

Prepared for: **Tūpuna Maunga Authority**

Date: **26 November 2018**

Title: **Ohuiarangi - Pigeon Mountain Exotic Tree Removal:
Assessment of Environmental Noise Effects**

Revision Number: Final

Prepared by:



Jon Styles
Director and Principal

Reviewed by:



Jamie Exeter
Senior Consultant

Table of Contents

| | | |
|----|--|----|
| 1. | Executive Summary | 1 |
| 2. | Proposed Tree Removal Methodology | 1 |
| 3. | Auckland Unitary Plan Construction Noise Limits..... | 1 |
| 4. | Noise Measurements | 3 |
| 5. | Noise Level Predictions..... | 4 |
| | 5.1 Noise Sources..... | 5 |
| 6. | Modelling Results..... | 5 |
| 7. | Assessment of Effects..... | 7 |
| 8. | Summary and Recommendations | 8 |
| | Appendix A – Noise Level Contour Maps | 10 |

1. Executive summary

Styles Group has been engaged by the Tūpuna Maunga Authority to assess the likely construction noise effects arising from the removal of a number of exotic trees from Ohuiarangi - Pigeon Mountain.

The proposed activity will exceed the construction noise limits set out under E25.6.27 of the AUP for short periods when works are close to the receivers and for much of the time when a helicopter is used to assist with 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 112 exotic trees that are currently established within the boundaries of Ohuiarangi - Pigeon Mountain.

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. Processing Site 1 occupies the area of flat grass behind the kindergarten, while Processing Site 2 is located on the sports field. Due to the proximity of the kindergarten to Processing Site 1, the applicant proposes to restrict the use of Processing Site 1 to school holiday periods when it is closed and unoccupied.

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 overleaf 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 11 trees within the Tihi and Eastern Slope. Manual felling is proposed within the North Corner; while crane assisted dismantling will be undertaken along Boundary Road and within the Quarry.

We understand the project is to be completed within 20 working days, with helicopter works to be undertaken in approximately 4 working days (subject to weather conditions).



Figure 1: Tree Location and Proposed Removal Methods (Source: Treescape Arboricultural Operations Plan)

Table 1: Tree Removal Method by Location and Processing Methods

| | | Felling/ Dismantling Method | | | | | | | | | Processing Method | | | | | |
|------|---------------|-------------------------------|-----------------------------------|----------------|--------------------------|--------------------|----------------|---------------------------|----------------------------|---------------------------------|-------------------|------|---------------|--------------------|---------------|----------------|
| Area | Description | Number of Trees to be Removed | Ring Barking/ Spraying/ drill and | Manual Felling | Machine Assisted Felling | Manual Dismantling | Manual Rigging | MEWP Assisted Dismantling | Crane Assisted Dismantling | Helicopter Assisted Dismantling | PS 1 | PS 2 | Cut and Leave | Processing in Situ | Mulch On Site | Mulch Off Site |
| A | Quarry | 57 | | | | | | | X | | X | X | | | X | |
| B | Eastern Slope | 11 | | | | | | | | X | | X | | | | X |
| C | Boundary Road | 26 | | | | | | | X | | | | X | X | X | X |
| D | North Corner | 6 | | X | | | | | | | | | X | | X | |
| F | Tihi | 12 | | | | | | | X | X | X | X | | | X | |

3. Auckland Unitary Plan construction noise limits

The site is predominantly located in the Open Space – Conservation Zone, with the north-western part of the site containing the Air Scouts facility and kindergarten located within the Open Space – Community Zone and the Pakuranga Domain zoned Open Space – Sports and Recreation. Figure 2 depicts the relevant zonings across the site, with adjacent sites zoned Residential.

