

Prepared for: **Tūpuna Maunga Authority**

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Title: **Owairaka – Mt. Albert Mountain Exotic Tree Removal:
Assessment of Environmental Noise Effects**

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1. Executive summary

Styles Group has been engaged by the Tūpuna Maunga Authority to assess the likely noise effects arising from the removal of 345 exotic trees from Owairaka – Mt Eden.

The proposed activity will exceed the construction noise limits set out under E25.6.27 of the AUP-OP for short periods when works are close to the receivers and for much of the time when a helicopter is used for the dismantling of trees. This report identifies the likely noise effects of the activity and proposes a suite of conditions to be imposed and complied with to ensure potential adverse effects on proximate residential receivers are adequately avoided or mitigated.

2. Proposed tree removal methodology

The Tūpuna Maunga Authority propose to remove 345 exotic trees within the boundaries of Owairaka – Mt Eden.

Treescape Arboricultural Consultants have prepared a methodology which identifies a suite of tree removal and processing methods, developed on the basis of feasibility, effectiveness, noise effects and cost, while seeking to avoid damage or disturbance of archaeological, cultural and historical features of the maunga. Tree removal methods include helicopter, manual, crane and elevated work platform assisted dismantling, and manual and machine assisted felling. Processing machinery will include several wood chippers, chainsaws, excavators, a mobile crane, mobile work platform and trucks to remove material off site.

Figure 1 overleaf depicts the proposed tree removal method by location and identifies the location of the two processing sites.

Trees removed by helicopter and crane assisted dismantling methods are to be loaded directly onto transport at the processing sites while cuts from all other trees (with the exception of specific logs that may be suitable for carving) will be moved to one of the processing sites for mulching and removal. During helicopter operations, one processing site will be utilised to process removed trees and one as a refuelling site for the helicopter.

Table 1 provides a summary of felling and processing methods by area. Of particular relevance to this assessment is the proposed use of helicopters for the removal of 36 trees over 20 days. The majority of trees subject to helicopter assisted dismantling are located within the central parts of the site, however the removal of a large eucalyptus (Item no 649) located at the south-eastern boundary of the maunga will require approximately 14 hours (over 2 days) of helicopter activity.



Figure 1: Treescape Arboricultural Operations Plan- Work Areas and Processing Sites (Sept 18)

Table 1: Tree Removal Method by Location and Processing Methods

Location		Felling/ Dismantling Method						Processing Method			
Area	Description	Crane Assisted Dismantling	Helicopter Assisted Dismantling	Machine Assisted Manual Felling	Manual Dismantling	Manual Felling	MEWP Assisted Dismantling	PS 1	PS 2	Processing in Situ	Mulch On Site
A1	South-Eastern Shoulder	3	1		10			X	X		X
A2	North-Eastern Shoulder	28			3				X		X
B	Western Shoulder			6	2			X	X		X
C	Sports field Mound	5			4	2		X			X
D	Central Rises	64	25		13	3	4		X		X
E	Tihi	30	11	2	9	7		X	X		X
F	Eastern Pseudo Shoulder	16		2	12	37		X			X

3. Auckland Unitary Plan construction noise limits

The site is located mostly in the Open Space – Conservation Zone, with the Open Space- Sport and Recreation zone applying to the two sporting domains. Figure 2 depicts the relevant zonings across the site, with surrounding sites zoned Residential.

The application site includes all areas zoned Open Space that share a common boundary with the central Maunga area in the Open Space – Conservation Zone. The noise levels and effects are not assessed at any building within the application site.

