Styles Group
Acoustics & Vibration Consultants

ASSESSMENT OF NOISE EFFECTS

AUCKLAND SURF PARK COMMUNITY - STAGE 2

PREPARED FOR

AW Holdings 2021 Limited Partnership

DATE

11 February 2026

Assessment prepared by Styles Group for AW Holdings 2021 Limited Partnership.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	27/11/25	Initial draft	Draft	Martyn Chambers, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Director and Principal Styles Group
2	5/02/26	Review following comments and updated masterplan.	Draft	Martyn Chambers, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Director and Principal Styles Group
3	10/02/26	Review following final comments	Final Draft	Martyn Chambers, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Director and Principal Styles Group
3	11/02/26	Final Stage 2 report	Final	Martyn Chambers, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Director and Principal Styles Group

Table of contents

Appendices

Appendix A	Glossary of terms
Appendix B	Predicted construction noise levels
Appendix C	Predicted vibration levels
Appendix D	Noise contour maps
Appendix E	Expert Summary Statement – Jon Styles
Appendix F	Expert Summary Statement – Martyn Chambers

Executive summary

Styles Group has assessed the operational noise and construction noise and vibration effects from Stage 2 of the Auckland Surf Park Community (the **ASPC**) in accordance with the permitted noise standards prescribed by the Auckland Unitary Plan- Operative in Part (**AUP**).

This assessment considers:

1. Aircraft noise from North Shore Aerodrome. It provides recommendations to manage reverse-sensitivity effects and maintain compatibility with aerodrome operations.
2. Noise generated and received within the ASPC site. It provides recommendations to manage noise effects between precincts within the development.
3. Noise generated by the ASPC that is received at receivers outside the site. It assesses potential effects and identifies where mitigation may be required to meet the relevant AUP Standards.

Summary of operational noise assessment

Stage 1

Stage 1 of the ASPC was consented under the COVID-19 Recovery (Fast-track Consenting) Act and enabled the construction and operation of the surf lagoon and ancillary amenities, a data centre, solar farm and associated activities. The conditions of consent attached to Stage 1 require the consented activities to comply with the maximum permitted noise levels prescribed by Standard E25.6.3(1) *Noise levels in rural and future urban zones* at any notional boundary adjacent to the Site.

Stage 2

Receivers outside the Site

Styles Group have used noise modelling software to predict the operational noise levels from Stage 2 activities, including changes to the design of the Surf Lagoon and solar farm. An additional Data Centre to the Stage 1 consented unit is also proposed on the Hyperscale Artificial Intelligence (AI) Data Centre campus. The noise modelling demonstrates that the design and operation of the Surf Lagoon will be required to be refined during the detailed design stage in order to comply with the “At all other times” noise limit of 45dB L_{Aeq} prescribed by the AUP at all notional boundaries **outside** the Site. Potential methods for achieving compliance are:

i. Work with the designer and supplier of the lagoon to incorporate noise reduction measures into the design of the Lagoon;

ii. Incorporate noise barriers or bunds or other noise mitigating features to reduce noise emissions;

iii. Implement manage measures to control the noise emissions from the Surf Lagoon such as limiting the wave height or frequency or other operational methods.

Given that some elements of the detailed design may change or are yet to be confirmed, we have recommended that conditions of consent require an Acoustic Design Report (ADR). The ADR process requires final noise level predictions and confirmation of what, if any mitigation measures will be required to comply with the consented noise limits. The ADR would be submitted to the Council after consent is granted, but before the operation of the noise-generating features. The ADR will ensure that the surf lagoon, data centre and solar farm are designed, constructed and maintained to ensure compliance with Standard E25.6.3(1) at any new or future notional boundary adjacent to the Site.

Future receivers within the Site

The proposal is to establish Neighbourhood Precincts within the Site. These receivers will be near to the Surf Lagoon that has the potential to operate between the hours of 6:00am and 10:00pm, 7 days per week.

Our noise modelling demonstrates the Surf Lagoon will exceed the maximum permitted noise level of 45 dB L_{Aeq} applying "At all other times" at future dwellings inside the North-West and South-West Neighbourhood Precinct. The noise modelling demonstrates that the noise levels from the Surf Lagoon will comply with the daytime limit of 55 dB L_{Aeq} at the future dwellings.

We have recommended that resource consent is sought to enable non-compliance with Standard E25.6.3(1) *Noise levels in rural and future urban zones* at the notional boundary of any activity sensitive to noise (**ASN**) within the North-West and South-West Neighbourhood Precincts during the morning and evening timeframes set out above.

We have recommended that the Neighbourhood Precinct dwellings that are exposed to external noise levels greater than 45 dB L_{Aeq} "At all other times" are provided with a mechanical cooling and ventilation system inside bedrooms. This system will enable windows to be closed to reduce external noise intrusion in the early morning period and will ensure occupants are provided with an adequate level of noise amenity for sleeping. We have recommended that the ADR is used to identify the specific dwellings that will require a mechanical cooling and ventilation system.

The Stage 2 proposal increases the number of accommodation units for visitors to the surf lagoon. The Surf Lagoon noise levels may exceed the maximum permitted noise levels prescribed by Standard E25.6.3 (1) at visitor accommodation facilities. We have not provided formal recommendations to manage Surf Lagoon noise levels at visitor accommodation facilities given that these buildings are part of the ASPC Resort.

Summary of aircraft noise assessment

The Site is adjacent to North Shore Aerodrome and is affected by the 65 dB L_{dn} and 55 dB L_{dn} aircraft noise control boundaries.

We have assessed the proposal in accordance with the noise-related land use controls prescribed by Chapter D24 of the AUP that manage the establishment of Activities Sensitive to Aircraft Noise (**ASAN**) on land between the 55 dB L_{dn} and 65 dB L_{dn} noise boundaries. No ASAN are proposed inside the 65 dB L_{dn} noise control boundary.

The proposal is to ensure all dwellings inside the 55 dB L_{dn} noise boundary are acoustically treated in accordance with the requirements of Chapter D24. These measures will protect the health and amenity of occupants while indoors. We have recommended conditions of consent require the provision of a mechanical ventilation and cooling system to ensure occupants are thermally comfortable in warm weather. The requirement for these systems is superior to the basic requirements of D24 and are considered best practice.

The North Shore Aerodrome Master Plan identifies that runway 09/27 may be disestablished in the future. Our assessment finds that the Site is highly unlikely to be covered by the 55 dB L_{dn} contour in the event that runway 09/27 is disestablished and the aircraft noise overlays are updated accordingly. We recommend that the conditions of consent require compliance with Chapter D24 until such time the Site is not affected by the relevant noise control boundaries.

Summary of construction noise and vibration assessment

Our assessment finds that construction noise can be managed to comply with the permitted construction noise standards prescribed by the AUP at all receivers adjacent to the Site.

Based on the proposed construction works, the permitted vibration amenity limit of 2 mm/s is only likely to be exceeded at one property, 1368 Dairy Flat Highway. All other properties within 30 m of the works are unlikely to experience vibration levels of 2 mm/s or greater. Accordingly, we recommend seeking resource consent to enable this isolated non-compliance at 1368 Dairy Flat Highway.

A draft Construction Noise and Vibration Management Plan (**CNVMP**) has been prepared and will be updated prior to construction. The CNVMP sets out the mitigation measures that must be implemented to ensure compliance with the permitted noise and vibration standards at the closest receivers adjacent to the Site.

1.0 Introduction

AW Holdings 2021 Limited Partnership (the **Applicant**) has engaged Styles Group to assess the noise effects from Stage 2 of the Auckland Surf Park Community (the **ASPC**) at 1320 and 1350 Dairy Flat Highway, 89 and 105 Lascelles Drive, and 237 and 253 Postman Road, Dairy Flat (the **Site**). This report has been prepared to accompany a substantive application under the Fast-track Approvals Act 2024.

We have assessed the operational noise, construction noise and vibration effects from the ASP and aircraft noise effects from the North Shore Aerodrome in accordance with the permitted noise standards prescribed by Auckland Unitary Plan - Operative in Part (**AUP**). This report includes recommended outcomes for the conditions of consent to deliver.

Our assessment is based on our understanding of the proposal following discussions with the project team. This report should be read in conjunction with the application site plans and the Assessment of Environmental Effects. A glossary of acoustical terms used within this document is attached as Appendix A.

1.1 Scope of this report and noise effects consented in Stage 1

Stage 1 of the ASPC was consented under the COVID-19 Recovery (Fast-track Consenting) Act 2020. The decision enables the construction and operation of the following activities:

iv. The surf lagoon and supporting buildings (surf academy, restaurant, and clubhouse).

v. Approximately 60 eco-cabins and visitor accommodation units

vi. A data-centre building platform;

vii. A solar farm;

viii. Internal roads, stormwater, wastewater and three-waters infrastructure

ix. Restoration and planting along the central stream corridor

The primary noise generating activities consented as part of Stage 1 include the surf lagoon data centre and solar farm. The Stage 1 consent includes a comprehensive set of conditions to ensure that the design, construction and operation of these activities comply with the permitted noise standards that apply at the notional boundary of any adjacent Site (outside the ASPC site).

2.0 Stage 2

Stage 2 proposes to vary the Stage 1 consents to align with the updated masterplan layout and to extend the development footprint to deliver a comprehensive mixed-use community anchored by the surf lagoon.

Stage 2 will enable approximately 486 residential units and 177 visitor accommodation units across multiple precincts. It also includes commercial, community, healthcare and other facilities. The proposed Stage 2 includes:

i. **Surf Lagoon and Amenity Precinct**: Changes to the consented precinct design and layout, incorporating new buildings and increasing the size of the surf lagoon.

ii. **Surf Village and Accommodation Precincts:** This Precinct provides 120 dwellings in apartment typologies, accommodation and amenity buildings for visitors to the Surf Lagoon.

iii. **Residential Neighbourhoods (North-West, North-East and South)**: These Residential Neighbourhood Precincts will provide for approximately 341 dwellings, including stand-alone and medium-density housing.

iv. **Live-Work Precinct:** This Precinct will provide 25 mixed residential and small-scale commercial/light-industrial lots.

v. **Hyperscale Artificial Intelligence (AI) Data Centre campus**: Replacement of the data centre arrangement consented under Stage 1 with a hyperscale AI data centre campus. This updated design includes internal changes to the consented data centre design (Data Centre 1). An additional module (Data Centre 2) approximately half the size of Data Centre 1 is proposed for the site and will be situated to the east of the consented unit.

vi. **Light Industry Precinct:** Providing 10 light industrial units.

vii. **Solar Farm North, Centre and South Precincts**: The proposal provides for solar farms comprising a total area of approximately 9 hectares of solar panels (total capacity ≈ 6.5 MW).

viii. **Roading and Infrastructure**: Including a new collector road linking Dairy Flat Highway and Postman Road, local roads and civil infrastructure and services.

ix. **Subdivision:** Superlot and individual lot subdivision.

x. **Wastewater and Water Treatment Plant:** Situated to the south of the Live-Work Precinct.

The precinct layout is shown in Figure 1.

Figure 1 Precinct layout

3.0 The Site and surrounding environment

The Site comprises approximately 54 hectares between Dairy Flat Highway and Postman Road. Figure 2 displays the AUP zonings and North Shore Aerodrome aircraft noise overlays applying to the Site and surrounding land.

The Site and the adjacent land to the north and south of the Site are in the Future Urban Zone (**FUZ**) of the AUP. The land on the western side of Dairy Flat Highway is zoned Rural – Mixed Rural (**Rural Zone**). The land use activities in the FUZ and Rural Zone are predominantly characterised by large lot rural lifestyle living.

The North Shore Aerodrome to the east of the Site is in the Special Purpose – Airports and Airfields Zone and the land adjacent to Kahikatea Flat Road is zoned Business -Light Industry Zone (**LIZ**) and occupied by industrial activities.

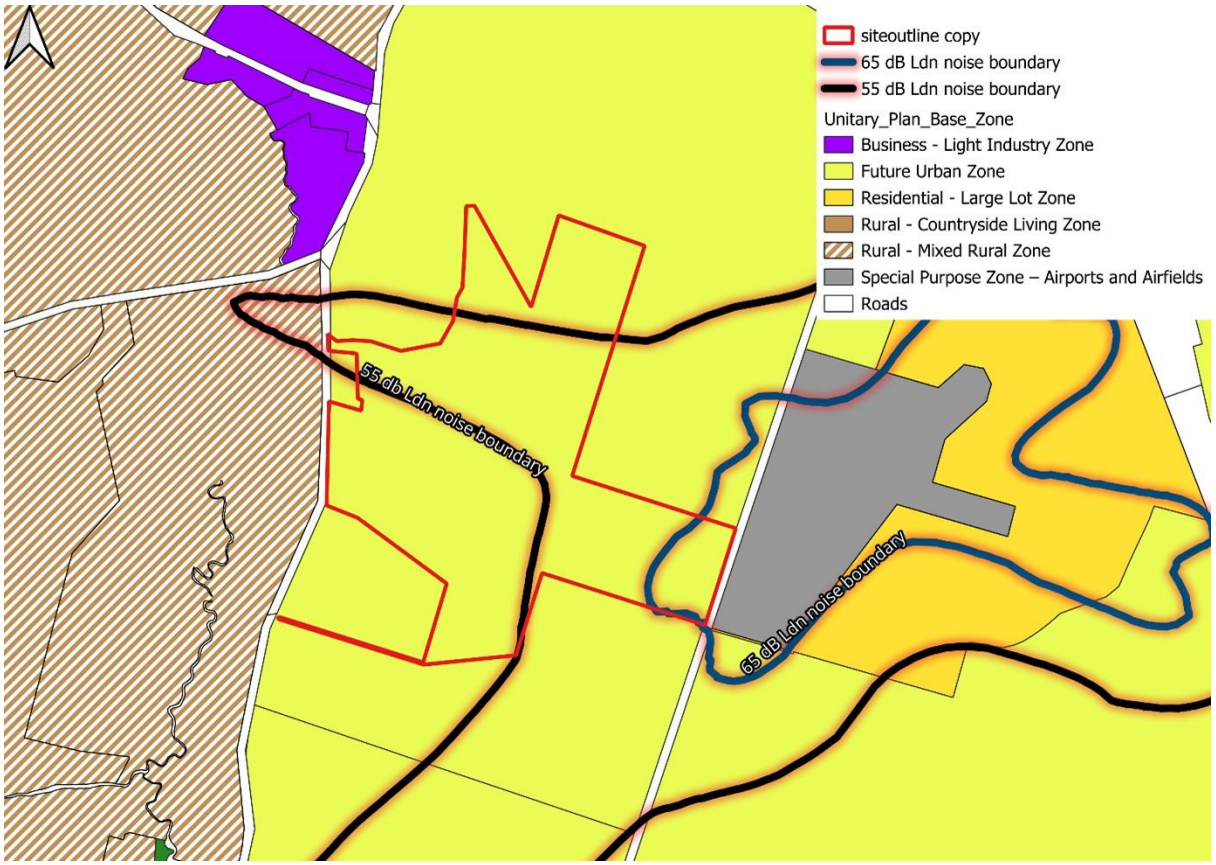

Figure 2 The Site and AUP zoning arrangements and Overlays

3.1 Noise sensitive receivers

The land use activities in the FUZ and Rural Zone are predominantly characterised by large-lot rural lifestyle living. Many of the properties surrounding the Site are occupied by residential dwellings that are defined as Activities Sensitive to Noise (**ASN**[1]).

The proposal is to manage construction noise and vibration and operational noise to achieve compliance with the relevant noise standards prescribed by the AUP at all existing and potential future receivers on adjacent sites.

Table 1 summarises the separation distance between the existing dwellings to the closest part of the Site boundary.

Figure 3 shows the location of the existing receivers. Figure 3 also shows the location of noise sensitive receivers that will be created as part of the development.

