Schedule 6: Acoustic Assessment

MARSHALL DAY Acoustics

HOBBITON DCP ACOUSTIC ASSESSMENT

Rp 001 2016302H | 13 January 2018

MARSHALL DAY Acoustics

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Report No.: **Rp 001 2016302H**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft		For client comment	1 July 2016	James Whitlock	James Bell-Booth
Draft	r01	"	9 July 2016	James Whitlock	
Draft	r02	Revised calc, assessment	21 July 2016	James Whitlock	James Bell-Booth
Approved	r03	Revised wording	21 July 2016	James Bell-Booth	
Approved	r04	Response to s92 comments	3 July 2017	James Whitlock	James Bell-Booth
Draft	R05	Response to HAC recommendations	21 December 2017	James Bell-Booth	James Whitlock
Approved	R06	Response to HAC recommendations	13 January 2018	James Bell-Booth	James Whitlock

Cover Photo: highresolution.photography - Tom Hall

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1.0 INTRODUCTION

Marshall Day Acoustics (MDA) has been engaged by Bloxam Burnett & Olliver (BBO), on behalf of Rings Scenic Tours Ltd to assess sound levels from events proposed in a Development Concept Plan (DCP) that covers the Hobbiton movie set and associated tourist facilities at Buckland Road, Matamata.

One of the key purposes of the DCP is to minimise the resource consent requirements for future activities including events such as weddings, birthday parties, corporate functions, concerts, festivals, group movie screenings, conferences and the like. These events are likely to involve the use of amplified music which, depending on the size and output level of the sound system, may be audible at neighbouring dwellings.

Since submitting revision four of this report (dated 3 July 2017) to Matamata-Piako District Council, we have received and reviewed a letter by Hegley Acoustic Consultants (HAC) dated 20 December 2017. The HAC letter contains '*comments and recommendations with respect to noise from the proposed activities*'.

This revision of the report incorporates those aspects that are agreed upon in the HAC letter.

A glossary of acoustic terms is included in Appendix A.

2.0 PROPOSAL

The DCP has been divided into two activity areas identified as Precincts 1 and 2 which are, for the most part, surrounded by a rural buffer zone. A map of the precincts is attached in Appendix B.

2.1 Precinct 1

Precinct 1 encompasses The Shire's Rest facility, including the visitor's centre, car parking, licensed restaurant, gift shop and staging area for tours to the movie set. It is surrounded on all sides by a rural buffer area.

The proposed DCP rules for Precinct 1 include events involving up to 300 people as a Permitted Activity i.e. typically small scale such as birthday parties, corporate events, weddings and other similar functions and outdoor movie screenings. Music events may be acoustic or amplified, and occur inside The Shire's Rest café or outside on the lawn.

Short term accommodation is also proposed in this Precinct, in the form of cabins located to the east of the current carpark.

2.2 Precinct 2

Precinct 2 includes the movie set, the Green Dragon Inn, restaurant marquee, retail souvenir shop, ancillary spaces (workshop, back of house etc.) and the connecting road to Precinct 1. It is surrounded by a rural buffer area on the north, east and south sides, but runs along a length of the legal boundary on the western edge.

The proposed DCP rules for Precinct 2 include the same types of events as for Precinct 1 but on a slightly larger scale – up to 500 people will be permitted if they arrive in private transport, or up to 1000 people if bus services are arranged.

Outdoor events with amplified sound systems are the primary concern relating to sound issues; however this assessment addresses other event types also.

3.0 NOISE PERFORMANCE STANDARDS

The site activities currently operate under specific noise conditions within issued Resource Consents that have been based upon the Rural zone permitted activity noise rules in the Matamata-Piako District Plan. The current operating noise limits are:

"5. Noise

The noise level (L_{10}) as measured at the notional boundary of any rural dwelling not located on the subject site shall not exceed the following:

7.00am to 8.00pm	*50dBA*
8.00pm to 7.00am	*40dBA*

The noise levels shall be measured and assessed in accordance with the requirements of NZS 6801:1991 "Acoustics – Measurement of Environmental Sound" and New Zealand Standard NZS 6802:1991"Assessment of Environmental Sound".

