



Te Ararata Flood Resilience Works - Walmsley Road Bridge Replacement

Draft Construction Noise and Vibration Management Plan (CNVMP)

Prepared for
Auckland Council

Prepared by
Tonkin & Taylor Ltd

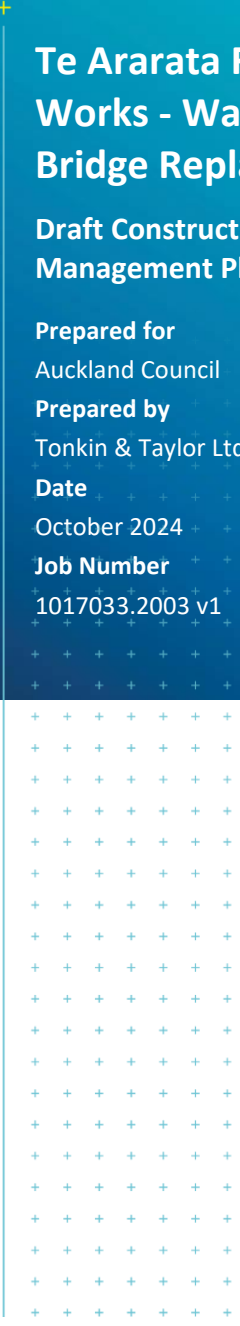
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1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by Auckland Council's Healthy Waters department to provide a draft Construction Noise and Vibration Management Plan (CNVMP) for works associated with the intervention works to address flood resilience issues at Walmsley Road Bridge (the Project) to support the resource consent application under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024. The Project seeks to achieve greater flow capacity and reduce blockage risk beneath Walmsley Road and within Te Ararata Stream.

This draft CNVMP identifies the likely construction noise and vibration levels for the project and sets out the best practicable options (BPO) for noise and vibration management that will be implemented to mitigate and minimise any adverse noise and vibration effects. It also outlines community engagement with surrounding affected residents in relation to the noise and vibration aspects of the Project.

This draft CNVMP relies on information around the preliminary construction methodology provided by the Project's Contractor. It will be finalised prior to works commencing.

The final CNVMP will be implemented throughout the construction period. It will be considered a 'living document' that should be amended and updated as appropriate and is intended to be the primary tool to manage the Project's construction noise and vibration effects.

2 Roles and responsibilities

2.1 Environmental roles and responsibilities

Each person involved in the Project has equal responsibility to avoid, remedy or mitigate adverse environmental effects. There are three key groups with responsibility for environmental management of the Project:

- Auckland Council's Healthy Waters as the Project owner and holder of the resource consents.
- Contractors (organisation(s) as identified in Table 2.1) undertaking the works.
- Auckland Council to audit the works and monitor compliance with designation and resource consent conditions, the Construction Management Plan (CMP) and sub-plans.

2.2 Project contacts

The Project Manager has the overall responsibility for complying with the requirement of this CNVMP. The Site Manager is responsible for community engagement.

Table 2.1 sets out the contact details for key Project personnel relevant to the implementation of this CNVMP.

Table 2.1: Contact details

Role	Name	Organisation	Phone	Email
Project & Site Manager (Contractor)	TBC	TBC	xx	xx
Site Manager	TBC	TBC	xx	xx
Community Liaison Manager	TBC	TBC	xx	xx
Acoustic Consultant	Sharon Yung	Tonkin and Taylor Ltd	xx	syung@tonkintaylor.co.nz
Compliance Officer	TBC	TBC	xx	xx

3 Project overview

3.1 Timeframe

The indicative construction methodology indicated construction activities are expected to be undertaken over a 10 - 12 month period. **Commencement date TBC.**

3.2 Hours of operation

Noise generating activities and truck movements will typically occur during standard construction hours, which are as follows:

- Monday to Friday: 7.00 am to 7.00 pm (site mobilisation and pack down works are proposed to occur 30 mins before and after these windows).
- Saturdays: 8.30 am to 7.00 pm.
- Sundays or public holidays: no planned works.
- Work outside of standard hours will be limited as far as is practicable to reduce disruption as outlined below.

Due to the nature of construction and the Project's timeline, it is likely that some activities will be undertaken outside these usual hours, for example, site meetings, setup, pack up, large plant delivery early in the morning or later in the evening to avoid peak traffic volumes. These activities undertaken outside work hours have been assessed as low risk, are likely to be within permitted noise levels and will be carried out to meet AUP requirements.

Early morning works (starting from 4.00 am) for concrete pours may be required for the temporary road and bridge construction. It is anticipated 3 - 5 early morning concrete pours may be required for the Project.

3.3 Description of works

The scope of works involves:

- Demolition and removal of the existing Walmsley Road twin culvert.
- Construction of a new replacement Walmsley Road bridge over Te Ararata Creek.
- Works to tie in the new replacement bridge with the existing road network.
- Recontouring of the stream banks under the bridge to achieve a wider stream channel.
- Relocation of the existing Watercare watermain pipe bridge foundations to achieve a wider clearance beneath the structure.
- Existing service relocation and/or realignment.
- Vegetation clearance, including within riparian margins and the removal of trees.
- Earthworks associated with temporary and permanent works, including within the riparian margins.
- Other temporary works and activities to facilitate the construction of the permanent Project including:
 - The formation and operation of laydown areas and a site compound predominantly within Black Bridge Reserve.
 - Works within and around the Te Ararata Creek including temporary stream diversion.
 - Temporary traffic management measures including a temporary bailey bridge to facilitate pedestrian and active mode diversions between Coronation Road and Walmsley Road. Vehicular traffic will be diverted to the wider existing road network.

