



CABRAMATTA LOOP PROJECT

AUSTRALIAN RAIL TRACK CORPORATION

CONSTRUCTION MONITORING REPORT

May 2022 to October 2022

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1. Introduction

Australian Rail Track Corporation (ARTC) is constructing a passing loop for up to 1,300m length trains on the Southern Sydney Freight Line (SSFL), which will allow freight trains travelling in opposite directions to pass and provide additional rail freight capacity along the SSFL. The project is referred to as the Cabramatta Loop Project. The project has been assessed under Division 5.2 (State significant infrastructure) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The project is State Significant Infrastructure (SSI #9186) and was declared Critical State Significant Infrastructure (CSSI) on 15 May 2020. The Minister for Planning and Public Spaces granted approval of the CSSI on 28 July 2020.

ARTC has contracted Fulton Hogan to construct the Cabramatta Loop Project. The construction works commenced in November 2021 and are being performed under the provisions of the Ministers Conditions of Approval and Environment Protection Licence 3142. In accordance with Condition of Approval C13, the following report details all required monitoring to be undertaken during the reporting period.

C13 The results of the Construction Monitoring Programs must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.

Note: Where a relevant CEMP Sub-Plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-Plan.

2. Site Activities and Rainfall

During May, efforts continued to be focused on implementation of site erosion and sediment controls, housekeeping and planning of measures to enable works associated with storm water and civil works in Broomfield St, water supply and crane pad construction adjacent and within Cabramatta Creek to progress. The closest Bureau of Meteorology (BoM) weather station at Bankstown Airport is approximately 4.5km south-east of the site and recorded 18 days of rainfall with a cumulative total of 111.8mm of rainfall for the month, which was almost double the historic mean of 64.3mm. Environmental controls appeared effective with no construction related impacts to water quality observed or detected in samples. It is noted that both upstream and downstream pH values were lower than baseline data and the NSW Water Quality Objective criteria for lowland rivers.

During June, ground saturation eased significantly with the BoM recording only 4.6mm of rainfall and drying winds dominating the month. As a result, the project was able to construct the highest environmental risk items associated with working in Cabramatta Creek for the piling pad extension enabling construction of pier two and a cantilevered extension to the Creek crossing. Generally, the drier weather also facilitated consolidation of stockpiles and improvements in environmental controls and housekeeping.

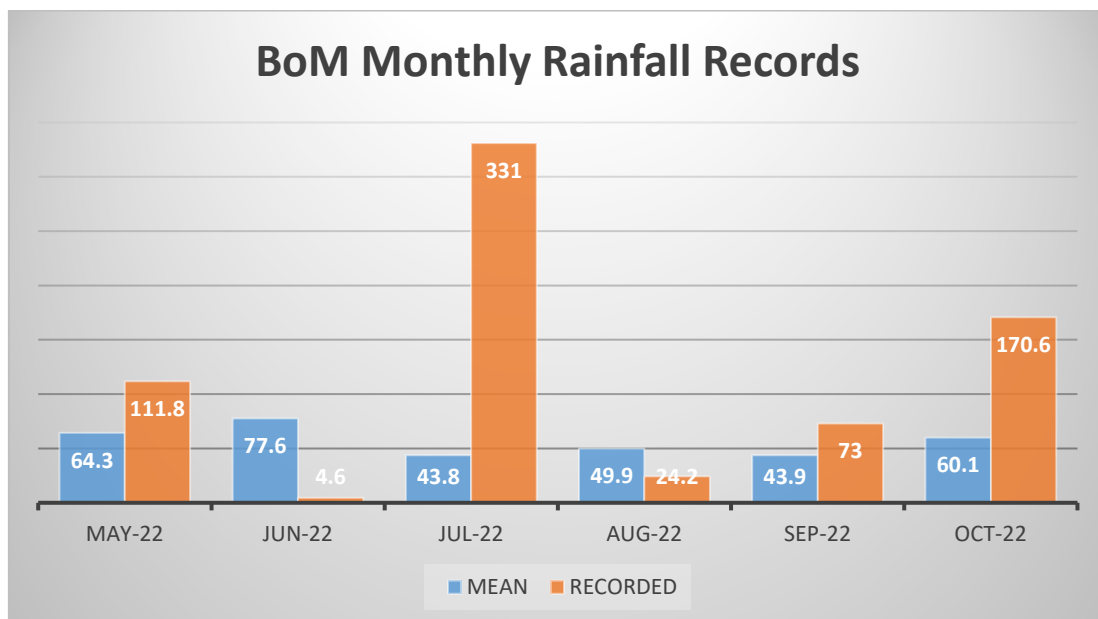
During July, the site was yet again significantly impacted by unseasonal precipitation, recording over 335mm of rainfall which produced two substantial flooding events. In comparison, the July historical mean is 43.8mm and the median is 29.6mm.

During August, seasonal conditions provided cold but drier influences. The month recorded only 23.2mm of rainfall. In comparison, the August mean is 49.9mm and the median is 25.1mm. The

majority of construction activity was associated with storm water and civil works along Broomfield Street, with piling also progressing on the northern side of Cabramatta Creek towards Sussex St.

During September, the site continued with opportunities to advance construction and stabilise the eastern side of Broomfield Street with permanent landscaping between wet weather influences. The BoM recorded 70mm of rainfall with 16 working days where little to no rainfall was recorded. In comparison, the September mean is 43.9mm and the median is 34.1mm. As a result, activities were somewhat stop-start with management of pooled and run-on water a challenge to maintain drainage installation and continuation of civil works. No water quality impacts were evident in Cabramatta Creek proving that mitigation measures and site controls have been implemented and maintained effectively..

During October, the site experienced more wet weather and additional flooding of the Cabramatta Creek work area. The BoM recorded nearly 171mm of rainfall with 18 working days where less than 2mm of rainfall was recorded. The historical October mean is 60.1mm and the median is 40.8mm. Despite having nearly triple the average rainfall, the construction team managed to complete the installation of mainline drainage on Broomfield street, stabilisation of civil works on the eastern side of Broomfield, and piling pad construction on the western side to allow the piling rig to advance northward. Upstream and downstream remained uninfluenced by construction activities largely due to the small catchment of the site and the effectiveness of controls, along with the significantly larger disturbed catchment upstream, which seems to dominate the water quality indicators.



Above: Rainfall data from the nearest Bureau of Meteorology station at Bankstown Airport vs statistical mean records



Above: July Floods at Cabramatta Rail Loop 2022



Above: Piling pad establishment at Cabramatta Creek during the end of July

6 Monthly Monitoring Data | Cabramatta Loop Project



Above: Progression of piling and bridge works at Cabramatta Creek during September



Above: Looking downstream of Cabramatta Creek following a minor rainfall event in October

3. Cabramatta Creek Water Quality Monitoring

The purpose of water quality monitoring during the construction phase is to determine impacts resulting from construction of the project only (i.e. road/ rail construction) and not other unrelated sources, such as upstream urban development, agricultural operations, sewage overflows, or runoff of nutrient rich fertilisers from nearby landscaped parks/ recreational areas such as playing fields or golf courses.

Sampling parameters have been assessed for consistency with the following NSW Water Quality Objective Criteria:

Turbidity - Lowland Rivers: 6-50 NTU

pH - Lowland Rivers: 6.5 – 8.5

Oil and Grease: No visual evidence

The GHD study titled Australian Rail Track Corporation – Cabramatta Loop Water Quality Monitoring Report (September 2020), provides the following insights to the two In situ tested physico-chemical indicators and significance :

Turbidity: *“High turbidity is typical of disturbed catchments and during high flow events. Not toxic, but can affect ecosystems and biota”*...*“Turbidity, directly measured in situ by the water quality probe, provides readings which express how light is scattered by suspended particulate material in the water. These results, given in Nephelometric Turbidity Units (NTU), generally provide a good correlation with the concentration of particles in the water that affect water clarity and phytoplankton productivity. Although high turbidity is often a sign of poor water quality and land management, crystal clear water does not always guarantee healthy water. Extremely clear water can signify very acidic conditions, or high levels of salinity. The ANZECC (2000) Freshwater Guidelines give a trigger value of 6-50 NTU for turbidity in lowland rivers”*.

pH: *“Extremes of pH can be directly toxic to biota, and can modify the effect of other stressors (eg release metals)”*.... *“Most of the adverse effects of pH in water are associated with low pH values (acidic), effectively when pH of less than 6.5 is recorded. ANZECC (2000) states that almost all water quality guidelines around the world recommend that pH should be maintained in the range 6.5 to 9.0 to protect freshwater aquatic organisms. The ANZECC (2000) Guidelines for pH are 6.5 - 8.0 for freshwater lakes and reservoirs, and 6.5 – 8.5 for NSW lowland rivers.”*

During the reporting period, surface water quality in Cabramatta Creek has been monitored immediately upstream and downstream of the bridge works at Cabramatta Creek so that any impacts directly related to construction activities can be identified and addressed.

The two construction water quality monitoring locations are indicated below as SW1 (Upstream) and SW2 (Downstream). The sampling sites were moved from those recommended by GHD in advance of construction occurring based on the following assessments:

SW1 (Upstream) was identified as the safest access immediately west of the existing rail bridge over Cabramatta Creek. This is downstream of GHD’s recommended location and picks up additional major urban inflows from a box culvert draining from the west adjacent Cabramatta Sports Grounds containing runoff from parts of Sussex Street (west), Jasmine Crescent and Begonia Avenue and two pipe culverts draining to a headwall just west of the rail bridge crossing, draining parts of Sussex Street (west), Church Street and Railway Parade. Without relocating this upstream monitoring location, any pollutants associated with urban runoff may have been thought attributable to the construction phase of the project.

SW2 (Downstream) was identified as the safest access immediately east of the existing shared user culvert crossing over Cabramatta Creek. Firstly, the site nominated by GHD as Downstream

(Broomfield Street cycleway) did not adequately capture potential runoff that could drain into Cabramatta Creek from the piling and crane pads associated with construction of the Cabramatta Creek rail bridge or the potential runoff from the laydown area adjoining Jacqui Osmond Reserve. During May, the project identified a potential new downstream location that took advantage of a previously cleared section of embankment associated with a pumping station to provide safe access to the waterway where potential hazards such as steep embankment, rock and woody debris trips and snakes can be easily identified without impacts to riparian flora. Following a major flooding event, along with antisocial behaviour of a vagrant living at the pumping station, it was determined unsafe to continue monitoring at this location and a contingency location was identified further downstream for times when safety of monitoring staff could not be guaranteed. See Figure 1 and below images for details.