Table 1 Existing receivers

Address	Zone	Approximate Separation distance from building façade to nearest site boundary
65 Lascelles Drive	Future Urban Zone	150 m
1306 Dairy Flat Highway	Future Urban Zone	115 m
1314 Dairy Flat Highway	Future Urban Zone	85 m
1315 Dairy Flat Highway	Mixed Rural Zone	47 m
1318 Dairy Flat Highway	Future Urban Zone	29 m
1321 Dairy Flat Highway	Mixed Rural Zone	30 m
1326 Dairy Flat Highway	Future Urban Zone	80 m
1327 Dairy Flat Highway	Mixed Rural Zone	140 m
1328 Dairy Flat Highway	Future Urban Zone	85 m
1332 Dairy Flat Highway	Future Urban Zone	90 m
1338 Dairy Flat Highway	Future Urban Zone	80 m

[1] Activities sensitive to noise are defined in Chapter J1 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”.

Address	Zone	Approximate Separation distance from building façade to nearest site boundary
1349 Dairy Flat Highway	Mixed Rural Zone	30 m
1355 Dairy Flat Highway	Mixed Rural Zone	40 m
1361 Dairy Flat Highway	Mixed Rural Zone	40 m
1368 Dairy Flat Highway	Future Urban Zone	12 m
1373 Dairy Flat Highway	Mixed Rural Zone	48 m
1412 Dairy Flat Highway	Future Urban Zone	155 m
1414 Dairy Flat Highway	Future Urban Zone	140 m
1416 Dairy Flat Highway	Future Urban Zone	35 m
1424 Dairy Flat Highway	Future Urban Zone	170 m
1428 Dairy Flat Highway	Future Urban Zone	80 m
1432 Dairy Flat Highway	Future Urban Zone	70 m
65 Lascelles Drive	Future Urban Zone	140 m
203 Postman Road	Future Urban Zone	200 m
207 Postman Road	Future Urban Zone	90 m
231 Postman Road	Future Urban Zone	33 m
273 Postman Road	Future Urban Zone	41 m
275 Postman Road	Future Urban Zone	100 m
293 Postman Road	Future Urban Zone	260 m
295 Postman Road	Future Urban Zone	20 m
313 Postman Road	Future Urban Zone	12 m
315 Postman Road	Future Urban Zone	110 m
327 Postman Road	Future Urban Zone	49 m
98A Wilks Road	Future Urban Zone	50 m

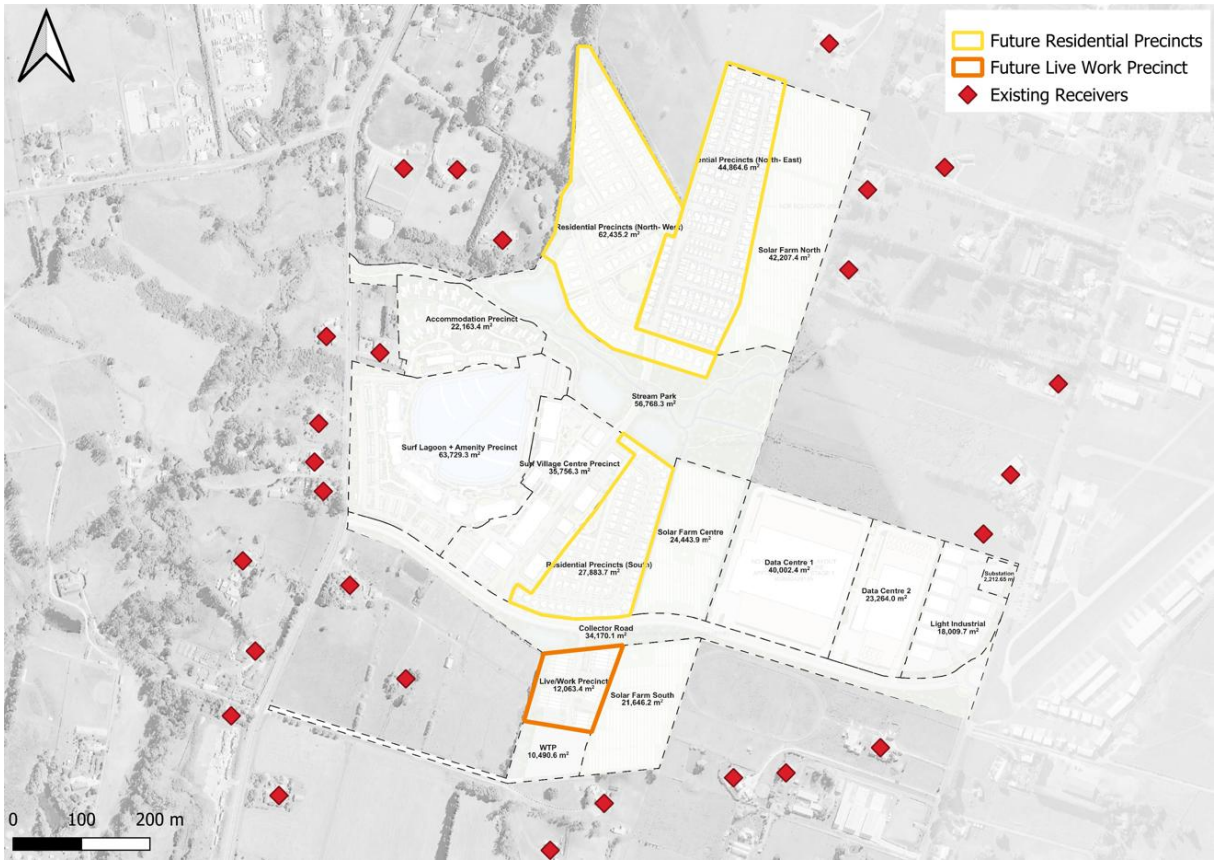

Figure 3 Existing receivers outside the Site (red) and ASN created by the proposal (yellow)

4.0 Operational noise standards applying to the proposal

4.1 Auckland Unitary Plan (Operative in Part)

Table E25.6.3.1 prescribes the following noise limits for noise generated from a Site within the FUZ and received at the notional boundary on any other site in the Mixed Rural or Future Urban zone:

Table E25.6.3.1 Noise levels in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone

Time	Noise level
Monday to Saturday 7am-10pm	55dB L_{Aeq}
Sunday 9am-6pm	
All other times	45dB L_{Aeq} 75dB L_{AFmax}

Standard E25.6.1(1) *General Standards* of the AUP requires noise levels to be measured and assessed in accordance with the New Zealand Standards NZS 6801:2008 *Acoustics – Measurement of environmental sound* and NZS 6802:2008 *Acoustics – Environmental noise* except where more specific requirements apply. All measurement and assessment of noise has been undertaken in accordance with these standards.

The proposal is to ensure that noise levels from Stage 2 (including changes to consented Stage 1 activities) comply with these noise limits when measured and assessed at the notional boundary of any other adjacent site in the FUZ or Rural Zone.

The proposal seeks consent to authorise noise levels higher than these standards when measured and assessed at ASN created by the proposal itself.

4.2 Resource Management Act

The overarching requirement for noise from the proposed activity is compliance with Section 16 of the Act, which states:

> Every occupier of land (including any premises and any costal marine area), and every person carrying out an activity in, on, or under a water body or the costal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level.

5.0 Operational noise modelling

We have used DGMR iNoise computer noise modelling software to predict the operational noise from the surf lagoon, data centre and solar farm, taking into account the design and layout changes proposed as part of Stage 2. The key changes and additions considered in our assessment include:

- Changes to the Surf Lagoon and Amenity Precinct layout. This includes changes to the layout, including the addition and removal of buildings and structures within the precinct.
- The Hyperscale Artificial Intelligence Data Centre Campus. We have included a noise model of Data Centre 1 (consented under the Stage 1) and the proposed Data Centre 2.
- The Solar Farm has been relocated for the north-eastern portion of the site to three key areas, the Northern, Central and Southern Solar Farm.
- The Early Childhood Education Centre (ECE) proposed within the Surf Village Centre Precinct

The predictions are based on the methods in International Standard ISO 9613-1/2 *Acoustics – Attenuation of sound during propagation outdoors*. The calculations assume meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6801:2008. The DGMR iNoise software is the successor to Brüel & Kjær Predictor software that is globally recognised and has been successfully implemented on many projects throughout New Zealand.

We have created noise models using information provided by the Project Team and manufacturer sound power level specifications detailed in the noise assessments[2] for Stage 1. The key modelling assumptions are described in Table 2. The noise contours for each modelling scenario are provided in Appendix D

Table 2: Noise model input parameters

Parameters/calculation settings/ assumptions	Details
Software	DGMR iNoise v2025
Calculation method	ISO 9613.1/2:2024

[2] Norman Disney & Young (NDY) completed an operational noise assessment for Stage 1 of the Auckland Surf Park and Marshall Day Acoustics (MDA) completed a Stage 1 operational noise assessment for the Data Centre in June 2023

Parameters/calculation settings/ assumptions	Details
Meteorological parameters	Single value, C0 = 0
Ground attenuation	General method, ground factor: 0.8 for rural areas 0.0 for Surf Lagoon and ponds 1.0 for sand areas around the Surf Lagoon
Air temperature	293.15 K
Atmospheric pressure	101.33k Pa
Air humidity	60%
Source heights (relative)	• Surf Lagoon area sources 0.25 m above ground • Data Centre external plant area sources 1 m above the ground. • Solar Farm Skids 1 m above the ground • ECE external area sources 1 m above the ground.
Receiver heights (relative)	1.5 m above ground
Surf Lagoon *Adjustments to derive a noise rating level in accordance with NZS6802:2008*	**Special audible character**[3] None **Duration adjustment** **None**
Data Centre *Adjustments to derive a noise rating level in accordance with NZS6802:2008*	**Special audible character** None (see notes in Section 0) **Duration adjustment** **None**
Solar Farm *Adjustments to derive a noise rating level in accordance with NZS6802:2008*	**Special audible character** + 5 dB **Duration adjustment** None

[3] Section 6.3 of NZS 6802:2008 states that where the sound being assessed has a distinctive character which may affect its subjective acceptability (for example, it is noticeably impulsive or tonal), the representative sound level shall be adjusted to take this into account.

Parameters/calculation settings/ assumptions	Details
ECE *Adjustments to derive a noise rating level in accordance with NZS6802:2008*	**Special audible character** None **Duration adjustment** -1 dB duration adjustment

5.1 Surf Lagoon noise modelling

The Stage 2 noise model is based on the same inputs and assumptions used for Stage 1 of the Surf Lagoon[4]. We have calibrated the model using the measurement data presented in Table 3 of the Hydrock Report[5]. The noise modelling for Stage 1 and 2 assesses the noise emissions from the Lagoon under its loudest operating condition, known as B6 ("Beast Mode").

The noise model the Stage 2 design was based solely on the Substance Masterplan[6] with no additional mitigation from noise barriers.

5.2 Surf Lagoon noise level predictions

Table 3 details the predicted noise levels at all existing receivers outside the Site and future receivers within the Site.

Where the noise level of 55 dB L_{Aeq} for Monday to Saturday, 7 am – 10 pm, and Sundays, 9 am - 6 pm, is predicted to be exceeded, the predicted noise level is highlighted in red.

Where the noise level of 45 dB L_{Aeq} applying "At all other times" is predicted to be exceeded, the predicted noise level is highlighted in yellow.

Table 3: Predicted Surf Lagoon noise levels

Receiver	Highest Predicted Noise Rating Level (L_{Aeq})
1306 Dairy Flat Highway	46 dB
1314 Dairy Flat Highway	38 dB
1315 Dairy Flat Highway	47 dB

[4] The NDY 2023 assessment created a noise model using Hydrock's noise measurements and the modelling methodology developed for The Wave, Bristol, UK. Marshall Day Acoustics (**MDA**) completed a peer review of the NDY 2023 assessment in October 2023.

[5] Hydrock – The Wave Bristol Detailed Measurement Assessment, September 2022.

[6] Auckland Surf Park - Substantive Fast Track Application Design Report - 10 December 2025

Receiver	Highest Predicted Noise Rating Level (L_{Aeq})
1318 Dairy Flat Highway	35 dB
1320 Dairy Flat Highway	36 dB
1321 Dairy Flat Highway	48 dB
1326 Dairy Flat Highway	48 dB
1327 Dairy Flat Highway	48 dB
1338 Dairy Flat Highway	49 dB
1349 Dairy Flat Highway	46 dB
1355 Dairy Flat Highway	47 dB
1361 Dairy Flat Highway	49 dB
1368 Dairy Flat Highway	59 dB
1373 Dairy Flat Highway	52 dB
1412 Dairy Flat Highway	46 dB
1414 Dairy Flat Highway	47 dB
1416 Dairy Flat Highway	47 dB
203 Postman Road, Dairy	38 dB
207 Postman Road	37 dB
231 Postman Road	37 dB
273 Postman Road	35 dB
275 Postman Road	37 dB
293 Postman Road	38 dB
295 Postman Road	44 dB
313 Postman Road	46 dB
315 Postman Road	43 dB

Receiver	Highest Predicted Noise Rating Level (L_{Aeq})
Live Work Precinct East	38 dB
Live Work Precinct West	35 dB
North Neighbourhood (West)	54 dB
North Neighbourhood (East)	37 dB
South Neighbourhood (East)	34 dB
South Neighbourhood (West)	47 dB

5.2.1 Compliance at receivers outside the Site

Table 3 shows that without any specific noise mitigation the Surf Lagoon is predicted to generate noise that exceeds the noise limits of Table E25.6.3.1 of the AUP. The noise limit of 55 dB L_{Aeq} for Monday to Saturday, 7 am–10 pm, and Sundays, 9 am–6 pm, is predicted to be exceeded at one property, 1368 Dairy Flat Highway. Fourteen further receivers are predicted to exceed the 45 dB L_{Aeq} noise limit applicable "At all other times".

The proposed ADR process will demonstrate how the final design and operational strategy of the Surf Lagoon will ensure that these exceedances do not occur at any receiver outside the site boundary. This is proposed to be achieved by one or more of the following methods:

i. Work with the designer and supplier of the lagoon to incorporate noise reduction measures into the design of the Lagoon.

ii. Incorporate noise barriers or bunds or other noise mitigating features to reduce noise emissions;

iii. Implement management measures to control the noise emissions from the Surf Lagoon such as limiting the wave height or frequency or other operational methods. Lower wave heights are likely to be quieter and may potentially comply with the 45 dB L_{Aeq} noise limit.

The final method for achieving compliance, including confirmation of any proposed noise barriers and management measures will be assessed through the ADR process (see Section 6.0 of this assessment).

5.2.2 Compliance at receivers within the Site

We understand that the Surf Lagoon could potentially operate between the hours of 6:00am and 10:00pm, 7 days per week.

Table 3 shows that the Surf Lagoon will generate noise levels of up to 47 dB L_{Aeq} at the South-West Neighbourhood Precinct and 54 dB L_{Aeq} at the North-West Neighbourhood Precinct.

These noise levels will comply with the daytime noise levels prescribed by Standard E25.6.3(1) but will exceed the noise limit of 45 dB L_{Aeq} that applies "At all other times".

5.2.2.1 Recommendations to manage Surf Lagoon noise at the North-West and South-West Neighbourhood Precincts

We recommend that the bedrooms of dwellings inside the Neighbourhood Precincts that are exposed to noise levels greater than 45 dB L_{Aeq} "At all other times" are provided with a mechanical cooling and ventilation system. This system will allow windows and doors to remain closed overnight which will reduce the noise levels inside bedrooms to reasonable levels. We recommend that conditions of consent are attached to the consent that require:

- The ADR to identify the noise sensitive spaces that are predicted to receive Surf Lagoon noise levels greater than 45 dB L_{Aeq} before 7am on weekdays or 9am on Sundays.
- Require bedrooms to be provided with a suitable mechanical ventilation / cooling system that will enable occupants to remain thermally comfortable ventilated when windows are closed to reduce external noise intrusion. An example of a suitable system is contained in the specifications set out in E25.6.10(3)(b) and (d) to (f) of the AUP.

