Appendix W Noise Assessment

REPORT

Tonkin+Taylor

Taharoa Ironsands Central and Southern Block Fast Track Application for Mining - Noise Assessment

Prepared for
Taharoa Ironsands Limited
Prepared by
Tonkin & Taylor Ltd
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Executive summary

Taharoa Ironsands Limited (TIL) has engaged Tonkin & Taylor Ltd (T+T) to conduct a noise assessment of mining activities at the existing ironsand mine in Taharoa for the purposes of assessing the effects of the Central and Southern Block Mining Project under the Fast-track Approvals Act 2024 (FTAA). The site is located on the west coast of the North Island, approximately 8 km south of Kawhia Harbour. Mining operations have been ongoing for 50 years.

TIL is seeking resource consent to continue the existing ironsand extraction, concentration, and processing activities in the Central and Southern Blocks under the FTAA.

On 1 October 2024, T+T undertook noise monitoring at noise sensitive receivers (NSRs) near the Taharoa Ironsands mining site. Observations indicated that noise from mining was generally indistinguishable from the existing environmental noise, even during the quietest periods.

Noise modelling results indicate that mining can take place anywhere within the Southern Block without exceeding noise limits at any time.

Mining using existing procedures in the Central Block have a risk of exceeding noise limits when mining occurs on the ridge area at the northern end of the block near three NSRs: New Kana Homestead, Old Kana Homestead, and Wetini Homestead (see Figure 3.4). When mining is taking place in this area, TIL will alter its mining methodology to ensure compliance with the maximum noise levels set out in Table 7.1 of this report. Mining in this area will be limited to daytime hours, 7 am to 7 pm. As works move away from the NSRs and below the ridge line normal 24/7 mining activities may recommence provided that noise monitoring has been conducted to demonstrate that noise limits will be met.

No noise exceedances are predicted during mining at any time within Taharoa township, at Te Kura o Taharoa School, or at the Aaruka Marae and Te Kooraha Marae.

1 Introduction

Taharoa Ironsands Limited (TIL) has engaged Tonkin & Taylor Ltd (T+T) to conduct a noise assessment of mining activities at the existing ironsand mine in Taharoa, located on the west coast of the North Island, approximately 8 km south of Kawhia Harbour.

The mine has been in operation since 1973 (owned by New Zealand Steel until 2017) and spans an area of approximately 1,300 hectares. The mining of ironsand is split into different geographical sections:

1 Northern Block
2 Central Block
3 Southern Block
4 Te Mania Block
5 Eastern Block
6 Pit 1 (located in the proposed Northern Block)

TIL holds a suite of existing resource consents for mining within the Central and Southern Blocks, which were granted in 2006. TIL is now seeking resource consents and other approvals to continue the existing ironsand extraction, concentration, and processing activities in the Central and Southern Blocks under the Fast-track Approvals Act 2024 (FTAA). Mining of the Northern Block will be the subject of a separate application under the FTAA as a listed project. The Te Mania, Pit 1 and Eastern Blocks are authorised by existing resource consents.

This assessment evaluates noise compliance for mining activities proposed in the Southern and Central Blocks. Noise compliance for other mining areas is outside the scope of this report.

2 Site overview

The Central and Southern Blocks are located to the west and south of the village of Taharoa. The approximate locations of the Central and Southern mining blocks, in relation to Taharoa Village, are shown in Figure 2.1.

The local topography of the site is extremely varied, as a result of both mining operations conducted over the past 50 years as well as the natural topography of the area. In many locations, this variation in topography creates natural noise barriers between the works and the surrounding areas.

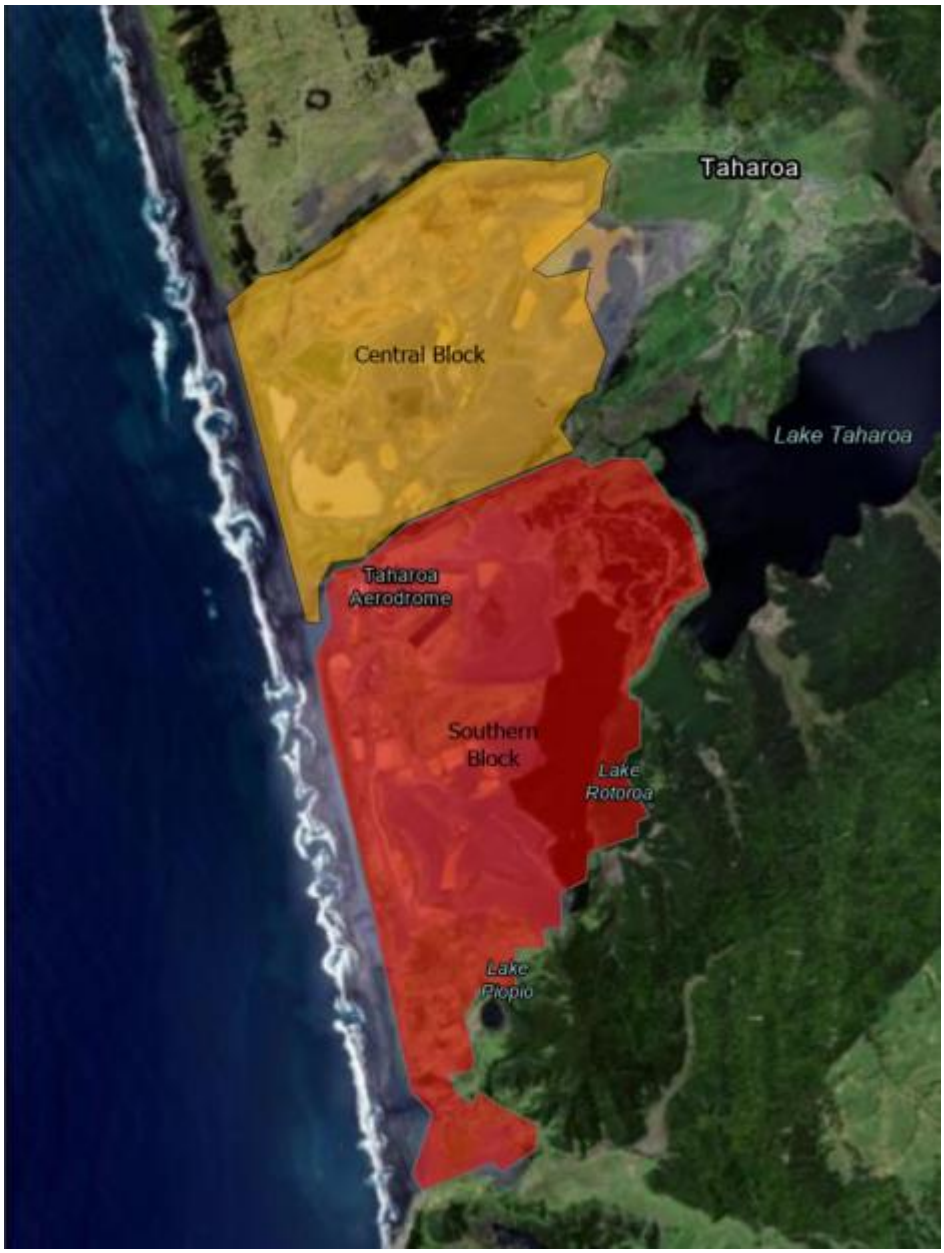

Figure 2.1: Site overview.
Note: Southern and Central Block outlines indicative only.

2.1 Noise sensitive receivers

In addition to the local noise sensitive receivers (NSRs) within the village of Taharoa, there are NSRs located closer to the mining blocks. The three closest NSRs are the dwellings on properties adjoining the mine owned by the Kana and Wetini whanau:

1 Wetini Homestead

2 New Kana Homestead

3 Old Kana Homestead

There are two Maraes at Taharoa:

1 Aaruka Marae – located within township of Taharoa

2 Te Kooraha Marae – located approximately one kilometre north of the Central Block

There is also the Te Kura o Taharoa School located at the western end of Taharoa Road.

The locations of these NSRs are shown in Figure 2.2.

