

MEMORANDUM

From: Stephen Chiles, Chiles Ltd
To: Pam Butler, KiwiRail
Date: 12 February 2021
Subject: KiwiRail Regional Freight Hub -
Response to requests for information relating to noise and vibration

Palmerston North City Council has requested further information relating to KiwiRail's Notice of Requirement for the proposed Regional Freight Hub (PNCC letter dated 14 December 2020). Items 7 to 31 of the request for information relate to noise and vibration. Responses to those items are provided in this memo. For each item the request is written in italics followed by the response. Several responses refer to a set of 17 figures that are attached to this memo.

Request 7

Please specify any appropriate noise criteria or explain why that would not be appropriate.

Response

Section 4 of Technical Report D sets out proposed noise and vibration criteria for different activities associated with the Freight Hub and the rationale for each set of criteria. The key criteria proposed in Technical Report D are:

- Operational noise (on-site) – Table 5, page 18
- Operational noise (road-traffic) – Table 6, page 20
- Operational vibration - 0.3 mm/s vw,95, page 20/21
- Construction noise – Table 7, page 21
- Construction vibration – Table 8, page 22

Request 8

Please provide predictions of noise management boundaries for the Regional Freight Hub.

Response

In response to the request for information, a potential 'noise management boundary' line has been produced and is attached as Figure 1. This line is based on an operational (on-site) noise level of 55 dB $L_{Aeq(1h)}$. This noise level has been selected for the management boundary as it is the most stringent daytime criterion proposed in Technical Report D (Table 5, page 18). Use of this particular noise level also results in a pragmatic location for the management boundary in that it should be close enough to the site to measure sound levels from site activity without too much contamination from other sound sources. At the same time the management boundary is far enough from the site to be representative of noise exposure of potentially affected houses.

The proposed boundary has been drawn with the following assumptions:

- The data has been taken from the modelling presented in Figure 12 of Technical Report D. The noise level relates to a height 1.5 metres above the ground. This modelling excludes all activity on the NIMT and the new perimeter road.
- The noise contour has been smoothed to reduce effects of modelling artefacts. It can be seen that the noise contours in Figure 12 of Technical Report D 'wobble' in and out along each side of the

site. These wiggles have been smoothed to result in a management boundary made up of straighter lines.

- A 2 dB tolerance has been added to provide some allowance for uncertainty. This is required both due to the limitation of information available prior to detailed design and due to the modelling accuracy. A 2 dB tolerance has been chosen to provide a pragmatic boundary. The use of a 2 dB tolerance is consistent with normal professional practice as applied for other environmental noise sources.
- The management boundary is a minimum distance of 100m from the site boundary, at the ends of the east site boundary.
- The management boundary has been extended to the property boundaries at the north.
- The North East Industrial Zone has been excluded as it should not contain noise sensitive activities, where the criteria proposed in Technical Report D (Table 5) apply.

Section 7 of Technical Report D sets out how operational (on-site) noise will require active management and mitigation throughout the development and operation of the Freight Hub. The proposed noise management boundary could be used as part of this process. As set out in Technical Report D, this will include confirmation of the actual noise emissions during detailed design and then determination of noise levels as different elements of the Freight Hub are commissioned. This will also identify the need to investigate any neighbouring houses to determine if any acoustic treatment is required. This process does not rely on fixing noise emissions at this stage, which would not be practical prior to the detailed design.

Request 9

Please identify the expected maximum levels of noise from daytime activity and the expected maximum levels of noise from night-time activity based on LAeq(1 hr) descriptor and the LAmax descriptor for night-time activity. If any duration corrections are assumed in the daytime predictions, please describe the assumptions.

Response

Section 5 of Technical Report D sets out how indicative sound levels have been determined for the Freight Hub based on other facilities. These predictions will be reviewed during detailed design, when the required information such as equipment models and operating times/locations is known. The indicative sound levels are based on the sound sources set out in Table 10 (pages 24-27), which includes both LAeq and LAFmax data. This has been used to generate the LAeq(1h) contours in Figures 9 (page 29) and 12 (page 38) for scenarios with and without perimeter barriers. As set out in Technical Report D, these figures represent a busy hour during the daytime, without duration adjustment. As set out on pages 37/38 of Technical Report D, the noise contours are expected to reduce for night operations but the exact contours at night cannot be reliably predicted at this stage because future operational requirements are unknown. The Operational Noise and Vibration Management Plan requires the plan to be reviewed prior to any significant changes in activity that might reasonably be expected to affect the noise and vibration levels generated, which would require the noise contours to be updated prior to any night operations.

Noise levels in terms of LAFmax are discussed on page 29 of Technical Report D.

Request 10

With respect to 8 & 9 above please provide night-time noise management boundaries predicted at 5 dB increments between 70 dB LAeq (1hr) and 40 dB LAeq (1hr) and 100 dB LAmax and 70 dB LAmax.

Response

It is an essential operational requirement for core elements of the Freight Hub to be able to operate 24/7. This includes some of the noisier elements such as the marshalling yard and container terminal. As such, the same noise management boundary (attached Figure 1), would apply to all operations daytime and night-time. However, in addition to 55 dB LAeq(1h) being achieved at this boundary, as set out in Technical Report D (page 38), existing dwellings where the Category A criteria is exceeded will need to be investigated to determine if treatment is required. As the Category A criteria is 45 dB LAeq(1h) at night, houses might be required to be treated over a wider area.

Request 11

With respect to 8 & 9 above please provide daytime noise management boundaries predicted at 5 dB increments between 70 dB LAeq (1hr) and 50 dB LAeq (1hr).

Response

As described above, a single noise management boundary for 55 dB LAeq(1h) is proposed. In the same manner as airports and ports, it is proposed for noise emission criteria to apply at a single boundary. While ports/airports do often have other additional concentric boundaries, those are often for the purposes of managing surrounding land-use rather than managing port/airport activity noise. The response to question 8 above outlines the reason 55 dB LAeq(1h) has been chosen for a management boundary in this instance.

The spatial distribution of other indicative LAeq(1h) noise contours is shown in Technical Report D Figure 12 (page 38). To aid reading of this figure the data has been reproduced at a larger scale and is attached as Figures 2 to 7. The range of noise contours shown is from 65 dB to 45 dB. Beyond this range contours are either within the site or extend over too great a distance for meaningful predictions.

Request 12

Given the different character of effects associated with the mitigation measure, please provide additional modelling of the acoustic screen height for daytime and night-time activity levels at the following height scenarios: (i) no bund or barrier; (ii) 3 m screen; (iii) 5 m screen.

Response

The key site boundary where this issue is relevant is the east, due to the proximity of houses to the operational site and the relatively high (5m) indicative barriers modelled on this boundary. To the north, there is complex terrain and the barriers proposed are at varying heights above ground level, for example resulting in a top height 3 metres above local ground level but 8 metres above the Freight Hub.

For the east boundary Technical Report D has figures showing noise levels with no barriers (Figure 9, page 29) and 5m high barriers above the Freight Hub (Figure 12, page 38). Modelling has also been conducted to evaluate other height barriers including 3m high barriers. That model for a 3m high barrier has been updated to use the same site layout and assumptions as shown in Technical Report D Figures 9 and 12. Based on this information a comparison of sound levels with no barriers, 3m high

barriers and 5m high barriers on the east boundary is shown in the attached Figures 8 to 10. For other site boundaries indicative barriers modelled in Technical Report D Figure 12 are conventional heights (up to 3m high) so a similar comparison is not necessary.

Request 13

The height of the acoustic screen is taken from the Regional Freight Hub side. Please provide additional sections through the high points on Sangsters Road, e.g. 27 & 91 Sangsters Road.

Response

Cross sections through the acoustics model are provided in the attached Figure 11. The horizontal alignment of the barrier top will vary to integrate with the engineering and landscape design, and that developed terrain contours have not been included. These cross sections are only relevant for acoustics modelling.