Figure 1 – Indicative water quality monitoring locations



Above:
Upstream Surface Water Sampling Point SW1
Latitude: -33.90260 °
Longitude: 150.93804
November 2021



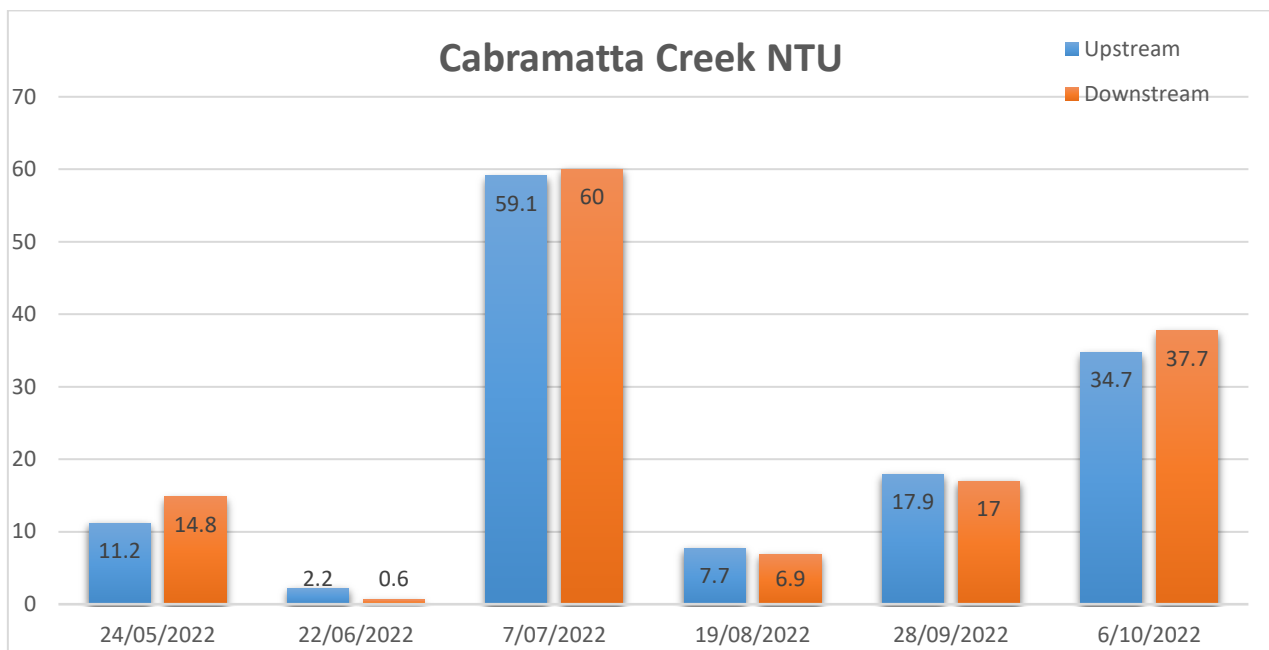
Above:
Downstream Surface Water Sampling Point SW2
Latitude: - 33.541814°
Longitude: 150.562122°
May 2022

Monitoring sites were sampled opportunistically on a monthly basis. At each site, grab samples were collected for field analysis. In addition, relevant site descriptions and notes were taken for each site and visual observations made. Visual observations included: Visual oil and grease; Stream flows; Water clarity; Water colour, odour and any other notable observations. Photos of each water quality sample site were taken to record the visual appearance of the site at the time of sampling. Where appropriate, photos of stream banks were taken providing a digital record of bank stability, geomorphology and riparian vegetation condition.

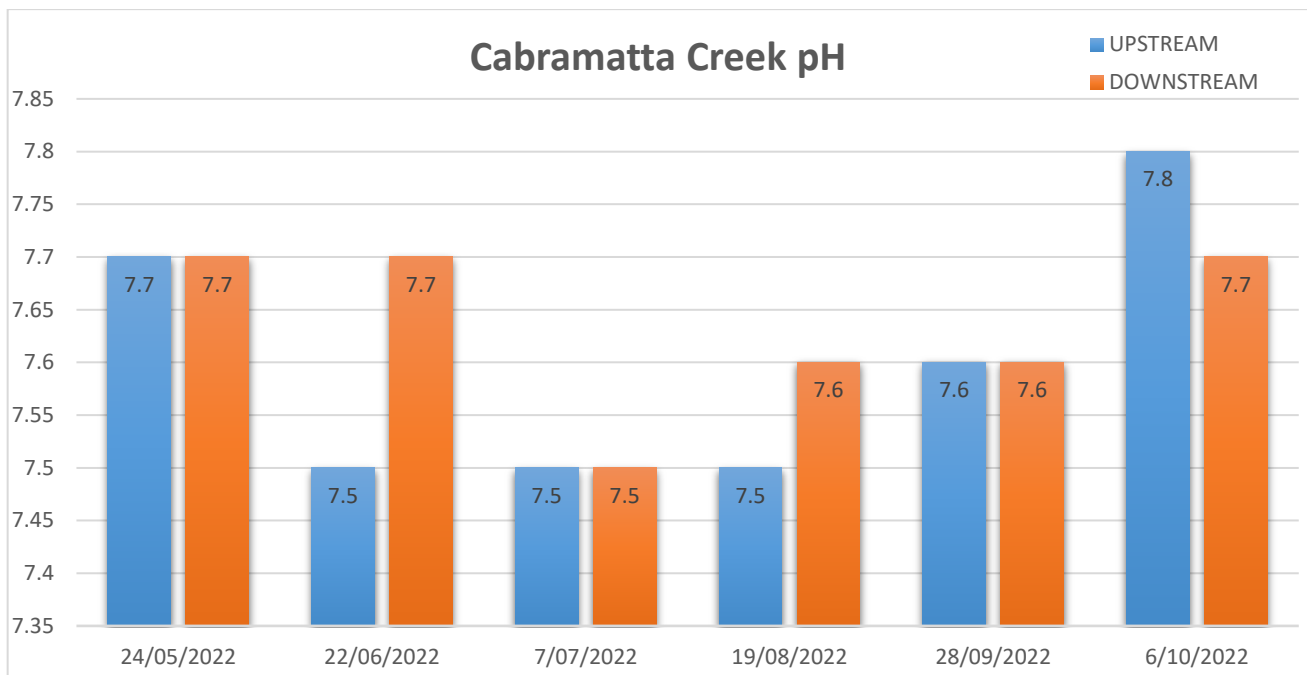
Water quality sampling was performed in accordance with Australian Standard AS/NZS 5667-1998 "Water Quality – Sampling" and "Approved methods for the sampling and analysis of water pollutants in NSW" (EPA, 2022) only when safe for personnel to get close enough to the live waterway. Therefore the data is not reflective of peak worst case water quality conditions, but is representative of general flow parameters at the time of sampling. This data is provided in Table 1 and monthly trends may be interpreted in the following graphs.

Table 1. Water quality monitoring results – May 2022 – October 2022

Date	Location	Co-ordinates	pH	NTU (Field)	Oil & Grease
24/05/2022	Cabramatta Creek Upstream	-33.90260° 150.93804°	7.7	11.2	Not visible
24/05/2022	Cabramatta Creek Downstream	-33.90531° 150.93942°	7.7	14.8	Not visible
22/06/2022	Cabramatta Creek Upstream	-33.90260° 150.93804°	7.5	2.2	Not visible
22/06/2022	Cabramatta Creek Downstream	-33.90531° 150.93942°	7.7	0.6	Not visible
07/07/2022	Cabramatta Creek Upstream	-33.90260° 150.93804°	7.5	59.1	Not visible
07/07/2022	Cabramatta Creek Downstream	-33.90531° 150.93942°	7.5	60	Not visible
19/08/2022	Cabramatta Creek Upstream	-33.90260° 150.93804°	7.5	7.7	Not visible
19/08/2022	Cabramatta Creek Downstream	-33.90531° 150.93942°	7.6	6.9	Not visible
28/09/2022	Cabramatta Creek Upstream	-33.90260° 150.93804°	7.6	17.9	Not visible
28/09/2022	Cabramatta Creek Downstream	-33.90531° 150.93942°	7.6	17	Not visible
06/10/2022	Cabramatta Creek Upstream	-33.90260° 150.93804°	7.8	34.7	Not visible
06/10/2022	Cabramatta Creek Downstream	-33.90531° 150.93942°	7.7	37.7	Not visible



Above: Turbidity data from Table 1 graphed demonstrating monthly trends



Above: pH data from Table 1 graphed demonstrating monthly trends

Prior to construction GHD was engaged by ARTC to prepare the baseline water quality monitoring program for the project titled 'Australian Rail Track Corporation Cabramatta Loop: Water Quality Monitoring Report' dated September 2020. This baseline monitoring of surface water quality commenced in May 2019 at various sites upstream and downstream from the project and monitored baseline conditions for twelve months between May 2019 and April 2020.

Any further direct comparison of the construction phase water quality to baseline parameters beyond the discussion below is difficult due to seasonal disparities and in particular the prominence of the La Nina effect experienced during 2021 and 2022. The GHD report stating "*Whilst the overall amount of rainfall was similar to the long term average, the distribution of rainfall was different. Rainfall was extremely light throughout most of the reporting period, with the exception of two wet weather events in September 2019 and February 2020. Eight of the twelve months in the period were drier than the corresponding long-term median. Most of the rainfall recorded fell during the February 2020 event; 328 millimetres fell between 7 and 10 February, and 160 millimetres was recorded on 10 February alone. As described, one wet weather sampling event was performed in February 2020. Additional wet weather sampling would have been preferable to better establish wet weather water quality conditions, however such sampling is of course weather-dependent, and was not able to be performed in the monitoring timeframe.*"

During the period May 2022 – October 2022 the following observations have been made:

- No oil or grease was observed as visible during any sampling event.
- In all months bar July, the turbidity recorded at both the upstream and downstream sites was below the 50 NTU NSW Water Quality Objective Criteria. In June, turbidity was recorded below the lower guideline of 6 NTU. Extremely clear water can signify very acidic conditions or high levels of salinity however these results are consistent with baseline monitoring data where GHD previously reported "*A number of samples at all sites were below the lower guideline, this was attributed to the salinity of the sites as recorded in the EC present. Whilst these samples are regarded as outside the*"

guideline range, the low turbidity can be expected due to natural processes present at the sites.” In relation to levels ranging from 6.9 to 60 NTU, these values are consistent with baseline maximums where GHD has commented “these results are as expected in wet weather flows through areas where urbanisation through the catchment has occurred, as it has in much of the Cabramatta Creek catchment.”

- pH was always within the ANZECC guideline range, with a high end of 7.8 pH and a lower end of 7.5 pH.
- Based on the available data and field observations, the construction phase environmental controls and management measures implemented during the six month period have been effective in meeting the project’s water quality objectives and minimising impacts to the Cabramatta Creek and Georges River ecosystems.

4. Noise Monitoring Results

Chapter 9 of the EIS assessed the potential extent and magnitude of noise impacts generated from construction of the project. This included a detailed assessment documented in EIS Volume 2 – Technical Report 2 – Cabramatta Loop Project: Noise and Vibration Impact Assessment (GHD, August 2019). As a result of this study, the area of potential noise sensitive receivers has been divided into four noise catchment areas (NCAs). These NCAs are based on ambient noise characteristics with respect to major roads and rail corridors in the project area as described and represented in Figure 2 below:

- **NCA 1:** The area to the North of Jacqui Osmond Reserve and west of the rail corridor. The area comprises of commercial and residential land uses. Rail noise, road traffic noise from Railway Parade and noise from commercial premises along Railway Parade dominate the noise environment in NCA01.
- **NCA 2:** The area to the North of Jacqui Osmond Reserve and east of the rail corridor. The area comprises of residential land uses. Road traffic noise from Broomfield Street and local roads in the area dominate the noise environment with Hume Highway operations contributing to background noise levels. An existing noise wall along Broomfield Street attenuates rail noise.
- **NCA 3:** The area to the South of Jacqui Osmond Reserve and West of the rail corridor. The area comprises of primarily residential land uses. Rail noise and traffic along the Hume Highway and local roads dominate the noise environment in NCA03.
- **NCA 4:** The area to the South of Jacqui Osmond Reserve and East of the rail corridor. The area comprises of primarily industrial and commercial land uses. Rail noise and industrial activities dominate the noise environment in NCA04.

