Valley to be a suitable location.

This report sets out the relevant noise performance standards, details the existing ambient noise environment, and assesses the noise effects from construction and operation of the new landfill site.

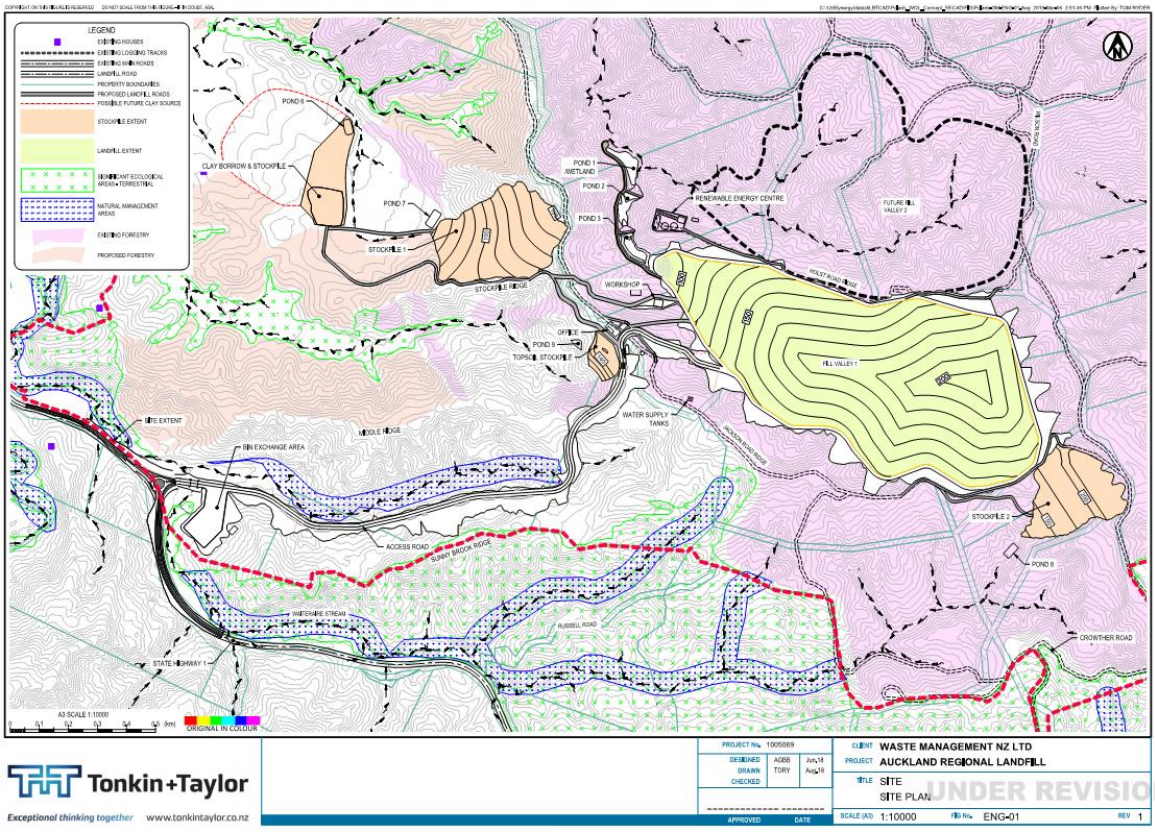
A glossary of terminology can be found in Appendix A.

2.0 PROJECT DESCRIPTION

2.1 Location and Project Layout

The project area (i.e. overall footprint related to landfill activities) would be located in Wayby Valley, approximately 13km north of Warkworth, and 6km south of Wellsford. The project area is zoned *Rural – Rural Production Zone* in the Auckland Unitary Plan (AUP). The concept plan for landfill activities can be seen below in Figure 1. A wider view of WMNZ's landholdings can be seen in Figure 2 in Section 2.3.

Figure 1: Proposed project area plan



As shown, there are proposed to be a clay borrow area and two main stockpile areas (located at the western end of the project area, middle of the project area, and eastern end of the project area respectively), and one significantly smaller topsoil stockpile located between the middle stockpile and the landfill area. The landfill area is proposed to be located in 'Valley 1', currently a commercial pine forest, and so would not have line of sight, in terms of acoustics, to any receivers for the majority of its operational life. The project area would be serviced by a new access road (approximately 2km long) constructed to connect the landfill working face to State Highway 1 and

the bin exchange area to the west. A landfill gas treatment plant (the renewable energy centre) would be constructed on a ridge line centrally within the WMNZ landholding, for electrical power generation from landfill gas collection (with associated flares), beginning in approximately year 2 of landfill operations.

For a full project description, refer to the Assessment of Environmental Effects (AEE) prepared by Tonkin & Taylor.

2.2 Operation Summary

The lifespan of the landfill in Valley 1 is estimated to be between 35 – 50 years. Therefore, WMNZ is seeking the maximum Resource Consent term of 35 years.

Valley 1 provides approximately 25 million m^3 of airspace for filling. The working face is proposed to be open between 0500 – 2200 hrs six days of the week and 0700 – 1700 hrs on Sunday. Nearby stockpile areas would be used to provide daily cover soil as required throughout the hours of operation. Initially, the valley would be contoured to enable construction of the lining system and will progressively be filled to its final capping level. The final cap level will vary across the valley with the highest point understood to be RL 200.

There would be seasonal cell construction works every year for approximately 30 weeks every summer (October – April). Cell development works are required to form the valley into a smooth shape and to place a lining system so that it would be suitable for landfill operations. These works will carry on seasonally until the base lining system for the whole landfill valley is completed up to the upper limit of the footprint. It is understood that blasting of rock may occasionally be required.

Landfill gas (LFG) is proposed to be collected in vertical and horizontal pipes constructed within the landfill waste as the waste placement progresses. LFG would be actively extracted from the landfill through a battery of pumps/blowers. Treatment would include combustion in a generator (for electricity generation), by flare, or purification/conversion to a level suitable for commercial use. LFG might also be used as part of the leachate treatment process (evaporation).

Leachate will be actively extracted from the landfill through a network of closed pipes and a pumping arrangement. Unlike gas extraction, leachate pumping would not be on continuous basis.

A Bin Exchange Area is proposed near the entrance of the project area. The main purpose of the Area is for the line haul trucks to exchange full waste containers for empty ones. Full bins would then be taken up to the tip face using dedicated mule trucks during the landfill work hours (0500 – 2200 hrs). The bins would then be emptied and returned to the Bin Exchange Area. MDA understands that electric mule vehicles are proposed in the latter years of landfill operations but for the purposes of this assessment, diesel trucks have been modelled as a conservative approach. The park would have capacity for 50 bins and would be open to vehicles exchanging bins at all times. WMNZ and third-party delivery vehicles bringing waste to the landfill during landfill work hours would proceed directly to the tip face via the weighbridge.

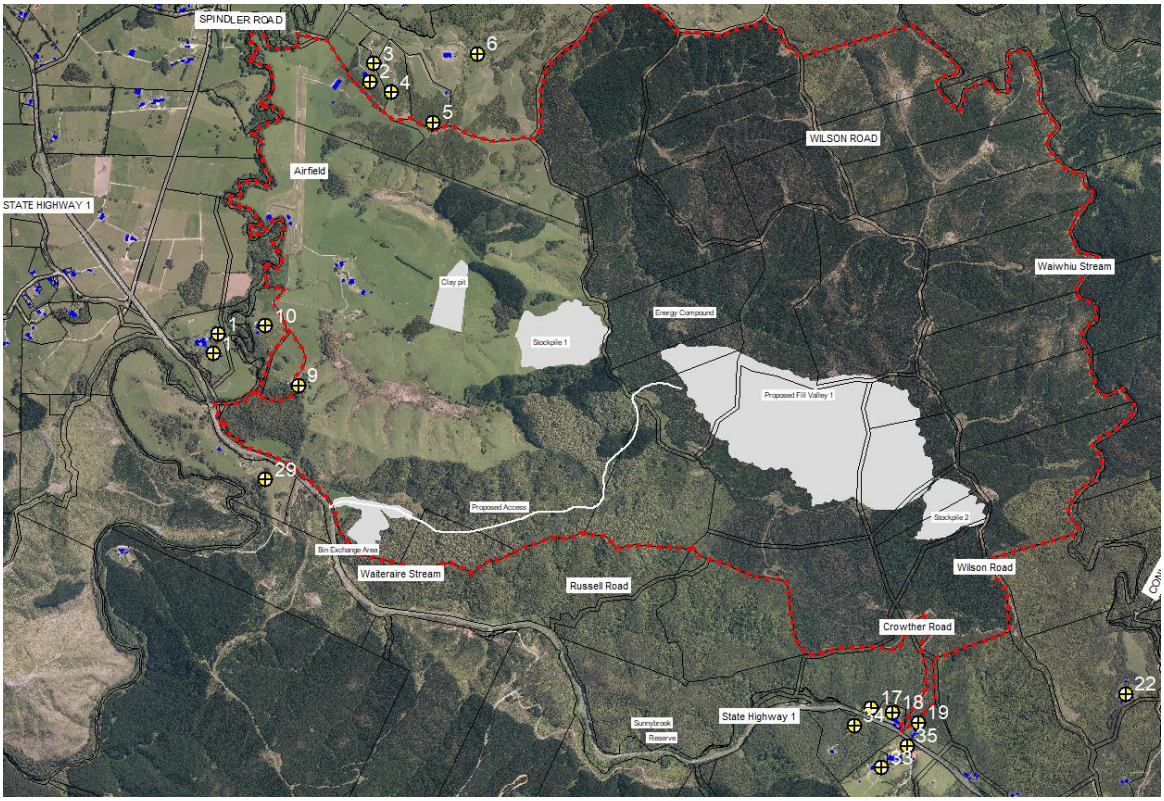
A full operational summary is provided by the Tonkin & Taylor AEE.

2.3 Nearby Receivers

All nearby receivers are zoned *Rural – Rural Production Zone* in the AUP. Figure 2 shows the location of the closest nearby receivers relative to the location of the proposed landfill valley and labelled according to the property owners list given in Appendix B. The nearby receivers are:

- 01. Springhill Estate
- 02. Fletcher, D.G. & Taylor, C.L.
- 03. Sarney, D.C. & I.A.
- 04. Rose, B.G. & I.A.
- 05. Markham, D.M. & S.
- 06. King S.L. & Tomlinson, P.W.
- 09. Izard-Price, P.D, Price, K.I. & Wiles
- 10. Harrison, C. & T.J.
- 17. Gallagher, R.N.
- 18. Barry, L.R. & M.J.
- 19. An Kyung H & Lee Ho S
- 22. Waterfall Farm (Waiwhiu) Ltd
- 29. McDougall, I.A.R & M.M
- 33. Appleby, F.J. & M.J.T.
- 34. Jung Hee Lee
- 35. Purvis, CW & ME

Figure 2: Nearby Receivers (half-yellow, half-white circles) and Waste Management landholdings outlined in red-dash



The nearest receiver to any of the project activity areas is receiver number 29, which is approximately 360m from the entrance of the proposed Bin Exchange Area. The nearest receiver to the proposed landfill valley are receivers 17, 18, and 19 who are approximately 1000m from the edge of valley 1 (i.e. the proposed landfill footprint). All other receivers are further setback from the landfill valley. All receivers are naturally shielded from the tip face by intervening ridgelines.

Note that the western block (Springhill Farm) directly west of the landfill valley has not been identified as a receiver as this block is part of the WMNZ landholdings. Receiver number 9 is the closest to the clay borrow pit and Stockpile 1.

3.0 EXISTING NOISE ENVIRONMENT

Two noise monitoring terminals (noise loggers) were deployed between 23 August 2018 and 31 August 2018 to measure the existing noise levels. The measurement locations can be seen in Figure 3 and a summary of the results given in Table 1. Appendix C provides detailed results and time traces of the measured noise levels over the period. Note that only days that provide complete 24-hour measurement results are presented. The presented data were also adjusted to exclude periods that had adverse weather conditions unsuitable for noise measurements (i.e. not in accordance with the relevant standards).

Measurement Position 1 (MP1) was selected to be representative of receivers 9 and 10 at the western boundary of the Western Block. MP2 is well setback from State Highway 1 and was selected to be representative of receivers where the background noise level is likely to be lowest, and therefore represents the worst-case location from an assessment perspective[1]. Noise measurements were not taken at receivers that are near SH1 (such as at receivers 17, 18, 19) or at the closest receiver (receiver 29) as the existing environment at these locations would be dominated by road traffic noise. It was considered more beneficial and conservative to measure away from SH1. Additionally, given the close proximity of these receivers to SH1, the likely existing ambient noise environment at these receivers can be modelled using acceptable noise prediction methods. This method was used and is discussed further in Section 5.3.2.

From observations during the noise logger deployment and retrieval, the main noise source was traffic on State Highway 1. Other noise sources may include, but not be limited to, insects during the night-time period, animals, and local traffic near the monitors themselves.

