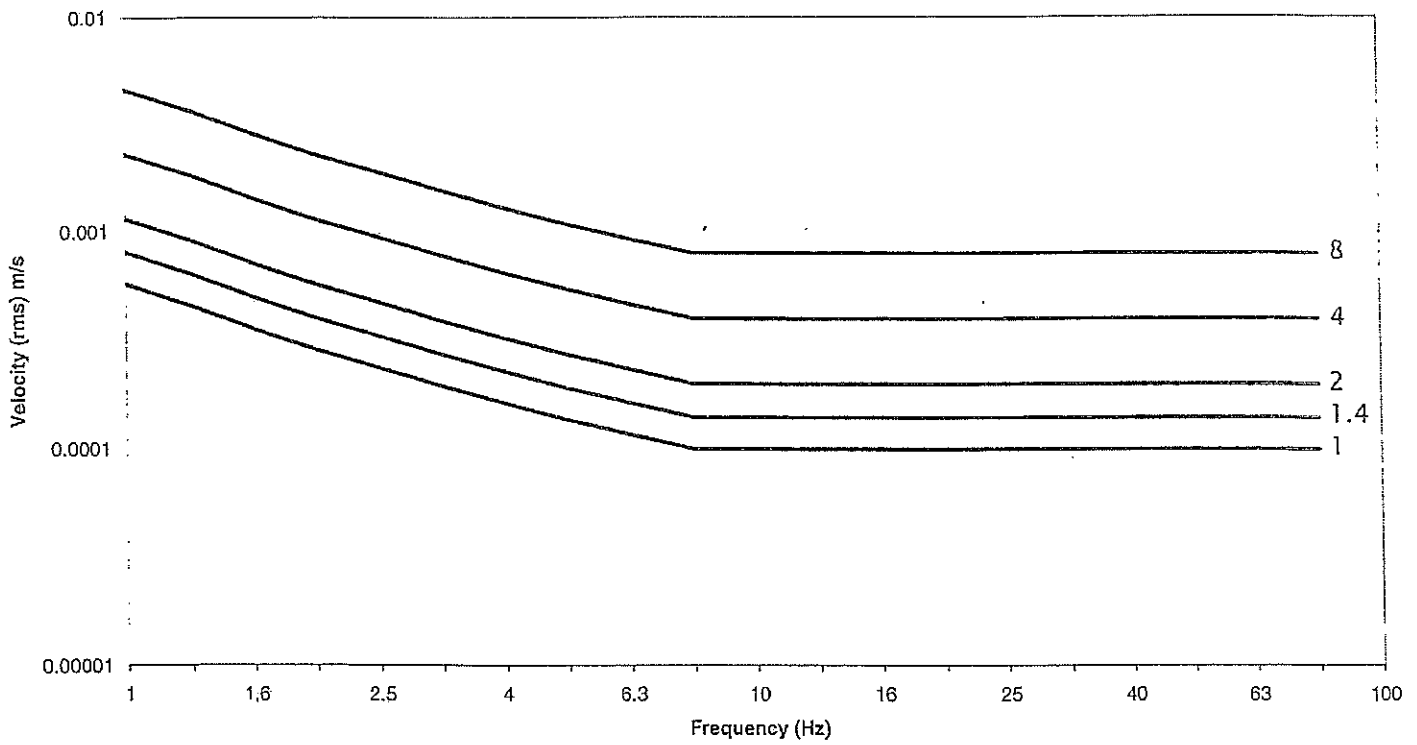


**Appendix A: ISO 2631:1989 Evaluations of Human  
Response Exposure to Whole Body  
Vibration – Part 2: Continuous and Shock  
Induced Vibrations in Buildings (1 to 80 Hz)**

- **A1 Peak Velocity Curves**
  - **A2 Multiplying Factors for Human Response Criteria**
-

Combined-direction criteria (ISO 2631-2:1989)  
Curves for multiplying factors 1, 1.4, 2, 4 and 8



Combined-direction weighting curves from ISO 2631-2:1989

The ISO 2631-2:1989 criteria for intermittent sources are summarised in Table below:

Multiplying factors to specify satisfactory vibration magnitudes for human response (ISO 2631-2:1989)

Place	Time	Continuous or intermittent vibration (Multiplying factor)
Critical working areas	Day	1
	Night	
Residential	Day	2 to 4
	Night	1.4
Office	Day	4
	Night	
Workshop	Day	8
	Night	

**Appendix B:**

**Waterview Connection Project. Extract of  
Conditions of Consent Referencing Criteria  
To Be Met for Construction Induced  
Vibrations**

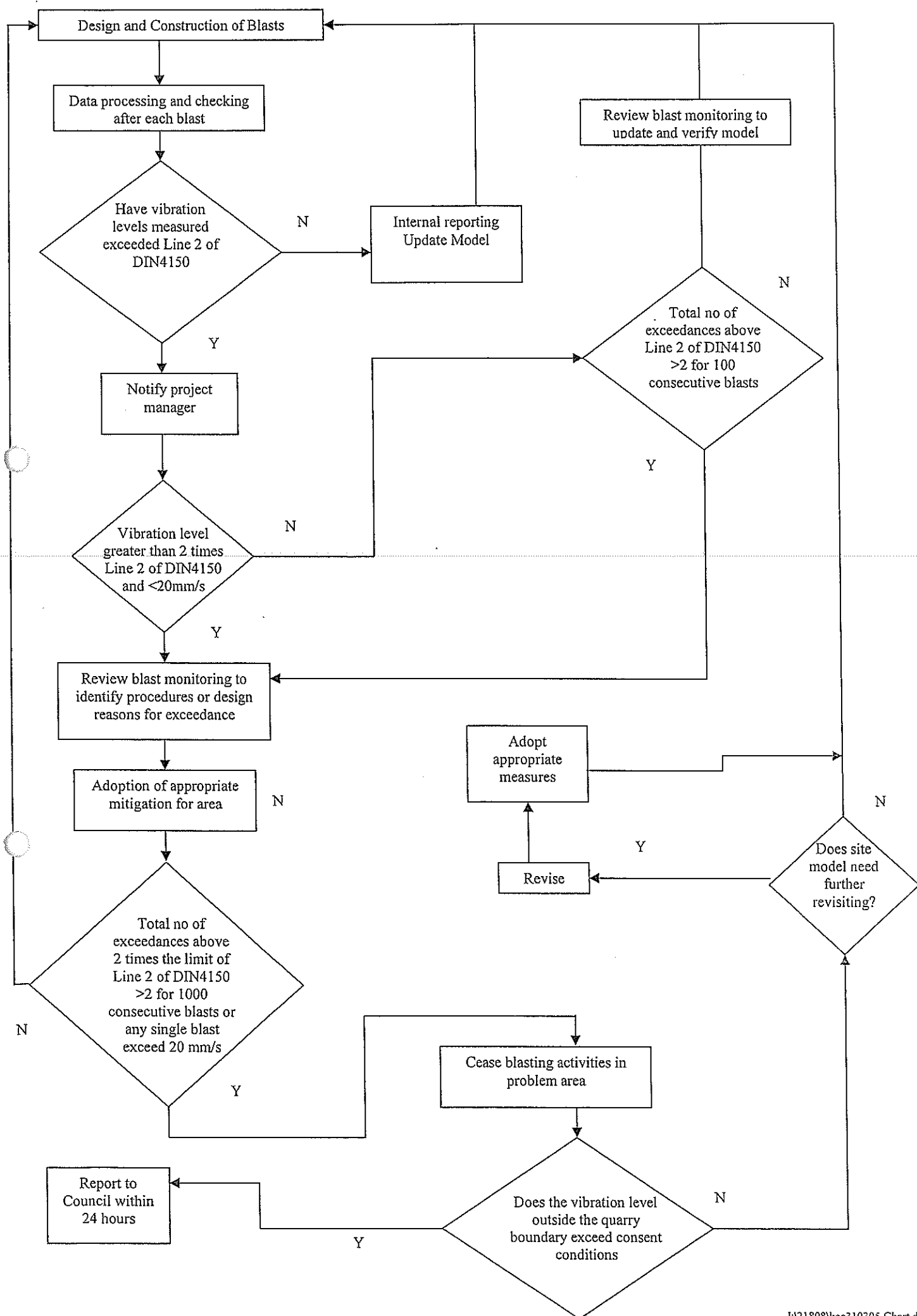
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### Noise and Vibration (NV) Conditions – Construction

CNV.1	<p>The NZTA shall finalise and implement through the CEMP, a Construction Noise and Vibration Management Plan (CNVMP) throughout the entire construction period of the Project.</p> <p>The CNVMP shall describe the measures adopted to meet:</p> <ul style="list-style-type: none"> <li>(a) the noise criteria set out in Conditions CNV.2 and 3 below;</li> <li>(b) the vibration criteria set out in Condition CNV.4 below; or</li> <li>(c) where (a) or (b) cannot be met, the process that will be followed to appropriately mitigate noise and vibration effects including methods that may be applied outside the designation.</li> </ul> <p>The CNVMP shall be provided to the Major Infrastructure Team Manager, Auckland Council at least 20 working days prior to construction activities being undertaken for review and certification that the CNVMP, as a minimum, addresses the following:</p> <ul style="list-style-type: none"> <li>(i) Construction noise and vibration criteria (Conditions CNV.2, CNV.3, and CNV.4);</li> <li>(ii) Hours of operation, including times and days when noisy and/or vibration inducing construction activities would occur;</li> <li>(iii) Machinery and equipment to be used;</li> <li>(iv) Vibration testing of equipment to confirm safe distances to buildings prior to construction;</li> <li>(v) Preparation of building condition surveys of critical dwellings prior to, during and after completion of construction works;</li> <li>(vi) Roles and responsibilities of personnel on site;</li> <li>(vii) Construction operator training procedures;</li> <li>(viii) Methods for monitoring and reporting on construction noise and vibration;</li> <li>(ix) A hierarchy of mitigation options that will be assessed for the Project noise mitigation, including alternative strategies where full compliance with the relevant noise and/or vibration criteria cannot be achieved;</li> <li>(x) Management schedules containing site specific information;</li> <li>(xi) Measures for liaising with and notifying potentially affected receivers of proposed construction activities and the potential for noise and vibration effects, specifically:             <ul style="list-style-type: none"> <li>• PPFs located within a horizontal distance of 35 metres of underground excavation works, along the tunnel alignment shall receive prior notification not greater than 7 days (and not less than 24 hours) prior to the commencement of works.</li> </ul> </li> </ul>
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**Appendix C:**

**Vibration Management Plan Response Flow  
Chart**



## **Appendix D:           Vibration Monitoring Results**

### **Background Monitoring**

- **D1     Motions Rd**
- **D2     Walmsley Park**
- **D3     Kiwi Esplanade**
- **D4     Miranda Reserve**

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### **Operations Monitoring**

- **D5     Victoria Avenue Pump Station**
- **D6     Okahu Bay Pump Station**

### **Construction Monitoring**

- **D7     Southwestern Interceptor Micro-tunnelling Machine**

## D1 Motions Rd



Vibration Monitoring - Site Observations

Geotechnics Ltd

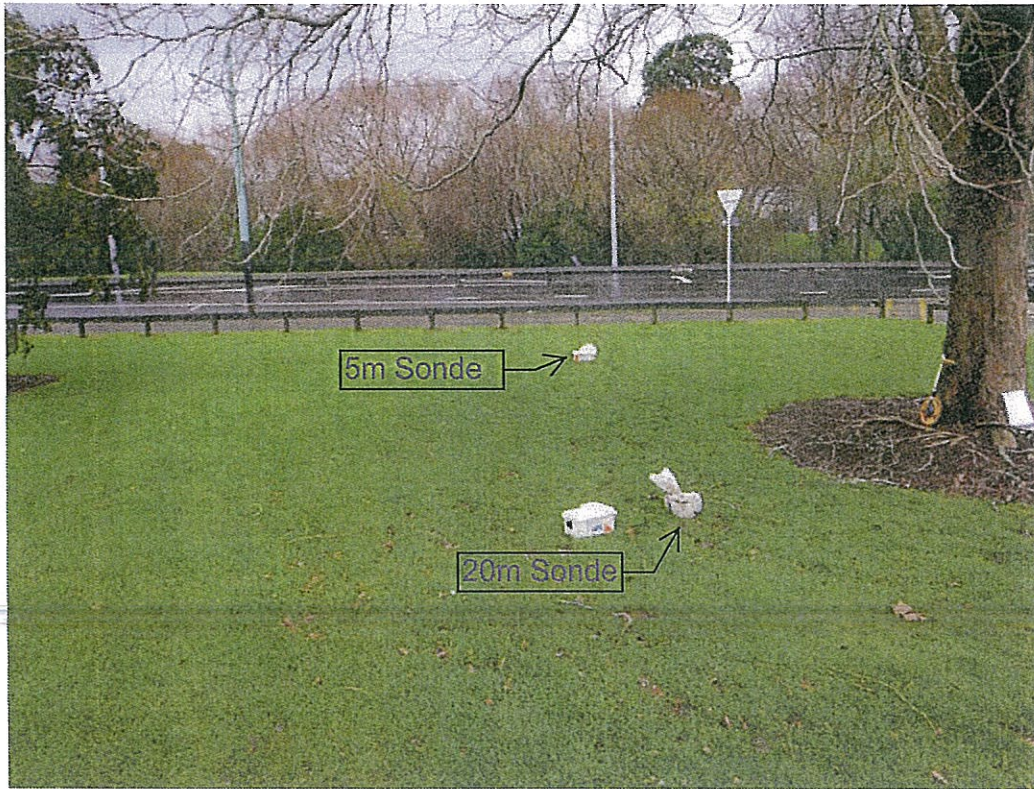
Date:		14/07/11				Site: Motions Road				Tech: CDR	
Sonde Location 1:		1m From Tramline/7.4m Road Kerb				Notes: Adjacent to join in tram rail.					
Sonde Serial #/Event #:		10086 / 23.NSZ				Road condition smooth, slight trench in road far side.					
Sonde Location 2:		10m From Tramline/16.4m Road Kerb				Sondes pinned in grass - saturated. Beside zoo entrance					
Sonde Serial #/Event #:		10046 / 718.NSZ				Cars / Vans : Table shows total No. of vehicles passing in each minute					
Time:	Car Near ↓	Car Far ↑	Van Near ↓	Van Far ↑	Truck Near ↓	Truck Far ↑	Bus Near ↓	Bus Far ↑	Tram Sth ↓	Tram Nth ↑	
13:25	1	2									
13:26	3	3									
13:27	3	2	1	1							
13:28		3									
13:29	2	3									
13:30	1			1							
13:31	3	1	1								
13:32	1	1	1								
13:32:15										1	
13:33	6	3									
13:34	4	3	1	1							
13:35	5	3	2	1							
13:36	1	2									
13:37	1	3									
13:38	2	2									
13:38:54	Pedestrians close to sonde										
13:39	3	1									
13:40	1	2	1								
13:41	4	1		2							
13:41:13						1					
13:42	3		1	1							
13:43	2										
13:44	2	5	1	1							
13:45	1	1									
13:45:16	Pedestrians close to sonde										
13:46		1									
13:47	2	1									
13:48	1	1		3							
13:48:22									1		
13:49	1	1	1								
13:50	2	1		1							
13:51	1	3									
13:52	1	4									
13:53		4									
13:54	3	2									
13:55	2	2									
13:56	3										
13:57		1									
13:58	1	3									
13:59	2	1									
14:00	2	4									
14:00:44					1						
14:01	2	3		1							
14:02	3	2									
14:03	4	2									
14:04	3	3		1							
14:05	2	2									
14:05:13										1	
14:06		2									
14:07	1										
14:08	3	1									
14:09	2	3									
14:10		2									
14:10:59					1						
14:11	2	4									
14:12	3	1	1								
14:13	1	1									
14:14	2	2	1								
14:14:22									1		
14:15	2	2									
14:16	3	1									
14:17	2	1									
14:18	1	3									

# Vibration Monitoring - Site Observations

Geotechnics Ltd

Date:		Site:				Tech:					
14/07/11		Motions Road				CDR					
Sonde Location 1:		5m From Tramline/11.4m Road Kerb				Notes: Adjacent to join in tram rail.					
Sonde Serial #/Event #:		10086 / 25.NSZ				Road condition smooth, slight trench in road far side.					
Sonde Location 2:		15m From Tramline/21.4m Road Kerb				Sondes pinned in grass - saturated. Beside zoo entrance					
Sonde Serial #/Event #:		10046 / 720.NSZ				Cars / Vans : Table shows total No. of vehicles passing in each minute					
Time:	Car Near ↓	Car Far ↑	Van Near ↓	Van Far ↑	Truck Near ↓	Truck Far ↑	Bus Near ↓	Bus Far ↑	Tram Sth ↓	Tram Nth ↑	
14:30	1	2									
14:30:26							1				
14:31	2	3									
14:32	2	2									
14:33	1	3									
14:34	1	1									
14:35	1	1		1							
14:35:49										1	
14:36	3	2									
14:37	1	3									
14:38	2	3									
14:39	1	2									
14:40	3	2									
14:41	2	3	1								
14:42	2	1									
14:43	1	1									
14:44	2	2									
14:44:15									1		
14:45		3	1								

## Background Vibration Monitoring - Sonde Locations



Motions Road - 14/07/11

Motions Road, Western Springs, Auckland - Google Maps

5/200  
200



14-Jul-11 at 14:30:39 Event # 25  
 End Time: 14:47:56  
 Sample Rate: 1024/sec

**Seismic**

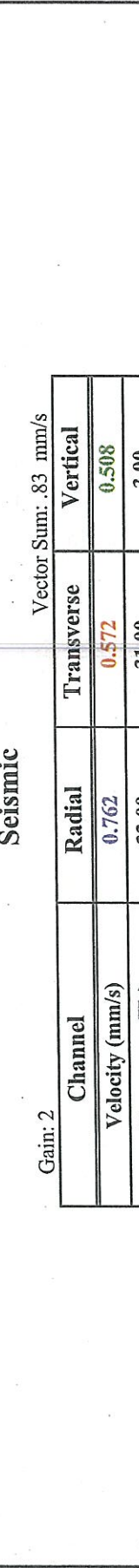
Gain: 2

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.762	0.572	0.508
Frequency (Hz)	33.00	31.00	3.00
Time	14:35:50	14:35:50	14:44:15
Displacement (mm)	0.0037	0.0029	0.0270
Acceleration (g's)	0.016	0.011	0.001