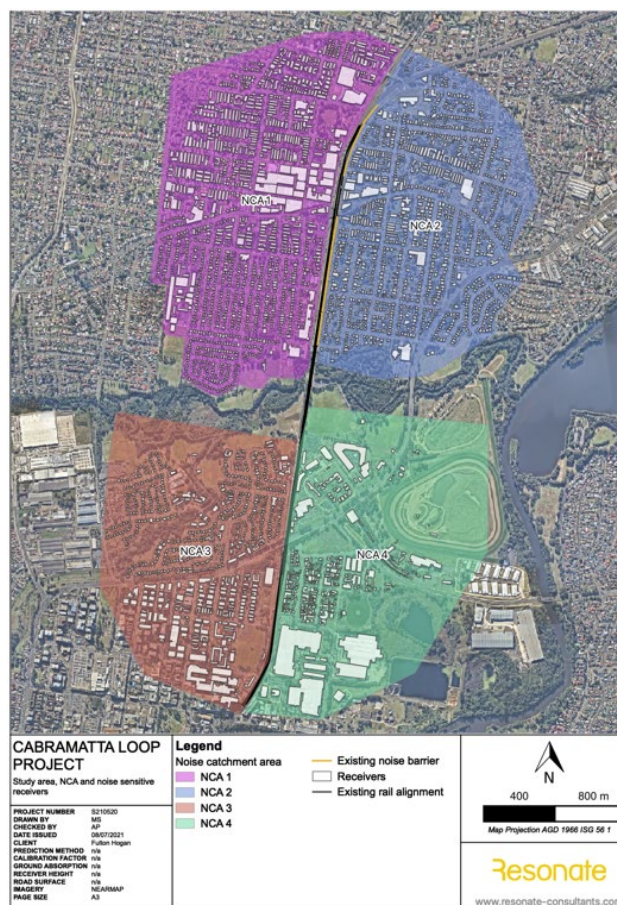


Figure 2: Noise Catchment Areas

The nominated monthly attended noise monitoring locations are shown in Figure 3 and listed below:

- Location 1: 225 Railway Parade, Cabramatta
- Location 2: 150 Broomfield Street, Cabramatta
- Location 3: Corner of Station Street and Lawrence Hargrave Road
- Location 4: In railway corridor north of Warwick Farm Station

The monitoring locations were selected to cover each NCA and proximity to key construction zones and most potentially affected sensitive receivers.

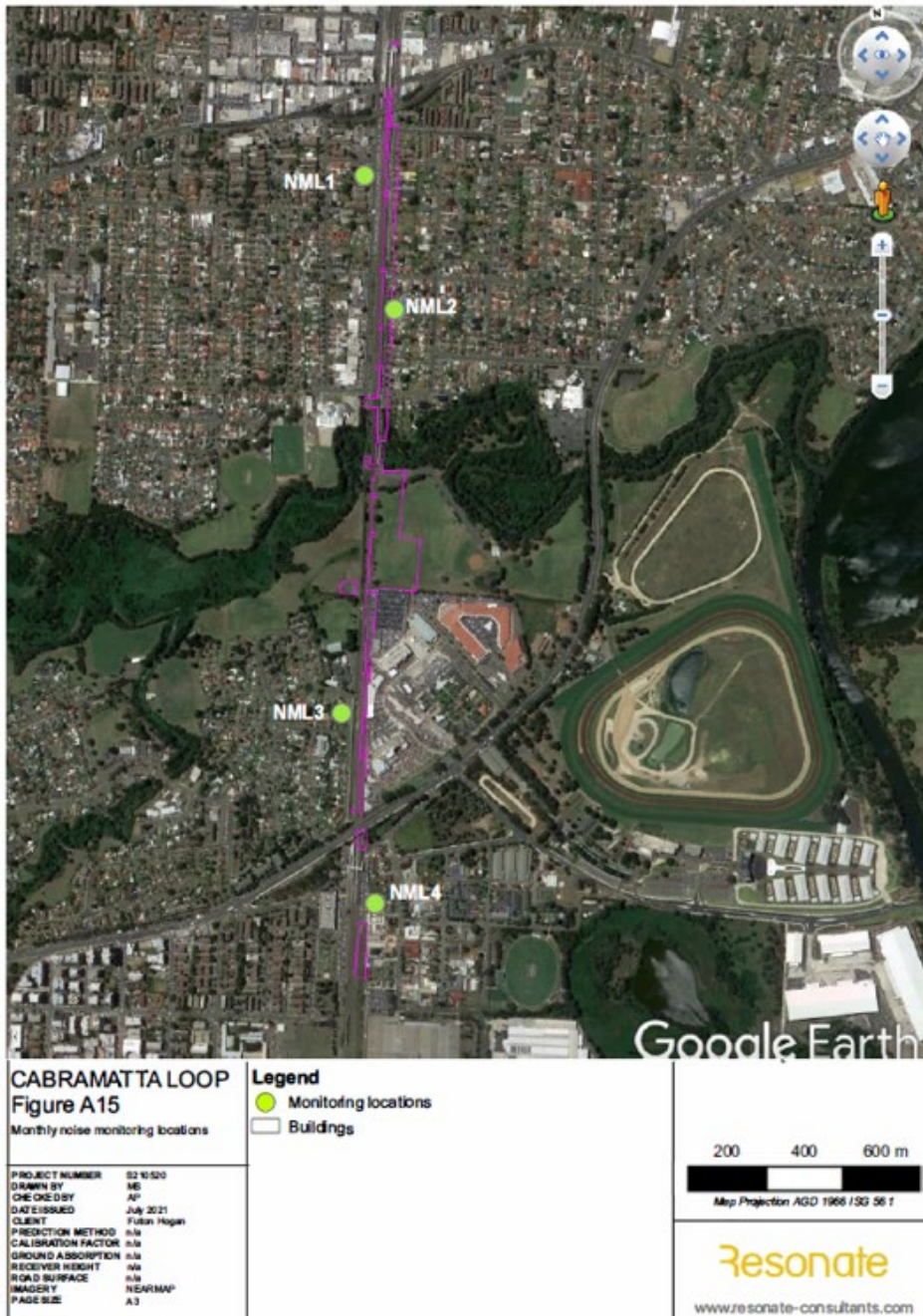


Figure 3 – Indicative noise monitoring locations

A summary of the baseline noise monitoring including a description of the ambient noise environment at each location is provided in the table below.

Table 2. Summary of Baseline Noise Monitoring

NCA	Address	Free-field or façade	Rating level (RBL)			Ambient noise levels, $L_{Aeq}(\text{period})$					Ambient noise observations
			Day	Evening	Night	Day	Evening	Night	Day (15 hour)	Night (9 hour)	
-	In rail corridor (North of Warwick Farm Station)	Free field	-	-	-	65	64	63	65	63	Rail noise dominant
-	In rail corridor (South of Cabramatta Station)	Free field	43	41	33	68	68	66	68	66	Rail noise dominant
01	225 Railway Parade, Cabramatta	Free field	45	44	33	61	61	59	61	59	Rail noise dominant, road traffic noise along Railway Parade
02	150 Broomfield Street, Cabramatta	Façade	39	38	31	56	56	52	56	52	Rail noise dominant, road traffic noise along Broomfield Street, construction works at residence along Broomfield Street
02	46a National Street, Cabramatta	Free field	38	37	31	53	48	46	51	46	Rail noise faintly audible, road traffic noise along National Street
01	41 Church Street, Cabramatta	Free field	38	39	30	55	53	50	54	50	Road traffic noise along Church Street, rail passbys in background
03	25 Lawrence Hargrave Road, Warwick Farm	Free field	37	38	32	52	50	47	50	47	Rail noise dominant, car passbys and bird noise

As a result of this baseline monitoring, the below noise management levels were determined and are used to ensure that impacts to noise and vibration are minimised and within the scope permitted by the project approval through the employment of reasonable and feasible attenuation and management measures:

Table 3. Summary of residential noise management levels

NCA	Standard hours, $L_{Aeq,15min}$	OOHW Period 1, $L_{Aeq,15min}$		OOHW Period 2, $L_{Aeq,15min}$	Sleep disturbance, L_{AFmax}
		Day	Evening	Night	Night
NCA01	48	43	42	36	52
NCA02	48	43	43	35	52
NCA03	47	42	42	37	52
NCA04	47	42	42	37	52

The following noise monitoring has been performed:

- Monthly noise monitoring at sensitive receiver locations identified as Noise Monitoring Locations 1 to 4 from May 2022 to October 2022;
- Where Out of Hours Works have been performed, monitoring has also been undertaken at the closest receivers and at random locations for the purpose of conducting spot checks within the catchment. This has occurred during weekend track closures known as “possessions”. Such activities are permitted by ARTC’s Environmental Protection Licence to provide a safe working

environment and the works are assessed in accordance with the OOHW Protocol approved by the Department of Planning and Environment.

- During this reporting period the following possessions have taken place:
WE 46 May 2022
WE10 September 2022

No complaints were received in relation to acoustic impacts within the four noise catchments during the reporting period.

Attended measurements were conducted using the following instrumentation:

- Sound Level Meter - Rion NA-28 sound level meter serial number: 01270688
- Sound Calibrator – Pulsar Model 106 serial number 83428

The sound level meter holds a current calibration certification. The Rion NA-28 was manufactured before 2019 and complies with Australian Standard IEC 61672.1:2013. The Pulsar 106 complies with the requirements set out in IEC 60942:2017 Electroacoustics: sound calibrators. The attended measurement events were guided by the methods described in Australian Standard 1055:2018 Acoustics: description and measurement of environmental noise and Approved methods for the measurement and analysis of environmental noise in NSW (EPA, 2022).

Field calibration of the sound level meter was checked both prior and post measurement and no noise level drift was observed. All monitoring locations have been established to ensure outdoor free-field noise level measurements where the influence of reflecting structures (other than the ground) is minimised ie: measurements have been undertaken at least 3.5m from any reflecting structure and at a height of 1.2m above ground level mounted on a tripod. There were no instances where the nearest residence was more than 30m away from the monitoring location.

Although the project formally entered “construction commencement” 30 days after approval of the Construction Environmental Management Plan, minimal enabling work activities beyond compound establishment in Jacqui Osmond Reserve occurred in November 2021, hence the attended monitoring data for November (as reported in Period 1 report) is very useful in terms of context and comparison against the baseline established in 2018/19 during the EIS planning phase. No construction impacts were audible during this time at any of the noise monitoring locations and on each occasion, the recorded minimums were above the rated background levels for each catchment. This has been a trend throughout the construction period, indicating some change in ambient acoustics has likely occurred during the past few years. Frequent monitoring in noise catchments 3 and 4 also provide insights to current ambient conditions with minimal project work occurring outside of possession weekends.

During this monitoring period, with the exception of possession weekends, almost always ambient acoustics are dominated by background noise in all catchments except for NCA 2 where Broomfield Street enabling work such as utility diversions and street realignment civil works are the primary noise source. Significant contributions to background levels are attributed to common noise sources including passenger and freight trains within the rail corridor, light and heavy vehicles on local roads and the Hume Highway bridge over the rail corridor at Warwick Farm (to the South for NCAs 3 and 4) and Cabramatta Road bridge over the rail at Cabramatta (to the North for NCAs 1 and 2), overhead aircraft including jet and propeller thrust aircraft as well as helicopters departing and approaching Bankstown Airport.

Each month of attended monitoring data and observations are represented in Tables 4 to 9.

