MARSHALL DAY Acoustics

MURIWAI DOWNS GOLF PROJECT
NOISE ASSESSMENT

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Project: **MURIWAI DOWNS GOLF PROJECT**

Prepared for: **The Bears Home Project Management Limited**

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1.0 SUMMARY

Marshall Day Acoustics has been engaged by The Bears Home Project Management Limited to assess the noise effects of the construction and operation of the proposed golf course at 610 Muriwai Road, Waimauku.

The development is described in detail by others but in summary the main facilities are; an international 19 hole golf course (plus a 9 hole short course), several associated buildings (clubhouse, Lodge, Sports Academy, maintenance buildings), a water storage reservoir and a helicopter landing facility.

The key activities likely to produce noise are discussed in detail in this report under three headings:

- Construction noise (golf course, associated buildings and reservoir)
- Operational noise (maintenance equipment)
- Helicopter noise

The findings of our assessment of noise effects are as follows:

- The proposed construction works are a significant distance from all nearby receivers. Noise levels of approximately 50 dB L_{Aeq} are predicted at the closest receiver (68 Muriwai Valley Road, 350m from the water reservoir area), which comfortably complies with the 75 dB L_{Aeq} noise limit. Construction noise may be audible at times but at a low level. The character of the construction noise is typical of normal rural farm machinery.
- The main noise from ongoing 'day to day' operation of the development will be from maintenance machinery and members using the course and facilities. The noise from this machinery is considerably less than that from the construction machinery and will thus be significantly below the 50 dB L_{Aeq} predicted for construction noise. These levels will be significantly below the 'day to day' noise limits of 55 dBA L_{Aeq} . Noise from these sources would be at a very low level and not generally be audible at the closest receivers.
- Helicopter activity at most times will be at a low level of operations with the typical day expected to be around 6 movements (3 flights in and out). Noise modelling of this level of activity (Figure 7) shows that the noise limits in AUP Rule 25.6.32 of 55 dB L_{Aeq} can readily be complied with. Due to the low level of noise exposure and the short duration intermittent nature of this noise source, the effects of helicopter noise are considered reasonable.

A glossary of acoustic terminology is included in Appendix A.

2.0 PROJECT DESCRIPTION

2.1 Proposed Development

The proposed development is described in detail in other documents, however in summary, the project comprises the construction, operation and maintenance of the following physical site components:

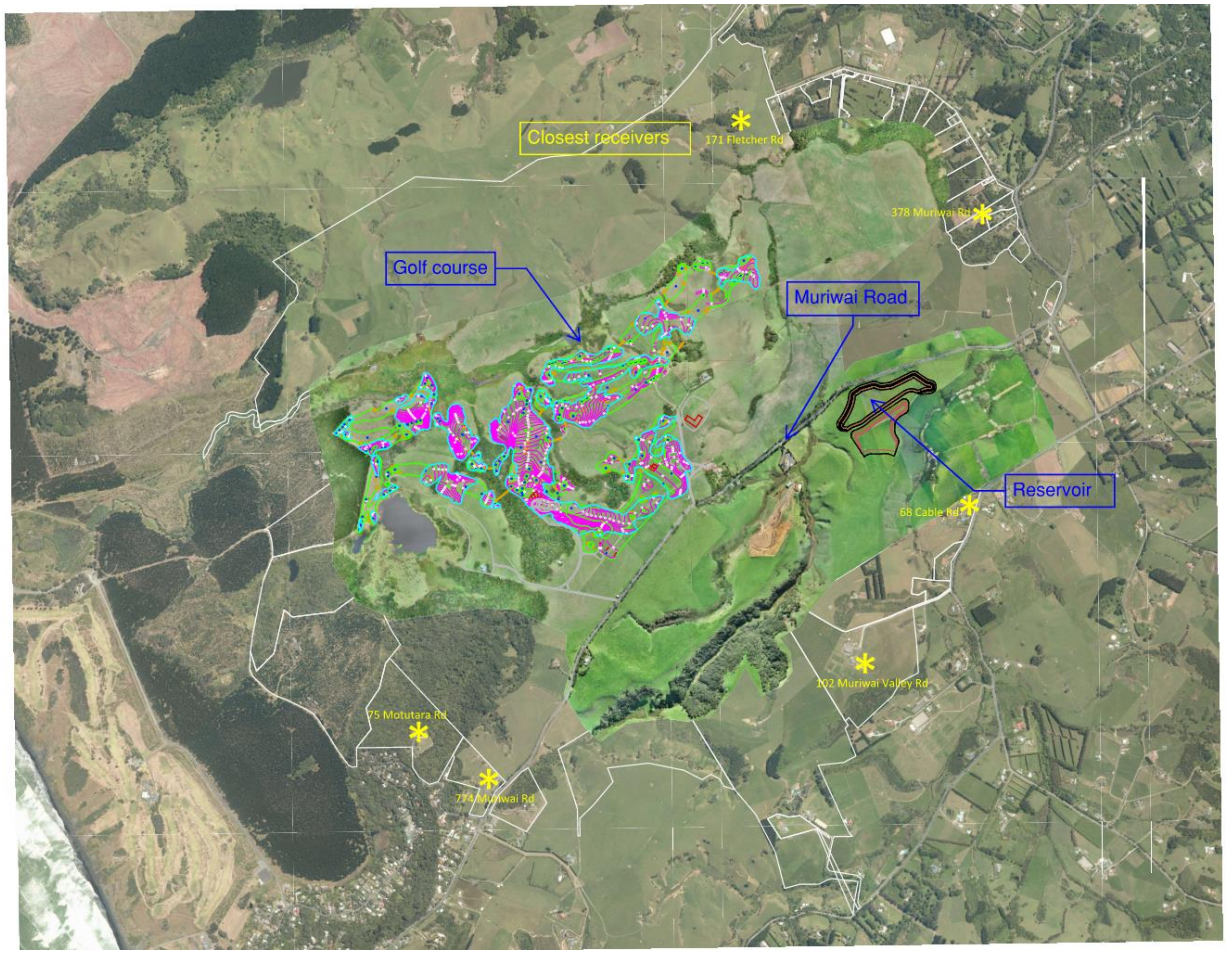
- An international, marquee standard 19-hole golf course with warm-up fairway and short-game practice area;
- A clubhouse;
- A sports academy including; an academy building, academy driving range, practice green, 9-hole short course, and indoor and outdoor tennis facilities;
- A golf and property maintenance complex;
- A luxury lodge which includes accommodation, a wellness centre and retreat;

