

APPENDIX C: ASSESSMENT OF VIBRATION EFFECTS FOR SPECIFIC PROPERTIES

Location	Properties closest to proposed works	Separations distance to dwellings	Risk of Damage/ Disturbance without mitigation	Key construction works generating vibrations	Potential Options	Mitigation	Residual Effect Post Mitigation
Western Springs	MOTAT	140m	Very Low ¹	Blasting of shafts and underground chambers in basalt rock.	Nil, Monitor.		Less than minor.
	42 Sefton Ave 3 Bullock Track	120m	Very Low		Nil, Monitor.		Less than minor.
Western Springs Interchange	790-802 Gt North Rd	25m Underground Storage Tanks	Moderate	Shaft in basalt proposed 20m from commercial property south side of Great North Rd (25m from UST) and 60 m from MOTAT).	Hydraulic rock breakers & limited use of blasting operated within Commercial limits of Din 4150.		Minor. Close monitoring required.
Mt Albert War Memorial Reserve - Reserve Site (Original Layout Drawing AEE-Main-2.2)	65 b (rear dwelling)	18	High	Drop and access shafts, thick layer of basalt in shaft.	Hydraulic rock breakers, possible limited use of small charges to loosen rock operated within Din 4150 or limits agreed with the occupier		Minor. No damage to structures but continuous vibrations from rock breakers likely to cause disturbance to residents. Can be further mitigated through measures as described in Section 8 of Vibration Report.
	65 c Asquith Ave (rear dwelling)	28m	Moderate	Drop and access shafts, thick layer of basalt in shaft.	Hydraulic rock breakers & limited use of blasting operated within Din 4150		Minor. No damage to structures. Clearly perceptible to residents and likely to cause disturbance but not fatigue. Can be mitigated through measures as described in Section 8 of Vibration Report.
	9 to 21 Wairere Ave, 65 Asquith Ave	30–60m	Low to Moderate	Access shaft, thick layer of basalt in shaft.	Hydraulic rock breakers and small charge weights to limit blasting vibrations to within Din 4150.		Minor. No damage to structures. Clearly perceptible to residents and likely to cause disturbance but not fatigue. Can be mitigated through measures as described in Section 8 of the Vibration Report.
	5 and 23, 16 – 26 Wairere Ave	80-130m	Very low	Blasting for shafts and control chamber.	Nil, monitor.		Less than minor, no damage to structures. Clearly perceptible but not likely to cause disturbance to residents. Can be mitigated through measures as described in Section 8 of Vibration Report.
	Community and Recreation Centre	70m	Low	Blasting for shafts.	Hydraulic rock breakers & limited use of blasting operated within Din 4150 (Commercial limits).		No damage to building. Likely to be disturbance to occupants in western end of building. Mitigation by measures as described in Section 8 of Vibration Report. Likely to include

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						coordination of blasting at times when the western end is not occupied
Mt Albert War Memorial Reserve - Car Park Site (Drawing AEE-Main-2.2A Rev B)	65 b and c Asquith Ave (2 rear dwellings)	65m	Moderate	Drop shaft, thick layer of basalt in shaft.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Less than minor. No damage to structures. Clearly perceptible to residents but should not cause disturbance. Can be mitigated through measures as described in Section 8 of Vibration Report.
	9 - 17 Wairere Ave	35-70m	Moderate to high	Drop shaft, thick layer of basalt in shaft.	Hydraulic rock breakers and small charge weights to limit blasting vibrations to within Din 4150.	Minor. No damage to structures. Clearly perceptible to residents and likely to cause disturbance but not fatigue. Can be mitigated through measures as described in Section 8 of Vibration Report.
	9 & 11 Wairere Ave	10m	High to Very High	Control Chamber and deep trench in basalt.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Minor. Low risk of cosmetic damage but no structural damage. Moderate level of disturbance likely for short period to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	5 Wairere Ave	50m	Moderate	Blasting for Working shaft and control chamber.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Minor, no damage to structures but likely disturbance to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	6 - 20 and 19 -21 Wairere Ave	100-130m	Very low	Blasting for shafts and control chamber.	Nil, monitor.	Minor, no damage to structures but likely disturbance to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	Community and Recreation Centre	25m	High	Blasting for shafts.	Hydraulic rock breakers & limited use of blasting operated within Din 4150 (Commercial limits).	Minor risk of cosmetic damage but no structural damage to building. Likely to be disturbance to occupants in western end of building. Mitigation by measures as described in Section 8 of Vibration Report.
Lyon Ave	11-27 Morning Star Place	15m	High	Trenching and blasting of shafts in basalt.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Minor, no damage to structures but likely disturbance to closest residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	12-28 Morning Star Place	40m	Moderate	Trench in basalt.	Hydraulic rock breakers & limited use of blasting	Minor, no damage to structures but likely disturbance to closest sensitive residents which

