Styles Group
Acoustics & Vibration Consultants

ACOUSTIC ASSESSMENT

MILLDALE WASTEWATER TREATMENT PLANT
PROPOSED CONSTRUCTION & OPERATION

PREPARED FOR

Fulton Hogan Land Development

DATE

26 February 2025

Assessment prepared by Styles Group for Fulton Hogan Land Development.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	26/02/25	Issued for resource consent	Final	Jamie Exeter, MASNZ, Assoc. NZPI Principal Styles Group	Kelly Leemeyer, MASNZ Senior Consultant Styles Group

Table of contents

Executive summary 1

1.0 Introduction 2

2.0 Statement of qualifications and experience 3

- 2.1 Author – Jamie Exeter 3
- 2.2 Reviewer – Kelly Leemeyer 3

3.0 The proposed wastewater treatment plant 4

4.0 The application site and nearest receivers 4

5.0 Construction noise assessment 5

- 5.1 AUP permitted construction noise standards 5
- 5.2 AUP permitted construction vibration standards 7
  - 5.2.1 Vibration building damage limits 7
  - 5.2.2 Vibration amenity limit 9
- 5.3 Construction noise and vibration mitigation 9
- 5.4 Construction noise levels 9
- 5.5 Construction vibration levels 11
- 5.6 Potential construction noise and vibration effects 12

6.0 Operational noise assessment 13

- 6.1 AUP permitted operational noise standards 13
- 6.2 Operational noise levels 13
- 6.3 Potential operational noise effects 16

7.0 Recommended conditions 16

8.0 Conclusion 17

Appendices

Appendix A Glossary

Executive summary

Fulton Hogan Land Development has engaged Styles Group to assess the potential noise effects associated with construction and operation of a wastewater treatment plant on Lysnar Road, Wainui.

This report has been prepared to accompany a resource consent application to the Environmental Protection Agency under the Fast-Track Approvals Act 2024. It includes:

- Recommended mitigation measures.
- An assessment of the worst-case noise levels against the Auckland Unitary Plan permitted standards.
- An assessment of the potential noise effects on the existing environment.

The following measures are proposed to ensure compliance with the noise and vibration limits set by the Auckland Unitary Plan for permitted activities and to minimise effects:

- All noisy construction work will be undertaken between 7:30 AM and 6:00 PM on Monday to Saturday.
- There will be proactive communication with the neighbours before construction work begins.
- At the operational stage, trucks will only access the plant site during daytime hours and on Monday to Friday.

The key findings of this report are:

- Consent is not required for infringements of the construction noise and vibration limits for permitted activities.
- Construction noise and vibration levels outside the nearest dwellings will be significantly lower than the permitted limits for most of the construction stage.
- Consent is not required for infringements of the operational noise limits for permitted activities.
- The level and character of the operational noise emissions during the day will be consistent with the existing noise environment. Noise emissions at night will not cause sleep disturbance.
- Noise from the construction and operation of the wastewater treatment plant will not cause unreasonable disturbance on any neighbouring site.

We have recommended appropriate conditions of consent based on our findings.

1.0 Introduction

This report has been prepared in support of an application for resource consent by Fulton Hogan Land Development (**FHLD**) to the Environmental Protection Authority under the Fast-Track Approvals Act 2024.

Resource consent is required for the construction and operation of a wastewater treatment plant on Lysnar Road, Wainui. The proposal includes earthworks, wastewater discharges, and vegetation removal.

FHLD has engaged Styles Group to assess the potential construction and operational noise effects of the proposal.

The purpose of this report is to:

- Determine the potential construction and operational noise levels at the nearest sites based on typical and worst-case scenarios.
- Assess the noise emissions in terms of the permitted standards of the Auckland Unitary Plan (the **AUP**) and identify whether consent is required for infringements.
- Recommend noise and vibration mitigation measures and consent conditions.
- Describe the potential noise effects of the proposal in the context of the existing environment and the provisions of the AUP.

Our assessment is based on design information provided by the relevant experts in the project team.