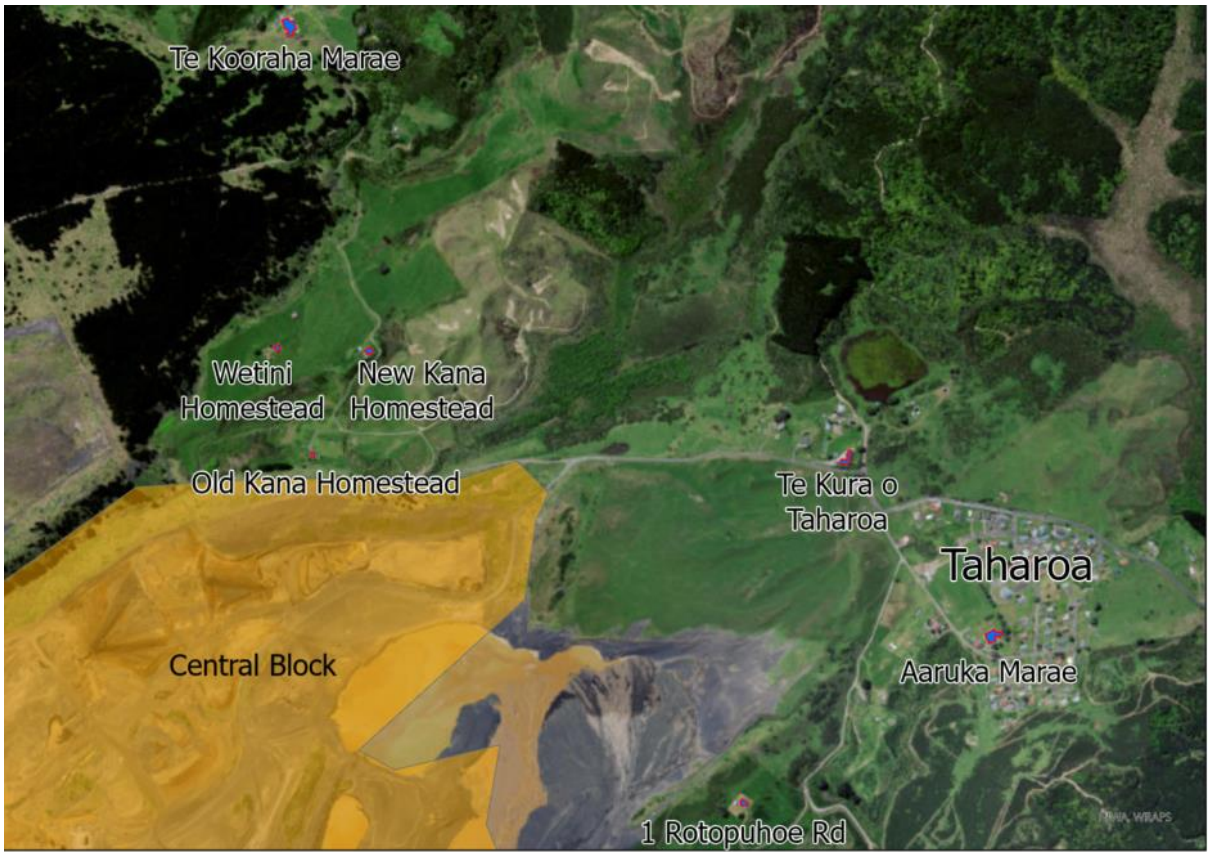

Figure 2.2: Local noise sensitive receivers.
Note: Southern and Central Block outline indicative only.

3 Description of proposed works

The mining process can vary depending on the characteristics of the ironsand deposits. The outline provided below is an overview of the typical process used at TIL.

1 **Vegetation and topsoil removal**
Clearing away existing vegetation. Stockpiling topsoil and vegetation to enable effective reuse in site rehabilitation.

2 **Overburden removal**
Removing non-economic surface materials (e.g. silts and clays) to access ironsand deposits and stockpiling for when post-mining rehabilitation occurs.

3 **Extraction of ironsand**

Ironsand extraction in the upper layers involves the use of standard earthmoving equipment, such as excavators, bulldozers, and trucks. Bulldozers normally operate in pairs: one unit collects and pushes the ironsand into piles within the active mining area, while the second unit pushes the ironsand directly to the Dry Mining Unit (DMU) located near the active mining area. Multiple active mining areas may feed into a single DMU, or a DMU may be dedicated to a specific mining area.

Mining the deeper layers of ironsand involves the creation of water-filled ponds using groundwater and excavators. A diesel-powered suction dredge floats on the water to cut, fluidise, and pump the ironsand slurry through a pipeline to the treatment plant. The dredger is capable of operating at depths of 8 to 15 m below the pond surface. In some instances, a long-reach excavator may also be used to extract material from within the pond.

4 **Processing**
Refining ironsand through mechanical methods (gravity and magnetic separation) without using hazardous chemicals; tailings are stored for rehabilitation, and water is recycled.

5 **Ship loading**
As the site has no natural harbour, ship loading requires the export vessel to be moored offshore at a single buoy mooring (SBM). Export pipelines run from the shore facility to the SBM, which is located approximately 3.5 km offshore. The 12 m diameter SBM is anchored to the seabed by six sets of chains and anchors, each weighing 124 tonnes. Loading at the SBM is restricted to suitable weather and swell conditions. The SBM is designed to allow a moored vessel to rotate freely around its circumference (weathervane) in response to varying wind and tide conditions.

As the vessels are moored 3.5 km offshore, with a minimum of another 2 km to the nearest NSR, ship loading has not been considered further in this assessment, as the noise levels generated by this activity are considered negligible at the nearest NSRs.

3.1 Projected mining sequence

Mining will not occur simultaneously across an entire block. Figure 3.1 to Figure 3.3[1] show the indicative projected mining sequence for the Central Block.

As part of the mining sequence the ridge (or bund) that separates the Central Block from the three closest NSRs (New Kana Homestead, Old Kana Homestead, and Wetini Homestead) will be partially mined. The ridge mining area is shown in Figure 3.4. A ridge of approximately 55 m in height will remain after mining between the Central Block and these NSRs. The approximate change in topography before and after the ridge mining is shown in Figure 3.5.

The sequence of mining shown in Figure 3.1 to Figure 3.3 indicates that once the mining of the ridge is completed, operations will begin winding down in the location closest to the three NSRs. Consequently, noise levels from mining activities are expected to decrease for these NSRs.

Figure 3.6 shows the proposed mining areas and sequence in the Southern Block. Figure 3.7 shows areas where mining maybe expanded into within the Southern Block.

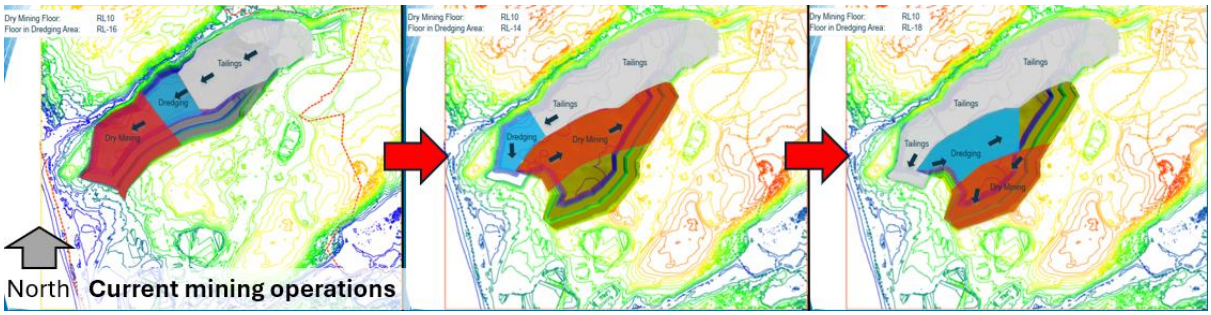

Figure 3.1: Proposed Central Block mining sequence 1.

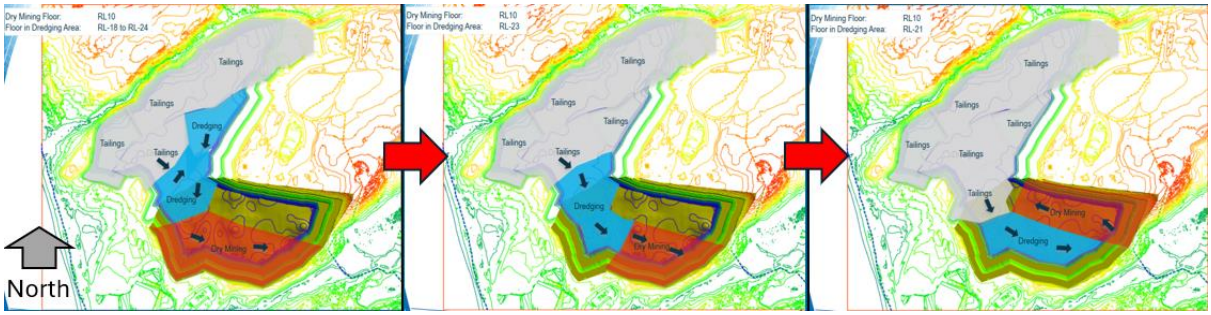

Figure 3.2: Proposed Central Block mining sequence 2.

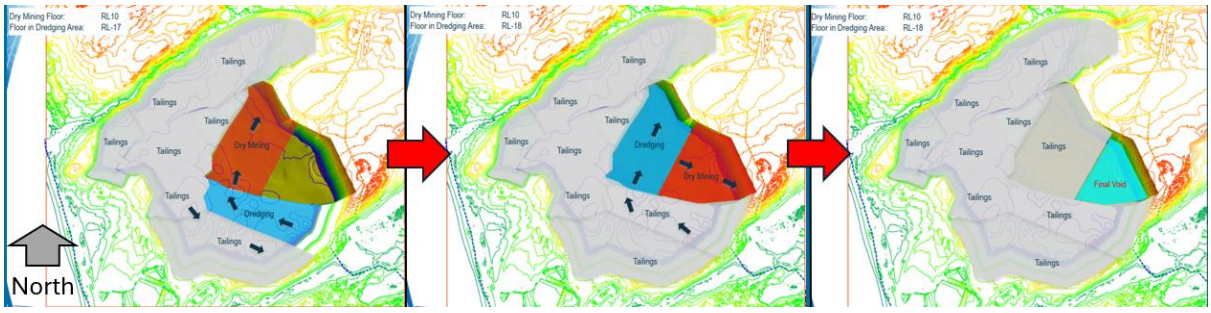

Figure 3.3: Proposed Central Block mining sequence 3.