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					operated within Din 4150.	can be mitigated through measures as described in Section 8 of Vibration Report.
	1 Wagener Pl	30m	Moderate	Blasting of shafts in basalt.	Small charge weights to limit blasting vibrations to within Din 4150.	Minor, no damage to structures but likely disturbance to closest sensitive residents which can be mitigated through measures as described in Section 8 of Vibration Report
	15 Lyon Ave	15m	Mod. - High	Trench in basalt.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Minor. No damage to structures but disturbance likely to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
Haverstock Rd	98 Haverstock Rd	40m	Low	Possibility of thin zone of basalt in shafts.	Small charge weights to limit blasting vibrations to within Din 4150.	Less than minor.
	7 Camden Rd	50m	Low		See above	Less than minor.
Walmsley Park	3 O'Donnell Ave	20m	High		Small charge weights to limit blasting vibrations to within Din 4150.	Minor. No damage to structures but disturbance likely to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	5-9 O'Donnell Ave	33m	Moderate		See above.	Minor, some disturbance to residents
May Rd	51a Marion Ave	25m	Mod - High	Large 25m diameter shaft. Basalt rock expected to be rubbly but there may be zones of stronger rock in shafts.	Small charge weights to limit blasting vibrations to within Din 4150.	Minor. No damage to structures but disturbance possible to residents.
	53a-55a Marion Ave	20m	Mod - Very High		Small charge weights to limit blasting vibrations to within Din 4150.	Minor.
Keith Hay Park	20 & 22 Gregory Pl	N/A	N/A		Purchased by Council and Watercare for Project	N/A
	19 Gregory Pl	12m	Low	Secant or sheet piles to ECBF.	Monitor.	Minor. No damage to structures but disturbance possible to residents for piling works closest to the structure
	18 Gregory Pl	16m	Low		Monitor.	Less than minor. No damage to structures but vibrations will be perceptible to residents. Can be mitigated through measures as described in Section 8 of Vibration Report.

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	47a Arundel St	30m	Low		Monitor	Less than minor.
Pump Station 23 (Frederick Street)	6/41 Frederick St	20m	Moderate	Secant or sheet piles to ECBF.	Small charge weights to limit blasting vibrations to within Din 4150.	Minor. No damage to structures but disturbance likely to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	52a Frederick St	40m	Low			Less than minor.
Kiwi Esplanade	Trench - Kiwi Esplanade, Yorkton Rise, Muir Ave, Villa Court	5-20m	Low to high	Shallow Trench in basalt.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Minor. No damage to structures but disturbance likely to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
	85 - 89 Kiwi Esplanade	120m	Low	Blasting of Shaft in basalt.	Nil, Monitor.	Less than minor.
	Mangere Pump Station	>200m	Low	Large Diameter shaft in weak materials.	Nil, monitor.	Less than minor.
Motions Rd	100-102 Motions Rd Western Springs College	140m	Low	Rock Breaker or blasting of thin layer of basalt rock.	Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Less than minor.
	Auckland Zoo ²	50m	Moderate		Hydraulic rock breakers & limited use of blasting operated within Din 4150.	Minor. No damage to structures but minor disturbance possible to residents and animals.
Western Springs Depot	WS Depot – Buildings	20m	Mod - High	Blasting of basalt in shaft.	Small charge weights to limit blasting vibrations to within Din 4150	Minor. No damage to structures but disturbance likely to residents which can be mitigated through measures as described in Section 8 of Vibration Report.
Rawalpindi Reserve	19 Rawalpindi	37m	Low	ECBF, secant piles to ECBF.	Nil, monitor.	Less than minor.
	17 Rawalpindi	30m	Low		Nil, monitor.	Less than minor.