We have prepared noise level predictions using manual calculations and computer noise modelling software (DGMR iNoise). All calculations have been undertaken in accordance with ISO 9613-1/2 *Attenuation of sound during propagation outdoors* and with the following Standards where applicable:

- NZS 6803:1999 *Acoustics – Construction noise*.
- NZS 6801:2008 *Acoustics – Measurement of environmental sound*.
- NZS 6802:2008 *Acoustics – Environmental noise*.

A glossary of acoustical terms used in this document is attached as Appendix A.

2.0 Statement of qualifications and experience

This section outlines the qualifications and professional experience of both the author and the reviewer of this report.

2.1 Author – Jamie Exeter

I am a Principal at Styles Group. Styles Group is an acoustics consultancy specialising in environmental noise and vibration, building acoustics, and underwater noise. I have been employed at Styles Group since January 2008.

I hold a Diploma of Audio Engineering from the School of Audio Engineer, which I completed in 2004. I am a professional Member of the Acoustical Society of New Zealand (MASNZ) and served as an elected council member from 2012 until 2018.

I have 20 years of experience in acoustics, with over 17 years specialising in measuring, predicting, and assessing environmental noise and vibration in accordance with District Plans and the Resource Management Act.

I have contributed to a significant number of construction projects including large scale residential developments and many of New Zealand's largest infrastructure projects. I regularly undertake peer review work for Local Government throughout New Zealand. I have provided expert evidence and advice for District Plan changes and reviews for a large number of private and public sector clients. I have written and presented guidelines on the measurement and assessment of environmental noise and construction noise and vibration to council staff and project teams throughout New Zealand.

I am one of three consultants in a working group currently drafting guidelines on the measurement and assessment of construction noise in New Zealand on behalf of the Association of Australasian Acoustical Consultants to address issues and ambiguities in NZS 6803:1999 *Acoustics – Construction Noise*.

I confirm that, in my capacity as author of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

2.2 Reviewer – Kelly Leemeyer

I am a Senior Consultant at Styles Group. I have been employed at Styles Group since November 2013.

I hold the qualifications of a Bachelor of Science Degree with a major in Geology and a specialisation in Geophysics from the University of Auckland and a Post Graduate Certificate in Planning from Massey University. I am a professional Member of the Acoustical Society of New Zealand.

I have 11 years of experience as an acoustics consultant specialising in measuring, predicting, and assessing environmental noise and vibration in accordance with District Plans and the Resource Management Act.

My experience relevant to this project includes the preparation and review of a significant number of construction noise and vibration assessments and construction noise and vibration management plans for projects throughout New Zealand. I have extensive experience in assessing the potential noise effects of applications similar to the proposal.

I confirm that, in my capacity as reviewer of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

3.0 The proposed wastewater treatment plant

FHLD is seeking approval to authorise the construction and operation of a wastewater treatment plant on Lysnar Road, Wainui.

The construction period will be approximately 18 months. All noisy construction work will be between 7:30 AM and 6:00 PM on Monday to Saturday. There will be no noisy construction work on Sundays or public holidays.

The wastewater pump station will operate continuously, 24 hours a day, seven days a week.

A full description of the project is provided in the application AEE.

4.0 The application site and nearest receivers

The land subject to the proposal is located at Lot 4 DP 353309, Wainui Road, Upper Orewa (the **site**). The site is approximately 10.45 ha and is within the Future Urban Zone under the AUP. The proposed activity will occur within a land area of approximately 1.21 ha in the southern portion of the site. Access to the wastewater pump station will be via Lysnar Road.

The adjoining land on the northern side of Lysnar Road is also in the Future Urban Zone. The nearest occupied dwelling in this zone is at 427 Wainui Road, more than 250 m from the proposed activity.

The nearest residentially zoned land is on the southern side of Lysnar Road within the Wainui Precinct. It includes vacant land and an occupied dwelling at 16 Lysnar Road.

5.0 Construction noise assessment

This section sets out our assessment of the potential noise effects during the construction stage of the proposal.