[1] Sequence provided by "*Mining Sequence and Dredge Path Central Taharoa - Preliminary View*" Taharoa Mine – TIL – 4/2/2025.

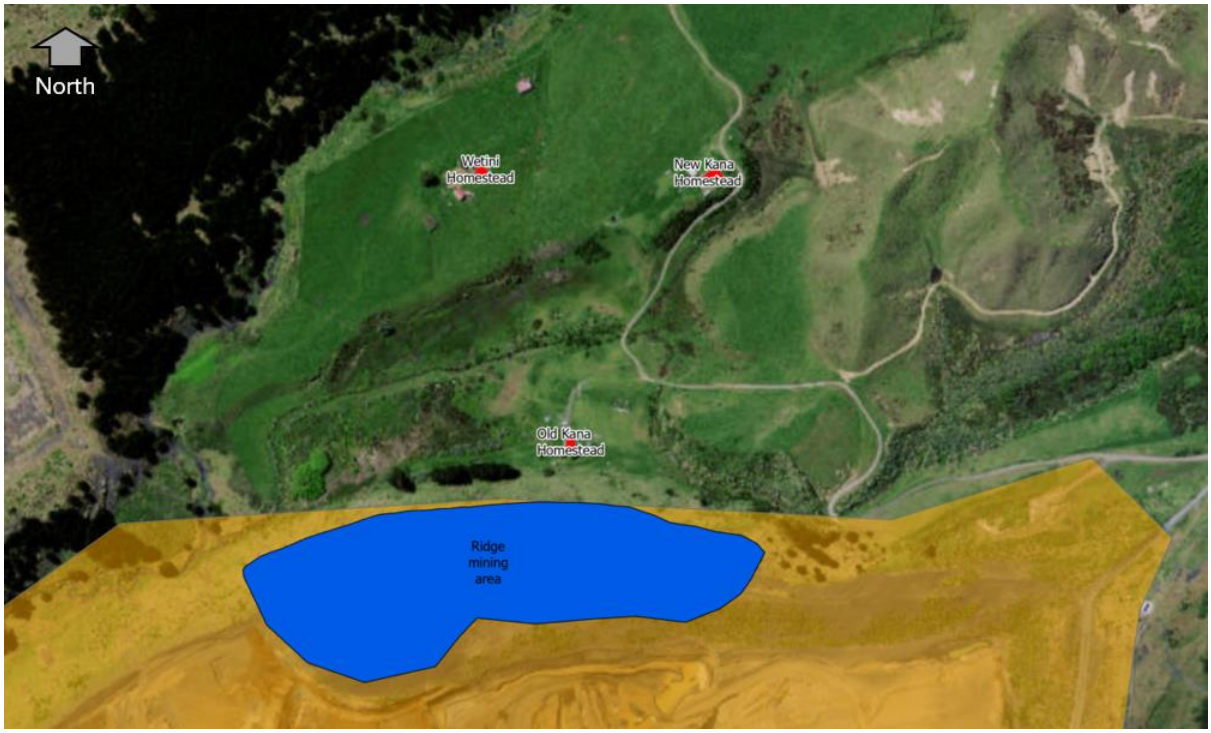

Figure 3.4: Ridge mining area.
Note: Central Block outline indicative only.

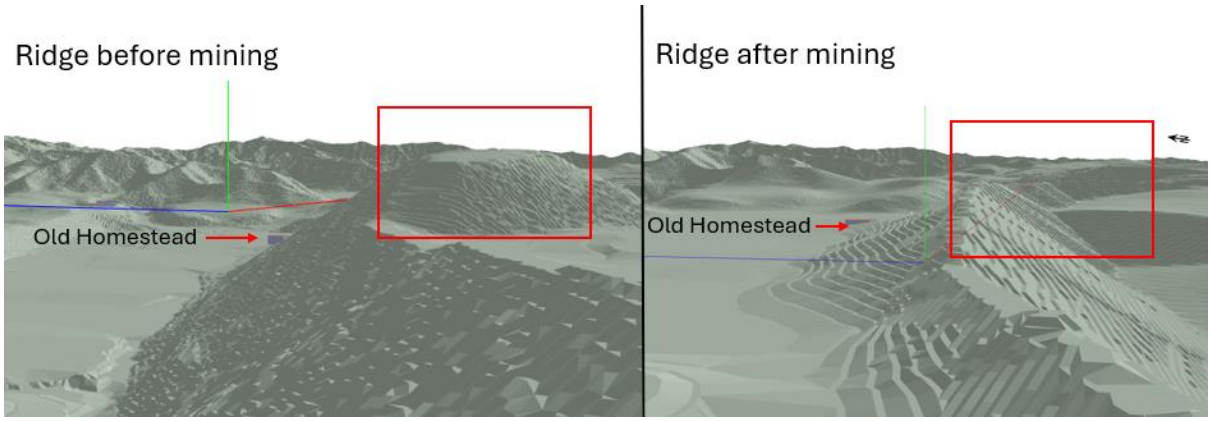

Figure 3.5: Topography changes following ridge mining.[2]

[2] The blue, green and red straight lines are vertical and horizontal axis within the 3D model. The variation in the contours on the Old Kana Homestead side of the ridge is due to the resolution of the contour data. No mining is proposed on the side of the ridge nearest to the Old Homestead.

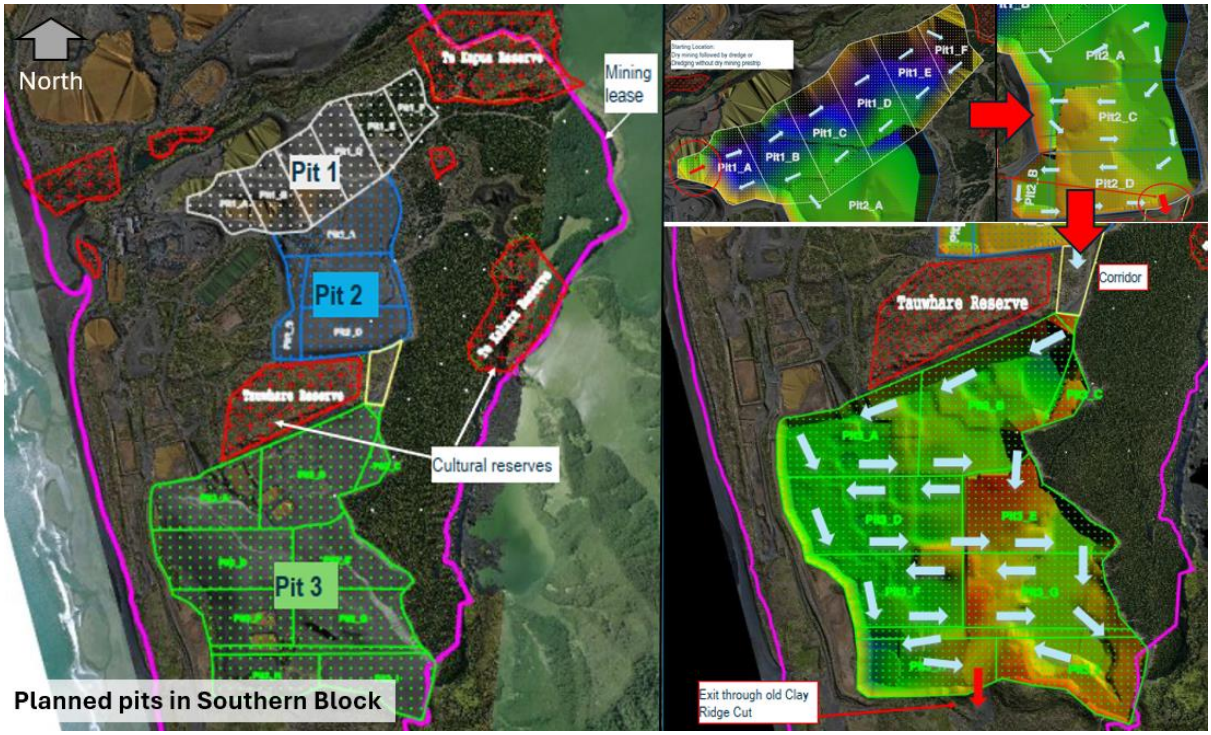

Figure 3.6: Planned pits and mining sequence in Southern Block.