The noise environment is mostly considered typical of a rural environment, where some rural industry may be present. The noise levels are somewhat elevated on some days relative to other days during the measurement period which is likely due to a combination of local anthropogenic sources (distant road noise, farm activity, and potentially some heavy vehicles for Crowther Road reconstruction work towards the end of the measurement period) and for MP2, natural sounds from the nearby forestry block (wind in trees).

During the night-time hours (shoulder periods of the night-time period) where the Bin Exchange Area would be operational (but not the landfill/working face) the background noise levels drop to 25-30 dB L_{A90} for MP1 and 20-25 dB L_{A90} for MP2. This is considered to be representative of a quiet rural environment. Only bin park operations would occur at this time, and these are located in close proximity to the State Highway, where background noise levels would likely be higher.

[1] The lower the ambient noise level at a given location then the greater the potential noise effect would be when introducing a new noise source to that environment

Figure 3: Measurement positions

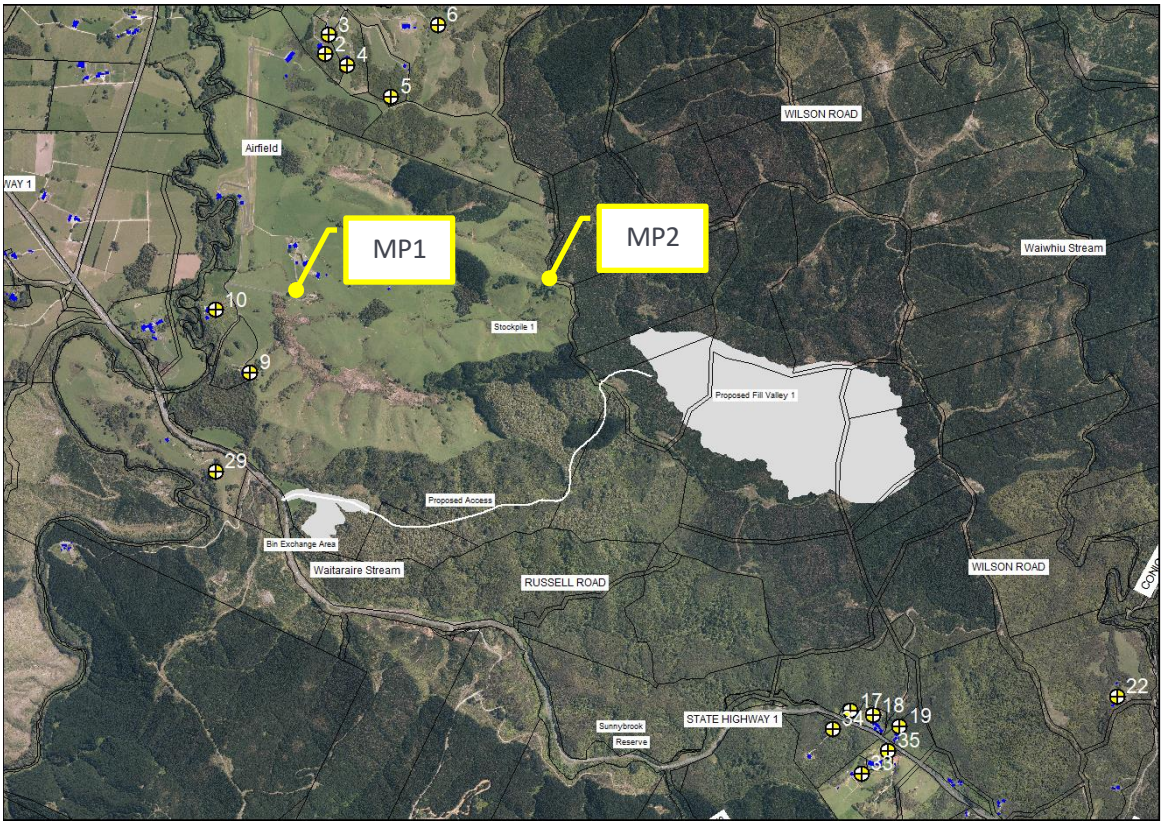


Table 1: Summary of measured noise levels

Measurement	Measured Noise Levels (dB)		
	L_{AFmax}	L_{Aeq}	L_{A90}
MP1 – Daytime	74	45	38
MP1 – Night-time	60	41	33
MP2 – Daytime	74	46	34
MP2 – Night-time	61	41	33

4.0 NOISE PERFORMANCE STANDARDS

4.1 Operational Noise

Noise limits for activities in the *Rural – Rural Production Zone* received at the notional boundary on any receiver site in any rural zone are given in Rule E25.6.3. This is reproduced below in Table 2. MDA consider that the AUP limits are reasonable and would provide acceptable noise controls for a project of this nature. It is recommended that these be used as the basis for the assessment

Table 2: Operational noise limits

Day	Time (hrs)	Noise Limit
Monday to Saturday	0700 – 2200	55 dB L_{Aeq}
Sunday	0900 - 1800	55 dB L_{Aeq}
All other times		45 dB L_{Aeq} 75 dB L_{AFmax}

4.2 Construction Noise

Construction noise limits are given in Rule E25.6.27 of the AUP. The noise limits apply at 1m from the façade of any occupied building that contains an activity sensitive to noise. The relevant limits for works greater than 20 weeks, and taking into account Rule E25.6.27 (4), are reproduced below in Table 3.

Table 3: Construction noise limits - activity sensitive to noise

Time of week	Time Period (hrs)	Noise Limit (dB)	
		L_{Aeq}	L_{AFmax}
Weekday	0630 – 0730	60	70
	0730 – 1800	70	85
	1800 – 2000	65	80
	2000 – 0630	40	70
Saturday	1800 – 0730	40	70
	0730 – 1800	75	85
Sunday and public holidays	1800 – 0730	40	70
	0730 – 1800	50	80

The noise limits applicable to a building containing any other type of activity are given in Table 4, below.

Table 4: Construction noise limits - other activities

Time Period	Noise Limits (dB L_{Aeq})
0730 – 1800	70
1800 – 0730	75

4.3 Blasting

To address startle, AUP rule E25.6.31 requires that noise from blasting must:

(1) Not exceed 120 dB L_{Zpeak} at the boundary of the site (i.e. WMNZ landholdings' boundary) on which the explosives are used

(2) Not exceed 120 dB L_{Cpeak} at 1m from the façade of an occupied building

New Zealand Standard NZS 6803:1999 "*Acoustics - Construction Noise*" recommends a blasting limit of 120 dB L_{Cpeak} and states that "*practices should conform with the provisions of documents such as AS 2187: Part 2*". The limit applies at 1m from external façades of occupied buildings. MDA consider these are an appropriate standard for blasting noise impacts.

5.0 OPERATIONAL NOISE

5.1 Prediction Methodology

A computer noise model of the landfill activity areas including stockpile areas and their final terrain height, landfill area final capping height, new access road, and the Bin Exchange Area was prepared using the internationally recognised sound modelling software SoundPLAN. This program utilises the algorithms contained in ISO 9613-2:1996 "*Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*".

ISO 9613 considers a range of frequency dependent attenuation factors, including spherical divergence, atmospheric absorption, ground effect, and acoustic screening. It assumes meteorological conditions favourable to propagation from sources (downwind and wind speeds of 1 – 5 m/s in all directions), and as such, represents a conservative 'reasonable worst case' approach.

Appendix D provides the plant sound power levels used in the model. The sound power levels are based on an extensive set of measurements previously carried out by MDA or were selected from noise source databases contained in BS 5228-1:2009 "*Code of practice for noise and vibration control on construction and open sites Part 1: Noise".* Measurements of Bin Park activity at Transwaste Canterbury Limited's Kate Valley facility were also used. A description of the measurements carried out at Kate Valley is given in Appendix E.

5.2 Prediction Results

Following discussions with the Project team, a number of scenarios were identified for noise predictions and are considered to represent a worst-case situation during different stages of the landfill lifetime. The scenarios used for the predictions are listed below:

- Scenario 1: Low-level fill with both western stockpiles (clay borrow and stockpile 1) in use and seasonal landfill cell works
- Scenario 2: Mid-level fill with both western stockpiles in use and seasonal landfill cell works
- Scenario 3: Mid-level fill with the eastern stockpile (stockpile 2) in use
- Scenario 4: Final cap level activity with western stockpile (stockpile 1) in use
- Scenario 5: Typical night-time activity with bin exchange area in use
- Scenario 6: Worst case night-time with western stockpile (stockpile 1) in use (0500 – 0700 assuming similar activity level over the two hours)[2]
- L_{max} night-time calculation based on a number of L_{max} noise sources in the Bin Exchange Area

[2] Stockpiles would only be used during working face hours (0500 – 2200hrs)

For each scenario, noise sources were placed at locations selected to represent the worst-case noise emission for that scenario. A detailed breakdown of the scenario inputs is attached in Appendix F.

The prediction results are provided in Table 5 overleaf and a noise contour map for each scenario provided in Appendix G. Note that for receiver 01, there appears to be multiple dwellings and therefore, two receiver points have been used. The higher of the two predicted noise levels is presented in Table 5

Table 5: Predicted noise levels

Receiver	Predicted Noise Level (dBA)						
	L_{eq}						L_{max}
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Night-time
01. Springhill Estate	40	40	37	37	30	35	48
02. Fletcher, D.G. & Taylor, C.L.	27	27	26	25	<25	<25	<45
04. Rose, B.G. & I.A.	29	30	30	30	<25	26	<45
05. Markham, D.M. & S.	27	27	27	27	<25	25	<45
09. Izard-Price, P.D, Price, K.I. & Wile	41	41	36	36	33	35	<45
10. Harrison, C. & T.J.	39	39	35	35	31	33	<45
17. Gallagher, R.N.	<25	<25	26	23	<25	<25	<45
18. Barry, L.R. & M.J.	<25	<25	29	31	<25	30	<45
19. An Kyung H & Lee Ho S	25	26	34	33	<25	32	<45
22. Waterfall Farm (Waiwhiu) Ltd	28	29	33	32	25	30	<45
29. McDougall, I.A.R & M.M	43	43	43	43	33	42	56
33. Appleby, F.J. & M.J.T.	30	31	36	35	29	33	<45
34. Jung Hee Lee	27	28	34	35	25	33	<45
35. Purvis, CW & ME	27	28	34	34	26	32	<45

5.3 Discussion

An assessment of compliance is made against the noise limits presented in Section 4.1 to determine if the predicted noise levels in Table 5 comply with the relevant noise limits of the District Plan. Section 0 discusses this.

Following the compliance assessment, a noise effects assessment is carried out. This assessment compares the predicted noise levels in Table 5 with the existing noise environment (detailed in Table 1). These predicted noise levels in Table 5 do not include any other noise contribution outside of the landfill activity areas (i.e. no influence from SH1). Therefore, an effects assessment is a comparison of the new sound against the existing noise environment. If the new sound is below the existing, then in this case it is considered to be acceptable. Note however, that although the new sound may be acceptable, it may still be perceivable at times if the new sound has a different character or if there are brief quiet periods from the existing noise sources (such as SH1 in this case).

5.3.1 Assessment of Compliance

Scenario 1 through 4 should be assessed against the daytime 55 dB L_{Aeq} noise limit whilst Scenario 5 and 6 should be assessed against the 45 dB L_{Aeq} night-time noise limit. Given this, compliance is predicted for all scenarios against their respective noise limit.

The predicted L_{max} noise level also readily complies with the night-time L_{max} noise limit of 75 dB L_{AFmax} even when a special audible character penalty[3] is applied for impulsive noise, such as banging from the bins being placed down and the latches closing, from the bin exchange area. The highest predicted L_{max} noise level is 56 dB L_{AFmax} at receiver 29. Note that the predicted noise level is considered an unlikely worst case as the model assumed that the L_{max} events all occurred at the same time for all individual sources. For one individual L_{max} noise event, the highest predicted noise level at the receiver is 50 dB L_{AFmax}.

Note that a prediction was not made for receiver 03 and 06 (refer Section 2.3) as these receivers are further setback from receiver 04 and 05. Therefore, the predicted compliance at receiver 04 and 05 indicates that compliance at receiver 03 and 06 can also be achieved.

In general, ready compliance against both the daytime and night-time noise limits is predicted for Scenarios 1 to 5. For scenario 6, receiver 29 is predicted to comply by 3 decibels during the worst-case night-time period between 0500 – 0700 as activity within the landfill activity areas ramp up. In all scenarios, receiver 29 is predicted to receive the highest noise levels given its proximity to the landfill entrance and the Bin Exchange Area.

5.3.2 Assessment of Effects

Daytime noise levels

At the closest receivers to the proposed landfill valley (receivers 17, 18, and 19), the predicted daytime noise level ranges from <25 to 34 dB L_{Aeq}. Comparing against the measured daytime L_{Aeq} noise level of 45 and 46 dB L_{Aeq} in Table 1, the predicted noise levels from landfill operations at these closest receivers are well below the measured daytime noise level. Given these predicted and measured ambient noise levels, landfill operations are likely to be inaudible for the majority of the time. Note also, that these receivers are in close proximity to SH1 and therefore, their existing ambient noise environment would likely be greater than the measured noise levels as discussed in Section 3.0.