5.2.2.2 Assessment of effects on future Neighbourhood Precinct receivers

The noise levels from the Surf Lagoon will comply with the permitted daytime noise standards prescribed by the Standard E25.6.3(1) but may exceed the noise limit of 45 dB L_{Aeq} that applies before 7am (Monday to Saturday), before 9:00am on Sundays and after 6:00pm on Sunday evenings. The exceedance is confined to future dwellings within the North-West and South-West Neighbourhood Precinct.

We consider that the noise effects on future occupants of the North-West and South-West Neighbourhood Precinct will be reasonable based on the nature of the noise and recommended mitigation. The provision of a mechanical ventilation / cooling system to affected dwellings will ensure occupants are provided with an adequate level of protection during sleeping hours, and the overall timing and level of noise. The noise levels will be controlled by breaking waves. In our experience the levels will be significantly lower than what is often encountered at houses along open coastlines which is not considered an annoying noise.

5.3 Data Centre noise modelling

The proposal includes an additional data centre (Data Centre 2), approximately half the size of the data centre consented during Stage 1 (Data Centre 1). The two separate data centres will be situated on separate land parcels; therefore, the noise generated by each unit is

required to be assessed separately. While Data Centre 1 has consent, a noise model for both data centres has been included for completeness.

Data Centre 1:

- One two-storey building approved under stage.
- Defined northern and southern outdoor plant areas.
- Noise sources: 32 generators, 32 transformers, 32 switch rooms, and 32 chillers.

Data Centre 2 layout:

- One two-storey building approved under stage.
- Defined northern and southern outdoor plant areas.
- Assumed noise sources: 16 generators, 16 transformers, 16 switch rooms, and 16 chillers.

Figure 4 shows the Data Centre layout and the proposed external plant locations

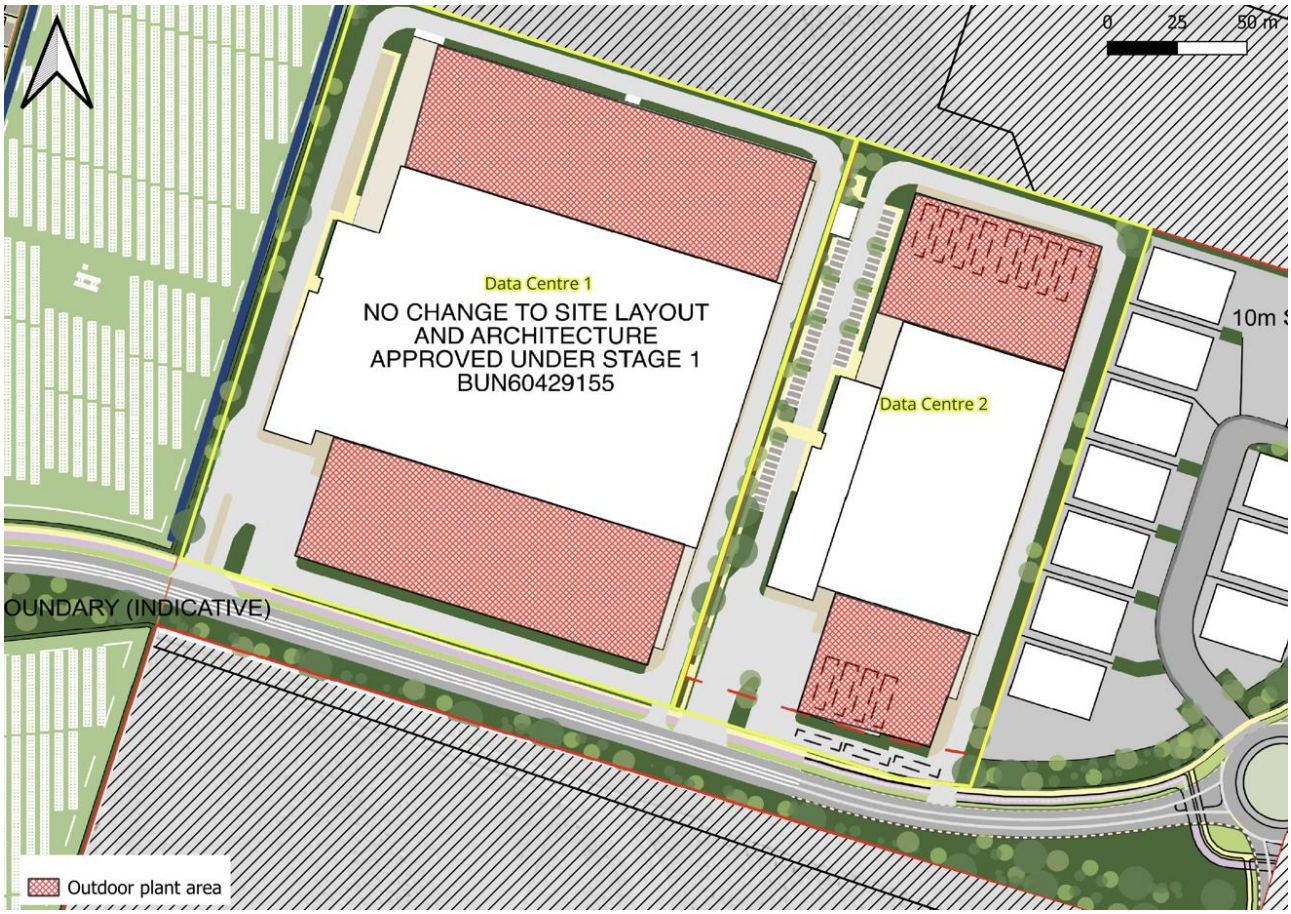

Figure 4 Data centre layout

5.3.1 Data Centre noise modelling

The noise model uses equipment data and mitigation assumptions provided by Aurecon for Stage 1:

Modelled sources (per building):

- **Emergency generator:** 55 dB L_{Aeq} at 7 m.
- **Switch rooms:**
  - 2 × 750 kW UPS per room – 70 dB L_{Aeq} at 1 m each.
  - 1 × 150 kW UPS per room – 65 dB L_{Aeq} at 1 m.
- **Transformer 2850 kVA:** 72 dB L_{Aeq} at 1 m (may have tonal element).
- **Chiller 1300 kW:** 95 dB L_{WA} unmitigated.

Internal noise from the Data Centre has not been included in the model, as it is unlikely to affect the overall L_{Aeq}. Aurecon's data indicates that the internal reverberant noise level within the Data Hall can reach "70 dB(A)". Assuming a conservative façade sound reduction of 30 dB, the corresponding external noise level immediately outside the buildings is estimated at no more than 40 dB(A). Noise breakout from the Data Centre will therefore be significantly lower than other data-related noise sources and will not meaningfully contribute to the overall noise emissions.

Noise from the transformers may contain a tonal component. However, the predicted transformer noise level is 24 dB lower than that of the proposed chillers. The chiller noise will therefore mask any tonal components. As a result, no special audible characteristics correction is required. This assumption should be confirmed as part of the ADR process.

The noise model for Data Centre 1 has area sources with a sound power level of 107 dB (based on L_{Aeq}) to represent the northern and southern plant areas.

The northern external plant area for Data Centre 2 is larger and has been assumed to house 10 of each type of plant. Therefore, an area source with a sound power level of 105 dB (based on L_{Aeq}) was created to represent the northern plant area. The southern plant area of Data Centre 2 has been assumed to have 6 of each type of plant. Therefore, an area source with a sound power level of 103 dB (based on L_{Aeq}) was created to represent the southern plant area.

5.3.2 Data Centre noise level predictions

Table 4 sets out the predicted noise levels at the notional boundaries of receivers adjacent to the Site as well as future receivers within the Site.

Table 4: Data Centre noise model results

Receiver	Data Centre 1 Noise rating level L_{Aeq}	Data Centre 2 Noise rating level L_{Aeq}
203 Postman Road	40 dB	36 dB
207 Postman Road	39 dB	34 dB
231 Postman Road	42 dB	43 dB
273 Postman Road	38 dB	43 dB
275 Postman Road	38 dB	41 dB
293 Postman Road	34 dB	34 dB
Neighbourhood Precincts (North)	36 dB	31 dB
Neighbourhood Precincts (South)	39 dB	31 dB
Live Work Precinct	37 dB	30 dB

5.3.3 Compliance at receivers outside the Site

The noise modelling demonstrates that the noise levels from the Data Centres can comply with the permitted noise standards prescribed by Standard E25.6.3(1) at the notional boundaries adjacent to the Site.

We understand that the Stage 1 consent includes conditions of consent relating to generator maintenance and testing, including:

- Regular testing of the generators must only occur between 7am – 10pm Monday to Saturday and 9am to 6pm Sunday.
- If the generators are required to operate, the noise level at the boundary must not exceed 55 dB $L_{Aeq(15min)}$ at all times.

We recommend that these conditions remain. We recommend that an ADR is used to ensure that the operational noise from the Data Centres is considered as part of the design process. The ADR condition will be used to demonstrate any physical or management measures are required to ensure that the noise standards for permitted activities are complied with on an ongoing basis.

5.3.4 Potential future receivers outside the Site

Additional noise mitigation may be required in the event that new notional boundaries are established on adjacent land that may be exposed to noise levels greater than 45 dB L_{Aeq}.

We recommend that the ADR is used to identify the noise mitigation measures that must be implemented if new notional boundaries are established adjacent to the Data Centres. Our analysis finds that acoustic enclosures can be installed around external plant to achieve compliance at new notional boundaries. Any required acoustic enclosures can be specified and installed at such time they may be required. The ADR will ensure that the applicant has a clear understanding of the noise mitigation measures that may be required in the event the receiving environment changes.

5.3.5 Compliance at receivers within the Site

The noise modelling demonstrates that the noise levels from the Data Centre can comply with the permitted noise standards prescribed by Standard E25.6.3(1) at all future ASN inside the Site.

5.4 Solar Farm noise modelling

The solar farms will include mechanical plant such as inverters and transformers as well as BESS used for the storage of electricity. Plant noise will be generated from the cooling fans and the “hum” generated by the transformer coils.

Light Years Solar have advised Styles Group that solar plant will be installed on central “Skids.” The exact skid locations have not been finalised. Our assessment assumes that solar plant will be positioned to maximise separation distance to the nearest noise-sensitive receivers. We understand that Skids will also be placed as close as practical to the Data Centre to minimise cable runs.

Figure 5 shows the Skid locations used in the noise modelling.

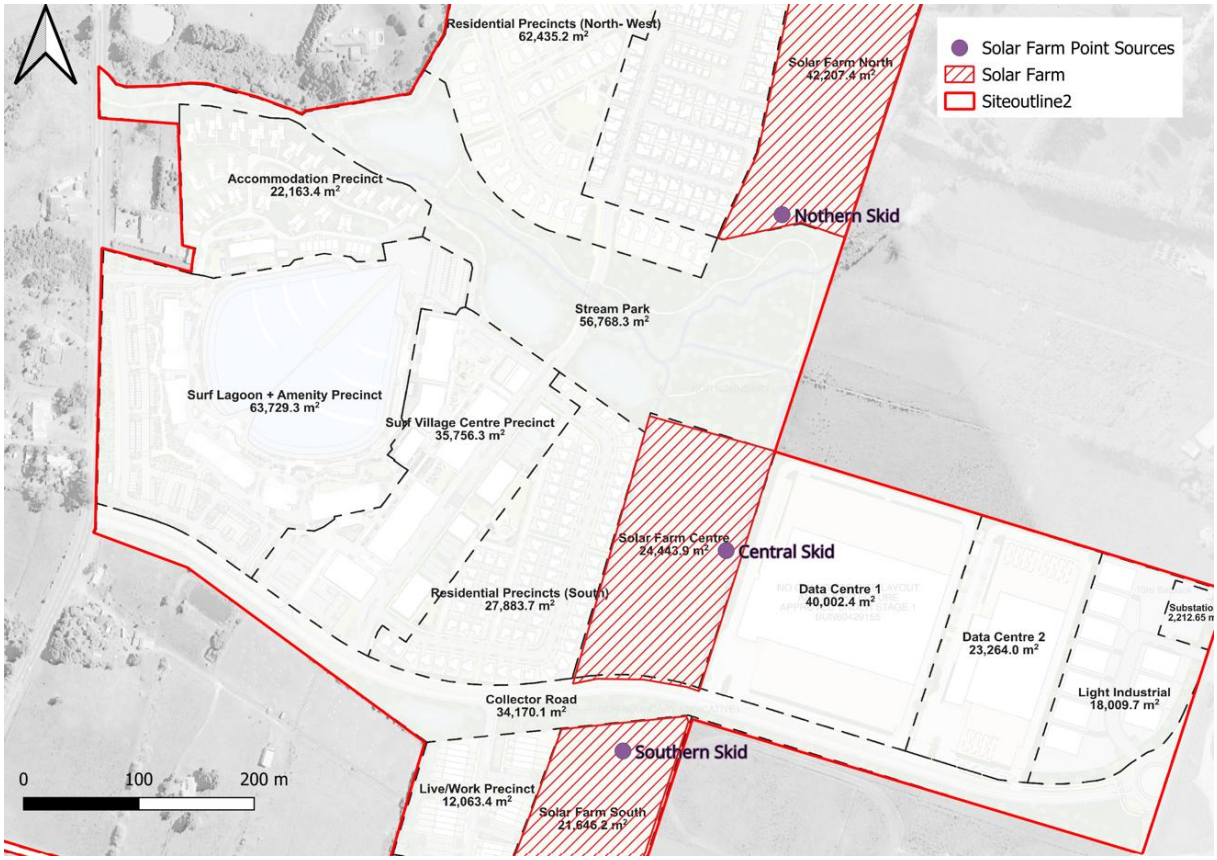

Figure 5 Skid locations

5.4.1 Solar Park noise modelling assumptions

The exact plant that will be installed has not yet been selected. Our noise modelling assumes the installation of plant used on similar Light Years solar projects. The noise model assumes that every skid will include the following plant:

Sungrow SG320HX-20 Inverter

- Noise level day 87 dB L_{WA}
- Noise level Night 81 dB L_{WA}

33kV MV Stations

- Noise level day 81 dB L_{WA}
- Noise level Night 81 dB L_{WA}

Caterpillar ETS1500+ECE2500 4 MWh BESS

- Noise level day 88 dB L_{WA}
- Noise level Night 71 dB L_{WA}

This provides every skid with a total sound power level (L_{WA}) of:

- Day: 91 dB L_{WA} (96 dB with +5dB for special audible character).
- Night: 82 dB L_{WA}

We understand that the inverter and BESS may exhibit tonal characteristics during the day. A +5 dB adjustment for special audible character has been added to the daytime sound power levels for the model.

5.4.2 Solar farm noise level predictions

Table 5 presents the predicted noise levels at the notional boundaries of existing (external) and future (internal) receivers. These predictions include a 5dB adjustment for special audible character for the predicted daytime noise levels.