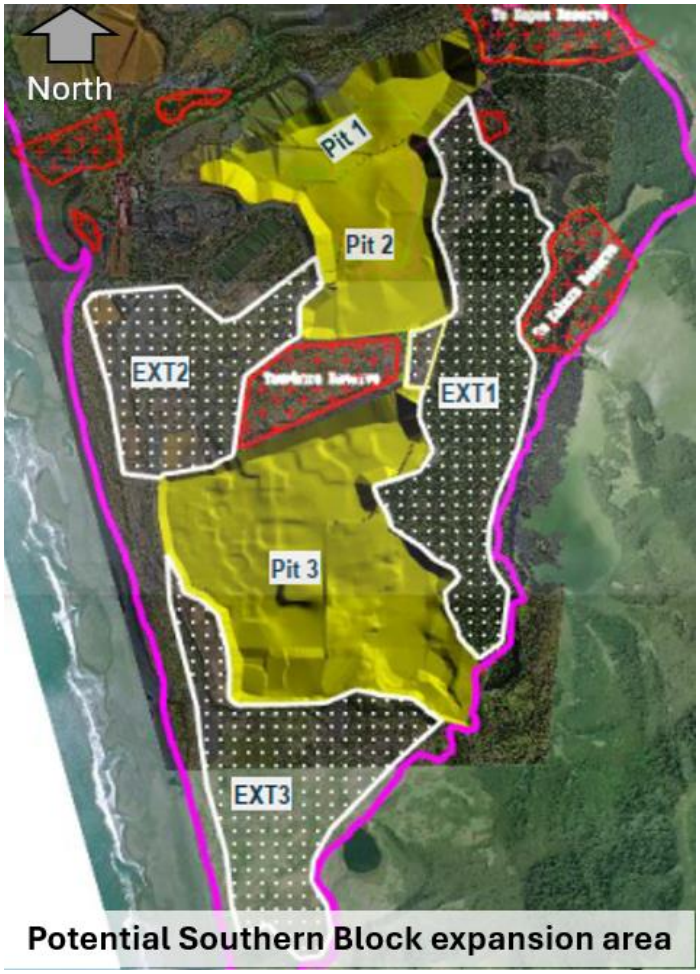

Figure 3.7: Potential Southern Block extended mining areas.

3.2 Hours of operation

Mining occurs 24 hours a day, seven days a week.

The exception will be mining along the ridge between the Central Block and the Old Kana Homestead. In this area, mining will occur between 7 am to 7 pm until operations progress below the ridge line and out of sight of the NSRs. Section 8.1 provides further details on work hour limitations for this phase of the project.

4 Noise criteria

4.1 Legislative framework

When considering a resource consent application under the FTAA, including conditions, the panel must take into account:

1 The purpose of the FTAA.

2 The provisions of Parts 2, 3, 6 and 8 to 10 of the Resource Management Act 1991 (RMA) that direct decision making on an application for resource consent (but excluding section 104D of that Act).

3 The relevant provisions of any other legislation that directs decision making under the RMA.

Relevant to this report, an application for resource consent under the FTAA must include an assessment of the activity against section 5 of the RMA, an assessment of the activity against relevant planning instruments under the RMA and an assessment of the activity's effects on the environment.

The purpose of the FTAA is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits.

4.2 Operational noise limits

The ironsand mine is located within the Operative Waitomo District Plan (OWDP) area. The OWDP will be superseded by the Proposed Waitomo District Plan (PWDP) which has been notified but does not yet have legal effect in terms of the noise rules.

The relevant noise limits can be found in section 20 of the OWDP. The table in Section 20.5.1 has been reproduced in Table 4.1. While the mine site itself is zoned Industrial in the OWDP and Rural Production Zone[3] in the PWDP, the three nearest NSRs (Wetini homestead, New Kana Homestead, Old Kana Homestead) are within the Rural Zone in the OWDP. These noise limits apply at the notional boundary (20 m from the façade) of the NSR.

Table 4.1: Noise limits from OWDP

Zone	Maximum noise level for the assessment period (dB)	
	Day LA10	Night LA10
Rural	50	40

Note: As the nearest receivers are within the Rural Zone, noise limits for other zones have not been included.

Daytime is defined as 7 am to 10 pm from Monday to Saturday and 8 am to 5 pm on Sundays and public holidays. Times outside these periods are defined as night-time. Section 20.5.1.1 of the OWDP states that no noise event shall exceed 70 dB LAmax at night.

While the noise chapter of the PWDP currently does not have legal effect, the noise standards from the PWDP are still considered relevant to this assessment as they indicate the likely future noise limits. Consistent with the OWDP, the nearest NSRs are in the General Rural Zone.

The relevant noise limits from NOISE-R10 'Noise standards for general rural and future urban zones' have been reproduced in Table 4.2 below. An evening noise limit (7 pm – 10 pm) is introduced throughout the Waitomo District by the PWDP to account for increased noise sensitivity during this period.

[3] This zone is applied to all Regionally Significant Industry and Mineral Extraction activities in the Waitomo District

Table 4.2: Noise limits from PWDP

Time period	Noise limit
7:00 am – 7:00 pm	50 dB LAeq, 15min
7:00 pm – 10:00 pm	45 dB LAeq, 15min
10:00 pm – 7:00 am	40 dB LAeq, 15min
	70 dB LAmax

These noise limits apply at the notional boundary of the NSR and are valid for weekends and public holidays.

4.3 NZS 6802:2008

The New Zealand Standard NZS 6802:2008 Acoustics – Environmental Noise 2008 (NZS 6802:2008) defines a procedure for the assessment of environmental noise. Both the OWDP and the PWDP require noise to be assessed in accordance with NZS 6802. The OWDP references the 1991 version of the standard. However, as this version of the standard has been superseded, the current revision of the standard, NZS 6802:2008, has been referenced in this assessment.

NZS 6802:2008 mandates a correction or penalty for noise sources that exhibit special audible characteristics (SAC), such as tonality or impulsivity.

4.4 World Health Organization - Guidelines for Community Noise 1999

Table 1 of the WHO's 1999 guidelines for community noise provides guideline levels for when sound can impact individuals' health, in terms of annoyance or sleep disturbance. The guideline levels are reproduced below in Table 4.3. The guidelines form the basis of noise limits in district plans and are referenced in NZS 6802:2008.

Table 4.3: WHO 1999 guideline values for community noise in specific environments[4]

Specific environment	Time period	Critical health effect(s)	L_{Aeq} / dB	L_{Amax} / dB
Outdoor living area	Daytime and evening	Serious annoyance Moderate annoyance	55 50	- -
Outside bedrooms	Night-time	Sleep disturbance, window open (outdoor value)	45	60
Dwelling, indoors	Daytime and evening	Speech intelligibility and moderate annoyance	35	N/A
Inside bedrooms	Night-time	Sleep disturbance	30	45

[4] Table 1 of World Health Organization: Guidelines for community noise 1999.

4.5 Assessment criteria

External noise levels have been assessed at the notional boundary (20 m from the façade) of the NSRs located near the Southern and Central Blocks. The noise levels have been evaluated against the standards in the PWDP, as these noise limits are more aligned with current NZ standards. Specifically, the PWDP uses the LAeq parameter rather than the L10 which is referenced in the OWDP and the 1991 version of NZS 6802. Additionally, the PWDP accounts for evening noise limits, whereas the OWDP does not. The assessment criteria are provided in Table 4.4.

Table 4.4: Assessment criteria

Time period	Noise level	Assessment location
7:00 am – 7:00 pm	50 dB LAeq, 15min	Notional boundary
7:00 pm – 10:00 pm	45 dB LAeq, 15min	Notional boundary
10:00 pm – 7:00 am	40 dB LAeq, 15min	Notional boundary
	70 dB LAmax	Notional boundary

5 Existing noise environment

On 1 October 2024, T+T conducted noise monitoring at the three NSRs closest to active mining areas on the Taharoa Ironsands mining site. Figure 5.1 shows the monitoring positions and DMU locations during the monitoring period. Mining activity during the measurements followed normal procedures, with bulldozers working in the areas between the DMUs and the NSRs.

Table 5.1 provides the monitoring results, recorded while mining was occurring near all three NSRs. A subjective assessment indicated that dominant noises were unrelated to mining, such as wind in vegetation and bird sounds. The only industrial noise noted by the T+T site technician occurred during daytime measurements at the Wetini Homestead location and included a thump likely from an excavator bucket and a reversing alarm. These were short in duration, did not cause a notable increase in sound level, and were not considered sufficiently frequent to qualify as a SAC under NZS 6802:2008. Mining noise at this location was generally not discernible, even during the quietest periods.

The higher LAeq, 15min level at Old Kana Homestead was attributed to bird noise rather than mining, supported by the elevated LAeq levels recorded when no mining was occurring (see Table 5.2). Measurements and subjective assessments indicate that SAC corrections are not required for mining (see Section 8.3 for further discussion).