At all other receivers, the predicted daytime noise level ranges from 25 to 43 dB L_{Aeq}. The predicted levels at these receivers are therefore lower than the existing ambient noise environment. Although the landfill activity would be audible on occasion at some receivers, the overall noise emissions from

[3] As allowed for in Appendix B4 of NZS 6802:2008

the activity areas would be lower than the existing ambient noise level (i.e. 45 – 46 dB L_{Aeq}) at all receivers.

Overall, MDA conclude that during the daytime, activity at the proposed landfill activity areas would be acceptable

Overall night-time noise levels

During the night-time the ambient noise environment is 41 dB L_{Aeq} measured at both measurement positions. The predicted noise levels for the typical night-time scenario (scenario 5), ranges from <25 to 33 dB L_{Aeq}, at all the receivers. The main noise sources are the flares and energy generation at the energy compound (gen sets) for the majority of receivers and vehicle noise for receiver 29. This indicates that landfill activities would be below the ambient noise environment. Although gen set activity and bin exchange activity during the typical night-time period may be just perceivable at times at receivers where the noise level is predicted to be higher than 30 dB L_{Aeq}, it is considered that it would be acceptable because of the overall low predicted noise levels.

At receivers 17, 18, and 19, the predicted typical night-time noise level is <25 dB L_{Aeq}. At these levels, landfill operations are unlikely to be audible.

It is noted that at the Redvale landfill site, noise barriers were required for the gen sets. At Wayby Valley, it is not considered necessary given the low predicted noise levels which mainly relates to the much greater separation distances at Wayby Valley.

Worst-case night-time noise levels

During the night-time period between 0500 – 0600 hrs, the measured ambient noise level was 38 dB L_{Aeq} at both MP1 and MP2.

At receivers 17, 18, and 19, the predicted worst-case night-time noise level is between <25 to 32 dB $L_{Aeq.}$ This is below the measured ambient noise levels. Except for receiver 29, predicted noise levels at all other receivers are also below the measured noise levels.

Receiver 29 was predicted to receive a noise level of 42 dB L_{Aeq} which is above the measured ambient noise levels. However, this receiver would likely experience higher noise levels at this time of day given its proximity to State Highway 1, and potentially higher levels due to growth in traffic numbers between now and the time that the landfill construction and operations commence.

Current traffic noise levels for receiver 29 have therefore been predicted using noise modelling software. This method is considered a standard and acceptable method and is often adopted by the NZTA on roading projects.

During the 0500 - 0600 hrs period at receiver 29 traffic noise is predicted to be 50 dB L_{Aeq}. Based on this, the predicted noise level from the landfill activity areas during the worst-case night-time period would be below the ambient noise environment at receiver 29 by 8 decibels.

Similarly, for the night-time period between 0600 – 0700 hrs, the predicted noise level from landfill activity would be below the measured ambient noise level at all receivers except receiver 29. The predicted ambient traffic noise level between this time period at receiver 29 is 53 dB L_{Aeq}. The predicted landfill activity during this period would be lower by 11 decibels.

At times, noise from the landfill may be perceivable at the nearby receivers, but noise from the landfill activity is considered acceptable and would be similar to what could reasonably be expected of the zoning.

Maximum noise levels

The highest predicted L_{max} noise level is 56 dB L_{AFmax} at receiver 29. Given that L_{max} noise levels from a truck pass-by on the State Highway would likely be 60 dB L_{AFmax} or higher at this location, the L_{max} noise event from the bin exchange area is therefore predicted to be lower. Although the character

may be different, it is considered that L_{max} events from the bin exchange area would be acceptable given that receiver 29 is already subject to a relatively high ambient noise environment.

At receivers 17, 18, and 19, the predicted L_{max} noise levels from the bin exchange area is less than <45 dB L_{AFmax}. This is considered to be acceptable.

Tonal reverse alarms often fitted to earthmoving machines have the potential to cause adverse effects during the night-time period. Therefore, MDA recommends that all vehicles operating on site, for the purposes of landfill activity, should be fitted with broadband reverse alarms to avoid this adverse effect.

6.0 CONSTRUCTION NOISE

Construction equipment and methodology is anticipated to be typical of that used for regional infrastructure earthmoving works. Table 6 overleaf presents indicative plant sound power levels and sound pressure levels at various distances. These are sourced from MDA database of measured noise sources or BS 5228-1:2009 "*Code of practice for noise and vibration control on construction and open sites* Part 1: Noise". Note that the presented values do not include mitigation. The list is not exhaustive.

Table 6: Indicative plant sound levels with no mitigation

Equipment	Typical Operating Sound Power (dB L_{wA})	Noise Level (dB L_{Aeq}) at a distance (m)				Setback distance to comply with 70 dB L_{Aeq}
		100	200	300	400	
Excavator (22t)	105	57	49	45	42	30
Excavator (47t)	106	58	50	46	43	33
Compactor CAT 836	109	61	53	49	46	44
Compactor CAT 826	109	61	53	49	46	44
Compactor CAT 815	110	62	54	50	47	48
Bulldozer CAT D8	109	61	53	49	46	44
Bulldozer CAT D6	109	61	53	49	46	44
Grader	112	64	56	52	49	58
ADT Truck	109	61	53	49	46	44
Tractor	111	63	55	51	48	52
Water Cart	97	49	41	37	34	13
Trucks for delivery and haulage	109	61	53	49	46	44
Light vehicles	86	38	30	26	23	4

Two initial construction scenarios have been assessed based on the sound power levels in Table 6. These two scenarios are discussed in the following subsections and are considered to be worst case scenarios as they are the ones closest to any receivers. Any other construction scenarios would be concentrated further within WMNZ landholdings and would therefore have more separation. Therefore, compliance with the noise limits for these two worst case scenarios would imply compliance for all other scenarios.

6.1 Crowther Road Upgrade

Two noise models have been prepared for the initial construction phase where Crowther Road would be upgraded and used as a temporary access route to the construction zones for the landfill, ponds, and upper part of the new access road over a period of 2 – 3 years. Refer Appendix G for the predicted noise contour maps of the scenarios. The scenarios have been calculated based on input provided by WMNZ. The noise sources have been located accordingly:

- To represent a reasonable worst-case situation where all large plant and trucks would be near the entrance of Crowther Road and near a receiver and working 100% of the time.
- To represent a reasonable worst-case situation where all large plant would be located at an elevated position on Crowther Road with potential line of sight to receivers south of SH1 and working 100% of the time.

Note that, no source in the Crowther Road model would be a noise emitter throughout the entire day (such as trucks making deliveries). Therefore, the predicted noise levels are conservative. Refer Appendix F for a breakdown of the plant numbers.

It is proposed that the daily construction period be from 0630 – 2000 hrs. Monday to Saturday. Therefore, the most stringent construction noise limit would be 60 dB L_{Aeq}. As shown in the Appendix G8, construction noise from traffic on Crowther Road has the potential to exceed this noise limit within a certain setback distance from the receivers during the initial construction phase near the entrance of Crowther Road. As works and traffic move up Crowther Road, compliance with 60 dB L_{Aeq} can be readily achieved at all receivers as shown in Appendix G9. Based on this, the following recommendations are made:

- No construction materials or earthmoving plant delivered prior to 0730 hrs as there is potential to exceed the L_{max} limit
- No construction works on road upgrades prior to 0730 hrs when an excavator or grader is anticipated to be within 150m of a receiver
- A Construction Noise and Vibration Management Plan is prepared by a suitably qualified person prior to construction works commencing for works that are within 100m of a receiver. It should, as a minimum, contain the provisions in Appendix E of NZS 6803:1999

Given the greater setback distances, compliance would also be predicted along any other section of Crowther Road and Wilson Road.

6.2 Roundabout Construction

Appendix G10 presents the predicted noise contours for works along the west bank of the roundabout. The prediction includes four excavators and four ADT trucks along the western bank, a compactor and an ADT along the east earth fill with one crane mounted auger working to construct the bridge piles over Waiteraire Stream. It is noted that this amount of equipment would likely not be required at all times and would therefore represent more than the expected construction activity. As such and taking into account that no source would be a noise emitter for the entire day, the predictions are considered to be conservative.

It is predicted that compliance can be readily achieved at the nearest receiver (receiver 29).

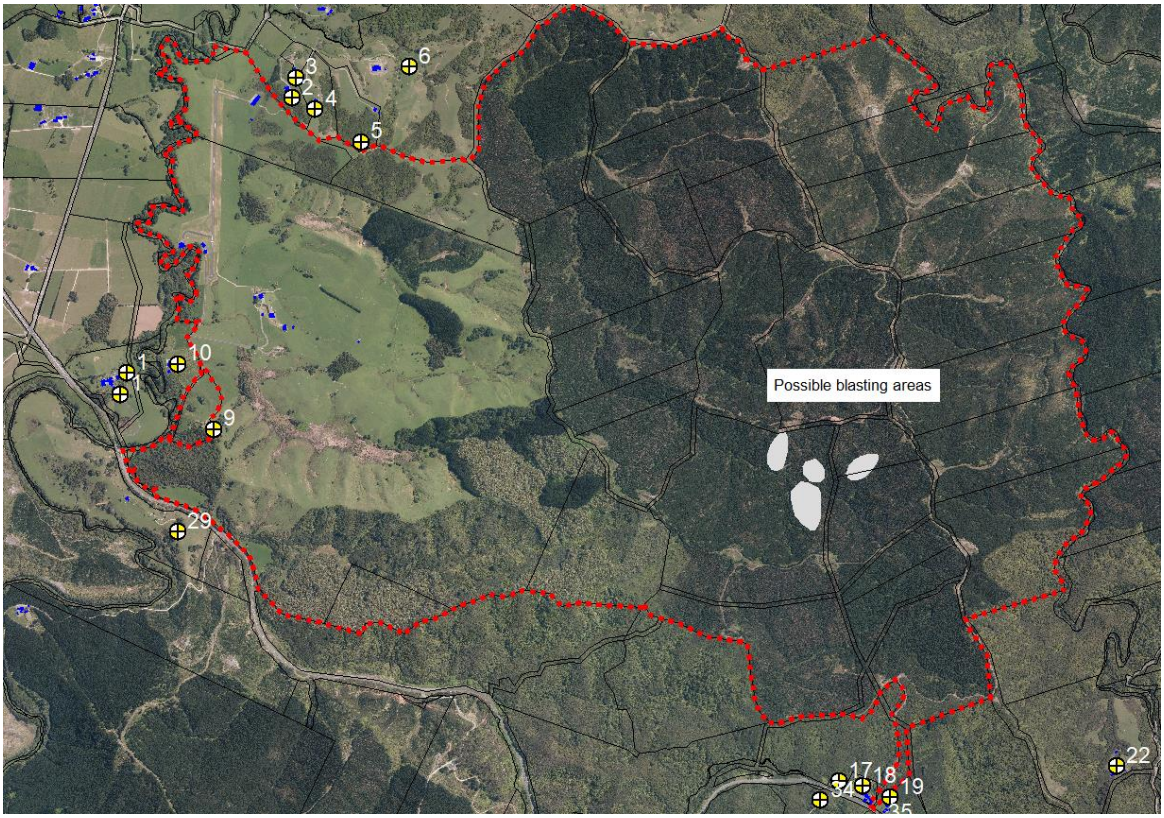
It is predicted that compliance can also be readily achieved at the second nearest receivers (receivers 17 and 18).

In general, given the large distances from the majority of construction areas to a nearby receivers, other construction noise is considered to be able to readily comply with the construction noise limits in Section 4.2. Truck noise is generally infrequent and is therefore considered to be acceptable during the normal daytime hours (i.e. 0730 – 1800 hrs).

7.0 BLASTING

Blasting may be required during the formation of some of the landfill cells, to create the landfill base grade, if rock cannot be excavated using conventional means. It is understood that this may be the case in limited areas within the landfill area. The likely blasting locations are shown in Figure 4 below.

Figure 4: Likely blasting areas and Waste Management landholdings shown in red-dash



Assuming a maximum instantaneous charge weight of 3kg, the required setback distance to comply with 120 dB L_{Zpeak} is 102m.

The nearest receiver to a potential blasting area is 357m away (receiver 17).

Therefore, it is predicted that compliance can be readily achieved at all assessment locations in accordance with E25.6.31.

8.0 CONCLUSIONS

Marshall Day Acoustics has been engaged by Waste Management New Zealand to prepare an Assessment of Environmental Noise Effects in relation to the operation of a new landfill site at Wayby Valley.

The new site would be a regionally significant landfill site following the closure of the existing site at Redvale (expected to be between 2026 – 2028) and is intended to serve approximately half of Auckland's waste disposal requirements.

Predictions have been carried out for a number of scenarios considered to be the worst-case for different phases of the project. Compliance is predicted with the appropriate noise limits in the Auckland Unitary Plan for all scenarios during both daytime and night-time.