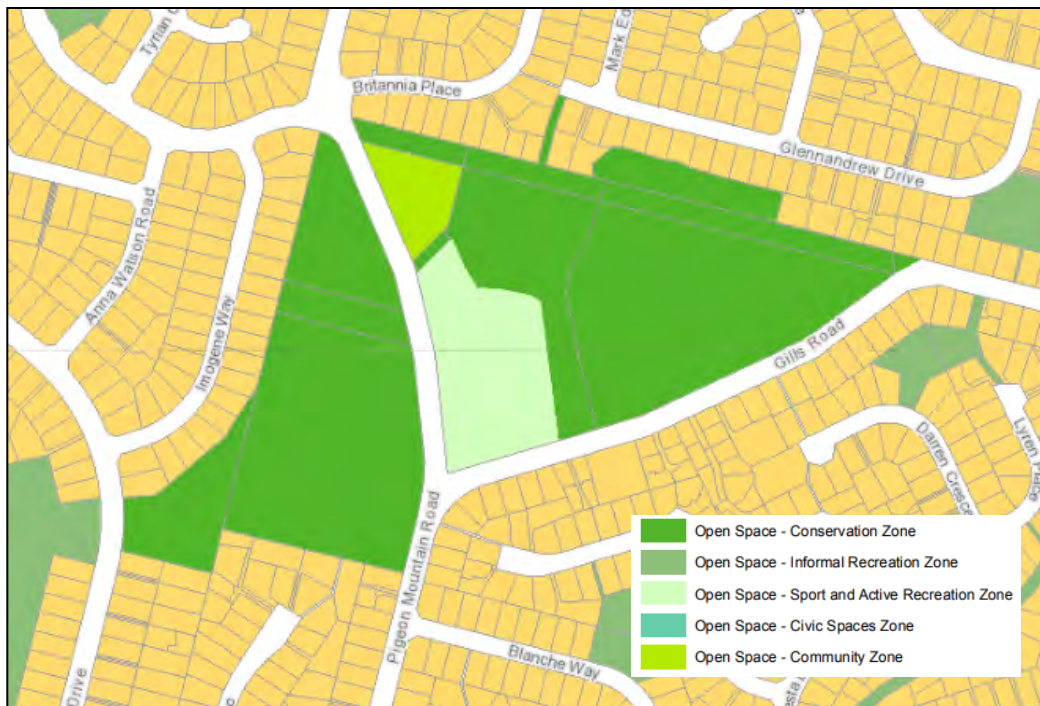


Figure 3: AUP Open Space Zoning of Site within Residential Context

The proposal has been assessed against the noise controls of E25 – Noise and Vibration of the AUP. 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):

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 other volcanic cones, including Maungarei / Mt Wellington.

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.

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

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

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

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

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

- (3) For a project involving a total duration of construction work that is less than 15 calendar days, the noise levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above may be increased by 5dB in all cases.
- (4) For a project involving a total duration of construction work that is more than 20 weeks the noise limits in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above may be decreased by 5dB in all cases.

The AUP also states that 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. Processing Site 1 will only be used when the Pigeon Mountain Kindergarten is closed during school 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 are shown in the following table.

| 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 below:

| 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 and an 80dB L_{Aeq} contour. Some models are presented with a third contour showing the level that is just achieved at the closest houses. 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 modelled scenarios are discussed below.

- 1) 'Heli 1' displays the noise levels generated by the use of the helicopter on the eastern slope. The noise levels will be above 75dB L_{Aeq} at many of the dwellings to the north and south of the Maunga, but compliant with a level of 80dB L_{Aeq} .
- 2) 'Heli 2' displays the noise levels generated by the use of the helicopter on one of the southern-most trees on the eastern slope. The noise levels will be above 75dB L_{Aeq} at many of the dwellings to the south of the Maunga, reaching a level of 80dB L_{Aeq} at 3-4 houses. These higher noise levels will be generated over a very short duration, with very few trees requiring removal in this area.
- 3) 'Heli 3' displays the noise levels generated by the use of the helicopter on one of the northern-most trees on the eastern slope. The noise levels will be above 75dB L_{Aeq} at many of the dwellings to the north of the Maunga, and over a level of 80dB L_{Aeq} at 6-8 houses. The highest level is 85dB L_{Aeq} at 36 Glennandrew Drive. These higher noise levels will be generated over a very short duration (likely to be no more than 1 day), with very few trees requiring removal in this area.
- 4) 'Heli 4' displays the noise levels generated by the use of the helicopter on one of the north-eastern-most trees on the eastern slope. The noise levels will be above 75dB L_{Aeq} at many of the dwellings to the northeast of the Maunga, and over a level of 80dB L_{Aeq} at 36 Glennandrew Drive. The highest level is 82dB L_{Aeq} at 36 Glennandrew Drive. These higher noise levels will be generated over a very short duration, with very few trees requiring removal in this area.
- 5) 'Heli 5' displays the noise levels generated by the use of the helicopter on one of the northern-most trees on the tihi. The noise levels will be above 75dB L_{Aeq} at many of the dwellings to the northern edge of the Maunga, and up to 80dB L_{Aeq} at the adjacent properties on Glennandrew Drive. These higher noise levels will be generated over a very short duration, with very few trees requiring removal in this area.
- 6) 'Manual Removal' displays the noise levels generated by the use of manual removal methods predominantly around the end of the Maunga. The primary noise source for this removal method is chainsaws, which may at times operate close to the residential boundaries, especially in the Northern Corner. Noise levels are generally less than the permitted limit of 75dB L_{Aeq} except during work on the trees closest to houses in the Northern Corner. When these trees are being removed, the noise levels are predicted to reach up to 79dB L_{Aeq} for short periods at 4 Himalaya Drive, and 74dB at 4 Imogene Way.