- Dining facilities including a clubhouse and lodge restaurants and a café at the sports academy;
- Groundwater and surface water abstraction facilities;
- Off-stream water storage reservoir;
- Significant ecological restoration and enhancement works; and
- Various supporting infrastructure associated with the above items.

2.2 Closest Receivers

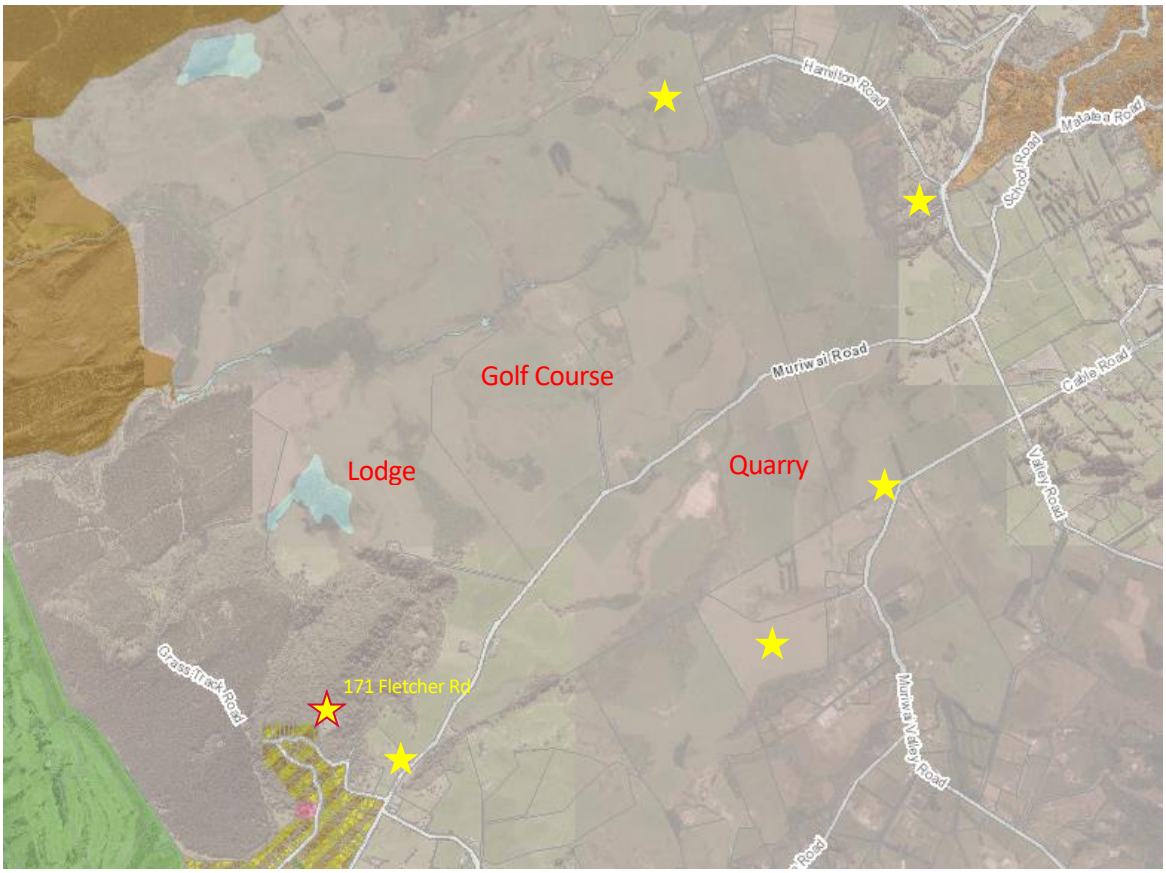
The proposed development and the closest potentially affected dwellings are shown in Figure 1 below. The closest dwelling is to the North at 171 Fletcher Road and is approximately 700m from the golf course. The other dwellings shown are 1100m to 1200m away.