Table 5: Solar Farm noise level predictions

Receiver	Predicted Daytime Rating Level $L_{Aeq(15min)}$	Predicted Nighttime Rating Level $L_{Aeq(15min)}$
1326 Dairy Flat Highway	20 dB	11 dB
1338 Dairy Flat Highway	19 dB	10 dB
1368 Dairy Flat Highway	18 dB	9 dB
273 Postman Road	21 dB	12 dB
275 Postman Road	21 dB	12 dB
295 Postman Road	29 dB	20 dB
Neighbourhood Precincts (North-West)	23 dB	14 dB
Neighbourhood Precincts (North-East)	43 dB	34 dB
Neighbourhood Precincts (South-East)	33 dB	24 dB
Neighbourhood Precincts (South-West)	27 dB	18 dB
Live Work Precinct (West)	22 dB	13 dB
Live Work Precinct (East)	35 dB	26 dB

5.4.3 Compliance at receivers outside the Site

The noise modelling demonstrates that the noise levels from the Solar Farms can comply with the permitted noise standards prescribed by Standard E25.6.3(1) at the notional boundaries adjacent to the Site.

We recommend that an ADR is used to ensure that the final solar farm design and specification of plant will be compliant with Standard E25.6.3(1). The ADR will ensure that solar plant is selected and located with appropriate consideration to noise emissions.

5.4.4 Compliance at receivers within the Site

The noise modelling demonstrates that the noise levels from the Solar Farms can comply with the permitted noise standards prescribed by Standard E25.6.3(1) at all future receivers inside the Site.

We recommend that the ADR is used to ensure that all noise generating plant is procured and located in a way that achieves compliance with E25.6.3(1) at all future notional boundaries inside the Site.

5.5 Early childhood education centre

An early childhood education centre (**ECE**) is proposed is proposed within the Surf Village Centre Precinct. The design and operational procedures of the ECE have not been finalised.

We have assessed the outline design of the ECE in comparison to requirements of the AUP. The finalised design and operational procedures of the ECE will need to be reviewed during the ADR process (see Section 6).

5.5.1 ECE Operations

The ECE is proposed to operate between 07:00 am and 06:00 pm. There are no specific numbers of children proposed at this stage. Schedule 4 of Education (Early Childhood Services) Regulations 2008 stipulates that minimum floor space required child is:

- Indoor—2.5 m^2 per child
- Outdoor—5 m^2 per child

The ECE indoor and outdoor space are both 300 m^2. Therefore, the maximum number of children would be limited to 60 children based on the size of outdoor area.

5.5.2 Site Location

The ECE is located to the east of the Surf Lagoon at the northern edge of the Surf Village Centre Precinct. The site is proposed to be split into indoor and outdoor spaces, with the outdoor space facing west towards the surf lagoon.

The closest residential receivers are located approximately 20 m to the east within the South Residential Precinct. The closest apartment block associated with the Surf Village Centre Precinct is Apartment Block APT_B, located approximately 10 m south of the ECE.

The location of the ECE and the surrounding receivers are shown in Figure 6.

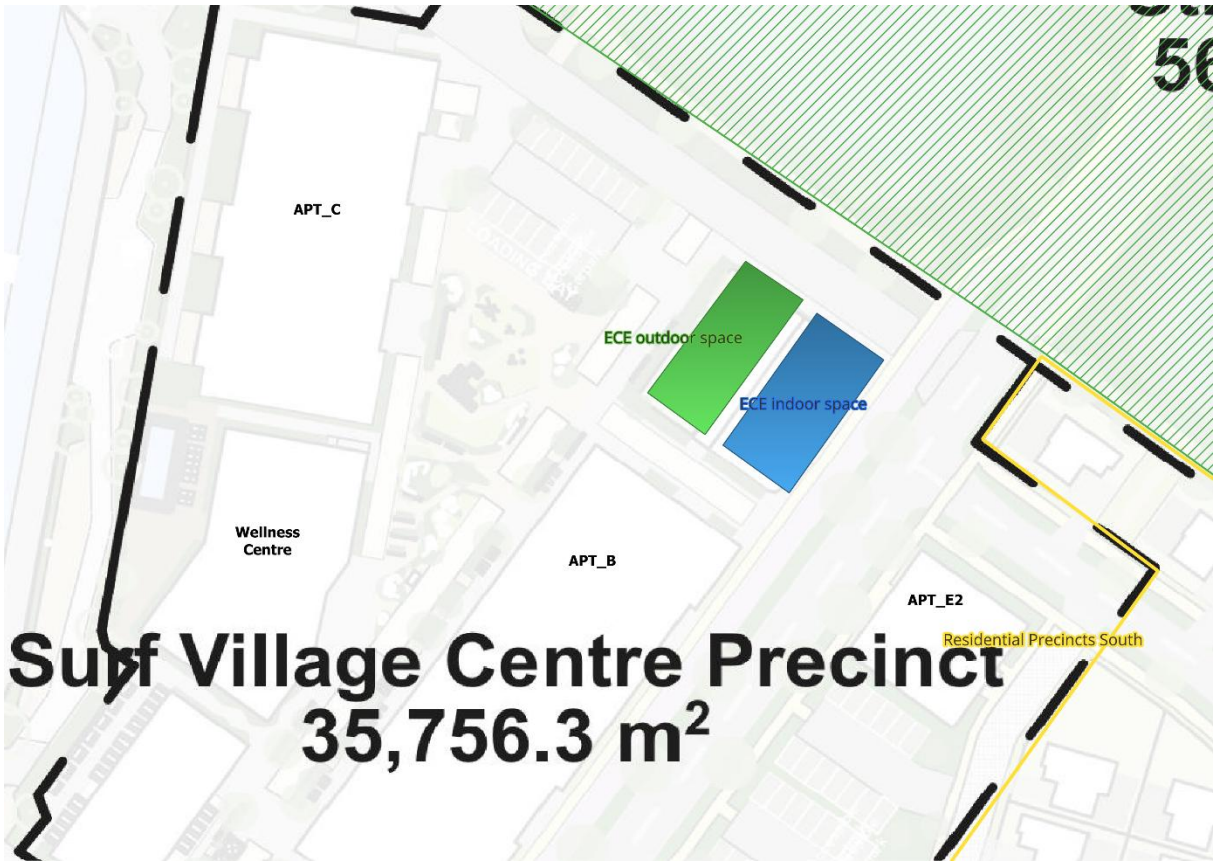

Figure 6 ECE location

5.5.3 Permitted noise limits – operational noise

E25.6.23 of the AUP prescribes a permitted noise limit of 55 dB L_{Aeq} from 07:00 to 18:00, Monday to Friday for noise from childcare centres when measured within the boundary of any site in a residential zone – unless the relevant zone in which the childcare centre is located provides for higher levels. The Site is currently Zoned as FUZ. Therefore, the noise limits would be as outlined in Table E25.6.3.1 of the AUP. The noise levels would be assessed at the notional boundary on any other site in the Mixed Rural or Future Urban zone.

5.5.4 Predicted noise levels

5.5.4.1 Outdoor noise

The predicted noise levels from the children during periods of free play outdoors are based on noise measurements undertaken by Styles Group at numerous existing childcare centres nationwide and with reference to published data by the Association of Australasian Acoustical Consultants[7]. The proposed operation of the centre is typical of childcare centres in New Zealand, and we consider the reference data to be appropriate for this application.

Our noise predictions assume that two-thirds (or 40) of the children will be outdoors and playing noisily at any one time. Three quarters (or 30) of these children would be aged 2 to 5 years. One quarter (or 10) would be under 2.

We have calculated area-source sound power levels (dB L_{WA}) for the children in the outdoor play areas using the following reference sound pressure levels (dB L_{Aeq}) and a typical noise spectrum for children at play:

i. 59 dB L_{Aeq} at 10 m for 30 children in the over 2's age group at free play outdoors.

ii. 49 dB L_{Aeq} at 10 m for 10 children in the under 2's age group at free play outdoors.

5.5.4.2 Indoor play

Indoor activities at childcare centres are typically quieter than free play outdoors. This is because the activities indoors are more structured and an acceptable internal acoustic environment must be maintained for other children within the centre. Any music, audiobooks or other sound sources indoors will not be played at a level where they will interfere with learning, communication, children following instructions in the classroom or sleeping.

Noise emissions from indoor activities to the surrounding environment will be mitigated by the building envelope and will not contribute to the noise rating level assessed over the day. The classrooms for the older children are along the east of the building. We recommend that any windows opening directly to the neighbouring sites are kept closed during indoor activities to reduce the noise effects on the neighbouring sites.

[7] Association of Australasian Acoustical Consultants, *Guideline for Child Care Centre Acoustic Assessment*, October 2013.

5.5.4.3 Vehicle movements

We have calculated an area-source sound power level of 81 dB L_{WA} for vehicle movements on site during the peak periods for the childcare centre. The sound power level is based on L_{Aeq} measurements. Our noise modelling of the vehicle activity on site represents a worst-case scenario and is based on the following assumptions:

- the ECE is operating at capacity with the maximum number of children in attendance
- Our sound power level calculations are based on the Bavarian State Office for the Environment (BAyLfU) parking noise methodology for a sealed parking area. We have adjusted the methodology and increased the sound power level per vehicle to correspond with our measurements of vehicle movements at childcare centres in New Zealand. We have verified our noise prediction model with compliance measurements at existing childcare centres
- We have used a typical noise spectrum for vehicles travelling at low speed, car doors opening and closing and engines starting. This is based on our measurements and published data
- There are four hours of peak vehicle activity per day
- There are 1.6 trips per child per peak period for the childcare centre. This is based on the Roads and Traffic Authority of New South Wales guidelines *Guide to Traffic Generating Developments*.

5.5.4.4 Mechanical services

Specific details and specifications for mechanical plant for the childcare centre have not been confirmed at this early stage of the development. Large systems are not likely to be required to service the facility and any mechanical plant, such as a heat pump or an extraction fan for the kitchen, will only be used from 7 am to 6 pm when the site is in operation.

When considering the scale of the development and the layout of the site, it is our opinion that the external components of any mechanical plant on site can be positioned and screened (if necessary) so that any noise generated by their operation will readily comply with the permitted noise limits, including the cumulative noise emissions from the site. Mechanical ventilation on site will not contribute to the noise rating level over the day.

5.5.5 Noise mitigation

The following noise mitigation measures are proposed to reduce noise emissions from the site and have been included in our calculations:

i. An acoustically effective 2 m high fence will be required to be constructed around the boundary of the outdoor play area.

5.5.6 ECE modelling and predictions

As the design of the ECE is only at preliminary stages and no details on if there will be an external carpark. The predicted L_{WA} of the traffic movement has been combined with that of the rest of the ECE.

Table 6 presents the predicted noise levels at the notional boundaries of existing (external) and future (internal) receivers. These predictions include a -1 dB duration adjustment as the ECE will only be in use for 11 hours of 15-hour assessment period.

Table 6: ECE noise level predictions

Receiver	Predicted Daytime Noise Rating Level (L_{Aeq})
APT_B[1]	50 dB
APT_C[1]	39 dB
Residential Precincts South (boundary)	22 dB

[1] Noise levels measured at 1.5m above the 1st floor (4.5 m above ground) of the facade of the apartment blocks.

5.5.7 Compliance with residential precincts

The noise modelling demonstrates that the noise levels from the ECE can comply with the permitted noise standards prescribed by Standard E25.6.3(1) at the boundary with the residential precincts.

We recommend that an ADR is used to ensure that the final ECE design and specification of plant will be compliant with Standard E25.6.3(1).

5.5.8 Compliance at receivers within the Site

The noise modelling demonstrates that the noise levels from the ECE can comply with the permitted noise levels of Standard E25.6.3(1) at the facades of the apartment buildings within the Surf Village Centre Precinct.

As the zoning for the location of these apartment blocks is currently FUZ the assessment location would be the notional boundary. There are currently no notional boundaries within Surf Lagoon, Accommodation and Amenity Precinct as it is classed as one site. However, we understand that the Proposal includes subdivisions so new notional boundaries will be created by the Proposal.

We recommend that the ADR condition is used to ensure that the noise from the ECE is compliant Standard E25.6.3(1) once site boundaries have been established in the Surf Lagoon, Accommodation and Amenity Precinct.

6.0 Acoustic Design Report Process

As set out in the earlier sections of this report, we have made some assumptions regarding the location and specifications for some noise sources as the detailed design of several aspects of the ASPC have not been finalised. Our experience is that the detailed design phase does not generally commence until consent is granted and establishment and earthworks are underway (or close to it). Accordingly, our noise level predictions are generalised and demonstrate that the proposal can comply with the recommended noise limits.

The detailed design process, including plant and equipment selection, building and landscaping design, dwelling design and specifications will provide the detail necessary for a more detailed computer noise model. The more detailed model can be used to determine what (if any) noise mitigation measures are required to achieve compliance with the conditions. The mitigation measures can also be refined so they are efficient and effective through this process.

We have recommended that a condition of consent be attached that requires this process to be followed so that compliance with the relevant noise limit conditions for all receivers is clear and certain.

However, the reasonably complex environment inside the Site and the need for some dwellings to be acoustically treated for Surf Lagoon and potentially aircraft noise (see Section 7.0) means that a two-stage ADR process is recommended.

6.1 Stage 1 ADR

The first stage of the ADR process is to manage and inform the design of the noise generating features of the proposal, so they all comply with the relevant noise limits as set out in our recommendations section. The noise sources are limited to the Surf Lagoon and all mechanical plant associated with the Surf Park, the Solar Farm, the ECE and the Data Centre.

It is understood that not all elements of the ASPC will be designed or constructed at the same time. Accordingly, separate ADRs may be required to demonstrate that each element of the ASPC meets the relevant noise limits.

6.2 Stage 2 ADR

The second stage of the ADR process is to determine the ASN and ASAN inside the Site that will need acoustic treatment. Acoustic treatment will be required where:

1) The Stage 1 ADR demonstrates that noise levels from the mechanical plant associated with the Surf Park, the Solar Farm and the Data Centre exceed 45dB L_{Aeq} during the nighttime period (generally between 10pm and 7am, but as defined in the proposed conditions) at any ASN inside the Site, or

2) Where aircraft noise levels are predicted to exceed 55dB L_{dn} at any ASAN inside the Site. The assessment of aircraft noise shall be taken from the air noise contours for North Shore Aerodrome that are operative at the time the ASAN will be occupied.

This ADR will set out which ASN or ASAN require acoustic treatment and the specifications for acoustic treatment for the relevant ASN or ASAN.

7.0 Assessment of aircraft noise effects

The proposal includes a mix of residential, village-centre, a live-work precinct and temporary accommodation. Some of these activities are located close to the Northshore Aerodrome and are within the currently operative air-noise contours.

Dwellings are defined as Activities Sensitive to Aircraft Noise[8] (**ASAN**) according to Chapter J of the AUP. The short stay visitor accommodation buildings within the Surf Lagoon, Village and Amenity Precinct are not defined as ASAN according to the AUP and are not considered in this assessment.

Chapter D24 of the AUP provides land use controls to manage the subdivision and development of land and establishment of ASAN on land affected by aircraft noise[9]. The controls seek to give effect to the objectives in D24.2(1) and (2) of the AUP which require:

(1) Airports and airfields are protected from reverse sensitivity effects.

(2) The adverse effects of aircraft noise on residential and other activities sensitive to aircraft noise are avoided, remedied or mitigated.

Policy D24.3(3) and D24.3(5) require:

(3) Avoid establishing residential and other activities sensitive to aircraft noise at:

(a) airports/airfields except for Auckland International Airport: within the area between the 55dB L_{dn} and 65dB L_{dn} noise contours, unless the effects can be adequately remedied or mitigated through restrictions on the numbers of people to be accommodated through zoning and density mechanisms and the acoustic treatment (including mechanical ventilation) of buildings containing activities sensitive to aircraft noise excluding land designated for defence purposes;

(5) Manage residential intensification and activities sensitive to aircraft noise within areas identified for accommodating urban growth in a way that avoids reverse sensitivity effects as far as practicable, including reverse sensitivity effects between those land uses and such effects on Auckland International Airport, Ardmore Airport, Whenuapai Airbase and North Shore Airport, and that avoids, remedies or mitigates adverse aircraft noise effects on people and communities.