Request 14

Please provide the predicted noise levels for individual dwellings or representative groups of dwellings with the predicted levels for the various scenarios (i.e. for the different screen heights). Sites on which dwellings can be constructed as a permitted activity and commercial buildings also need to be identified.

Response

To aid reading of Technical Report D Figure 12 (page 38) the data for the scenario with noise barriers has been reproduced at a larger scale in the attached Figures 2 to 7. The indicative sound level has been annotated on each building that has been assumed to be a house. At this stage houses near the site have been identified from inspection of aerial photographs.

There is the potential for an additional dwelling as a permitted activity in most of the immediate surrounding rural zone sites as they are all over 20ha in size. In terms of the residential zone, there are two sites south of Maple Street and a number of sites to the North of Maple Street that could have an additional dwelling as a permitted activity. No houses can be constructed as a permitted activity in the NEIZ.

Request 15

Please provide the addresses of dwellings or groups of dwellings within the 50 metre and 200 metre buffers illustrated in Figure 11 of the Acoustic Assessment for construction noise impacts.

Response

The relevant addresses can be identified using the data contained at Figure 11 of Technical Report D. To aid reading of Technical Report D Figure 11 (page 33) the data has been reproduced at a larger scale in the attached Figures 12 to 17.

Request 16

Please confirm whether the proposed acoustic bund/wall will provide mitigation for the upper level of these residences and if not, what will the significance of effect be on these three residences?

Response

An upper floor of the existing dwellings in this area would be likely to overlook the proposed bund by Maple Street. If it is determined through further investigation that the Category A criteria would be exceeded at the upper floor then it would need to be investigated to determine if acoustic treatment is required, as set out in Technical Report D page 38.

Request 17

Assumed noise measures in the Acoustic Assessment include quiet road surfacing measures (stone mastic asphalt). What precisely will the road surfacing material be and where should this surfacing start and finish?

Response

As set out in Technical Report D page 29, it has been assumed that the entire alignment of the new perimeter road would have an asphaltic mix surface for engineering reasons rather than on the basis of noise reduction. The acoustics assessment has been based on any asphaltic mix surface, with stone mastic asphalt being used in the calculations to provide representative levels. The actual surface to be used would be determined during detailed design.

Request 18

There are no NPS or NZS criteria for operational noise controls and the Acoustic Assessment derives 'Recommended Noise Criteria' in Table 5. In relation to the Categories (A, B and C):

Request 18(i)

Did the development of the criteria take into account the Residential Zone of Bunnythorpe?

Response

Yes. As set out in Technical Report D Section 4 (pages 16-18), the District Plan noise limits for sound received in the residential zone were explicitly considered.

Request 18(ii)

Did the development of the criteria take into account the noise limits of the adjacent Rural Zone?

Response

Yes. As set out in Technical Report D Section 4 (pages 16-18), the District Plan noise limits for sound received in the rural zone were explicitly considered.

Request 18(iii)

At page 19 it is specified that no corrections for Special Audible Characteristics (SACs) were made for railway activity such as impulsive noises associated with shunting. Why not?

Response

Railway activity inherently includes sounds that might be judged subjectively as having special audible characteristics. Given that this is likely to depend on an individual subjective judgement it could create uncertainty and ambiguity in future. Therefore, in the same manner as NZS 6807 for helicopters, it is proposed that the criteria for the Freight Hub are not subject to additional adjustment for special audible characteristics.

Request 19

Please list any/all railway activities in the railway yards (e.g. possibly shunting, reversing beepers on forklift trucks, the log yard or roots blower noise) that would have special audible characteristics?

Response

As discussed above, it is likely to be dependent on individual subjective judgements as to whether various sources would be deemed to have special audible characteristics. Some assessors could judge various sources to have special audible characteristics such as container handling and shunting/train movements.

Request 20

Is noise to be assessed in accordance with NZS 6801 and NZS 6802? If the answer is no, please explain why the standard is not appropriate, and identify which standards should be applied?

Response

Sound would be measured in accordance with NZS 6801:2008 without modification.

Sound would be assessed in accordance with NZS 6802:2008 subject to the matters set out at the top of page 19 of Technical Report D. In terms of the basic assessment the main points are that there would not be adjustments for special audible characteristics or duration (which work in opposite directions), for the reasons set out above.

Request 21

Please provide noise measurements or predictions for: (i) the noise of shunting rolling stock (including short term impulsive noise of the freight wagon couplings on small shunts); and (ii) starting, stopping (braking) noise of assembled trains.

Response

Sound source data is presented in Technical Report D Table 10. The first row of Table 10 on page 24 includes data for rail movements. As noted in the table, the locomotive noise is dominant and similar whether idling or moving.

Data is provided for brake squeal that was observed when trains stop and also for release of air hoses when separating wagons.

During four surveys conducted at four different sites no trains were observed being assembled so sound levels are not available for that source. Based on the other measurements, the same locomotive noise is expected to remain the dominant source during assembly of trains.

Request 22

Has the potential for refraction caused by Palmerston North's predominant westerly winds been taken into account in relation to the 5 metre continuous barrier on the eastern boundary? How might refraction in this location impact the effectiveness of the barrier?

Response

As set out in Table 9 of Technical Report D, the computer noise model has used the ISO 9613 algorithm for sound propagation. This is a conservative approach as it represents downwind conditions in all directions (whether or not a barrier is present). Therefore, the model is appropriate for a predominant westerly wind at this site.

As shown in attached Figures 8 to 10, the proposed noise barriers primarily benefit the nearest houses. Noise propagation is affected by wind mainly over longer distances. At nearby houses where the modelled barrier has a material effect, any wind effect should be minor.

Request 23

Please provide an assessment of noise from future traffic flows at expected full-build

Response

The traffic data for 2041 with and without the full implementation of the Freight Hub has been reviewed on the basis there would not be wider network improvements such as a regional ring road. The same criteria for identifying affected sections of road have been used as set out on page 30 of Technical Report D; a 50% increase in overall traffic or 100% increase in heavy vehicles. With these criteria the same three sections of road are identified with 2041 data as those set out in Table 13 using 2031 data. In addition to these three sections, Railway Road south of the site might also have an increase in heavy vehicles greater than 100% due to the Freight Hub in 2041. However, this increase on Railway Road is in the context of a high overall traffic flow in an area that is generally not noise sensitive.

The traffic forecast (as amended in response to section 92 questions) show a greater number of heavy vehicles using Roberts Line and Kairanga Bunnythorpe Road in 2041 than previously assessed. As discussed on page 36 of Technical Report D, this route has already been identified in the District Plan as a strategic route for freight movements so noise associated with this traffic volume should be reasonably expected in this environment.

Therefore, the assessment of off-site road-traffic noise effects in Technical Report D remains appropriate.

Request 24

What temporary mitigation measures are available (if any) for this phase to protect sensitive receptors on the eastern boundary of the Regional Freight Hub during these construction activities?

Response

While there are substantial earthworks required, these occur across a wide area and would only be in proximity of any particular house for a small portion of the time. As set out on pages 34 and 35 of Technical Report D, given the nature of the works and separation distances from houses, compliance with the construction noise limits (Technical Report D, Table 7) should be maintained. This might require limitation of some works to daytime hours, temporary screening and use of lower powered equipment for some works, which can be managed through the proposed Construction Noise and Vibration Management Plan under the proposed designation conditions.

Request 25

If existing vibration levels are to be relied upon as a baseline at any dwellings, then please undertake vibration monitoring of the existing NIMT line at those dwellings.

Response

Existing vibration levels are not being relied on as a baseline for the Freight Hub. As set out on page 32 of Technical Report D, while there should be a reduction in vibration associated with NIMT, as it is on a level formation further from houses, this is separate to vibration from the Freight Hub. Vibration from the Freight Hub (excluding the NIMT) should comply with the 0.3 mm/s_w,95 criterion.

Request 26

What is "this environment" as referred to in this conclusion?