Furthermore, it is considered that any adverse effects for nearby receivers would be at a low level given that the predicted noise levels would be comfortably lower than the existing noise environment for the majority of receivers. However, there is one receiver (receiver 29 – McDougall) where predicted noise levels from the landfill activity, specifically the bin exchange, would be higher than the measured ambient levels. Nevertheless, based on a prediction of road traffic noise at this receiver between 0500 – 0700, the predicted noise level from the proposal would be lower than the ambient road traffic noise. Therefore, it is considered that any adverse noise effects at this receiver would be acceptable.

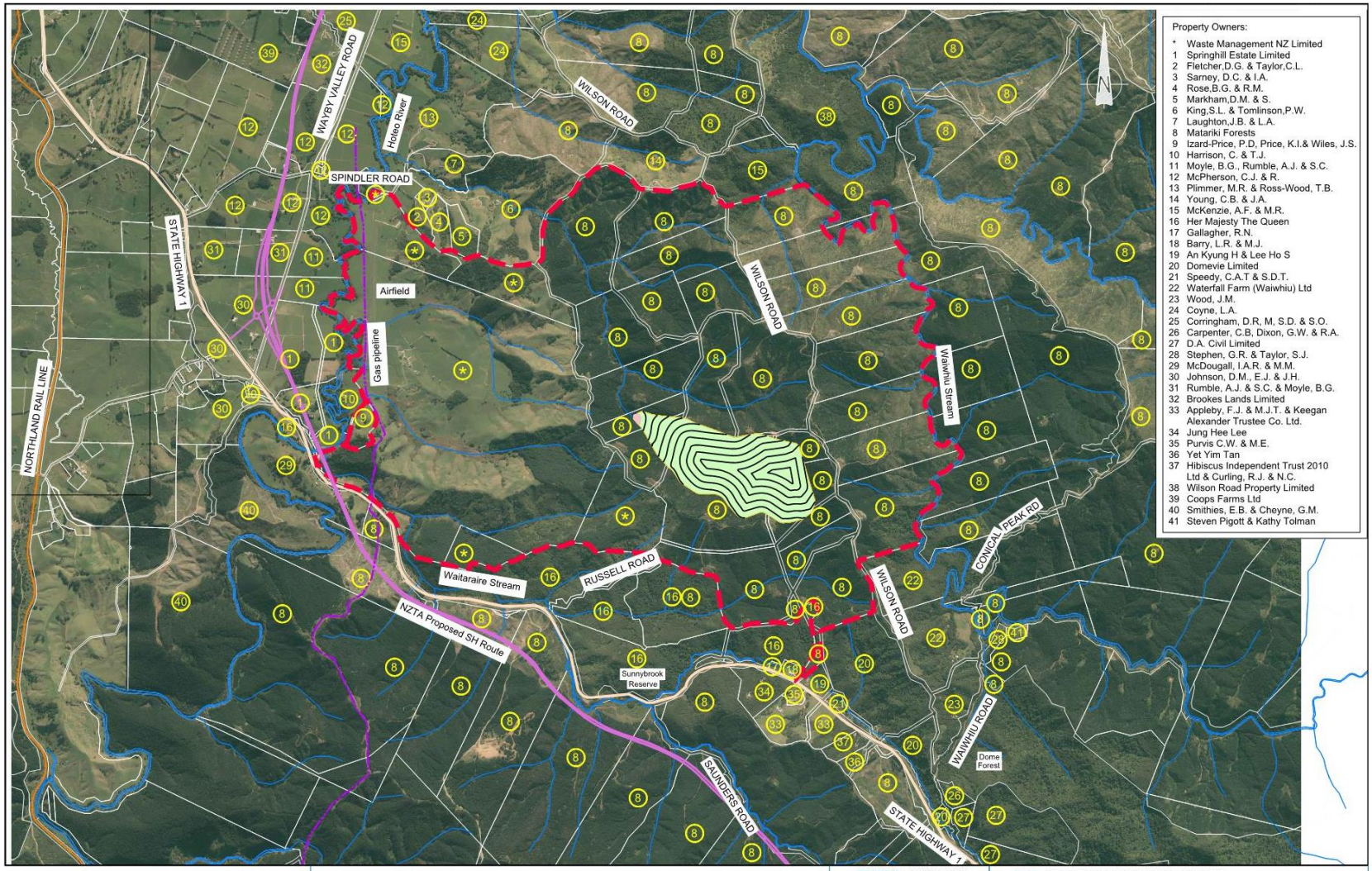
Noise from the landfill activity areas may be noticeable at times during the night-time period at the nearby receivers identified in this report but it is considered to be acceptable given the underlying zoning of the area and that the character would be somewhat similar to that of road traffic noise.

Restrictions on the hours of activity on Crowther Road during the 2 – 3 year construction phase are also recommended. Additionally, all vehicles operating on the landfill and in the bin exchange area are recommended to be fitted with broadband reverse alarms.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
$L_{A10\,(t)}$	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A90\,(t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of environmental sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise"*
Octave Band	A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the noticable range of sound.
SPL or L_P	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 μPa RMS) and expressed in decibels.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

APPENDIX B PROPERTY OWNERS LIST



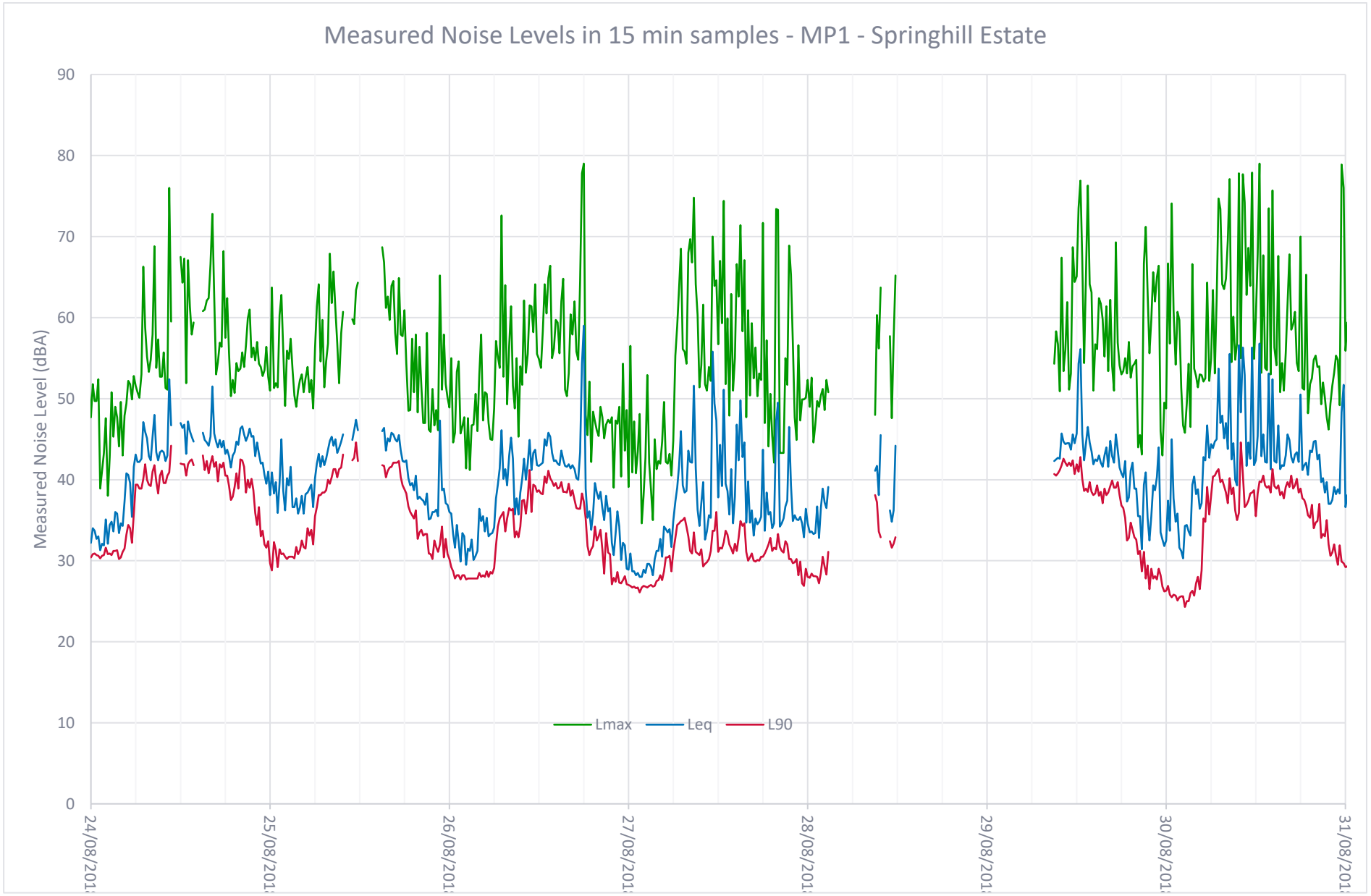
APPENDIX C MEASURED NOISE LEVELS

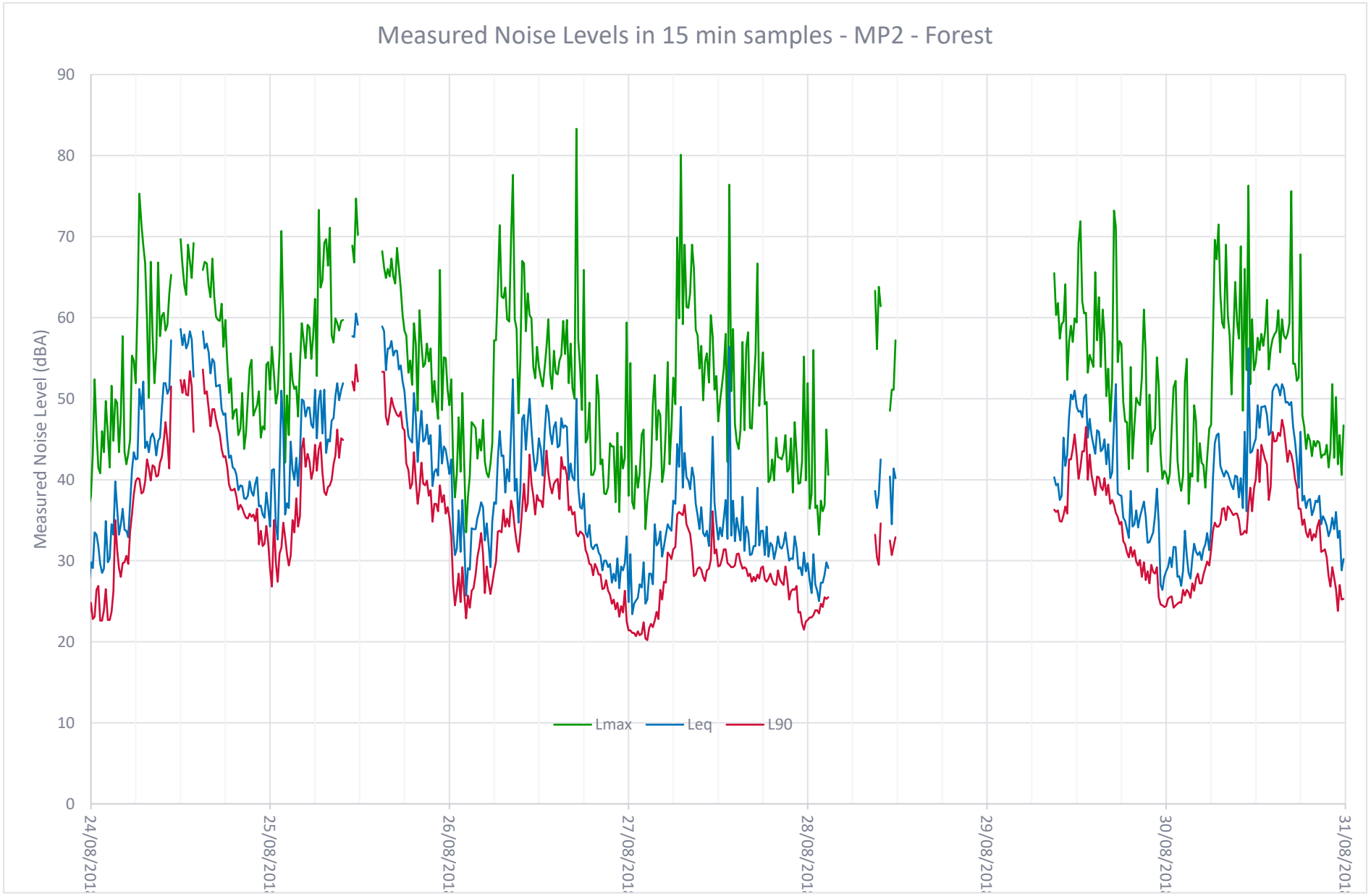
Table 7: Detailed daytime measured noise levels