[8] ASAN are defined by Chapter J1 of the AUP to mean "Any dwellings, boarding houses, marae, papakāinga, integrated residential development, retirement villages, supported residential care, care centres, education facilities, tertiary education facilities, hospitals, and healthcare facilities with an overnight stay facility".

[9] Greater than 55 dB L_{dn}

7.1 The Aircraft Noise Boundaries across the Site

Figure 7 shows that a small part of the Data Centre area of the Site sits within the 65dB L_{dn} noise boundary. A larger part of the Site sits within the 55dB L_{dn} noise boundary.

A large proportion of the Site and the majority of ASAN are outside the noise control boundaries. There are no aircraft noise-related controls applying to subdivision and development outside the 55 dB L_{dn} noise contour.

The noise contours define the locations at which the maximum sound exposure (expressed in dB L_{dn}) from the Aerodrome must not be exceeded. The Aerodrome must also comply with the limit specified at the 65 dB L_{dn} contour and the 55 dB L_{dn} contour.

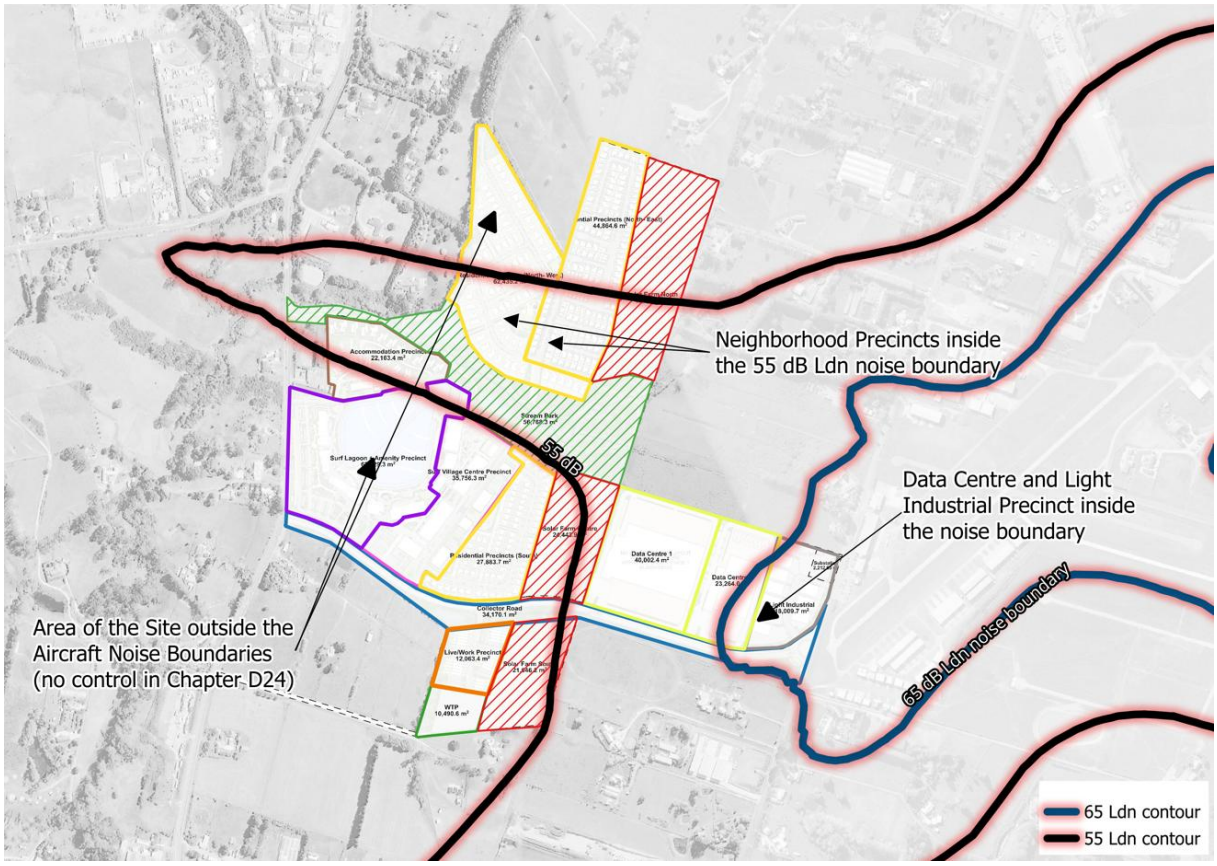

Figure 7 Aircraft Noise Contours overlayed on to the Site

7.2 The North Shore Aerodrome Master Plan

The North Shore Aerodrome has recently published its draft Master Plan. The Master Plan proposes changes to a range of activities and land uses in and around the North Shore Aerodrome. A key aspect of the Master Plan is to disestablish runway 09/27. Runway 09/27 is the secondary cross-wind runway with a gravel surface and it's current primary use is to facilitate the arrival and departures of helicopters without interfering with operations on the main (03/21) runway. The Master Plan describes this use as "*a luxury that has little necessity*."

The Master Plan states that disestablishing runway 09/27 will deliver five key benefits. The two benefits that are relevant to the ASP proposal are:

- "*Strategic land is released for repurposing*
- *The airport noise overlays in the AUP can be amended to reshape the 55dB and 65dB boundaries reducing their impact on neighbouring properties."*

The significance of this to the ASP proposal is that the 55dB L_{dn} noise boundary is likely to shrink a significant amount back towards the North Shore Aerodrome. Figure 8 shows the range within which we estimate the revised 55dB L_{dn} contour will likely sit once the aircraft noise level predictions are recalculated without runway 09/27. The markup shows that there will be no ASAN inside the 65dB L_{dn} or 55dB Ldn noise boundaries when runway 09/27 is disestablished.

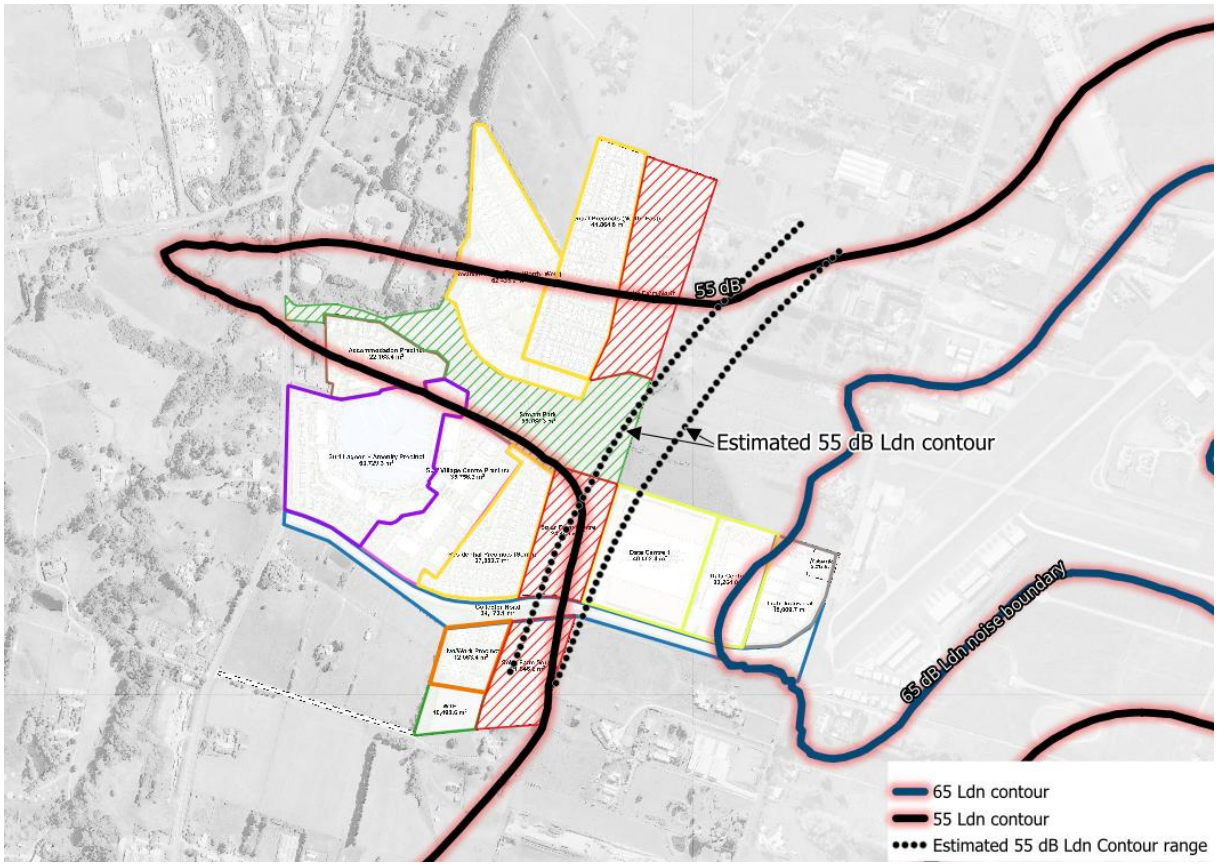

Figure 8 Site plan showing existing L_{dn} noise contours and the approximate worst-case estimated locations of the 55dB L_{dn} contour following the disestablishment of runway 09/27

We understand that the North Shore Aerodrome has not yet lodged a request or proposal to disestablish runway 09/27 and amend the noise boundaries.

We therefore recommend that the conditions of consent require compliance with the requirements of Chapter D24 until such time that the AUP aircraft noise control overlays are revised and when they do not cover or include any ASAN within the Site.

7.3 Compatibility with Chapter D24

As above, there is a possibility that development of ASAN inside the 55dB L_{dn} contour could occur before the noise control boundaries are recalculated according to the Northshore Aerodrome Master Plan. We recommend that if this occurs, the development of ASAN should be undertaken in accordance with the provisions of D24.

7.3.1 Land use activities inside the 65dB L_{dn} noise boundary

Table D24.4.1 of the AUP states that new ASAN inside the 65dB L_{dn} noise boundary are prohibited, and that any alteration or addition to any existing ASAN is a non-complying activity.

The proposal does not seek to authorise any ASAN inside the 65dB L_{dn} noise boundary. The only area of the Site within the 65dB L_{dn} contour is proposed to be developed for a Data Centre. This activity is not defined as ASAN. We consider that the Data Centre will be compatible with aircraft noise.

7.3.2 Land use activities between the 55 dB L_{dn} contour and the 65 dB L_{dn} contour.

The Neighbourhood Precincts are the only ASAN proposed on land between the 65 dB L_{dn} contour and the 55 dB L_{dn} contour. We expect that the external aircraft noise levels will be between approximately 60dB L_{dn} and 55dB L_{dn}.

Table D24.4.1 of the AUP states that new ASAN are a restricted-discretionary activity where they are designed and constructed to comply with Standard D24.6.1(1). This Standard states:

> (a) to ensure the internal noise environment of habitable rooms does not exceed a maximum noise level of 40dB Ldn;
>
> (b) that are certified by a person suitably qualified and experienced in acoustics to the Council's satisfaction prior to its construction; and
>
> (c) so that the related ventilation and/or air conditioning system(s) satisfies the requirements of New Zealand Building Code Rule G4 with all external doors of the building and all windows of the habitable rooms closed.

The proposal is to comply with the requirements of Chapter D24 by ensuring that all ASAN inside the 55dB L_{dn} contour are provided with acoustic treatment that meets or exceeds the requirements set out in D24. We recommended that the conditions of consent require future dwellings to be designed and constructed in accordance with Standard D24.6.1(1).

We recommend conditions that will require dwellings to be provided with a mechanical ventilation and cooling system that meets or exceeds the specifications in Standard E25.6.10(3)(b) to (f) for the reasons set out below. Such a system will comply with and exceed the requirements of D24.6.1(1)(c).

We expect that the highest noise level in the Neighbourhood Precincts will be no greater than 60dB L_{dn}. Achieving the indoor noise level of D24.4.1(a) will require an inside to outside noise reduction (NR) of only 20dB. It will be necessary to close windows and doors to achieve this NR.

In our experience, modern homes will achieve an NR of at least 25dB and sometimes 30dB or more without any additional effort to attenuate aircraft noise and provided the windows and doors are kept closed. Accordingly, it is likely that the indoor noise level will be generally below 35dB L_{dn} and potentially lower – especially for downstairs rooms in multi-storey buildings.

Based on this, we expect that the indoor noise level in most or all new homes will be considerably lower than the requirements of D24.

In our experience is it simple to achieve these requirements for newly built homes. It is likely that the only specific aircraft noise mitigation measure will be the provision of mechanical cooling and ventilation to enable windows and doors to be kept closed.

7.3.2.1 Proposed ventilation and/or air-conditioning measures for ASAN

D24.6.1(1)(c) simply requires that new ASAN are provided with ventilation and/or air-conditioning measures that satisfy the requirements of New Zealand Building Code Rule G4 when windows are shut to reduce aircraft noise. This is a relatively simple requirement and does not include any provision for keeping the enclosed rooms cool.

Styles Group understand that the requirements of D24.6.1(1)(c) do not reflect best practice as the solutions required by the New Zealand Building Code are not effective for cooling and do not address the potential for overheating where windows and doors are closed to reduce noise intrusion from aircraft.

Our experience is that mechanical ventilation and cooling systems are a fundamental part of the overall acoustic treatment package and will ensure occupants are provided with a thermally comfortable internal environment, particularly in warm weather. If such a system is not provided, or is inadequate, occupants may be compelled to open windows and doors for ventilation and to remain cool in hot weather. This results in aircraft noise intrusion and invalidates the effort of applying acoustic treatment to the building envelope and the effort to be consistent with the objectives of D24.

We therefore recommend the conditions of consent require the adoption of the mechanical ventilation and cooling specifications in AUP standard E25.6.10(3)(b) to (f) instead of the requirements of D24.6.1(1)(c). The system specification in E25.6.10(3)(b) to (f) requires temperature control to ensure that the indoor environments remain cool whilst windows and doors are closed to reduce noise intrusion. The requirements of Clause G4 of the Building Code will still apply. Our experience is that the controls we recommend are typically complied with by the implementation of domestic air conditioning systems and an extraction fan that is capable of ensuring an adequate fresh air supply to reduce the concentration of contaminants (CO_2, moisture, cooking smells etc).

We recommend that the ADR is used to identify all dwellings that will require acoustic treatment in accordance with Chapter D24.

7.4 Assessment of aircraft noise effects on ASAN

The proposal is to enable dwellings between the 55 dB L_{dn} and 65 L_{dn} boundary of North Shore Aerodrome, where they are acoustically treated in accordance with Chapter D24.

We have prepared an assessment of noise effects in accordance with the following assessment criteria set out in D24.8.3 of the AUP.

> (1) The internal noise environment of the proposed and any existing structure should provide satisfactorily levels of health and amenity values to occupants.
>
> (2) The internal air quality of the proposed or any existing structure should provide satisfactory health, and amenity values to occupants.
>
> (3) The proposed measures for attenuation of aircraft noise arising in connection with the airport/airfield/airbase should satisfactorily avoid, remedy or mitigate those effects.
>
> (4) Mechanisms should be put in place to ensure there is an ongoing obligation on owners to ensure that required acoustic treatment measures are not removed without the Council's prior consent.
>
> (5) Having regard to all the circumstances, including location in relation to the airport/airfield/airbase, likely exposure of the site to aircraft noise, noise attenuation and ventilation measures proposed, and the number of people to be accommodated, the nature, size and scale of the proposed activity should not be likely to lead to potential conflict with and adverse effects upon the operation of the airport/airfield/airbase.

7.4.1 The proposed internal noise environment and health and amenity values

The proposed dwellings will be designed and constructed to comply with the acoustic criteria in D24. All habitable rooms will be designed and constructed to ensure aircraft noise levels indoors do not exceed 40 dB L_{dn}. In most or all cases the indoor noise levels will be considerably lower.