Vector Sum: .83 mm/s

**BarGraph**

Seismic Scale: 2.03 mm/s/div. Summary Interval (min): 5. Bar Interval (sec): 1  
 Bar Samples total/shown: 1037/172



WATERCARE

MOTIONS RD

GEOTECHNICS

LOC1 - 5m From Tramline

Graph: 10086

BarGraph Job # 25

Start: 14-Jul-11 @ 14:30:39

End: 14-Jul-11 @ 14:47:56

Summary Interval: 4

Air: 103 dB @ 3.0 Hz

Radial: 0.762 (mm/s) @ 33.0 Hz @ 14:35:50

Transverse: 0.5715 (mm/s) @ 31.0 Hz @ 14:35:50

Vertical: 0.508 (mm/s) @ 3.0 Hz @ 14:44:15

Vector Sum: .83 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.29 hr

Battery Level: 6.27

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	14:30	102	102	3 14:30:59	0.3175	1.5	14:31:56	0.3175	0.3175	0 14:34:19	0.508	93.1	14:31:56	0.0221	0.769
2	14:35	103	103	3 14:39:34	0.762	33	14:35:50	0.5715	0.5715	31 14:35:50	0.508	37.9	14:35:50	0.0933	0.409
3	14:40	102	102	341.3 14:43:54	0.635	33	14:44:15	0.508	0.508	0 14:44:15	0.508	3	14:44:15	0.0778	0.341
4	14:45	99	99	3 14:45:48	0.3175	0	14:46:18	0.254	0.254	0 14:46:19	0.254	2.9	14:47:10	0	0

end of data

**Company: WATERCARE**  
**Location: MOTIONS RD**  
**Unit #: 10046**  
**Operator: GEOTECHNICS**  
**14-Jul-11 at 14:30:40 Event # 720**

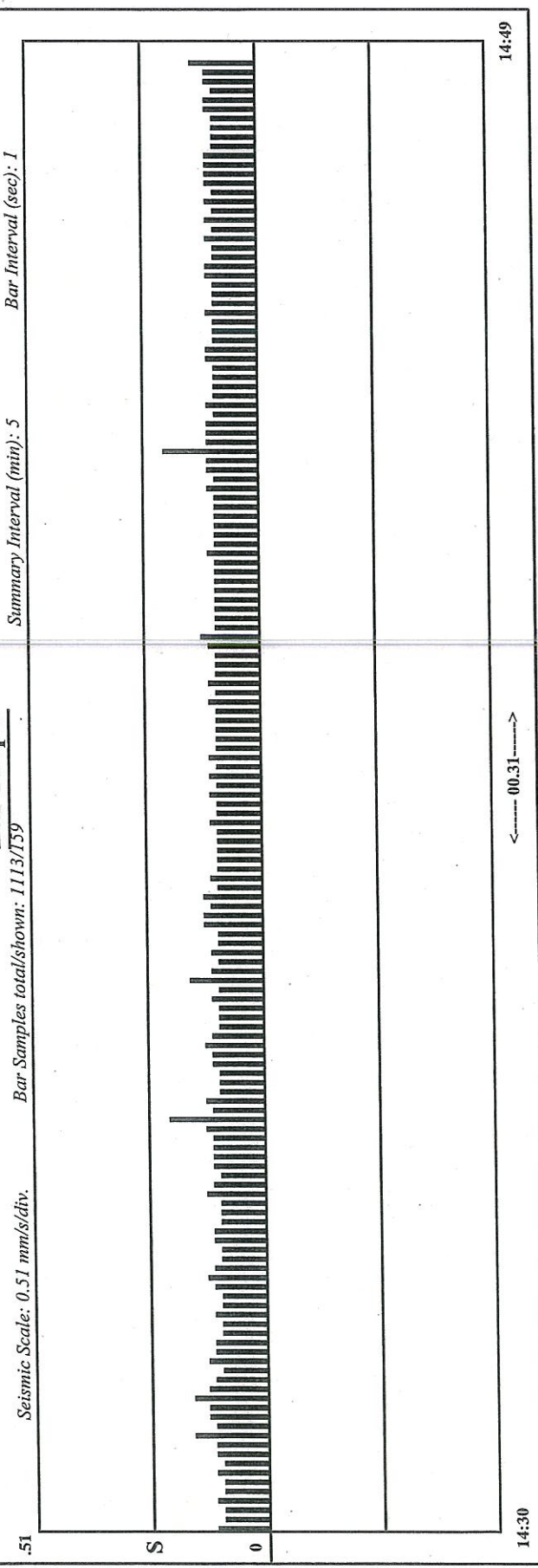
**Notes: LOC2 - 15m From Tramline**  
 End Time: 14:49:13  
 Sample Rate: 1024/sec  
 Distance-Source: N

Gain: 2

Vector Sum: .25 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.206	0.191	0.206
Frequency (Hz)	44.50	29.30	60.20
Time	14:35:49	14:35:49	14:44:14
Displacement (mm)	0.0007	0.0010	0.0005
Acceleration (g's)	0.006	0.004	0.008

**BarGraph**



WATERCARE  
 MOTIONS RD  
 GEOTECHNICS  
 LOC2 - 15m From Tramline  
 Graph: 10046  
 BarGraph Job # 720  
 Start: 14-Jul-11 @ 14:30:40  
 End: 14-Jul-11 @ 14:49:13  
 Summary Interval: 4  
 Air: 101 dB @ 341.3 Hz  
 Radial: 0.206375 (mm/s) @ 44.5 Hz @ 14:35:49  
 Transverse: 0.1905 (mm/s) @ 29.3 Hz @ 14:35:49  
 Vertical: 0.206375 (mm/s) @ 60.2 Hz @ 14:44:14  
 Vector Sum: .25 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00:31 hr  
 Battery Level: 6.3

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	14:30	101	341.3	14:30:43	0.15875	146.3	14:31:57	0.15875	37.9	14:32:20	0.111125	25	14:34:53	0.0169	0.098
2	14:35	101	341.3	14:39:39	0.206375	44.5	14:35:49	0.1905	29.3	14:35:49	0.15875	48.8	14:35:50	0.0187	0.149
3	14:40	100	341.3	14:42:02	0.206375	60.2	14:44:14	0.1905	33	14:44:14	0.206375	60.2	14:44:14	0.0139	0.202
4	14:45	100	204.8	14:48:00	0.111125	68.3	14:48:37	0.142875	4.9	14:49:07	0.111125	44.5	14:46:55	0.1179	0.011

end of data



Unit #: 10086  
14-Jul-11 at 13:10:53 Event # 21

Operator: **GEOTECHNICS**

Record Duration: 3.0 sec  
Sample Rate: 1024/sec

Distance: N      Wgt. Per Delay: N      Scaled Distance: 0.0

**Seismic**

Gain: 2      Trigger: 1.778 mm/s      Vector Sum: 14.94 mm/s @ 73.14 Hz

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	10.033	4.826	10.986
Frequency (Hz)	85.30	102.40	73.10
Displacement (mm)	0.0187	0.0075	0.0239
Acceleration (g's)	0.548	0.316	0.514
Trigger >>> Peak	434.6	1280.3	440.4

**Air**

Gain: 1      Trigger: N

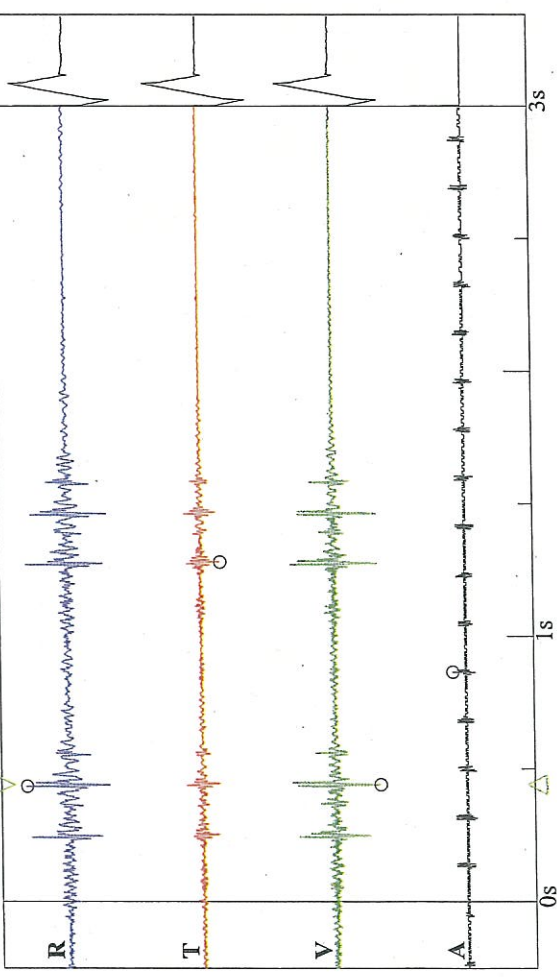
Measurement	Value	Trigger >>> Peak
kPa	.00175	865.2
dBL	99	
Hz	512	

**Waveform Analysis / Frequency Plot**

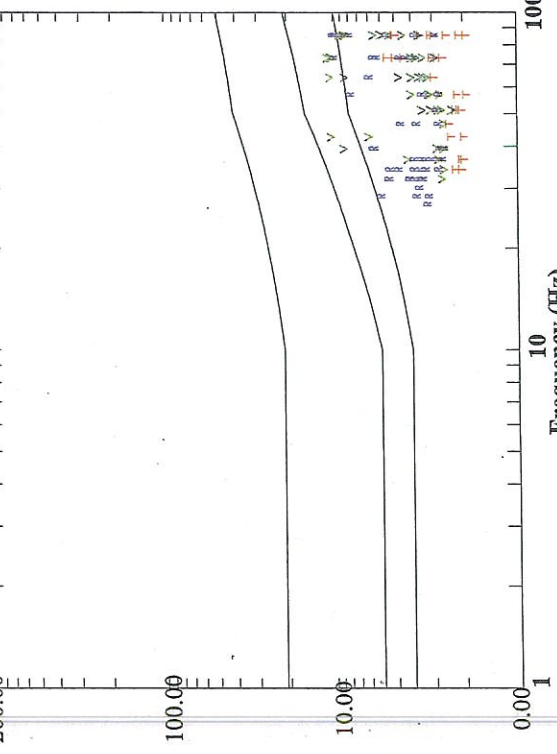
DIN 4150-3-Table 1

Air Scale: .00799 kPa/div.

Seismic Scale: 16.26 mm/s/div.



Velocity (mm/s)



Gain: 2

**Seismic**

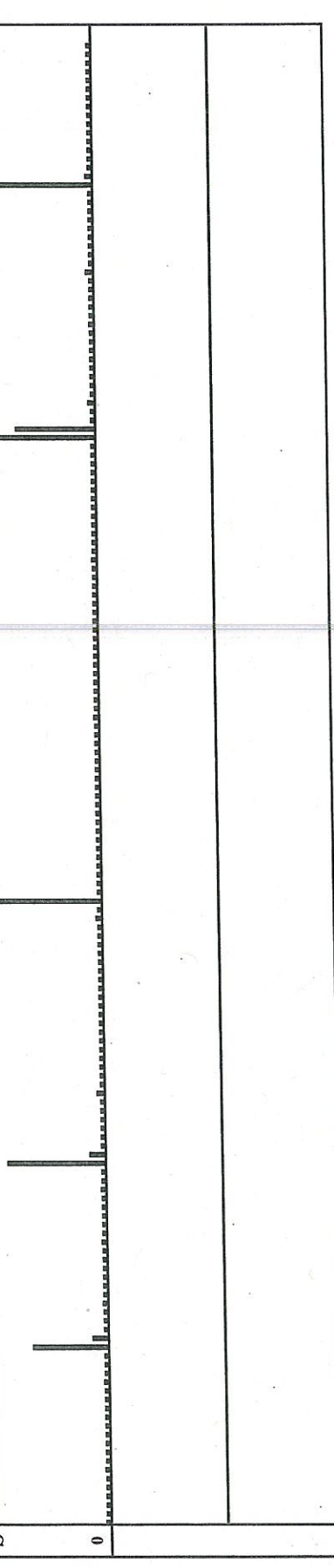
Channel	Radial	Transverse	Vertical
Velocity (mm/s)	10.795	4.191	8.827
Frequency (Hz)	113.80	93.10	78.80
Time	13:48:22	13:48:22	13:48:21
Displacement (mm)	0.0151	0.0072	0.0178
Acceleration (g's)	0.786	0.250	0.445

Vector Sum: 13.09 mm/s

**BarGraph**

Seismic Scale: 16.26 mm/s/div. Bar Samples total/shown: 3227/169

Summary Interval (min): 5 Bar Interval (sec): 1



WATERCARE  
 MOTIONS RD  
 GEOTECHNICS  
 LOC1 - 1m From Tramline  
 Graph: 10086  
 BarGraph Job # 23  
 Start: 14-Jul-11 @ 13:25:39  
 End: 14-Jul-11 @ 14:19:27  
 Summary Interval: 11  
 Air: 102 dB @ 3.0 Hz  
 Radial: 10.795 (mm/s) @ 113.8 Hz @ 13:48:22  
 Transverse: 4.191 (mm/s) @ 93.1 Hz @ 13:48:22  
 Vertical: 8.8265 (mm/s) @ 78.8 Hz @ 13:48:21  
 Vector Sum: 13.09 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00.90 hr  
 Battery Level: 6.31

summary interval	Start Time	Air dB	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	13:25	101	101	3 13:27:24	0.3175	0.3175	0 13:27:34	0.254	0.254	0 13:27:34	0.3175	0.3175	2.6 13:25:41	0.4937	0.013
2	13:30	101	341.3	13:31:35	5.207	68.3	13:32:17	2.032	93.1	13:32:17	4.699	68.3	13:32:17	0.3082	5.783
3	13:35	99	341.3	13:35:43	6.7945	1.9	13:38:55	1.9685	0	13:38:55	2.159	3.7	13:38:55	14.4563	0.21
4	13:40	101	341.3	13:43:18	0.508	0.1	13:41:13	0.254	0	13:41:13	0.254	1.4	13:44:30	20.5361	0.001
5	13:45	99	341.3	13:47:20	10.795	113.8	13:48:22	4.191	93.1	13:48:22	8.8265	78.8	13:48:21	0.3835	19.976
6	13:50	102	341.3	13:55:03	0.3175	0.1	13:54:50	0.254	0	13:53:00	0.254	2.9	13:55:15	12.8351	0.001
7	13:55	99	341.3	13:56:29	0.254	0	13:57:47	0.254	0	13:55:52	0.254	2.6	13:56:07	0.3949	0.011
8	14:00	99	341.3	14:00:50	8.001	113.8	14:05:14	4.1275	93.1	14:05:14	6.9215	78.8	14:05:14	0.2842	14.806
9	14:05	102	3	14:06:41	0.4445	0	14:06:11	0.3175	0.5	14:06:12	0.3175	7.3	14:06:12	0	0
10	14:10	99	341.3	14:10:53	9.017	113.8	14:14:22	3.81	113.8	14:14:22	7.3025	93.1	14:14:23	0.3203	16.686
11	14:15	99	341.3	14:17:52	0.254	0	14:19:20	0.254	0	14:15:45	0.254	2.9	14:17:12	0.3541	0.012

end of data

**Company: WATERCARE**

Unit #: 10046

14-Jul-11 at 13:25:39 Event # 718

**Location: MOTIONS RD**

Operator: GEOTECHNICS

Notes: LOC2 - 10m From Tramline

End Time: 14:19:44  
 Sample Rate: 1024/sec

Distance-Source: N

**Seismic**

Gain: 2

Vector Sum: .53 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.413	0.349	0.365
Frequency (Hz)	41.00	8.20	37.90
Time	14:05:12	14:14:24	14:14:21
Displacement (mm)	0.0016	0.0068	0.0015
Acceleration (g/s)	0.011	0.002	0.009

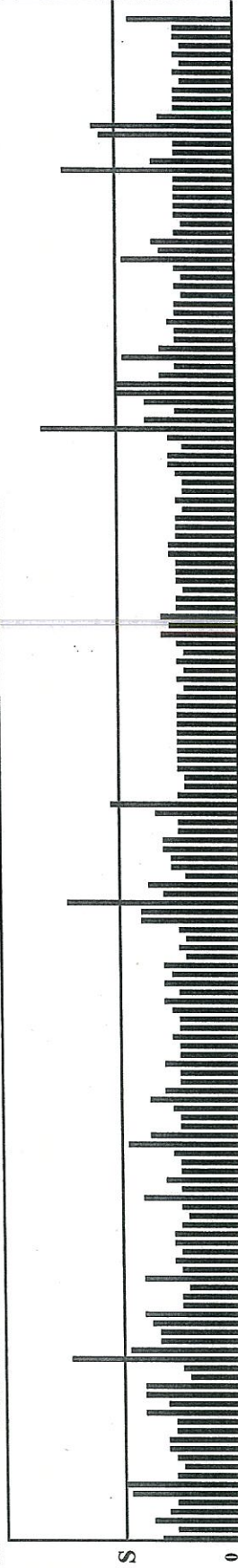
**BarGraph**

Seismic Scale: 0.51 mm/s/div.