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Norgrove Ave	16 Norgrove Ave	12m	Mod - High	ECBF, high potential to disturb residents by piling works.	Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling likely to result in some disturbance to residents.	
	14 Norgrove Ave	15m	Moderate			Minor. Low risk of vibration damage, piling closest to dwelling likely to result in some disturbance to residents.	
	27 Verona Ave	12m	High			Minor. Low risk of vibration damage, piling closest to dwelling likely to result in some disturbance to residents.	
Pump Station 25	30a Miranda Pl	55m shaft	Low	Secant or sheet piles to ECBF. (New dwelling)	Nil, monitor.	Less than minor.	
	3/28 Taylors Close	40m Chamber	Low	ECBF.	Nil, monitor.	Less than minor.	
Miranda Reserve	353 Blockhouse Bay Rd Units	50m	Low	Secant or sheet Piles to ECBF.	Nil, monitor.	Less than minor.	
	373 Blockhouse Bay Road	27m	Low-Moderate			Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling may result in some disturbance to sensitive residents.
	356 East side of Blockhouse Bay Rd	30m	Low			Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling may result in some disturbance to sensitive residents.
Whitney St	124 Whitney St	22m	Low - Moderate	6 m shaft, Secant or sheet Piles to ECBF.	Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling likely to result in some disturbance to some residents.	
	128 Whitney St	15m	Moderate -High (disturbance)			Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling likely to result in disturbance to residents.
	130 Whitney St	15m	Moderate - High (disturbance)			Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling likely to result in disturbance to residents.
Dundale Ave	66D Dundale Ave	30m	Low	2.4 m ϕ shaft (piling rig - bored and cased shaft),	Piling equipment operated to limit vibrations to within DIN4150.	Less than minor.	

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	68-78 Dundale Ave	50m	low	Preschool facility.	Nil, monitor.	Less than minor.
Haycock Ave	2 Haycock Ave	6m	High	Secant or sheet piles to ECBF rock.	Piling equipment operated to limit vibrations to within DIN4150.	Minor. Low risk of vibration damage, piling closest to dwelling likely to result in disturbance to residents.
	4 Haycock Ave	-	N/A. House to Be Removed		N/A	N/A
	6 Haycock	3m	Very High		Piling equipment operated to limit vibrations to within DIN4150	Minor. Low risk of vibration damage, piling closest to dwelling likely to result in disturbance to residents.
	79b White Swan Rd	25m	Low		Piling equipment operated to limit vibrations to within DIN4150.	Less than Minor.
Tunnels³		>20m	low	Excavation in ECBF (see note 2).	Monitor. (EBPM Machine expected to progress at >10m/day ...	Less than minor, short period of perceptible vibrations.

Note 1. The vibration levels generated by the MOTAT tram are expected to exceed transmitted vibrations from construction works at the Western Springs and Motions Road sites.

Note 2. The potential for disturbance to animals in the zoo has previously been considered by Tonkin & Taylor during an assessment of effects for the MOTAT tram. This study concluded that animals in zoos adjust quickly to levels of vibration which are below human perception levels (about 0.3mm/s). Most would also not be highly alarmed by low frequency events which transmit vibrations up to 1mm/s such as blasting.

Note 3. The depth of the tunnels generally exceeds 20m. It is concluded the risk of damage from vibration to dwellings due to tunnelling beneath the properties is less than minor. The levels of vibrations should not cause disturbance to people but may be perceptible to sensitive receivers, particularly if also associated with regenerated noise. The tunnelling excavation will progress rapidly (about 10-20m/day) and the short period of any felt effects are not expected to result in any significant discomfort. Intermittent higher levels of vibration may be generated by tunnelling related activities such as shunting of muck wagons, handling of segments, etc. These activities will need to be managed to limit vibrations, particularly if these are undertaken regularly at the same locations. It will be important to keep sensitive receivers informed on progress of the tunnelling as it passes under their location.