Response

This refers to the existing environment described in Section 3 of Technical Report D.

Request 27

What changes will occur to noise levels on the NIMT line north of the Regional Freight Hub as trains approach and pass through Bunnythorpe, e.g. would additional brake squeal occur that would increase nuisance noise? How would this be mitigated?

Response

As set out on page 7 of Technical Report D, noise from train activity in the NIMT has been excluded from the assessment, as that activity is separately authorised under the existing NIMT designation.

Some Southbound trains on the NIMT may need to slow down in advance of Bunnythorpe if entering the Freight Hub to use the Hub. Some trains will also simply continue to pass through using the NIMT as they do now. In the context of existing authorised use of the NIMT through Bunnythorpe, trains travelling slower on route to the Freight Hub are likely to have a similar noise effect in Bunnythorpe as is currently authorised by the existing designation.

Request 28

Is it intended that any shunting will occur on the NIMT, outside of the proposed designation? If yes, has that been taken into account in the noise assessment?

Response

The Freight Hub has been designed so that most movements can be accommodated within the site, but there is provision for a 'back shunt track' to the south of the site. This track would be entirely accommodated within the existing NIMT designation. As discussed above, noise effects of train activity in the NIMT has been excluded from the assessment.

Request 29

What does practicable mean in this context (for example, see page 20), and how will practicability of potential mitigation options be assessed?

Response

The term 'practicable' has been used in Technical Report D in the same context as included in the definition of 'best practicable option' in section 2 of the Resource Management Act 1991 (RMA) as meaning the best method of preventing or minimising the adverse effects on the environment. In terms of the example stated on page 20, the reference is to road-traffic noise where NZS 6806 also explicitly adopts the definition from the RMA. In terms of noise emission, the best practicable option must achieve a reasonable level of noise. What is practicable in the circumstances is a factual inquiry. In the RMA context, "practicable" has been held to mean possible of being accomplished within known means and resources, and enables consideration of a range of factors, including costs. The practicability of mitigation options will therefore be assessed in terms of what is the best method for managing the adverse effects on the environment, having regard to relevant considerations such as the cost and effects of that option on the environment.

Request 30

Please identify what practicable adaptations or refinements to the site layout were recommended to reduce noise emissions?

Response

Adaptations to the site layout that were beneficial in terms of noise and vibration are listed on page 6 of Technical Report D. These are:

- The marshalling yard and container terminal are as far south on the site as possible such that they are furthest from residential areas of Bunnythorpe and towards the NEIZ.
- The warehouse buildings are a continuous built form providing noise screening to the west, rather than being discrete buildings with gaps between.
- The NIMT is moved west allowing space for a high noise barrier and associated planting for visual treatment along the east boundary of the Freight Hub (and NIMT).
- Land behind houses on Maple Street has been included in the Designation Extent so that noise mitigation can be located close to the houses where it will be most effective.
- The new perimeter road reconnects to the existing Railway Road at Maple Street which avoids redistribution of traffic on minor roads around the west of Bunnythorpe.
- The log yard has been positioned to the west Freight Hub boundary away from houses on Maple Street.

Request 31

The following questions concern general good practice to be addressed in the Noise Management Plan:

Response

The Freight Hub is a relatively large site that will develop over time and will have varying activity. As such, it is not akin to a fixed industrial process plant that can be designed, commissioned and then operated at a relatively constant sound level. Rather the Freight Hub will require proactive ongoing management to control noise as set out in Section 7 of Technical Report D. The proposed Operational Noise and Vibration Management Plan sets out how a reasonable noise level will be achieved.

Request 31(i)

Is it practicable to avoid the use of tonal alarms at night?

Response

Alarms can provide a vital safety function. In most cases the safety function can be achieved using a broadband rather than tonal alarm. It is therefore generally expected that it would be practicable to avoid tonal alarms, but this might depend on specific circumstances.

Request 31(ii)

Is a swing nose crossing practicable?

Response

Use of swing nose crossings is not standard on the KiwiRail network. It is understood that an alternative of a flange running frog has been used in special circumstances. As such, the practicability of crossing types would need to be determined during the detailed design.

Request 31(iii)

Is it practicable to maintain the couplings on the general freight wagons in line with these noise mitigation requirements?

Response

KiwiRail uses auto-couplings. The reference in Technical Report D (page 39) to keeping couplings tight is therefore erroneous in that context. With respect to avoidance of loose shunting, it should generally be practicable to avoid uncoupled shunting and this is required not only for noise management purposes but also for safety reasons. However, there may be occasions when uncoupled shunting cannot be avoided, particularly in relation to the workshops.

Request 31(iv)

Will internal container handling areas and vehicle circulation areas be sealed?

Response

As in the response to question 17 above, the appropriate road surfaces will be determined at the detailed design stage. This assessment has been prepared on the basis that the internal circulation and container handling areas will be designed to minimise body noise from vehicles passing over them as far as practicable.

Request 31(v)

Would the noise insulation investigation for dwellings include ventilation?

Response

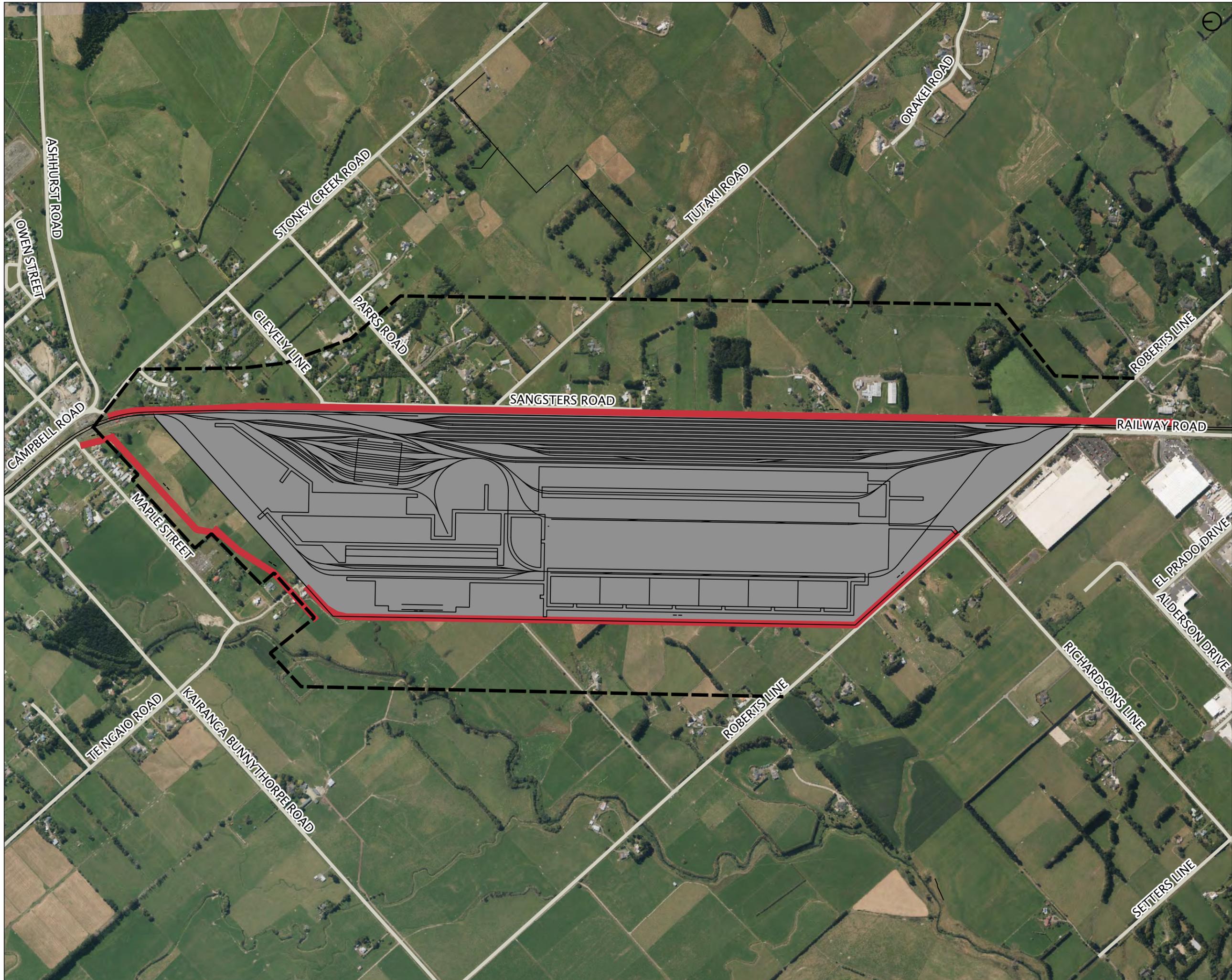
Mechanical ventilation would be included if windows need to be kept closed to achieve reasonable internal sound levels. The Operational Noise and Vibration Management Plan will outline the outcome of investigations of existing dwellings and any treatment that is determined necessary for dwellings that are predicted to exceed the Category A criteria.