Bar Samples total/shown: 3244/170

Summary Interval (min): 5

Bar Interval (sec): 1



WATERCARE  
 MOTIONS RD  
 GEOTECHNICS  
 LOC2 - 10m From Tramline  
 Graph: 10046  
 BarGraph Job # 718  
 Start: 14-Jul-11 @ 13:25:39  
 End: 14-Jul-11 @ 14:19:44  
 Summary Interval: 11  
 Air: 102 dB @ 78.8 Hz  
 Radial: 0.41275 (mm/s) @ 41.0 Hz @ 14:05:12  
 Transverse: 0.34925 (mm/s) @ 8.2 Hz @ 14:14:24  
 Vertical: 0.365125 (mm/s) @ 37.9 Hz @ 14:14:21  
 Vector Sum: .53 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00.90 hr  
 Battery Level: 6.32

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	13:25	100	341.3	13:26:55	0.238125	5.9	13:27:34	0.254	4.2	13:27:35	0.127	13	13:27:33	0.2445	0.017
2	13:30	101	341.3	13:31:32	0.301625	37.9	13:32:15	0.28575	33	13:32:17	0.365125	41	13:32:17	0.036	0.243
3	13:35	102	341.3	13:37:39	0.1905	12	13:39:50	0.238125	4.9	13:39:50	0.111125	10.8	13:37:51	0.1965	0.019
4	13:40	100	146.3	13:42:42	0.1905	20.1	13:41:13	0.174625	8.2	13:41:27	0.142875	35.3	13:41:13	0.0383	0.062
5	13:45	101	341.3	13:46:13	0.365125	41	13:48:21	0.301625	4.4	13:48:21	0.3175	41	13:48:22	0.036	0.243
6	13:50	102	78.8	13:51:55	0.15875	11	13:51:49	0.269875	9.6	13:51:49	0.127	14	13:51:49	0.1136	0.042
7	13:55	100	341.3	13:55:54	0.111125	10.1	13:58:09	0.15875	3.6	13:57:50	0.111125	15.8	13:57:46	0.1783	0.009
8	14:00	100	341.3	14:01:44	0.41275	41	14:05:12	0.3175	37.9	14:05:12	0.34925	44.5	14:05:13	0.0407	0.275
9	14:05	102	341.3	14:07:53	0.238125	13.7	14:07:41	0.254	3.9	14:06:17	0.22225	48.8	14:07:41	0.2633	0.016
10	14:10	102	341.3	14:12:19	0.28575	35.3	14:14:23	0.34925	8.2	14:14:24	0.365125	37.9	14:14:21	0.0389	0.225
11	14:15	101	341.3	14:18:15	0.28575	9.4	14:15:57	0.301625	3.8	14:15:56	0.1905	48.8	14:19:36	0.3209	0.019

end of data

Motions Rd Tram Monitoring and Site Attenuation Analysis

Setup 1

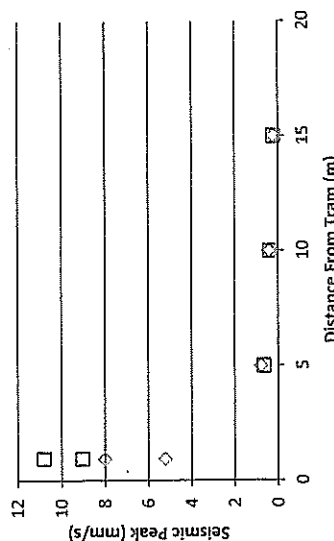
1m		10m		15m			
Bar	Time	Seismic Peak (mm/s)	Vector Sum (mm/s)	Bar	Time	Seismic Peak (mm/s)	Vector Sum (mm/s)
	13:32:16	5.207	6.6675		13:32:16	0.36513	0.39688
	13:48:21	10.795	12.446		13:48:20	0.36513	0.41275
	14:05:13	8.001	10.3505		14:05:11	0.41275	0.52388
	14:14:22	9.017	10.9855		14:14:21	0.36513	0.36513

Setup 2

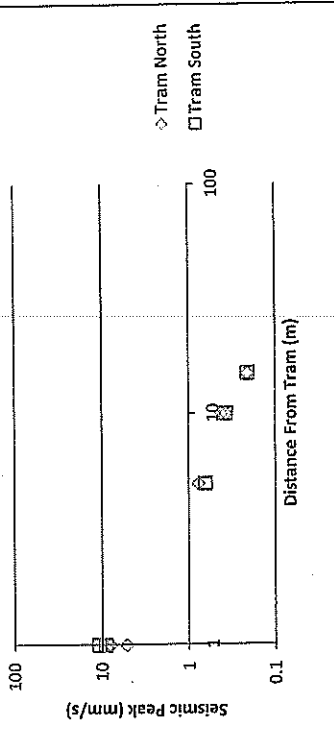
5m		15m					
Bar	Time	Seismic Peak (mm/s)	Vector Sum (mm/s)	Bar	Time	Seismic Peak (mm/s)	Vector Sum (mm/s)
	14:35:49	0.762	0.8255		14:35:49	0.20638	0.23813
	14:44:14	0.635	0.762		14:44:14	0.20638	0.254

Distance	Tram North Seismic Peak (mm/s)	Tram South Seismic Peak (mm/s)
1	5.207	10.795
1	8.001	9.017
5	0.762	0.635
10	0.36513	0.36513
10	0.41275	0.36513
15	0.20638	0.20638

Motions road



Motions road - Log-log scale



## D2 Walmsley Park

**Legend**

- MAIN TUNNEL
- LINK SEWER
- CSO COLLECTOR
- CONNECTION PIPELINE
- VENTILATION DUCTS
- EXISTING RETICULATION SEWER
- EXISTING TRUNK SEWER
- EXISTING STORMWATER
- PROPOSED DESIGNATION BOUNDARY
- LIU/STRUCTURE FLUSH WITH GROUND
- LIU/STRUCTURE ABOVE GROUND
- PROPOSED NOISE BARRIER



DATE 23-May-12  
 ORIGINAL SCALE AT  
 1:1000 A3  
 CONTRACT No.  
 0538  
 DRAWING No.  
 AEE-MAIN-5.2  
 ISSUE  
 4

**DRAFT**

CENTRAL INTERCEPTOR  
 GENERAL  
 WALMSLEY PARK (ASA) - CONSTRUCTION WORKS PLAN

**waterCare**  
 services limited

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SITE LAYOUT AND DESIGNS INDICATIVE ONLY AND SUBJECT TO CHANGE DURING DETAILED DESIGN DEVELOPMENT

AEE JUNE 2012

DESIGNED	DRAWN	CHECKED	DATE	BY	DATE
AP	AP	AP	30/05/12	AP	30/05/12
AP	AP	AP	14/06/12	AP	14/06/12
AP	AP	AP	11/07/12	AP	11/07/12
AP	AP	AP	27/07/11	AP	27/07/11





## Background Vibration Monitoring - Sonde Locations



Walmsley Park (AS4) - 14/07/11

Vibration Monitoring - Site Observations

Geotechnics Ltd

Date: 14/07/11		Site: Walmsley Park (AS4)				Tech: CDR		
Sonde Location 1: 0.5m From Kerb		Notes:						
Sonde Serial #/Event #: 10086 / 18.NSZ		Road condition smooth, slight trench in road. Traffic moving fast.						
Sonde Location 2: 10m From Kerb		Sondes pinned in grass - saturated. Beside zebra crossing.						
Sonde Serial #/Event #: 10046 / 716.NSZ		<i>Cars / Vans : Table shows total No. of vehicles passing in each minute</i>						
Time:	Car Near ↑	Car Far ↓	Van Near ↑	Van Far ↓	Truck Near ↑	Truck Far ↓	Bus Near ↑	Bus Far ↓
10:50	3	14	2	2				
10:51	5	8	2	4				
10:52	4	6		4				
10:52:16					1			
10:53	15	9	2	3				
10:53:43						1		
10:54	8	3	1	1				
10:54:34					1			
10:55	13	12	1	1				
10:55:03						1		
10:55:16						1		
10:55:59					1			
10:56	4	4	4					
10:56:45						1		
10:56:51						1		
10:57	8	11	4	2				
10:57:15								1
10:57:43						1		
10:57:54					1			
10:58	6	10						
10:58:17							1	
10:59	9	3	4	1				
11:00	3	7		1				
11:00:23						1		
11:00:33						1		
11:00:42						1		
11:01	19	7						
11:02	3	9		2				
11:03	13	4	2	1				
11:03:43							1	
11:04	2	10		1				
11:04:14						1		
11:05	10	5		1				
11:05:19					1			
11:05:42						1		
11:05:57								1
11:06	3	6		2				
11:06:00					1			
11:07	13	11		1				
11:07:39						1		
11:07:57							1	
11:08	4	4						
11:09	14	6		1				
11:09:27						1		
11:10	4	5		2				
11:10:57					1			
11:11	9	1	2					
11:11:05					1			
11:12	5	15		1				
11:12:11							1	
11:12:49						1		
11:12:53					1			
11:13	13	6		1				
11:14	3	1	3	1				
11:15	12	8		2				
11:16	5	3	1	1				
11:16:16	Pedestrian							
11:16:31	Pedestrian							
11:16:39					1			
11:17	15	4		3				
11:17:24								1
11:17:53						1		
11:18	8	4	3					

Vibration Monitoring - Site Observations

Geotechnics Ltd

Date: 14/07/11		Site: Walmsley Park (AS4)						Tech: CDR		
Sonde Location 1: 0.5m From Kerb		Notes: Road condition smooth, slight trench in road. Traffic moving fast. Sondes pinned in grass - saturated. Beside zebra crossing. Cars / Vans : Table shows total No. of vehicles passing in each minute								
Sonde Serial #/Event #: 10086 / 18.NSZ										
Sonde Location 2: 10m From Kerb										
Sonde Serial #/Event #: 10046 / 716.NSZ										
Time:	Car Near ↑	Car Far ↓	Van Near ↑	Van Far ↓	Truck Near ↑	Truck Far ↓	Bus Near ↑	Bus Far ↓		
11:19	3	15	1							
11:19:03						1				
11:19:09						1				
11:20	7	3	1	1						
11:20:53					1					
11:21	4	5	1							
11:22	18	9	3	1						
11:23	10	5								
11:24	14	7	1	3						
11:24:32								1		
11:24:45						1				
11:25	11	7								

**Company: WATERCARE**

**Unit #: 10086**

**14-Jul-11 at 10:50:39 Event # 18**

**Location: WALMSLEY PARK (AS4)**

**Operator: GEOTECHNICS**

**Notes: LOCI - 0.5m From Kerbside**

**End Time: 11:27:56**  
**Sample Rate: 1024/sec**

**Distance-Source: N**

**Seismic**

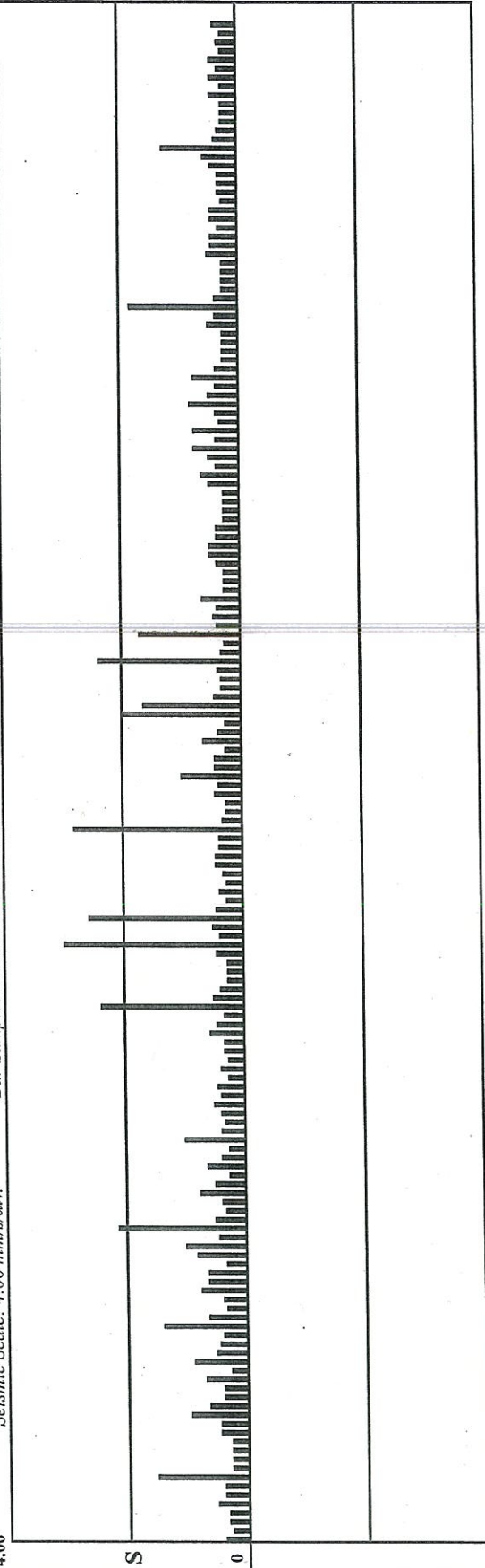
Gain: 2

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	3.048	1.143	2.858
Frequency (Hz)	11.00	0.00	6.60
Time	11:05:22	11:05:22	11:08:00
Displacement (mm)	0.0441	0	0.0689
Acceleration (g's)	0.021	0.000	0.012

Vector Sum: 3.93 mm/s

**BarGraph**

Seismic Scale: 4.06 mm/s/div. Bar Samples total/shown: 2236/172 Summary Interval (min):.5 Bar Interval (sec): 1



11:27

10:50

← 00.02 →

WATERCARE  
 WALMSLEY PARK (AS4)  
 GEOTECHNICS  
 LOC1 - 0.5m From Kerbside  
 Graph: 10086  
 BarGraph Job # 18  
 Start: 14-Jul-11 @ 10:50:39  
 End: 14-Jul-11 @ 11:27:56  
 Summary Interval: 8  
 Air: 102 dB @ 341.3 Hz  
 Radial: 3.048 (mm/s) @ 11.0 Hz @ 11:05:22  
 Transverse: 1.143 (mm/s) @ 0.0 Hz @ 11:05:22  
 Vertical: 2.8575 (mm/s) @ 6.6 Hz @ 11:08:00  
 Vector Sum: 3.93 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00.62 hr  
 Battery Level: 6.37

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	10:50	101	341.3	10:50:49	1.524	8.1	10:52:18	0.5715	8.1	10:52:18	1.3335	9.2	10:52:18	0.7606	0.201
2	10:55	101	341.3	10:56:42	1.7145	9.6	10:58:21	0.5715	0	10:56:01	2.159	9.9	10:58:21	0.8816	0.348
3	11:00	101	341.3	11:01:11	3.048	11	11:05:22	1.143	0	11:05:22	2.667	9.2	11:05:22	1.1201	0.545
4	11:05	102	341.3	11:08:20	2.3495	10.6	11:08:00	0.889	6.7	11:08:00	2.8575	6.6	11:08:00	1.7502	0.307
5	11:10	102	341.3	11:11:17	2.2225	0	11:12:13	0.8255	8.8	11:11:07	2.413	8.2	11:12:13	1.1896	0.322
6	11:15	99	341.3	11:18:03	0.8255	10.3	11:18:29	0.4445	3.4	11:20:21	0.762	6.7	11:19:11	0.324	0.138
7	11:20	100	1024	11:20:54	1.8415	11.3	11:20:54	0.6985	0	11:20:54	1.524	9.8	11:20:54	0.6588	0.338
8	11:25	99	341.3	11:26:51	0.4445	1.6	11:26:59	0.4445	3.8	11:26:58	0.4445	7.9	11:26:32	0.2275	0.057

end of data

**Company: WATERCARE**  
**Unit #: 10046**  
**14-Jul-11 at 10:50:39 Event # 716**

**Location: WALMSLEY PARK (AS4)**  
**Operator: GEOTECHNICS**

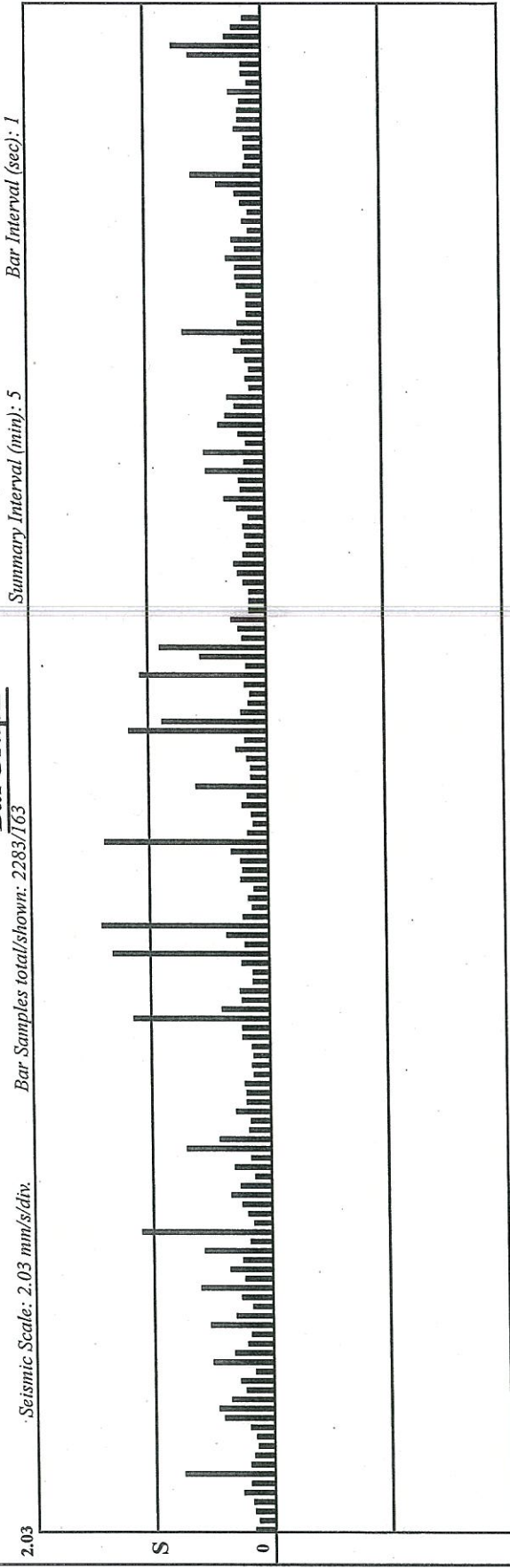
**Notes: LOC2 - 10m From Kerbside**  
**Distance-Source: N**  
**End Time: 11:28:43**  
**Sample Rate: 1024/sec**

**Seismic**

Gain: 2  
 Vector Sum: 1.44 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	1.016	0.730	1.429
Frequency (Hz)	8.90	3.60	10.30
Time	11:05:19	11:10:56	11:05:58
Displacement (mm)	0.0182	0.0323	0.0221
Acceleration (g's)	0.006	0.002	0.009

**BarGraph**



WATERCARE

WALMSLEY PARK (AS4)

