

KANIERE FORKS HYDRO DEVELOPMENT
Assessment of Construction Noise Effects
Rp001 R01 2011196C

21 April 2011



Project: **KANIERE FORKS HYDRO CONSTRUCTION**

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Report No.: **Rp001 R01 2011106C**

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Status:	Issue:	Date:	Prepared by:	Reviewed by:
DRAFT		22/03/2011	Robbie Blakelock	Stuart Camp
FINAL	R01	21/04/2011	Robbie Blakelock	Stuart Camp

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1.0 INTRODUCTION

Marshall Day Acoustics has been engaged to provide a preliminary assessment of construction noise effects relating to the proposed redevelopment of the Kaniere Forks Hydro scheme. This report is intended to be used as part of the Assessment of Environmental Effects (AEE) accompanying the consenting submission. Details of the proposed development are contained in the Enhancement Scope Civil Report.

This report provides a brief outline of the proposed works from the point of view of assessing the effects of construction noise on nearby residents and gives an overview of the construction noise limits laid out in the New Zealand construction noise standard NZS6803:1999. Four different construction activity scenarios are outlined and noise levels calculated at the noise sensitive locations identified. The expected noise levels at a range of distances are also given to aid in the management of construction noise throughout the period of works. Finally the receiver noise levels are assessed with regard to compliance with the construction noise limits in NZS6803, and options for the mitigation of construction noise and minimisation of noise effects outlined.

2.0 SITE AND ACTIVITY DESCRIPTION

The Kaniere Forks Hydro scheme currently consists of an open water race running from Lake Kaniere to a down-stream power generation facility. A second generator is located further downstream and has a separate inlet from the Kaniere Stream. The development will increase the size of the open water race and increase the head available at the second power station.

The geographical extent of the proposed works is significant, however we have only assessed the effects for the works occurring close to the Lake Kaniere Village, as this is the only area where sensitive receivers are located. The construction period for the works up to the first 500m of race is expected to be two to three months. We have not located any other dwellings within 500m of the construction corridor, and the effect of construction noise on dwellings at distances greater than this will be less than minor.

2.1 Existing Site

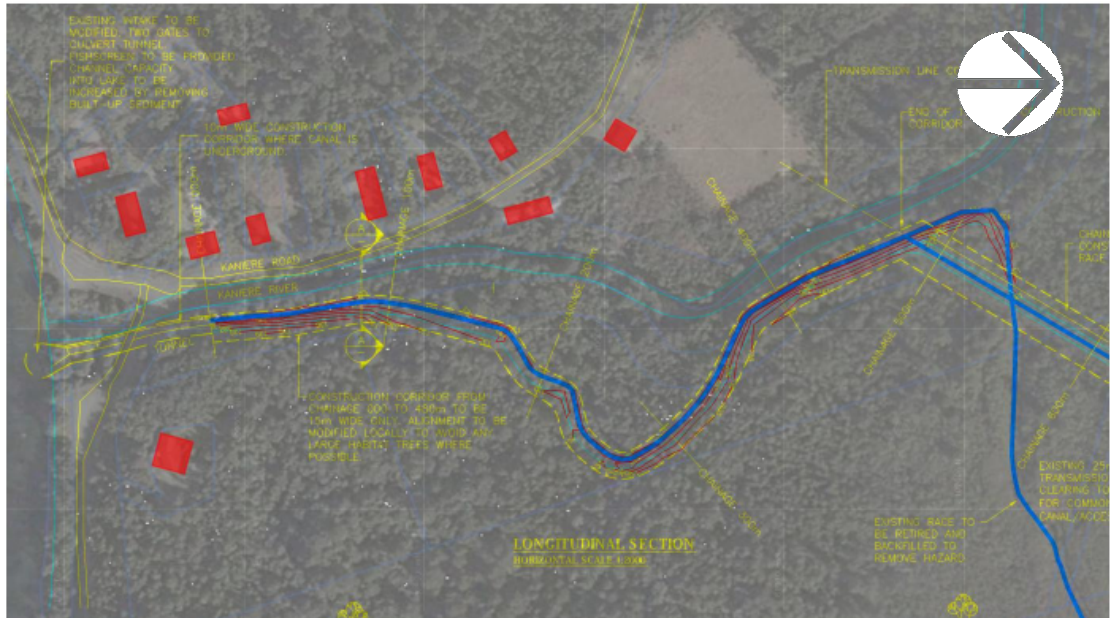
Lake Kaniere Village is located at the northern end of Lake Kaniere at the outlet of the Kaniere River. There are around 10 dwellings clustered around this area with all but one located on the western side of the river. We understand that many of these dwellings are holiday homes and have only temporary occupancy.