- 7) 'Manual Removal' also displays the noise levels generated by Processing Site 1 behind the kindergarten. The predicted noise levels are over 80dB L_{Aeq} at the kindergarten, but as stated earlier this site will not be used when the kindergarten is operating. The noise level at the closest houses to the north is predicted to be 75-76dB L_{Aeq} . We recommend that where practicable, the chipper used on this site should be moved as far to the south as possible, and screened by trucks or other machinery if space is available. We also recommend that this processing site be used as little as possible, with preference given to the use of Processing Site 2.

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} .

7. Assessment of Effects

The project will require approximately 4 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.

We support the applicant's suggestion to only use Processing Site 1 when the kindergarten is not operating.

We also recommend that if practicable, the works in the vicinity of the northern part of the tih are scheduled for when the dwelling at 36 Glennandrew Drive is unoccupied. This could be by arrangement, or simply undertaken if and when the occupants are at work / school following consultation.

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 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), with the highest predicted noise levels up to 85dB being subjectively twice compared to a compliant situation. These higher noise levels will be generated over a very short duration of approximately 4 days depending on weather and helicopter availability.

It is also relevant to note that the project is only expected to take 20 days (4 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 2-3 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, being up to five times 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 most of the activities will be compliant with the permitted noise limits in Rule E25.6.27 of the AUP for most of the project. The use of the helicopter and chainsaws used close to houses will infringe this rule by up to approximately 10dB at the closest residential receivers, and there will be lower-level 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. For the short period where the use of the helicopter generates noise levels up to 85dB L_{Aeq} , the noise levels will be subjectively twice as loud as a compliant situation.

The infringements are expected to last for no more than 2-3 days over the course of the project at any receiver. The remainder of the works are likely to be 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, 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. We understand that the provision of written advice to those

affected by the noise from the works will be undertaken as part of the wider communications strategy for the project.

- (1) The noise from all works (except the use of the helicopter) shall comply with noise limits of 80dB L_{Aeq} when measured 1m from the facade of any occupied building in accordance with NZS6803:1999 *Acoustics – Construction Noise*.
- (2) The noise from the use of the helicopter 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*.
- (3) The Communications Plan shall require that 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 Plan 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.

The written communications to 36 Glennandrew Drive shall also include details of the scheduled timing for helicopter tree removal in the vicinity of the northern part of the tihi, and provide the opportunity for the occupiers to arrange a mutually convenient time for the works to be undertaken when the house is vacant.

- (4) The use of a helicopter for lifting is only permitted between the hours of 9am to 5pm from Monday to Friday.
- (5) Processing Site 1 may only be used during the school holiday period (weekdays), when Pigeon Mountain Kindergarten is closed for sessions.