GEOTECHNICS

LOC2 - 10mFrom Kerbline

Graph: 10046

BarGraph Job # 716

Start: 14-Jul-11 @ 10:50:39

End: 14-Jul-11 @ 11:28:43

Summary Interval: 8

Air: 102 dB @ 341.3 Hz

Radial: 1.016 (mm/s) @ 8.9 Hz @ 11:05:19

Transverse: 0.73025 (mm/s) @ 3.6 Hz @ 11:10:56

Vertical: 1.42875 (mm/s) @ 10.3 Hz @ 11:05:58

Vector Sum: 1.44 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00:63 hr

Battery Level: 6.4

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	10:50	100	341.3	10:51:51	0.508	10.1	10:55:05	0.301625	7.1	10:52:15	0.762	9.4	10:52:15	0.3277	0.116
2	10:55	100	341.3	10:56:14	0.682625	9.4	11:00:23	0.365125	4.2	11:00:34	1.1125	9.8	10:58:18	0.4584	0.177
3	11:00	100	341.3	11:02:11	1.016	8.9	11:05:19	0.428625	9.6	11:05:20	1.3335	9.4	11:05:19	0.5735	0.204
4	11:05	101	146.3	11:09:27	0.936625	8.6	11:07:57	0.53975	9.4	11:07:57	1.42875	10.3	11:05:58	0.5608	0.239
5	11:10	100	341.3	11:10:52	0.873125	4.1	11:10:56	0.73025	3.6	11:10:56	1.17475	4.3	11:10:57	1.1044	0.082
6	11:15	102	341.3	11:18:38	0.508	8.9	11:17:52	0.3175	7.4	11:17:54	0.508	8.5	11:17:51	0.2416	0.07
7	11:20	100	68.3	11:23:52	0.460375	9.1	11:24:45	0.4445	9.6	11:20:51	0.682625	9.6	11:20:51	0.2875	0.107
8	11:25	100	341.3	11:26:43	0.619125	6	11:27:58	0.333375	7.9	11:27:58	0.762	8.5	11:28:04	0.3624	0.105

end of data

## D3 Kiwi Esplanade





## Background Vibration Monitoring - Sonde Locations

---



Kiwi Esplanade (AS6) - 13/07/11



# SuperGraphics - Report

Telephone: (205)592-2488 x 23

**Company: WATERCARE**

Unit #: 10086

13-Jul-11 at 09:35:39 Event # 12

**Location: KIWI ESPLANADE (AS6)**

Operator: GEOTECHNICS

Notes: LOC1 - 1m From Kerbline

End Time: 10:10:39  
 Sample Rate: 1024/sec

Distance-Source: N

## Seismic

Gain: 2

Vector Sum: .50 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.318	0.381	0.254
Frequency (Hz)	0.00	0.00	1.40
Time	09:57:39	09:52:56	09:35:43
Displacement (mm)	0	0	0.0289
Acceleration (g's)	0.000	0.000	0.000

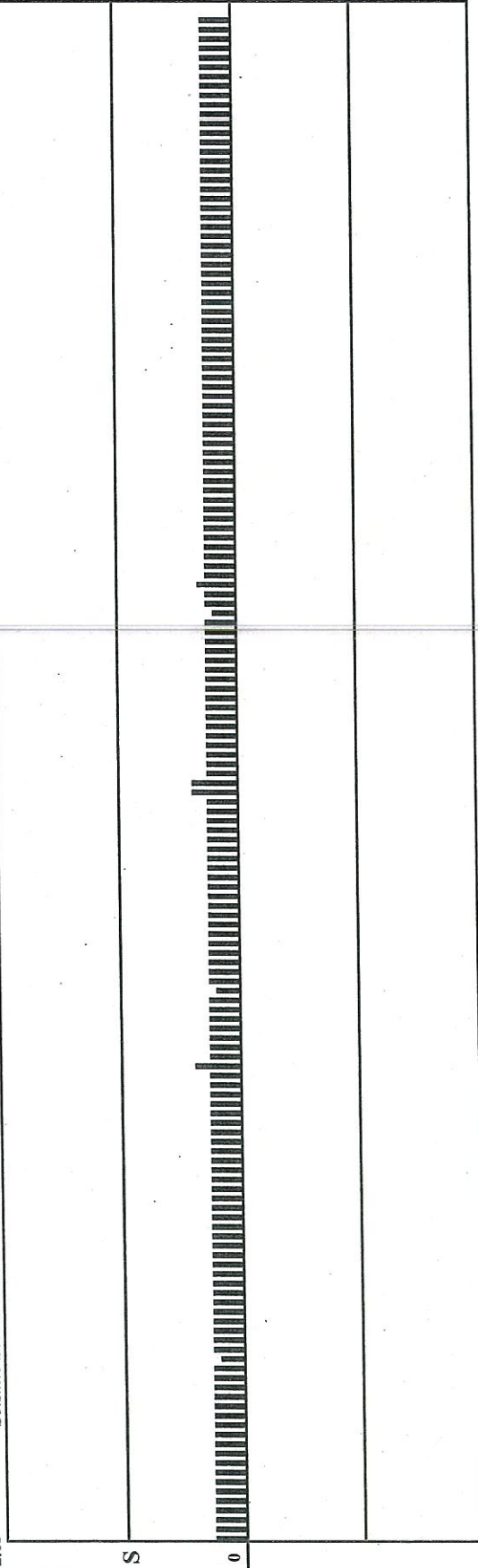
## BarGraph

2.03 Seismic Scale: 2.03 mm/s/div

Bar Samples total/shown: 2100/161

Summary Interval (min): 5

Bar Interval (sec): 1



09:35

←----- 00.58 ----->

10:10

WATERCARE

KIWI ESPLANADE (AS6)

GEOTECHNICS

LOC1 - 1m From Kerbline

Graph: 10086

BarGraph Job # 12

Start: 13-Jul-11 @ 09:35:39

End: 13-Jul-11 @ 10:10:39

Summary Interval: 8

Air: 102 dB @ 341.3 Hz

Radial: 0.3175 (mm/s) @ 0.0 Hz @ 09:57:39

Transverse: 0.381 (mm/s) @ 0.0 Hz @ 09:52:56

Vertical: 0.254 (mm/s) @ 1.4 Hz @ 09:35:43

Vector Sum: .50 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.58 hr

Battery Level: 6.32

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	09:35	102	341.3	09:38:35	0.254	0.254	0 09:37:37	0.254	0.254	0.1 09:39:45	0.254	1.4	09:35:43	0.7334	0.006
2	09:40	100	341.3	09:41:41	0.254	0.254	0 09:43:43	0.254	0.254	0 09:42:22	0.254	2.6	09:41:25	0.3949	0.011
3	09:45	102	1024	09:47:32	0.254	0.254	0 09:47:47	0.381	0.381	3.6 09:46:36	0.254	3	09:48:02	0.4278	0.022
4	09:50	99	341.3	09:51:32	0.3175	0.3175	0.2 09:53:09	0.381	0.381	0 09:52:56	0.254	2.9	09:52:06	0	0
5	09:55	100	341.3	09:56:18	0.3175	0.3175	0 09:57:39	0.254	0.254	0 09:58:05	0.254	3	09:59:37	0	0
6	10:00	101	341.3	10:04:43	0.254	0.254	0 10:05:04	0.254	0.254	0 10:01:30	0.254	2.9	10:01:12	0.3541	0.012
7	10:05	100	341.3	10:06:26	0.254	0.254	0 10:09:38	0.1905	0.1905	0 10:05:39	0.254	2.9	10:08:01	0.3541	0.012
8	10:10	96	5.1	10:10:39	0.1905	0.1905	0 10:10:39	0.1905	0.1905	0 10:10:39	0.1905	341.3	10:10:39	0.0023	1.057

end of data

# SuperGraphics - Report

Telephone: (205)592-2488 x.23

Company: WATERCARE

Unit #: 10046

13-Jul-11 at 09:35:40 Event # 701

Location: KIWI ESPLANADE (AS6)

Operator: GEOTECHNICS

Notes: LOC2 - 10m From Kerbline

End Time: 10:10:08  
Sample Rate: 1024/sec

Distance-Source: N

## Seismic

Gain: 2  
Vector Sum: 48 mm/s

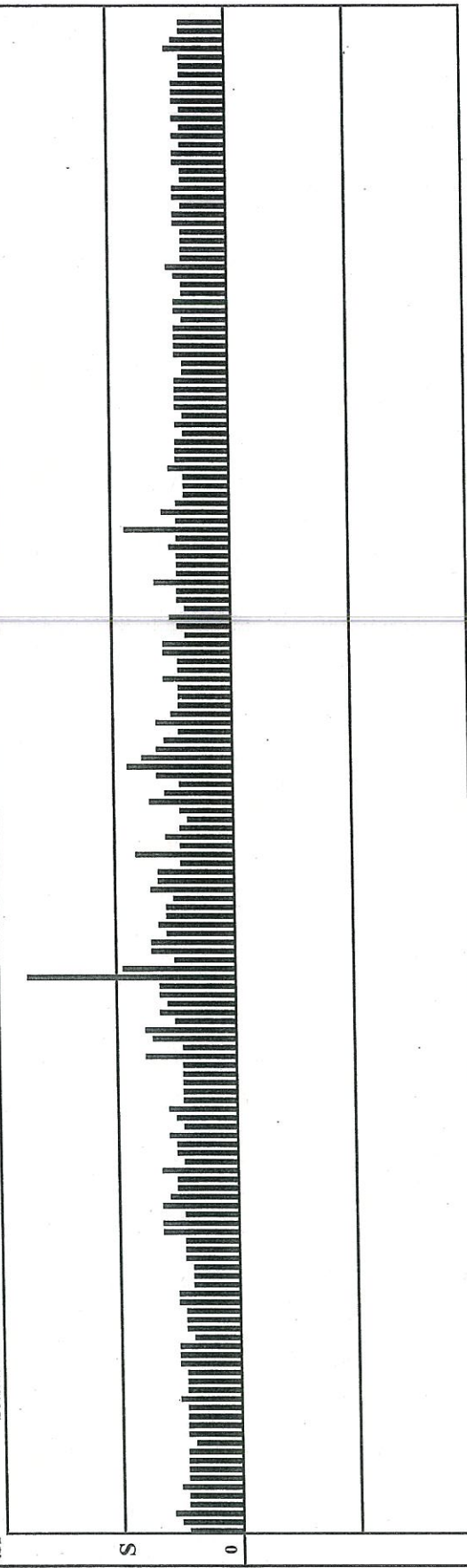
Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.365	0.445	0.254
Frequency (Hz)	15.80	6.00	10.30
Time	09:48:22	09:48:22	09:48:20
Displacement (mm)	0.0037	0.0118	0.0039
Acceleration (g's)	0.004	0.002	0.002

## BarGraph

Summary Interval (min): 5  
Bar Interval (sec): 1

Bar Samples total/shown: 2068/172

Seismic Scale: 0.51 mm/s/div.



09:35

← 00.57 →

10:10

WATERCARE

KIWI ESPLANADE (AS6)

GEOTECHNICS

LOC2 - 10m From Kerbline

Graph: 10046

BarGraph Job # 701

Start: 13-Jul-11 @ 09:35:40

End: 13-Jul-11 @ 10:10:08

Summary Interval: 7

Air: 102 dB @ 341.3 Hz

Radial: 0.365125 (mm/s) @ 15.8 Hz @ 09:48:22

Transverse: 0.4445 (mm/s) @ 6.0 Hz @ 09:48:22

Vertical: 0.254 (mm/s) @ 10.3 Hz @ 09:48:20

Vector Sum: .48 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.57 hr

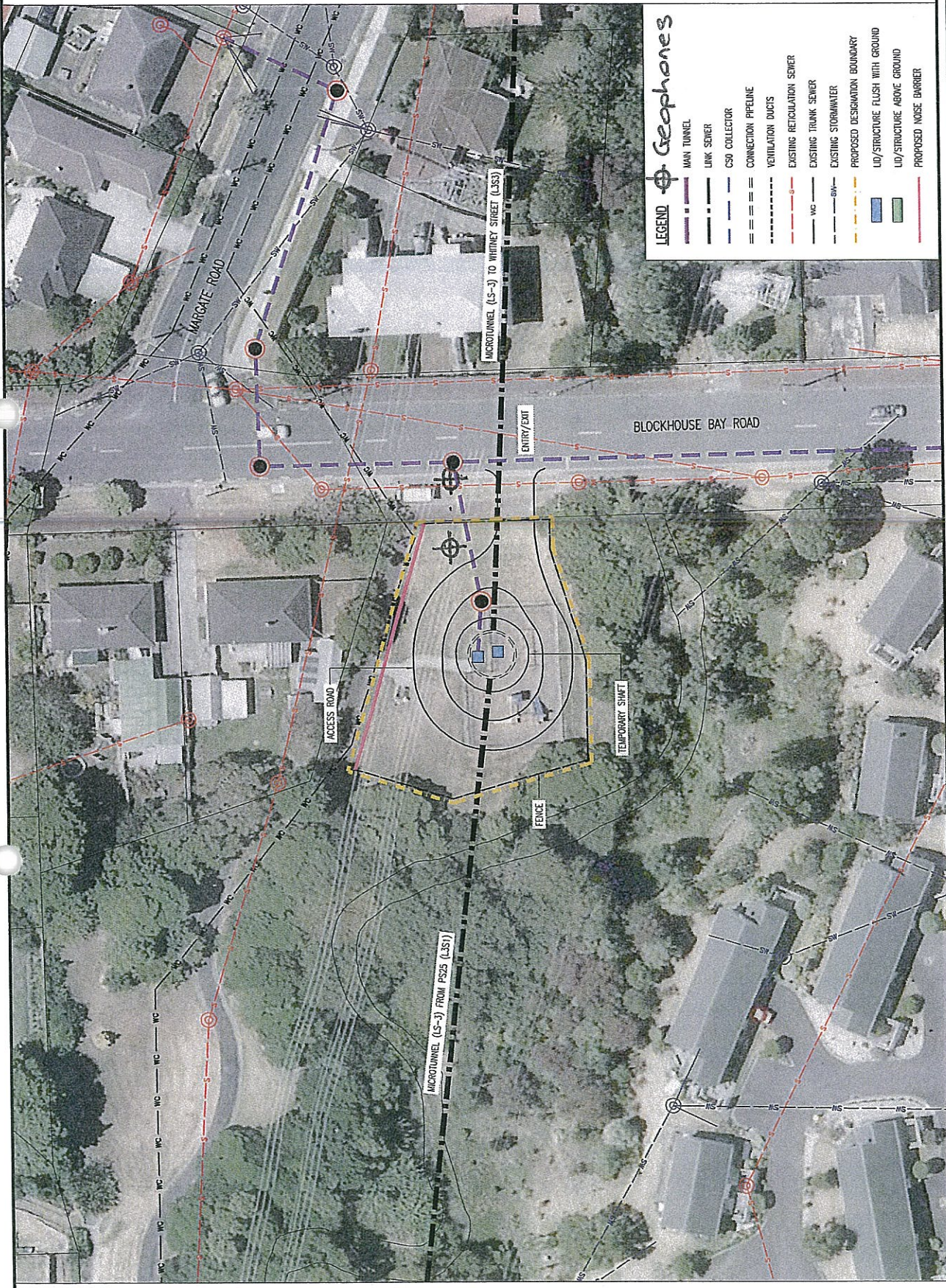
Battery Level: 6.34

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	09:35	100	341.3	09:35:40	0.111125	13	09:35:40	0.142875	13	09:35:40	0.127	16.3	09:39:44	0.1863	0.007
2	09:40	100	341.3	09:41:16	0.15875	14.8	09:43:55	0.15875	14.8	09:43:55	0.127	12.6	09:44:40	0.2468	0.007
3	09:45	100	204.8	09:50:02	0.365125	15.8	09:48:22	0.4445	15.8	09:48:22	0.254	10.3	09:48:20	0.2995	0.043
4	09:50	101	341.3	09:53:24	0.1905	10.6	09:53:15	0.22225	10.6	09:53:15	0.15875	16.8	09:53:15	0.0749	0.043
5	09:55	100	341.3	09:55:44	0.22225	12.6	09:58:34	0.174625	12.6	09:58:34	0.111125	204.8	09:57:23	0.0713	0.046
6	10:00	102	341.3	10:03:15	0.09525	25	10:01:49	0.127	25	10:01:49	0.111125	1024	10:05:29	0.0626	0.017
7	10:05	102	341.3	10:09:16	0.111125	44.5	10:06:58	0.127	44.5	10:06:58	0.111125	60.2	10:08:47	0.0295	0.036

end of data

## D4 Miranda Reserve





**Legend** Geophones

- MAN TUNNEL
- LINK SEWER
- CSO COLLECTOR
- CONNECTION PIPELINE
- VENTILATION DUCTS
- EXISTING RETICULATION SEWER
- EXISTING TRUNK SEWER
- EXISTING STORMWATER
- PROPOSED DESIGNATION BOUNDARY
- LID/STRUCTURE FLUSH WITH GROUND
- LID/STRUCTURE ABOVE GROUND
- PROPOSED NOISE BARRIER

DATE: 28-May-12	CONTRACT NO. 0538
ORIGINAL SCALE AT 1:500 A3	ISSUE 4
DRAWING NO. AEE-MAIN-16.2	

**DRAFT**

CENTRAL INTERCEPTOR  
 GENERAL  
 MIRANDA RESERVE (L3S2) - CONSTRUCTION WORKS PLAN



SITE LAYOUT AND DESIGNS INDICATIVE ONLY AND SUBJECT TO CHANGE DURING DETAILED DESIGN DEVELOPMENT

AEE JUNE 2012

ISSUE	DATE	AMENDMENT	BY	DATE	APPROD.	ASSET MANAGER
1	22/12/11	ISSUE	IP			
2	17/02/12	ISSUE	IP			
3	16/03/12	ISSUE	IP			
4	30/05/12	ISSUE	IP			