The proposed water race to serve the Lake Kaniere Hydro scheme is located on the eastern side of the river, the inlet of which is at the lake edge at the same point as the Kaniere River inlet. From the inlet, the water race travels under the road, then through a tunnel for approximately 50m before appearing as an open water race.

Figure 1 shows the extent of the proposed works in the Kaniere Village area, and dwellings are highlighted in red. The construction corridor is outlined in dashed yellow lines, and the

dwellings are setback from the construction corridor by at least 30m at any point. The residences of primary concern are those to the west (above) the river as they are within approximately 250m of the construction corridor.

Figure 1: Proposed Re-Development - Lake Kaniere Village Area



2.2 Construction Activities

The existing intake will be modified to create new gates for the proposed race, and the culvert under the road replaced with a new concrete box culvert. The underground section will be constructed using a cut-and-cover method.

Construction for the underground section of the race is limited to a 10m wide corridor. After this the corridor is increased to 15m for the next 500m, and then opened to a 20m wide corridor for the rest of the race. The 15m width for the first 500m is due to the steep bank to the east of the race.

Information provided by TrustPower indicates that the construction sequence for the first 200m of the construction is likely to be as follows:

- Mark out the construction corridor and install silt curtains/fences as required;
- Clear vegetation from the alignment;
- Progressively excavate and install pre-fabricated race pipe/box culvert/open sections along the construction corridor;
- Backfill over the race and reinstate vegetation above it; and
- Install the walkway.

Some of the excavated material will be removed from the site via Kaniere Road with the remainder used to fill in the existing race.

3.0 NOISE PERFORMANCE CRITERIA

NZS6803:1999 is the New Zealand standard for construction noise and provides recommended noise limits for construction noise. Noise limits are provided for weekdays, Saturdays, and Sundays separately, with significantly lower noise limits on a Sunday designed to severely limit construction activity and thereby give affected receivers a day of rest from the noise. Each day is broken down into a night-time and daytime, with a morning and evening shoulder period during weekdays.

Construction activities are broken down into three classes based on the duration of work. Short-term is defined as works occurring for 14 days or less; typical duration is defined as greater than two weeks but less than 20 weeks; and long-term is any works where the duration is longer than 20 weeks. The works considered in the report are therefore classed as “typical duration.”

The applicable limits for construction noise from Table 2 of the standard provides are reproduced below as Table 1.

Table 1: Recommended Upper Limits for Construction Noise Received in Residential Zones

Time of week	Time period	Duration of work	
		Typical duration	
		(dB)	
		$L_{Aeq(T)}$	L_{AFmax}
Weekdays	0630-0730	60	75
	0730-1800	75	90
	1800-2000	70	85
	2000-0630	45	75
Saturdays	0630-0730	45	75
	0730-1800	75	90
	1800-2000	45	75
	2000-0630	45	75
Sundays and public holidays	0630-0730	45	75
	0730-1800	55	85
	1800-2000	45	75
	2000-0630	45	75

The noise limits of the Standard are widely acknowledged as being appropriate for the control of construction noise, and compliance with these limits generally ensures acceptability of noise generated by construction activities.

For typical “daytime” construction activity, the most important noise limit is 75 dB (L_{Aeq}).

4.0 CONSTRUCTION NOISE LEVELS

A detailed construction scheme has not been developed, however initial information has been provided regarding the likely activities, progression of works and equipment that will be used in this area. Construction corridors are defined, giving clear restrictions on the location of the construction activity, however as the specific equipment and duration of each activity has not been specified, we have made a number of assumptions in order to predict noise levels. The sound power data we have used is typical of equipment used for the construction activities described, and as such the noise levels calculated are representative of the actual levels expected.