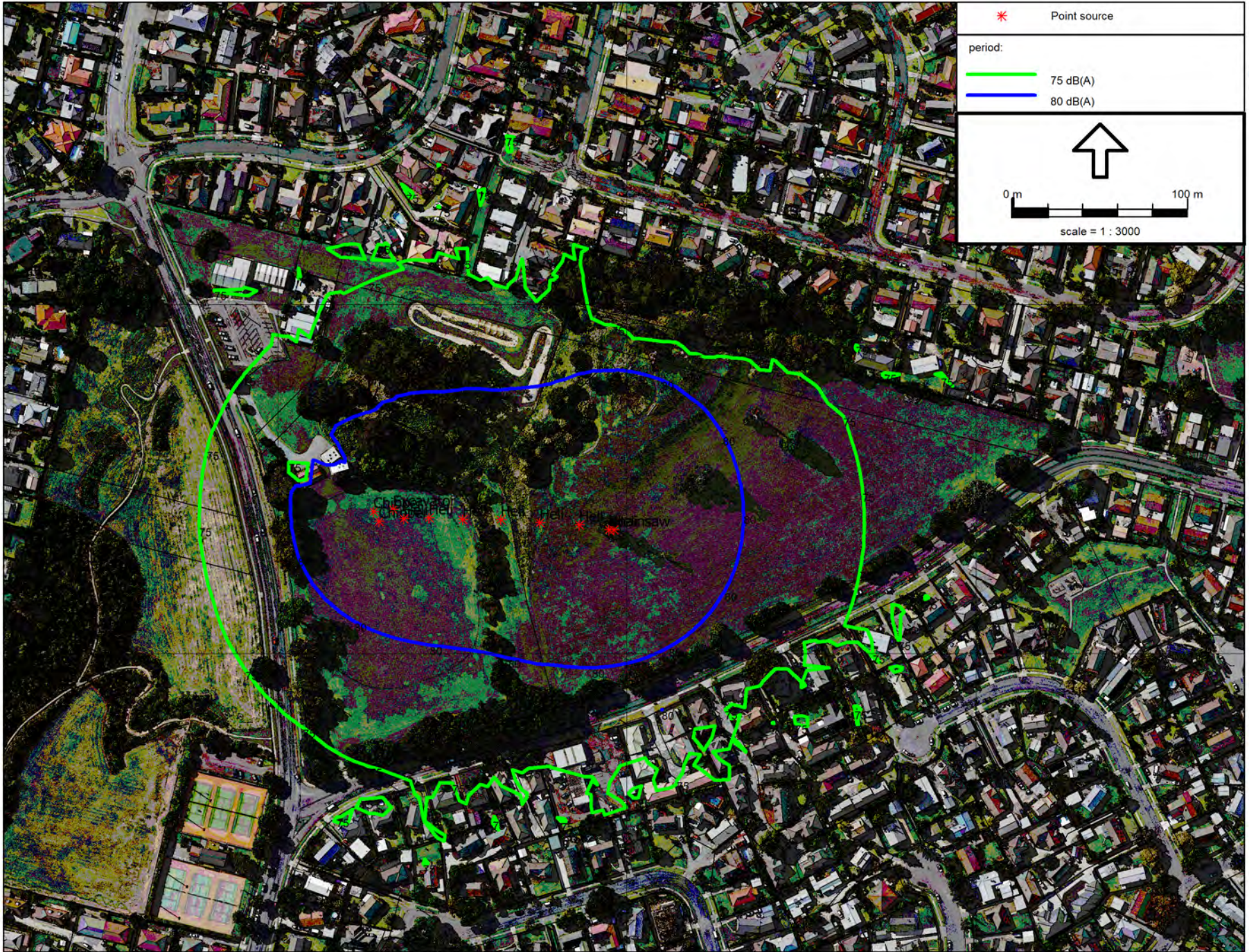
Appendix A – Noise Level Contour Maps

Notes:

- (1) 'Manual' refers to the manual removal of trees using excavators, trucks and/ or a crane where avoiding disturbance of the ground is not critical.
- (2) 'Heli' refers to the use of a helicopter for lifting tree segments away from the work area to Processing Site 1 or 2.