## Background Vibration Monitoring - Sonde Locations

---



Miranda Reserve (L3S2) 13/07/11



**Company: WATERCARE**

**Unit #: 10086**

**13-Jul-11 at 13:10:39 Event # 16**

**Location: MIRANDA RESERVE (L3S2)**

**Operator: GEOTECHNICS**

**Notes: LOC1 - 1m From Kerbline**

**End Time: 13:45:36**  
**Sample Rate: 1024/sec**

Distance-Source: N

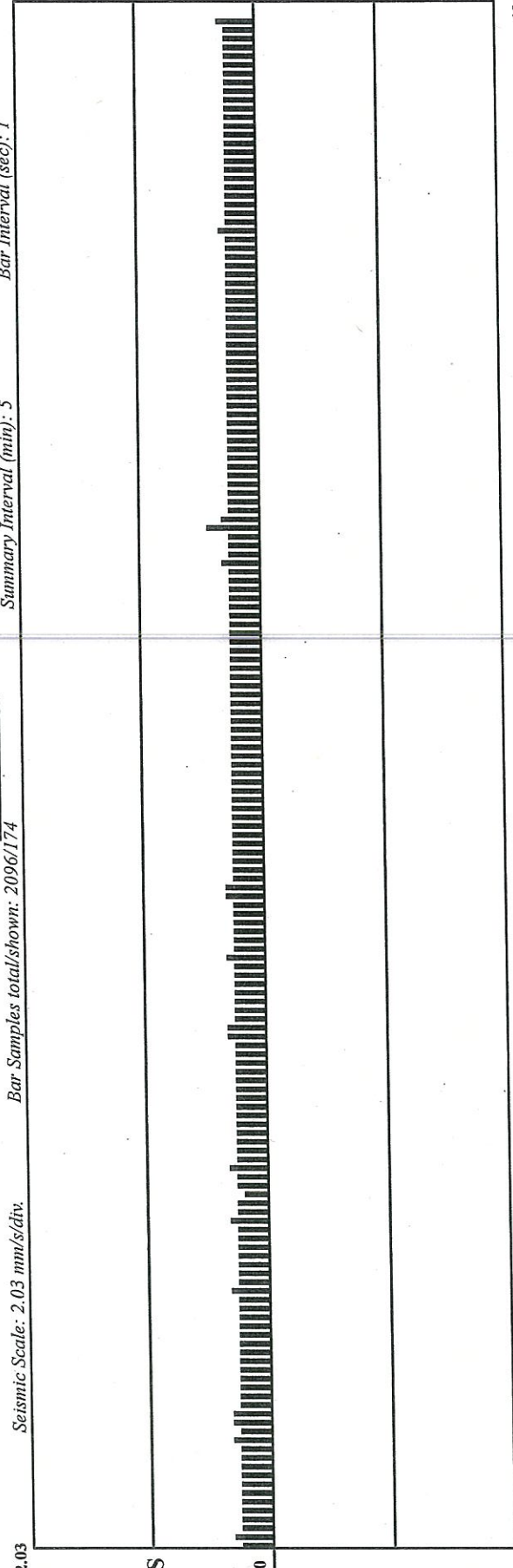
**Seismic**

Gain: 2

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.318	0.318	0.445
Frequency (Hz)	0.00	0.00	11.50
Time	13:16:31	13:45:31	13:33:56
Displacement (mm)	0	0	0.0062
Acceleration (g's)	0.000	0.000	0.003

Vector Sum: .51 mm/s

**BarGraph**



WATERCARE

MIRANDA RESERVE (L352)

GEOTECHNICS

LOC1-1m From Kerbline

Graph: 10086

BarGraph Job # 16

Start: 13-Jul-11 @ 13:10:39

End: 13-Jul-11 @ 13:45:36

Summary Interval: 7

Air: 101 dB @ 3.0 Hz

Radial: 0.3175 (mm/s) @ 0.0 Hz @ 13:16:31

Transverse: 0.3175 (mm/s) @ 0.0 Hz @ 13:45:31

Vertical: 0.4445 (mm/s) @ 11.5 Hz @ 13:33:56

Vector Sum: .51 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.58 hr

Battery Level: 6.29

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	13:10	101	101	341.3	0.3175	0.3175	0	0.3175	0.3175	13:13:08	0.254	0.254	13:10:47	0.6418	0.01
2	13:15	101	101	341.3	0.3175	0.3175	0	0.254	0.254	13:16:31	0.3175	0.3175	13:19:20	0.1565	0.042
3	13:20	100	100	341.3	0.3175	0.3175	0	0.3175	0.3175	13:20:57	0.3175	0.3175	13:22:36	0.0589	0.113
4	13:25	99	99	341.3	0.254	0.254	0	0.254	0.254	13:27:56	0.4445	0.4445	13:25:49	0.207	0.032
5	13:30	101	101	341.3	0.254	0.254	0	0.254	0.254	13:31:16	0.254	0.254	13:33:56	0.1563	0.083
6	13:35	100	100	341.3	0.254	0.254	0	0.254	0.254	13:36:39	0.254	0.254	13:37:02	0.3803	0.011
7	13:40	101	101	3	0.254	0.254	0	0.3175	0.3175	13:44:47	0.3175	0.3175	13:40:46	0.0589	0.113

end of data

# SuperGraphics - Report

Telephone: (205)592-2488 x 23

**Company: WATERCARE**

Unit #: 10046

13-Jul-11 at 13:10:39 Event # 705

**Location: MIRANDA RESERVE (L3S2)**

Operator: GEOTECHNICS

Notes: LOC2 - 10m From Kerbline

End Time: 13:46:04  
 Sample Rate: 1024/sec

Distance-Source: N

## Seismic

Gain: 2

Vector Sum: .24 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.175	0.175	0.143
Frequency (Hz)	18.60	8.50	13.30
Time	13:25:50	13:19:21	13:33:56
Displacement (mm)	0.0015	0.0033	0.0017
Acceleration (g/s)	0.002	0.001	0.001

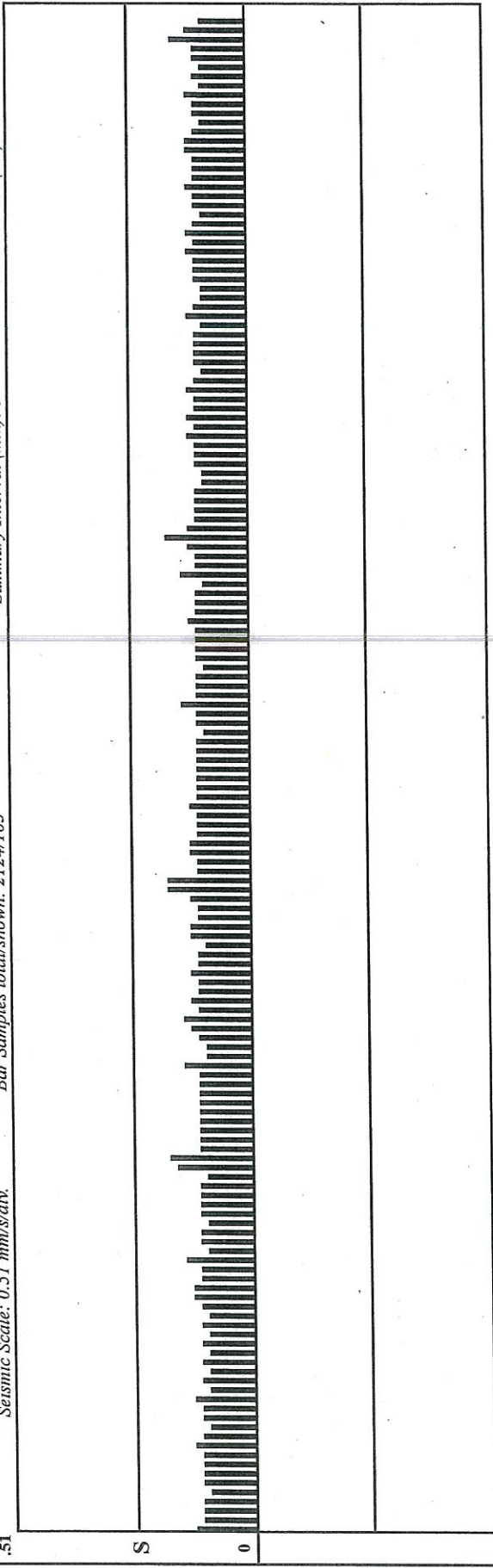
## BarGraph

Summary Interval (min): 5

Bar Samples total/shown: 2124/163

Seismic Scale: 0.51 mm/s/div.

Bar Interval (sec): 1



WATERCARE  
 MIRANDA RESERVE (L3S2)  
 GEOTECHNICS  
 LOC2-10m From Kerbline  
 Graph: 10046  
 BarGraph Job # 705  
 Start: 13-Jul-11 @ 13:10:39  
 End: 13-Jul-11 @ 13:46:04  
 Summary Interval: 8  
 Air: 101 dB @ 93.1 Hz  
 Radial: 0.174625 (mm/s) @ 18.6 Hz @ 13:25:50  
 Transverse: 0.174625 (mm/s) @ 8.5 Hz @ 13:19:21  
 Vertical: 0.142875 (mm/s) @ 13.3 Hz @ 13:33:56  
 Vector Sum: .24 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00.59 hr  
 Battery Level: 6.31

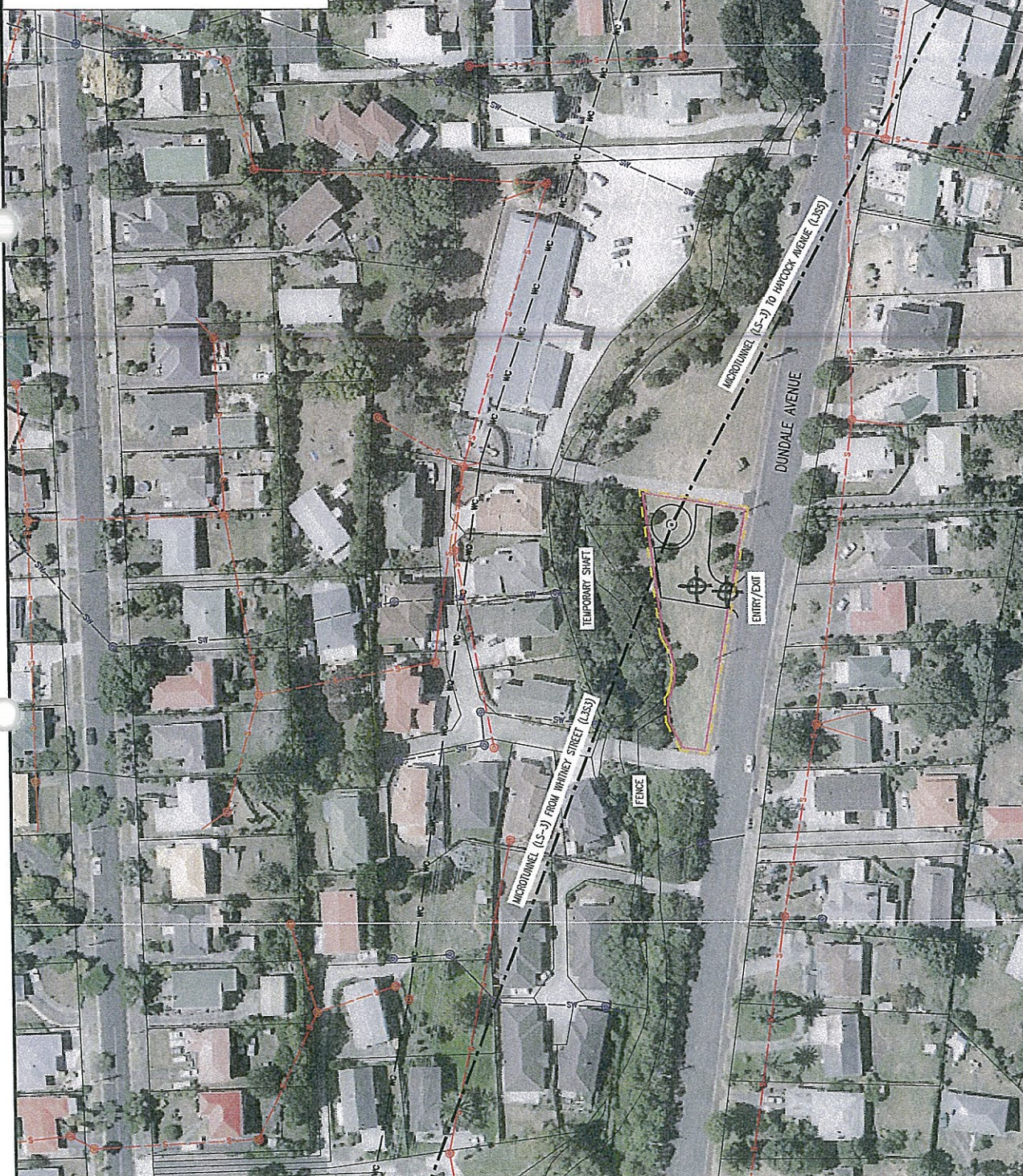
summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	13:10	101	93.1	13:10:59	0.127	11.3	13:12:38	0.127	5.2	13:12:40	0.127	20.9	13:10:41	0.0246	0.043
2	13:15	100	204.8	13:16:16	0.174625	20.9	13:19:21	0.174625	8.5	13:19:21	0.127	16.3	13:19:20	0.0831	0.024
3	13:20	100	341.3	13:20:42	0.142875	12	13:21:36	0.142875	13.3	13:22:40	0.127	20.1	13:22:40	0.0434	0.031
4	13:25	100	113.8	13:28:01	0.174625	18.6	13:25:50	0.174625	14.8	13:25:49	0.142875	16.3	13:25:50	0.0477	0.042
5	13:30	101	341.3	13:31:22	0.174625	22.8	13:33:57	0.15875	9.2	13:33:55	0.142875	13.3	13:33:56	0.031	0.065
6	13:35	101	341.3	13:36:51	0.111125	22.8	13:40:39	0.127	10.6	13:39:14	0.127	21.8	13:36:40	0.0236	0.045
7	13:40	100	113.8	13:41:04	0.15875	16.8	13:45:39	0.142875	4.7	13:45:37	0.142875	18.6	13:45:38	0.0382	0.043
8	13:45	98	341.3	13:45:52	0.127	33	13:45:46	0.127	13	13:45:41	0.127	31	13:45:46	0.0166	0.064

end of data

**D5 Dundale Ave**



- LEGEND**
- MAIN TUNNEL
  - LINK SEWER
  - CSO COLLECTOR
  - CONNECTION PIPELINE
  - VENTILATION DUCTS
  - EXISTING RETICULATION SEWER
  - EXISTING TRUNK SEWER
  - EXISTING STORMWATER
  - PROPOSED DESIGNATION BOUNDARY
  - LI/STRUCTURE FLUSH WITH GROUND
  - LI/STRUCTURE ABOVE GROUND
  - PROPOSED NOISE BARRIER



DATE 20-10-12  
 CONTRACT No. 0538  
 ORIGINAL SCALE AT 1:1000 A3  
 DRAWING No. AEE-MAIN-18.2  
 ISSUE 4

**CENTRAL INTERCEPTOR**  
**GENERAL**  
 DUNDALE AVENUE (L334) - CONSTRUCTION WORKS PLAN



SITE LAYOUT AND DESIGNS INDICATIVE ONLY AND SUBJECT TO CHANGE DURING DETAILED DESIGN DEVELOPMENT  
 AEE JUNE 2012

ISSUE	DATE	BY	APPD.	DATE	BY	APPD.
4	30/05/12	FINAL DWT AEE ISSUE				
3	16/05/12	DWT AEE ISSUE - 3				
2	17/02/12	DWT AEE ISSUE - 2				
1	22/12/11	DWT AEE ISSUE				

## Background Vibration Monitoring - Sonde Locations

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Dundale Avenue (L3S4) 13/07/11

Vibration Monitoring - Site Observations

Geotechnics Ltd

Date: 13/07/11		Site: Dundale Avenue (L3S4)					Tech: CDR				
Sonde Location 1: 2m From Kerb		Notes: Road condition smooth, slightly undulating. Traffic moving fast.									
Sonde Serial #/Event #: 10086 / 14.NSZ		Sondes pinned in grass - saturated. 21m West of Church driveway									
Sonde Location 2: 10m From Kerb		Some cars slowing to enter Blockhouse Bay Community Church									
Sonde Serial #/Event #: 10046 / 703.NSZ											
Time:	Car Near ↓	Car Far ↑	Van Near ↓	Van Far ↑	Light Truck Near ↓	Light Truck Far ↑	Truck Near ↓	Truck Far ↑	Bus Near ↓	Bus Far ↑	
11:25:00											
11:25:34										1	
11:25:46	1										
11:26:33	1										
11:26:41	1										
11:28:05		1									
11:28:38	Pedestrian										
11:29:35	Pedestrian										
11:29:36		1									
11:29:47	1										
11:30:42		1									
11:31:10	1										
11:31:46		1									
11:33:42		1									
11:33:46		1									
11:34:32		1									
11:35:20									1		
11:35:37	1										
11:35:53		1									
11:36:17	1										
11:36:27		1									
11:38:26	1										
11:38:33	1										
11:40:28		1									
11:40:51	1										
11:40:56	1										
11:42:21		1									
11:42:32				1							
11:44:18		1									
11:44:19		1									
11:45:44		1									
11:47:01	1										
11:47:22		1									
11:48:37	1										
11:50:00		1									
11:50:05										1	
11:50:14					1						
11:50:50		1									
11:51:19	1										
11:52:41	1										
11:53:05		1									
11:53:24	1										
11:53:53		1									
11:54:10	1										
11:54:20		1									
11:56:16	1										
11:56:24									1		
11:56:50									1		
11:56:58	1										
11:57:29	1										
11:58:02	1										
11:58:25		1									
11:58:38	1										
11:58:41	1										
11:59:00	1										
11:59:22				1							

# SuperGraphics - Report

Telephone: (205)592-2488 x.23

Company: WATERCARE

Unit #: 10086

13-Jul-11 at 11:25:39 Event # 14

Location: DUNDALE AVE (L3S4)

Operator: GEOTECHNICS

Notes: LOCI - 2m From Kerbline

Distance-Source: N

End Time: 12:02:07  
Sample Rate: 1024/sec

## Seismic

Gain: 2

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	1.461	0.508	1.143
Frequency (Hz)	15.80	0.00	13.00
Time	11:56:26	11:56:26	11:56:26
Displacement (mm)	0.0147	0	0.0140
Acceleration (g's)	0.015	0.000	0.010

Vector Sum: 1.55 mm/s

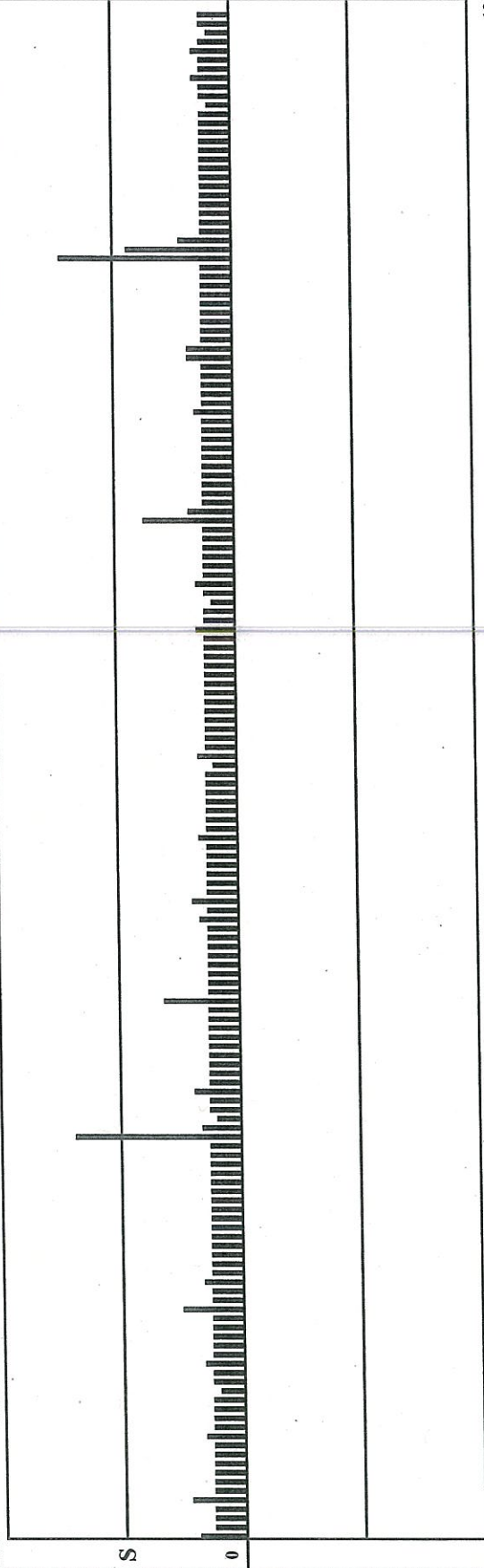
## BarGraph

Summary Interval (min): 5

Bar Samples total/shown: 2187/168

Seismic Scale: 2.03 mm/s/div.