Construction noise from the site shall comply with the relevant noise levels stated in New Zealand Standard NZS 6803P:1984 "The measurement and assessment of noise from construction, maintenance and demolition work". Adjustments provided in clause 6.1 of NZS 6803P:1984 shall apply with references in the table to "NZS6802", shall be read as references to clause 4.2.2 of " NZS 6802:1991"

4.0 COMPUTER MODEL

4.1 SoundPLAN software

The sound level from an outdoor amplified music event has been modelled using the SoundPLAN environmental modelling package. An outdoor amplified music event was modelled as it is considered to be the noisiest potential event. SoundPLAN applies the prediction method contained in International Standard ISO 9613-2:1996 to a 3D model space. The model incorporates a digital terrain map (generated from mesh contours with 1m elevations provided by the client), buildings, sound sources and selected receivers. The sound level predictions take account of propagation over distance, air and ground absorption, a slight positive wind effect and shielding provided by the ground topography and built structures.

The following specific inputs have been used.

4.1.1 Sound sources

Options for event sound systems for outdoor amplified music are many and varied, with a wide range of sound level outputs and directivity characteristics. The sound sources in this model are based on a typical industry standard line array system such as shown in Figure 1 overleaf.

Figure 1: Indicative event sound system array (one side)

Photo credit: ProAV Max

These systems are highly directional (i.e. they project sound in specific directions). However, because the orientation of the sound systems in Precincts 1 and 2 is not fixed, the directivity characteristics in the model (in terms of frequency) have been applied omnidirectionally – as if the loudspeakers were pointing in all directions at once. This is a conservative approach to ensure the model is applicable to all events, regardless of the stage/system orientation.

Three concert systems have been placed in the model to represent stages in the following outdoor locations:

- Precinct 1 – The Shire's Rest
- Precinct 2 – Hobbiton village green (i.e. on the lawn under the party tree)
- Precinct 2 – Hobbiton flat lawn (the event area adjacent to the tour drop off point)

The locations described above are shown on the plan in Appendix C.

In the model, the sound sources have been placed at a height of 3 metres above ground, except the Hobbiton village green system which is at 6 metres (to represent a flown line array system).

4.1.2 Receivers

The receivers in the model are those existing dwellings not located on land within the DCP area (i.e. outside the rural buffer area shown in Appendix B). The model includes the dwellings themselves as building objects but the actual receiver location is at their notional boundary, which is 20 metres from the dwelling façade or the site boundary, whichever is closest.

Three additional receivers have been added – one representing a mixing desk 30 metres from each concert system source. These are used as the datum points for each system, to control sound levels received by dwellings.

All receivers have been placed at a height of 1.5 m above ground level, in accordance with NZS 6801:2008.

A map of receivers included in the model is attached in Appendix C. Note that two receivers are located off the edge of the aerial photo, however they are still on the digital ground map so the model results at these locations are valid.

5.0 PREDICTED SOUND LEVELS

The following event scenarios have been modelled:

- Precinct 1 The Shire's Rest outdoor event
- Precinct 2 village green event
- Precinct 2 flat lawn event
- All events occurring simultaneously

Table 1 below shows the predicted sound levels. These have been adjusted to achieve compliance with a night-time limit of 40 dB L_{A10} at the closest receiver, as well as to include a +5 adjustment for special audible character (which is appropriate for music events, in accordance with NZS 6802:2008).

No duration adjustment has been applied in the model because the duration of the proposed events will vary considerably, and to keep the model conservative. Duration adjustment is allowed for in NZS 6802, and would average event sound levels over the full daytime period (including when the event is not happening) making the assessment level lower.

The upper level at each mixing desk in order to ensure compliance is shown in **bold,** and the controlling level for each scenario is indicated in red.