5915800

5915600



* Point source

period:

75 dB(A)

80 dB(A)

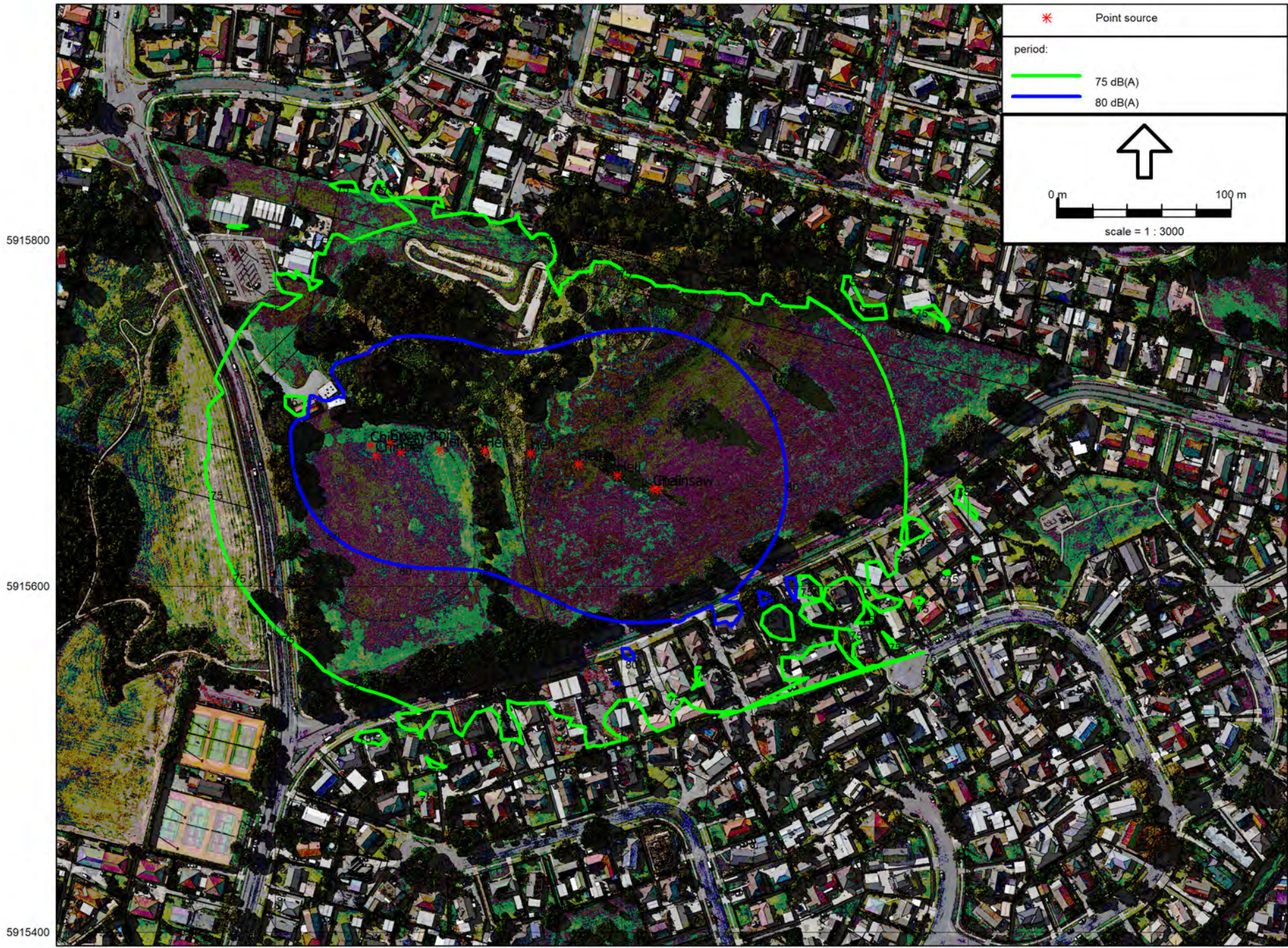
0 m 100 m