The relevant rooms will be serviced with a ventilation or air conditioning system to enable occupants to close windows and doors to reduce external noise. We have recommended that the superior mechanical cooling and ventilation requirements in Standard E25.6.10(3)(b) to (f) apply to the development as it will ensure occupants are provided with a thermally comfortable internal environment, particularly in warm weather. This system will provide a superior level of internal amenity than the system required by the provisions of Chapter D24.

It is our experience that the proposed mechanical cooling and ventilation provisions will manage indoor air quality in accordance with clause G4 of the Building Code and better than the provisions of D24.

7.4.2 Mechanisms to ensure acoustic treatment measures are not removed without the Council's prior consent

It is our experience that legal mechanisms such as consent notices or covenants can be used to directly inform purchasers about the nature and extent of acoustic treatment measures that have been applied, and ongoing responsibilities to maintain the treatment in an acoustically effective state. We support conditions of consent that deliver this outcome.

These mechanisms can also be used to set the expectations of incoming residents that the noise environment is, or has the potential to be, noisier than what could be expected in other parts of the city, and that aircraft noise could be a regular feature of the area. It is our experience that such covenants can have the effect of 'filtering out' the most noise-sensitive of the potential incoming residents. The overall merit of applying consent notices or covenants in this case is a planning and legal matter that is addressed by others.

7.4.3 Outdoor noise effects

The Standards in D24 will ensure that the indoor noise environment is reasonable. However, there will still be some effects that will arise on people when they are outdoors that cannot be avoided or mitigated.

The effects on people outdoors can be described as the 'residual' effects. The potential residual effects cannot be fully quantified using any annoyance data or curves that we are aware of. This is because the annoyance data available is generally based on large studies of people living in environments with a mixture of housing typologies where:

1. Only a portion of the population live in acoustically treated dwellings.
2. There are flights at night that can cause sleep disturbance and additional annoyance.

By contrast;

1. The residents of the ASP will all be in acoustically treated dwellings.
2. There are no night flights permitted.
3. All incoming residents will be made aware of the potential for higher aircraft noise levels. Either via the proposed covenant or other mechanism for requiring the ongoing maintenance and upkeep of the mechanical cooling and ventilation requirements.

We consider that these factors make the situation better than the general circumstances that the published literature is based on.

We consider that the 2018 World Health Organisation Environmental Noise Guidelines[10] and the recent Waka Kotahi survey in New Zealand[11] provide the most relevant guidance in this case. These two guidelines indicate that approximately 24% to 33% of the population would be highly annoyed by aircraft noise at external noise levels between 55dB and 60dB L_{dn}.

We consider that the annoyance figures will be appreciably lower when accounting for the specific features of the North Shore Aerodrome and the Proposal. As these are studies of people exposed to aircraft noise during the day and night, in a mix of treated and untreated houses and where there is no covenant or other mechanism to forewarn residents of a noise issue. However, the lack of relevant studies or data means that it is not possible determine how much lower the annoyance figures will be in this case.

We consider that the area is moderately affected by aircraft noise. Although the character of aircraft noise is different, we note that exposure to noise levels of 55dB to 60dB L_{dn} from a variety of transport and business noise sources is very common across Auckland and New Zealand.

We leave any assessment of dwelling density and the overall assessment of potential reverse sensitivity effects to others.

[10] World Health Organisation. (2018). Environmental Noise Guidelines for the European Region. Copenhagen: WHO Regional Office for Europe.

[11] Waka Kotahi New Zealand Transport Agency (2024) Research Report 727 Community response to transport noise exposure in New Zealand.

8.0 Assessment of construction noise and vibration effects

The conditions of consent attached to Stage 1 include a comprehensive framework to ensure that construction noise and vibration levels comply with the permitted standards at any receiver adjacent to the ASPC.

The conditions require that a Construction Noise and Vibration Management Plan (**CNVMP**) is prepared and implemented to ensure that the Best Practicable Option (**BPO**) is identified and then adopted for the management of construction noise and vibration.

The proposal is to manage the noise and vibration effects from Stage 2 in accordance with the approach for Stage 1. We have prepared a draft CVNMP that sets out the mitigation measures that must be adopted to ensure compliance with the relevant limits at the closest receivers adjacent to the Site. The draft CNVMP will be updated when a contractor has been appointed, and more detailed information is available relating to the proposed construction methodology.

As with the detailed design of the operational phase of Stage 2, the construction methods, plant and equipment details for the construction phase are not known. The noise and vibration predictions in this report are therefore indicative and designed to demonstrate that the recommended outcomes can be achieved in principle. We recommend that a CNVMP be developed to manage the construction phase once the detail is known.

8.1 Permitted construction noise standards

The permitted limits for construction noise are set out in E25.6.27:

> **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[12] 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.

[12] 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.

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.

Standard E25.6.1.3 of the AUP states that noise from any construction work activity must be measured and assessed in accordance with the requirements of New Zealand Standard NZS 6803: 1999 *Acoustics – Construction Noise*. This means the assessment position for all construction noise is at 1 m from the most exposed façade of any occupied building.

8.1.1 Summary of applicable construction noise limits

The potentially occupied buildings adjacent to the Site include commercial and residential activity. All noisy construction works will be undertaken between 07:30 and 18:00 Monday to Saturday and will take more than 20 weeks to complete. The relevant AUP construction noise limits are therefore:

- 70 dB L_{Aeq} at 1 m from the most exposed façade of any occupied commercial building.
- 70 dB L_{Aeq} and 85 dB L_{max} at 1 m from the most exposed façade of any occupied dwelling.

8.2 Permitted construction vibration limits

Standard E25.6.30 prescribe following construction vibration limits for permitted activities:

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	Nighttime 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.

8.3 Reasons for consent - construction noise

8.3.1 Receivers outside the Site

Appendix B and Appendix C include construction noise and vibration level predictions based on the nature of construction work that we expect to be undertaken on the Site.

Our assessment finds construction noise and vibration levels can be managed to comply with the permitted noise standards, subject to the implementation of noise mitigation measures for high noise generating works that are within 40m of any occupied building outside the Site.

We consider that works within 40m of any occupied building outside the Site can readily be managed to comply with the permitted noise standards with a moderate degree of care and management, and without the need for detailed or expensive mitigation measures.

Section 8.4 describes how a Construction Noise and Vibration Management Plan (**CNVMP**) will be implemented to ensure compliance with the relevant construction noise standards. A critical feature of the CNVMP will be managing works within 40m of any occupied building outside the Site.

8.3.2 Potential future receivers within the Site

We understand that future buildings within the Site may be constructed and occupied while construction is ongoing in other parts of the Site.

We understand that sale and purchase agreements for all new and existing residential units will set the expectation that construction noise and vibration may be expected during the construction phase and that exceedances of the construction noise and vibration standards may arise.

Construction noise and vibration effects on future residents *within* the Site have therefore been disregarded.

We recommend that the consent conditions provide for this.

8.4 Reasons for consent- construction vibration

The permitted vibration amenity limit of 2 mm/s may be temporarily exceeded when vibratory compaction works are undertaken within approximately 20-30m of any neighbouring occupied building, or other heavy tracked plant is operated within 10-20m of any neighbouring occupied building.

We expect that the proposed construction works will be likely to exceed the permitted vibration amenity limit of 2 mm/s at one property - 1368 Dairy Flat Highway. The works proposed within 30 m of all other properties are unlikely to generate vibration levels over 2 mm/s at those locations.

Construction vibration between 2 mm/s and 5 mm/s will be clearly felt within buildings. This is typically tolerated providing that it occurs intermittently, during the day, and where there is effective prior engagement.

Potential effects on building damage from vibration are assessed under the AUP in accordance with the German Standard DIN 4150–3:1999 Structural vibration, Part 3: Effects of vibration on structures. The guideline values recommended by this standard to avoid cosmetic damage occurring in dwellings from short-term vibration at dominant frequencies of 15 Hz to 40 Hz are 6.25 mm/s to 12.5 mm/s PPV (measured at the foundations of the structure). Vibration from the proposed activity will be significantly lower than these guideline values.

Any perceptible vibration would be for short periods when heavy plant is operated at the Site boundary. Cosmetic damage to buildings from construction vibration, such as cracked plaster or enlargement of existing cracks, will not occur based on the guidance of DIN 4150–3:1999.

We consider that construction vibration effects can be effectively managed through the following measures:

- The implementation of a CNVMP which will set out the measures by which vibration (and noise) emissions will be minimised as far as practicable or are otherwise compliant at all times
- Restricting vibration generating works, such as vibratory compaction, near to dwellings to daytime hours only
- Providing written advice to all receivers within 50m of the site boundary that construction vibration may be perceptible at times during the day when works are near to the site boundary. This will form part of the advice provided about the project in accordance with the CNVMP.

The vibration levels will comply with the permitted construction vibration amenity limits at receivers that are separated from high vibration-generating construction work by distances exceeding 50m. The effects from the compliant vibration levels will range from not noticeable to noticeable but are unlikely to unreasonably disrupt residential or normal business activities.

8.5 Construction noise and vibration management plan

Our assessment finds that the proposed construction works will comply with the permitted construction noise and vibration limits at most receivers for the vast majority of the construction phase without the need for any specific noise mitigation or management. Relatively straightforward mitigation can be applied to ensure compliance with the permitted standards for all works.

A CNVMP will be used to set out the noise mitigation measures that must be implemented to ensure compliance with the construction noise and vibration standards when works are within proximity to the closest receivers listed below:

Table 7 Existing receivers within 40 m of Site boundary

Address	Approximate Separation distance from building façade to nearest site boundary
1318 Dairy Flat Highway	29 m
1321 Dairy Flat Highway	30 m
1349 Dairy Flat Highway	30 m
1368 Dairy Flat Highway	12 m
1416 Dairy Flat Highway	35 m
231 Postman Road	33 m
295 Postman Road	20 m
313 Postman Road	12 m

The draft CNVMP sets out how the mitigation measures that must be implemented to ensure that construction noise and vibration levels comply with the relevant limits when works are undertaken in proximity to noise sensitive receivers. Figure 9 shows the areas of the Site within 40m of the nearest receivers. Works within these areas will need to be managed carefully and in accordance with the CNVMP.

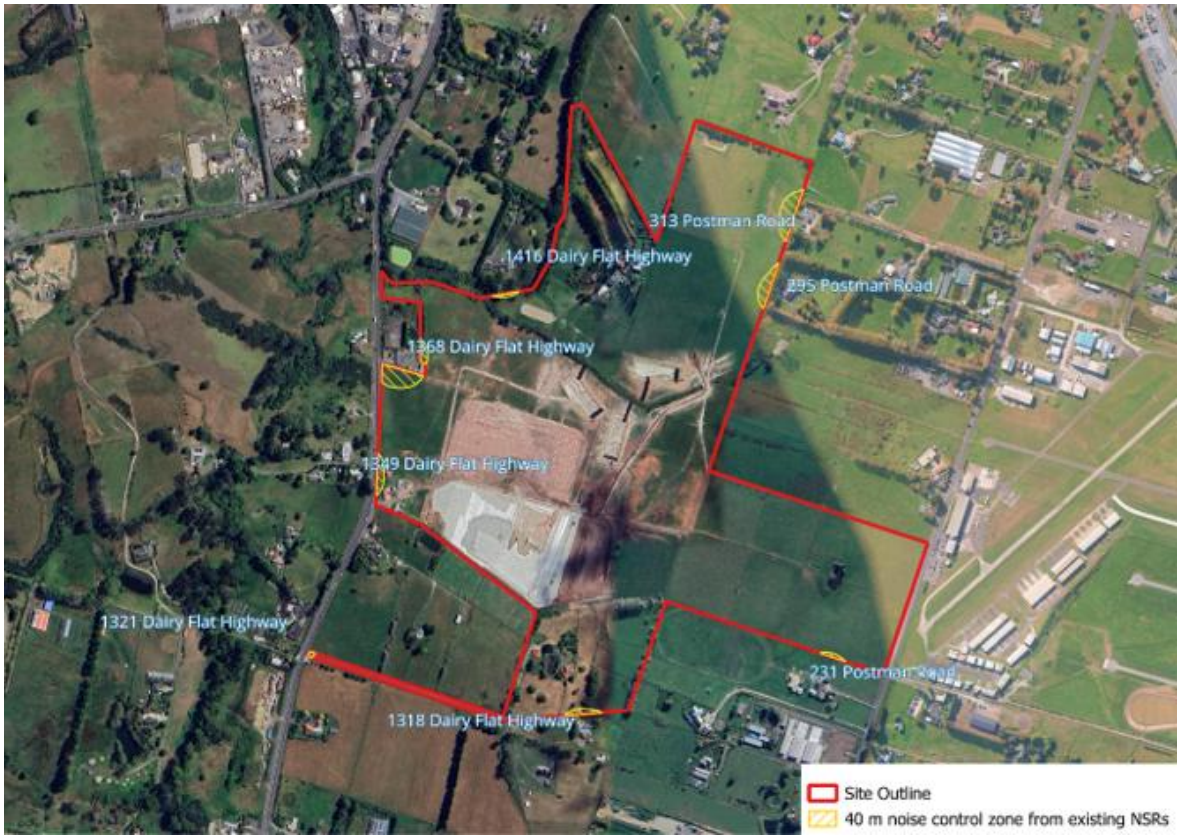

Figure 9 40m construction noise and vibration management zones

The final CNVMP will also need to set out:

i. The construction noise and vibration limits for the project

ii. Limitations on working hours for specific activities and work areas

iii. Specifications and requirements for acoustically effective barriers

iv. Minimum separation distances for compliance with the noise and vibration limits in the consent conditions

v. Procedures for response to neighbour's concerns and dealing with any complaints

vi. Procedures for any noise and vibration monitoring during the works

vii. Details of any further noise and vibration mitigation measures available

viii. Details for advising the occupiers of the neighbouring buildings of the works, including when the highest noise levels and perceptible vibration can be expected

ix. Details for ensuring that contractors and operators on site are aware of the requirement to minimise noise and vibration effects on the neighbouring sites.

8.6 Assessment of construction noise and vibration effects

E25.2 *Objectives* in Chapter E25 of the AUP includes:

4) Construction activities that cannot meet noise and vibration standards are enabled while controlling duration, frequency and timing to manage adverse effects.

E25.3 *Policies* sets out the following requirements for construction noise and vibration:

10) Avoid remedy or mitigate the adverse effects of noise and vibration from construction, maintenance and demolition activities while having regard to:

a) The sensitivity of the receiving environment; and

b) The proposed duration and hours of the operation of the activity; and

c) The practicability of complying with permitted noise and vibration standards.

8.6.1 Construction noise

Receivers within 40m of the Site may experience construction noise levels of up to 70 dB L_{Aeq} when earthworks and civil works occur within this proximity. At times, fixed noise barriers or localised screening may be required to ensure noise levels do not exceed the permitted standard of 70 dB L_{Aeq}.

The Site is large, and we understand that the construction will be staged. The construction noise levels generated from construction work in other areas of the Site will be much lower than for closer works and will readily comply with the noise limits without any specific noise mitigation or management.

A CNVMP will specify the noise mitigation methods that must be adopted when construction works occur within 40 m of occupied properties. It will ensure that the closest receivers receive advanced notice of the timing and duration of construction activities. Warning residents about temporary high construction noise levels and vibration reduces startle effects and allows them to plan around the works. Higher noise levels from temporary construction activities are generally tolerated when there is clear communication with neighbours, the works are no louder than necessary, and noise occurs only during daytime hours.

The potential effects typically associated with construction noise up to the predicted levels are displayed in Table 8.