Request 31(vi)

Are two permanent noise monitoring locations adequate for an operation of this size?

Response

Two permanent noise monitoring locations are considered appropriate for an operation of this size, given the extensive noise barriers proposed and separation from most houses. Additional temporary monitoring might be required and is provided for under the Operational Noise and Vibration Management Plan.



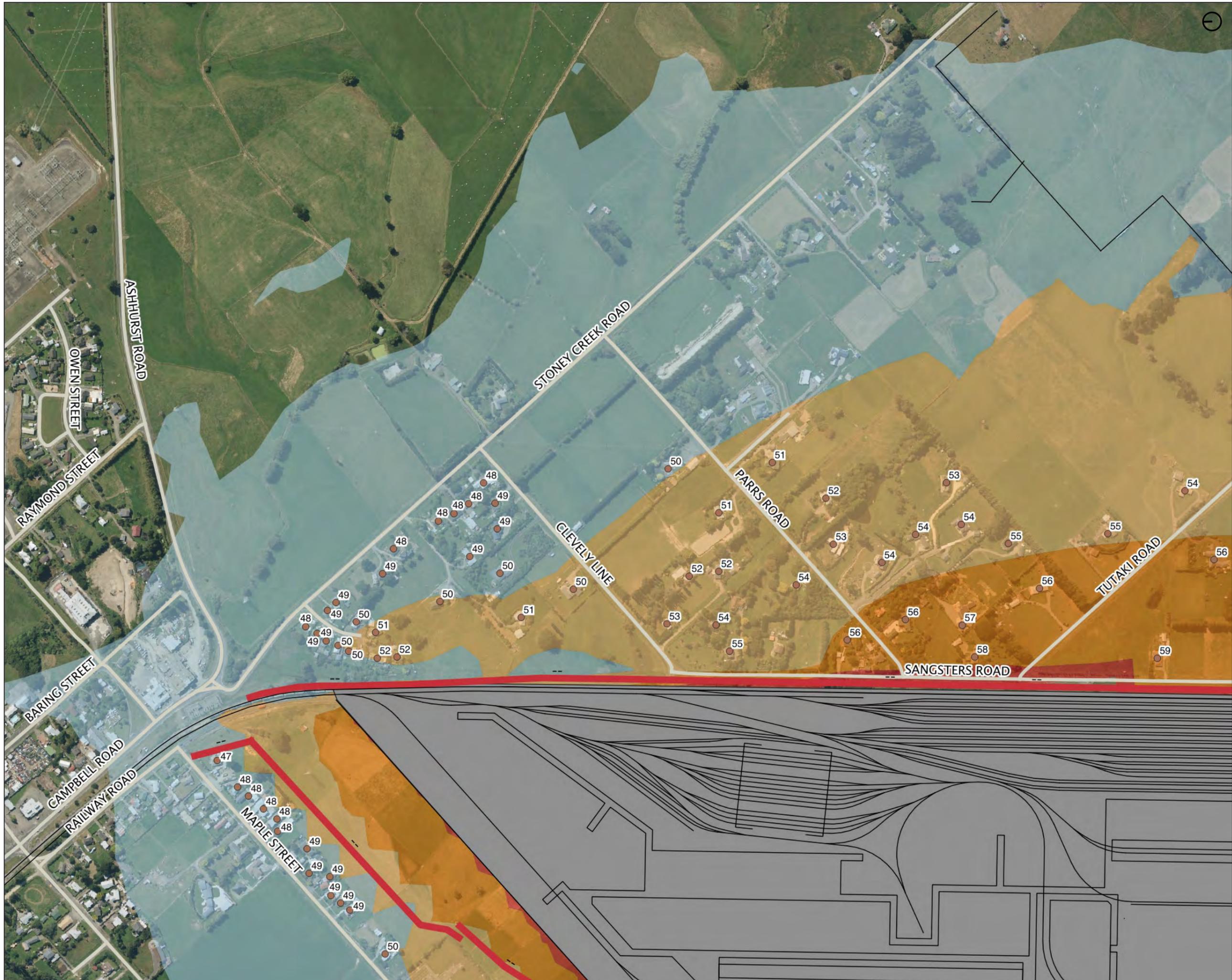
Legend

-  Boundary
-  Noise wall

Scale: 1:10000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 1
 Proposed Noise Management Boundary

Drawn: MS
 Date: 26 Jan 2021



Legend

■ Noise wall

Noise contour, LAeq(1h)

- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

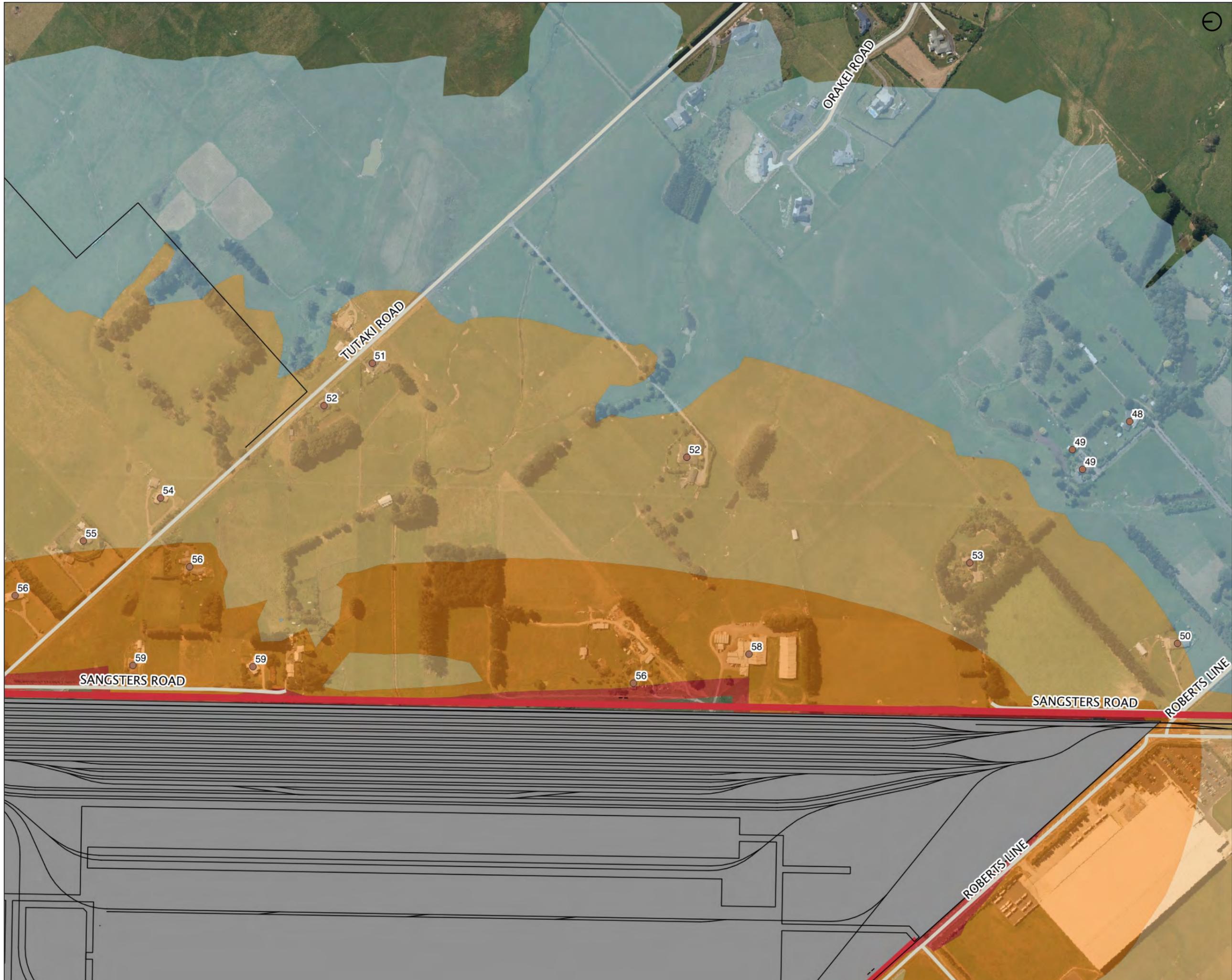
Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 2