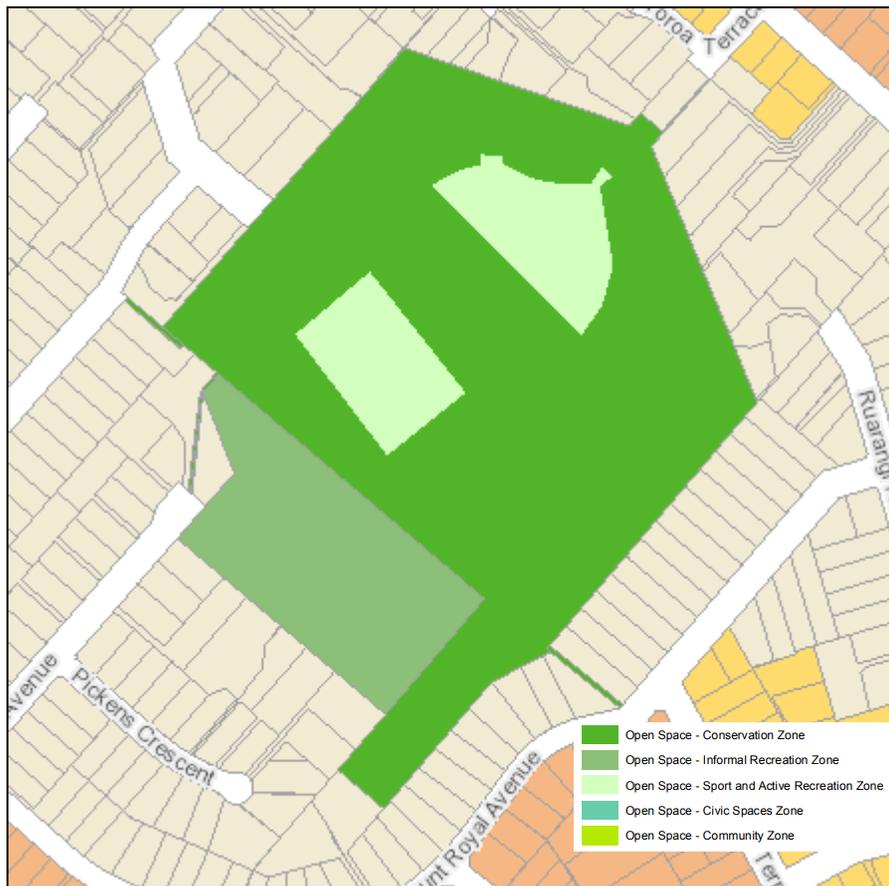


Figure 3: AUP Open Space Zoning of Site within Residential Context

The proposal has been assessed against the noise controls of E25 – Noise and Vibration of the AUP-OP. E25.6.27 sets out the noise limits that apply to construction activities, which is the appropriate control¹ for the tree removal proposed under this application (with relevant noise limits highlighted):

E25.6.27. Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone Potentially Affected Sites

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

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.

¹ The tree removal proposed in this application is a one off, temporary construction event, and does not seek to authorise ongoing helicopter movements on the Maunga. The application of construction-related rules to the use of helicopters for construction activities is common and traditional. This interpretation was accepted in the resource consent for exotic tree removal from Maungarei / Mt Wellington.

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.

The AUP-OP also states that any construction noise shall be measured and assessed in accordance with *NZS 6803: 1999 Acoustics – Construction Noise*.

The construction works will be undertaken between 7:30am and 6:00pm on Monday to Friday and will take less than 20 weeks to complete. No construction works will be undertaken on weekends or public holidays. The permitted noise limits for these times are 75 dBA L_{eq} and 90 dBA L_{max} for all neighbouring buildings while occupied. The noise limits are applicable at 1m from the most exposed façade of any surrounding occupied building.

4. Noise measurements

Noise measurements of the proposed helicopter (an AS350 B3) were undertaken at a different location on 03 October 2017 while the helicopter was carrying out work of similar nature: lifting using a 45 metre long line. The measurements were used to derive a sound power (source) level for the AS350 B3 for use in the noise model.

The measurements were performed in accordance with NZS 6801:1991 using a Norsonic Type 1 sound level meter. Serial numbers and calibration details are available on request. Meteorological conditions during the measurements were overcast with light winds. The controlling noise source was the operation of the helicopter. A sound power level of 135dBA was calculated based on the noise measurements for the various phases of the lifting operation (to reflect the emissions over a typical 15min period).

5. Noise level predictions

Styles Group has used Brüel & Kjær Predictor computer noise modelling software to prepare noise level predictions, based on the International Standard ISO 9613-1/2. The noise level predictions assume meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6802:2008. The Brüel & Kjær Predictor software is globally recognised and has been successfully implemented on a large number of projects throughout New Zealand.

Terrain contours, land parcels and building footprints for the models were acquired from the Auckland Council GIS service and have been confirmed by site observations. The topographical contours encompass the entire site and the surrounding land. We have ensured the integrity of the noise models by verifying the data during our site visit and by careful scrutiny of the final three-dimensional models. The input parameters for the Predictor noise model is shown in the table overleaf.