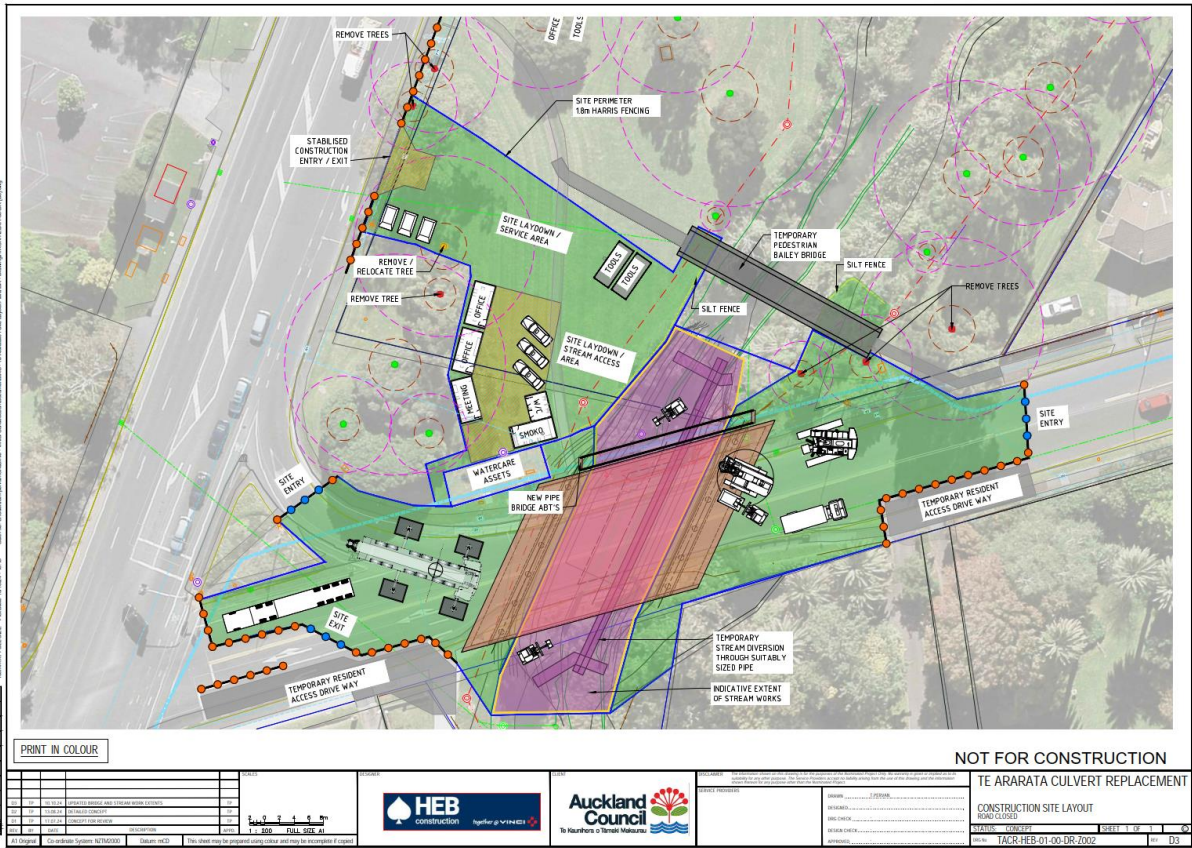


Figure 3.1: Full road closure construction overview plan.

3.4 Construction method and staging

Construction will be carried out in stages and generally in a continuous manner as outlined in **Table 3.1**. Items of equipment or key noise / vibration generating activities have been highlighted in bold.

Table 3.1: Construction and staging activities

Stage of works	Key anticipated construction activities
Site establishment and temporary bailey bridge construction	<ul style="list-style-type: none"> Establish environmental controls, site fencing, working areas, laydown areas, crane platforms and site offices. Vegetation and tree removal and pruning will also be undertaken, and tree protection measures installed as necessary. Delivery of construction equipment (e.g. cranes, excavators, piling rig, vibro and impact hammers) and materials (e.g. H piles and temporary bridge beams). Some of these deliveries may need to occur at night due to the size of equipment and materials. Construction of the temporary bailey bridge abutments either side of the stream. This is expected to comprise shallow pad concrete abutments with some localised clearing and minor earthworks using typical civil equipment such as excavators. Installation of temporary micro piles may be required to provide additional slope stability measures using a mini piling rig. Delivery and installation of the temporary bailey bridge into place with a mobile or crawler crane.

Stage of works	Key anticipated construction activities
	<ul style="list-style-type: none"> Construction of the footpaths approaching on either side of the bailey bridge using conventional civil works plant and equipment (e.g. trucks, graders, excavators and rollers).
Existing Culvert Removal and Temporary Stream Works	<ul style="list-style-type: none"> Establish environmental controls in and around the stream. This includes temporary stream diversion through a pipe and creating a temporary dry instream working area. Construction access for installing the temporary stream diversion will be via temporary access tracks cut down from both upstream and downstream ends of the existing culvert. Identify and protect and/or divert existing services within works area (as required). Excavate, demolish and remove existing twin culvert. The eastern and western side walls of the existing culvert will be progressively excavated and exposed down to the base slab of the culvert. The culvert side walls will then be cut and lifted out in sections. Where basalt is encountered, this will be broken out. Temporary retaining walls will be installed as required to provide temporary ground retention during excavation and exposure of the culvert side walls.
Permanent bridge substructure construction	<ul style="list-style-type: none"> Identify and protect and/or divert existing services within works area (as required). Install piles required for each permanent bridge abutment, starting on one side of the stream and then moving to the other side. <ul style="list-style-type: none"> For the western abutment, a drill rig will be used to drill/core an oversized hole through the upper basalt layer (approximately 2 – 3 m thick close to ground surface) as required. On both abutments, closed end tube piles will be driven into the ground using a vibro hammer. A hydraulic impact hammer will be used to drive the pile to its design founding depth. Piles will then be concreted. Form abutment caps, wingwalls and settlement slabs for the permanent bridge, place reinforcing and pour using boom pumps. These activities will occur on both sides of the existing bridge (eastern and western). Piles will also be cut down to the underside of the abutment beam.
Watercare pipe strengthening and foundation relocation	<ul style="list-style-type: none"> Construct new shallow foundations on either side of the existing pipe and install micro piles if required for additional support using a mini piling rig and excavator. Install new steel girder beams and then transfer the weight of the pipe from the existing foundations to the new girder beam supports. The existing foundations will then be demolished using typical civil works plant and equipment.
Permanent stream works	<ul style="list-style-type: none"> Cut back stream banks to achieve final stream profile. Will include construction of retaining walls and installation of rip rap. Excavators will work from behind both abutments to service smaller excavators positioned on working platforms within the dry instream working area.
Permanent bridge superstructure construction	<ul style="list-style-type: none"> Establish mobile crane behind the western abutment of the permanent bridge. Bridge beams to be delivered, lifted from the truck and placed into position using the crane. Undertake superstructure works including deck pours, edge barrier placements, wingwall construction and service installation / relocation.