Table 1: Predicted sound levels during outdoor events

Receiver	Predicted concert sound level (dB L_{A10})			
	Precinct 1 event	Precinct 2 village green event	Precinct 2 flat lawn event	All events together
The Shire's Rest mixing desk	**68**	28	29	**68**
Hobbiton village green mixing desk	21	**72**	58	**66**
Hobbiton flat lawn mixing desk	21	55	**74**	**66**
161B Jondor Rd	19	25	27	24
226A Buckland Rd	27	23	24	27
226B Buckland Rd	26	23	24	27
236 Buckland Rd	27	24	25	28
277A Buckland Rd	27	23	25	27
277B Buckland Rd	26	22	23	26
277C Buckland Rd	20	19	20	21
328 Buckland Rd	28	26	27	29
385 Buckland Rd	30	25	27	30
399A Buckland Rd	35	26	27	35
399B Buckland Rd	33	26	26	33
553A Buckland Rd	33	35	35	35
632 Buckland Rd	27	33	33	31

Note: A special audible character penalty has been applied so limit for assessment is 5 decibels below the night-time limit of L_{A10} 40 dB

These results indicate that to achieve compliance with a 40 dB L_{A10} night time noise level at all receivers, the sound system output must be reduced to 66 – 74 dB at the mixing desk (30 metres), depending on the scenario.

To achieve compliance with a 50 dB L_{A10} day time noise level at all receivers, the sound system output can be 10 decibels higher i.e. 76 – 84 (depending on which location – refer Table 1).

6.0 DISCUSSION

6.1 Outdoor amplified events

The control levels outlined above are considered to be rather restrictive. For a typical outdoor concert such as a music event or local band performance (but not a major international concert event), the mixing desk level would be around 95 – 100 dB. An outdoor cinema screening would typically have levels around 85-90 dB at the mixing desk.

Most outdoor concert events permitted in the DCP (to larger audiences of 300 – 1000) may be on a smaller scale but could, if initiated by the sound engineer, readily encroach into this sound level range.

Outdoor concert and cinema screening events with levels below 85 dB at the mixing desk would probably be considered 'too quiet' by the sound engineer and audience alike. This may also be the case for outdoor movie screenings, which would typically be played at a lower (and less consistent) sound level than concerts but could readily go above 66 – 74 at 30 metres (and therefore potentially be non-compliant).

For any amplified outdoor event, the actual sound level will be at the sound engineer's discretion so they should understand the noise limits, how they restrict the event, and how to facilitate compliance with them.

6.2 Sound system directivity

As discussed in Section 4.1.1, the prediction model has used omnidirectional sound sources to enable event loudspeakers to be oriented in any direction. If the orientation of the concert systems is constrained, then the loudspeaker directivity can be exploited to enable higher output levels.

The model has been rerun with directivity characteristics included and the systems oriented as follows:

- The Shire's Rest system facing due east
- Hobbiton village green system facing north-west
- Hobbiton flat lawn system facing north-east

These orientations result in the maximum mixing desk levels for night-time events shown in Table 2 below. Mixing desk control levels can be 10 decibels higher for daytime events:

Table 2: Maximum sound levels at each mixing desk during night-time events using directional sound systems

Receiver	Predicted concert sound level (dB L_{A10})			
	Precinct 1 event	Precinct 2 village green event	Precinct 2 flat lawn event	All events together
The Shire's Rest mixing desk	73	-	-	73
Hobbiton village green mixing desk	-	79	-	69
Hobbiton flat lawn mixing desk	-	-	85	72

Note: A special audible character penalty has been applied so limit for assessment is 5 decibels below the night-time limit of L_{A10} 40 dB

These results show that with sound system directivity taken into account, the sound levels at mixing desks can be increased by 3 – 11 decibels and still comply with the currently consented noise limits. However the levels at the mixing desk would still likely be considered 'too quiet'.

In lieu of restricting the concert/movie screening sound systems, MDA considers it is reasonable to adopt more permissive noise controls in the DCP for these specific event types, provided there is a control over the number of events per year.

Specifically, it is considered that 55 dB L_{Aeq} for up to 12 movie screening events and 65 dB L_{Aeq} for up to 6 concert events per year would be reasonable. This would enable levels of 90 to 100 dB at the mixing desk for those event types respectively.

Compliance with these proposed levels should be monitored at the first instance of each event type to corroborate the modelled transfer functions. If required, further controls can be placed on mixing desk sound levels to ensure compliance with the DCP.

A discussion on noise limits proposed for the DCP are set out below.

A grid noise map of the 'all events- directional sound system' scenario is also attached in Appendix D. This shows how sound from each concert system propagates over the terrain.