Start date and time of measurement			Measured Noise Levels (dB)		
			L_{AFmax}	L_{Aeq}	L_{A90}
MP1					
Friday	24-Aug	0700 – 2200 hrs	76	46	41
Saturday	25-Aug	0700 – 2200 hrs	69	43	40
Sunday	26-Aug	0900 – 1800 hrs	78	44	38
Monday	27-Aug	0700 – 2200 hrs	75	44	32
Tuesday	28-Aug	0700 – 2200 hrs	65	41	35
Wednesday	29-Aug	0700 – 2200 hrs	77	45	39
Thursday	30-Aug	0700 – 2200 hrs	79	48	39
		Average	74	45	38
MP2					
Friday	24-Aug	0700 – 2200 hrs	70	52	47
Saturday	25-Aug	0700 – 2200 hrs	75	53	47
Sunday	26-Aug	0900 – 1800 hrs	83	45	39
Monday	27-Aug	0700 - 2200 hrs	80	41	30
Tuesday	28-Aug	0700 - 2200 hrs	64	40	32
Wednesday	29-Aug	0700 - 2200 hrs	73	45	39
Thursday	30-Aug	0700 - 2200 hrs	76	47	40
		Average	74	46	39

Table 8: Detailed measured night-time noise levels

Start date and time of measurement			Measured Noise Levels (dB)		
			L_{AFmax}	L_{Aeq}	L_{A90}
MP1					
Friday	24-Aug	0000 – 0700 hrs	53	43	39
Friday	24-Aug	2200 – 0700 hrs	64	45	38
Saturday	25-Aug	2200 – 0700 hrs	73	47	37
Sunday	26-Aug	2200 – 0900 hrs	79	59	37
Monday	27-Aug	1800 – 0700 hrs	57	39	31
Tuesday	28-Aug	2200 – 0700 hrs	-	-	-
Wednesday	29-Aug	2200 – 0700 hrs	74	47	41
Thursday	30-Aug	2200 – 0700 hrs	79	52	44
	Average		60	41	33
MP2					
Friday	24-Aug	0000 – 0700 hrs	75	51	40
Friday	24-Aug	2200 – 0700 hrs	73	51	45
Saturday	25-Aug	2200 – 0900 hrs	78	52	39
Sunday	26-Aug	1800 – 0700 hrs	70	44	36
Monday	27-Aug	2200 – 0700 hrs	56	33	27
Tuesday	28-Aug	2200 – 0700 hrs	-	-	-
Wednesday	29-Aug	2200 – 0700 hrs	70	46	35
Thursday	30-Aug	2200 – 0700 hrs	69	52	41
	Average		61	41	33





APPENDIX D PLANT SOUND POWER LEVELS

Source	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	dBA
Articulated dump truck and Big Haul Mule	110	108	110	107	103	100	96	109
Blower – large	92	92	96	102	103	105	98	109
Bulldozers	101	110	99	99	106	104	97	109
Compactors	106	115	108	103	105	102	95	109
Customer trucks	112	105	103	100	96	94	88	102
Excavator (22t)	103	112	106	102	98	96	92	105
Excavator (47t)	104	113	107	103	99	97	93	106
Flare	107	108	101	101	105	106	100	110
Genset exhaust	105	104	100	96	93	88	84	99
Genset extract fans	91	95	90	88	87	83	77	91
Genset intake louvre	95	100	86	79	73	71	70	86
Genset pump	95	100	91	86	84	85	84	92
Site Utes	94	90	86	82	82	78	73	86
Water pump	94	93	91	91	91	90	82	96
Water truck	105	101	97	93	93	89	84	97

APPENDIX E KATE VALLEY NOISE MEASUREMENTS

A site visit was carried out on 3 May 2018 between 1030 to 1130 hrs to measure noise levels from the Kate Valley landfill bin transfer area. The activity here was understood to be representative of the type of activity to occur at Wayby Valley. Therefore, the measurements were undertaken to quantify the noise levels from this activity, so the data may be used as noise source inputs for the model.

The meteorological conditions at the time was suitable for an environmental noise survey with little to no wind and no clouds in the sky.

The measurement results are given below:

Measurement	Duration (mm:ss)	Measured Noise Levels (dB)			Comments
		L_{AFmax}	L_{Aeq}	L_{A90}	
1	00:46	79	76	71	Approx. 18m away from source Tipper truck unloading bin onto ground. Mainly hydraulic arm noise. Observed 5 other trucks in the pad area
2	15:00	87	73	64	Approx. 15 to 20m away from sources Tipper truck unloading bin onto ground, other activity includes reversing, driving, idling, thuds as bin hits pad, hydraulic arm actuation
3	00:47	75	70	66	Approx. 28m away from source Tipper truck unloading bin onto ground, includes some noise from idling trucks nearby
4	02:00	87	73	70	Approx. 20 to 30m away from sources Tipper truck unloading bin, truck loading bin
5	00:27	82	73	64	Approx. 25m from sources. Bin being emptied, noise includes tipping arm in action and engine noise as truck drives off. Dozer idling nearby Observed L_{max} of 77 dBA at 20m from gate slam
6	00:36	91	76	70	Approx. 20 to 25m from sources Bin being emptied, noise includes tipping arm in action and engine noise as truck drives off. Dozer operating nearby Observed L_{max} of 77 dBA at 20m from gate slam

APPENDIX F MODELLED SCENARIOS

F1 Scenario 1: Low-level fill with both western stockpiles in use and seasonal landfill cell works

	Tip face	Soil capping near tip face	Soil stockpile #1 (west)	Soil stockpile #2 (east)	Clay pit/ stockpile #3 (farm)	Renewable energy centre	Bin exchange area	Landfill seasonal cell works	Access road movements (vph)
Compactor Cat 836	1								
Compactor Cat 826	1		1					2	
Excavator 47t	1							1	
Excavator 22t			1		1			2	
Bulldozer Cat D8	2							1	
Bulldozer Cat D6		1	1		1			1	
ADT Truck	2	2	2		2			3	
Water Cart			1				1	1	
Bin haul mule	2						3		
Mobile Generator	1								
Landfill Gas Blowers						1			
Flare 2500 m3/hr						1			
Generators (each 1MW)						3			
Site Ute	1	1	1			1	1	2	
Customers' trucks							10		76

F2 Scenario 2: Mid-level fill with both western stockpiles in use and seasonal landfill cell works

	Tip face	Soil capping near tip face	Soil stockpile #1 (west)	Soil stockpile #2 (east)	Clay pit/ stockpile #3 (farm)	Renewable energy centre	Bin exchange area	Landfill seasonal cell works	Access road movements (vph)
Compactor Cat 836	1								
Compactor Cat 826	1		1					2	
Excavator 47t	1		1		1			1	
Excavator 22t								2	
Bulldozer Cat D8	2							1	
Bulldozer Cat D6		1	1		1			1	
ADT Truck	2	2	2		2			3	
Water Cart			1				1	1	
Bin haul mule	2						3		
Mobile Generator	1								
Landfill Gas Blowers						2			
Flare 2500 m3/hr						2			
Generators (each 1MW)						6			
Site Ute	1	1	1			1	1	2	
Customers' trucks							10		76

F3 Scenario 3: Mid-level fill with the eastern stockpile in use

	Tip face	Soil capping near tip face	Soil stockpile #1 (west)	Soil stockpile #2 (east)	Clay pit/ stockpile #3 (farm)	Renewable energy centre	Bin exchange area	Landfill seasonal cell works	Access road movements (vph)
Compactor Cat 836	1								
Compactor Cat 826	1		1	1				2	
Excavator 47t	1							1	
Excavator 22t			1	1				2	
Bulldozer Cat D8	2							1	
Bulldozer Cat D6		1	1	1				1	
ADT Truck	2	2	2	2				3	
Water Cart			1				1	1	
Bin haul mule	2						3		
Mobile Generator	1								
Landfill Gas Blowers						3			
Flare 2500 m3/hr						3			
Generators (each 1MW)						9			
Site Ute	1	1	1			1	1	2	
Customers' trucks							10		76

F4 Scenario 4: Final cap level activity

	Tip face	Soil capping near tip face	Soil stockpile #1 (west)	Soil stockpile #2 (east)	Clay pit/ stockpile #3 (farm)	Renewable energy centre	Bin exchange area	Landfill seasonal cell works	Access road movements (vph)
Compactor Cat 836	1								
Compactor Cat 826	1	1							
Excavator 47t	1								
Excavator 22t		1	1						
Bulldozer Cat D8	2								
Bulldozer Cat D6		2	1						
ADT Truck	2	2	2						
Water Cart			1				1		
Bin haul mule	2						3		
Mobile Generator	1								
Landfill Gas Blowers						4			
Flare 2500 m3/hr						4			
Generators (each 1MW)						12			
Site Ute	1	1	1			1	1		
Customers' trucks							10		76

F5 Scenario 5: Typical night-time activity

	Tip face	Soil capping near tip face	Soil stockpile #1 (west)	Soil stockpile #2 (east)	Clay pit/ stockpile #3 (farm)	Renewable energy centre	Bin exchange area	Landfill seasonal cell works	Access road movements (vph)
Compactor Cat 836									
Compactor Cat 826									
Excavator 47t									
Excavator 22t									
Bulldozer Cat D8									
Bulldozer Cat D6									
ADT Truck									
Water Cart							1		
Bin haul mule									
Mobile Generator	1								
Landfill Gas Blowers						4			
Flare 2500 m3/hr						4			
Generators (each 1MW)						12			
Site Ute						1	1		
Customers' trucks							2		5

F6 Scenario 6: Worst case night-time (0500 – 0700 assuming similar activity level per hour)

	Tip face	Soil capping near tip face	Soil stockpile #1 (west)	Soil stockpile #2 (east)	Clay pit/ stockpile #3 (farm)	Renewable energy centre	Bin exchange area	Landfill seasonal cell works	Access road movements (vph)
Compactor Cat 836	1								
Compactor Cat 826	1								
Excavator 47t	1								
Excavator 22t	1								
Bulldozer Cat D8	2								
Bulldozer Cat D6									
ADT Truck									
Water Cart			1				1		
Bin haul mule	3						2		
Mobile Generator	1								
Landfill Gas Blowers						4			
Flare 2500 m3/hr						4			
Generators (each 1MW)						12			
Site Ute			1				1		
Customers' trucks							10		87

F7 Construction Scenario: Crowther Road Upgrade

	Crowther Road Access	Notes
Machinery delivery on low-loader	1	1 delivery per day. 10 deliveries per season.
Grader - road formation	1	9 hours/weekday for 3 months.
Excavator 22t for dig-outs & side drains	2	9 hours/weekday for 3 months.
ADT Truck - unsuitables to spoil dumps	2	9 hours/weekday for 3 months.
Construction deliveries - geotextile/ pipes	2	2 per weekday. 10 deliveries per season.
Fuel deliveries and mechanical services	2	2 per weekday for 3 months.
Truck & trailer bringing basecourse	2	10 deliveries per weekday for 2 months. 2 onsite at a time.
Supervisor and surveyor utes	4	Coming and going throughout weekdays for 3 months.
Staff, operators and visitors light vehicles	12	Once in once out each weekday.

APPENDIX G NOISE CONTOUR MAPS

G1 Scenario 1: Low-level fill with both western stockpiles in use and seasonal landfill cell works

G2 Scenario 2: Mid-level fill with both western stockpiles in use and seasonal landfill cell works