Stage of works	Key anticipated construction activities
	<ul style="list-style-type: none"> • Undertake civil tie in works at each permanent bridge abutment to tie the existing road into the new bridge. This will involve standard plant equipment such as excavators, rollers and graders.
Demobilisation	<ul style="list-style-type: none"> • Once the new bridge has re-opened to traffic, the temporary work site and activities can be demobilised. <ul style="list-style-type: none"> – Temporary pathways and hardstand areas will be stripped off and any temporary concrete abutments will be demolished using typical civil works plant and equipment. – A crane will be mobilised to the existing site compound to lift out any temporary structures and remove them offsite. – Any temporary piling will be extracted with a crane and piling rig. – Environmental controls, tree protection measures, office and security fencing will be removed.

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4 Performance standards

4.1 Consent conditions

Resource consent **BUN xxxxx** provides the following consent condition(s) in relation to construction noise:

XXX TBC upon receipt of consent XXX

4.2 Project thresholds

Where works are within the road reserve there are no noise limits applicable, and the vibration limits are solely those set out in DIN 4150-3:2016 provided this CNVMP is submitted to Council no less than five days prior to works commencing.

The removal of noise limits for works in the road reserve allows for potentially disruptive works to be completed efficiently to minimise road closures and subsequent disruption. As stated, this does not remove the requirement to manage noise levels.

Outside the road reserve, the noise and vibration limits in Table 4.1 and Table 4.2 apply.

Table 4.1: Construction noise levels - Applies to buildings containing noise sensitive activities AUP Table 25.6.27.1)

Time of week	Time period	Noise limit dB	
		L _{Aeq}	L _{Amax}
Weekdays	6:30 am – 7:30 am	55	70
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	45	75
Saturdays	6:30 am – 7:30 am	45	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75

Table 4.2 DIN 4150-3:2016 guidelines for evaluating the effects of short-term vibration on structures

Line	Type of structure	Vibration at the foundation at a frequency of			Vibration at horizontal plane of the highest floor	Floor slabs, vertical direction
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All frequencies	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s	20 mm/s

Line	Type of structure	Vibration at the foundation at a frequency of			Vibration at horizontal plane of the highest floor	Floor slabs, vertical direction
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All frequencies	
2	Dwellings and buildings of similar design and/or occupancy.	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s	20 mm/s
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value.	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s	20 mm/s

A summary of the most stringent noise and vibration standards for the core proposed hours of construction (Monday to Friday 7:30 am to 6 pm with potential weekends works) is provided in Table 4.3.

Table 4.3: Project criteria for construction noise and vibration

Day of week	Time of work	Noise dB		Vibration mm/s PPV		
		L _{Aeq}	L _{Amax}	Amenity	Effects on sensitive structures	Effects on residential structures
Monday to Saturday	7.30 am to 6 pm	70	85	2 [^]	3 [*]	5 [*]

* Guideline value increases with high frequency (3 mm/s PPV for sensitive/heritage properties, 5 mm/s PPV for residential properties 1-10 Hz), see DIN 4150-3:2016.

[^] Applicable for works outside road reserve.

5 Construction equipment

5.1 Noise sources

Table 5.1 provides indicative construction noise levels for proposed activities 1 m from building façade without noise barriers and approximate activity sound power levels in Table 5.2. Table 5.3 lists the equipment potentially used for outside of standard hour works with setback distances to meet compliance levels without mitigation.

These tables will be used by the Project Manager (or nominated person) prior to construction to inform what equipment will require mitigation and/or management and when specific engagement is required with affected properties. At the request of the Project Manager, it shall be kept up to date by the Acoustic Consultant when new information becomes apparent through noise monitoring or other means.

Table 5.1: Equipment list – Source data and indicative construction noise levels at different distances (without mitigation)

Equipment	Sound power level dB LWA	Noise level dB L _{Aeq}					Set back distance to achieve 70 dB L _{Aeq} (m)
		10 m	20 m	30 m	40 m	50 m	
45t bore pile	111	86	80	76	73	71	52
Vibro piles	114	89	83	79	76	74	69
10t hydraulic hammer piles	117	92	86	82	79	77	91
20t excavator with rock breaker	120	95	89	85	82	80	120 ^
8t excavator	94	69	63	59	56	54	9
12t excavator	95	70	64	60	57	55	10
16t excavator	96	71	65	61	58	56	11
20t excavator (with and without selector grab)	102	77	71	67	64	62	22
30t excavator	110	85	79	75	72	70	48
25t rough terrain crane	104	79	73	69	66	64	28
150t mobile crane	101	76	70	66	63	61	20
120t crawler crane	101	76	70	66	63	61	20
25t crane	99	74	68	64	61	59	16
Concrete boom truck	103	78	72	68	66	64	25
8t Roller	105	80	74	70	67	65	30
Large roller	109	84	78	74	71	69	44
Asphalt paver	104	79	73	69	66	64	28
Grader	96	71	65	61	58	56	71
6 wheeler trucks	107	82	76	72	69	67	36
35 kVA generator	101	76	70	66	63	61	20

Equipment	Sound power level dB LWA	Noise level dB L_{Aeq}					Set back distance to achieve 70 dB L_{Aeq} (m)
		10 m	20 m	30 m	40 m	50 m	
Woodchipper	124	99	93	89	86	84	174 *
Dewatering Pump	98	73	67	63	60	58	14
Small diesel generator	83	58	52	48	45	43	3

^ with partial screening (5 dB reduction) distance to meet 70 dB L_{Aeq} is reduced to 76 m.

* with effective screening (10 dB reduction) distance to meet 70 dB L_{Aeq} is reduced to 69 m.

Table 5.2: Activity sound power levels and compliance distance without mitigation

Activity	Activity sound power level, dB L_{Aeq}	Setback distance to achieve 70 dB L_{Aeq} without mitigation (m)
Site compound	105	30
Bridge piling	117	91
Bridge construction (civil)	110	48
Culvert Demolition / rock breaking	119	110
Bridge construction (Roading)	105	30
Concrete pouring	103	25*

Note: Bridge piling assumes only hydraulic hammer pile operating at 100% of the time, culvert demolition assumes only 20t excavator with breaker attachment operating at 75% of the time. *Night-time set back distance is approximately 250 m to achieve 45 dB L_{Aeq} .