Bar Interval (sec): 1



11:25

←----- 00.61 ----->

12:02

WATERCARE

DUNDALE AVE (L3S4)

GEOTECHNICS

LOC1 - 2m From Kerbline

Graph: 10086

BarGraph Job # 14

Start: 13-Jul-11 @ 11:25:39

End: 13-Jul-11 @ 12:02:07

Summary Interval: 8

Air: 101 dB @ 341.3 Hz

Radial: 1.4605 (mm/s) @ 15.8 Hz @ 11:56:26

Transverse: 0.508 (mm/s) @ 0.0 Hz @ 11:56:26

Vertical: 1.143 (mm/s) @ 13.0 Hz @ 11:56:26

Vector Sum: 1.55 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.61 hr

Battery Level: 6.3

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	11:25	99	341.3	11:28:23	0.4445	14.8	11:26:42	0.254	0.254	0	11:26:32	0.381	2.9	11:25:45	0.1214
2	11:30	99	341.3	11:31:20	1.397	16.8	11:35:21	0.508	0.508	14.8	11:35:21	1.0795	15.3	11:35:21	0.3362
3	11:35	101	341.3	11:40:22	0.635	14.4	11:38:27	0.254	0.254	0	11:38:26	0.635	15.8	11:38:27	0.1625
4	11:40	99	12	11:44:19	0.3175	0	11:40:51	0.254	0.254	0	11:40:52	0.381	13.7	11:40:56	0.1124
5	11:45	99	341.3	11:47:29	0.762	2.7	11:50:05	0.4445	0.4445	0.1	11:50:04	0.635	13.3	11:50:05	1.1409
6	11:50	99	1024	11:51:32	0.381	10.8	11:54:11	0.254	0.254	1.6	11:53:52	0.381	3	11:53:53	0.5134
7	11:55	101	341.3	11:57:59	1.4605	15.8	11:56:26	0.508	0.508	0	11:56:26	1.143	13	11:56:26	0.3737
8	12:00	99	341.3	12:00:43	0.254	0	12:01:10	0.1905	0.1905	0	12:00:40	0.3175	4.4	12:01:17	0.2917

end of data

# SuperGraphics - Report

Telephone: (205)592-2488 x.23

**Company: WATERCARE**  
**Unit #: 10046**  
**13-Jul-11 at 11:25:39 Event # 703**  
**Operator: GEOTECHNICS**

**Location: DUNDALE AVE (L3S4)**  
**Notes: LOC2 - 10m From Kerbline**  
 End Time: 12:02:28  
 Sample Rate: 1024/sec

Distance-Source: N

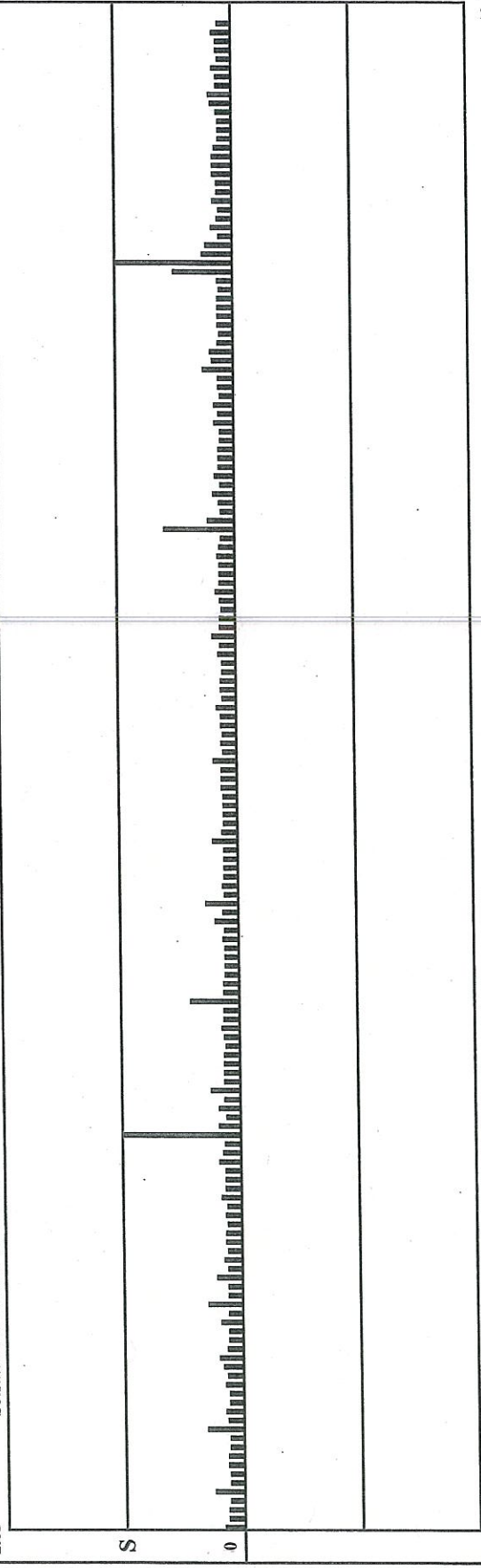
## Seismic

Gain: 2      Vector Sum: 1.03 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.445	0.365	1.016
Frequency (Hz)	16.80	8.80	16.80
Time	11:35:22	11:50:05	11:35:22
Displacement (mm)	0.0042	-0.0066	0.0096
Acceleration (g's)	0.005	0.002	0.011

## BarGraph

2.03      Seismic Scale: 2.03 mm/s/div.      Bar Samples total/shown: 2208/769      Summary Interval (min): 5      Bar Interval (sec): 1



WATERCARE  
 DUNDALE AVE (L354)  
 GEOTECHNICS  
 LOC2 - 10m From Kerbline  
 Graph: 10046  
 BarGraph Job # 703  
 Start: 13-Jul-11 @ 11:25:39  
 End: 13-Jul-11 @ 12:02:28  
 Summary Interval: 8  
 Air: 102 dB @ 341.3 Hz  
 Radial: 0.4445 (mm/s) @ 16.8 Hz @ 11:35:22  
 Transverse: 0.365125 (mm/s) @ 8.8 Hz @ 11:50:05  
 Vertical: 1.016 (mm/s) @ 16.8 Hz @ 11:35:22  
 Vector Sum: 1.03 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00.61 hr  
 Battery Level: 6.33

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	11:25	102	341.3	11:27:12	0.174625	19.3	11:26:42	0.15875	9.6	11:28:05	0.301625	15.3	11:28:05	0.0797	0.075
2	11:30	101	341.3	11:33:15	0.4445	16.8	11:35:22	0.34925	9.4	11:35:24	1.016	16.8	11:35:22	0.2445	0.278
3	11:35	101	341.3	11:35:57	0.333375	22.8	11:38:27	0.15875	1.4	11:36:17	0.41275	15.8	11:38:28	0.1056	0.106
4	11:40	101	341.3	11:43:12	0.174625	21.8	11:40:51	0.142875	8.3	11:44:19	0.269875	16.3	11:40:56	0.0669	0.072
5	11:45	100	341.3	11:45:44	0.3175	16.8	11:50:06	0.365125	8.8	11:50:05	0.60325	14.4	11:50:06	0.1694	0.141
6	11:50	100	341.3	11:51:37	0.15875	15.8	11:53:53	0.206375	12.6	11:53:50	0.254	20.1	11:53:53	0.0511	0.083
7	11:55	100	113.8	11:57:21	0.4445	16.8	11:56:26	0.34925	8.8	11:56:27	1.016	16.8	11:56:26	0.2445	0.278
8	12:00	100	341.3	12:01:46	0.111125	12	12:00:57	0.127	1.8	12:01:52	0.15875	14.4	12:02:09	0.0446	0.037

end of data

## D6 Victoria Avenue Pump Station

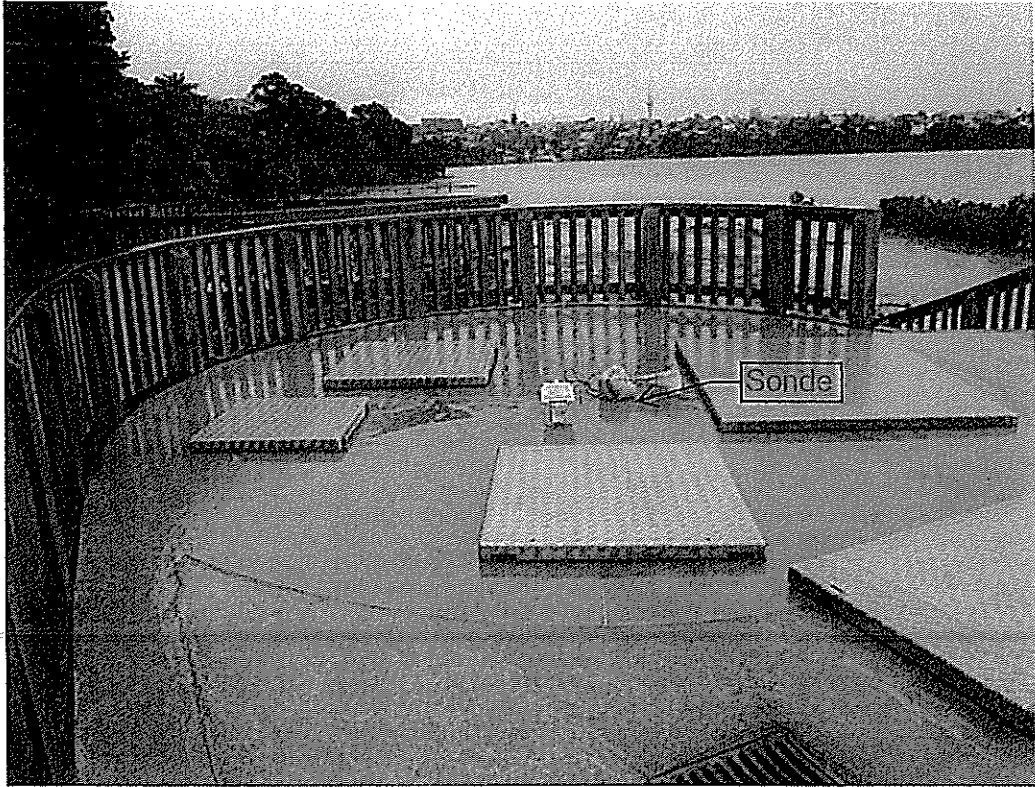


Vibration Monitoring - Site Observations

Geotechnics Ltd

Date:	14/07/11	Site:	Victoria Ave Drop Shaft	Tech:	CDR
Start Time:	16:05:19	Sonde Location :	Roof of Drop Shaft	Sonde Location 2:	---
Finish Time:	16:10:29	Sonde Serial #/Event #:	10046 / 722.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on concrete roof of shaft structure					
Following day of rain, sound of running water below. Tide out.					
<i>Bargraph mode.</i>					
Start Time:	16:11:39	Sonde Location :	Roof of Drop Shaft	Sonde Location 2:	---
Finish Time:	16:11:49	Sonde Serial #/Event #:	10046 / 723.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on concrete roof of shaft structure					
Following day of rain, sound of running water below. Tide out.					
<i>Waveform mode.</i>					
Start Time:		Sonde Location :		Sonde Location 2:	
Finish Time:		Sonde Serial #/Event #:		Sonde Serial #/Event #:	
Start Time:		Sonde Location :		Sonde Location 2:	
Finish Time:		Sonde Serial #/Event #:		Sonde Serial #/Event #:	
Start Time:		Sonde Location :		Sonde Location 2:	
Finish Time:		Sonde Serial #/Event #:		Sonde Serial #/Event #:	

## Background Vibration Monitoring - Sonde Locations



Roof of Shaft Structure - Victoria Ave Drop Shaft - 14/07/11



Victoria Ave Drop Shaft - 14/07/11

**Company: WATERCARE**

**14-Jul-11 at 16:11:39 Event # 723**

**Location: VICTORIA AVE DROP SHAFT**

**Operator: GEOTECHNICS**

**Unit #: 10046**

**Notes: Top of Drop Shaft**

**Record Duration: 10.0 sec**  
**Sample Rate: 1024/sec**

Distance: N      Wgt. Per Delay: N      Scaled Distance: 0.0

**Seismic**

Gain: 2      Trigger: .048 mm/s      Vector Sum: 0.11 mm/s @ 512.00 Hz

Channel	Radial	Transverse	Vertical
○	0.095	0.079	0.095
○	512.00	512.00	512.00
○	0.0000	0.0000	0.0000
○	0.031	0.026	0.031
○	2428.7	3454.1	4473.6
○	Trigger >>> Peak		

**Air**

Gain: 1      Trigger: N

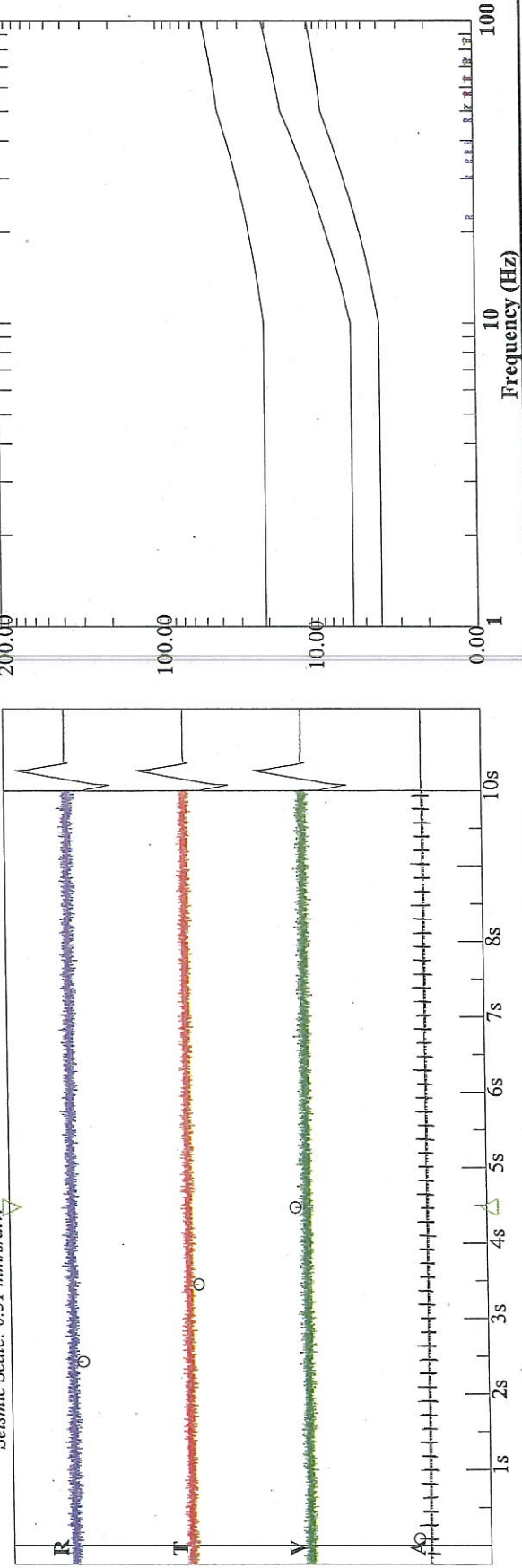
Measurement	Value	Trigger >>> Peak
kPa	.0015	86.9
dBL	98	
Hz	512	

**Waveform Analysis / Frequency Plot**

Air Scale: .00799 kPa/div.

DIN 4150-3-Table 1

Seismic Scale: 0.51 mm/s/div.