G3 Scenario 3: Mid-level fill with the eastern stockpile in use

G4 Scenario 4: Final cap level activity

G5 Scenario 5: Typical night-time activity

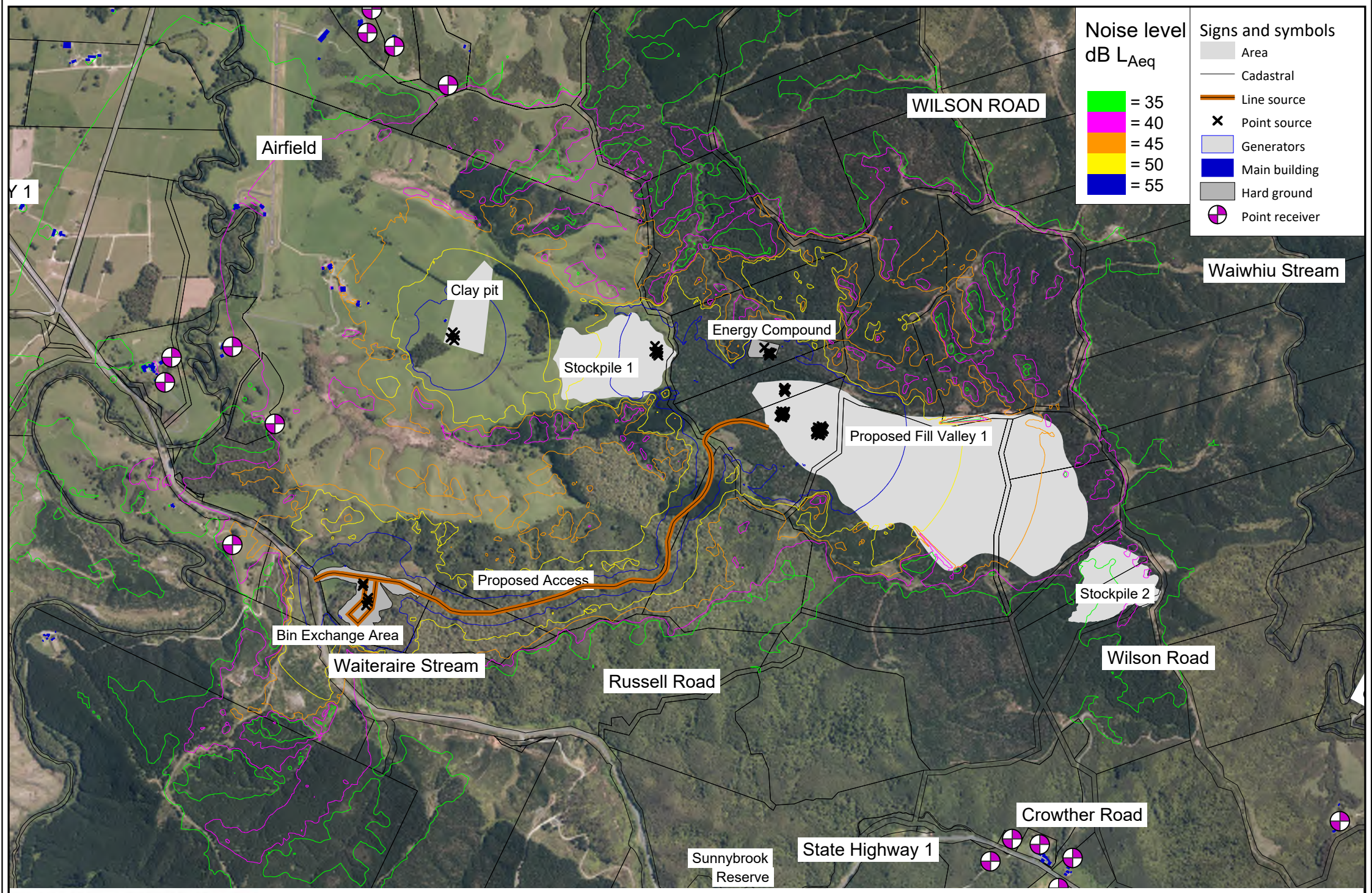
G6 Scenario 6: Worst case night-time (0500 – 0700)

G7 L_{max} night-time noise

G8 Construction Scenario – Crowther Road Entrance

G9 Construction Scenario – Incline to Wilson Road

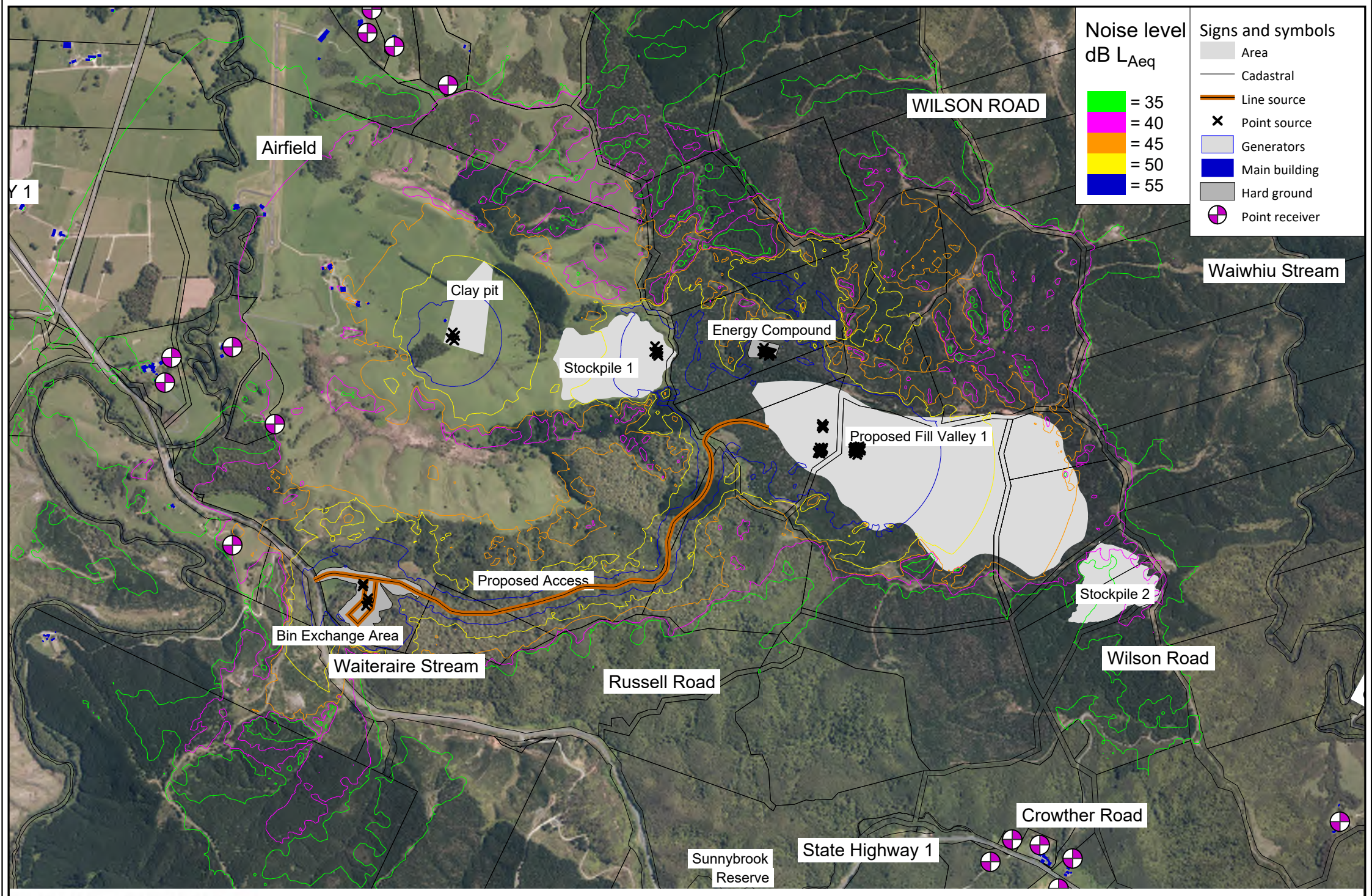
G10 Construction Scenario – Roundabout West Bank