Table 5.3: Outside of standard hours activities - set back distances

Equipment	Set back distance to achieve 45 dB L_{Aeq} (night works 8:00pm – 6:30am) (m)	Set back distance to achieve 55 dB L_{Aeq} (6:30am – 7:30am) (m)	Set back distance to achieve 65 dB L_{Aeq} (evening 6:00pm – 8:00pm) (m)
Concrete boom truck	250	100	40
Dewatering pump	160	63	25
Small diesel generator	40	14	4
Asphalt paver	275	110	69

5.2 Vibration sources

Vibration predictions have been carried out using the empirical relations contained in BS 5228-2:2009¹. These relations are known to be conservative as they tend to over-predict compared to validation trials. Set back distances have been calculated for the main items of equipment and presented in Table 5.4 below for distances up to 100 m.

¹ BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Vibration.

Table 5.4: Indicative vibration levels at distances

Distance from activity	Excavator with breaker – percussive breaking of concrete hard surfaces	10t Hydraulic hammer piles	Vibratory piles	Large Roller (vibratory)	20 - 30 t Excavator
	(mm/s PPV)	(mm/s PPV)	(mm/s PPV)	(mm/s PPV)	(mm/s PPV)
10 m	3 – 4	10 – 15	4 – 5	2 – 3	1 - 2
20 m	2 – 3	10 – 12	3 – 4	1 – 2	~ 1
30 m	1 – 2	~ 8	2 – 3	1 – 2	< 1
40 m	1 – 2	6 – 7	2 – 3	~ 1	< 1
50 m	1 – 2	5 – 6	~ 2	~ 1	< 1
60 m	1 – 2	4 – 5	1 – 2	< 1	< 1
70 m	1 – 2	3 – 5	1 – 2	< 1	< 1
80 m	~ 1	3 – 4	1 – 2	< 1	< 1
90 m	< 1	3 – 4	1 – 2	< 1	< 1
100 m	< 1	2 – 4	1 – 2	< 1	< 1

6 Noise and vibration levels

6.1 Receivers

Residential receivers are situated around all construction work areas of the Project. There is a mixture of one and two storey buildings. A map of nearby properties within 90 m from the construction activities that may potentially be affected by noise and/or vibration from the construction works have been identified in Figure 6.1.

164 Coronation Road to the west of the site is classified as 'Historic Heritage' as shown in Figure 6.1. These properties are considered sensitive to vibration for this Project and are subjected to the DIN 4150-3:2016 limit of 3 mm/s.



Figure 6.1: Location of receivers less than 90 m from the construction activities and including heritage site.

6.2 Predicted noise and vibration levels

Appendix B provides a full list of receivers with their worst-case predicted noise and vibration level for the high impact activities identified in Table 5.2 and the associated distance from the works. Noise and vibration levels are shaded to identify low (green), medium (orange) and high (red) risk ratings with the same shading as the hierarchy of mitigation Table 7.1.

The table identifies receivers located within 90 m radius of piling works and should be used in conjunction with Table 5.1 to consider mitigation measures required.

Stakeholder engagement as per Section 9 will be undertaken with all adjacent landowners affected by the exceedance identified in Appendix B. Stakeholder engagement and specific mitigation will be documented and appended to this report (Appendix D).

7 Procedures for managing risk

7.1 General requirements

Works within the road reserve for piling works are going to be less than 60 m from the nearest receivers and likelihood of exceedances are likely to be medium and high risk. Works shall adopt BPO to ensure that noise and vibration levels do not exceed a reasonable level for prolonged durations.

Rock breaking / culvert demolition works within 60 m of nearby receivers should adopt physical mitigation measures as set out in Section 7.2 and 8 where practicable.

A hierarchy of mitigation measures is set out in Table 7.1. Mitigation measures are outlined in detail in Section 8.

Table 7.1: Hierarchy of mitigation

Risk	Hierarchy of mitigation
Low ($< 70 \text{ dB } L_{Aeq}$)	General measures: <ul style="list-style-type: none"> • Staff training and awareness. • Stakeholder / community engagement. • General equipment measures.
Medium ($70 - 75 \text{ dB } L_{Aeq}$)	Mitigation measures: <ul style="list-style-type: none"> • Stakeholder engagement and confirmation of occupancy and times of greatest sensitivity to noise exposure (both residential and commercial). • Where practicable utilise acoustic screens / barriers for works at ground level. • Use of low vibration equipment or alternative construction methodology.
High ($> 75 \text{ dB } L_{Aeq}$)	Enhanced mitigation measures: <ul style="list-style-type: none"> • Where practicable place additional acoustic screens including at the source of the noise, i.e. if percussive breaking or concrete cutting is required. • Further engagement with affected parties for works to be arranged around times when properties will be unoccupied, or occupants agree to high noise / vibration levels. • Methodology to be changed e.g. to crushing / grinding or hand breaking if practicable.

7.2 Specific requirements

7.2.1 Noise

- 1.8 m acoustic screens should be erected around the perimeter of the active construction site to mitigate noise levels at ground level, if practicable.
- Care should be taken when creating high noise near to where the public may be present (adjacent to pedestrian walkways), such as during surface breaking and saw cuts.
- Advanced notice and communication should be given to the most affected receivers within 50 m around each work site at least 3 weeks prior to work commencing for piling and rock breaking activities.

7.2.1.1 Rock breaking / culvert demolition

Where practicable:

- Additional localised screening should be included, if practicable. For example, when percussive breaking is undertaken for extended periods of time (> 1 hour) and within ~ 60 m of occupied receivers – locate barriers along the top of the bank where practicable to block line of sight as per Section 8.4.
- Use the correct chisel / tip shape for the type of material being broken.
- Schedule percussive breaking to occur between less noise sensitive times, e.g. 9 am – 5 pm, or through consultation with neighbours.

If it is not feasible to install barriers during rock breaking / culvert demolition due to terrain, the following alternative mitigation should be adopted where practicable:

- The use of a shroud around the breaker attachment.
- A three-sided screen around the immediate area of the works.
- Use of a smaller machine and attachment to reduce noise levels.