Table 5.2 provides the noise monitoring results from an evening period (7 pm to 9.30 pm) when the DMUs were inactive and there was minimal mining. Any mining that did occur was inaudible at all three monitoring locations. Dominant noise sources at Wetini Homestead and New Kana Homestead were wind-related (vegetation movement and wind across the microphone), with wind speeds ranged from 3.7 to 7.4 km/h, shifting from south-southwest to east-northeast during the monitoring period. At Old Kana Homestead, bird noise was the dominant source.

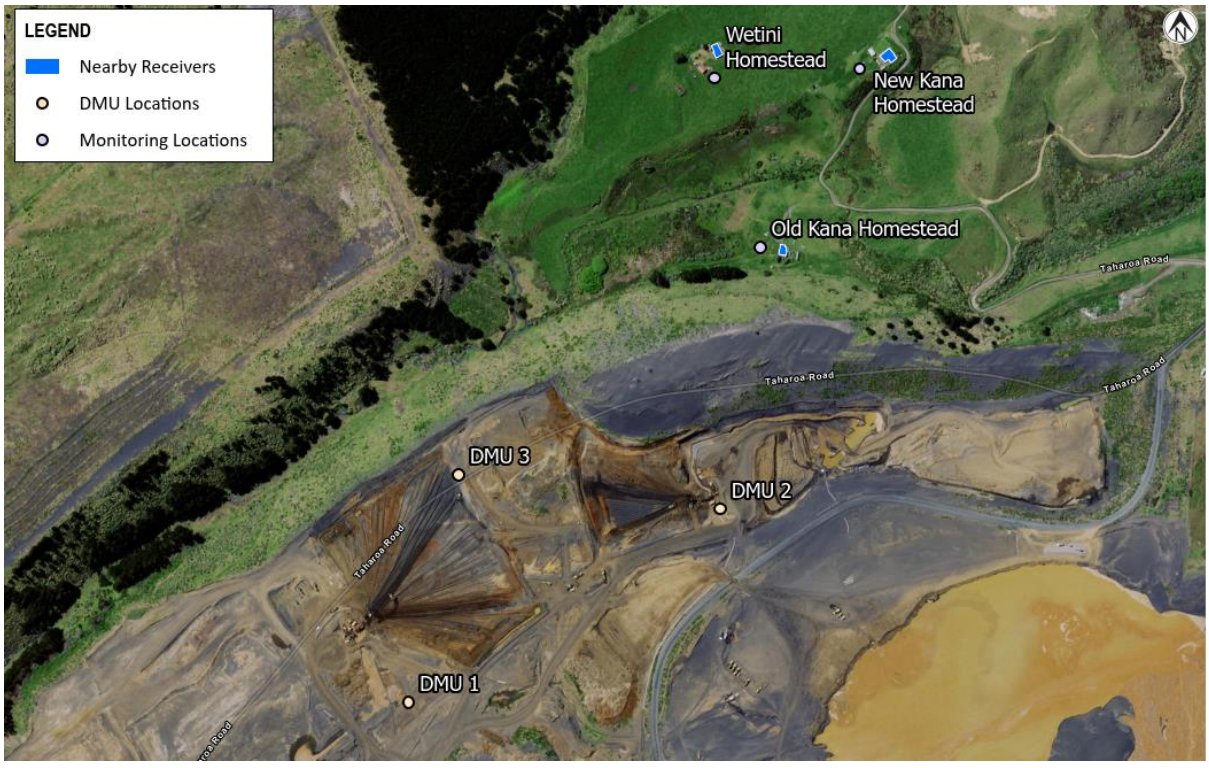

Figure 5.1: DMU and noise monitoring locations.

Table 5.1: Operational noise monitoring results (daytime)

Location	LAeq, 15 min / dB	LAmax / dB	LA90, 15 min / dB	LA10, 15min / dB
Old Kana Homestead	44	56	34	48
New Kana Homestead	37	49	32	39
Wetini Homestead	37	48	33	39

Table 5.2: Ambient noise monitoring results (evening)

Location	LAeq, 15 min / dB	LAmax / dB	LA90, 15 min / dB	LA10, 15 min / dB
Old Kana Homestead	42	50	31	45
New Kana Homestead	34	44	32	36
Wetini Homestead	32	48	30	33

6 Assessment methodology

Noise levels have been predicted using sound propagation modelling software, SoundPLAN version 9.1. The software enables noise contours to be produced and location specific noise levels to be calculated based on a three-dimensional model of the Project and the local area. SoundPLAN calculations have been undertaken in accordance with ISO 9613-2:2024 *Acoustics – Attenuation of sound outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors.* The assumptions and settings used in the model are summarised in Table 6.1.

Table 6.1: SoundPLAN noise model parameters

Parameter	Setting / assumption
Topography	1 m contours downloaded from LINZ Data Service. Existing / final design contours for the project site were spliced into LINZ data.
Ground absorption	The ground has been assumed to be hard (ground factor = 0) across water bodies. Over the rest of the calculation area, the ground is assumed to be mainly soft. A conservative ground factor 0.8 has been applied to the model.
Screening	Screening due to buildings and topography only.

6.1 Modelled scenarios

Noise levels have been modelled using SoundPLAN to determine how close mining can occur to the notional boundary of each NSR without exceeding the noise limits. Two noise modelling scenarios have been assessed:

1 Mining the majority of the Central and Southern Blocks

2 Mining the ridge separating the Central Block from the closest three NSRs (see Figure 3.4)

6.1.1 Central and Southern Block mining scenario

TIL uses two Komatsu 475 bulldozers. One bulldozer collects and pushes ironsand into piles within the active mining area, while the second bulldozer collects and deposits ironsand for processing at the DMU. Each bulldozer has a sound power level of 110 dBA. If both bulldozers were operating in the same location, this would theoretically result in a combined sound power level of 113 dBA.

The bulldozers are mobile noise sources. One bulldozer operates within the active mining area but does not remain stationary for an extended period. This mobility is likely to result in a 2 dBA reduction in the worst-case LAeq noise level at an NSR over a 15-minute assessment period. The second bulldozer operates by tracking between the active mining area and the DMU site, which is set back from the block boundary. Given the potential for this bulldozer to operate at a sufficient distance, its contribution to the overall noise level may be negligible, resulting in an additional 3 dBA reduction. T+T has observed bulldozer activity at the site and these noise level adjustments are conservative. The resulting averaged sound power level over a 15 minute period would be 108 dBA.

The DMUs used by TIL have a measured sound power level of 107 dBA[5]. From T+T's understanding and discussions on site with TIL, it is standard practise to position the DMU set back from the site boundary therefore their noise contribution at any NSR is negligible[6].

The dredge used for mining below the water table has a sound power level comparable to the DMUs. However, as mining below the water table only occurs in ponds created in the deeper layers of ironsand, there will always be a natural noise barrier between the dredge and the NSRs.

[5] T+T measured level.

[6] DMU mitigation is discussed in Section 9.3.

Therefore, noise generated by mining below the water table will always be lower than that from non-dredge mining methods.

The SoundPLAN modelling assumes that the ridge (see Section 6.1.1) has been mined prior to the commencement of mining in the remainder of the Central and Southern Blocks. For the remainder of the blocks the elevation of the noise source was set at current ground elevation, i.e. it is representative a situation at the commencement of mining operations in these areas. In the future, once mining is reasonably well progressed, the elevations of the noise sources will reduce. This will likely result in an increased reduction due to terrain shielding.

6.1.2 Ridge mining scenario

Due to the proximity of the NSRs to the ridge, TIL will adapt its current mining practices to ensure compliance with the applicable noise limits. An alternative mining methodology for this area will be developed in accordance with the recommendations and maximum noise levels outlined in this report.

T+T has used SoundPLAN to calculate the maximum noise levels at the notional boundary of the three nearest NSRs when mining occurs at the top of the ridge. Section 8.1.1 provides details on how noise levels are expected to reduce as mining progresses below the ridgeline and out of sight of the nearest NSRs.

7 Results

7.1 Ridge mining

To establish the maximum permissible noise level for mining at the top of the ridge, an area sound source was modelled at this location. The sound power level of the source was incrementally adjusted until the predicted noise levels at the notional boundary of the nearest NSR (the Old Kana Homestead), complied with the applicable limits for day (50 dB LAeq), evening (45 dB LAeq), and night (40 dB LAeq) periods.

The results of this assessment are presented in Table 7.1. Figure 7.1 shows the daytime 50 dB LAeq limit contour relative to the three nearest NSRs, based on a 100 dBA sound power level source operating on the ridge. For evening and night periods, the contour would remain unchanged if the source sound power level were reduced by 5 dB for each period to align with the respective noise limits (i.e. 95 dBA - evening and 90 dBA - night).

Section 8.1.1 discusses the expected reduction in noise levels as mining progresses below the ridgeline and the equipment moves out of sight of the NSRs.