Figure 1: Map of development and closest receivers



2.3 Auckland Unitary Plan (AUP) Zoning

Figure 2: AUP Zoning and Closest Dwellings



Legend

- Rural - Rural Production Zone
- Residential - Rural and Coastal Settlement Zone
- Rural - Rural Coastal Zone
- Rural - Countryside Living Zone
- Open Space - Informal Recreation Zone
- Closest Dwellings

The golf course development itself is zoned *Rural – Rural Production Zone*.

The 6 closest potentially affected dwellings (shown in Figures 1 and 2) are all located in the Rural Production Zone. Of those, the closest dwelling at 171 Fletcher Road is at 700m to the north of the development. There are houses located to the north-east of Fletcher Road that are in the 'Rural - Countryside Living Zone'. These dwellings are slightly further away than 171 Fletched Road and we understand the noise limits in the Rural - Countryside Living Zone are the same as for the Rural Production Zone receivers (171 Fletcher Road). Thus 171 Fletcher Road is the critical receiver.

The applicable noise standards copied from the Auckland Unitary Plan (Operative in Part) (**AUP**) are attached as Appendix B. The rules applying to each of the different parts of the development - construction, maintenance, helicopters, are all quite different and are discussed under separate sections below.

2.4 Ambient Noise Environment

The area surrounding the proposed development is a typical rural environment. The ambient noise environment would also be typical for a rural environment that is relatively close to a busy rural road (Muriwai Road carries approximately 3500 vehicles per day 7 day average ADT and 620vph in peak hour).

In this case an ambient noise survey is not necessary as the noise levels will be typical (or slightly higher than typical) for a rural environment and thus the AUP rural noise rules provide an appropriate level of protection for surrounding residents. If compliance with these limits is achieved the noise effects are considered to be reasonable.

Compliance with the noise limits for construction noise, operational noise and helicopter noise are considered separately in the next three sections.

3.0 CONSTRUCTION NOISE ASSESSMENT

This section contains the noise limits for construction activity and our assessment of noise from the proposed construction activities.

Construction vibration has not been assessed because of the large setback from the construction works to nearby receivers. Vibration is predicted to be imperceptible at these distances.

3.1 Construction Noise Performance Standards

The AUP construction noise limits applying to all receivers in this area are shown in Rule E25.6.27 which is copied in full in Appendix B.

In summary the critical noise limit during construction hours (Weekdays and Saturdays 7:30 am to 6:00pm) is L_{Aeq} 70 dB.

3.2 Proposed Construction Activities and Equipment

The following equipment list was provided by McKenzie & Co[1].

We have provided the sound power levels for each item of equipment in Table 1 which are based on many years of Marshall Day measurements at a number of similar construction sites and quarries. These source levels are used in the noise modelling (see Section 3.2.1).

The key sources are the heavy earth works machinery and large excavators.

[1] Email from James Dufty, 19 August 2021

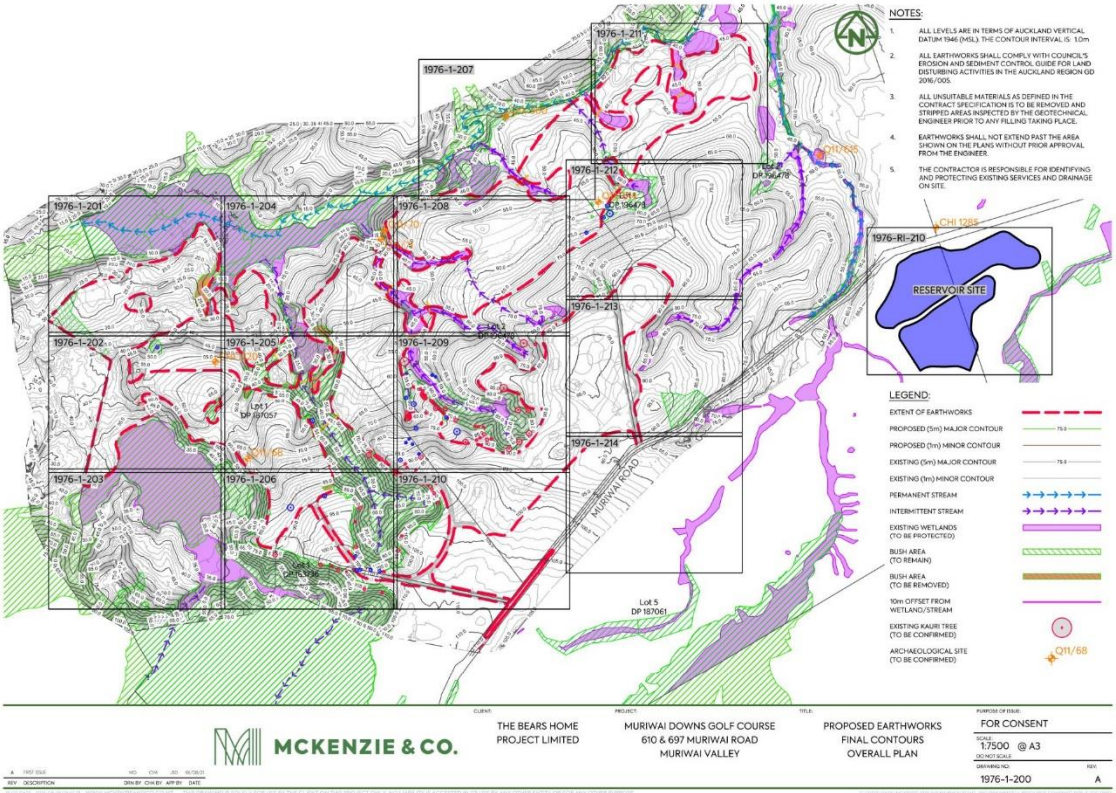
Table 1: Summary of earthworks equipment