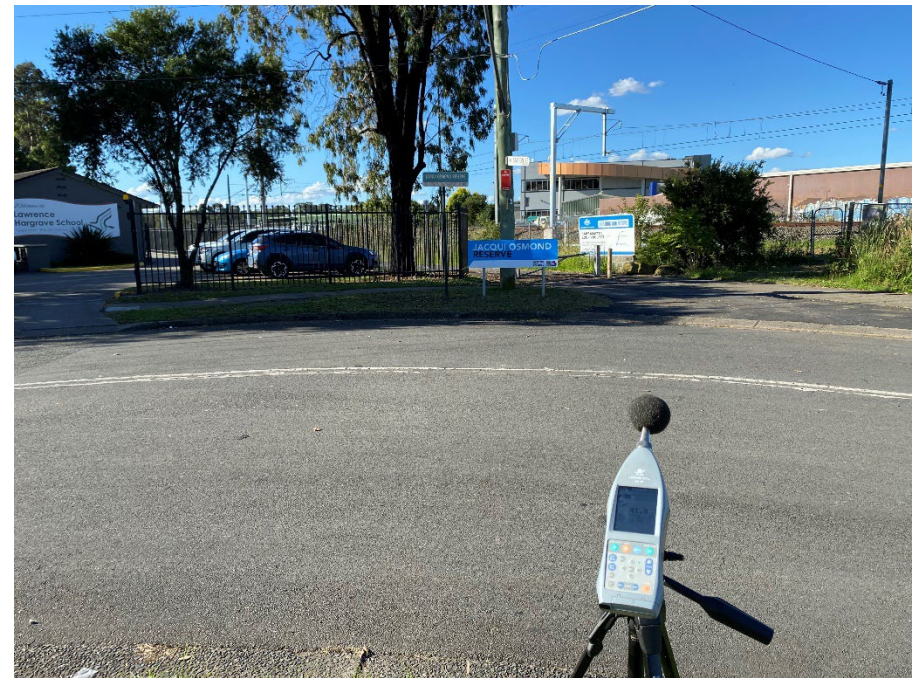
Table 4. Attended noise monitoring results – May 2022

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML1 NCA1	Location 1 – 225 Railway Parade, Cabramatta	Monthly Monitoring - check of background noise levels	3/5/2022 10:45am	45	67	<p>Lmax – 93 dB Lmin – 41 dB L10 – 70 dB L90 – 48 dB</p> <p>Passing Sydney trains from 63-75dB. Noise dominated by LVs frequently passing between 65-74dB. Buses frequently turning at Boundary Lane, typically around 72dB. Freight trains from 64-72dB. The Lmax can be attributed to a nearby Telstra technician.</p> <p>Civil works on Broomfield Street was occurring at time of monitoring in the vicinity. No construction noise was audible at the time of monitoring. All noise is attributable to background noise sources.</p>
NML2 NCA2	Location 2 – 150 Broomfield Street, Cabramatta	Monthly Monitoring - check of background noise levels	3/5/2022 11:27am	39	55	<p>Lmax – 72 dB Lmin – 44 dB L10 – 58 dB L90 – 47 dB</p> <p>Nearby works involved installation of drainage north of Junction St, along with retaining wall block removal on western side of Broomfield St.</p> <p>Hammering of the retaining wall occurred approximately 6 times for a duration of around 10 seconds each burst, hitting 55-62 dB.</p> <p>3 Sydney trains passed during the monitoring, measuring 57-62 dB over 7 seconds each time.</p> <p>Idling excavator dominated background noise at 49-54dB</p> <p>4 aircrafts passed overhead at 50-71dB over 20-30 seconds</p> <p>LVs audible from 53-58dB</p>

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML3 NCA3	Location 3 - Corner of Station Street and Lawrence Hargrave Road, Warwick Farm	Monthly Monitoring - check of background noise levels	3/5/2022	37	58	<p>Lmax – 74 dB Lmin – 39 dB L10 – 63 dB L90 – 42 dB</p> <p>No construction occurring at time of monitoring in the vicinity. No construction noise was audible at the time of monitoring.</p> <p>1 x freight train audible for 70 seconds at 50-71db 5 x Sydney trains audible for 15 seconds at 50-73dB 2 x passing LVs audible for 7 seconds at 50-64dB 3 x Aircraft audible for 30 seconds at 48-52db Quick yet frequent horns from Peter Warren automotive were observed during monitoring Machinery/engine noise from Peter Warren dominated the background noise levels at 42-46 dB</p>
NML4 NCA4	Location 4 - Warwick Farm Station Car Park	Monthly Monitoring - check of background noise levels	3/5/2022	37	62	<p>Lmax – 79 dB Lmin – 44 dB L10 – 67 dB L90 – 48 dB</p> <p>No project related construction occurring at time of monitoring in the vicinity.</p> <p>The acoustic environment is dominated by the rail corridor and train movements, along with aircraft and Hume Hwy traffic. A significantly long freight train passed the location during monitoring, hitting between 55-79dB over 130 seconds.</p> <p>All noise is attributable to background noise sources</p>



Above: Attended monitoring at Warwick Farm station (NML4) during May.



Above: Attended monitoring at 2 Lawrence Hargrave Dr (NML3) during May.

During the May possession WE46, Resonate (acoustic consultants) were procured to conduct attended OOHW monitoring. See the report below:



Acoustics • EMF • Structural Dynamics • Vibration

Tuesday, 24 May 2022

Project number: S210520
Reference: S210520LT1A

Shannon Chisholm
Fulton Hogan
End Sappho Road
Warwick Farm NSW 2170

Dear Shannon,

**Cabramatta Loop Project
Construction Noise Monitoring Report**

1 Introduction

The purpose of this letter is to present the results of construction noise verification measurements undertaken for the Cabramatta Loop Project Out of Hours Works (OoHW) on Saturday, 14 May 2022. Operator attended noise measurements were conducted between 4 pm and midnight covering the daytime, evening and night-time periods.

1.1 Instrumentation and weather conditions

Measurements were conducted using the following instrumentation

- Rion NL-42 sound level meter serial number: 00946983.
- Rion NL-52 sound level meter serial number: 820994.

The sound level meters held current calibration certification. Calibration of each the sound level meter was checked both prior and post measurement and no noise level drift was observed.

The weather conditions were calm and clear with no precipitation observed.

2 Noise Measurement Locations

A map showing the noise measurement locations is provided in Appendix A and listed in Table 1.

Table 1 Noise Measurement Locations

ID	Location	Description of Works Observed
1	225 Railway Parade, Cabramatta.	Excavation of pit at Cabramatta Station. Works not discernible.
2	150 Broomfield Street, Cabramatta.	No works were discernible or observed from this location.
3	Corner of Lawrence Hargrave Road and Station Street in Warwick Farm.	Loading of a hi-rail Hydrema by an excavator at Jacquie Osmond Reserve compound.
4A	Eastern side of the rail corridor adjacent to the Warwick Farm car park.	No works were discernible or observed from this location.
5	Western side of the rail corridor adjacent to the multi-story Warwick Farm commuter car park.	No works were discernible or observed from this location.
6	Footpath outside 25 National Street, Cabramatta.	No works were discernible or observed from this location.
7	Footpath outside 148 Lansdowne Road, Canley Vale.	<ul style="list-style-type: none"> • Signals cable pit installation no visible from measurement location. • Works just audible during lull in background noise levels. • Not directly measurable estimated to be approximately 10 dB less than ambient
8	Footpath adjacent to southern side 102 Broomfield Street on Bridge Street, Cabramatta.	Excavation of pit at Cabramatta Station. Works visible and discernible.
9	Footpath outside 100 Broomfield Street, Cabramatta.	Excavation of pit at Cabramatta Station. Works visible and discernible.
10	Footpath outside 102 Broomfield Street, Cabramatta.	Excavation of pit at Cabramatta Station. Works visible and discernible.

3 Noise Measurement Results

The measured noise levels and discussion of key observations is presented in Table 2.

Table 2 Noise Measurement Results

ID	Time	Duration (minutes)	Predicted L _{Aeq} (15 minute) dB(A)	Estimated (Measured) L _{Aeq} (15 minute) dB(A) Construction Noise	Measured L _{Aeq} (15 minute) dB(A) Total Noise	Measured L _{A90} dB(A) Total Noise	Comment
1	18:08	15	49	Not Measurable	66	53	<ul style="list-style-type: none"> Works not discernible over ambient. Ambient noise levels controlled by local road traffic and occasional aircraft flyovers. Car passbys ranged between 60 dB(A) and 89 dB(A).
2	18:34	15	49	Not directly measurable	56	44	<ul style="list-style-type: none"> Works not discernible over ambient. Ambient noise levels controlled by local road traffic and occasional aircraft flyovers. Car passbys ranged between 55 dB(A) and 74 dB(A).
3	23:02	3	64	Not directly measurable: likely less than 40 dB(A)	48	44	<ul style="list-style-type: none"> Hydrema non-tonal reversing alarm just discernible but did not change noise L_{Aeq} noise level. Note that no works were occurring directly adjacent hence difference between measured and predicted noise levels. Distant traffic noise ranged between 42 dB(A) and 54 dB(A).

ID	Time	Duration (minutes)	Predicted L _{Aeq} (15 minute) dB(A)	Estimated (Measured) L _{Aeq} (15 minute) dB(A) Construction Noise	Measured L _{Aeq} (15 minute) dB(A) Total Noise	Measured L _{A90} dB(A) Total Noise	Comment
4A	22:44	3	N/A	Not directly measurable	50	45	<ul style="list-style-type: none"> Works not discernible over ambient. Ambient noise levels controlled by local road traffic and industry to the south of the station. Maximum traffic noise levels in the order of 57 dB(A) to 60 dB(A). No works were active in the section of the project.
5	22:12	15	N/A	Not directly measurable	49	46	<ul style="list-style-type: none"> Works not discernible over ambient. Ambient noise levels controlled by local road traffic and industry to the south of the station. Maximum traffic noise levels in the order of 57 to 60 dB(A). No works were active in the section of the project.
6	23:32	3	35 dB(A) or less	Not directly measurable	43	40	<ul style="list-style-type: none"> Works not discernible over ambient. Ambient noise levels controlled by distant road traffic in the order of 40 dB(A) to 45 dB(A).

ID	Time	Duration (minutes)	Predicted L _{Aeq} (15 minute) dB(A)	Estimated (Measured) L _{Aeq} (15 minute) dB(A) Construction Noise	Measured L _{Aeq} (15 minute) dB(A) Total Noise	Measured L _{A90} dB(A) Total Noise	Comment
7	17:09	15	44-46	46	56	42	<ul style="list-style-type: none"> Works just audible during lull in background noise levels. Not directly measurable estimated to be approximately 10 dB less than ambient. Car passbys ranged between 55 dB(A) and 74 dB(A).
8	21:00	1	-	-	-	-	<ul style="list-style-type: none"> Noise measurement to check Hydrema non-tonal reversing alarm at alternative location: Estimated to be 53 dB(A) at this location.
9	17:35	15	53	57-59	63	59	<ul style="list-style-type: none"> Works visible and discernible. Maximum levels resulted from car and aircraft flyovers. Car passbys ranged between 64 dB(A) and 75 dB(A). Maximum construction noise sources were the excavator and Hydrema. Short-term noise levels in the order of 59 dB(A) to 73 dB(A). Noise blankets observed to be effective on corridor fencing and around the lighting towers.

ID	Time	Duration (minutes)	Predicted L _{Aeq} (15 minute) dB(A)	Estimated (Measured) L _{Aeq} (15 minute) dB(A) Construction Noise	Measured L _{Aeq} (15 minute) dB(A) Total Noise	Measured L _{A90} dB(A) Total Noise	Comment
9	20:34	15	53	57-59	61	57	<ul style="list-style-type: none"> Works visible and discernible. Maximum levels resulted from car and aircraft flyovers. Maximum construction noise sources were the excavator and Hydrema. Short-term noise levels in the order of 60 dB(A) to 67 dB(A). Occasional use of rock hammer produced noise levels in the order of 59 dB(A). The rock hammer was not audible at a location approximately 30m in an easterly direction up Bridge Street (an aural assessment was conducted at this location on completion of the 15 minute measurement). The consultant returned to this location at 11pm. There was no rock hammer activity at this time. Constant noise level of 54 dB(A) from the lighting towers Noise blankets observed to be effective on corridor fencing and around the lighting towers.