Table 7.1: Maximum noise level when mining is taking place at the top of the ridge

Time period	Maximum noise level
Day (7 am – 7 pm)	100 dB LAeq 15-minute
Evening (7 pm – 10 pm)	95 dB LAeq 15-minute
Night (10 pm – 7 am)	90 dB LAeq 15-minute

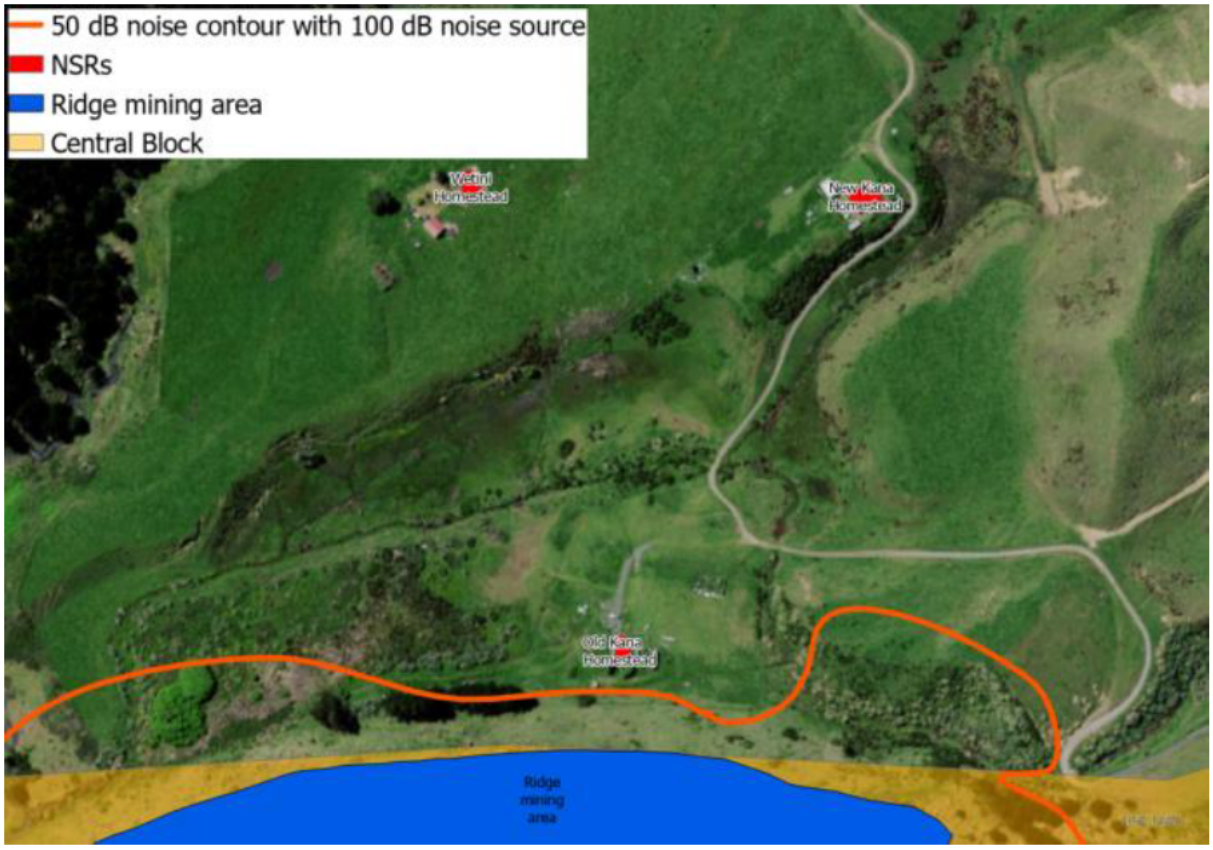

Figure 7.1: Ridge mining contour at 100 dB.
Note: Central Block outline indicative only.

7.2 Central and Southern Block mining

Figure 7.2 and Figure 7.3 show noise limit contours of how close mining can occur to the NSRs without exceeding the noise limits.

1 The **red** line represents the day-time noise limit

2 The **orange** line represents the evening noise limit

3 The **green** line represents the night-time noise limit

The noise contours have been modelled on the assumption that the ridge is mined first prior to the remainder of the blocks (as discussed in Section 6.1.1). Figure 7.2 shows an overview of the whole site and Figure 7.3 shows a closeup of the noise contours near the three closest NSRs:

1 Wetini Homestead

2 New Kana Homestead

3 Old Kana Homestead

The noise contour lines show that mining can take place anywhere within the Southern Block and not exceed the relevant noise limits at any time.

In general, the noise contours show that mining in the Central Block will not exceed the noise limits once mining is behind the ridge line. However, the contours do show there is the potential for exceedances during the evening and night-time in some areas close to the three NSRs This is likely due to the topography of the locations.

The mining sequence for the Central Block (Figure 3.1 to Figure 3.3) indicates that areas where the noise model predicts potential exceedances – excluding works on the ridge – are primarily those shown in Figure 7.3. Based on the current mining plan, further mining in these areas is unlikely. However, if mining were to occur, compliance with the noise standards would require that no mining takes place during evening or night-time periods unless an alternative methodology is implemented and additional noise monitoring is undertaken. For the ridge area, the mining methodology will need to be modified to comply with noise limits (see Section 8.1). Further details on monitoring requirements are provided in Section 9.2.

No noise exceedances are predicted within the Taharoa township, at the Te Kura o Taharoa school, or at the Aaruka Marae and Te Kooraha Marae.

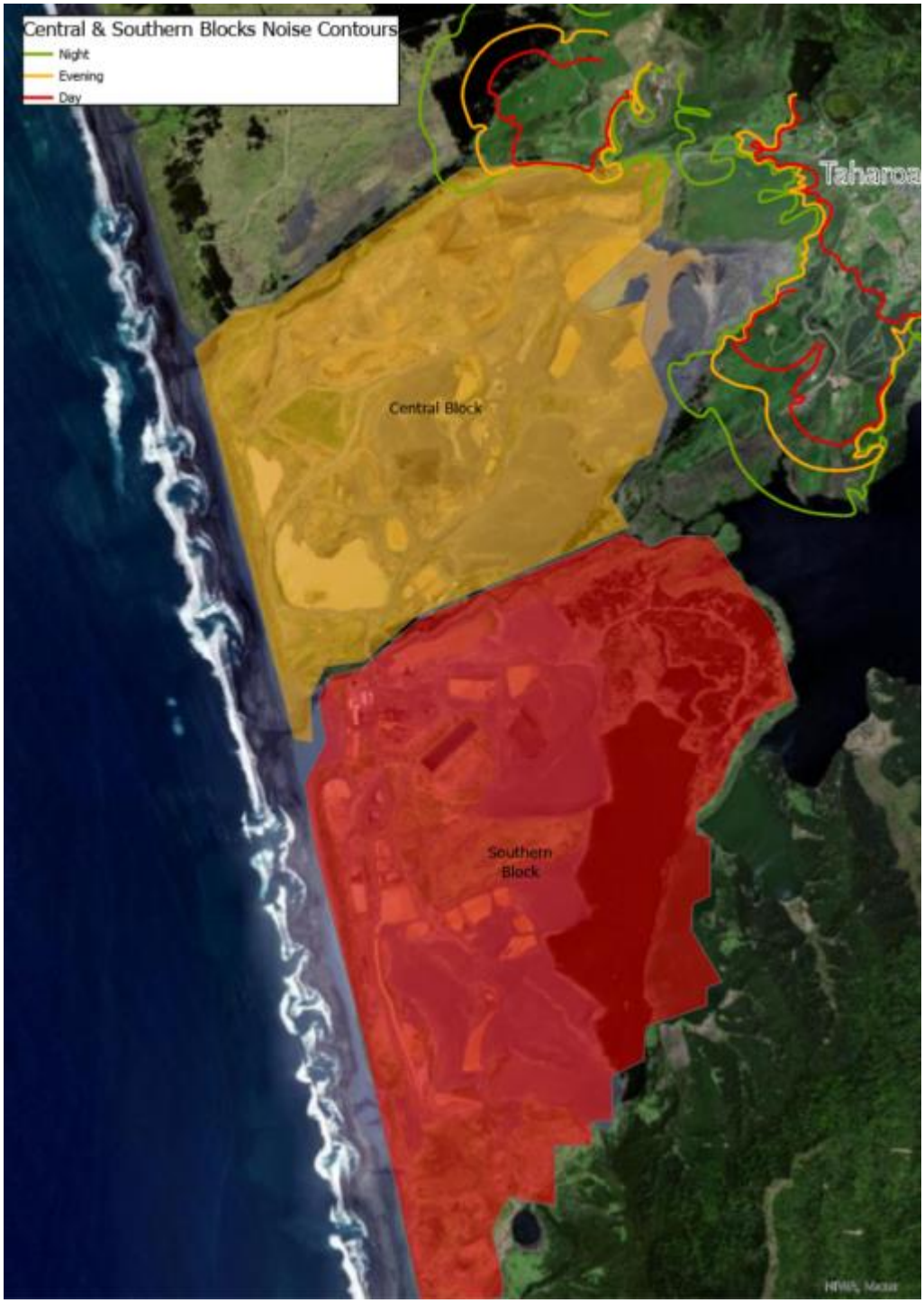

Figure 7.2: Central and Southern Block noise contours.
Note: Southern and Central Block outline indicative only.