Type	Equipment	Number on site	Sound power level (dB L_{WA})
Heavy earthworks machinery	Motorscraper (657s and 637s)	2	114
	D8 bulldozer	2	114
	825 compactor	4	113
	30 tonne moxy	4	110
Excavators	30 tonne	4	106
	20 tonne	3	103
	10 tonne	2	102
	5 tonne	2	101
Miscellaneous	Concrete trucks, staff vehicles, asphalting equipment, kerbing machines, small compactors	Typical construction site numbers	Generally 90 – 100

3.2.1 Location of Construction Activity

Areas of golf course earthworks and construction activity are shown within the red dashed line in Figure 3 below [2]. The earthworks footprint for the water storage reservoir is shown in blue shading.

Figure 3: Areas of Construction Operation



[2] Provided by McKenzie & Co ('*1976-1-200.pdf*', provided on 19 August 2021

3.3 Predicted Construction Noise Levels

3.3.1 Noise Modelling Details

We have modelled noise from the proposed construction works using SoundPLAN® environmental noise modelling software.

The following information has been incorporated in the noise model:

- Topographical contours at 1m intervals obtained from Auckland Council
- Aerial maps, cadastral boundaries and buildings obtained from LINZ
- Equipment locations based on the extent of earthworks figure)

We predicted noise levels in accordance with the algorithm detailed in ISO9613-2: 1996- *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO9613) as implemented in SoundPLAN®.

ISO9613 considers a range of frequency dependent attenuation factors, including spherical divergence, atmospheric absorption, ground effect, acoustic screening and directivity effects. It assumes meteorological conditions favourable to propagation from sources (downwind at wind speeds 1 – 5m/s in all directions), and as such, calculates slightly conservative sound levels.

The noise contours are obtained by computer interpolation between calculated grid points at 20m intervals, 1.5m above ground level.

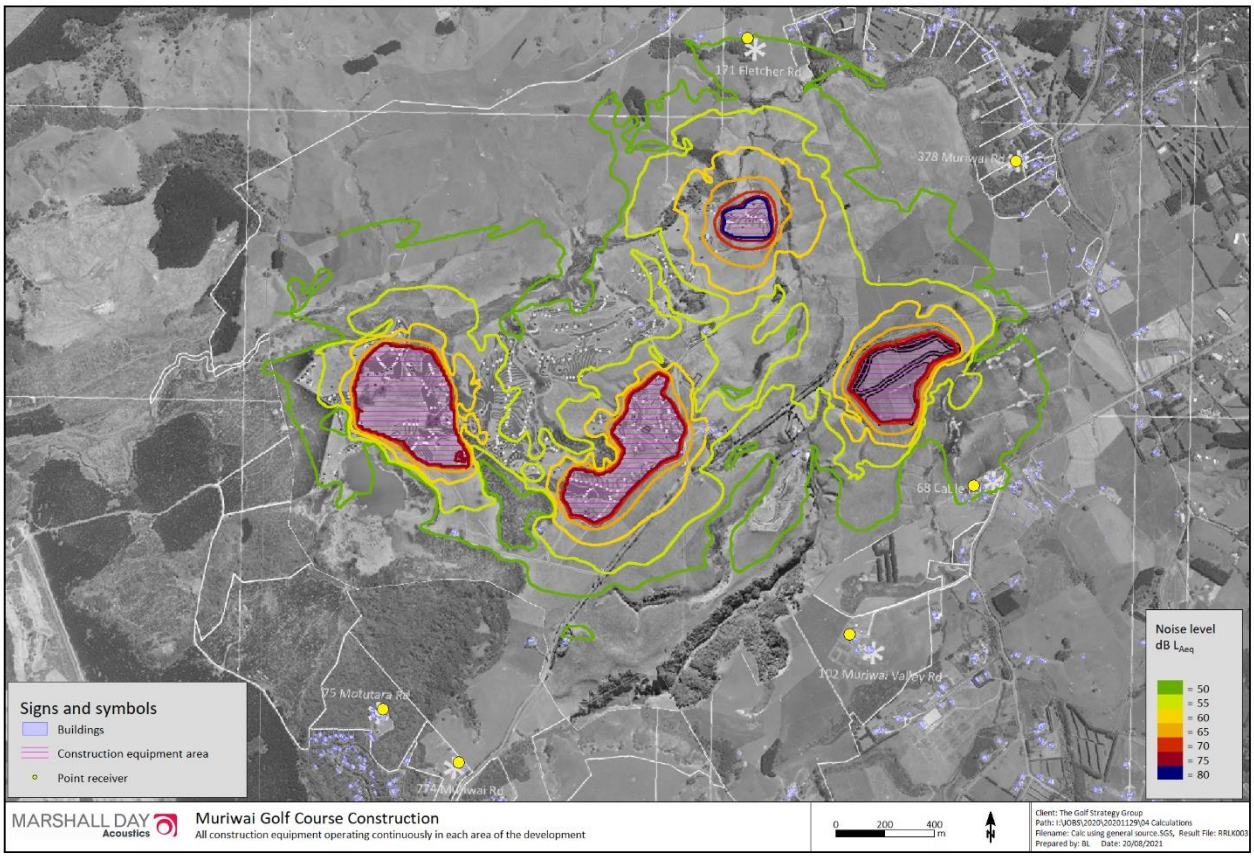
3.3.2 Construction Noise Contours

Figure 4 presents noise contours based on a very conservative worst-case scenario.