7.2.2 Vibration

Properties where vibration is predicted to exceed DIN 4150-3:2016 limits of 5 mm/s for residential and 3 mm/s for sensitive / heritage buildings will require a building condition survey as per Section 8.7.1 prior to piling works commencing. Vibration monitoring as per Section 10 will be required throughout works within 30 m of the properties to ensure vibration levels do not exceed predicted levels where possible.

- Properties within 190 m of hydraulic piling works may experience vibration levels of 2 mm/s and above. Advance notification to these properties and communication as per Section 9.1 will be undertaken. Properties within 190 m of the piling area are identified visually in Appendix C.

The following properties will require a building condition survey and to be consulted with:

Table 7.2: Properties requiring building surveys (due to hydraulic hammer piles)

Address	Building Classification	Predicted vibration level, PPV
4 Walmsley Road	Residential	9 – 10 mm/s
8 Walmsley Road	Residential (2 Storey)	7 – 8 mm/s
15 Walmsley Road	Residential (2 Storey - raised due to terrain)	6 – 5 mm/s
2 McKenzie Road	Residential	5 – 7 mm/s
14 Walmsley Road	Residential (2 Storey)	5 – 6 mm/s
6 Walmsley Road (1)	Residential	4 – 6 mm/s
164 Coronation Road (1)	Heritage (2 Storey)	3 – 4 mm/s
164 Coronation Road (2)	Heritage	2 – 4 mm/s

Note: Property address with more than one affected building is identified by a bracketed number.

7.2.2.1 Heritage buildings – 168 Coronation Road

Building condition surveys as per Section 8.7.1 and enhanced communications as per Section 9.1 shall be undertaken.

7.2.3 Works outside of standard hours

Where practicable all works should be undertaken during the standard construction hours (see Section 3.2).

Where there are no practicable alternative options to complete works within standard hours and noise level exceedances are anticipated (for concrete pours and road tie-in activities), it will be necessary to implement enhanced noise and vibration management measures. For example:

- Locate the main source of noise further from sensitive receivers as far as practicable.
- Increase the frequency of communications with stakeholders.
- Carry out regular noise and vibration monitoring to confirm noise and vibration levels.
- Offer temporary relocation to affected residents if unreasonable noise and/or vibration levels cannot be avoided.

Activities outside of standard work hours such as site meetings, setup, pack ups, large plant delivery and CCTV should be limited as far as practicable.

This CNVMP shall be updated with an activity specific section if these activities are required to identify management and mitigation measures (i.e. adopting the best practicable option (BPO) to minimise potential adverse effects) such as communication with surrounding properties, the use of acoustic barriers and other practicable controls.

7.2.3.1 Overpumping / Dewatering overnight

- Specification of pump should be selected where night-time noise limits of 45 dB LAeq can be achieved with or without mitigation in place.
- Pump should be located at least 50 m from nearest residential receivers and appropriately screening or placed within an enclosure.
- Increase communication with stakeholders when overnight dewatering activities are required.

8 Noise management and mitigation

8.1 Training

All staff will participate in an induction training session prior to the start of construction, see Appendix A, with attention given to the following matters:

- Construction noise and vibration thresholds.
- Activities with the potential to generate high levels of noise or vibration.
- Noise mitigation and management procedures.
- The sensitivity of receivers and any operational requirements and constraints identified through communication and consultation.

Awareness of current noise on, or near, active worksites will be addressed during regular site meetings and/or 'toolbox' training sessions.

8.2 Equipment selection

When selecting construction equipment, where practicable:

- Prioritise quieter construction methodologies.
- Prioritise electric motors over diesel engines.
- Prioritise rubber tracked equipment over steel tracked equipment.
- Equipment should be suitably sized for the proposed task.
- Equipment should be maintained and fitted with exhaust silencers and engine covers.
- Avoid tonal reversing or warning alarms (suitable alternatives may include flashing lights, broadband audible alarms or reversing cameras inside vehicles).

8.3 General measures

Complaints can arise whether or not noise levels comply with the thresholds. To avoid complaints, general mitigation and management measures include, but are not limited to, the following:

- Avoid unnecessary noise, such as shouting, the use of horns, loud site radios, rough handling of material and equipment, and banging or shaking excavator buckets.
- Avoid high engine revs through appropriate equipment selection and turn engines off when idle.
- Mitigate track squeal from tracked equipment, such as excavators (may include tensioning and watering or lubricating the tracks regularly).
- Minimise construction duration near sensitive receivers.
- Stationary equipment should be located away from noise sensitive receivers and site buildings and material stores used to screen them.
- Orient mobile machinery to maximise the distance between the engine exhaust and the nearest sensitive building façade (e.g. excavators).
- Utilise noise barriers where appropriate.
- Implement specialised mitigation measures for concrete cutting and percussive breaking.
- Ensure additional communication with affected building occupants is completed prior to commencing activities that are predicted to exceed the noise performance standards; and
- Undertake noise and vibration monitoring as appropriate.

8.4 Noise barriers

Where practicable, panels should be positioned as close as possible to the construction activity to block line-of-sight between the activity and noise sensitive receivers. Additional local barriers may be necessary near the activity to ensure effective mitigation for sensitive receivers on upper floor levels. The panels should be a minimum height of 1.8 m, and higher if practicable to block line-of-sight². The panels must be abutted or overlapped to provide a continuous screen without gaps at the bottom or sides of the panels.

Examples of temporary noise barriers include the following proprietary 'noise curtains':

- Echo Barrier Temporary Acoustic Noise Barrier (<http://www.supplyforce.co.nz/>).
- Duraflex 'Noise Control Barrier - Performance Series' (www.duraflex.co.nz).
- Soundex 'Acoustic Curtain - Performance Series' (www.ultimate-solutions.co.nz).
- Flexshield 'Sonic Curtain with 4 kg/m² mass loaded vinyl backing' (www.flexshield.co.nz).

8.5 Piling and compaction

Noise and vibration mitigation methods and measures for piling and compaction activities shall include, where practicable:

- Minimising cable slap and chain clink.
- Providing mufflers and engine covers / screens on plant where appropriate.
- Removing obstructions which may exacerbate vibration transmission where appropriate, prior to piling operations.
- Minimise alternating rotation of the bored piling auger to loosen spoil into the muck bin; Shaking the 'kelly bit' connection creates very loud banging that can result in noise complaints.