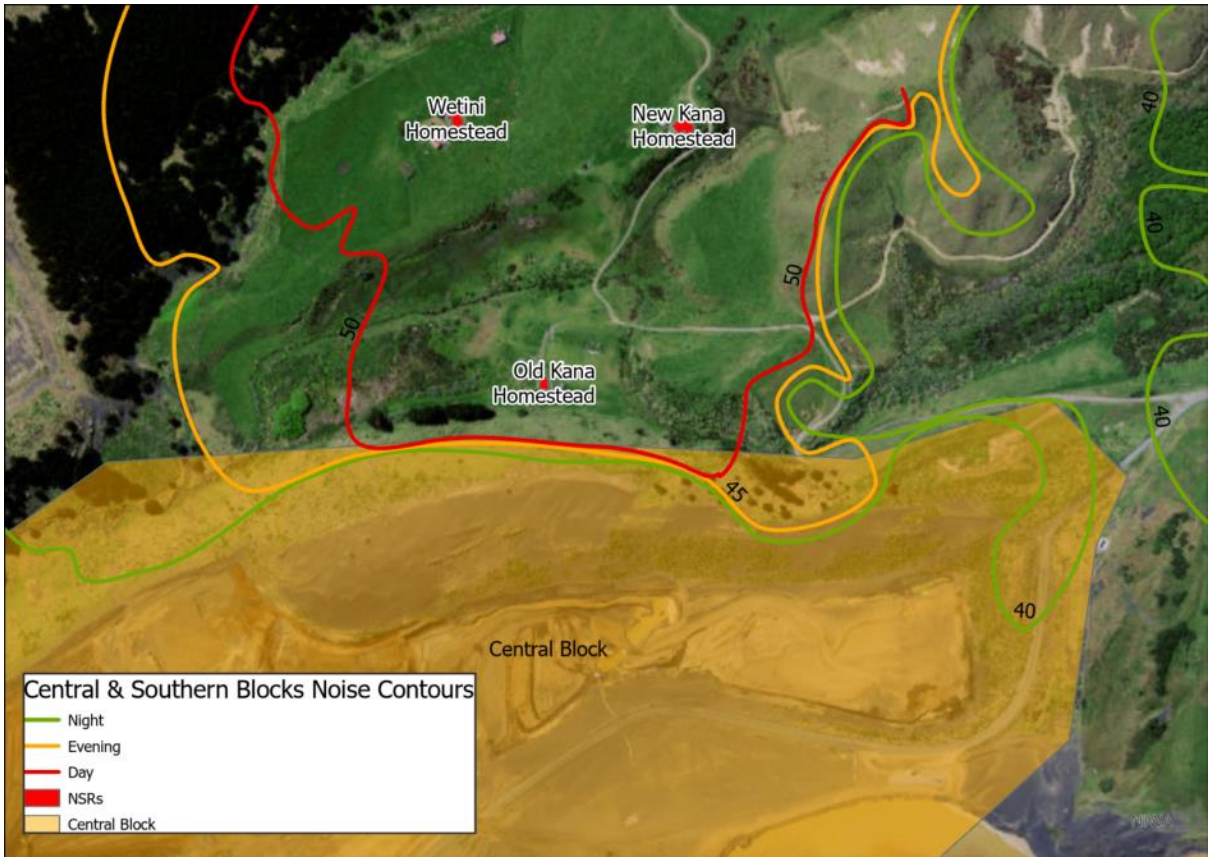

Figure 7.3: Noise contours near closest NSRs.
Note: Southern and Central Block outline indicative only.

8 Discussion

8.1 Ridge mining

The ridge mining noise model confirms that TIL will need to implement a tailored mining methodology (based on a reduction in plant noise and/or restriction on line of sight to the nearest NSRs – see below) that will comply with the PWDP daytime noise limits. The methodology will be designed to meet the maximum noise levels in Table 7.1.

For the night-time period (10 pm – 7 am), the maximum permissible source sound power level is approximately 90 dBA, equivalent to a 5-ton excavator operating on the ridge. During the evening period (7 pm – 10 pm), the source sound power levels increases to approximately 95 dBA, comparable to a 10-ton excavator. These results indicate that mining at the top of the ridge during evening or night-time periods is likely to be impractical given the size of the equipment required to feasibly undertake mining.

During the daytime period (7 am – 7 pm), the noise limit of 50 dB LAeq allows for a maximum source level of 100 dBA. While this precludes the use of bulldozers, a compliant methodology could involve a 15 to 20 ton excavator operating on the ridge in combination with a rope-trawl bucket crane positioned behind the ridgeline to benefit from terrain shielding. Either of these options is practicable.

TIL will develop the final methodology in consultation with a suitably qualified and experienced acoustics specialist (e.g. a Member of the Acoustical Society of New Zealand) to confirm compliance with the noise limits prior to mining the ridge.

8.1.1 Noise levels as mining continues below the ridge line

Noise levels will be reduced as the ridge is mined and mining progresses behind the ridge, i.e. out of sight of the nearby NSRs, notably the Old Kana Homestead. Once mining progresses below the ridge, the terrain will act as a natural noise barrier. This will reduce noise levels by:

- 8 – 10 dB where line of sight is fully blocked
- 3 – 5 dB where line of sight is partially blocked

This will allow TIL to operate using normal working practices, i.e. the use of bulldozers, as works will occur below the ridge line and out of sight of the NSRs. Before evening and night works commence, noise monitoring would likely be required to check for compliance with the noise limits.

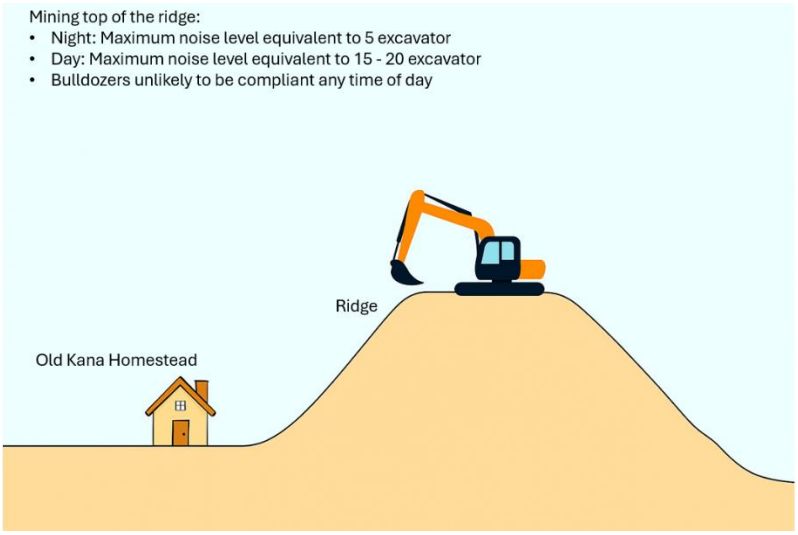

Figure 8.1: Mining the top of the ridge limitations.

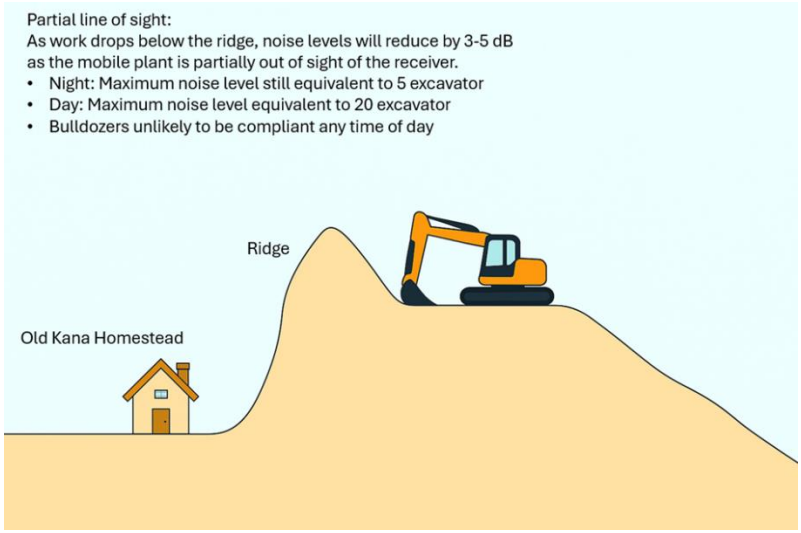

Figure 8.2: Partial line of sight mining limitations.