Resonate

Acoustics • EMF • Structural Dynamics • Vibration

3.1 Hydrema Sound Power Level Check

The following noise measurements were conducted by Resonate and Fulton Hogan in order to confirm the sound power level of the Hydrema hi-rail vehicles:

- Idling at a distance of 7 m: 61 dB(A).
- Operation of the hydraulic systems at a distance of 7 m: 61 dB(A).
- Operation of the non-tonal reversing alarm at a distance of 20 m: 67 dB(A).

An updated sound power level of 102 dB(A) has been determined on the basis of the aforementioned noise levels and will be used in future construction noise assessments.

4 Summary and General Observations

In general, noise levels aligned with those predicted of for the works. The noise measurements confirmed that the noise mitigation implemented in accordance with the Construction Noise and Vibration Management Plan was appropriate. Whilst the use of a rock hammer was required for a short duration, the noise levels were not of sufficient magnitude to require additional mitigation measures over and above that which was implemented.

Please let me know if you have any queries or wish to discuss the above.

Yours sincerely,



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Table 5. Attended noise monitoring results – June 2022

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML1 NCA1	Location 1 – 225 Railway Parade, Cabramatta	Monthly Monitoring - Potential construction impacts vs ambient noise levels	23/6/2022 12:21	45	65	<p>Lmax – 80 dB (LV) Lmin – 43 dB L10 – 69 dB L90 – 48 dB</p> <p>No construction noise was audible from the monitoring location.</p> <p>In excess of 15 audible LVs passed the monitoring location per minute, over 3-5 seconds at 50-78dB.</p> <p>4 x buses were recorded turning off Railway Pde at 60-70dB, audible for 3-5 seconds each.</p> <p>3 x passing Sydney trains at 52-72dB over 10 seconds and 1 x freight train at 60-68dB over 30 seconds.</p> <p>2 x aircraft passing overhead at 58-65dB over 20 seconds.</p> <p>Constant traffic on nearby Cabramatta Rd maintained the lowest background level of 47dB.</p>

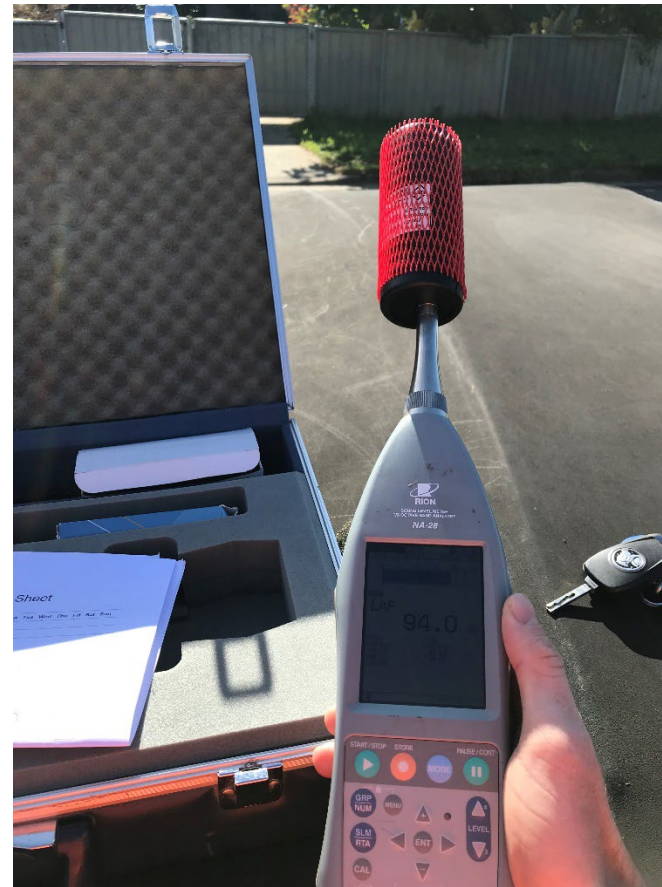
ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML2 NCA2	Location 2 – 150 Broomfield Street, Cabramatta	Monthly Monitoring - Potential construction impacts vs ambient noise levels	23/06/2022 11:50am	39	66	<p>Lmax – 87 dB (horn) Lmin – 44 dB L10 – 71 dB L90 – 48 dB</p> <p>Nearby drainage works involved trenching, backfilling and laying of drainage pipes on Broomfield St.</p> <p>Construction workers talking constantly at 46-53 dB</p> <p>3 x Sydney Trains at 50-53dB</p> <p>3 x aircraft at 47-50dB over 30 seconds</p> <p>2 x passing HVs at 55-68dB</p> <p>3 x occurrences of excavator digging at 68-73 dB over approx. 180 seconds.</p> <p>5 x LVs passing at ~55dB</p>

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML3 NCA3	Location 3 - Corner of Station Street and Lawrence Hargrave Road, Warwick Farm	Monthly Monitoring - check of background noise levels	23/06/2022 2:40pm	37	59	<p>Lmax- 73 Lmin- 40 L90- 44 L10- 64</p> <p>Aircraft- 12 x 47- 57, 59, jet 47- 55-58 Sydney trains - count 6 : 58-73 typical 63-66</p> <p>Freight train typical 63-, 59-66, 145secs</p> <p>Hume Hwy audible from 43-45, 46, 49, 53 Walkers talking - 51-62</p> <p>Birds in tree at LH School 45, 47, 52, 53-65</p> <p>Cars tooting horn at Peter Warren going up round ramp 4@10sec intervals - 47- 50 count 4</p> <p>Vehicles passing on Station St - 56, 66 69-63, 65, count 5</p> <p>No construction occurring at time of monitoring in the vicinity. All noise is attributable to background noise sources</p>

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML4 NCA4	Location 4 - Warwick Farm Station Car Park	Monthly Monitoring - check of background noise levels	23/06/2022 14:15	37	62	<p>Lmax: 79.4 Lmin: 43.6 L90: 48.1 L10: 67.3</p> <p>Sydney trains x 3 - 50-51-53- 57 doors closing beep alarm x 2- 58-62x 4-count 3 (5secs)</p> <p>Freight train - 78, typical 71. Range 66- 711 @ 120 sec</p> <p>Passing Aircraft - 50- 66- 71-72(typical 59+)</p> <p>Public announcements from Station 49-53 Hume Hwy bridge traffic provides dominant background noise source - constant 48-49-52</p> <p>Buses on other side of station contribute 59-61</p> <p>Construction or maintenance on Sydney Trains side of rail corridor approx 300m away - 49-51 intermittent</p> <p>No project related construction occurring at time of monitoring in the vicinity. The acoustic environment is dominated by the rail corridor trains.</p>
Spot check	JOR compound – Northern Laydown area	Test monitoring of piling rig	9/6/2022	N/A	N/A	Spot test indicated noise level at approximately 63dB during auguring.



Above: Test monitoring of piling rig on the 9th June 2022, weeks prior to works near the sensitive receivers at Sussex Street and along Broomfield Street.



Above: Calibrating the machine at 94 dB(A) before monitoring in June.

Table 6. Attended noise monitoring results – July 2022

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML1 NCA1	Location 1 – 225 Railway Parade, Cabramatta	Monthly Monitoring - Potential construction impacts vs ambient noise levels	27/07/22	45	66	<p>Lmax – 84 Lmin – 46 L10 – 69 L90 – 51</p> <p>Light vehicle traffic dominates the acoustics – almost a continuous stream of LVs: 58-72dB (for 3-5 secs) 2 buses audible form 58-76dB turning at Boundary Lane 1 aircraft: 53-55secs (30 secs) Sydney Trains: 55-72 dB (x2 for 10secs)</p> <p>No construction noise audible from monitoring location. All noise relevant to ambient conditions.</p>
NML2 NCA2	Location 2 – 150 Broomfield Street, Cabramatta	Monthly Monitoring - Potential construction impacts vs ambient noise levels	27/07/22	39	70	<p>Lmax – 90 Lmin – 61 L10 – 90 L90 – 72</p> <p>2 x Sydney Trains @ 52-63 6 x aircraft @ 65-78 Excavator idling @ 64-66 Excavator dig and load @ 66-69 Plant quacker @ 67-71 Concrete saw@ 65-68</p>

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML3 NCA3	Location 3 - Corner of Station Street and Lawrence Hargrave Road, Warwick Farm	Monthly Monitoring - check of background noise levels	27/07/22	37	59	Lmax – 74 Lmin – 46 L10 – 62 L90 – 49 No construction noise was audible during monitoring. Catchment noise dominated by LVs and passing Sydney trains + 1 x recorded freight train.
NML4 NCA4	Location 4 - Warwick Farm Station Car Park	Monthly Monitoring - check of background noise levels	27/07/22	37	56	Lmax – 76 Lmin – 46 L10 – 56 L90 – 50 No construction noise was audible during monitoring. 4 x overhead aircraft for 10-45secs @ 51-54dB. 7 x Syd trains passing/stopping (incl whistle) for 20-40secs @50-67dB. Hume Hwy constant @ 49-54dB. Birds (Lorikeets) constant @48-54dB.

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
Spot check	10 Sussex St, Cabramatta	Monitoring to determine potential noise impacts at most sensitive receiver during piling	26/7/22	N/A	62	<p>Lmax – 71 Lmin – 52 L10 – 65 L90 – 60</p> <p>4 x passing LVs @ 55-61dB 1 x overhead aircraft for 20 secs @ 59-65dB 6 x Syd trains for 10-15 secs @ 63-68dB Piling rig auguring in hole @ 60-63dB 2 x piling rig quacker for 3 secs @ 59-65dB Piling rig idling @ 52-54dB 3 x dog barks nearby @~60dB</p>
Spot check	10 Sussex St, Cabramatta	Monitoring to determine potential noise impacts at most sensitive receiver during piling break-back	27/7/22 12:19	N/A	58	<p>Lmax – 70 Lmin – 48 L10 – 61 L90 – 51</p> <p>1 x Passing heavy vehicle with beeper @ 52-55dB 6 x overhead aircraft for 30-45 secs @ 51-61dB 2 x Syd trains for 10 secs @59-65dB 1x small freight train for 16 secs @63-68dB Pile break-back for 80% of monitoring @55-61dB Excavator idling on RW10 pile @50dB</p>



Above: Spot check at 10 Sussex St during piling activities in July

Table 7. Attended noise monitoring results – August 2022

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML1 NCA1	Location 1 – 225 Railway Parade, Cabramatta	Monthly Monitoring - Assessment of potential noise impacts	31/8/22	45	64	Lmax – 86 Lmin – 45 L10 – 68 L90 – 50 Passing light vehicles and Sydney Trains dominant with aircraft and heavy vehicles. Passing LVs x >50 @62-72dB Passing HVs x 5@85dB Overhead aircraft for 30secs@53dB Sydney Trains 10-15secs@72dB Birds constant @ 52dB Car horn x 3@63dB
NML2 NCA2	Location 2 – 150 Broomfield Street, Cabramatta	Monthly Monitoring - Assessment of potential noise impacts	31/8/22	39	61	Lmax – 78 Lmin – 44 L10 – 66 L90 – 47 Kubota digger moving topsoil close by monitoring location. Sydney Train x 2 for 10-20secs each@58dB Excavator for 10secs@60-70dB x 2 Movement quacker @76dB for 20secs

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML3 NCA3	Location 3 - Corner of Station Street and Lawrence Hargrave Road, Warwick Farm	Monthly Monitoring - Assessment of potential noise impacts	31/8/22	37	64	Lmax – 86 Lmin – 45 L10 – 68 L90 – 50 Passing LVs@72dB for 6-10secs Passing HVs@ 70-86dB for 6secs Overhead aircraft@50dB for 30secs Sydney Trains x 3@ 74dB for 10secs Freight Train x 1@75dB Hume Hwy constant @ 48dB Birds constant @54dB
NML4 NCA4	Location 4 - Warwick Farm Station Car Park	Monthly Monitoring - Assessment of potential noise impacts	31/8/22	37	52	Lmax – 67 Lmin – 41 L10 – 55 L90 – 47 Aircraft x 3@55-60dB for 30secs Sydney Trains x 2 for 10-20secs@55-65dB Hume Hwy constant @ 47-50 dB Birds & general background noise 47-52 constant



Above: Attended monitoring at 225 Railway Pde, Cabramatta (NML1)



Above: Attended monitoring at 150 Broomfield St, Cabramatta (NML2) during August.