Indicative operational noise with noise barriers (Technical Report D Figure 12)

Drawn: MS

Date: 26 Jan 2021



Legend

Noise wall

Noise contour, LAeq(1h)

- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

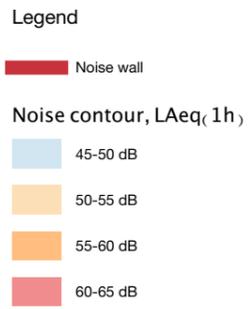
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Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 3

Indicative operational noise with noise barriers (Technical Report D Figure 12)

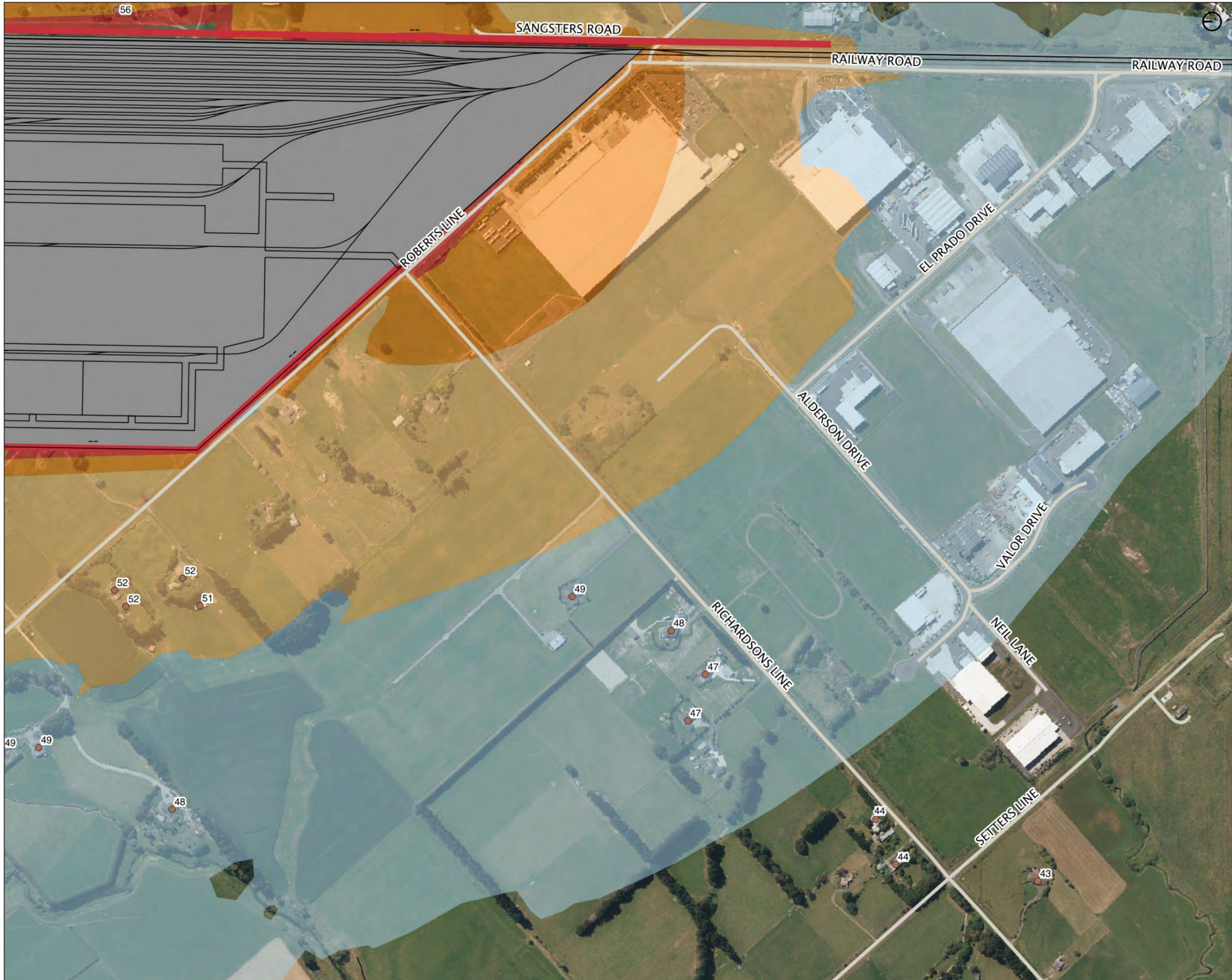
Drawn: MS

Date: 26 Jan 2021



Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 4
 Indicative operational noise with noise barriers (Technical Report D Figure 12)
 Drawn: MS
 Date: 26 Jan 2021



Legend

- Noise wall

Noise contour, LAeq(1h)

- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 5
 Indicative operational noise with noise barriers (Technical Report D Figure 12)
 Drawn: MS
 Date: 26 Jan 2021



Legend

■ Noise wall

Noise contour, LAeq(1h)