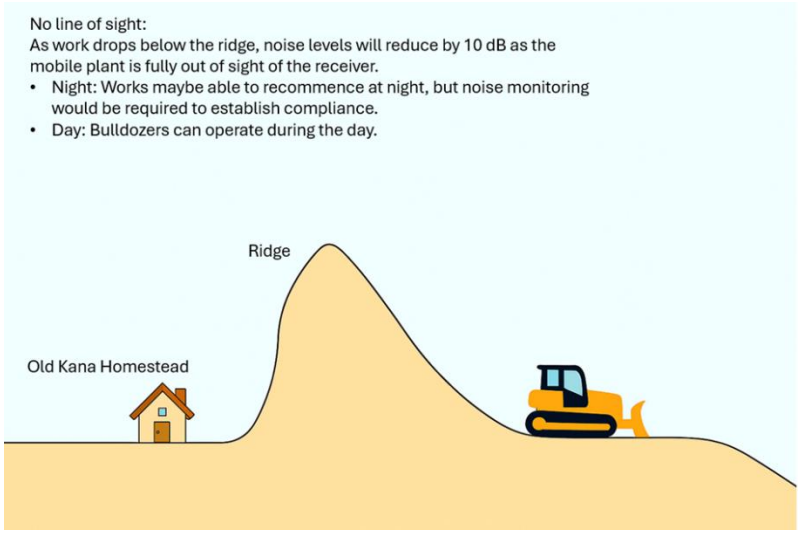

Figure 8.3: No line-of-sight mining limitations.

8.2 Overall assessment of effects

As discussed in Section 3.1, mining will not occur simultaneously across an entire block. Instead, mining will be conducted in segments, as indicatively illustrated for the Central Block in Figure 3.1 to Figure 3.3 and the Southern Block in Figure 3.6 and Figure 3.7.

Following mining of the ridge, activities closest to the three nearest NSRs (New Kana Homestead, Old Kana Homestead, and Wetini Homestead) will decrease as mining in the Central Block moves away from these properties. Figure 7.2 and Figure 7.3 show that once mining moves away from the NSRs the potential for exceedances is significantly reduced.

Compliance with applicable noise limits is predicted at all times within Taharoa township, at Te Kura o Taharoa School, or at either the Aaruka Marae or the Te Kooraha Marae. Therefore, disruption at these locations is considered unlikely.

8.3 Noise rating level discussion

The noise level predictions do not include any adjustments for duration or SAC. As mining is continuous throughout a 15-minute assessment period, no duration correction in accordance with NZS 6802:2008 is warranted.

Noise monitoring results presented in Section 5 indicated that, for the majority of the time, mining activity is indistinguishable from existing sources of environmental noise. Therefore, SAC corrections are not considered necessary for current operations. It is recommended, however, that this assumption be validated through ongoing noise monitoring and site management practices.

When developing the methodology for ridge mining, TIL will need to ensure that the approach either incorporates an SAC correction in the final rating level assessment or is designed so that no SAC correction is required.

8.4 Noise model uncertainty

While noise modelling inherently involves some uncertainty due to changing site conditions and environmental factors, conservative assumptions and best practice modelling techniques have been applied to ensure a robust and conservative assessment. Ongoing monitoring and model updates will further reduce uncertainty and confirm compliance throughout the life of the project

9 Recommendations

9.1 Ridge mining

TIL will implement a modified mining methodology for activities on the ridge area shown in Figure 3.4. The methodology will be designed to ensure:

1 Noise rating levels do not exceed the maximum levels specified in Table 7.1, including consideration of any potential SAC corrections.

2 Mining on the ridge will only occur between 7 am and 7 pm until operations progress below the ridge line.

3 A suitably qualified and experienced specialist (e.g. a Member of the Acoustical Society of New Zealand) will review and confirm the methodology's compliance prior to implementation.

4 Once mining moves behind the ridge line and out of sight of the NSRs, 24/7 operations using TIL's standard mining methodology will only commence after noise monitoring by a suitably qualified and experienced specialist confirms compliance.

9.2 Assessing compliance

As shown by the noise contour results in Figure 7.2 and Figure 7.3, there is potential for noise limit exceedances during evening and night-time periods when mining occurs at locations closest to the NSRs.

To proactively manage compliance, TIL will evaluate the most practical solutions, which may include:

1 **Attended monitoring:** Conducting attended monitoring while equipment operates at the closest location to the site boundary.

2 **Permanent noise monitoring:** Installing a permanent noise monitoring station at an appropriate location. This system could be programmed to identify mining related noise and trigger alerts when noise levels approach compliance thresholds, enabling TIL to take timely corrective action.

If monitoring indicates elevated noise levels during evening or night-time operations, TIL may adjust activities, such as rescheduling work to daytime periods when higher noise limits apply.

This assessment has not applied a SAC correction under NZS 6802:2008, as monitoring by T+T indicated that mining noise is likely to be barely audible at the nearest NSRs. Ongoing noise monitoring will confirm whether an SAC correction is necessary. Monitoring results should also be reviewed to identify any tonal or impulsive characteristics (e.g. squeak, squeals, clanks and bangs), which can typically be mitigated through good practice, equipment maintenance, and operational management (see Section 9.3 below).

9.3 Best practice measures

The following best practice measures can help to avoid, remedy or mitigate adverse noise effects from mining activities:

1 **Operation of equipment:** Minimise the simultaneous use of multiple items of plant, particularly bulldozers, near the edge of a mining block or within the line of sight of an NSR. Where practical, plan operations so that only one piece of heavy equipment operates in noise-sensitive areas at a time.

2 **Timing of activities:** Prioritise conducting mining near NSRs during daytime periods whenever possible (locations shown in Figure 7.3).

3 **Reversing alarms:** To reduce tonal noise, avoid tonal reversing alarms on mobile plant where practicable, while maintaining compliance with Health and Safety requirements. Alternatives such as flashing lights, broadband alarms, or rear sensors are recommended, particularly for night-time operations, as tonal alarms could trigger an SAC correction.

4 **Equipment maintenance:** Ensure all equipment is well maintained. Proper maintenance can reduce noise levels by up to 50%. For example, ensuring tracked vehicles do not produce 'squealing' sounds helps minimise disturbance and avoids an SAC correction.

5 **Idling equipment:** Avoid leaving equipment and vehicles running when not in use to avoid unnecessary noise.

6 **DMU location:** Position the DMU at least 400 m away from the NSR notional boundary when there is line of sight and 200 m when out of sight. Locating the DMU near the Old Homestead could result in exceedances; however, this is unlikely as it is more practical to position the DMU centrally within the block to minimise relocation during operations.

10 Summary

T+T has undertaken a comprehensive noise assessment of mining activities at the existing ironsand mine near Taharoa, where operations have been established for over 50 years and form part of the local noise environment.

On 1 October 2024, T+T undertook noise monitoring at NSRs near the site. Observations confirmed that mining noise was generally indistinguishable from the existing environmental noise, even during the quietest periods.

Noise modelling results indicate that:

1 **Southern Block**: Mining can occur anywhere within the Southern Block without exceeding noise limits at any time.

2 **Central Block**: There is potential for noise exceedances when mining occurs on the ridge area at the northern end of the block near three NSRs: New Kana Homestead, Old Kana Homestead, and Wetini Homestead (see Figure 3.4). To ensure compliance in this area:

- TIL will implement a modified mining methodology designed to meet the maximum noise levels in Table 7.1, including any potential SAC corrections.
- The methodology will be verified by a suitably qualified acoustic specialist prior to commencement.
- Ridge mining will be restricted to 7 am to 7 pm until operations progress below the ridgeline.
- Standard 24/7 operations will only resume after noise monitoring confirms compliance.

As mining moves away from the northern ridge, no further exceedances are predicted within the Central Block.

No exceedances are predicted at any time within Taharoa township, Te Kura o Taharoa School, or at Aaruka Marae and Te Kooraha Marae.

It is recommended that noise monitoring is conducted at representative locations to validate ongoing compliance. It is also recommended that where practical alternatives to tonal reversing alarms are implemented to minimise potential SAC corrections.

11 Applicability

This report has been prepared for the exclusive use of our client Taharoa Ironsands Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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Appendix A Noise Glossary

Term	Definition
A-Weighted	A frequency weighting devised to attempt to take into account the human response to sound.
dB	A unit of measurement on a logarithmic scale which describes the magnitude of sound pressure with respect to a reference value (20 µPa).
dBA	The A-weighted sound pressure level.
$L_{Aeq,T}$	The steady noise level that over the period of time (T) under consideration, contains the same amount of (A-weighted) sound energy as the time varying noise over the same period of time.
L_{max}	The maximum sound pressure, measured in units of decibels (dB).
L_{Amax}	The maximum A-weighted sound pressure, measured in units of decibels (dB).
$L_{A90,t}$	The A-weighted sound pressure level that is exceeded for 90% of the measurement interval, t, measured in units of decibels (dB).
$L_{A10,t}$	The A-weighted sound pressure level that is exceeded for 10% of the measurement interval, t, measured in units of decibels (dB).
Noise	Unwanted sound.
SAC	Special audible characteristics.
Sound pressure	The fluctuation in air pressure from the steady atmospheric pressure created by sound. Measured in Pascals.
Sound pressure Level	The sound pressure measured in decibels (dB).
Sound Power Level	Total sound energy radiated by the source (dB).
Receiver	A location for where sound pressure levels from a noise source could be assessed.
Noise Sensitive receiver (NSR)	A receiver that the assessment has identified as having the potential to be adversely impacted by noise from the activity.

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