7.0 PROPOSED REVISION TO DCP NOISE LIMITS

7.1 Background guidelines and standards

7.1.1 NZS 6802:2008

This NZ Standard provides the following guidelines. It is suggested that these be applied at the notional boundary of rural dwellings.

Daytime:	55 dB $L_{Aeq(15\ min)}$	
Evening:	50 dB $L_{Aeq(15\ min)}$	
Night:	45 dB $L_{Aeq(15\ min)}$	75 dB L_{AFmax}

The Standard is clear that these are provided only as guidelines and that District Councils should set their own limits, however this night-time control is generally accepted to be the upper threshold of acceptability.

7.1.2 World Health Organisation

The World Health Organisation Guidelines on Community Noise state that during the daytime, few people are seriously annoyed by external noise levels of less than 55 dB $L_{Aeq\ (16\ hour)}$ with few people moderately annoyed by noise levels of less than 50 dB $L_{Aeq(16\ hour)}$. These guidelines suggest that to ensure sleep disturbance does not arise, noise levels should be no greater than 45 dB $L_{Aeq(8\ hour)}$ and 60 dB L_{AFmax} outside dwellings. For a typical NZ dwelling, this equates to an indoor noise level of around 30 dB L_{Aeq} if the windows are slightly ajar.

7.1.3 Temporary Events

It is important to note that the guidance from NZS6802 and WHO are intended to control activities which occur every day. Infrequent events with amplified sound typically have a noise limit of 75 – 85 dB L_{A10}. Examples of controls applied to a number of outdoor venues are as follows:

- Trusts Stadium, Auckland – 75 dB L_{A10} (3 events per year, until 10:30 pm)
- Western Springs Stadium, Auckland – 85 dB L_{A10} (6 events per year, until 11:30 pm)
- Arena Manawatu, Palmerston North – 75 dB L_{A10} (30 events per year, until 10:30 pm)

- Okara Stadium, Whangarei – 75 dB L_{A10} (5 events per year, until 11 pm)
- Hamilton Major Facilities Zone – 75 dB L_{A10} (5 events per year, until 11 pm)
- The Hub, Hawera – 80 dB L_{A10} (6 events per year, until 10 pm)

It is noted that the examples given are generally located in urban/suburban environments with residential receivers located very close to the activity. At the Hobbiton site, the nearest receivers are further away from the proposed speaker systems therefore a noise limit lower than 75 dB could be achieved whilst generating adequate sound levels for the audience (85-100 dB at the mixing desk). Furthermore the ambient sound levels in the rural environment will be lower than those in a urban/suburban context. In recognition of the above less permissive standards, 65 dB L_{Aeq} for amplified music events/concerts and 55 dB L_{Aeq} for movie screenings are proposed.

7.2 Recommended DCP Permitted Activity Noise Performance Standards

To ensure that the intent of the above is captured within the proposed DCP, the following permitted activity performance standards for the DCP are recommended:

" Noise

a) The noise level from site activities other than the exclusions listed in b, c and d below, as measured at or within the notional boundary of any rural dwelling located outside the DCP area and existing at [insert date of plan change notification] shall not exceed the following:

7.00am to 10.00pm	*50 dB L_{Aeq}*
10.00pm to 7.00am	*40 dB L_{Aeq} and 70 dB L_{AFmax}*

b) Seasonal or temporarily intermittent noise resulting from agriculture and forestry activities (e.g. crop spraying, agriculture or forestry harvesting etc.) consistent with the predominant character of the Rural zone, are permitted provided that:

i) The activity is conducted in accordance with the requirements of section 16 of the Resource Management Act 1991; and

ii) The activity is conducted in accordance with good management practice; and

iii) Machinery is operated in accordance with manufacturers' specifications.

This exclusion does not include rural operations such as the distribution of industrial factory by-products.