8.6 Scheduling

Scheduling of construction activities can be a key tool for managing construction noise and vibration effects. The time of day and the duration of the construction activities will be adjusted after consultation, where possible, to avoid particularly sensitive times for affected receivers.

The following should be considered:

- Identify any particularly sensitive times for high-risk receivers and where practicable avoid nearby noisy works during those times.
- Night-time disturbance to nearby residential receivers will be reduced by carrying out noisy activities during the day.
- Provide respite periods by limiting the number of consecutive nights worked near residences.
- Where practicable, avoid conflicts with community events.

Where there are no practicable alternative options to complete works prior to 7 pm and noise level exceedances are anticipated, it will be necessary to implement enhanced noise and vibration management measures. For example:

- Increase the frequency of communications with stakeholders.
- Carry out regular noise and vibration monitoring to confirm noise and vibration levels.

² Temporary barriers greater than 3-4 m are generally impracticable to construct due to wind loading constraints.

- Offer temporary relocation to affected residents if unreasonable noise and/or vibration levels cannot be avoided.

8.7 Vibration mitigation

A hierarchy of vibration mitigation measures should be adopted through the CNVMP as follows:

- Managing times of activities to avoid night works and other sensitive times where practicable (communicated through community liaison).
- Liaising and consultation with neighbours prior to commencing works for vibration generating activities.
- Selecting equipment and methodologies to minimise vibration.
- Monitoring of vibration during activities predicted to exceed the 2 mm/s amenity limit and at the two heritage buildings.
- Where vibration levels are predicted to exceed the applicable DIN 4150-3:2016 limit (5 mm/s for residential, 3 mm/s for heritage) then a building condition survey shall be undertaken in general accordance with the parameters set out in Section 8.7.1.

Mitigation will therefore focus on effective communication with neighbours, and selection of appropriate equipment and methods.

8.7.1 Building condition surveys

A pre-construction building condition survey will be undertaken at all of the buildings identified in Table 7.2 before the main works construction begins. The Project Manager will request in writing the approval of the property owner to undertake a building condition survey at the following times:

- Where vibration is predicted to exceed the cosmetic building damage limits (Table 7.2).
- Where vibration is measured to exceed the cosmetic building damage limits in (Appendix B) and/or in response to a reasonable claim of damage from construction vibration.
- A post condition survey will be undertaken after construction works has been completed, unless the landowner agrees otherwise, or if monitoring determines the post condition survey is unnecessary (i.e. below the DIN 4150-3:2016 threshold).

The building condition surveys will generally be undertaken as follows:

- The building surveys will be undertaken by a suitably qualified and experienced practitioner.
- Permission will be sought from the owner of a building, structure or service for a suitably qualified and experienced practitioner to prepare a report that includes:
 - Information about the type of foundations.
 - The existing levels of damage (cosmetic, superficial, affecting levels of serviceability).
 - Any observed damage that is associated with structural damage.
 - Identifies the potential for further damage to occur and describes actions that will be taken to avoid further damage.
 - Photographic evidence.

The Project team will provide the building condition survey report to the property owner.

Where further surveys identify damage has been encountered, relevant suitably qualified specialists will be engaged to investigate the cause. This may include the vibration specialist, building inspector and building condition author. The outcome of the investigation will be shared with the complainant

/ affected receiver. If it is determined that the Project is responsible for the damage, a plan will be made to rectify it at Auckland Council's cost.

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9 Communication and complaints

This section details the communication procedures relating to noise and vibration for the Project as well as the complaints process. The CMP and Communications Plan contain a more detailed discussion of communication activities for the Project.

9.1 Communication

Written communication (e.g. newsletter, emails, letter drops) shall be provided to occupiers of buildings within 100 m at least 5 days prior to the Project works commencing. It will acknowledge that some activities are predicted to generate high noise and/or vibration levels that may result in disturbance for short periods. It will include details of the overall works, its timing, duration and contact details for where complaints and enquiries should be directed.

- Prior notification of the works via a letterbox drops or supplemented by other means (news article, website, emails etc) to affected neighbours and properties within the areas identified in this assessment. The letterbox drop will provide contact details and will detail the overall nature and expected duration of the works.
- Prior to any particularly noisy process being identified, the most affected neighbours as identified in Appendix B will be contacted individually. Neighbours will be informed of the proposed timing of the specific works. Ongoing consultation and communication with neighbours less than 50 m from any construction works should be undertaken.

9.2 Complaints

All construction noise and/or vibration complaints will be recorded in a complaints file that is available to Auckland Council on request. For each complaint, an investigation will be undertaken involving the following steps as soon as practicable:

- Acknowledge receipt of the concern or complaint and record:
 - Time and date the complaint was received and who received it.
 - Time and date of the activity subject to the complaint (estimated where not known).
 - The name, address and contact details of the complainant (unless they elect not to provide).
 - The complainant's description of the activity and its resulting effects.
 - Any relief sought by the complainant (e.g. scheduling of the activity)
- Identify the relevant activity and the nature of the works at the time of the complaint.
- If a reasonable complaint relates to building damage, inform the on-duty site manager as soon as practicable and cease associated works pending an investigation.
- Review the activity noise and/or vibration levels (Section 6) to determine if the activity is predicted to comply with the relevant performance standards (Section 4) at the complainant's building.
- Consider attended monitoring to verify the underlying reference level assumptions.
- If the activity is measured to be non-compliant with the noise and/or vibration limits (Section 4) the following shall be undertaken:
 - Implement mitigation measures (Sections 7 and 8) and undertake additional monitoring to determine compliance.
- If compliance cannot be achieved, halt works and prepare an addendum to this CNVMP (if not already done).

- Report the findings and recommendations to the Project Manager, implement changes and update this CNVMP as appropriate.
- Report the outcomes of the investigation to the complainant, identifying where the relief sought by the complainant has been adopted or the reason(s) otherwise.