■ 45-50 dB

■ 50-55 dB

■ 55-60 dB

■ 60-65 dB

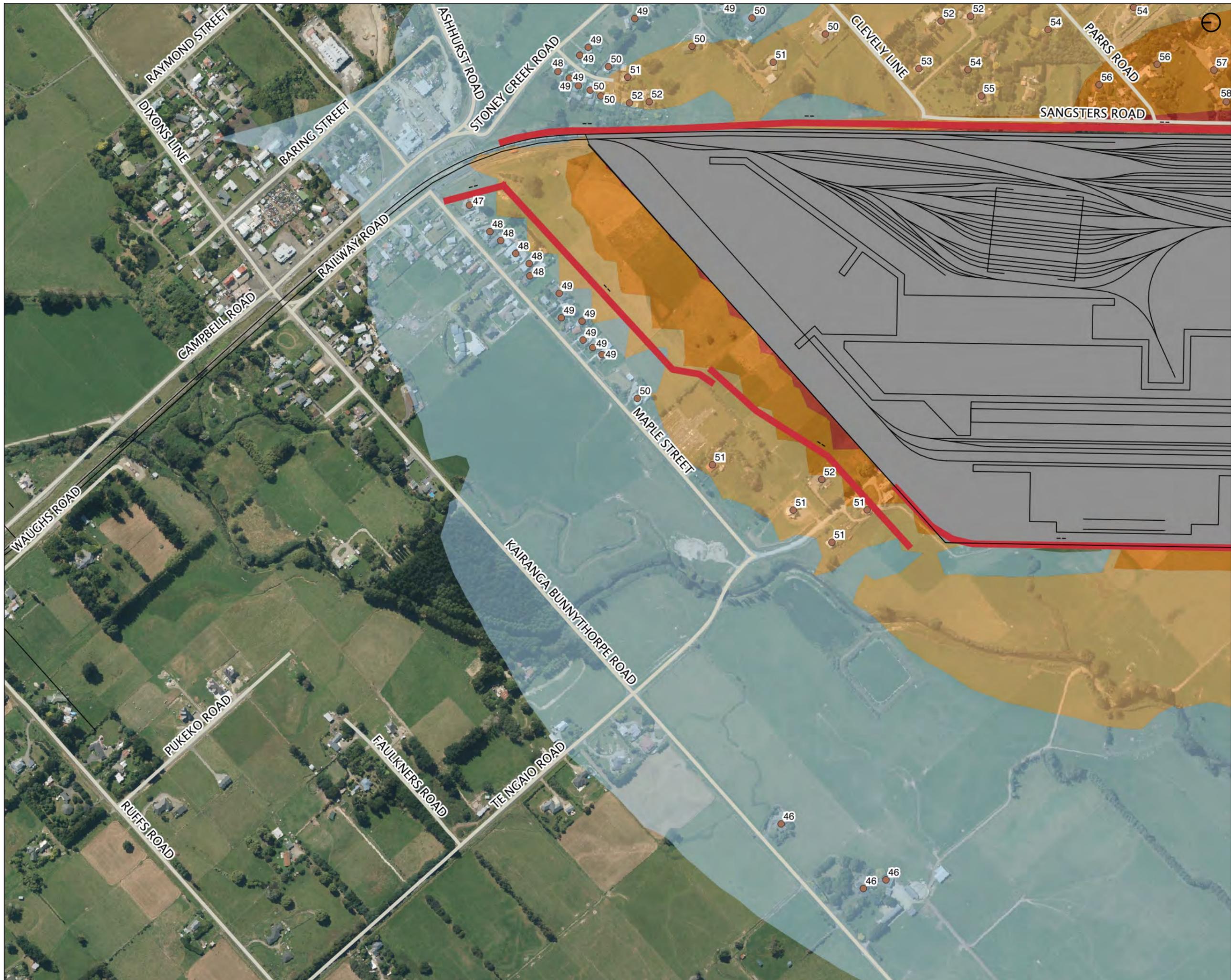
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Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 6

Indicative operational noise with noise barriers (Technical Report D Figure 12)

Drawn: MS

Date: 26 Jan 2021



Legend

- Noise wall
- Noise contour, LAeq, 1h,**
- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 7
 Indicative operational noise with noise barriers (Technical Report D Figure 12)
 Drawn: MS
 Date: 26 Jan 2021



No specific noise mitigation



3m high noise wall



5m high noise wall

Legend

— Noise wall

Noise level, LAeq(1h)

- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

Scale: 1:5000

Project: Central North Island Freight Hub
Client: KiwiRail

Title: Figure 8
Comparison of east mitigation options

Date: 27 Jan 2021
Drawn: MS



No specific noise mitigation



3m high noise wall



5m high noise wall

Legend

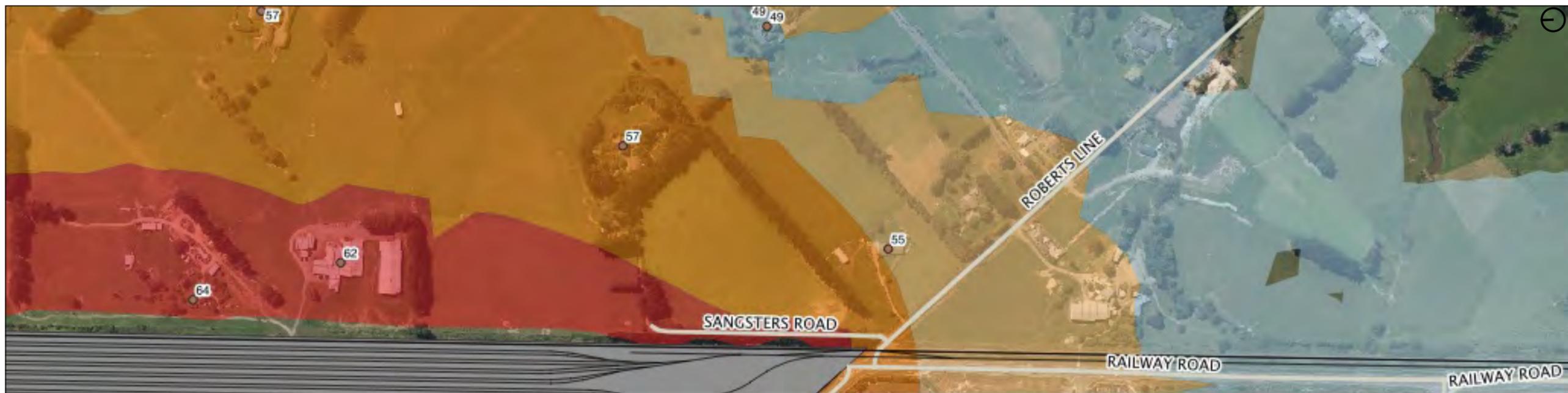
— Noise wall

Noise level, LAeq(1h)

- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 9
 Comparison of east mitigation options
 Date: 27 Jan 2021
 Drawn: MS



No specific noise mitigation



3m high noise wall



5m high noise wall

Legend

Noise wall

Noise level, LAeq(1h)

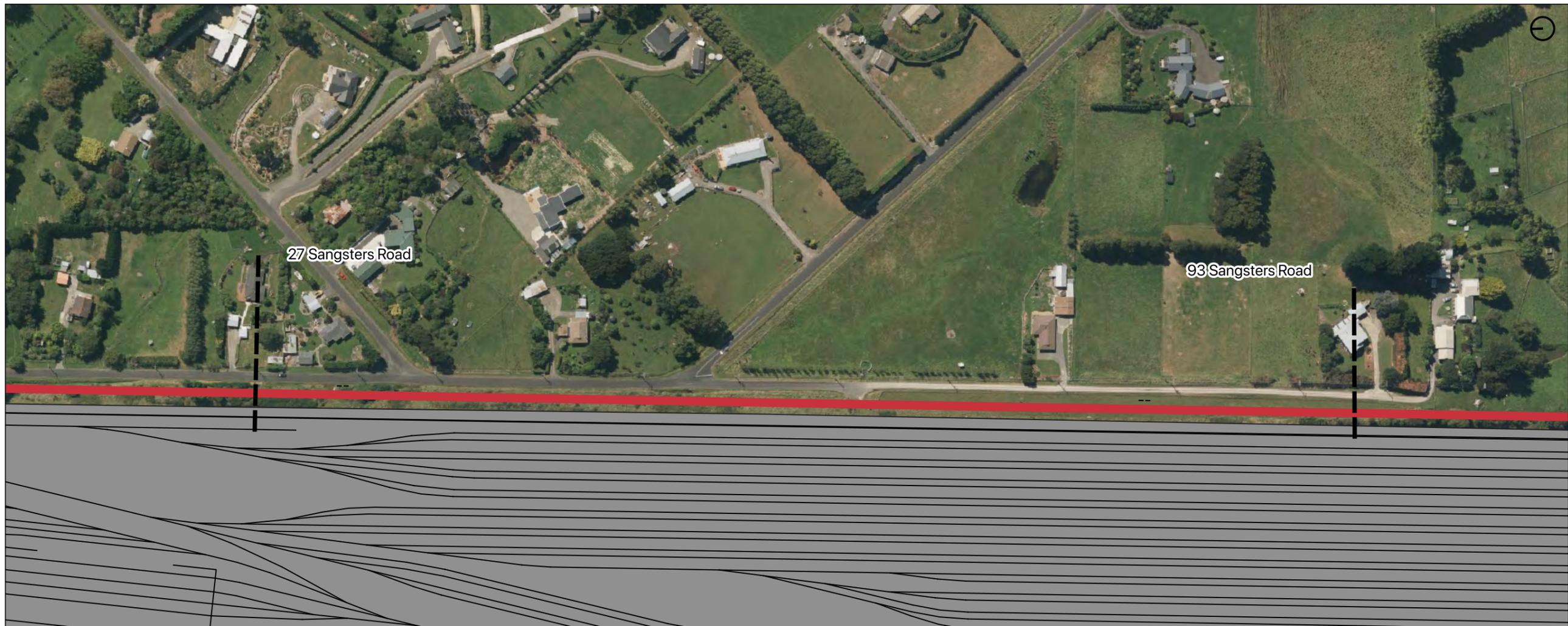
- 45-50 dB
- 50-55 dB
- 55-60 dB
- 60-65 dB