*c) Up to **12 outdoor movie screening events** that exceed the noise levels in (a) are permitted in any calendar year, with no more than two events in a seven-day period, and no more than three events in a calendar month. The events shall not exceed the following when measured within the notional boundary of any rural dwelling located outside the DCP area and existing at [insert date of plan change notification]:*

7.00am to 11.00pm during daylight savings time *7.00am to 10.00pm outside of daylight savings time*	*55 dB L_{Aeq}*
All other times	*40 dB L_{Aeq} and 70 dB L_{AFmax}*

Continued overleaf

d) *Up to **6 outdoor amplified music /concert events** are permitted in any calendar year, with no more than two events in a seven-day period, and no more than three events in a calendar month. The events shall:*

   i. *Not exceed six hours duration (excluding sound testing and balancing on the day of the event)*
   ii. *Not exceed 65dB L_{Aeq} as measured within the notional boundary of any rural dwelling located outside the DCP area and existing at [insert date of plan change notification]*
   iii. *End by 11.00pm during daylight savings, and by 10.00pm at all other times of the year*
   iv. *Have a period of sound testing and balancing undertaken on the day of the event between 9am and 3pm. The noise from the testing shall not exceed 55 dB L_{Aeq} as measured within the notional boundary of any rural dwelling located outside the DCP area and existing at [insert date of plan change notification]. The cumulative sound testing period shall not exceed 1 hour.*

e) *Written notice shall be provided to the occupiers of all properties, within a 3km radius of the precinct where any outdoor amplified music / concert event is being held, a minimum of seven days prior to the event. The written notice shall include the following details:*

- *The date and time of the event; and*
- *The name and mobile phone number of a contact person who will be available to respond to any enquirers prior to, during and after the event*

f) *A single noise management plan shall be prepared for all concert and outdoor movie events. It shall be submitted to MPDC at least 10 working days prior to the first event and shall detail:*

- *The applicable noise limits*
- *How noise from the events will be managed and controlled to comply with the limit*
- *Noise monitoring locations and methodology*
- *A list of neighbours who have been consulted and a summary of the consultation*
- *How any complaints will be recorded and managed*

g) *Monitoring of sound levels during the first occurrence of each event type listed in Conditions (c) and (d) shall be carried out at the closest neighbouring dwelling to that event, and in response to any complaints of these event types should they arise. A report of the monitoring results shall be submitted to council within 10 working days of the event(s).*

h) *All Sound levels shall be measured in accordance with the requirements of NZS 6801:2008 "Acoustics – Measurement of Environmental Sound" and assessed in accordance with the requirements of New Zealand Standard NZS 6802:2008 "Acoustics – Environmental Noise".*

i) *Construction noise from the site shall comply NZS6803:1999 "Acoustics – Construction Noise".*

8.0 CONCLUSIONS

MDA has been engaged to predict sound levels from events proposed at Hobbiton in relation to the proposed DCP, and make recommendations to manage any effects.

Events, outdoor amplified music/ concert events and outdoor movie screenings with sound systems set to typical levels (85-100 dB at the mixing desk) are predicted to comply with the New Zealand Standards and World Health Organisation guidelines recommended as the DCP rules in Section 7.2.