We have assumed that all noisy construction equipment (all heavy earthworks machinery and excavators in Table 1) are operating simultaneously in a given area of the site. While this scenario is unrealistic, it illustrates the highest noise levels that could be received at any of the adjacent receivers.

The combined sound power level of the noisy equipment is 124 dB L_{WA}. We have modelled this as an area source, as shown by the pink hatched areas in Figure 4 below.

Figure 4: Predicted Construction Noise Levels



3.4 Assessment of Construction Noise Effects

The noise limits for construction activity (L_{Aeq} 75 dB) are set much higher than the limits for normal 'day to day' activities (L_{Aeq} 55 dB) because of the community acceptance of construction noise being of short duration and construction being necessary for society to progress.

The noise limits contained in Rule E25.6.27 of the AUP, are based on the limits in New Zealand Standard NZS 6803: 1999 "Acoustics - Construction Noise". NZS 6803:1999 states the following regarding people's reaction to these activities:

"As noise from construction projects is generally of limited duration, people and communities will usually tolerate a higher noise level provided it is no louder than necessary, and occurs within appropriate hours of the day."

The higher noise limits contained in Rule E25.6.27 of the AUP, are based on the limits in NZS 6803:1999. A noise level of 75 dB L_{Aeq} is allowed for 'typical-duration' projects such as this one.

The proposed construction works are a significant distance from all nearby receivers (350m to 1000m). Figure 4 shows that the proposed construction activity can comply with the 75 dB noise limit by a considerable margin at all the closer dwellings. The most affected dwelling (68 Muriwai Valley Road, 350m from the water reservoir area) will receive approximately 50 dB.

Construction noise may be audible at times but at a low level.

The character of the noise from golf course construction equipment is similar to the character of noise from rural plant such as tractors and harvesting machinery ie large mobile diesel engines.

4.0 DAY-TO-DAY OPERATIONAL NOISE ASSESSMENT

4.1 AUP Noise Limits

The AUP noise limits applying to the closest dwellings and the various zones surrounding the site are included in Appendix B. In summary, noise from 'day to day' operational activities at the closest receivers shown in Figure 2 will need to comply with a daytime noise limit of 55 dB L_{Aeq} and 45 dB L_{Aeq} at night.

Most of the maintenance activity happens between 7am and 3pm but it can start as early as 5:30 am in summer. The night-time noise limits would apply from 5:30am to 7:00 am.

4.2 Predicted Operational Noise

Once the golf resort becomes operational, the main sources of noise will that of normal golf maintenance equipment and golfers accessing the site.

Apart from helicopters (which are discussed separately below) the noise from cars and delivery trucks accessing the site is considered to be insignificant considering the large distances to the closest dwellings and the existing level of vehicle noise on Muriwai Road.

The golf course operations and maintenance report prepared by Marsden Turf Solutions and NZ Sports Turf Institute is appended to the AEE. All staff will be trained and inducted in their use of maintenance equipment with individual SOP (Safe Operating Procedure) to achieve the highest quality of maintenance standards. The following description of the 'day to day' golf maintenance activities has been provided by Golf Strategy Group.

> Our equipment wouldn't provide any more noise than the current farming equipment. The farm tractors are significantly bigger than anything that we tend to use in a golf course maintenance environment.
>
> There have been significant advances in technology with regards to golf course maintenance equipment.
>
> - the daily use of greens mowers is now all Lithium ion battery operated, these are early morning use machines, so NO noise.
> - light weight greens rollers are also early morning pieces of equipment used regularly, again these are battery powered.
> - the fairway mowers are hybrid machines, and are considered low noise equipment.
> - most of the utility vehicles used to transport staff and equipment around the golf course are also battery powered, except for four (4) units that we would have that are diesel powered where extra payload and attachments are required.
> - the largest tractor we would use would be 80hp.
>
> Technology will continue to evolve within this specialty area, and so will the range of equipment that is battery powered.

Our experience of golf maintenance equipment aligns with the description above. Typical suburban golf courses throughout Auckland involve golf maintenance equipment operating as close as 20m from residential dwellings at some clubs and we are not aware of any noise problems arising.