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail

Title: Figure 10
 Comparison of east mitigation options

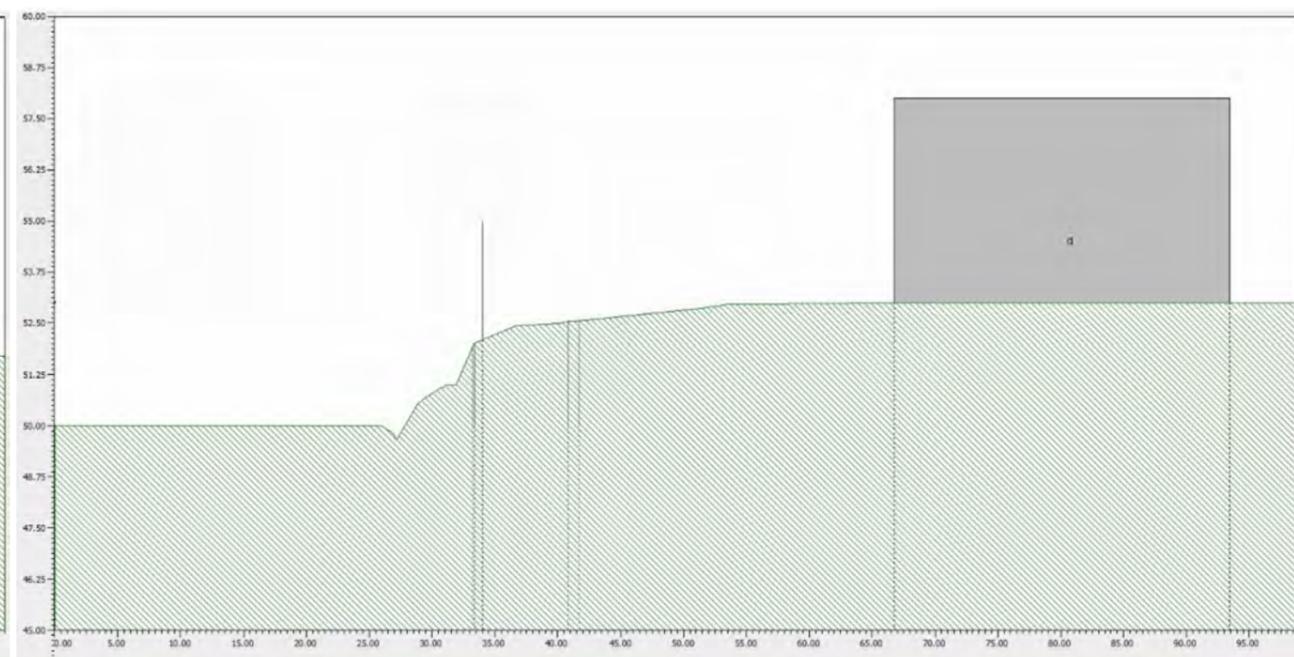
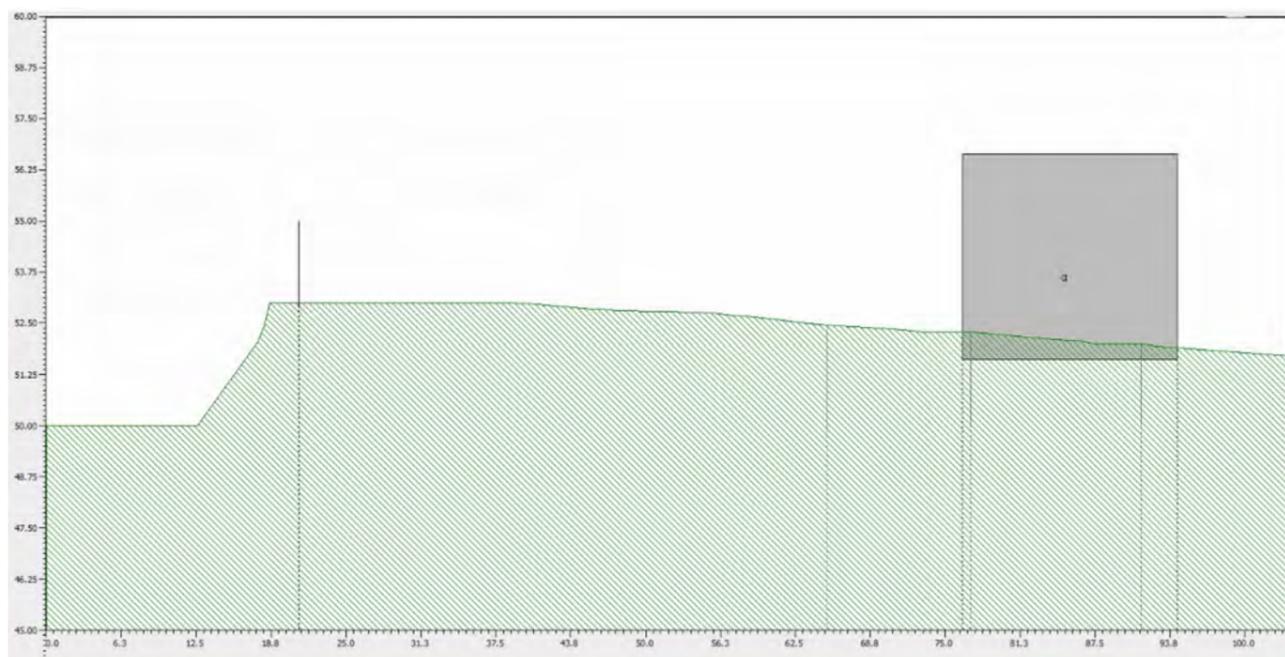
Date: 27 Jan 2021
 Drawn: MS



Legend

— Cross section

█ Noise wall



27 Sangsters Road

90 Sangsters Road

Scale: 1:2500

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 11
 East Noise Wall Cross Sections

Drawn: MS
 Date: 26 Jan 2021



- Legend**
- Designation boundary
 - 50m buffer
 - 200m buffer

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 12
 Construction buffers
 (Technical Report D Figure 11)

Drawn: MS
 Date: 27 Jan 2021



Legend

-  Designation boundary
-  50m buffer
-  200m buffer

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 13
 Construction buffers
 (Technical Report D Figure 11)

Drawn: MS
 Date: 27 Jan 2021



Legend

- Designation boundary
- 50m buffer
- 200m buffer

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 14
 Construction buffers (Technical Report D Figure 11)