# SuperGraphics - Report

Telephone: (205)592-2488 x.23

**Company: WATERCARE**

Unit #: 10046

14-Jul-11 at 16:05:19 Event # 722

**Location: VICTORIA AVE DROP SHAFT**

Operator: GEOTECHNICS

Notes: Top of Drop Shaft

End Time: 16:10:29  
Sample Rate: 1024/sec

Distance-Source: N

## Seismic

Gain: 2

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.111	0.095	0.127
Frequency (Hz)	146.30	20.10	1024.00
Time	16:07:48	16:08:59	16:09:31
Displacement (mm)	0.0001	0.0008	0.0000
Acceleration (g's)	0.010	0.001	0.083

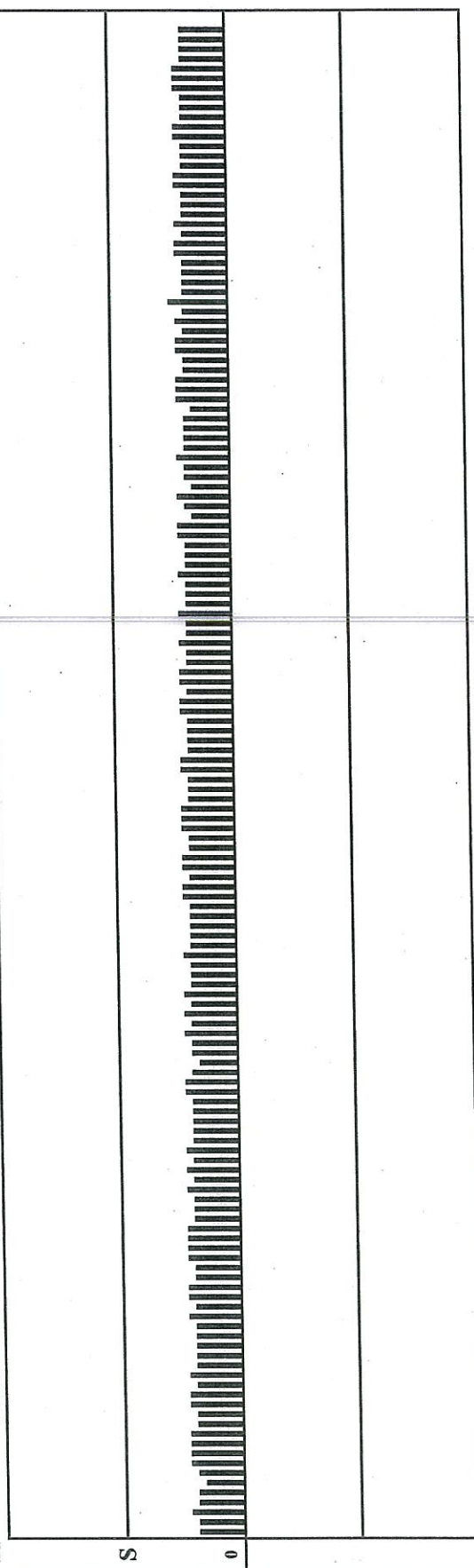
Vector Sum: .14 mm/s

## BarGraph

Summary Interval (min): 5 Bar Interval (sec): 1

Bar Samples total/shown: 310/155

Seismic Scale: 0.51 mm/s/div.



WATERCARE  
 VICTORIA AVE DROP SHAFT  
 GEOTECHNICS

Top of Drop Shaft

Graph: 10046

BarGraph Job # 722

Start: 14-Jul-11 @ 16:05:19

End: 14-Jul-11 @ 16:10:29

Summary Interval: 2

Air: 102 dB @ 341.3 Hz

Radial: 0.111125 (mm/s) @ 146.3 Hz @ 16:07:48

Transverse: 0.09525 (mm/s) @ 20.1 Hz @ 16:08:59

Vertical: 0.127 (mm/s) @ 1024.0 Hz @ 16:09:31

Vector Sum: .14 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.09 hr

Battery Level: 6.27

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	16:05	102	341.3	16:09:52	0.111125	146.3	16:07:48	0.09525	20.1	16:08:59	0.127	1024	16:09:31	0.0005	2.115
2	16:10	98	113.8	16:10:20	0.079375	22.8	16:10:23	0.079375	22.8	16:10:21	0.111125	29.3	16:10:29	0.0153	0.053

end of data

## D6 Okahu Bay Pump Station

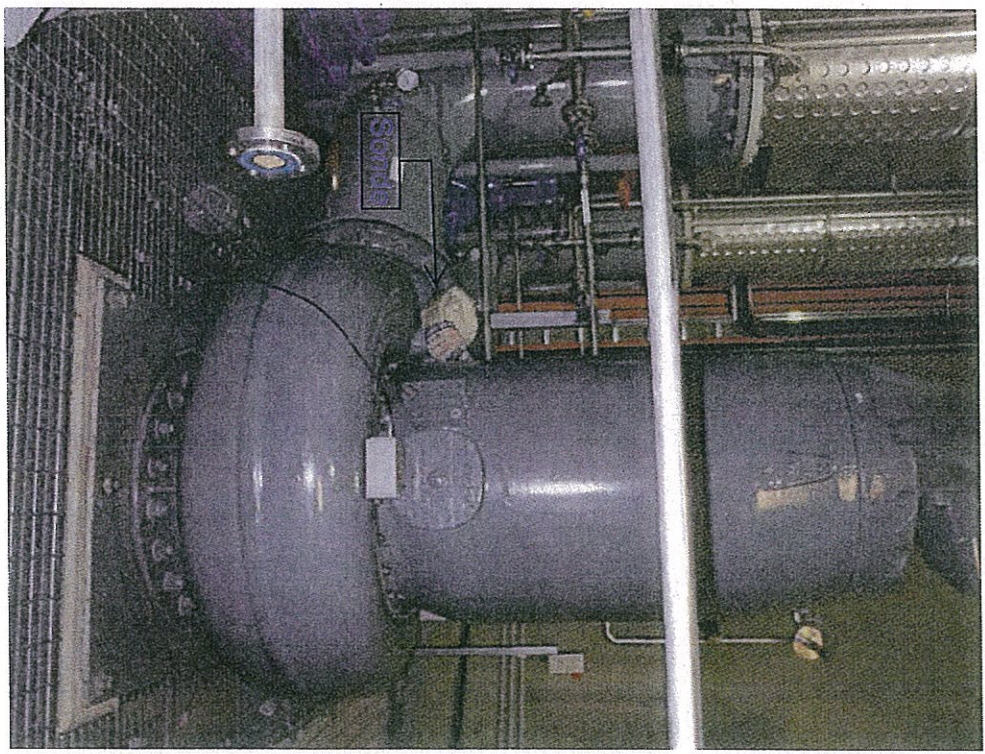
## D7 Okahu Bay Pump Station

# Background Vibration Monitoring - Sonde Locations



Below Pump #2 - Orakei Domain Pumpstation (PS64) - 14/07/11

Job No: 615613



On Pump #2 - Orakei Domain Pumpstation (PS64) - 14/07/11

Geotechnics



## Background Vibration Monitoring - Sonde Locations

---



18m From Shaft - Orakei Domain Pumpstation (PS64) - 14/07/11

Vibration Monitoring - Site Observations

Geotechnics Ltd

Date:	13/07/11	Site:	Orakei Domain Pumpstation (PS64)	Tech:	CDR
Start Time:	16:31:08	Sonde Location :	Below Pump #2	Sonde Location 2:	---
Finish Time:	16:31:34	Sonde Serial #/Event #:	10046 / 707.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on concrete floor below Pump #2.					
Pumps #2 and #6 running. Following day of rain					
<i>Bargraph mode.</i>					
Start Time:	16:37:04	Sonde Location :	On Pump #2	Sonde Location 2:	---
Finish Time:	16:37:20	Sonde Serial #/Event #:	10046 / 709.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on Pump #2.					
Pumps #2 and #6 running. Following day of rain					
<i>Bargraph mode.</i>					
Start Time:	16:38:04	Sonde Location :	On Pump #2	Sonde Location 2:	---
Finish Time:	16:38:25	Sonde Serial #/Event #:	10046 / 710.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on Pump #2.					
Pumps #2 and #6 running. Following day of rain					
<i>Waveform mode.</i>					
Start Time:	16:50:02	Sonde Location :	18m From Shaft	Sonde Location 2:	---
Finish Time:	16:50:57	Sonde Serial #/Event #:	10046 / 712.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on concrete floor 18m from shaft in ground floor machine hall.					
Pumps #2 and #6 running. Following day of rain					
<i>Bargraph mode.</i>					
Start Time:	16:53:57	Sonde Location :	18m From Shaft	Sonde Location 2:	---
Finish Time:	17:03:07	Sonde Serial #/Event #:	10046 / 713.NSZ	Sonde Serial #/Event #:	---
Sonde sandbagged on concrete floor 18m from shaft in ground floor machine hall.					
Pumps #2 and #6 running. Following day of rain					
<i>Waveform mode.</i>					

# SuperGraphics - Report

Telephone: (205)592-2488 x.23

Company: **WATERCARE**

Unit #: 10046

13-Jul-11 at 16:38:04 Event # 710

Location: **Orakei Domain (PS64)**

Operator: **GEOTECHNICS**

Notes: On Pump #2

Record Duration: 21.0 sec  
Sample Rate: 4096/sec

Distance: N      Wgt. Per Delay: N      Scaled Distance: 0.0

## Seismic

Gain: 2      Trigger: 4.35 mm/s      Vector Sum: 6.82 mm/s @ 3.59 Hz

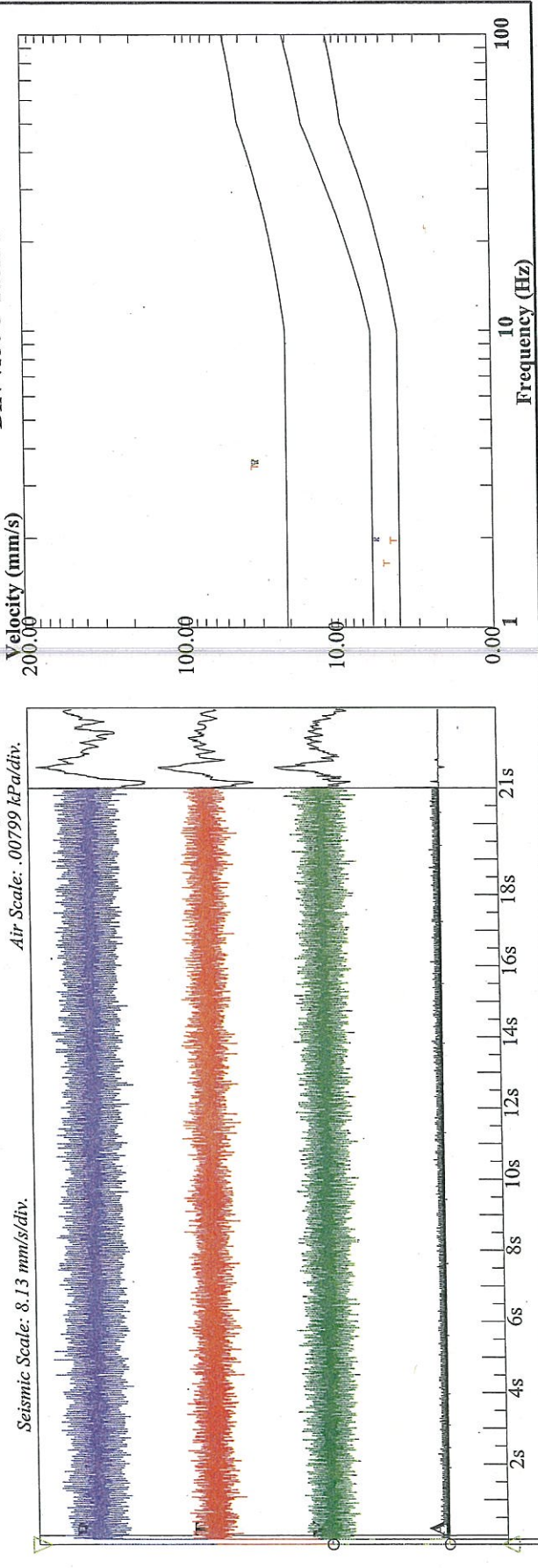
Channel	Radial	Transverse	Vertical
○ Velocity (mm/s)	5.842	4.413	5.239
Frequency (Hz)	35.90	70.60	43.50
Displacement (mm)	0.0259	0.0099	0.0192
Acceleration (g's)	0.134	0.199	0.146
Trigger >>> Peak	0	0	0

## Air

Gain: 1      Trigger: N

Measurement	Value	Trigger >>> Peak
kPa	.0015	0
dB	98	
Hz	1024	

## Waveform Analysis / Frequency Plot



# SuperGraphics - Report

Telephone: (205)592-2488 x 23

Version 3.0.8  
Expirable Date: 25Jan10

**Company: WATERCARE**

Unit #: 10046

13-Jul-11 at 16:37:04 Event # 709

**Location: Orakei Domain (PS64)**

Operator: GEOTECHNICS

Notes: On Pump #2

End Time: 16:37:20  
Sample Rate: 1024/sec

Distance-Source: N

## Seismic

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	5.175	4.413	4.620
Frequency (Hz)	44.50	53.90	53.90
Time	16:37:20	16:37:13	16:37:14
Displacement (mm)	0.0185	0.0130	0.0136
Acceleration (g's)	0.147	0.152	0.159

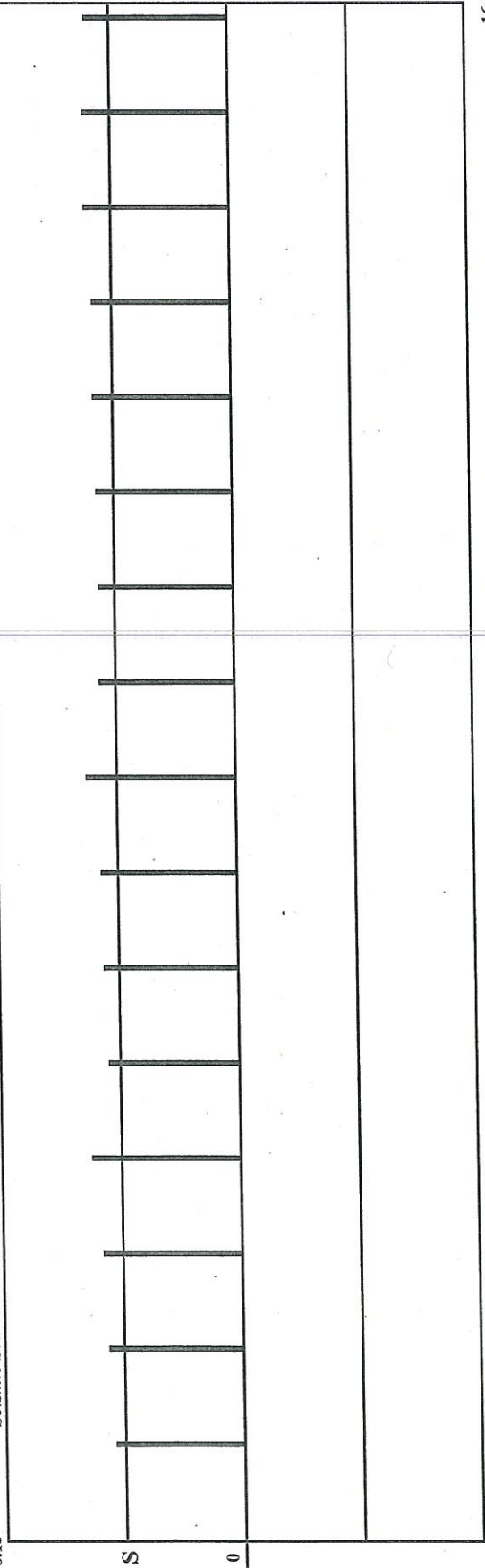
Gain: 2      Vector Sum: 5.73 mm/s

## BarGraph

Summary Interval (min): 5      Bar Interval (sec): 1

Bar Samples total/shown: 16/16

Seismic Scale: 8.13 mm/s/div.



WATERCARE

Orakel Domain (PS64)

GEOTECHNICS

On Pump #2

Graph: 10046

BarGraph Job # 709

Start: 13-Jul-11 @ 16:37:04

End: 13-Jul-11 @ 16:37:20

Summary Interval: 1

Air: 98 dB @ 113.8 Hz

Radial: 5.17525 (mm/s) @ 44.5 Hz @ 16:37:20

Transverse: 4.41325 (mm/s) @ 53.9 Hz @ 16:37:13

Vertical: 4.619625 (mm/s) @ 53.9 Hz @ 16:37:14

Vector Sum: 5.73 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.00 hr

Battery Level: 6.29

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	16:37	98	113.8	16:37:11	5.17525	44.5	16:37:20	4.41325	53.9	16:37:13	4.619625	53.9	16:37:14	0.4701	3.745

end of data

WATERCARE

Orakei Domain (PS64)

GEOTECHNICS

On Pump #2

Graph: 10046

BarGraph Job # 709

Start: 13-Jul-11 @ 16:37:04

End: 13-Jul-11 @ 16:37:20

Bar Interval (sec): 1

Count: 16

Air: 98 dB @ 113.8 Hz

Radial: 5.17525 (mm/s) @ 44.5 Hz @ 16:37:20

Transverse: 4.41325 (mm/s) @ 53.9 Hz @ 16:37:13

Vertical: 4.619625 (mm/s) @ 53.9 Hz @ 16:37:14

Vector Sum: 5.73 (mm/s)

Sample Rate:1024/sec

Record Duration: 00.00 hr

Battery Level: 6.29

Bar interval	Bar Time	Air dBL	Seismic Peak (mm/	Vector Sum (mm/s)
	1 16:37:04	98	4.36563	5.47688
	2 16:37:05	98	4.55613	5.2705
	3 16:37:06	98	4.699	5.17525
	4 16:37:07	96	5.03238	5.54038
	5 16:37:08	98	4.42913	4.699
	6 16:37:09	96	4.55613	5.54038
	7 16:37:10	98	4.60375	5.11175
	8 16:37:11	98	5.06413	5.22288
	9 16:37:12	96	4.58788	5.461
	10 16:37:13	98	4.572	5.55625
	11 16:37:14	96	4.61963	5.73088
	12 16:37:15	98	4.699	5.3975
	13 16:37:16	98	4.699	5.23875
	14 16:37:17	96	4.93713	5.31813
	15 16:37:18	98	4.96888	5.461
	16 16:37:19	98	4.87363	5.69913

end of data

# SuperGraphics - Report

Telephone: (205)592-2488 x 23

Version 3.0.8  
Executable Date: 25Jan10

**Company: WATERCARE**

**13-Jul-11 at 16:31:08 Event # 707**

Unit #: 10046

**Location: Orakei Domain (PS64)**

Operator: GEOTECHNICS

Notes: Below Pump #2

End Time: 16:31:34  
Sample Rate: 1024/sec

Distance-Source: N

## Seismic

Gain: 2

Vector Sum: .15 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.127	0.111	0.143
Frequency (Hz)	41.00	41.00	78.80
Time	16:31:21	16:31:15	16:31:15
Displacement (mm)	0.0005	0.0004	0.0003
Acceleration (g's)	0.003	0.003	0.007

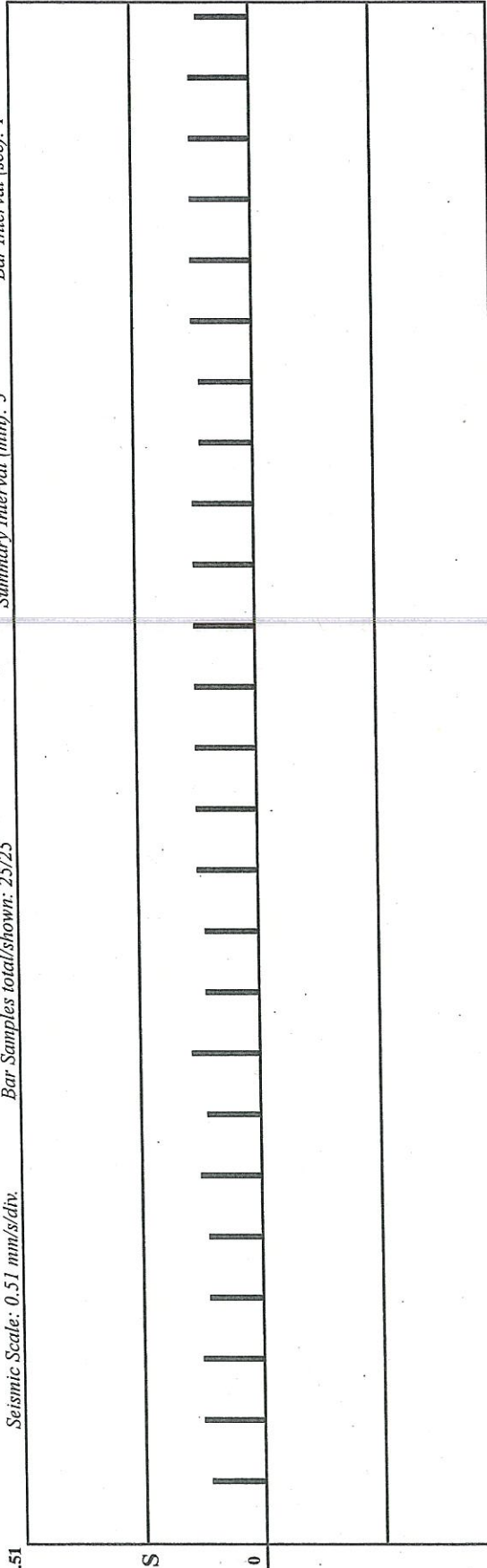
## BarGraph

Seismic Scale: 0.51 mm/s/div.