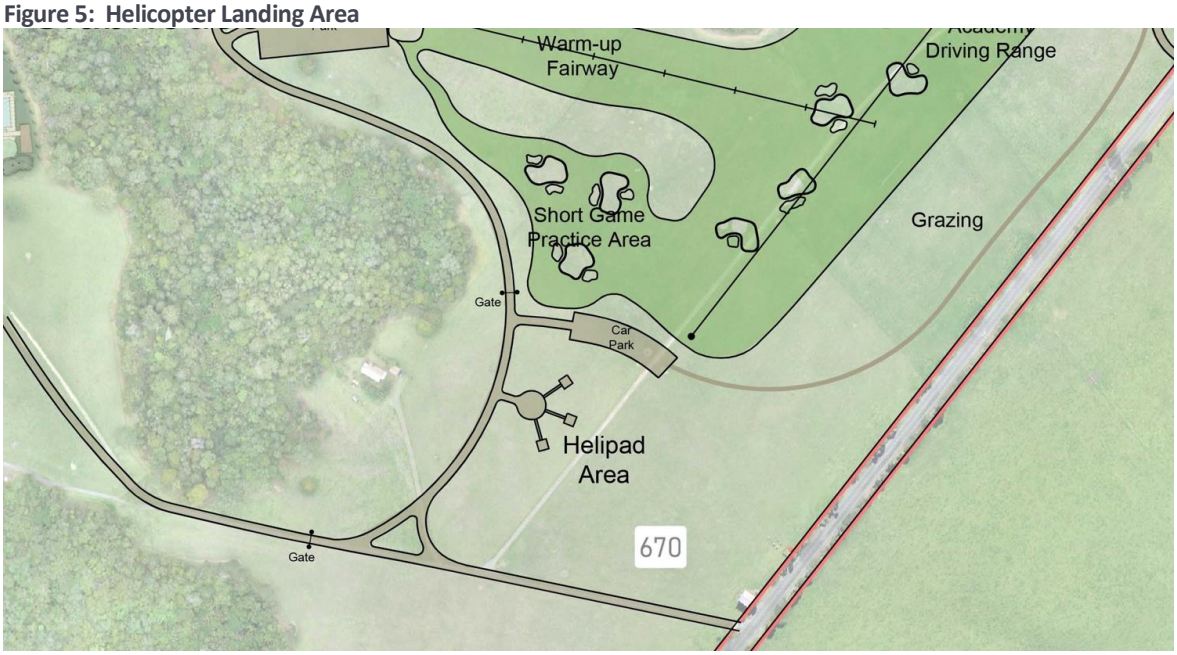
If heavy construction equipment can comply with 50 dBA at the closest dwellings, the much quieter maintenance equipment will be able to comply with both the daytime and night-time noise limits of 55/45 dB L_{Aeq} .

Noise from these sources would be at a very low level and not generally be audible at the closest receivers. In our opinion the noise effects are reasonable.

5.0 HELICOPTER NOISE ASSESSMENT

A collection of helipads are included in the design close to the main entrance on Muriwai Road as shown in Figure 5 below. This helicopter facility is provided to enable clients and members to fly into the golf course from Auckland Airport or from other golf resorts. On busy days there could be a number of helicopters 'parked' at the site for several hours hence several helipads are provided for in Figure 5 below.

Figure 5: Helicopter Landing Area



5.1 AUP Noise Limits

The following noise limits from the AUP would apply to helicopters landing and taking-off from the golf course.

E25.6.32. Noise levels for helicopters take-off or landing

(1) The take-off or landing of a helicopter on any site except for emergency services must not exceed L_{dn} 50dB or 85dB L_{AFmax} measured within the boundary or the notional boundary of any adjacent site containing activities sensitive to noise and L_{dn} 60dBA within the boundary of any other site.

5.2 Predicted Helicopter Noise Levels

5.2.1 Helicopter Operations

Operational data for the likely helicopter operations has been provided by Richard Poppelwell of Eagle Flight. Richard is intimately involved with the Tara Iti and Kauri Cliffs golf courses and is familiar with the level of activity, type of helicopters and procedures that take place at these resort style golf courses.

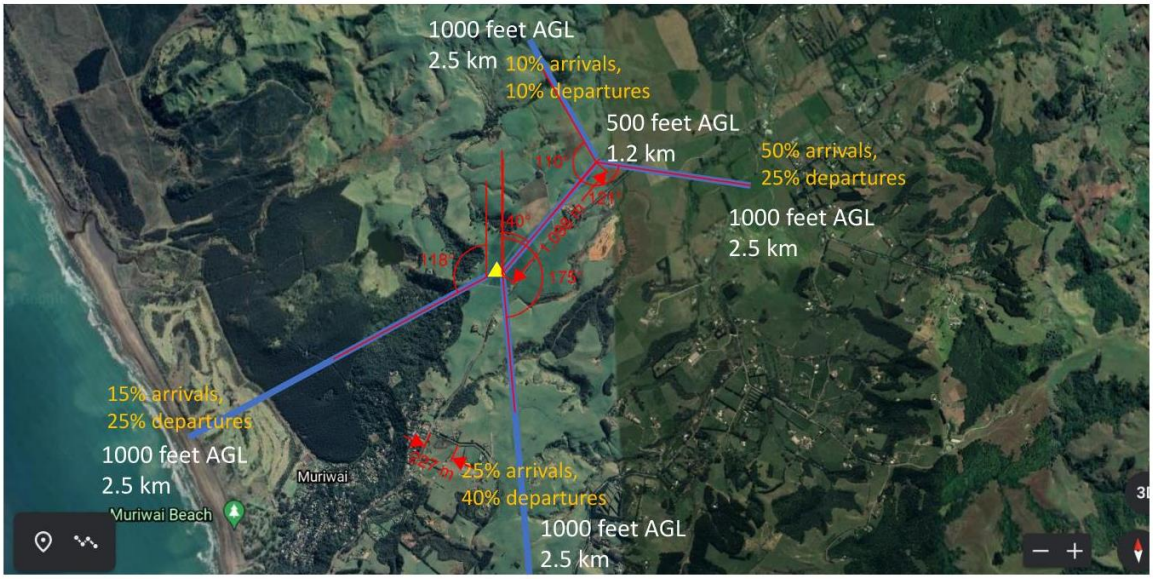
Richard has estimated the number and type of helicopter operations during the busiest peak based on his knowledge of these other courses and the particular relationship of Muriwai Downs to Auckland Airport.