Drawn: MS
 Date: 27 Jan 2021



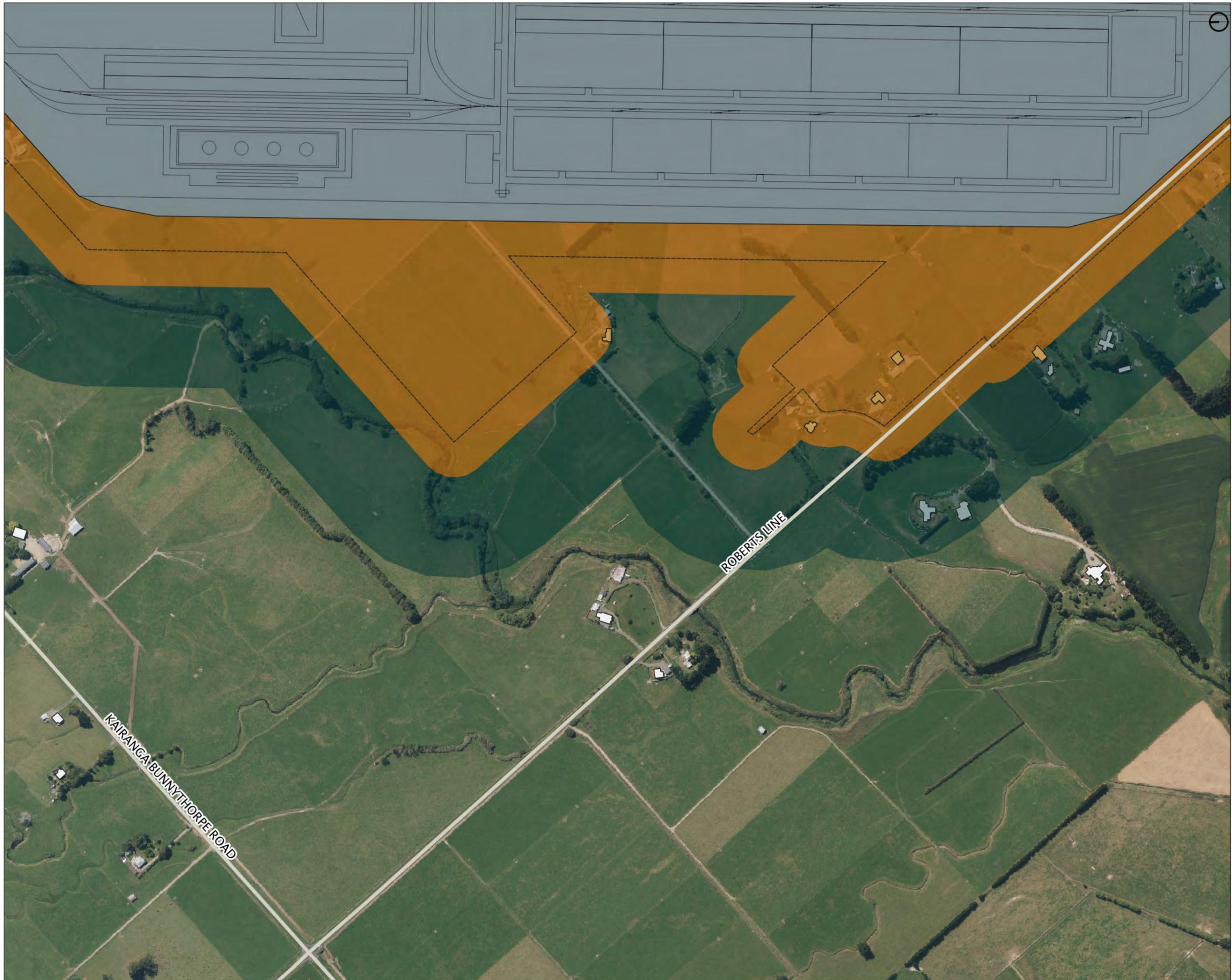
Legend

-  Designation boundary
-  50m buffer
-  200m buffer

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 15
 Construction buffers
 (Technical Report D Figure 11)

Drawn: MS
 Date: 27 Jan 2021



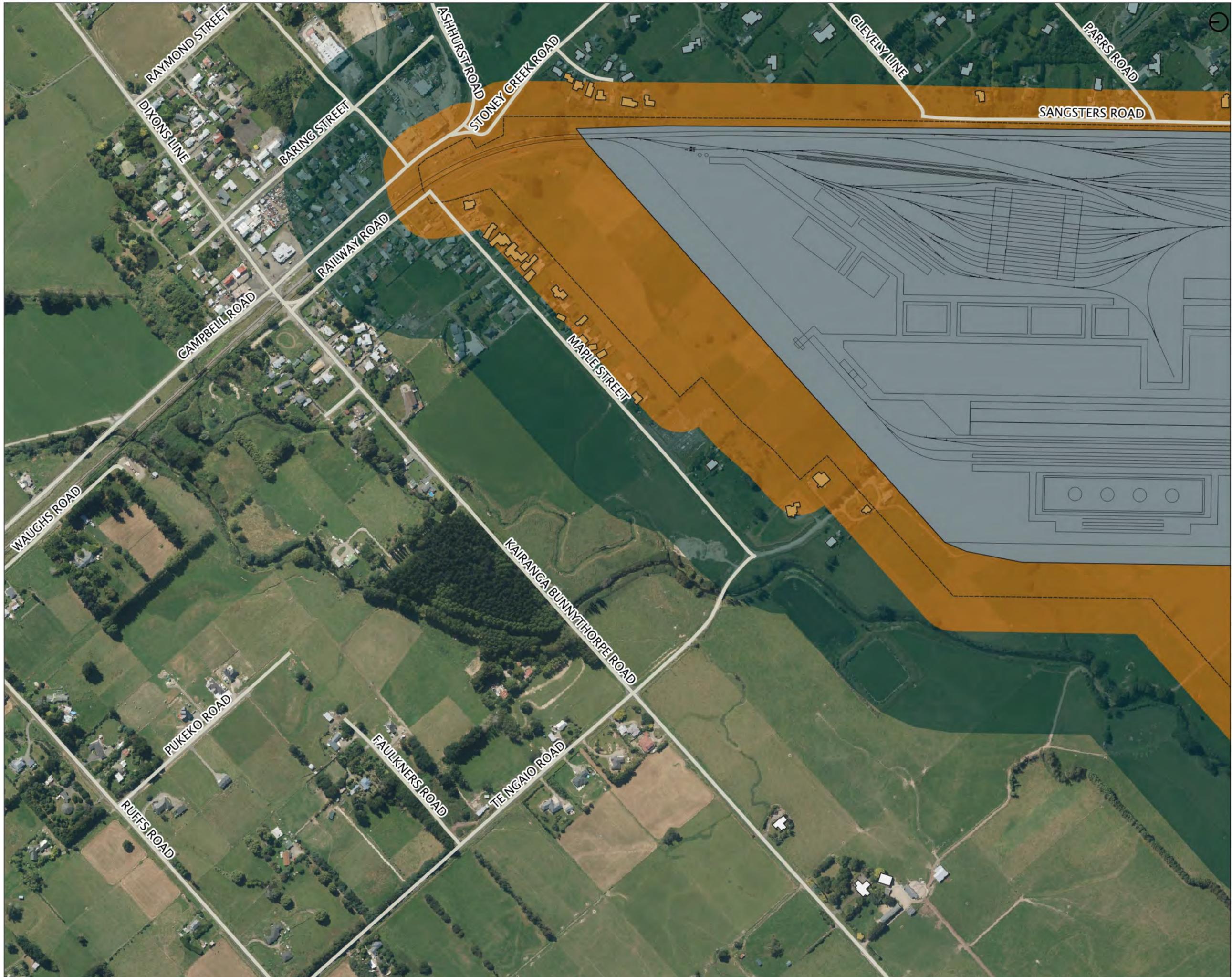
Legend

- Designation boundary
- 50m buffer
- 200m buffer

Scale: 1:5000

Project: Central North Island Freight Hub
Client: KiwiRail
Title: Figure 16
Construction buffers
(Technical Report D Figure 11)

Drawn: MS
Date: 27 Jan 2021



Legend

-  Designation boundary
-  50m buffer
-  200m buffer

Scale: 1:5000

Project: Central North Island Freight Hub
 Client: KiwiRail
 Title: Figure 17
 Construction buffers
 (Technical Report D Figure 11)

Drawn: MS
 Date: 27 Jan 2021