Table 8: Temporary construction noise effects at the nearest sites

Noise level at 1 m from the façade $L_{Aeq\ (15\ min)}$	Potential effects outside the building	Potential effects inside the nearest room of the building	Frequency
<55 dB	Will range from imperceptible to noticeable.	Unlikely to be noticeable.	Large periods of the project when works are remote or screened by structures.

Noise level at 1 m from the façade $L_{Aeq\ (15\ min)}$	Potential effects outside the building	Potential effects inside the nearest room of the building	Frequency
55-65 dB	Conversations may require raised voices. Construction noise may be dominant (depending on existing ambient level).	Up to 42 dB L_{Aeq} inside. Noise may be noticeable inside the building, but it is unlikely to interfere with daily residential activities.	When works are within 100-200m of the receiver and when there is line of sight between the dwelling and earthworks.
65-70 dB	Conversation will require raised voices. People are unlikely to spend time outside.	Up to 47 dB L_{Aeq} inside. Noise will be noticeable inside the building, but it is unlikely to interfere with daily residential activities.	When earthworks are undertaken near to a dwelling.

Overall, the construction noise levels at receivers outside the Site can readily be managed to be compliant with the permitted standards.

8.6.2 Construction vibration

We expect that the occupiers of one property, 1368 Dairy Flat Highway, may experience vibration levels above 2 mm/s. This is only likely to occur when works take place directly on the southern boundary of the Site. We expect that occupants within 30 m of the Site may experience brief, intermittent, but perceptible vibration when earthworks machinery is operating in the areas close by.

The vibration levels discussed may be experienced as small jolts or short periods of steady vibration that are just perceptible or noticeable. The vibration levels will comply with Project Vibration Standard to avoid building damage at all times based on the ample separation distances involved. It is our experience that the vibration levels could be reduced to comply with 2mm/s but this would be likely to require a longer construction timeframe and only a modest reduction in level from what would otherwise be received. It is our experience that given the relatively low levels of vibration (<5mm/s), the effects of allowing activities to exceed the 'amenity' limit of 2mm/s but get the work done faster is preferred by most people compared to ensuring compliance with 2mm/s but over a longer period of time.

The CNVMP will ensure that receivers are provided with advance notice of the timing and duration of the proposed construction works. The vibration levels are not expected to unreasonably disrupt residential activities.

9.0 Live Work Precinct

The Live Work Precinct will be a mixed-use area with both residential and commercial activities. The FUZ noise limits apply at the site boundary and are not intended to protect occupiers from noise generated within a building or between adjoining units.

To protect future occupiers in this Precinct, we recommend adopting the internal design noise levels in Table E25.6.9.1 of the AUP. This approach aligns with the requirements applied in Mixed Use and Centre Zones, where noise from activities must not exceed the levels in Table E25.6.9.1 when measured in any unit that shares common building elements such as walls or floors with another unit.

We recommend that consent conditions deliver this outcome.

10.0 Light Industrial Precinct

The Light Industrial Precinct will comprise 10 units. The occupiers of these units will be required to comply with the noise limits set out in Table E25.6.3.1 at any notional boundary of the surrounding residential properties.

We recommend that consent conditions deliver this outcome.

11.0 Water Treatment Plant

Noise generated by the operation of the Water Treatment Plant will be required to ensure that noise levels do not exceed the limits stated in Table E25.6.3.1 of the AUP at the notional boundary of any existing residential properties or any dwellings constructed as part of the ASPC development, most notably within the Live Work Precinct.

We recommend that consent conditions deliver this outcome.

12.0 Recommended outcomes for conditions of consent

Overall, we recommend that conditions are attached to the consent that manage noise and vibration as E25 would manage it in the event that the Site was rezoned. The exceptions to this are to allow the Surf Lagoon to exceed the equivalent permitted noise standard of 45dB L_{Aeq} at ASN within the Site during the operating hours of 6:00am and 10:00pm on all days, to allow construction vibration to exceed the amenity standard at one dwelling outside the Site and to allow construction noise and vibration to exceed the permitted standards at occupied buildings within the Site only and only for the initial construction phase.

We recommend that conditions of consent deliver the following outcomes:

Operational noise received outside the Site

i. Require compliance with the operational noise standards prescribed by the AUP at any notional boundary outside the Site

ii. Require an Acoustic Design Report to be submitted prior to construction that sets out the final noise predictions for the Surf Lagoon and all mechanical plant associated with the Surf Park, Solar Farm and Data Centre, confirms compliance with the relevant AUP noise limits at all external notional boundaries, and identifies any mitigation measures required to achieve compliance.

Operational noise received inside the Site

i. Require all commercial activities, including in the Surf Park, Solar Farm, Data Centre, ECE, Light Industrial Precinct, Live Work Precinct and Water Treatment Plant to comply with the numerical noise standards prescribed by the AUP for the FUZ at any ASN on a separate site inside the Site. The compliance position is inside the boundary of any residential site or as the incident noise level 1m from the façade and 1.5m above the floor level of any residential dwelling located on the second level (above ground floor) or higher.

ii. Require an Acoustic Design Report to be submitted prior to construction that identifies which ASN inside the Site require acoustic treatment and specifies the treatment required, where the Stage 1 ADR demonstrates that the operational noise standards prescribed by the condition required by (i) above cannot be complied with at those locations.

iii. Require commercial activities in the Live Work Precinct to comply with the internal design noise levels in Table E25.6.9.1 of the AUP. This requires that noise from commercial activities must not exceed the levels in Table E25.6.9.1 when measured in any unit that shares common building elements such as walls or floors with another unit.

4. Construction noise

i. Require compliance with the construction noise and vibration (except as detailed in the point below) standards at any receiver outside the Site, while enabling exceedances of the construction noise and vibration standards at any building that may be established and occupied within the Site while construction work is ongoing.

ii. Allow for the exceedance of the permitted vibration amenity limit of 2 mm/s PPV but compliance with 5mm/s PPV at 1368 Dairy Flat Highway.

iii. Require a CNVMP to be submitted for certification prior to construction.

iv. Allow for construction noise and vibration to exceed the permitted standards in the AUP at occupied buildings inside the Site, but only for the initial construction phase.

5. Aircraft Noise Effects from North Shore Aerodrome

v. Require any ASAN between the 55 dB L_{dn} and 65 dB L_{dn} noise boundary of North Shore Aerodrome to be acoustically treated in accordance with Standard D24.6.1(1) except that the mechanical ventilation and cooling specifications referred to in AUP standard E25.6.10(3)(b) to (f) should replace the specifications in D24.6.1(1)(c). The determination of the external aircraft noise levels shall be taken from the air noise boundaries that are operative in the AUP at the time the ASAN will be occupied.

6. Recommendations for the management of noise effects <u>within</u> the overall ASPC

i. Enable the Surf Lagoon to generate noise levels of up to 55dB L_{Aeq} during the operating hours of 6:00am and 10:00pm at ASN on separate sites within the Site (except those inside the Surf Lagoon Amenity, Accommodation and Surf Village Centre Precincts where no noise limits apply)

ii. Require bedrooms of dwellings inside the Neighbourhood Precinct that are predicted to receive external façade noise levels greater than 45dB L_{Aeq} to be provided with a mechanical ventilation and cooling system (i.e. one that meets the specifications referred to in AUP standard E25.6.10(3)(b) to (f)). The ASN subject to this requirement will be determined by the Stage 2 ADR.

iii. Require that noise levels between separately owned or leased units in the Live/Work Precinct are required to comply with the provisions of E25.6.9 of the AUP (Noise levels between units).

13.0 Summary

Styles Group has assessed the actual and potential noise and vibration effects from the construction and operation of Stage 2 of the ASPC development.

Stage 2 does not seek to change the Stage 1 noise limits set under the COVID-19 Fast-track consent. To ensure compliance with the existing contests an Acoustic Design Report (ADR) is recommended to confirm compliance once the detailed design process has been completed.

Overall, we recommend that conditions are attached to the consent that manage noise and vibration as E25 would manage it in the event that the Site was rezoned. The exceptions to this are to allow the Surf Lagoon to exceed the equivalent permitted noise standard of 45dB L_{Aeq} at ASN within the Site during the operating hours of 6:00am and 10:00pm on all days, to allow construction vibration to exceed the amenity standard at one dwelling outside the Site and to allow construction noise and vibration to exceed the permitted standards at occupied buildings within the Site only and only for the initial construction phase.

We consider that it will be complex to properly manage the noise from the mix of land uses and activities that are proposed. We consider that the consent conditions will need to be carefully drafted to reflect the complexity and to ensure proper management of noise and compatibility of land uses. Consent is sought to authorise the Surf Lagoon to exceed the night-time 45 dB L_{Aeq} limit at ASAN inside the Site in the North-West and South-West Neighbourhood Precincts. Daytime noise will comply. A requirement for mechanical cooling and ventilation for affected bedrooms is recommended as part of the consent condition. The ADR will identify which dwellings require treatment.

Parts of the Site sit within the 55 dB Ldn aircraft noise boundary. All dwellings in this area will be acoustically treated to meet AUP D24, including mechanical ventilation and cooling. The Site is unlikely to be affected by aircraft noise if runway 09/27 is removed in future. D24 compliance should remain until the runway is removed.

A draft CNVMP been prepared and will be updated prior to construction. The CNVMP sets out the mitigation measures that must be implemented to ensure compliance with the permitted noise and vibration standards at the closest receivers adjacent to the Site.

Appendix A Glossary of terms

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.
Best practicable option	Defined in section 2 of the Resource Management Act as: in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to— a. the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and b. the financial implications, and the effects on the environment, of that option when compared with other options; and c. the current state of technical knowledge and the likelihood that the option can be successfully applied.
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 takes into account 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.
Noise rating level	A derived noise level used for comparison with a noise limit.
Notional boundary	A line 20 metres from any side of a residential unit or other building used for a noise sensitive activity, or the legal boundary where this is closer to such a building.
NZS 6801:2008	N.Z. Standard NZS 6801:2008 Acoustics – Measurement of environmental sound.
NZS 6802:2008	N.Z. Standard NZS 6802:2008 Acoustics – Environmental noise.
NZS 6803:1999	N.Z. Standard NZS 6803:1999 Acoustics – Construction noise.

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.
s16	Section 16 of the Act states that “every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level”.
DIN 4150–3:1999	German Standard DIN 4150-3:1999 Structural Vibration – Part 3: Effects of vibration on structures. Typically adopted for the assessment of structure borne vibration in New Zealand.
PPV	Peak particle velocity, measured in mm/s. The standard metric for the measurement of ground borne vibration in New Zealand. The instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
CNVMP	Construction noise and vibration management plan. A document to help the contractor manage noise and vibration emissions during construction works.

Appendix B Predicted construction noise levels

A contractor has not yet been appointed which means that there is little or no detail on the type of equipment and durations of work phases for the Project. However, we have worked on a significant number of projects of a similar nature and scale which allows us to reliably estimate the type of activities, durations and likely noise levels at neighbouring properties.

We have calculated construction noise levels at the neighbouring sites based on reasonable worst-case scenarios and the references displayed in Appendix B. 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 Standard).

13.1 Potential construction noise levels

Table 9 lists the equipment that is proposed and typical for this type of project.

Table 9 sets out minimum separation distances required for the equipment to comply with the noise limits of 70 dB L_{Aeq} and 85 dB L_{AFmax}.

The L_{AFmax} noise levels from the proposed construction activities will generally be 10-15 dB higher than the L_{Aeq} noise levels. Compliance with the AUP permitted L_{Aeq} limits will therefore result in compliance with the permitted L_{AFmax} noise limits.

Table 9 also provides minimum separation distance for compliance when effective screening is provided from a noise barrier.

The noise levels in Table 9 are 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 façade.
- The plant is being used continuously at the reference distance over a 15-minute sample period (i.e., 100% on-time) 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 a 10 dB reduction from temporary acoustic barriers effectively screening a property from the noise generating construction activity.

Table 9: Noise sources levels and minimum separation distances where a noise limit of 70 dB L_{Aeq} applies

Construction activity	Unmitigated LAeq(15 min) noise level at 10 m	Unmitigated compliance distance	Mitigated compliance distance (with noise barrier)
Bored piling with a 20-t excavator	79 dB	38 m	12 m
Chainsaw works to remove 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
Vibratory compaction roller 15t – 20-t	76 dB*	27 m	9 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
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
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
Large generator	66 dB	9 m	3 m
Terrex TS14 30-t motor scraper	65 dB*	8 m	3 m
7,000 L watercart	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

Construction activity	Unmitigated LAeq(15 min) noise level at 10 m	Unmitigated compliance distance	Mitigated compliance distance (with noise barrier)
Paving works (with all ancillary equipment operating)	75 dB	25 m	8 m

* Reference noise level is for a moving noise source.

Appendix C Predicted vibration levels

The German Standard DIN 4150–3:1999 *Structural vibration – Part 3 Effects of vibration on structures* (**DIN 4150–3:1999**) recommends vibration limits for avoiding cosmetic building damage according to the design, occupancy, and sensitivity of the 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 on Line 1 of the DIN 4150–3:1999 criteria applying at the neighbouring commercial buildings and Line 2 applying at the residential dwellings. Line 3 applies to any receiving structure that is deemed by a suitably qualified and experienced person as being particularly sensitive to vibration and/or of great intrinsic value e.g., heritage buildings. We are not aware of any Line 3 structures near to the Site.

The guideline values provided by DIN 4150–3:1999 also depend on whether the vibration is "short-term" or "long-term". Short-term vibration is defined 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 construction vibration measured within low-rise structures typically meets the short-term criteria.

The DIN 4150–3:1999 frequency-dependent values for short-term vibration are illustrated in Figure 10 below for reference. Typical dominant frequencies for the proposed construction works are less than 50 Hz.

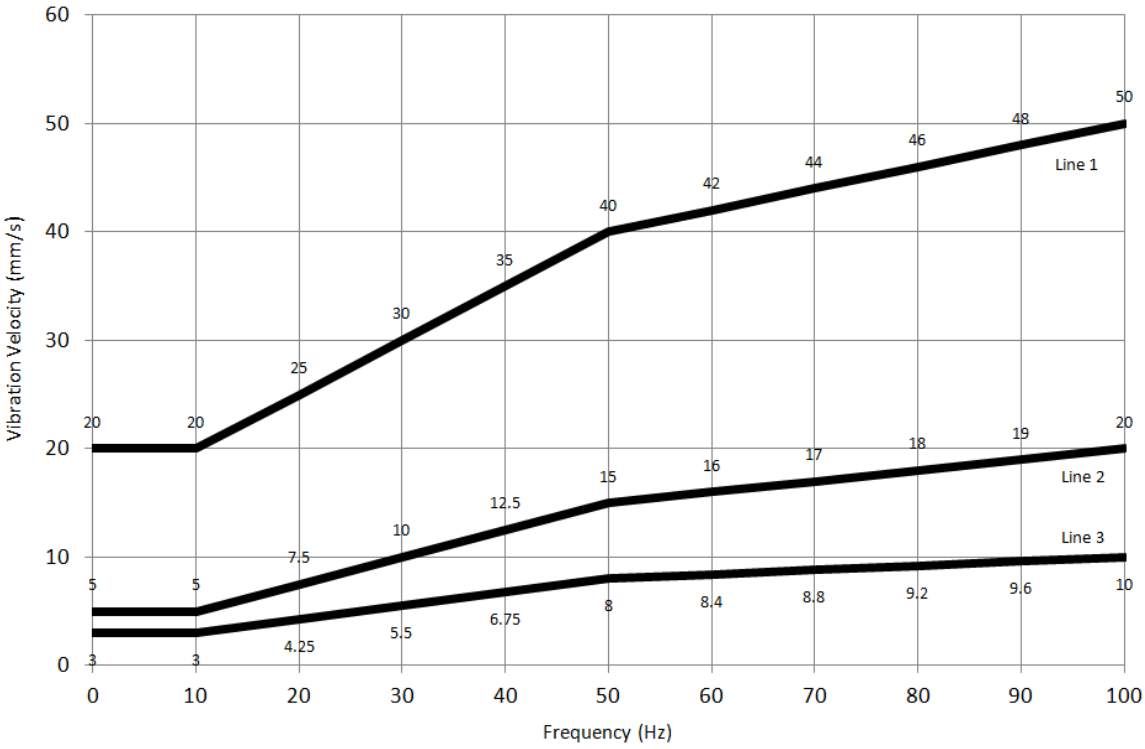

Figure 10: DIN 4150–3: 1999 guideline values for short-term vibration

Potential construction vibration levels

The operation of heavy construction plant near the boundaries of a site can generate vibration that is perceptible within nearby buildings. Vibration levels above 0.3 mm/s peak particle velocity (PPV) within buildings can be perceptible and levels exceeding 1 mm/s PPV can cause concern if the vibration is unexpected.