Table 1: Helicopter Type from Eagle Flight

Helicopter movements by type	Percentage
Robinson R44	5
Airbus AS-350	10
Airbus H130	50
Augusta 109	5
Bell 429	5
Airbus H145	10
Airbus H155	5
Leonardo 169	5
Sikorsky S76	5

Mr Poppelwell has flown a helicopter into the Muriwai Downs site and from this experience has laid out the following flight paths that would typically be flown to and from the site.

Figure 6 - Helicopter Flight Paths



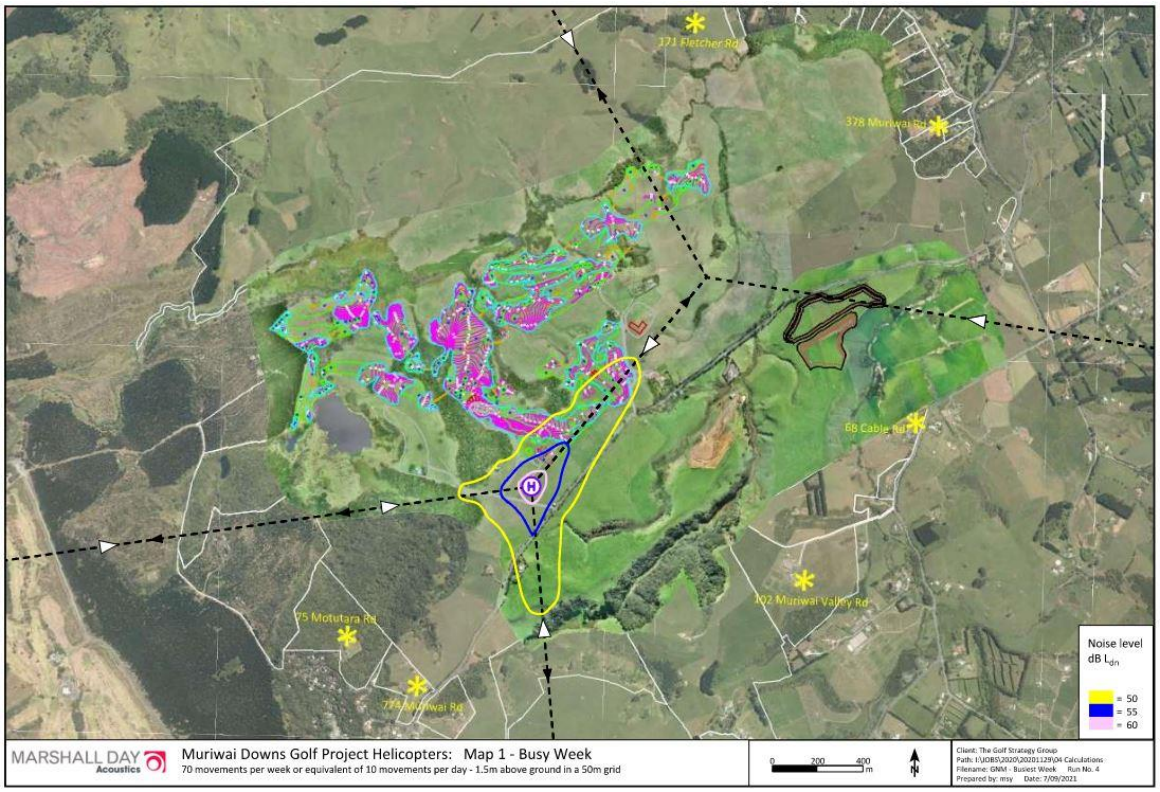
5.2.2 Predicted Helicopter Noise Contours

Noise modelling has been carried out using the internationally recognised software package called SoundPlan. Marshall Day Acoustics have found this software to be more accurate for certain types of helicopters than the FAA software INM, which is used for modelling airport noise and helicopter noise. We have carried out a significant number of measurements of various helicopters used in New Zealand and used these measurements to calibrate the SoundPlan model for specific helicopter types.

The helicopter types used in the modelling have been selected as close as possible to the helicopter types provided in Table 1 above.

We are informed the expected level of helicopter movements is 6 per day (3 flights). Initial modelling used a conservative 10 movements per day to allow for some growth and the results are shown in Figure 7 below.

Figure 7: Helicopter Noise Contours – 10 movements per day



5.2.3 Helicopter Noise Assessment

The predicted noise levels (Figure 7) from the conservative level of activity of 10 movements per day shows noise levels well below the AUP noise limit of 50 dB L_{dn}. The helicopter landing area could be moved to a number of different locations on the site and readily comply with the helicopter noise limits.

Due to the low level of noise exposure and the short duration intermittent nature of this noise source, the effects of noise from helicopters are considered reasonable.