10 Noise and vibration monitoring

Construction noise and vibration levels will be monitored:

- At the start of high noise and vibration activities (Table 3.1 and Table 5.4).
- As required by this CNVMP.
- In response to a reasonable noise or vibration complaint.
 - For noise – at 1 m from the most affected building façade, or proxy position and adjusted for distance and façade reflections where appropriate.
 - For vibration – at the foundation of the building or in accordance with DIN 4150-3:2016.
- By a suitably qualified and experienced practitioner (e.g. Member of the Acoustical Society of New Zealand).
- For a representative duration, reported with the measured level (e.g. 70 dB L_{Aeq} (15 min)).
- The results should be used to update the noise and vibration source data used in the calculations if appropriate.

Noise and vibration monitoring will be undertaken in accordance with the requirements of NZS 6803:1999 and DIN 4150-3:2016 respectively.

A monitoring flowchart is presented in Figure 10.1 below.

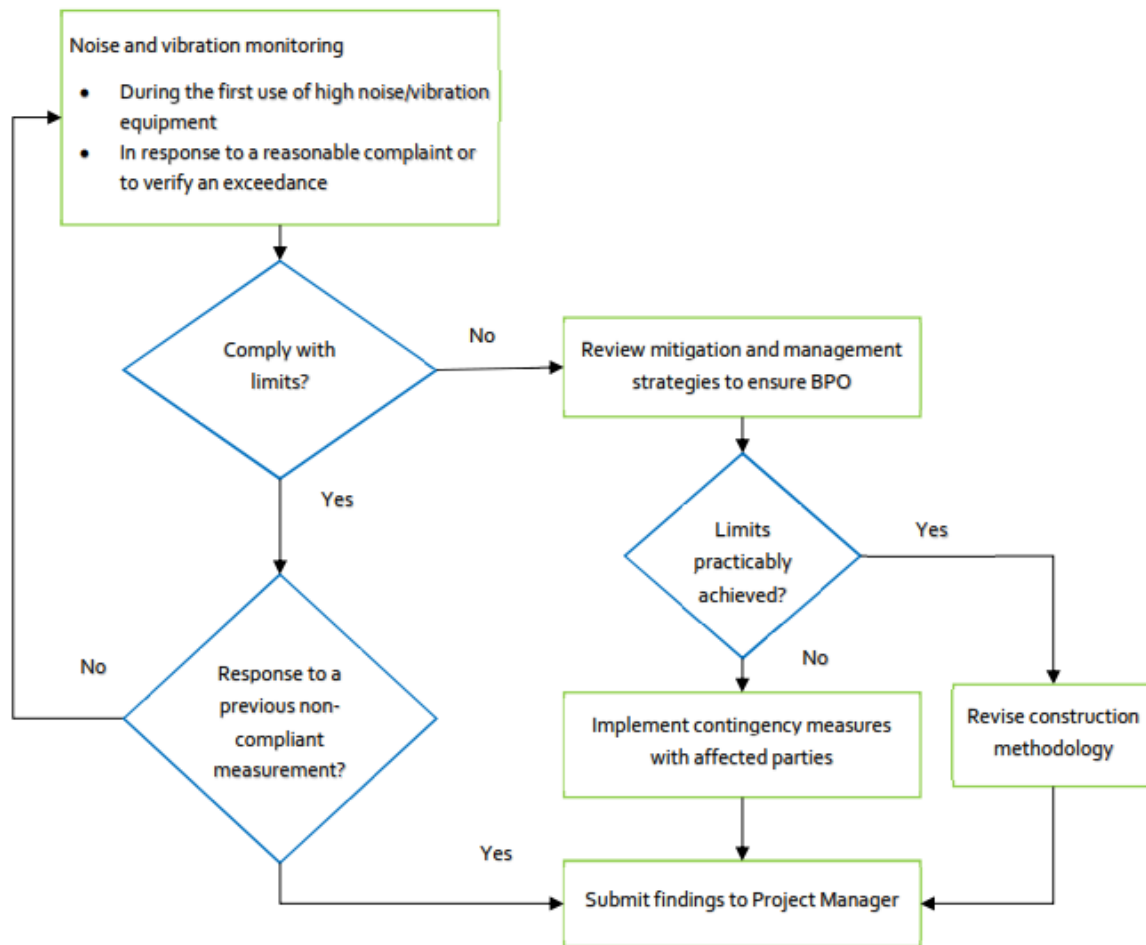


Figure 10.1: Noise monitoring flowchart.

Measurements will be taken if there are high-risk construction activities source levels which need validating. These source measurements will be performed by the Project's Acoustic Consultant. The results of these source measurements will be used to update the noise source data in this draft CNVMP.

If noise monitoring indicates that Project criteria are being exceeded, and that was not anticipated in the draft CNVMP for the activity / location, then the management plan will be immediately reviewed. A construction noise management schedule will be prepared if one does not already exist. The schedule will provide an activity specific assessment together with management controls.

11 Documentation

All electronic files relating to construction noise and vibration will be kept by the Project Manager. This will include:

- Section 1: Construction noise and vibration management plans:
 - This draft CNVMP and any revisions.
 - Construction noise induction sheets.
- Section 2: Consultation and complaints registers.
- Section 3: Noise and vibration monitoring:
 - Site survey sheets and associated aerial photographs.
 - Site survey summary sheet.
 - Survey reports.
 - Survey and equipment operating procedures.
 - Current and past equipment kit details and calibration summary.
 - Copies of calibration certificates.

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12 Applicability

This report has been prepared for the exclusive use of our client Auckland Council’s Healthy Waters, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Auckland Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:

Authorised for Tonkin & Taylor Ltd by:

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Sharon Yung
Acoustic Noise Specialist

.....
Chris Bauld
Project Director

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cnvmp v1 22.10.24.docx

Appendix A Project induction form

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There are residential neighbours in close proximity to the works, where noise and vibration criteria apply. To ensure criteria are achieved, all staff are responsible for good noise and vibration management.

- When arriving at work, please drive slowly on site and keep revs to a minimum. Keep stereos off and do not slam doors.
- No shouting or swearing on site. Either walk over and talk to somebody or use a radio / phone.
- Be careful with tools and equipment. Place them down and do not drop them.
- Do not drag materials on the ground. Place them down when you arrive at the work area.
- Equipment and vehicles should not be left running when not in use.
- When loading trucks try not to drop material from a height.
- Stationary equipment such as pumps and generators should be located away from neighbours.
- All equipment is to be well maintained.
- No work that could cause noise and/or vibration disturbance shall be conducted outside the hours of 0700 h to 1800 h Monday to Saturday unless by arrangement with the Project Manager / Construction Site Management.
- If you see anything /anyone making unnecessary noise, then stop it/them.
- It is essential that good relationships are maintained with neighbours. Any queries from members of the public should be responded to politely and referred to the site manager. Staff shall assist the public to make contact with this person. Staff shall not enter into debate or argue with members of the public.