5.1 AUP permitted construction noise standards

Standard E25.6.1.3 of the AUP requires all construction noise to be measured and assessed in accordance with NZS 6803: 1999 *Acoustics – Construction Noise*.

The permitted construction noise limits are provided in E25.6.27, as follows.

> **E25.6.27. Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone**
>
> 1) Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone when measured 1m from the façade of any building that contains an activity sensitive to noise that is occupied during the works.

Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone

Time of week	Time Period	Maximum noise level (dBA)	
		L_{eq}	L_{max}
Weekdays	6:30am – 7:30am	60	75
	7:30am – 6:00pm	75	90
	6:00pm - 8:00pm	70	85
	8:00pm - 6:30am	45	75
Saturdays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	75	90
	6:00pm - 8:00pm	45	75
	8:00pm - 6:30am	45	75
Sundays and public holidays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	55	85
	6:00pm - 8:00pm	45	75
	8:00pm - 6:30am	45	75

2) Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.2 Construction noise levels for noise affecting any other activity when measured 1m from the façade of any other building that is occupied during the works.

Table E25.6.27.2 Construction noise levels for noise affecting any other activity

Time Period	Maximum noise levels L_{eq} (dBA)
7:30am – 6:00pm	75
6:00pm – 7:30am	80

3) For a project involving a total duration of construction work that is less than 15 calendar days, the noise levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above may be increased by 5dB in all cases.

4) For a project involving a total duration of construction work that is more than 20 weeks the noise limits in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above may be decreased by 5dB in all cases.

Activities sensitive to noise are defined in Chapter J of the AUP as 'any dwelling, visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village, supported residential care, care centres, lecture theatres in tertiary education facilities, classrooms in education facilities and healthcare facilities with an overnight stay facility'.

With respect to the criteria for determining the permitted construction noise limits under E25.6.27:

- The works are outside of the Business – City Centre Zone and the Business – Metropolitan Centre Zone.
- All noisy work will be within the period of 7:30 AM to 6:00 PM on Monday to Saturday.
- The project will involve a total duration of construction work that is more than 20 weeks.
- The nearest neighbouring sites include activities sensitive to noise (dwellings).

The permitted construction noise limits for the project are therefore 70 dB L_{Aeq} and 85 dB L_{Amax} at 1 m from the most exposed façade of any occupied dwelling.

5.2 AUP permitted construction vibration standards

The AUP permitted construction vibration standards are provided in E25.6.30.

E25.6.30. Vibration

1) Construction and demolition activities must be controlled to ensure any resulting vibration does not exceed:

   a. the limits set out in German Industrial Standard DIN 4150-3 (1999): Structural vibration – Part 3 Effects of vibration on structures when measured in accordance with that Standard on any structure not on the same site; and

   b. the limits in Table E25.6.30.1 Vibration limits in buildings in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building.

Table E25.6.30.1 Vibration limits in buildings

Receiver	Period	Peak Particle Velocity Limit (mm/s)
Occupied activity sensitive to noise	Night time 10pm to 7am	0.3 mm/s
	Daytime 7am to 10pm	2 mm/s
Other occupied buildings	At all times	2 mm/s

Works generating vibration for three days or less between the hours of 7am to 6pm may exceed the limits in Table E25.6.30.1 Vibration limits in buildings above, but must comply with a limit of 5mm/s peak particle velocity in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building, where:

   i. all occupied buildings within 50m of the extent of the works generating vibration are advised in writing no less than three days prior to the vibration-generating works commencing; and

   ii. the written advice must include details of the location of the works, the duration of the works, a phone number for complaints and the name of the site manager.

The criteria specified in E25.6.30.1.a are designed to prevent cosmetic damage to buildings, while those in E25.6.30.1.b aim to mitigate potential effects on people inside the buildings.