APPENDIX A GLOSSARY OF TERMINOLOGY

dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\,(t)}$	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_{dn}	The day night noise level which is calculated from the 24 hour L_{Aeq} with a 10 dB penalty applied to the night-time (2200-0700 hours) L_{Aeq}.
NZS 6802	New Zealand Standard NZS 6802:2008 *"Acoustics - Environmental Noise"*
NZS 6807	New Zealand Standard NZS 6807:1994 *"Noise Management and Land Use Planning for Helicopter Landing Areas"*
AUP	Auckland Unitary Plan

APPENDIX B RELEVANT AUP NOISE RULES

<table>
<tr><th>Noise Receiver Location</th><th>Performance Standards</th><th>Comments</th></tr>
<tr><td></td><td rowspan="2">E25.6. Standards

E25.6.1 General standards

(1) Noise levels arising from activities must be measured and assessed in accordance with the New Zealand Standard NZS 6801:2008 Measurement of environmental sound and the New Zealand Standard NZS 6802:2008 Acoustics - Environmental noise except where more specific requirements apply.

(2) The application of an adjustment for noise containing special audible characteristics in terms of Appendix B4 Special Audible Characteristics in New Zealand Standard NZS 6802:2008 Acoustics – Environmental noise may apply to the A weighted level for any measurement but an adjustment must not be applied to any level measured in the 63Hz and 125Hz octave bands.

(3) The noise from any construction work activity must be measured and assessed in accordance with the requirements of New Zealand Standard NZS6803:1999 Acoustics – Construction noise. Construction work is defined in New Zealand Standard NZS6803:1999 Acoustics – Construction noise.

(4) The noise limits of the Plan do not apply to emergency service sirens and callout sirens during emergency situations.

(5) Where more than one standard applies that requires insulation of a noise sensitive space from an external noise source, the standards must be applied cumulatively.

(6) Where standards are provided for specific activities, the zone interface standards and the zone standards do not apply to that activity

E25.6.2 Maximum noise levels in residential zones

(1) The noise (rating) levels and maximum noise level arising from any activity in the Residential – Large Lot Zone, Residential – Rural and Coastal Settlement Zone, Residential – Single House Zone, Residential – Mixed Housing Suburban Zone, Residential – Mixed Housing Urban Zone and the Residential – Terrace Housing and Apartment Buildings Zone measured within the boundary of an adjacent site in these residential zones must not exceed the levels in Table E25.6.2.1 Noise levels in residential zones below:

Table E25.6.2.1 Noise levels in residential zones.

<table><tr><th>Time</th><th>Noise level</th></tr><tr><td>Monday to Saturday 7am-10pm</td><td rowspan="2">50dB L_{Aeq}</td></tr><tr><td>Sunday 9am-6pm</td></tr><tr><td>All other times</td><td>40dB L_{Aeq}
75dB L_{AFmax}</td></tr></table>
E25.6.3 Noise levels in rural and future urban zones

(1) The noise (rating) level from any activity in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone measured within the notional boundary on any site in any rural zone must not exceed the limits in Table E25.6.3.1 Noise levels in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone below:</td><td>Proposal will comply with relevant permitted activity Standards in E25.6.</td></tr>
</table>

Table E25.6.3.1 Noise levels in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone

Time	Noise level
Monday to Saturday 7am-10pm	55dB L_{Aeq}
Sunday 9am-6pm	
All other times	45dB L_{Aeq} 75dB L_{AFmax}

E25.6.15 Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or Future Urban Zone interface

(1) The noise (rating) level and maximum noise level from any activity in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or Future Urban Zone measured within the boundary of any site in a residential zone must not exceed the levels in Table E25.6.15.1 Noise levels at the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or Future Urban Zone interface below:

Table E25.6.15.1 Noise levels at the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or Future Urban Zone interface

Time	Noise level
Monday to Saturday 7am-10pm	55dB L_{Aeq}
Sunday 9am-6pm	
All other times	45dB L_{Aeq} 75dB L_{AFmax}

(2) Standard E25.6.15(1) above does not apply to:

(a) animal noise on farms unless they are confined within a building or enclosure on a permanent or semi-permanent basis; or

(b) the use of mobile agricultural horticultural or forestry vehicles or machinery, or other mobile or portable agricultural, horticultural or forestry equipment; or

Note 1 The operator of such vehicles or machinery is required by the Resource Management Act 1991 to adopt the best practicable option to ensure that noise emissions do not exceed a reasonable level, which will depend on the time they are used, how loud they are, how long it is used for and how often it is used near dwellings.

(c) the use of post-harvest facilities including vehicle access ways and milking sheds set back at least 100m from any residential zone.

25.6.22. All other zone interfaces

(1) Except as provided for in Standards E25.6.14 to E25.6.21 above, where noise generated by any activity on a site in one zone is received by any activity on a site in a different zone, the activity generating the noise must comply with the noise limits and standards of the zone at the receiving site.

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

(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.

Refer AUP **Table E25.6.27.1**

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.

Refer AUP **Table E25.6.27.2**

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

Time Period	Maximum noise levels Leq dBA
7:30am – 6:00pm	75
6:00pm – 7:30am	80

E25.6.32 Noise levels for helicopters take-off or landing

(1) The take-off or landing of a helicopter on any site except for emergency services must not exceed Ldn 50dB or 85dB LAFmax measured within the boundary or the notional boundary of any adjacent site containing activities sensitive to noise and Ldn 60dBA within the boundary of any other site.