Table 8. Attended noise monitoring results – September 2022

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML1 NCA1	Location 1 – 225 Railway Parade, Cabramatta	Monthly Monitoring - Assessment of potential noise impacts	2/09/2022	45	63	Lmax – 82 Lmin – 47 L10 – 67 L90 – 51 Pre-WE10 Possession Friday afternoon Light vehicles on Station St and Junction Ln dominate the acoustic environment with Sydney Trains Passing LVs@98 - 57-68dB 3x buses turning @Boundary Ln-67-82@10 secs Overhead aircraft@52-65 for approx 40secs Sydney Trains x 5@54-72, typically 67 - for 15-20 secs each Cabramatta Rd East traffic on bridge is constant @49-53 Lorikeets impulsive on and off @ 48-58dB Quacker form plant in Broomfield barely audible x 2 for 5secs each time @49-53 Possibly a roller audible for 10secs@51dB
NML2 NCA2	Location 2 – 150 Broomfield Street, Cabramatta	Monthly Monitoring - Assessment of potential noise impacts	2/09/22	39	57	Lmax – 88 Lmin – 46 L10 – 58 L90 – 49 Pre-WE10 Possession Friday afternoon. Piling work inaudible. 2 excavators working on drainage dominant and one tiny digger doing pathway trimming on corner of Boundary Lane audible when movement alarm is on. Mynah birds constantly on & off - 53-55/58-61dB Excavator quackers dominant when moving (frequently): 53-55/ 59-61/ 58-60, 57-62dB Worker voices 15secs @ 49-51dB Steel road plate dropping on asphalt (max) - 87dB 1Sec Postie bike deliveries@60-63, 10Secs Residents animated discussion at 148 Broomfield, 60secs - 54-60

ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML3 NCA3	Location 3 - Corner of Station Street and Lawrence Hargrave Road, Warwick Farm	Monthly Monitoring - Assessment of potential noise impacts	2/9/22	37	60	<p>L_{max} – 77dB L_{min} – 46dB L₁₀ – 68dB L₉₀ – 50dB</p> <p>Pre-WE10 Possession Friday Evening. 1 excavator visible working on stockpile in JOR but inaudible Passing LVsx 2@57-59dB for 5-7secs Aircraft x 2@48-50 & 58-76dBfor 20 &46secs Sydney Trains@53-73 x 5 1 Freight Train @ 60-73 for 44secs Hume Hwy constant @ 48-60dB, typically 53-55 Mynah and lorikeet birds constantly on & off 49-57 & 54 - 61dB No construction noise audible- all noise attributable to background noise levels.</p>
NML4 NCA4	Location 4 - Warwick Farm Station Car Park	Monthly Monitoring - Assessment of potential noise impacts	2/9/22	37	52	<p>L_{max} – 67 L_{min} – 46 L₁₀ – 54 L₉₀ – 48</p> <p>Pre-WE10 Possession Friday afternoon. No construction work in this area. Sydney Trains x 4@50-60dB for up to 60-75secs each dominate acoustics and platform noises such as door opening alarms and platform announcements @ 49, 54-60dB Hume Hwy is constant @46, 48-51, 54dB Birds constant on & off@48-63dB. All noise attributable to background noise - no construction audible or occurring in this location</p>

ID#	LOCATION	Reason for monitoring	Date / Time	L(A) _{eq(15min)}	Comments
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	2/09/2022 21:37	59dB(A)	<p>Lmax – 81 dB Lmin – 44 dB L10 – 58 dB L90 – 47 dB</p> <p>Pre-WE10 background monitoring – No work yet. Passing vehicles overhead on Cabramatta Rd rail overbridge is the dominant noise contribution in the catchment along with frequent Sydney Trains. Passing light vehicles (8) audible from 54-63dB (5secs). Bridge traffic audible from 49-62 (truck), typical: 55-57 dB (generally continuous). Sydney Trains (x4) frequently audible from 54-62dB. Doors closing alarm @ 50-53 and Cabramatta Train Station platform announcements @ 48-51dB Max contribution from overhead helicopter @51-78 (x2 for approx. 45secs each)</p> <p>No construction noise was audible at the time of monitoring. All noise is attributable to background noise sources</p>
NML2	Location 2 – 150 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	2/09/2022 22:01	51dB(A)	<p>Lmax – 67 dB Lmin – 40 dB L10 – 53 dB L90 – 42 dB</p> <p>Pre-WE10 background monitoring – No work yet. Overhead aircraft and Sydney Trains dominate the acoustic catchment during the monitoring period. Passing Light vehicles audible from 46-61dB (x2) Sydney Trains Passing Sydney Trains (x4) audible 46-63dB tailing off over 30secs Overhead aircraft including helicopters (x5): 46-65dB (duration 15s, 35s, 90sec, 100secs)</p> <p>No construction noise was audible at the time of monitoring. All noise is attributable to background noise sources</p>

ID#	LOCATION	Reason for monitoring	Date / Time	L(A) _{eq(15min)}	Comments
N/A	108-110 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	2/09/2022 22:29	60dB(A)	<p> Lmax – 81 dB Lmin – 39 dB L10 – 62 dB L90 – 44 dB Public traffic on Cabramatta Road bridge dominates the background acoustic environment along with frequent Sydney Trains. Max noise (81dB) due to freight train passing northbound @ 22:35 for 160secs. 50T mobile crane observed arriving to Cabramatta Station with 3 minutes remaining in the monitoring period, idling engine barely perceptible @ 44-45dB (180secs) Sydney Trains (x6) audible between 54-63dB, Northbound Freight Train: 48-81. Locomotives loud for short duration @ 79-81. Carriages 61-65dB Passing Light vehicles (x12) audible from 51-58dB Emergency sirens (x2) @ 58dB for 30secs Arrival of Mobile Crane – acoustic contribution: 44-45 dB vs PNL (55dB). </p> <p> Only 3 minutes of crane truck idling representative of construction noise audible at the time of monitoring. This noise was not discernible as construction related. Noise record only available as crane was visible on arrival, otherwise I wouldn't have known based on noise alone. </p>

ID#	LOCATION	Reason for monitoring	Date / Time	L(A) _{eq(15min)}	Comments
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	2/09/2022 23:55	56dB(A)	<p>Lmax – 76 dB Lmin – 48 dB L10 – 58 dB L90 – 50 dB</p> <p>Public traffic on Cabramatta Road bridge dominates the background acoustic environment along with frequent Sydney Trains. Sydney Trains (x5) audible between 53-63dB (approx. 20-25 secs each) Cabramatta Road traffic audible frequently 52-58dB, typical 55-58dB. 50T mobile crane audible @ 49-54dB with idling typical @ 50-51dB. Crane revving as boom goes up audible @ 55-58dB (4s / 10secs) Lighting tower engine barely perceptible behind noise panels – difficult to determine any contribution to perceived crane idling noise. FCC street sweeper on Station St @ 58-63dB (120secs) dominates the acoustics whilst in operation Tree leaves rustling in wind: 52-53 dB (on & off throughout) Traffic Management voices: 52-54dB (5-10secs x 3)</p>
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	3/09/2022 00:23	56dB(A)	<p>Lmax – 72 dB Lmin – 52 dB L10 – 57 dB L90 – 54 dB</p> <p>Very similar to last recording. Public traffic on Cabramatta Road bridge dominates the background acoustic environment along with frequent Sydney Trains. 50T mobile crane audible up to 55dB for short periods with idling typical @ 50-51dB. Lighting tower engine not perceptible behind noise panels –Passing light vehicles: 56-72dB</p>

ID#	LOCATION	Reason for monitoring	Date / Time	L(A) _{eq(15min)}	Comments
N/A	108-110 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	3/09/2022 01:35	54dB(A)	Lmax – 76 dB Lmin – 40 dB L10 – 53 dB L90 – 42 dB Construction noise is dominant along with regular Sydney Trains and overhead helicopters (accounting for max). Sydney Trains (x2) audible: 46-61dB (approx. 30s) 50T mobile crane audible idling: 42-44dB. Lighting tower engine not perceptible behind noise panels & noise from within rail corridor – excavator operating on SSFL at WF3Loc base work area 42-45dB for 5-10sec periods infrequently, difficult to hear.
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	3/09/2022 02:45	52dB(A)	Lmax – 69 dB Lmin – 47 dB L10 – 53 dB L90 – 49 dB Construction noise is dominant. 50T mobile crane audible idling: 49-53dB under max load lifting drill rig into rail corridor. 2 short periods of higher revs during the lift: 56-59dB for around 5secs each. Lighting tower engine not perceptible behind noise panels & noise from within rail corridor – excavator & hydrema operating on SSFL at WF3Loc base work area 51-54dB. Leaves blowing in trees on Cabramatta Rd: 52-53dB on & off throughout the period.
NML1	Location 1 – 225 Railway Parade, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	3/09/2022 04:10	55dB(A)	Lmax – 72 dB Lmin – 38 dB L10 – 56 dB L90 – 40 dB No construction noise associated with the ER approval for enabling work is audible from this location. Excavator is barely perceptible and dominant noise is light vehicles passing on Boundary Road and two passings of hydrema on rail 47-56dB (30-40secs)

ID#	LOCATION	Reason for monitoring	Date / Time	L(A) _{eq(15min)}	Comments
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	3/09/2022 16:56	60dB(A)	<p>Lmax – 73 dB Lmin – 53 dB L10 – 63 dB L90 – 56 dB</p> <p>Construction noise is audible during quieter periods of urban noise, but Cabramatta is busy with lots of local traffic on Broomfield St and Cabramatta Rd as well as Sydney Trains increased frequency of service dominating the monitoring period.</p> <p>Sydney Trains (x7) audible between 59-66dB (between 13-30 secs each) Cabramatta Road bridge traffic – constant between 55-66dB Overhead aircraft: 58-69dB Passing light vehicles on Broomfield St (x32): 53-69dB (3-5secs each) 50T mobile crane audible revving under load retrieving plant from SSFL: 59-63dB – typically 62 for 30secs. Crane slewing: 56-58dB & spooling down 57-59dB 120secs. Note: Crane Departed site 17:40 – inaudible against traffic Parrots in trees on Cabramatta Rd: 54-63dB on & off throughout the period. Plant operations inside SSFL at WF3Loc work area include compactor plate : 59-61dB; quacker on moving Hydrema: 57-62dB</p>
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	4/09/2022 11:50	63dB(A)	<p>Lmax – 78 dB Lmin – 55 dB L10 – 65 dB L90 – 58 dB</p> <p>Construction noise is audible during quieter periods of urban noise, but Cabramatta is busy with lots of local traffic on Broomfield St and Cabramatta Rd as well as v frequent Sydney Trains services dominating the monitoring period.</p> <p>Sydney Trains (x5) audible between 59-65dB (between 25-30 secs each) Cabramatta Road bridge traffic – constant between 56-67dB Overhead aircraft (lear jet): 64-78 dB (max) Passing light vehicles on Broomfield St (x36): 59-70dB (3-5secs each) Parrots in trees on Cabramatta Rd: 58-61dB on & off throughout the period. Plant operations inside SSFL at WF3Loc work area include quacker: 57-60dB. Concrete boom arrival (imperceptible against traffic) Concrete agitator truck arrival: 58-60dB, idling 57-58dB (120secs) Agi high rev spinning: 70-72dB (7 secs)</p>