MARSHALL DAY Acoustics

Grid Noise Map - Scenario 1

Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 20



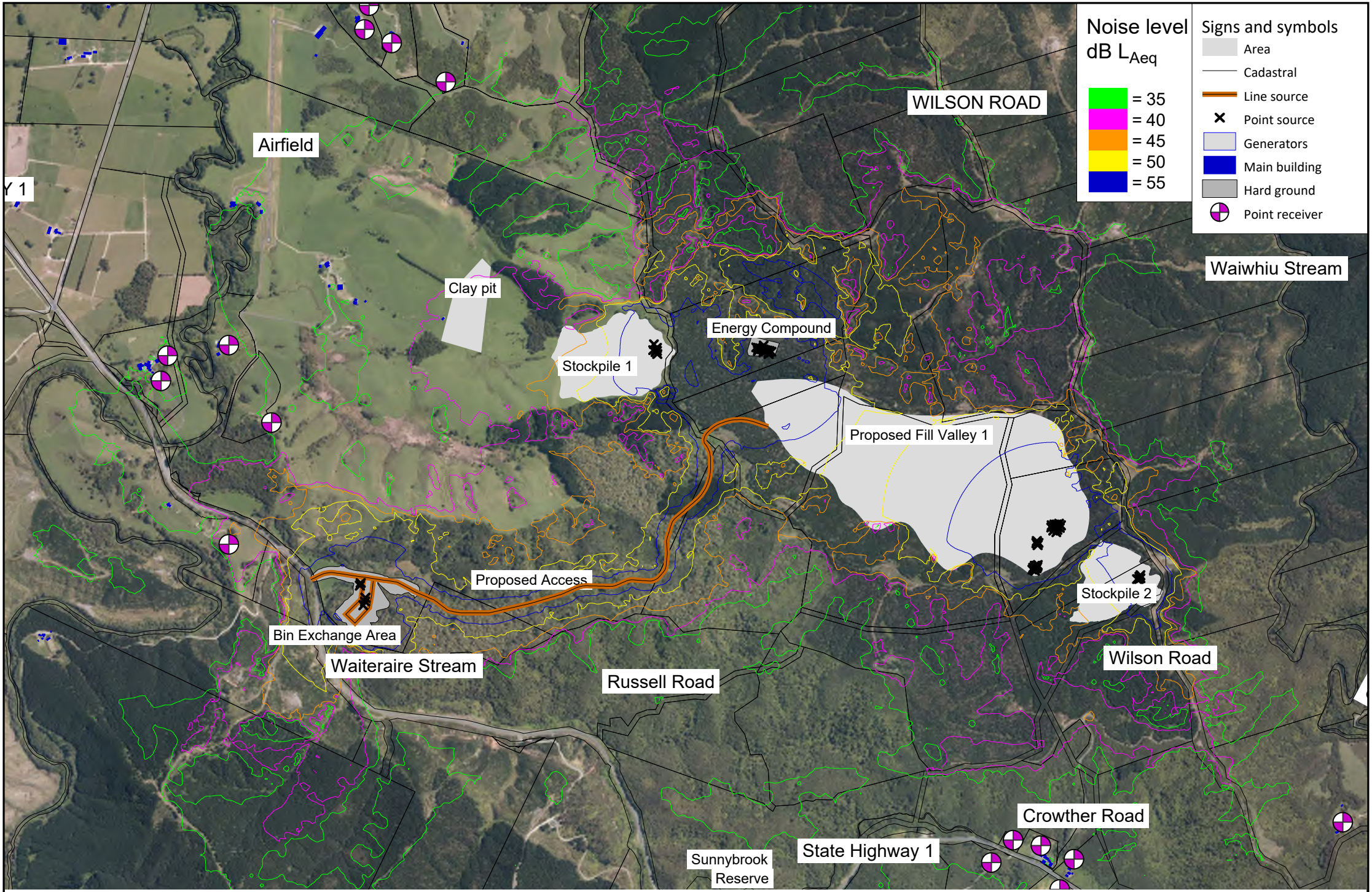
MARSHALL DAY Acoustics

Grid Noise Map - Scenario 2

Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 22

0 100 200 400 600 800 m

N



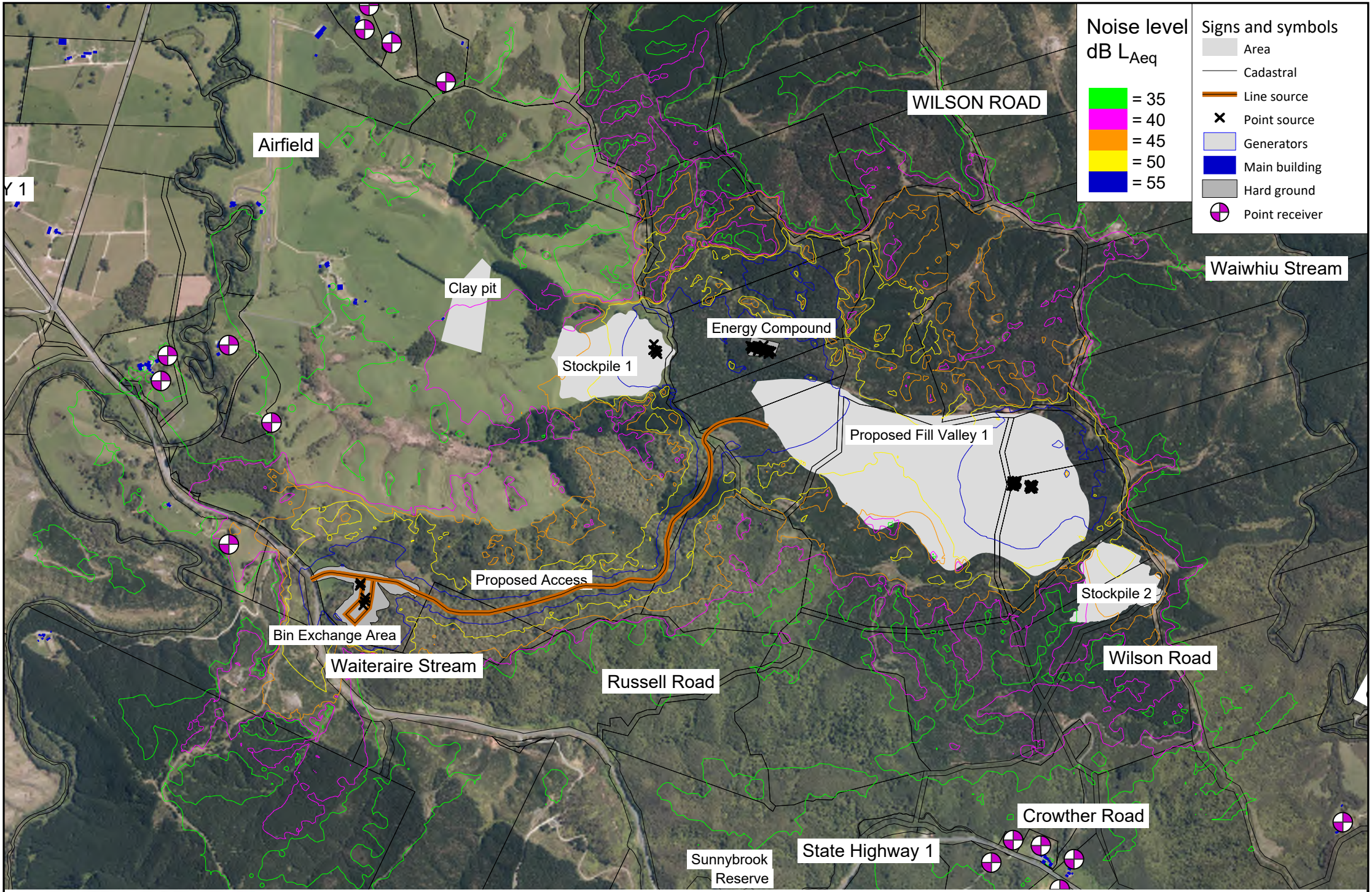
MARSHALL DAY Acoustics

Grid Noise Map - Scenario 3

Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 23

0 100 200 400 600 800 m

N



MARSHALL DAY Acoustics

Grid Noise Map - Scenario 4

Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 24

0 100 200 400 600 800 m

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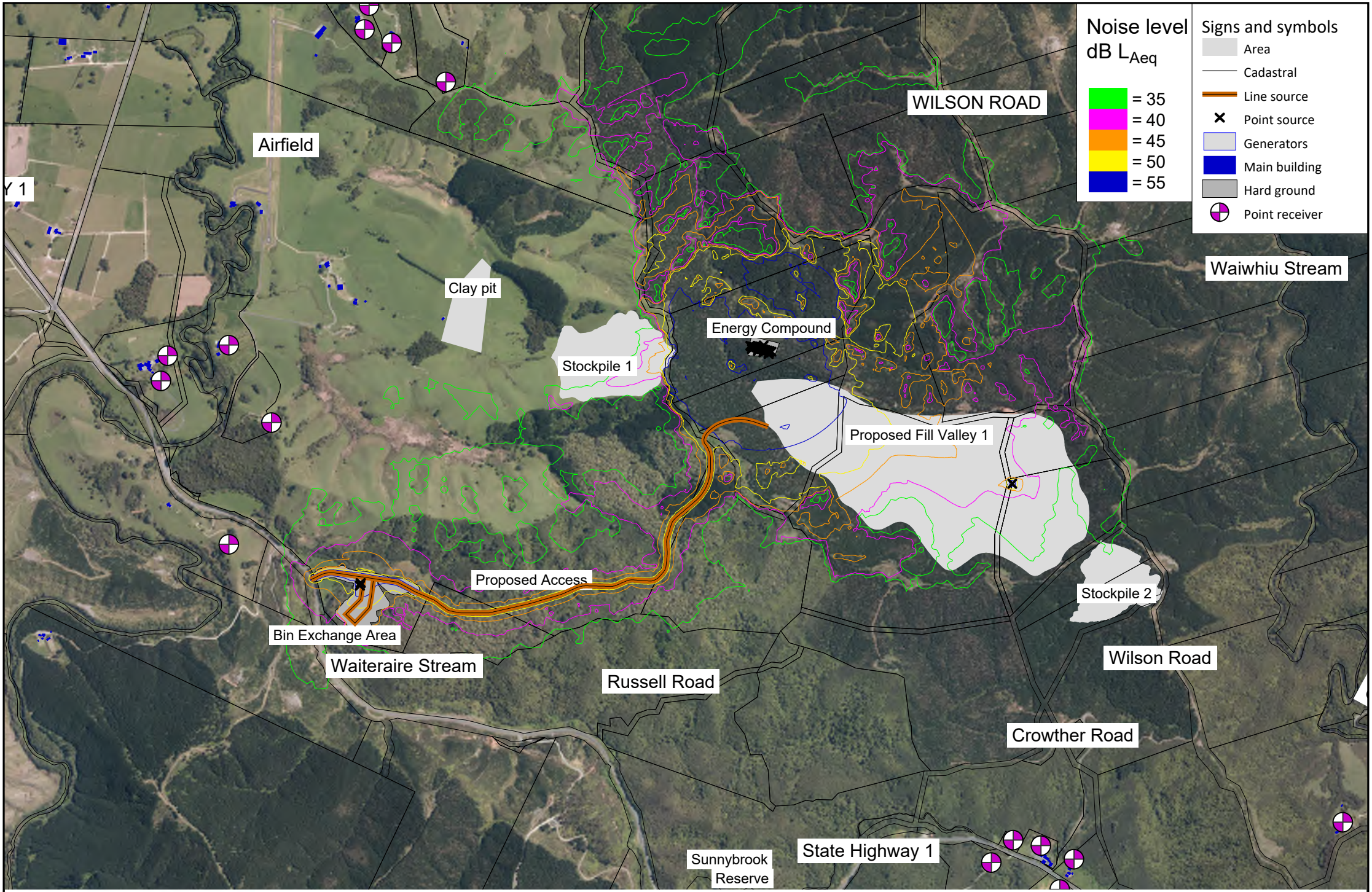