5.2.1 Vibration building damage limits

The DIN 4150–3:1999 Standard referenced in E25.6.30.1.a recommends vibration limits for avoiding cosmetic building damage according to the design, occupancy, and sensitivity of the subject building. The classifications are:

- Line 1: Buildings used for commercial purposes, industrial buildings, and buildings of similar design
- Line 2: Dwellings and buildings of similar design and/or occupancy
- Line 3: Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g., listed buildings under preservation order).

We have based our assessment against the permitted construction vibration limits on Line 2 of the DIN 4150–3:1999 criteria applying at the neighbouring residential dwellings.

Line 3 would apply to any receiving structure that is deemed by a suitably qualified person to be particularly sensitive to vibration and/or of great intrinsic value e.g., a heritage building. We are not aware of any nearby Line 3 structures.

The guideline values provided in DIN 4150–3:1999 also depend on whether the vibration is 'short-term' or 'long-term'. Short-term vibration is defined by the Standard as vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance. Long-term vibration is all other types of vibration. In our experience in measuring vibration in low-rise structures shows that construction vibration typically meets the short-term criteria.

The DIN 4150–3:1999 frequency-dependent values for short-term vibration are illustrated in Figure 1 for reference. Dominant frequencies for construction vibration in dwellings are typically less than 50 Hz.

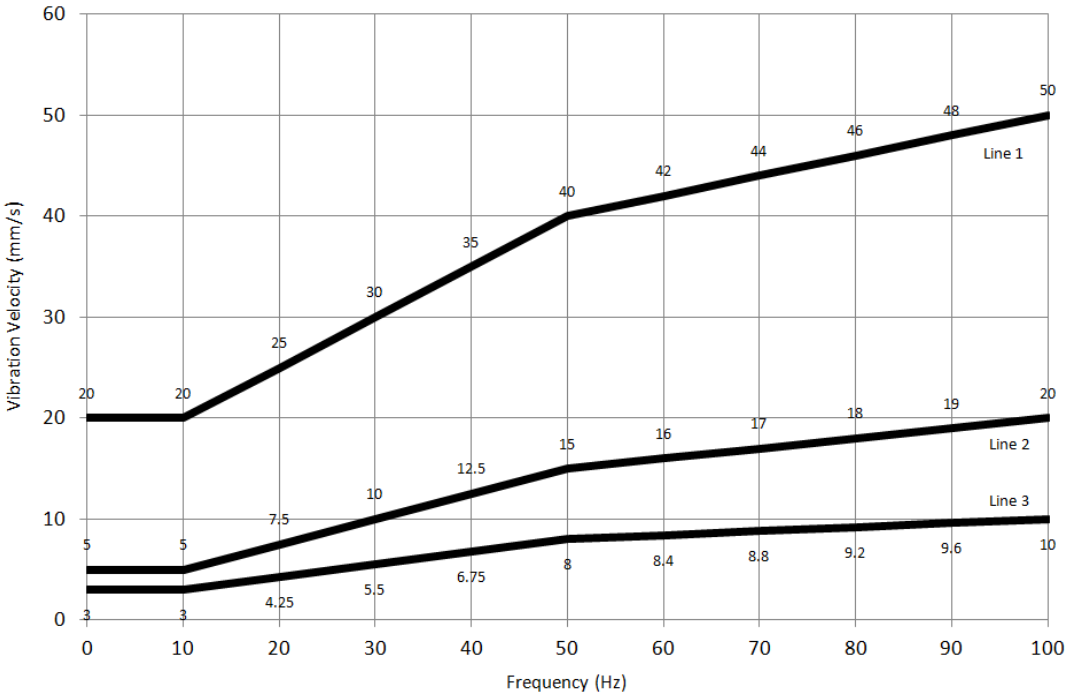

Figure 1: DIN 4150–3: 1999 guideline values for short-term vibration

5.2.2 Vibration amenity limit

The works will be during the daytime only and vibration will be generated for more than three days. The permitted construction vibration amenity limit under E25.6.30.1.b is therefore 2 mm/s PPV when measured within any occupied building.

5.3 Construction noise and vibration mitigation

The following measures will be adopted to minimise construction noise and vibration emissions and avoid unnecessary effects on the neighbouring sites.