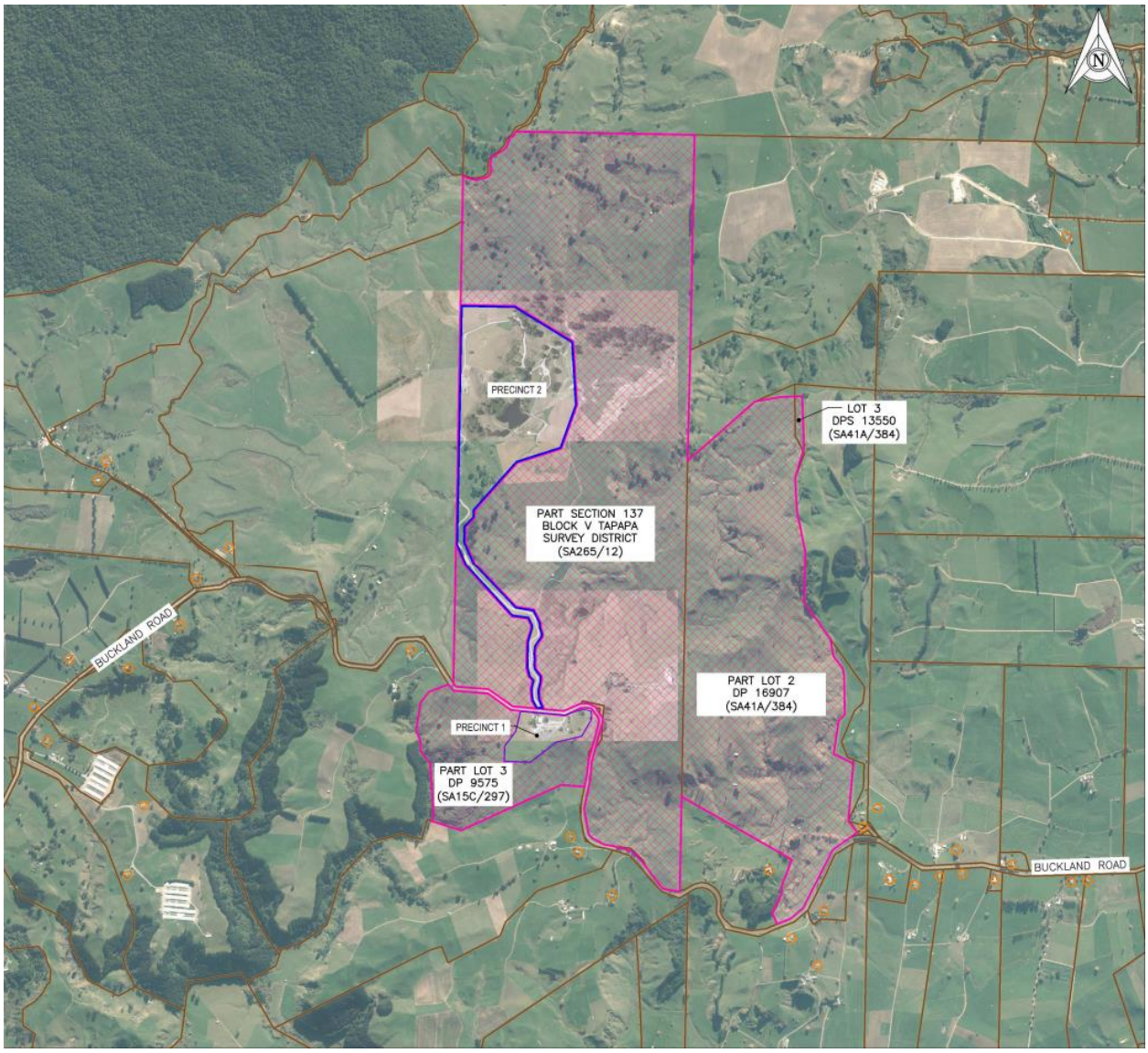
All other event types proposed for Hobbiton are also predicted to, under normal circumstances, comply with the proposed DCP rules in Section 7.2. These include (but are not limited to):

- Indoor events (provided the opening of doors and windows is well managed)
- Unamplified music (indoor or outdoor)
- Weddings
- Birthday parties
- Corporate functions
- Conferences
- Movie set tours
- Short stay accommodation

APPENDIX A – GLOSSARY OF TERMINOLOGY

Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A10\,(t)}$	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Notional Boundary	A line surrounding a dwelling at a distance of 20 metres, or the property boundary, whichever is closer to the dwelling
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of environmental sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise"*
Special Audible Characteristics	Distinctive characteristics of a sound which are likely to subjectively cause adverse community response at lower levels than a sound without such characteristics. Examples are tonality (e.g. a hum or a whine) and impulsiveness (e.g. bangs or thumps).

APPENDIX B – PRECINCT MAPS



PART SECTION 137
BLOCK V TAPAPA
SURVEY DISTRICT
(SA265/12)

FARM ACCESS

BUCKLAND ROAD

1

2

PRECINCT 1

PART LOT 3
DP9575
(SA15C/297)