scale = 1 : 3000

1769400

1769600

1769800



5915800

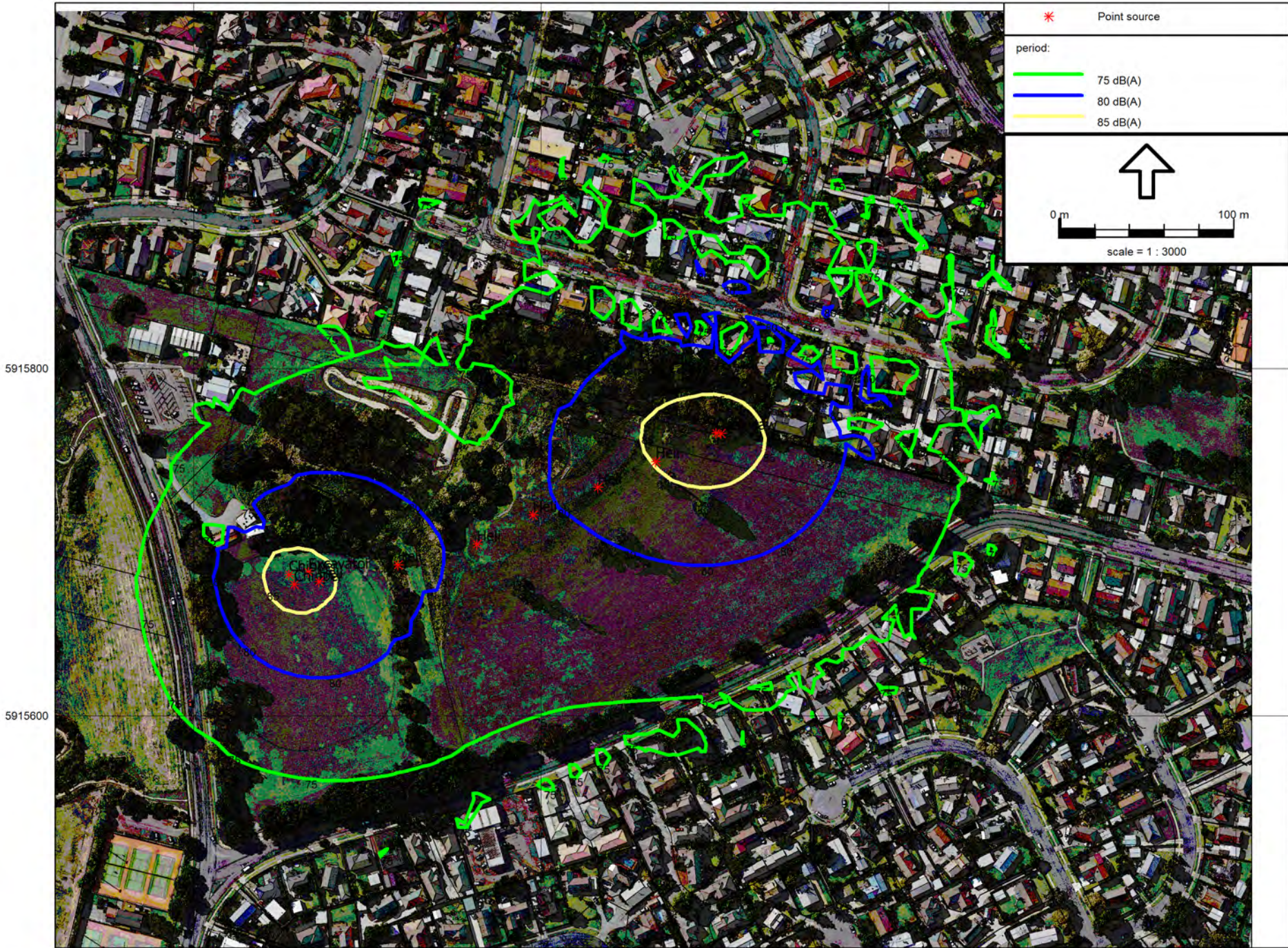
5915600

5915400

1769400