ID#	LOCATION	Reason for monitoring	Date / Time	L(A) _{eq(15min)}	Comments
N/A	98-100 Broomfield Street, Cabramatta	WE10 possession monitoring – Assessment for potential noise impacts	4/09/2022 12:10	61dB(A)	<p>Lmax – 79 dB Lmin – 55 dB L10 – 62 dB L90 – 57 dB</p> <p>Construction noise is audible in between periods of urban noise, but Cabramatta is busy with lots of local traffic on Broomfield St and Cabramatta Rd as well as frequent Sydney Trains services & overhead aircraft dominating the monitoring period. Sydney Trains (x4) audible between 59-67dB between 25-30 secs each Train horn (77-79dB max) Cabramatta Road bridge traffic – constant between 56-67dB Overhead aircraft: 56-77 dB (approx. 25secs each) Passing light vehicles on Broomfield St (x33): 55-63dB (3-5secs each) Parrots in trees on Cabramatta Rd: 58-64dB (truck) constant throughout the period. Plant operations inside SSFL at WF3Loc work area include quacker: Concrete agi & pump discharging via boom: 57-60dB audible but not intrusive against background. Cab Rd & local traffic is more dominant. Concrete agitator truck finish discharge 0 quick spin of bowl 2-3secs@ 68-69dB. 1 agi pour completed in 12:05mins</p>



Above: Monitoring during WE10 possession on the 2nd September 2022

Table 9. Attended noise monitoring results – October 2022

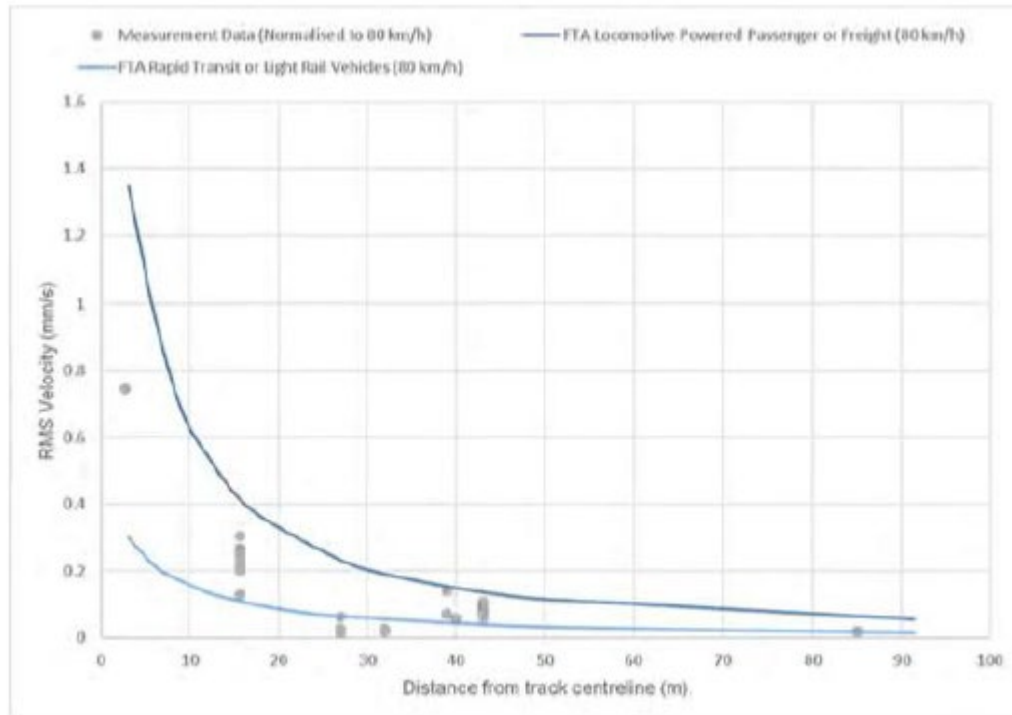
ID# / NCA	Location	Reason for monitoring	Date/Time	RBL dB(A)	L(A) _{eq(15min)} dB(A)	Comments
NML1 NCA1	Location 1 – 225 Railway Parade, Cabramatta	Monthly Monitoring - Assessment of potential noise impacts	28/10/2022	45	64	Lmax – 79 Lmin – 43 L10 – 69 L90 – 45 Construction noise from Broomfield St inaudible. The acoustic catchment is dominated by passing light vehicles (>100) @ 54-77dB, buses (x5) @ 53-78dB and Sydney Trains (x 2) @ 53-73dB
NML2 NCA2	Location 2 – 150 Broomfield Street, Cabramatta	Monthly Monitoring - Assessment of potential noise impacts	28/10/22	39	72	Lmax – 89 Lmin – 51 L10 – 70 L90 – 55 2 excavators working close by monitoring location removing old drainage pipe and backfill with construction of piling pad underway and piling ongoing to the south. Street sweeper in operation at close proximity to monitoring location during the period on two occasions, affects the Leq. Street sweeper@ 63-88 Approx 240secs Excavator incl clanging buckets @ 60-68dB Truck being loaded @ 55-62-66dB (60secs) Excavator backfilling trench & roller compacting backfill – 62-66dB (120secs) Sydney Trains x 3 for 10-15secs each@58-62dB Constant music from residential neighbour@ 55-56 (min)
NML3 NCA3	Location 3 - Corner of Station Street and Lawrence Hargrave Road, Warwick Farm	Monthly Monitoring - Assessment of potential noise impacts	28/10/22	37	59	Lmax – 74 Lmin – 45 L10 – 58 L90 – 48 Construction noise not audible. All noise relates to ambient conditions including Sydney Train (x 4 @ 60-74dB) and Hume Hwy constant typically@ 47-49dB Overhead aircraft @ 50-53 (x2)@30secs) Tree leaves blowing in wind frequent @ 50-55dB Passing light vehicles (x5)@55-65dB (5-8secs)

NML4 NCA4	Location 4 - Warwick Farm Station Car Park	Monthly Monitoring - Assessment of potential noise impacts	28/10/22	37	65	Lmax – 81 Lmin – 48 L10 – 71 L90 – 52 Construction noise not audible. No work in this area. All noise relates to ambient conditions
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5. Vibration Monitoring Results

Baseline Vibration Monitoring

During the EIS assessment in 2018, attended and unattended vibration monitoring was undertaken within and outside the rail corridor. The results of the monitoring indicated 4-5 mm/s peak vibration levels 6 metres from the railway tracks and levels between 0.1 mm/s and 0.3 mm/s at the residence (150 Broomfield Street, 31 metres from the SSFL). The vibration environment was dominated by road traffic noise and intermittent rail passbys. The measured vibration levels from train passbys as presented in the EIS is shown in Figure 2. The Construction Noise and Vibration Plan commits to monitoring to confirm that works occur outside of the minimum working distances and to ensure consistency with the approved level of anticipated impacts.



Above: Excerpt from EIS - Figure 2: Baseline Vibration Monitoring Data

Vibration Management

Construction vibration criteria are detailed in the approved Construction Noise and Vibration Management Plan (CNVMP) and have been adopted from the following sources, consistent with the EIS:

- Cosmetic and structural damage to heritage buildings: German Standard DIN 4150-31
- Human comfort: British Standard BS 6472-12 and BS 6472-23
- Human comfort: Assessing Vibration – a technical guideline (the Guideline).
- Ground-borne noise, that is ground vibration re-radiated as noise internally within a building, has also been assessed against the requirements of the ICNG.

The project aims to achieve compliance with the following accepted parameters and well established construction vibration criteria:

- for structural damage to heritage structures, the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration - effects of vibration on structures:

Type of Structure	Peak Particle Velocity (PPV) mm/s			
	Vibration at the foundation at a frequency of:			Vibration of horizontal plane of highest floor at all frequencies
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz ¹	
Structures that are particularly sensitive to vibration, e.g. heritage-listed structures.	3	3 to 8	8 to 10	8

(1) For frequencies above 100 Hz, the maximum values specified in this column shall be applied.
Values referred to are at the base of the building

Above: Excerpt from CNVMP Table 12: Structural Damage Criteria – Heritage Structures

- for damage to other buildings and/or structures, the vibration limits set out in the British Standard BS 7385-2:1993 - Evaluation and measurement for vibration in buildings - Guide for measurement of vibration and evaluation of their effects on buildings (and referenced in Australian Standard 2187.2 – 2006 Explosives – Storage and use – Use of explosives).

Line (see Figure 3)	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4 to 15 Hz	15 Hz and above
1	Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
2	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	

Notes 1. Values referred to are at the base of the building
 2: For line 1, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

Above: Excerpt from CNVMP Table 13: Transient Vibration Guide Values for Cosmetic Damage

■ for human exposure, the acceptable vibration values set out in Environmental Noise Management Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006).

Building type	Preferred VDV (m/s ^{1.75})	Maximum VDV (m/s ^{1.75})
Residential daytime (7am-10pm)	0.20	0.40
Residential night-time (10pm-7am)	0.13	0.26
Offices, schools, educational institutions and places of worship (day and night-time)	0.40	0.80

Above: Excerpt from CNVMP Table 14: Acceptable Vibration Dose Values for Intermittent Vibration

All plant selection during construction has been guided by the safe working distances established detailed in Table 25 of the CNVMP below:

Plant item	Rating / Description	Safe working distance, m					
		Cosmetic damage			Human response		
		Heritage structure	Residential structure	Commercial / industrial	Residence – night	Residence – day	Educational
Vibratory roller	<50 kN (typically 1-2t)	7	5	2	25	15	10
	<50 kN (typically 2-4t)	9	6	2	35	20	13
	<50 kN (typically 4-6t)	22	12	5	65	40	25
	<50 kN (typically 7-13t)	27	15	6	140	110	65
	<50 kN (typically 13-18t)	36	20	8	170	140	70
	<50 kN (typically >18t)	45	25	10	170	140	75
Handheld compactor	Up to 300 kg	7	5	2	30	20	12
Small hydraulic hammer	300 kg – 18-34t excavator	3	2	–	10	7	5
Medium hydraulic hammer	1600 kg – 5-12t excavator	12	7	3	35	23	15
Large hydraulic hammer	1600 kg – 12-18t excavator	30	22	9	100	73	45
Bored piling	< 800 mm	3	2	–	7	4	2
Excavation works	12-18t excavator	3	2	–	15	10	7
Jackhammer	Handheld	2	1	–	5	–*	–*

Above: Excerpt from CNVMP Table 25: Vibration Safe Working Distances

Construction Monitoring:

Construction monitoring was performed during the reporting period utilising the following equipment:

- Equipment: Ground Vibration Monitor
- Manufacturer: Svantek
- Meter type: Svan-958A
- Date of calibration: 9/3/22

Summary:

No vibration complaints regarding property damage or human exposure were received during the reporting period and no vibration limit exceedances were recorded during the period. Vibration monitoring was carried out at the commencement of vibratory compaction work and piling adjacent the heritage listed brick arch bridge to ensure that vibration levels specified in the CNVMP were not exceeded and to confirm safe working distances were appropriate. Attended monitoring observations were consistent with the EIS findings with rail related vibration dominant for short durations associated with train movement across the brick arch bridge and little to no vibratory impact being detected at residential properties. This was particularly evident during pile construction with the excavation representing a continuous activity in clay soils with bedrock between 12-20 metres below ground level, registering minimal vibratory impact as opposed to the peaks recorded by the monitoring equipment which coincided with the routine passing of rolling stock.