4.1 Construction Scenarios

Based on the processes outlined in Section 2.2 a number of different construction scenarios have been defined. These are:

Scenario 1: General Earthworks

This scenario relates to the clearing of vegetation from the alignment. It accounts for noise generated by the following:

- Two excavators (20 tonne or similar);
- One genset in a container; and
- Two truck movements every 15 minutes.

Scenario 2: Concrete Breaking, Concrete Cutting and Removal

This scenario relates to the modification of the current gate system and replacement of the concrete box culvert underneath the road with a larger one. It accounts for noise generated by the following;

- Single hydraulic concrete breaker;
- Concrete Cutting;
- Single excavator (20 tonne maximum); and
- Typically two truck movements per 15 minutes.

Scenario 3: Cutting and Covering

This scenario relates to the cut and cover sections of the construction where significant amounts of material are being removed or replaced. It assumes that there is no installation of new pipe/culvert/open race sections. The following noise sources are included:

- Two excavators (20 - 40 tonne or similar);
- Three truck movements per 15 minutes; and
- One genset in container.

Scenario 4: Installation

This scenario relates to any installation involving the mobile crane. It is assumed that there is no earthworks occurring during the installation period, and as such includes noise from the following sources:

- Single Mobile Crane;
- Single 20 tonne hydraulic excavator operating for half the assessment period; and
- One genset in container.

4.2 Noise Source Data

The following table specifies the sound power levels used to predict noise levels from different activities. Marshall Day Acoustics has made many noise measurements of construction equipment under typical operation and this data comes from site measurements made. The actual plant/equipment used may be different to that specified in the table, and sound power levels can vary significantly depending on the make, size, activity and duty of the equipment. Nevertheless, we believe that this data provides an appropriate estimate of the noise from the proposed equipment.

Table 2: Activity Sound Power Levels

Activity	Plant Type	Plant Specification / Activity	Sound Power Level (L _{Aw} dB)
Bulk Earthworks and Cut to Fill	Dump Truck	Moxy MT31 (28 t payload)	106
	Hydraulic Excavator	Cat 340B approx 40 t	113
		Hitachi EX220 23 t	115
		Komatsu PC710 14 t	112
Rock/Concrete Breaking	Hydraulic Excavator/Breaker	Average of Several Measurements	123
Concrete Cutting	Concrete Saw	Typical Level During Cutting	112
Installing Concrete Race Sections	Mobile Crane	Mobile Crane 50 t 315HP Nissan Motor	110
Power Generation	Genset	Caterpillar 330kVA Inside a container	108

4.3 Calculated Noise Levels

From the sound power levels in the above table, noise levels for typical construction scenarios outlined have been determined at distances of 30, 50 and 100 metres.

Table 3: Activity Sound Pressure Levels

Scenario/Activity	Activity Sound Power Level (dB L _{AW,eq})	Noise Level (dB L _{Aeq})		
		No mitigation		
		@ 30 m	@ 50 m	@ 100 m
1: General Earthworks	117	80	76	70
2: Concrete Breaking	124	87	82	76
3: Cut and Cover	118	80	76	70
4: Installation	114	76	72	66

Using the activity sound powers in Table 3 and a setback distance of 35m the worst-case noise levels at the nearest dwellings to the construction corridor shown in Figure 1 have been calculated. These are outlined in Table 4.

Table 4: Sound Pressure Levels at Nearest Dwellings

Scenario/Activity	Noise Level at residences (dB L _{Aeq})
1: General Earthworks	75 - 80
2: Concrete Breaking	85
3: Cut and Cover	75 - 80
4: Race Installation	75

Some of these activities exceed the 75 dB noise limit recommended in the standard.

Our calculations also show that with a setback of 55 metres or more, all activities other than concrete breaking will comply with the 75 dB daytime noise standard. This is the case from the 200m chainage mark onwards. Concrete Breaking does not occur beyond this point of the works.

5.0 COMPLIANCE WITH NOISE LIMITS

As already discussed, the applicable limits in the standard can be summarised as follows;

Table 6: Construction Noise Limits that apply to Works

	Noise Limit (dB)	
	$L_{Aeq}(T)$	L_{AFmax}
0730 – 1800 Monday - Saturday	75	90
1800 – 2000 Monday - Friday	70	85
0630 – 0730 Monday - Friday	60	75
0730 – 1800 Sunday	55	85
All other times	45	75

As can be seen, construction activity will need to be restricted to within the hours of 0730 – 1800, Monday to Saturday when noise limits are most lenient

In addition, the standard requires that construction activity adopts the best practicable option to minimise noise.