1769600

1769800



5915800

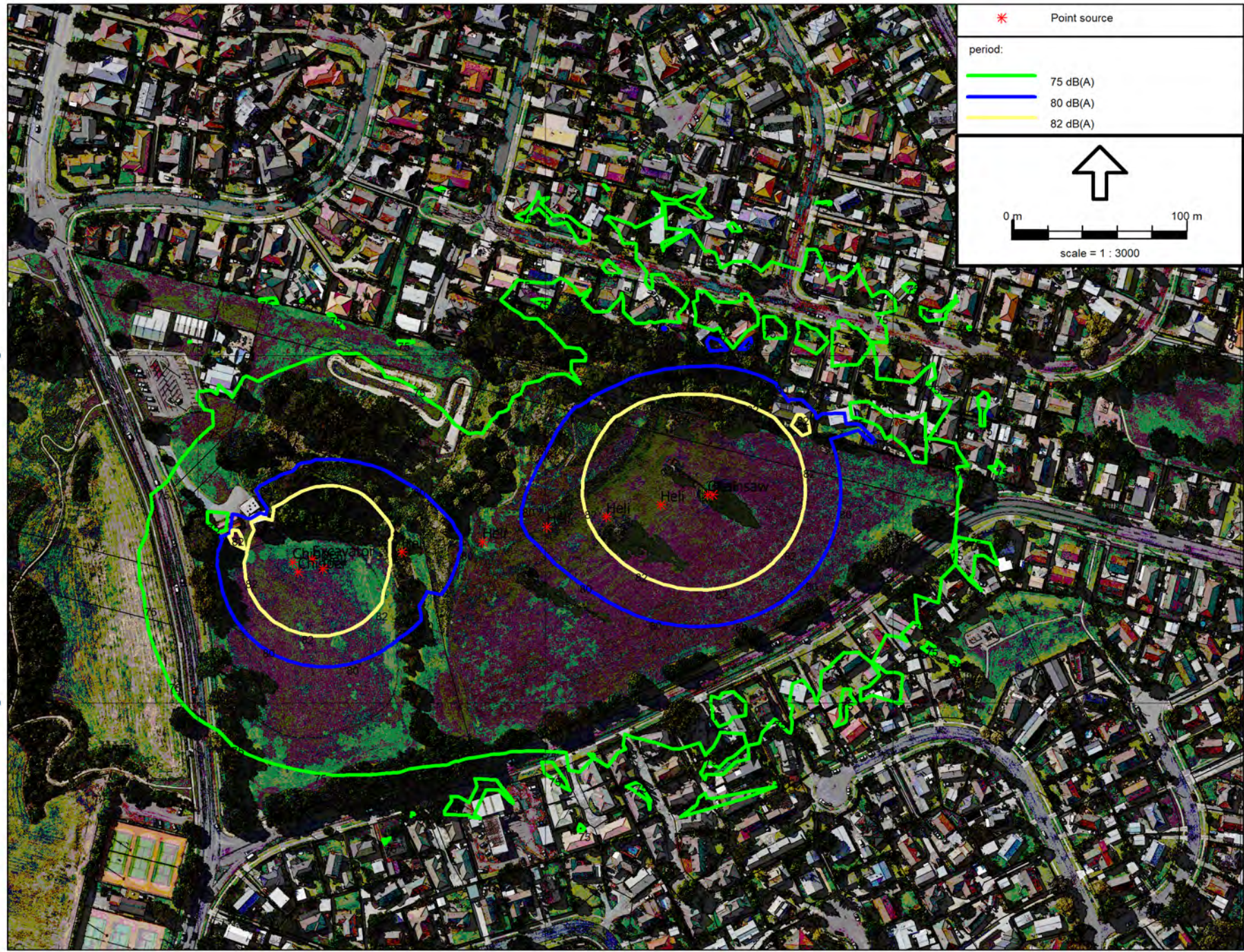
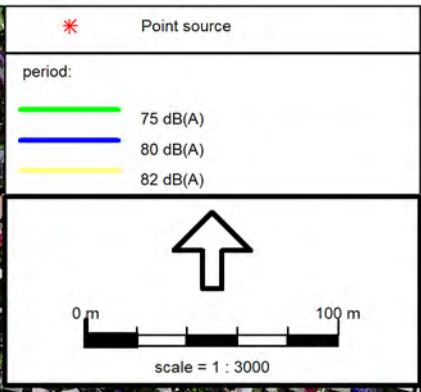
5915600