1. The occupants of any dwelling within 200 meters of the site will receive written advice at least five days before earthworks begin. This advice will provide an overview of the works, approximate dates for the noisiest activities, and contact details for any questions or concerns.
2. Noisy construction work will only occur between 7:30 AM and 6:00 PM on Monday to Saturday. There will be no noisy work at night or on Sundays and public holidays.

5.4 Construction noise levels

We have calculated construction noise levels at the neighbouring sites based on reasonable worst-case scenarios and the references displayed below in Table 1. Our references are based on measurement data. They are generally consistent with the data provided in NZS 6803:1999 Appendix C *Guide to Sound Level Data on Site Equipment and Site Activities* (but more relevant to modern construction equipment than the examples provided in the Standard).

Table 1 displays the minimum separation distances for each activity to comply with the relevant AUP permitted noise limit based on the following assumptions:

- The minimum distance stated is from the noise-generating plant to the assessment position at 1 m from the most exposed façade of the building (e.g., from the excavator engine to 1 m from the building façade).
- The plant is being used continuously at the reference distance over a 15-minute sample period unless otherwise stated.
- The distances include a +3 dB adjustment to the noise levels for reflections from the façade of the receiving building (as required by NZS 6803:1999).
- Acoustically reflective ground is assumed between the noise source and the receiver.
- The mitigated compliance distances are based on construction noise barriers effectively screening the ground level of the building from the noise-generating activity and reducing the noise levels by 10 dB.

Table 1: Reference noise levels and compliance distances

Construction activity	Unmitigated $L_{Aeq(15\ min)}$ noise level at 10 m	Unmitigated compliance distance	Mitigated compliance distance (with noise barrier)
Mulcher / chipper	83 dB	60 m	19 m
Petrol chainsaw felling trees (33% on-time)	77 dB	30 m	10 m
D6, D7, or D8 bulldozer working in small area	76 dB*	27 m	9 m
Padfoot vibratory compaction roller 15t – 20-t	76 dB*	27 m	9 m
Drilling with a 12-t excavator	75 dB	24 m	8 m
Plate compactor	74 dB	22 m	7 m
Cut and fill, clearing, and loading trucks with a 40-t – 50-t excavator	72 dB	17 m	6 m
Cat 825 static compactor 30-t	72 dB*	17 m	6 m
Drilling with a 6-t – 10-t excavator	72 dB	17 m	6 m
Cut and fill, clearing, and loading trucks with a 20-t excavator	69 dB	12 m	4 m
Cat 815 static compactor 18-t	69 dB*	12 m	4 m
Vibratory compaction roller 5-t – 7-t	69 dB*	12 m	4 m
Concrete pump and truck discharging	69 dB	12 m	4 m
Cut and fill, clearing, and loading trucks with a 12-t excavator	67 dB	10 m	3 m
Single drum static compaction roller 5-t	67 dB*	10 m	3 m
Vibratory compaction roller 3-t	67 dB*	10 m	3 m
Large generator	66 dB	9 m	3 m

Construction activity	Unmitigated $L_{Aeq(15\ min)}$ noise level at 10 m	Unmitigated compliance distance	Mitigated compliance distance (with noise barrier)
Single drum static compaction roller 3-t	65 dB*	8 m	3 m
Terrex TS14 30-t motor scraper	65 dB*	8 m	3 m
Use of handheld power tools	65 dB	8 m	3 m
Grader	62 dB*	6 m	2 m
Idling delivery truck, dump truck, moxy, tractor	62 dB	6 m	2 m

* Reference noise level is for a moving noise source.

The nearest occupied dwelling is more than 130 m from the proposed construction work. All of the construction activities on site will be outside of the unmitigated compliance distances displayed in Table 1 and will not require acoustic screening for compliance.

The proposed construction works will consistently comply with the AUP permitted construction noise limits by undertaking all noisy construction work between 7:30 AM and 6:00 PM on Monday to Saturday.