5.1 Removal of Existing Box Culvert and Modification of Existing Gate

From the calculated noise levels in Table 4 it is clear that the noise from the concrete breaking activities during demolition of the existing culvert will not comply with the 75 dB daytime noise limit at the nearest dwellings without mitigation.

The area in which concrete breaking is required is limited to the intake and road crossing area and as a result the activity will only occur for a brief section of the overall construction period. We recommend negotiating appropriate times with residents, and giving them advance notice of this work. It is anticipated that the breaking work will be completed in about two working weeks. The mitigation given in Section 6 should be applied to concrete breaking work.

5.2 Other Activities

5.2.1 Up to 200m chainage mark

Based on the predicted noise levels, all other construction activities will also require mitigation to comply with the daytime noise limit of 75 dB when working in the area up to the 200m chainage mark. The mitigation in Section 6 should therefore also be applied to works occurring in this area.

5.2.2 From 200m chainage mark onwards

The construction corridor from the 200m chainage mark onwards is more than 55m from any identified dwelling, and hence the from this point onwards mitigation will not be required to comply with the construction noise limits in Table 6.

6.0 NOISE REDUCTION AND MITIGATION

6.1 All Activities

The following steps should be taken for all construction activities within the first 500m of works to minimise the noise effects on the residences and comply with the noise limits in NZS:6803:

- All significant noise generating construction activities shall occur between the hours of 0730 and 1800, Monday to Saturday;
- Construction should take place when occupancy in the Lake Kaniere Village is lowest; Where options are available regarding construction methods and equipment, an effort should be made to select the equipment and method that will produce the least amount of noise; and Work should be undertaken in accordance with a comprehensive Construction Noise Management Plan which includes notification and liaison with the residents before and during the construction period.

6.2 Works Occuring up to 200m Chainage Mark

For works occurring up to the 200m chainage mark, noise levels must be reduced in order to comply with the noise limits set out in NZS:6803 and it must be ensured that the best practicable option is implemented to ensure that effects are no more than minor. We recommend mitigation methods along the lines of the following. Actual methodology will need to be refined based on site conditions. A detailed noise management plan would be appropriate to assist in this process.

- Ensure that all residents are contacted and involved in discussions regarding the works, particularly the timing of construction activities;
- Confine significant noise generating construction activities to occur between the hours of 0730 and 1800, Monday to Saturday;
- Utilise acoustic screens where possible, erected close to the edge of the construction corridor/construction area to provide a break in line-of-sight from any occupied houses within 50m of the construction activity. These barriers would typically need to be 17 mm thick plywood or equivalent, at least 2.4 metres high, and overlapping at all joints. The design and layout of the acoustic barriers shall be checked by a qualified acoustics engineer and noise levels at the boundary of the properties shall be monitored to determine the effectiveness of the barriers;
- Construct a “lid” over below ground activities where appropriate. The construction of lids should be at least the same as proposed for acoustic screens;
- Schedule particularly noisy activities such as demolition of the existing culvert and gate system to times of day agreed with residents. As an example, a 9 am start may prevent interruption of breakfast;
- Relocation should be offered to residents in dwellings within 50m of the construction corridor during the periods where construction activity is highest;

- Construction schedule for works from the inlet to 200m chainage mark shall be designed to allow for the minimal duration of works; and
- Complete all construction works as quickly as possible.

7.0 CONCLUSIONS

Construction noise will only be an issue around the Lake Kaniere Village. There are no dwellings within 500 metres of any other part of the construction.

Our calculations show that construction occurring within the construction corridor beyond the 200m chainage mark requires no mitigation and will comply with the noise limits.

Noise levels from construction occurring up to the 200m chainage mark require mitigation to reduce the noise levels at nearby property boundaries in order to comply with the noise limits set out in NZS:6803. Appropriate mitigation is possible through the use of a comprehensive Construction Noise Management Plan and the use of a variety of physical mitigation measures.