Parameters/calculation settings	Details
Software	Brüel & Kjær Predictor
Calculation method	ISO 9613.1/2
Meteorological parameters	Single value, C0 = 0
Ground attenuation	General method, ground factor 0.95
Air temperature	293.15K
Atmospheric pressure	101.33kPa
Air humidity	60%
Source heights (relative)	Helicopter: 45m above load; Chainsaw: 1.5m above ground or at cut level in tree; Chipper: 2m above ground level
Receiver heights (relative)	1.2 - 1.5m above floor level
Building heights (nominal)	Single level: 4m; double level: 7m.

5.1 Noise Sources

A noise model has been prepared for the locations where helicopters will be used to remove trees and also for areas where helicopters are not needed to remove trees i.e. only chainsaws. The noise models also include the noise from the processing sites involving chippers and excavators for handling. The chippers will dominate the noise environment in those areas. The sound power levels that have been used in the models are shown in the table overleaf:

Noise Source	Sound Power Level (dBA)	Min Separation Distance (to comply with 75dB L _{Aeq})
Chainsaw	112	12m (at 33% on-time)
Log Chipper	114	25m
Excavator	96	4m
Crane	95	4m
Helicopter	135	200m

These sound power levels are based on measurements undertaken by Styles Group in the past, including some specific to this project. The sound power level for the chippers has been provided by the project arborist.

To derive noise level predictions over a representative 15 minute period as required by NZS6803:1999, we have assumed that the helicopter operation will comprise a 66% 'on-time' over each tree, 30% on-time over the processing area and the remaining time (approximately 4%) travelling between the areas. We understand from the helicopter operator that this represents the expected operating scenario.

We have assumed that the chainsaws will have an on-time of no greater than 50% each generally, and no greater than 33% in areas where there is only one tree being removed at a time. All other plant and machinery is assumed to have a 100% on-time.

6. Modelling results

The noise modelling results are shown in Appendix A. The results include a noise level contour for where the 75dB L_{Aeq} noise limit is achieved, an 80dB L_{Aeq} contour and an 82dB L_{Aeq} contour. For some scenarios the 75dB L_{Aeq} noise level contour runs midway through some properties, but is still compliant with the 75dB L_{Aeq} standard. This is because of the very elevated nature of the primary noise source.

The results for each of the four modelled scenarios are discussed below.

- 1) This noise model displays the noise levels generated by the use of the helicopter in the tihī area. The noise levels will be above 75dB L_{Aeq} at many of the dwellings east of the Maunga, but compliant with a level of 80dB L_{Aeq} .
- 2) This noise model displays the noise levels generated by the use of the helicopter in the pseudo rim area on the eastern side of the Maunga. The noise levels will be above 75dB L_{Aeq} at many of the dwellings east of the Maunga, but compliant with a level of 80dB L_{Aeq} . Works involving the helicopter in this area and in the generally central area of the Maunga will comprise the majority of helicopter work.
- 3) This noise model displays the noise levels generated by the use of the helicopter on the western side of the Maunga. The noise levels will be above 75dB L_{Aeq} at many of the dwellings west of the Maunga, but compliant with a level of 82dB L_{Aeq} . There is only a few trees in this area, so noise levels over 80dB L_{Aeq} will be present only for 1-2 days.
- 4) This noise model displays the noise levels generated by the use of the helicopter to remove the large eucalyptus in the south eastern part of the site. The noise levels will be above 80dB L_{Aeq} at approximately 10 dwellings, but compliant with a level of 82dB L_{Aeq} at the dwellings themselves (the assessment point in terms of the AUP-OP rules).

The works will also involve the use of cranes, work platforms and chainsaws all around the site, and at times in close proximity to dwellings. However, these works are much quieter than the use of the helicopter, and will move very quickly past each receiver. There may be occasions when a noise level of 75dB L_{Aeq} is exceeded by these activities, but these will be intermittent and of a short duration only, and will comply with a limit of 80dB L_{Aeq} .

At all other receivers and for the majority of the works (in the middle of the site) the noise levels will be below the relevant noise limit of 75dB L_{Aeq} .

7. Assessment of Effects

The project will require up to 36 days of helicopter activity. From our experience on other helicopter projects, there is little, if anything that can be done to reduce the noise levels associated with helicopter movements. Whilst a quieter machine could be used, it would have a lower lifting capacity and would therefore take longer (likely to be greater than twice as long) to complete the work due to the segments of tree needing to be smaller and lighter, generating more lifts and a subsequent increase in the duration of chainsaw noise (twice the number of cuts required)

We consider that the primary mitigation measures should include advising the neighbours of the works including the timeframes, durations and the details of a contact person on site should

issues arise, as well as getting the helicopter lifting work completed as quickly as practicable. We consider that all those buildings likely to be exposed to noise levels above 75dB L_{Aeq} should be advised in writing prior to the works commencing. This would generally be any dwelling within 200m of the extent of helicopter usage. We also understand that the applicant has proposed a communications strategy which would satisfy the matters set out above.