The highest construction noise levels during the closest activities will be approximately 50 to 60 dB $L_{Aeq(15\ min)}$ outside the dwelling at 16 Lysnar Road. When construction activities are more distant the noise levels will range from 40 to 50 dB $L_{Aeq(15\ min)}$. There will also be periods when little or no noise is generated.

The predicted construction noise levels represent the peak 15-minute periods during the noisiest and closest activities. They are not averaged and will not be generated for long periods.

The L_{Amax} noise levels from the proposed construction activities will generally be 10-15 dB higher than the L_{Aeq} noise levels and will consistently comply with the permitted L_{Amax} noise limits.

5.5 Construction vibration levels

Table 2 displays typical vibration levels for the proposed construction activities. These are derived from previous measurements using a geophone buried in the ground. Measuring from the foundations of a dwelling may show slightly lower results due to the loss of energy when the vibration transfers from the ground into the structure.

Table 2: Typical construction vibration levels

Construction activity	Distance	Typical vibration level (PPV)
Vibratory compaction with a 15-t – 20-t roller	10 m	3-4 mm/s
Vibratory compaction with a 5-t – 7-t roller	10 m	2-3 mm/s
Compaction with a large static roller	10 m	1 mm/s
Cut and fill works, loading trucks, and tracking slowly with a 20-t excavator	10 m	1 mm/s
Heavy vehicle or tractor pass-by on even ground	10 m	<1 mm/s

The nearest occupied dwelling is more than 130 m from the proposed construction work. The proposed activities will consistently comply with the permitted construction vibration limits for amenity and structures without requiring specific mitigation.

5.6 Potential construction noise and vibration effects

The AUP permitted construction noise and vibration standards will readily be complied with due to the distance between the construction work and the nearest occupied dwellings. The proposed communication with the nearest residents will minimise the potential effects.

Construction noise will be audible outside at 16 Lysnar Road and may be heard inside the dwelling when the work is in the nearest part of the site. It is unlikely to cause annoyance or interfere with residential activities at the level predicted. Construction vibration is unlikely to be perceptible within the dwelling at any time. The construction noise and vibration levels at all other occupied dwellings will be considerably lower than at 16 Lysnar Road because they are further away.

Construction vibration generated by the proposed work is unlikely to be perceptible within the nearest dwellings and it will not exceed the AUP building damage limits.

Construction noise and vibration from the proposed work will remain within the permitted limits set by the AUP for long-term construction projects and be significantly lower during most of the proposed work. We do not expect noise and vibration from the proposed construction work to cause unreasonable disturbance on any neighbouring site.

6.0 Operational noise assessment

This section sets out our assessment of the potential noise effects during the operation of the wastewater treatment plant.

6.1 AUP permitted operational noise standards

The operational noise limits are the AUP permitted noise standards for the Residential – Mixed Housing Suburban Zone (E25.6.2) and the Future Urban Zone (E25.6.3). These are summarised below.

Noise received at any point within the boundary of a site in the Residential – Mixed Housing Suburban Zone:

- Monday to Saturday: 50 dB L_{Aeq} from 7:00 AM to 10:00 PM; 40 dB L_{Aeq} and 75 dB L_{Amax} at all other times.
- Sunday: 50 dB L_{Aeq} from 9:00 AM to 6:00 PM; 40 dB L_{Aeq} and 75 dB L_{Amax} at all other times.

Noise received within the notional boundary of a site in the Future Urban Zone:

- Monday to Saturday: 55 dB L_{Aeq} from 7:00 AM to 10:00 PM; 40 dB L_{Aeq} and 75 dB L_{Amax} at all other times.
- Sunday: 55 dB L_{Aeq} from 9:00 AM to 6:00 PM; 45 dB L_{Aeq} and 75 dB L_{Amax} at all other times.

All operational noise must be measured and assessed in accordance with NZS 6801:2008 and NZS 6802:2008 (E25.6.1).