NAME	COMPANY	SIGNED	DATE

Appendix B Predicted noise and vibration levels

The following table provides the highest predicted noise and vibration level (worst case) for various construction activities when works are at the closest location to each receiver. Highest noise levels are typically at first floor level or above. Where predictions exceed applicable criteria, the results are identified in red.

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Activity		Bridge construction (piling)			Culvert Demolition / Rock breaking		
Address	Receiver Type	Distance from nearest piling works (m)	Predicted noise level, dB LAeq	Predicted vibration levels (mm/s PPV)	Distance from rockbreaking works (m)	Predicted noise level, dB LAeq	Predicted vibration levels (mm/s PPV)
4 Walmsley Road	Residential	24	80	9 - 10	20	84	2 - 3
8 Walmsley Road	Residential (2 Storey)	33	78	7 - 8	25	81	2 - 3
15 Walmsley Road	Residential (2 Storey - raised due to terrain)	47	74	6 - 5	24	81	2 - 3
2 McKenzie Road	Residential	43	75	5 - 7	38	78	1 - 2
14 Walmsley Road	Residential (2 Storey)	50	72	5 - 6	61	76	1 - 2
6 Walmsley Road (1)	Residential	53	74	4 - 6	46	79	1 - 2
18 Walmsley Road	Residential	58	73	4 - 5	46	77	1 - 2
17 Walmsley Road	Residential	71	69	3 - 5	49	75	1 - 2
12 Walmsley Road (1)	Residential	69	70	3 - 5	62	72	1 - 2
2A McKenzie Road (2)	Residential	62	70	4 - 5	56	75	1 - 2
12 Walmsley Road (2)	Residential	73	70	3 - 5	61	74	1 - 2
19 Walmsley Road	Residential	79	67	3 - 4	85	71	1
20 Walmsley Road	Residential	73	70	3 - 5	58	74	1 - 2
22 Walmsley Road	Residential	101	68	2 - 4	83	73	1
14A Walmsley Road	Residential	92	69	3 - 4	69	72	1 - 2
68 Molesworth Place	Residential	89	66	3 - 4	91	70	< 1
1B Miller Road	Residential	72	71	3 - 5	72	74	1 - 2
6 Walmsley Road (2)	Residential	70	69	3 - 5	63	72	1 - 2
2A McKenzie Road (1)	Residential	60	68	4 - 5	55	68	1 - 2
164 Coronation Road – Heritage (1)	Heritage (2 storey)	88	70	3 - 4	90	71	< 1
4 McKenzie Road	Residential	77	67	3 - 4	71	72	1 - 2
3 Hall Avenue	Residential	102	63	2 - 4	87	70	< 1
164 Coronation Road – Heritage (2)	Heritage	103	67	2 - 4	105	69	< 1
6 McKenzie Road	Residential	91	51	3 - 4	85	52	1

Activity		Bridge construction (civil)			Construction support area	
Address	Receiver Type	Distance from nearest bridge works (m)	Predicted noise level, dB L _{Aeq}	Predicted vibration levels (mm/s PPV)	Distance from nearest boundary (m)	Predicted noise level, dB L _{Aeq}
4 Walmsley Road	Residential	24	71	1 - 2	20	70
8 Walmsley Road	Residential (2 Storey)	33	72	1 - 2	25	69
15 Walmsley Road	Residential (2 Storey - raised due to terrain)	47	66	1 - 2	24	70
2 McKenzie Road	Residential	43	66	1 - 2	38	65
14 Walmsley Road	Residential (2 Storey)	50	65	1 - 1	61	62
6 Walmsley Road (1)	Residential	53	65	1 - 1	46	61
18 Walmsley Road	Residential	58	65	1 - 2	46	63
17 Walmsley Road	Residential	71	60	1 - 2	49	60
12 Walmsley Road (1)	Residential	69	64	< 1	62	58
2A McKenzie Road (2)	Residential	62	62	< 1	56	58
12 Walmsley Road (2)	Residential	73	62	< 1	61	58
19 Walmsley Road	Residential	79	58	< 1	69	57
20 Walmsley Road	Residential	73	60	1 - 2	58	60
22 Walmsley Road	Residential	101	60	< 1	83	59
14A Walmsley Road	Residential	92	61	< 1	85	56
68 Molesworth Place	Residential	89	60	< 1	91	56
1B Miller Road	Residential	72	61	< 1	72	64
6 Walmsley Road (2)	Residential	70	60	< 1	63	56
2A McKenzie Road (1)	Residential	60	60	< 1	55	57
164 Coronation Road – Heritage (1)	Heritage (2 storey)	88	60	< 1	90	60
4 McKenzie Road	Residential	77	59	< 1	71	58
3 Hall Avenue	Residential	102	54	< 1	87	55

164 Coronation Road – Heritage (2)	Heritage	103	57	< 1	105	57
6 McKenzie Road	Residential	91	48	< 1	85	54

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Appendix C Sensitive receivers within 190 m of works

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NOTES: Basemap NZ Hybrid Reference (Vector), Eagle Technology, LINZ, StatNZ, NIWA, Natural Earth, © OpenStreetMap contributors, NZ Navigation Map, Eagle Technology, LINZ, StatNZ, NIWA, Natural Earth, © OpenStreetMap contributors, NZ Imagery, Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors				Auckland	
0	First version	XXXX	2024	18/10/24	
REV	DESCRIPTION	GIS	CHK	DATE	LOCATION PLAN

PROJECT No.	1017033
DESIGNED	SHYU OCT24
DRAWN	SHYU OCT24
CHECKED	LILE OCT24

CLIENT	AUCKLAND COUNCIL HEALTHY WATERS
PROJECT	TE ARARATA - WALMSLEY BRIDGE
TITLE	RECEIVERS WITHIN 190 M OF PILING WORKS
SCALE (A3)	1:1,800
FIG No.	APPENDIX C FIGURE 1
REV	0

Appendix D Stakeholder Engagement

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