Bar Samples total/shown: 25/25

Summary Interval (min): 5

Bar Interval (sec): 1



WATERCARE

Orakei Domain (PSG4)

GEOTECHNICS

Below Pump #2

Graph: 10046

BarGraph Job # 707

Start: 13-Jul-11 @ 16:31:08

End: 13-Jul-11 @ 16:31:34

Summary Interval: 1

Air: 100 dB @ 341.3 Hz

Radial: 0.127 (mm/s) @ 41.0 Hz @ 16:31:21

Transverse: 0.111125 (mm/s) @ 41.0 Hz @ 16:31:15

Vertical: 0.142875 (mm/s) @ 78.8 Hz @ 16:31:15

Vector Sum: .15 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.01 hr

Battery Level: 6.3

summary interval	Start Time	Air dBL	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	16:31	100	341.3	16:31:19	0.127	41	16:31:21	0.111125	41	0.142875	78.8	16:31:15	0.0073	0.183

end of data



WATERCARE  
 Orakei Domain (PS64)  
 GEOTECHNICS  
 Below Pump #2  
 Graph: 10046  
 BarGraph Job # 707  
 Start: 13-Jul-11 @ 16:31:08  
 End: 13-Jul-11 @ 16:31:34  
 Bar Interval (sec): 1  
 Count: 25  
 Air: 100 dB @ 341.3 Hz  
 Radial: 0.127 (mm/s) @ 41.0 Hz @ 16:31:21  
 Transverse: 0.111125 (mm/s) @ 41.0 Hz @ 16:31:15  
 Vertical: 0.142875 (mm/s) @ 78.8 Hz @ 16:31:15  
 Vector Sum: .15 (mm/s)  
 Sample Rate:1024/sec  
 Record Duration: 00.01 hr  
 Battery Level: 6.3

Bar interval	Bar Time	Air dBL	Seismic Peak (mm/	Vector Sum (mm/s)
1	16:31:08	96	0.11113	0.14288
2	16:31:09	96	0.127	0.14288
3	16:31:10	96	0.127	0.15875
4	16:31:11	96	0.11113	0.127
5	16:31:12	96	0.11113	0.127
6	16:31:13	96	0.127	0.14288
7	16:31:14	98	0.11113	0.14288
8	16:31:15	96	0.14288	0.14288
9	16:31:16	96	0.11113	0.127
10	16:31:17	98	0.11113	0.14288
11	16:31:18	96	0.127	0.14288
12	16:31:19	100	0.127	0.14288
13	16:31:20	96	0.127	0.14288
14	16:31:21	96	0.127	0.14288
15	16:31:22	96	0.127	0.14288
16	16:31:23	96	0.127	0.14288
17	16:31:24	96	0.127	0.14288
18	16:31:25	96	0.11113	0.14288
19	16:31:26	96	0.11113	0.14288
20	16:31:27	96	0.127	0.127
21	16:31:28	96	0.127	0.14288
22	16:31:29	98	0.127	0.14288
23	16:31:30	96	0.127	0.14288
24	16:31:31	98	0.127	0.14288
25	16:31:32	96	0.11113	0.127

end of data

# SuperGraphics - Report

Telephone: (205)592-2488 x.23

Company: **WATERCARE**

Unit #: 10046

13-Jul-11 at 16:53:57 Event # 713

Location: **Orakei Domain (PS64)**

Operator: **GEOTECHNICS**

Notes: 18m From Shaft

Record Duration: 10.0 sec  
Sample Rate: 1024/sec

Distance: N      Wgt. Per Delay: N      Scaled Distance: 0.0

## Seismic

Gain: 2      Trigger: .064 mm/s      Vector Sum: 0.12 mm/s @ 102.40 Hz

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.095	0.079	0.111
Frequency (Hz)	46.50	170.60	128.00
Displacement (mm)	0.0003	0.0001	0.0001
Acceleration (g's)	0.003	0.009	0.009
Trigger >>> Peak	0.0	284.2	1360.4

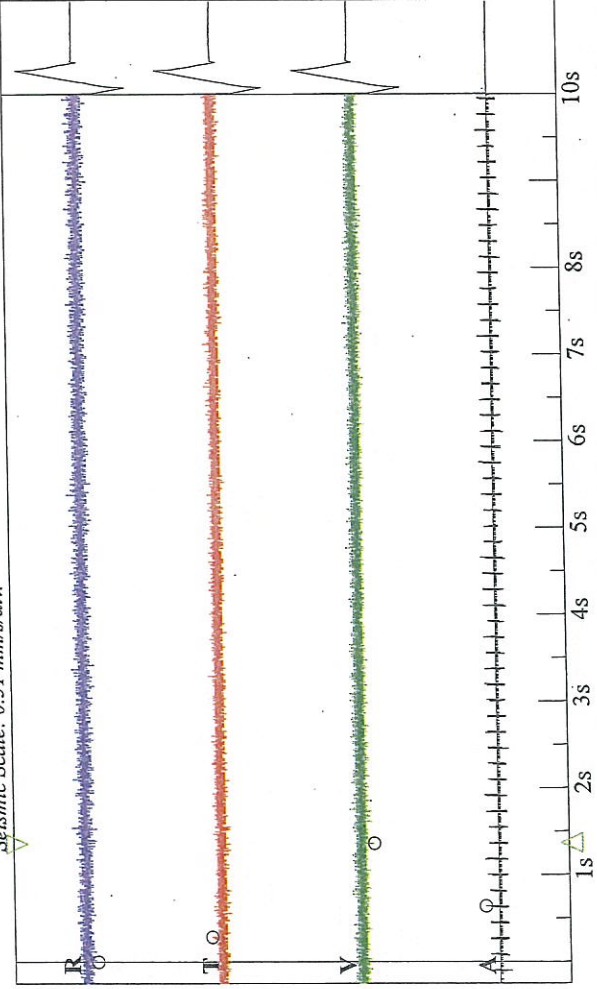
## Air

Gain: 1      Trigger: N

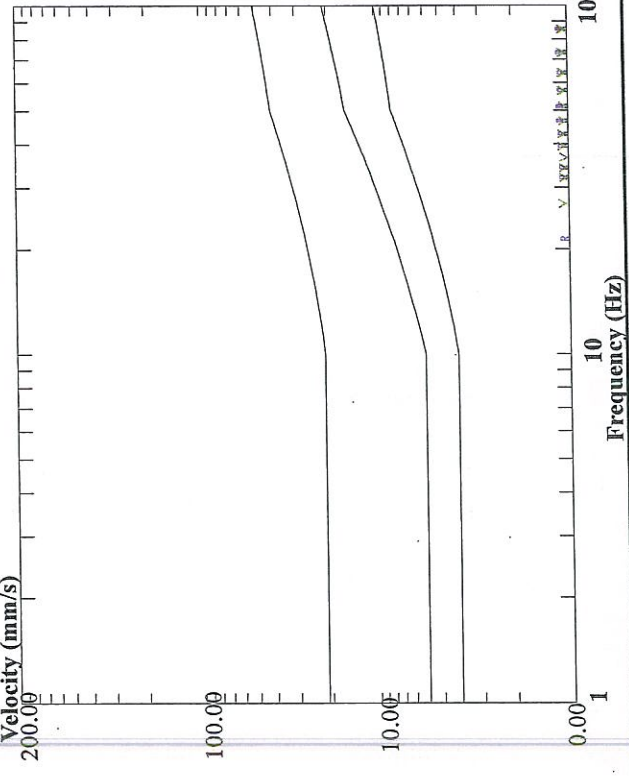
Measurement	Value	Trigger >>> Peak
kPa	.0015	640.6
dB	98	
Hz	512	

## Waveform Analysis / Frequency Plot

Air Scale: .00799 kPa/div.



DIN 4150-3-Table 1



**Company: WATERCARE**      **Unit #: 10046**      **13-Jul-11 at 16:50:02 Event # 712**

**Location: Orakei Domain (PS64)**      **Operator: GEOTECHNICS**

**Notes: 18m From Shaft**      **Distance-Source: N**

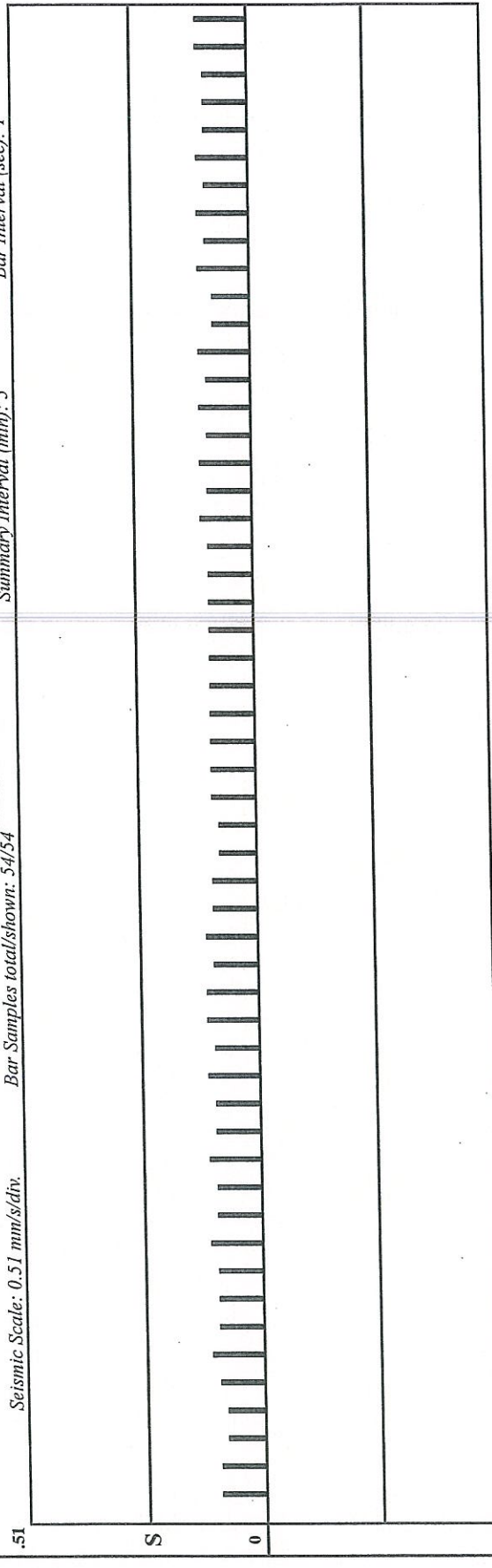
**End Time: 16:50:57**  
**Sample Rate: 1024/sec**

**Seismic**

Gain: 2      Vector Sum: .12 mm/s

Channel	Radial	Transverse	Vertical
Velocity (mm/s)	0.111	0.095	0.111
Frequency (Hz)	60.20	19.30	18.00
Time	16:50:23	16:50:15	16:50:12
Displacement (mm)	0.0003	0.0008	0.0010
Acceleration (g's)	0.004	0.001	0.001

**BarGraph**



WATERCARE

Orakei Domain (PS64)

GEOTECHNICS

18m From Shaft

Graph: 10046

BarGraph Job # 712

Start: 13-Jul-11 @ 16:50:02

End: 13-Jul-11 @ 16:50:57

Summary Interval: 1

Air: 98 dB @ 68.3 Hz

Radial: 0.111125 (mm/s) @ 60.2 Hz @ 16:50:23

Transverse: 0.09525 (mm/s) @ 19.3 Hz @ 16:50:15

Vertical: 0.111125 (mm/s) @ 18.0 Hz @ 16:50:12

Vector Sum: .12 (mm/s)

Sample Rate: 1024/sec

Record Duration: 00.02 hr

Battery Level: 6.29

summary interval	Start Time	Air dB	Air Hz	Air Time	R (mm/s)	R Hz	R Time	T (mm/s)	T Hz	T Time	V (mm/s)	V Hz	V Time	Disp. (mm)	Accel. (g's)
1	16:50	98	68.3	16:50:32	0.111125	60.2	16:50:23	0.09525	19.3	16:50:15	0.111125	18	16:50:12	0.025	0.033

end of data

WATERCARE  
 Orakei Domain (PS64)  
 GEOTECHNICS  
 18m From Shaft  
 Graph: 10046  
 BarGraph Job # 712  
 Start: 13-Jul-11 @ 16:50:02  
 End: 13-Jul-11 @ 16:50:57  
 Bar Interval (sec): 1  
 Count: 54  
 Air: 98 dB @ 68.3 Hz  
 Radial: 0.111125 (mm/s) @ 60.2 Hz @ 16:50:23  
 Transverse: 0.09525 (mm/s) @ 19.3 Hz @ 16:50:15  
 Vertical: 0.111125 (mm/s) @ 18.0 Hz @ 16:50:12  
 Vector Sum: .12 (mm/s)  
 Sample Rate: 1024/sec  
 Record Duration: 00.02 hr  
 Battery Level: 5.29

Bar Interval	Bar Time	Air dBL	Seismic Peak (mm/	Vector Sum (mm/s)
1	16:50:02	96	0.09525	0.11113
2	16:50:03	96	0.09525	0.11113
3	16:50:04	96	0.07938	0.11113
4	16:50:05	96	0.07938	0.09525
5	16:50:06	96	0.09525	0.11113
6	16:50:07	98	0.11113	0.11113
7	16:50:08	96	0.09525	0.11113
8	16:50:09	96	0.09525	0.09525
9	16:50:10	96	0.09525	0.11113
10	16:50:11	96	0.11113	0.127
11	16:50:12	98	0.09525	0.11113
12	16:50:13	96	0.09525	0.11113
13	16:50:14	96	0.11113	0.11113
14	16:50:15	98	0.09525	0.127
15	16:50:16	96	0.09525	0.11113
16	16:50:17	96	0.11113	0.11113
17	16:50:18	96	0.09525	0.11113
18	16:50:19	96	0.11113	0.11113
19	16:50:20	96	0.11113	0.11113
20	16:50:21	96	0.09525	0.11113
21	16:50:22	96	0.11113	0.11113
22	16:50:23	98	0.09525	0.11113
23	16:50:24	96	0.09525	0.11113
24	16:50:25	96	0.07938	0.09525
25	16:50:26	98	0.07938	0.11113
26	16:50:27	96	0.09525	0.11113
27	16:50:28	98	0.09525	0.11113
28	16:50:29	98	0.09525	0.11113
29	16:50:30	96	0.09525	0.11113
30	16:50:31	98	0.09525	0.09525
31	16:50:32	96	0.09525	0.11113
32	16:50:33	96	0.09525	0.11113
33	16:50:34	96	0.09525	0.09525
34	16:50:35	96	0.09525	0.11113
35	16:50:36	96	0.09525	0.09525
36	16:50:37	98	0.11113	0.11113
37	16:50:38	96	0.09525	0.11113
38	16:50:39	96	0.11113	0.11113
39	16:50:40	96	0.09525	0.09525
40	16:50:41	96	0.11113	0.11113
41	16:50:42	96	0.09525	0.11113
42	16:50:43	96	0.11113	0.127
43	16:50:44	98	0.07938	0.11113
44	16:50:45	98	0.07938	0.11113
45	16:50:46	98	0.11113	0.127
46	16:50:47	98	0.09525	0.11113
47	16:50:48	96	0.11113	0.127
48	16:50:49	98	0.09525	0.11113
49	16:50:50	96	0.11113	0.11113
50	16:50:51	96	0.09525	0.11113
51	16:50:52	98	0.09525	0.11113
52	16:50:53	96	0.09525	0.09525
53	16:50:54	96	0.11113	0.11113
54	16:50:55	98	0.11113	0.11113

end of data

# D7 Southwestern Interceptor Micro-tunnelling Machine

## **D8 Southwestern Interceptor Micro-tunnelling Machine**

# ISO 2631 Satisfactory magnitudes of building vibration with respect to human response