KEY

PRECINCT BOUNDARIES

DEVELOPMENT CONCEPT PLAN BOUNDARY

RURAL BUFFER AREA

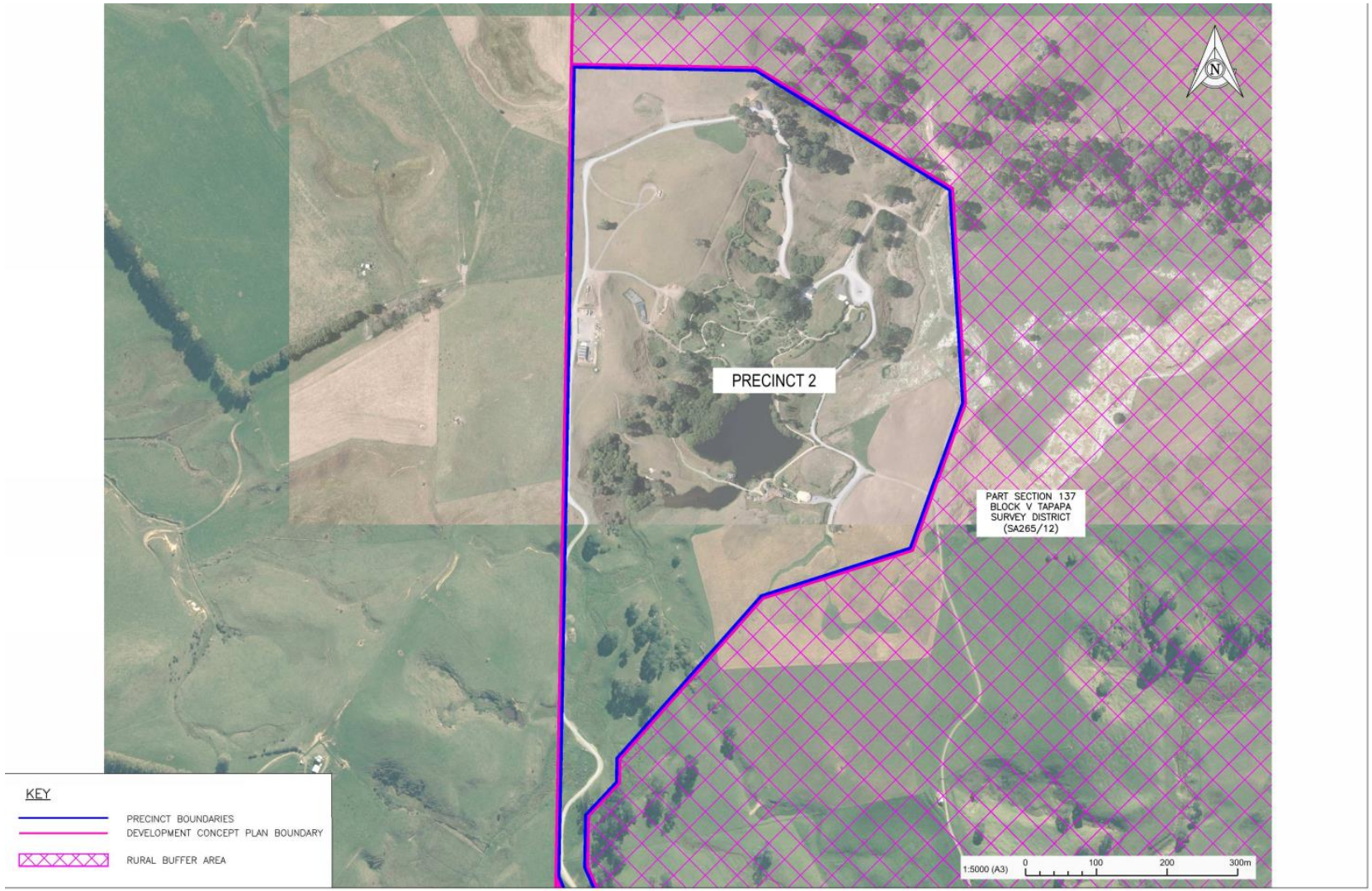
1 2 LOCATION OF VEHICLE ACCESSES TO PRECINCT 1

1:1250 (A3) 0 25 50 75m

K:\144150 Hobbiton Proposed Plan Change to District Plan\Hobbiton DCP\Drawings\144150_00_DCP SHT 2_2018.dwg 26/1/2018 4:06 p.m. jbowen

JANUARY 2018

DEVELOPMENT CONCEPT PLAN
HOBBITON MOVIE SET, BUCKLAND ROAD, MATAMATA



JANUARY 2018

DEVELOPMENT CONCEPT PLAN
HOBBITON MOVIE SET, BUCKLAND ROAD, MATAMATA

SHEET 3 OF 6

APPENDIX C – MAP SHOWING RECIEVERS IN MODEL