Additionally, we recommend that for works which are predicted to exceed a level of 75dB L_{Aeq} and are proposed to occur for more than 3 days in any one area, the work should be limited to only 3 consecutive days per week, and for the same 3 days in the subsequent weeks. This will likely apply to most of the works, except the use of the helicopter at the extremities, including the south-eastern eucalyptus and the western area near Summit Drive.

For the removal of the eucalyptus in the south-eastern part of the site, we recommend that the works are undertaken only when the 7 closest dwellings are unoccupied. This could be by arrangement with the consent holder, or simply undertaken if and when all occupants are at work / school. We have recommended a condition of consent to this effect.

We have assessed the effects of the construction noise infringement based on noise levels of up to 75dB L_{Aeq} being permitted by the AUP-OP for a project affecting any receiver for up to 20 weeks. The subjective difference in effects between the permitted noise level of 75dB L_{Aeq} and the predicted noise levels of up to 82dB L_{Aeq} will be greater by a noticeable or appreciable amount (but noticeably less than twice as loud) compared to a compliant situation.

It is also relevant to note that the project is only expected to take 50 days (10 weeks) in total to complete. The duration of the project works that will generate noise levels over 75dB L_{Aeq} is likely to be no greater than 10-12 days at any receiver, and the noise levels at any particular receiver will be between 60-70dB where works are undertaken at other areas of the site for the remaining days. In our opinion, this constitutes a considerably lower degree of effect overall than what is permitted by the AUP-OP, being up to twice the project duration (100 days or 20 weeks) at a level of 75dB L_{Aeq} at any receiver.

8. Summary and Recommendations

Our assessment has identified that noise levels generated by all activities (except for the use of the helicopter) will be generally compliant with the permitted noise limits in Rule E25.6.27 of the AUP-OP for most of the project. The use of the helicopter will infringe this rule by up to approximately 7dB at the closest residential receivers, and there will be short term and intermittent exceedances where chainsaws are used close to neighbouring dwellings. The subjective difference in effects between the permitted noise level of 75dB L_{Aeq} and the predicted noise levels of up to 82dB L_{Aeq} will be greater by a noticeable or appreciable amount (but noticeably less than twice as loud) compared to a compliant situation. The infringements are expected to last for no more than 10-12 days over the course of the project at any receiver. The

remainder of the works will be generally compliant with the relevant construction noise controls at all receivers and in our opinion, this proposal constitutes a considerably lower degree of effect overall than what is permitted by the AUP-OP, being up to 100 days (20 weeks) at a level of 75dB L_{Aeq} at any receiver.

With the mitigation that we have recommended, and taking into account the working hours and short duration of the works, we consider that the noise levels will be reasonable.

Should consent be granted, we recommend that the following conditions of consent be imposed and complied with, in addition to the standard conditions controlling hours and days of work in accordance with the application. A condition requiring written advice to those affected by the noise from the works has not been included as we understand that such advice will be provided as part of the wider communications strategy for the project.

- (1) The noise from all works shall comply with a noise limit of 85dB L_{Aeq} when measured 1m from the facade of any occupied building in accordance with NZS6803:1999 *Acoustics – Construction Noise*.
- (2) The owners and occupants of all neighbouring buildings within a minimum of 200 m of the extent of helicopter use within site shall be advised of the works in writing at least ten (10) days prior to the commencement of works on site. The written advice shall set out a brief overview of the construction works its expected duration, the mitigation measures to be implemented, availability of monitoring where concerns about noise are raised, the working hours, and a contact phone number for any concerns regarding noise.
- (3) Where the use of a helicopter is required for a period of more than 3 days in any work area which would result in noise levels exceeding 75dB L_{Aeq} at any receiver, the use of the helicopter shall be limited to 3 consecutive days per week, and may only be continued on the same 3 consecutive days in the subsequent weeks until the work in that area is complete.
- (4) The use of a helicopter for lifting is only permitted between the hours of 9am to 5pm from Monday to Friday.
- (5) The use of a helicopter for the removal of tree 649 (eucalyptus in the south-eastern part of the site) may only be undertaken when the properties at 25 to 37 (odd numbers) Mount Royal Avenue are unoccupied.

Appendix A – Noise Level Contour Maps