6.2 Operational noise levels

We have calculated operational noise levels at the nearest residentially zoned sites based on reasonable worst-case scenarios and the references displayed in Table 3. The source reference for truck movements is derived from our measurement database. The project design team provided all other references.

Table 3: Reference noise levels

Noise source	Reference noise level	Location and use
Three blowers	79 dB L_{Aeq} @ 1 m (each)	Internal blower room. Two blowers used continuously 24/7
Compressor	69 dB L_{Aeq} @ 1 m	Internal blower room. Used two hours per day. During daytime hours only.

Noise source	Reference noise level	Location and use
Odour fan	69 dB L_{Aeq} @ 1 m	Plant room. Used 24/7
Centrifuge	77 dB L_{Aeq} @ 1 m	Plant room. Used five hours per day. During daytime hours only.
Two headworks screens	70 dB L_{Aeq} @ 1 m (each)	Plant room. Used 24/7 Used intermittently for five-minute periods at any time of day.
Two pumps	67 dB L_{Aeq} @ 1 m (each)	Plant room. Used 24/7
Five pumps	55 dB L_{Aeq} @ 1 m (each)	Plant room. Used 24/7
Anoxic mixer	55 dB L_{Aeq} @ 1 m	External. Positioned between tanks southeast of the Plant room. Used 24/7
VSD controller	60 dB L_{Aeq} @ 1 m	External controller housed within a steel cabinet in the southeast area of the site next to the stormwater dry basin. Noise from this source has an audible “whine” under certain conditions.
Truck movements	100 dB L_{WA}	Three truck movements per week. During daytime hours on Monday to Friday.

We have calculated break-out noise from the plant building based on the following specifications provided by the design team:

- Tilt slab façade construction.
- Insulated sectional garage doors on the southern façade.
- An acoustic louvre air inlet on the eastern façade.
- Long-run iron roofing lined with acoustic-rated batts and 16 mm plywood.

We have assumed that all relevant sources will generate noise within the same fifteen-minute sample period to assess a worst-case scenario for noise emissions.

The predicted operational noise levels at the nearest sites are displayed in Table 4. The noise levels including a truck movement would only occur during the daytime on Monday to Friday.

Table 4: Predicted operational noise levels

Location	Predicted noise level during the day	Predicted noise level including truck movement	Predicted noise level at night
Within the site boundary of the nearest residentially zoned land at LOT 9006 DP 609046 (southwest of the plant room).	36 dB $L_{Aeq(15\ min)}$	47 dB $L_{Aeq(15\ min)}$	33 dB $L_{Aeq(15\ min)}$
At the notional boundary of 427 Wainui Road (20 m from the nearest dwelling in the Future Urban Zone).	22 dB $L_{Aeq(15\ min)}$	36 dB $L_{Aeq(15\ min)}$	21 dB $L_{Aeq(15\ min)}$

The predicted operational noise levels represent the highest measurable L_{Aeq} noise levels under a worst-case scenario. These levels must be used to derive a Noise Rating Level for comparison with the AUP permitted noise standards by making any applicable adjustments for duration and special audible characteristics under NZS 6802:2008.

There are items of plant that will operate continuously on all days. Therefore, we have not applied any adjustment for duration during the day.

Noise generated by the VSD controller can have a noticeable tonal component, but this will not be audible at the nearest sites. The predicted noise level from the VSD controller alone is 13 dB $L_{Aeq(15\ min)}$ at the boundary of the nearest residentially zoned land. We have not applied any adjustment for special audible characteristics.

The Noise Rating Levels for comparison with the AUP permitted noise standards are:

Residential – Mixed Suburban Zone

- Daytime: 47 dB L_{Aeq} on days when there is a truck movement on site and 36 dB L_{Aeq} on all other days. These Noise Rating Levels comply with the AUP permitted noise limit of 50 dB L_{Aeq}.
- Night-time: 33 dB L_{Aeq} which complies with the AUP permitted noise limit of 40 dB L_{Aeq}.