1769400

1769600

1769800

1770000



5915800

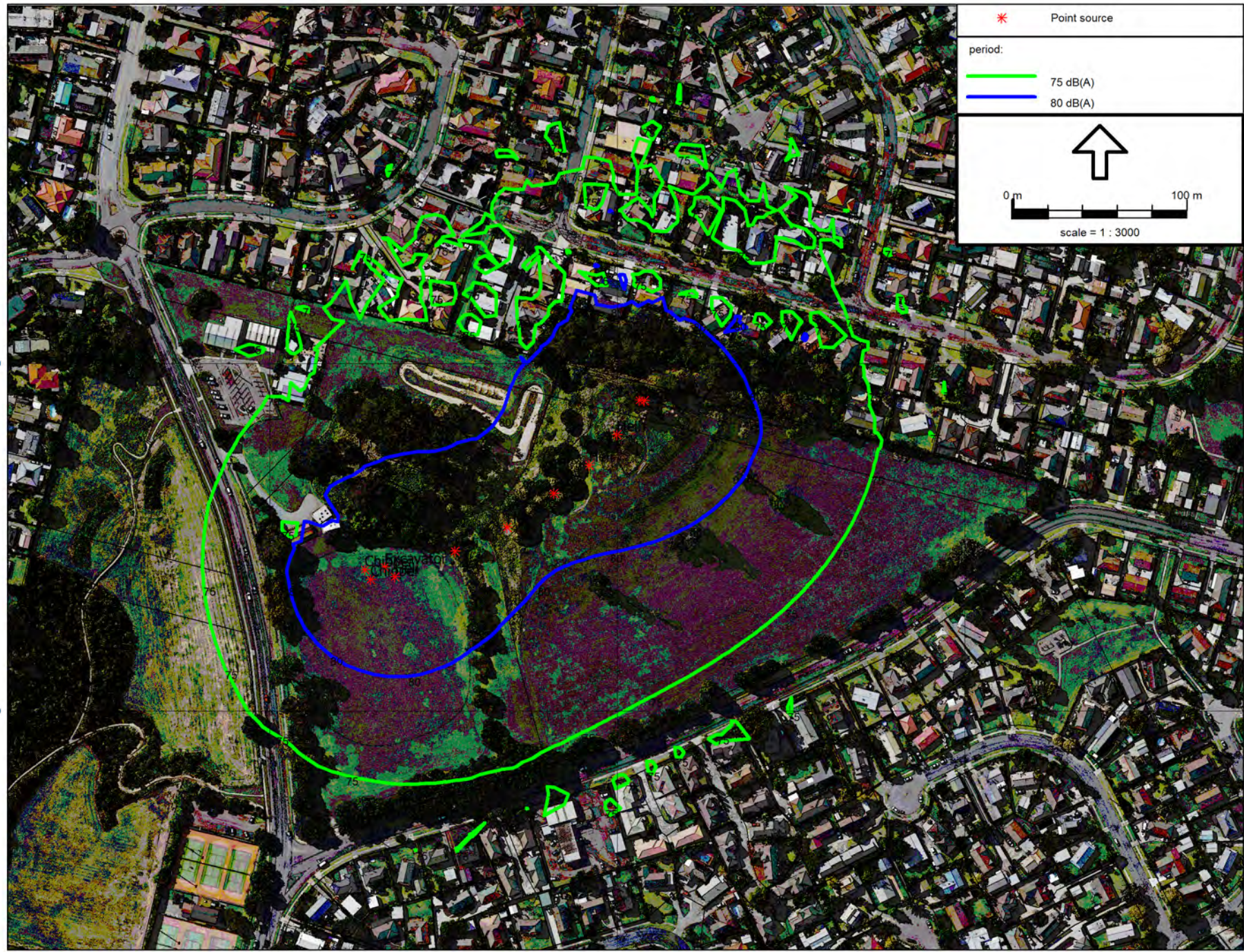
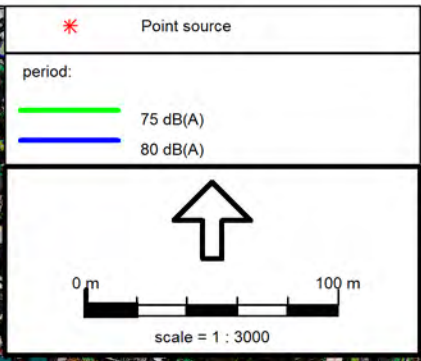
5915600

1769400

1769600

1769800

1770000



5915800

5915600

1769400

1769600

1769800