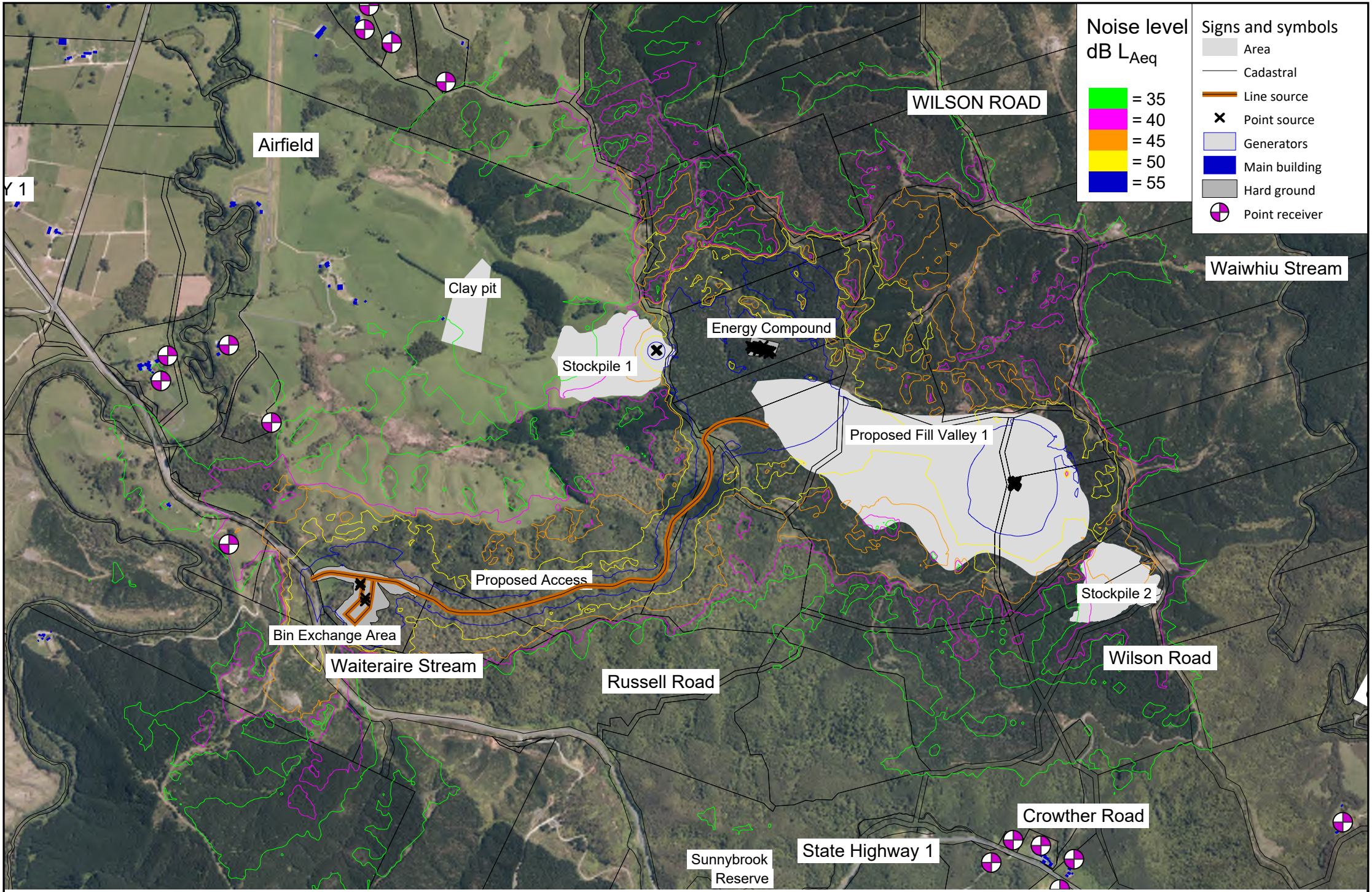
MARSHALL DAY Acoustics

Grid Noise Map - Scenario 5

Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 25

0 100 200 400 600 800 m

N



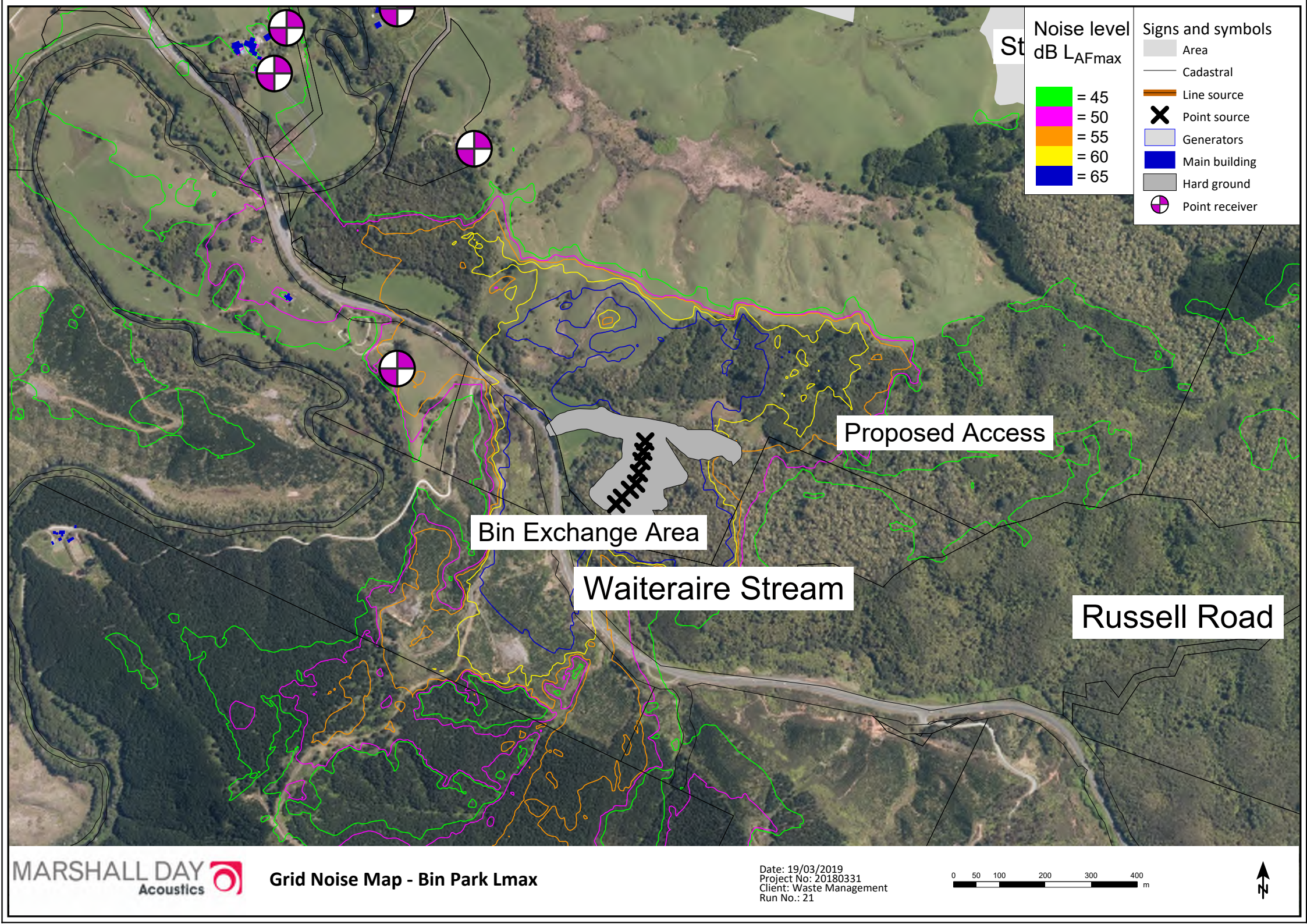
MARSHALL DAY Acoustics

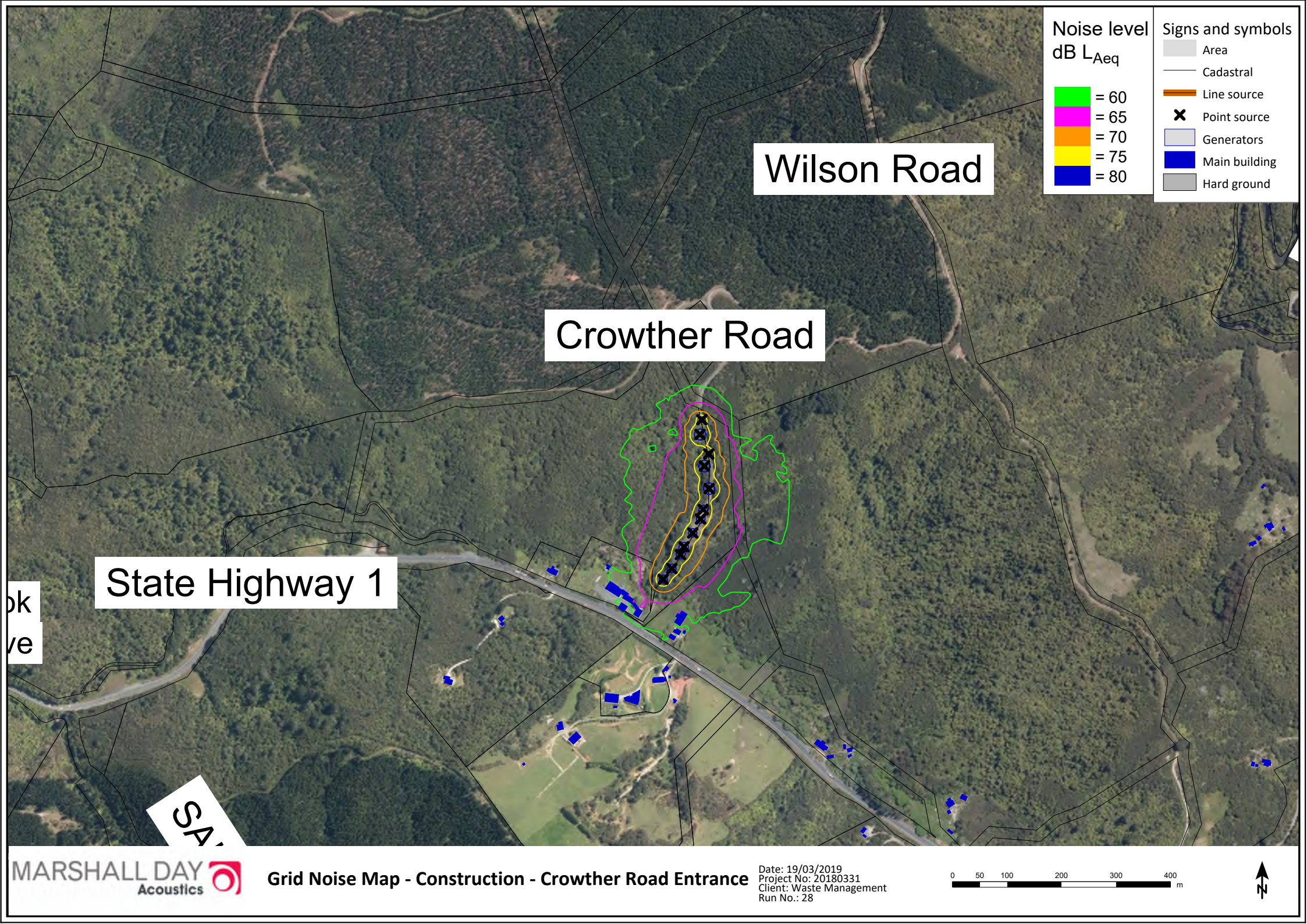
Grid Noise Map - Scenario 6

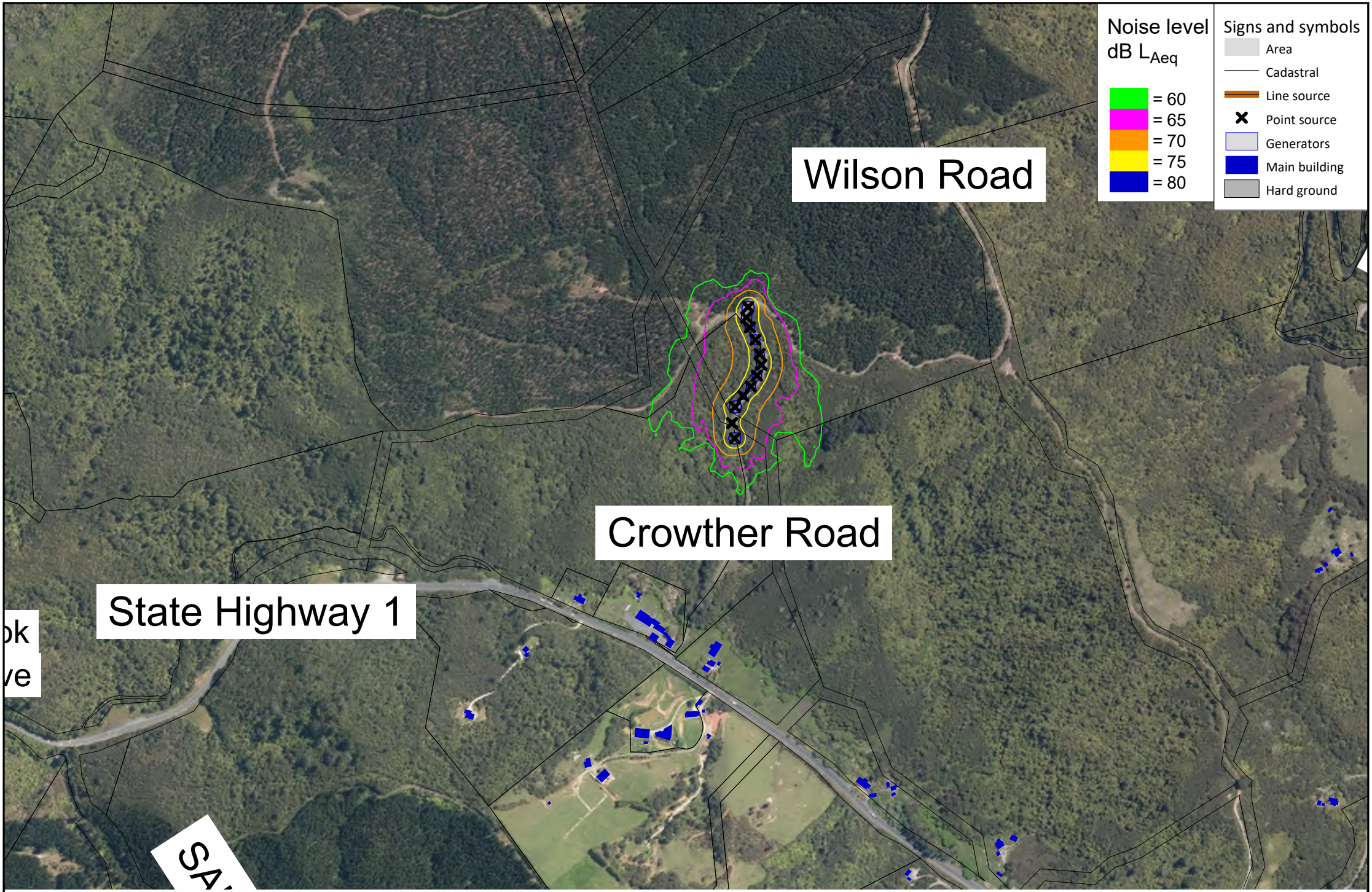
Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 26

0 100 200 400 600 800 m

N


Noise level
dB L_{AFmax}
= 45
= 50
= 55
= 60
= 65
Signs and symbols
Area
Cadastral
Line source
Point source
Generators
Main building
Hard ground
Point receiver
Proposed Access
Bin Exchange Area
Waiteraire Stream
Russell Road
MARSHALL DAY Acoustics
Grid Noise Map - Bin Park Lmax
Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 21
0 50 100 200 300 400 m
N


Noise level
dB L_{Aeq}
= 60
= 65
= 70
= 75
= 80
Signs and symbols
Area
Cadastral
Line source
Point source
Generators
Main building
Hard ground
Wilson Road
Crowther Road
State Highway 1
MARSHALL DAY Acoustics
Grid Noise Map - Construction - Crowther Road Entrance
Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 28
0 50 100 200 300 400 m
N



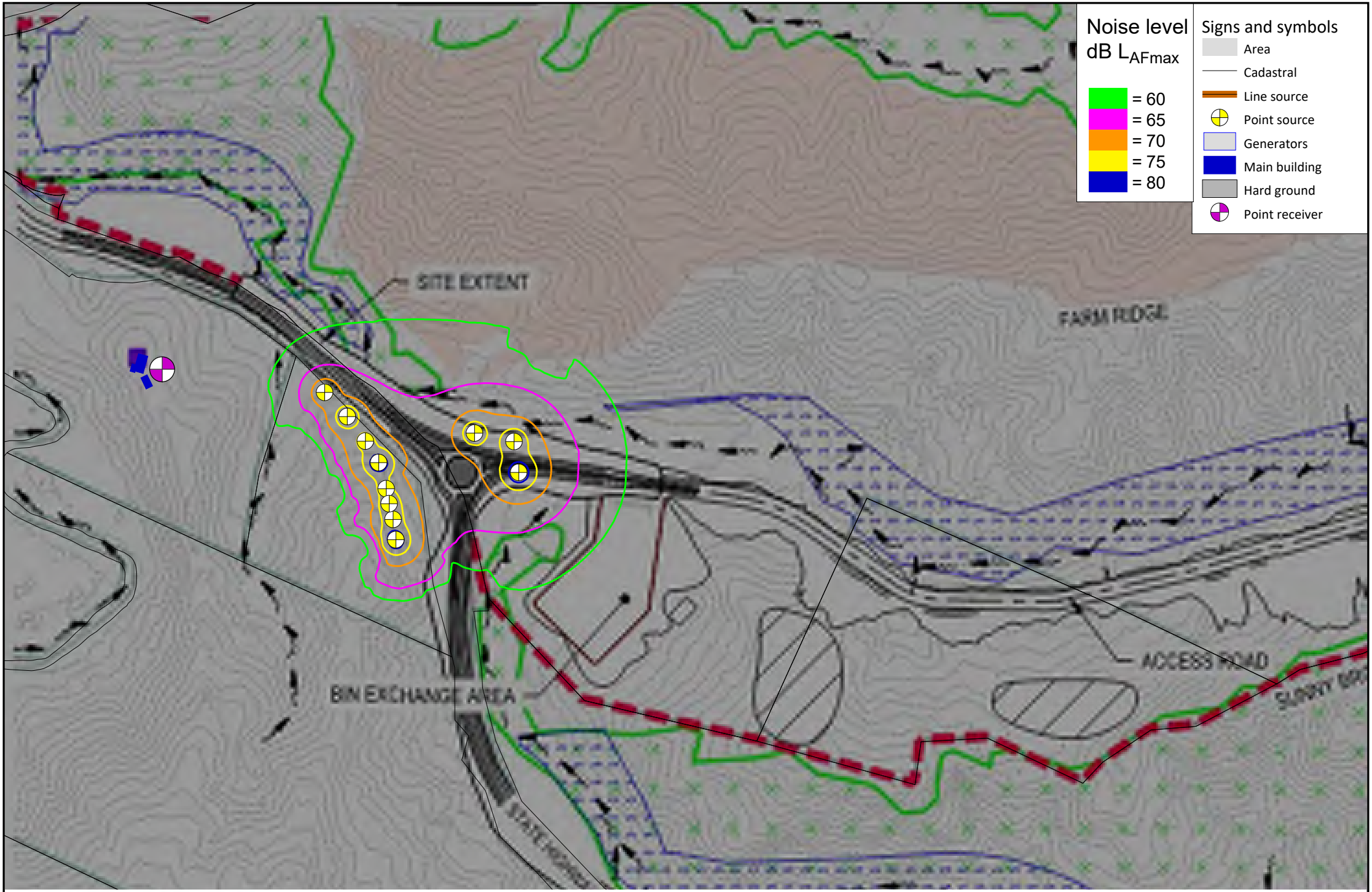
MARSHALL DAY Acoustics

Grid Noise Map - Construction - Incline to Wilson Road

Date: 19/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 41

0 50 100 200 300 400 m

N



MARSHALL DAY Acoustics

Grid Noise Map - Construction - Roundabout West Bank

Date: 4/03/2019
Project No: 20180331
Client: Waste Management
Run No.: 38

0 45 90 180 270 360 m

N