The construction vibration levels received at the neighbouring sites will depend on the distance between the plant and the structure, the equipment used, the experience of the operator, the ground conditions, and the response of the receiving building.

The highest vibration levels will be generated during excavation, compaction, and bored piling. Typical vibration levels for these activities are provided in Table 10. These reference levels are from our measurement database and were obtained using a geophone buried in the ground. The levels measured at the foundations of the neighbouring buildings (the AUP assessment location) at the same distance are likely to be lower.

Table 10: Typical construction vibration levels

Construction activity	Distance	Typical vibration levels (PPV)
Vibratory compaction with a 10-t roller	2 – 10 m	2 – 10 mm/s
Vibratory compaction with a 3-t roller	2 – 10 m	1.5 – 5 mm/s
Compaction with a large static roller	2 – 10 m	< 2 mm/s
Cut and fill works, loading trucks, and tracking slowly with a 6-t to 20-t excavator	2 – 10 m	< 2 mm/s
Heavy vehicle or tractor pass-by	10 m	< 1 mm/s
Bored piling	5 – 10 m	2 – 5 mm/s

Appendix D Noise contour maps

Figure 11 Surf lagoon noise contours

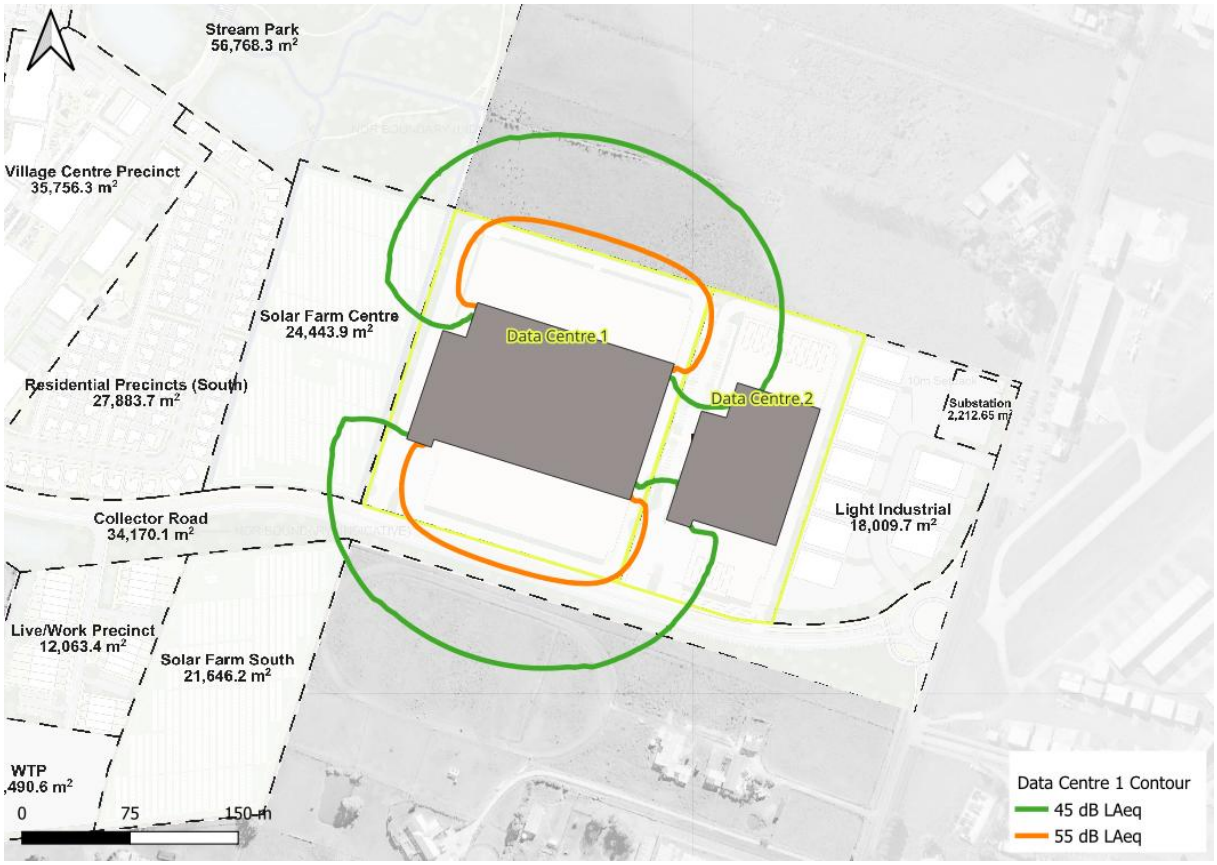

Figure 12 Data Centre 1 noise contour

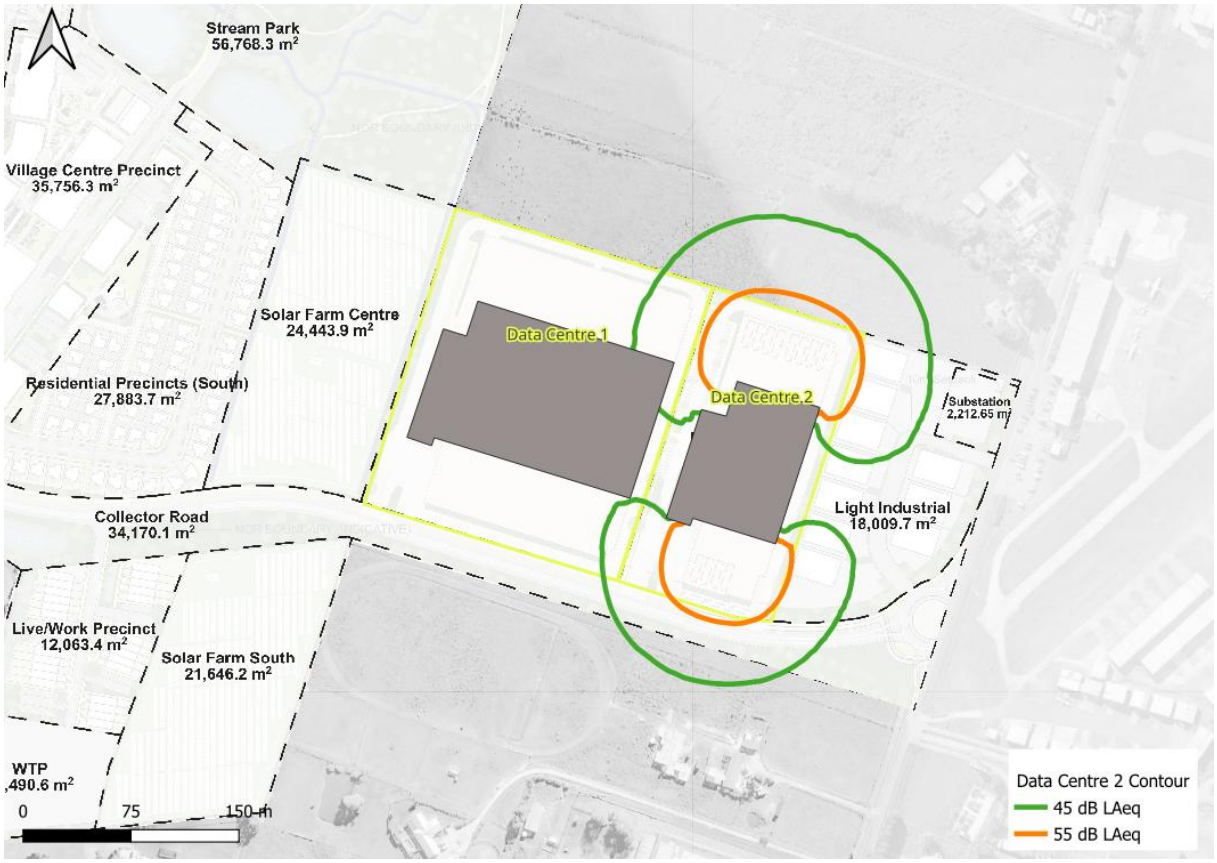

Figure 13 Data Centre 2 noise contour

Figure 14 Solar Park noise contour (day)

Figure 15 Solar Park noise contour (night)

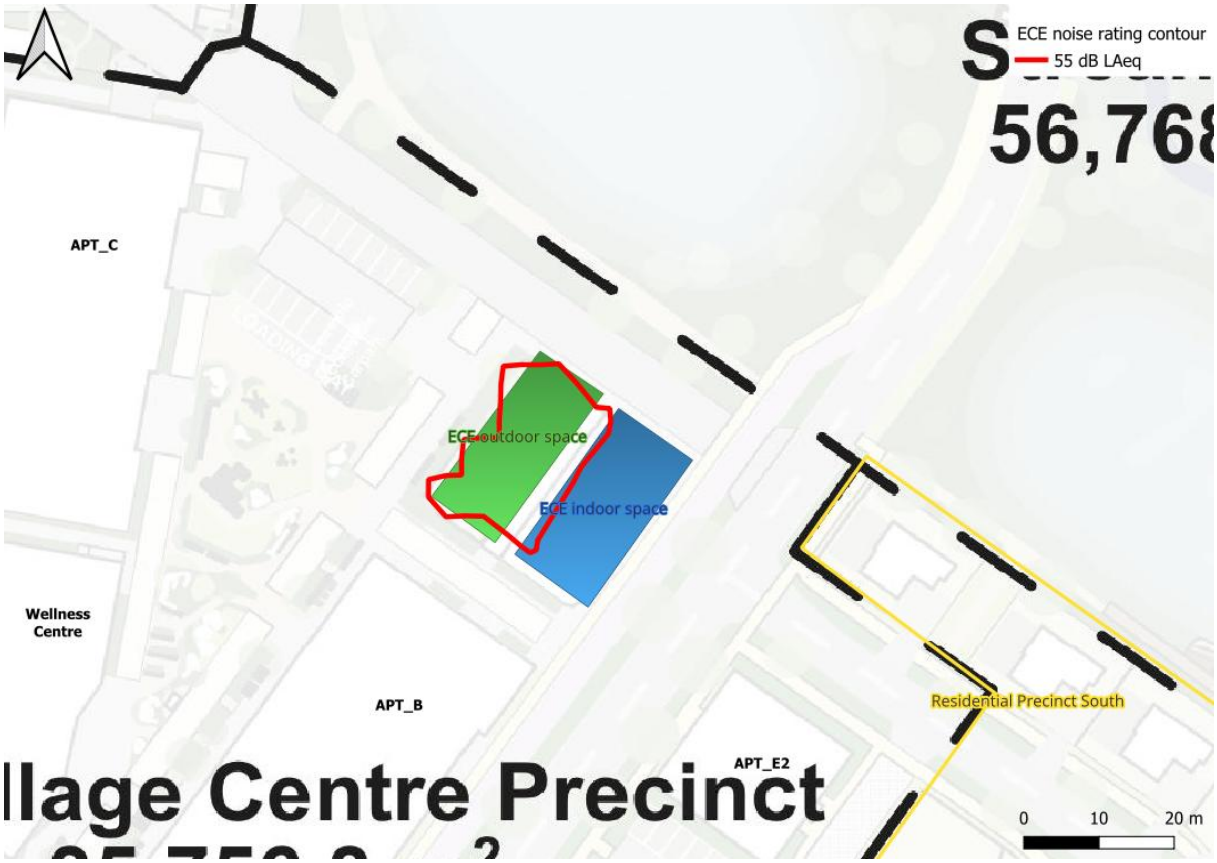

Figure 16: ECE Noise contour (with 2 m noise barrier)

Appendix E Expert Summary Statement – Jon Styles

I am and have been the Director and Principal of Styles Group Acoustics and Vibration Consultants for over 20 years. I have twice been the President and am and have been a Council Member of the Acoustical Society of New Zealand (ASNZ) for 17 years. I am on the Board of Directors of the Australasian Association of Acoustical Consultants (AAAC).

I have over 24 years' experience in advising on the management of noise and vibration effects, including the construction, maintenance and operational noise effects of major and strategic facilities and infrastructure (including port, road, air and rail) and the development of provisions to improve the compatibility of residential development around such infrastructure.

I have undertaken a significant number of acoustic assessments across New Zealand for Notices of Requirements and alterations to designations. I am regularly engaged by Councils across New Zealand to review resource consents and Notices of Requirement subject to noise and vibration standards. I have worked on approximately 20 FTAA projects.

I am a regular and experienced expert witness for Council, Environment Court, District Court and High Court and Board of Inquiry hearings.

Code of conduct for expert witnesses

In the context of this application, which is made under the Fast-track Approvals Act 2024, and in relation to which there may be no hearing, I have been asked to confirm that the reporting has been prepared in accordance with the Environment Court's Code of Conduct for Expert Witnesses.

I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses, as contained in section 9 of the Environment Court's Practice Note 2023 and agree to comply with it.

The data, information, facts and assumptions that I have considered in forming my opinions are set out in my technical report. The reasons for the opinions expressed are also set out in the technical report.

I confirm that the matters addressed in the technical report are within my area of expertise, with the exception of where I confirm that I am relying on information provided by another person. I have not omitted to consider material facts known to me that might alter or detract from my opinions expressed. I have specified where my opinion is based on limited or partial information, and I have identified any assumptions I have made in forming my opinion.

Appendix F Expert Summary Statement – Martyn Chambers

I am a Senior Acoustic Consultant at Styles Group Acoustics and Vibration Consultants.

I am a member of the Acoustical Society of New Zealand (ASNZ) and the Institute of Acoustics (MIOA). I hold a Master of Science (MSc) in Applied Acoustics and a Postgraduate Diploma (PGDip) in Acoustics and Noise Control.

I have nine years' experience consulting on noise and vibration effects in New Zealand and the United Kingdom. My experience includes assessing noise impacts on residential developments; construction, maintenance, and operational noise for major facilities and strategic infrastructure (including ports, roads, aviation, and rail). I also have extensive experience modelling complex sites with multiple noise sources and receivers of varying sensitivity.

I regularly review noise assessments for councils across New Zealand and the UK, and have worked on a number of Fast-track Approvals Act (FTAA) projects.

Code of conduct for expert witnesses

In the context of this application, which is made under the Fast-track Approvals Act 2024, and in relation to which there may be no hearing, I have been asked to confirm that the reporting has been prepared in accordance with the Environment Court's Code of Conduct for Expert Witnesses.

I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses, as contained in section 9 of the Environment Court's Practice Note 2023 and agree to comply with it.

The data, information, facts and assumptions that I have considered in forming my opinions are set out in my technical report. The reasons for the opinions expressed are also set out in the technical report.

I confirm that the matters addressed in the technical report are within my area of expertise, with the exception of where I confirm that I am relying on information provided by another person. I have not omitted to consider material facts known to me that might alter or detract from my opinions expressed. I have specified where my opinion is based on limited or partial information, and I have identified any assumptions I have made in forming my opinion.