Future Urban Zone

- Daytime: 36 dB L_{Aeq} on days including a truck movement and 22 dB L_{Aeq} on all other days. These Noise Rating Levels comply with the AUP permitted noise limit of 55 dB L_{Aeq}.
- Night-time: 21 dB L_{Aeq} which complies with the AUP permitted noise limit of 45 dB L_{Aeq}.

The L_{Amax} noise levels are unlikely to be more than 10 dB higher than the night-time L_{Aeq} noise levels at the nearest sites and will readily comply with the permitted L_{Amax} noise limits.

6.3 Potential operational noise effects

Operational noise emissions from the site will readily comply with the AUP noise limits for permitted activities in the Residential – Mixed Housing Suburban Zone and the Future Urban Zone.

Truck movements will generate the highest noise emissions. Noise from trucks on the site will be brief, infrequent, during daytime hours, and on Monday to Friday only. The character of the noise will be consistent with road traffic noise in the surrounding area. Other noise from the site during the day will be significantly lower.

Noise emissions at night will consistently comply and will not cause sleep disturbance.

We do not expect noise from the operation of the wastewater treatment plant to cause unreasonable disturbance on any neighbouring site.

7.0 Recommended conditions

We recommend the following conditions for the wastewater treatment plant:

Construction

1. The consent holder must advise the occupants of all dwellings within 200 m of the site boundary of the project at least five days before earthworks begin. The advice must be provided in writing and must include the following information:
    i. A general description of the construction works including the duration of the project and the working hours on site.
    ii. The approximate dates and durations of the activities that will generate the highest levels of construction noise and vibration for them.
    iii. A contact name and phone number to advise of any sensitive times for high noise levels and for any questions or complaints during the project.
2. Construction work and heavy vehicle movements must only take place between 7:30 AM and 6:00 PM on Monday to Saturday. No noisy work can be undertaken on Sundays or public holidays. This condition does not prevent meetings or quiet activities from taking place outside of standard construction hours providing they are generally inaudible outside any residential dwelling.

Operational

3. Trucks must not access the wastewater treatment plant site outside of the hours of 7:00 AM and 10:00 PM on Monday to Friday, or at any time on Saturday and Sunday.

8.0 Conclusion

Styles Group has assessed the potential noise effects of the proposed wastewater treatment plant.

The proposed construction works will consistently comply with the AUP permitted construction noise and vibration limits. The potential construction noise and vibration effects will be mitigated by working during standard construction hours and communicating with the neighbours before the works begin.

Operational noise emissions from the site will readily comply with the AUP noise limits for permitted activities in the Future Urban Zone and the neighbouring Residential – Mixed Housing Suburban Zone. The level and character of the noise during the day will be consistent with the existing environment and the noise emissions at night will not cause sleep disturbance.

We do not expect noise from the construction and operation of the wastewater treatment plant to cause unreasonable disturbance on any neighbouring site.

We have recommended conditions based on our findings.

Appendix A Glossary

Noise	A sound which serves little or no purpose for the exposed persons and is commonly described as ‘unwanted sound’. The definition of noise includes vibration under the Resource Management Act.
dB (decibel)	The basic measurement unit of sound. The logarithmic unit used to describe the ratio between the measured sound pressure level and a reference level of 20 micropascals (0 dB).
A-weighting	A frequency filter applied to the full audio range (20 Hz to 20 kHz) to approximate the response of the human ear at lower sound pressure levels.
$L_{Aeq(t)}$ (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it considers the total sound energy over the time period of interest.
L_{AFmax} (dB)	The maximum A-weighted sound pressure level recorded during the measurement period using a fast time-weighting response.
PPV (mm/s)	Peak particle velocity is the metric commonly used for measuring construction vibration in New Zealand. It is the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
Notional boundary	A line 20 m from any side of a building containing an activity sensitive to noise, or the legal boundary where this is closer to the building.
Activities sensitive to noise	Defined in Chapter J of the AUP as ‘any dwelling, visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village, supported residential care, care centres, lecture theatres in tertiary education facilities, classrooms in education facilities and healthcare facilities with an overnight stay facility’.