Monitoring was undertaken at a number of potentially sensitive receiver locations whilst piling and vibratory rolling activities were being performed in Sussex and Broomfield Streets throughout the reporting period. Monitoring consisted of a number of trials, attended and non-attended vibration monitoring events for activities involving vibratory compaction for pavements and piling for structures. For the majority of pavement works, the construction methodology excluded the use of vibration, utilising heavy static rollers with no vibration and additional passes to achieve the specified compaction. Aside from these activities, no other vibration generating works were performed by the construction team during the monitoring period.

Representative vibration data samples are presented in the graphs below with site photos. Overall, vibration monitoring data was within vibration guidelines outlined in the project construction noise and vibration management plan. Any notable spikes in monitoring of the Station Street bridge were attributed to passing Sydney trains and freight rolling stock. Vibration resulting from compaction rollers remained below guidelines during trials and pavement construction, providing confidence that work activities have been performed by conservatively sized equipment at appropriate safe operations distances from sensitive receivers in accordance with the project CNVMP.

LOCATION: Heritage Bridge at Station Street

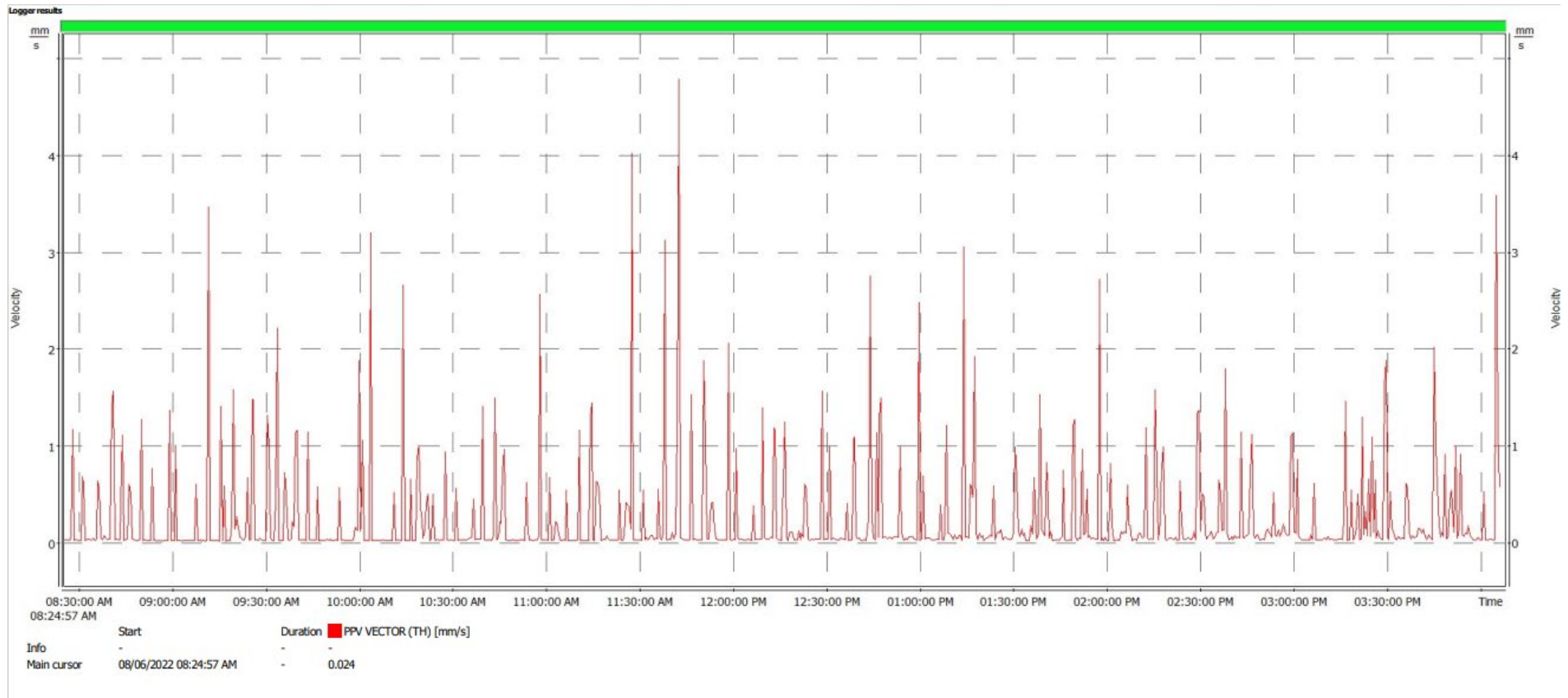
ACTIVITY: Piling for Cabramatta Creek bridge – 8th June 2022



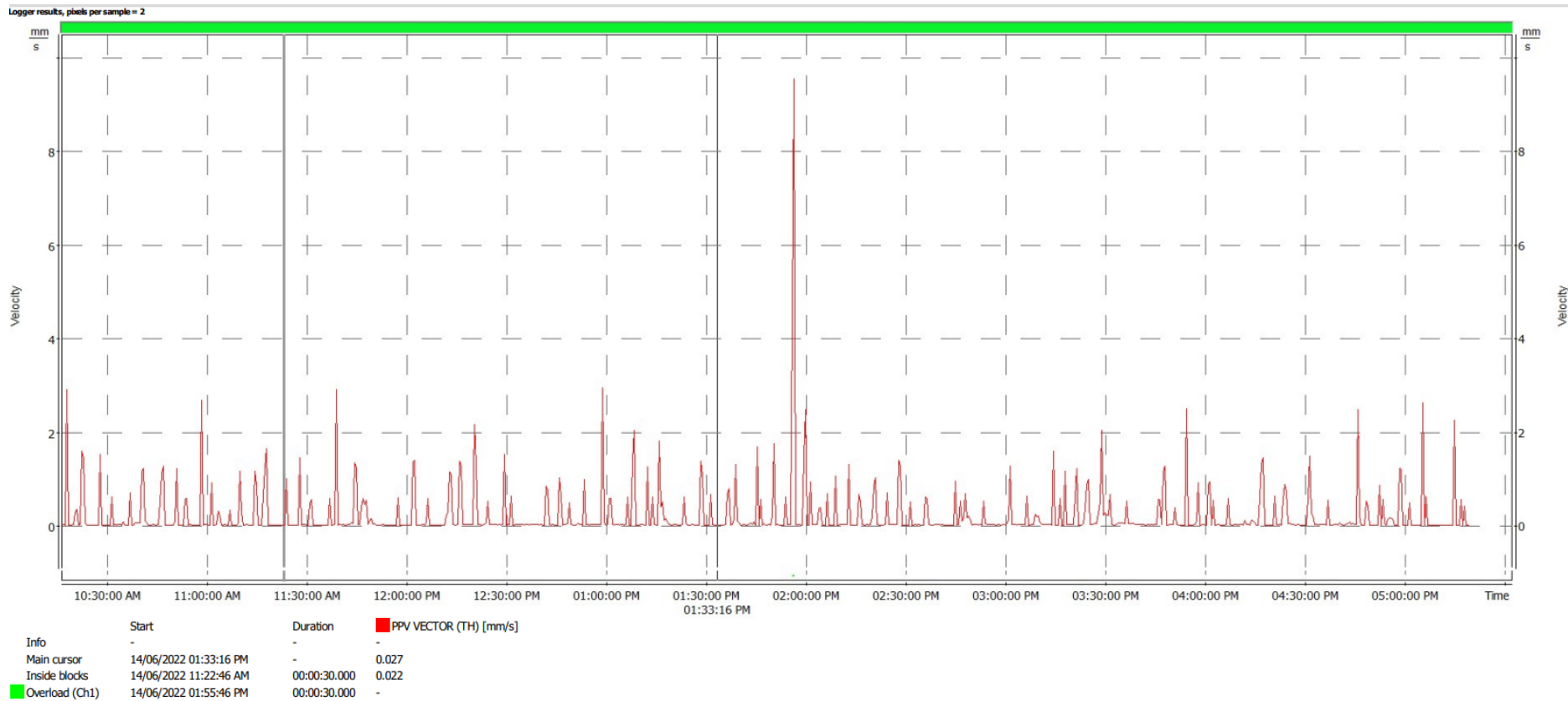
Above: Monitoring setup of the heritage bridge that carries Sydney Trains. The device was firmly strapped to the pylon during monitoring.



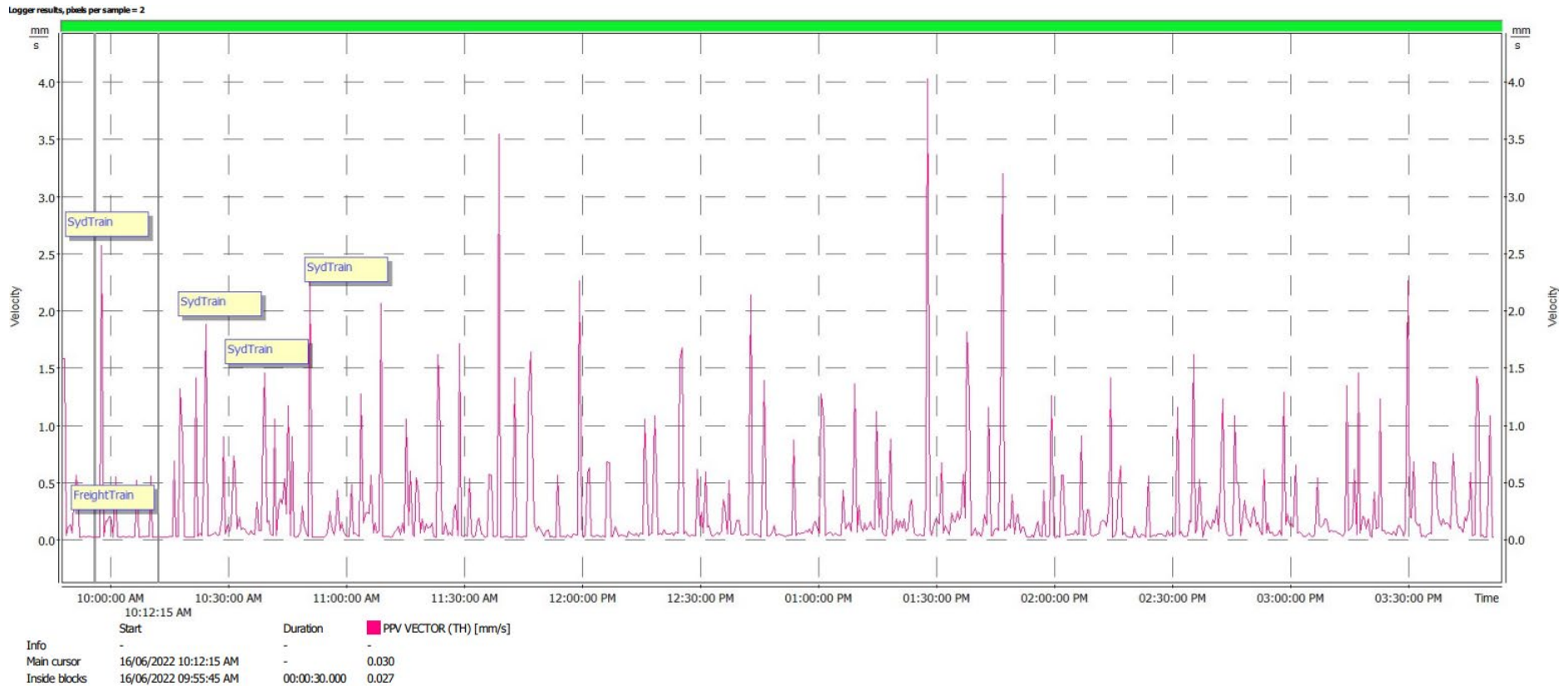
Above: Typical piling activity during monitoring in June. Piling progressed northward over the course of the month.



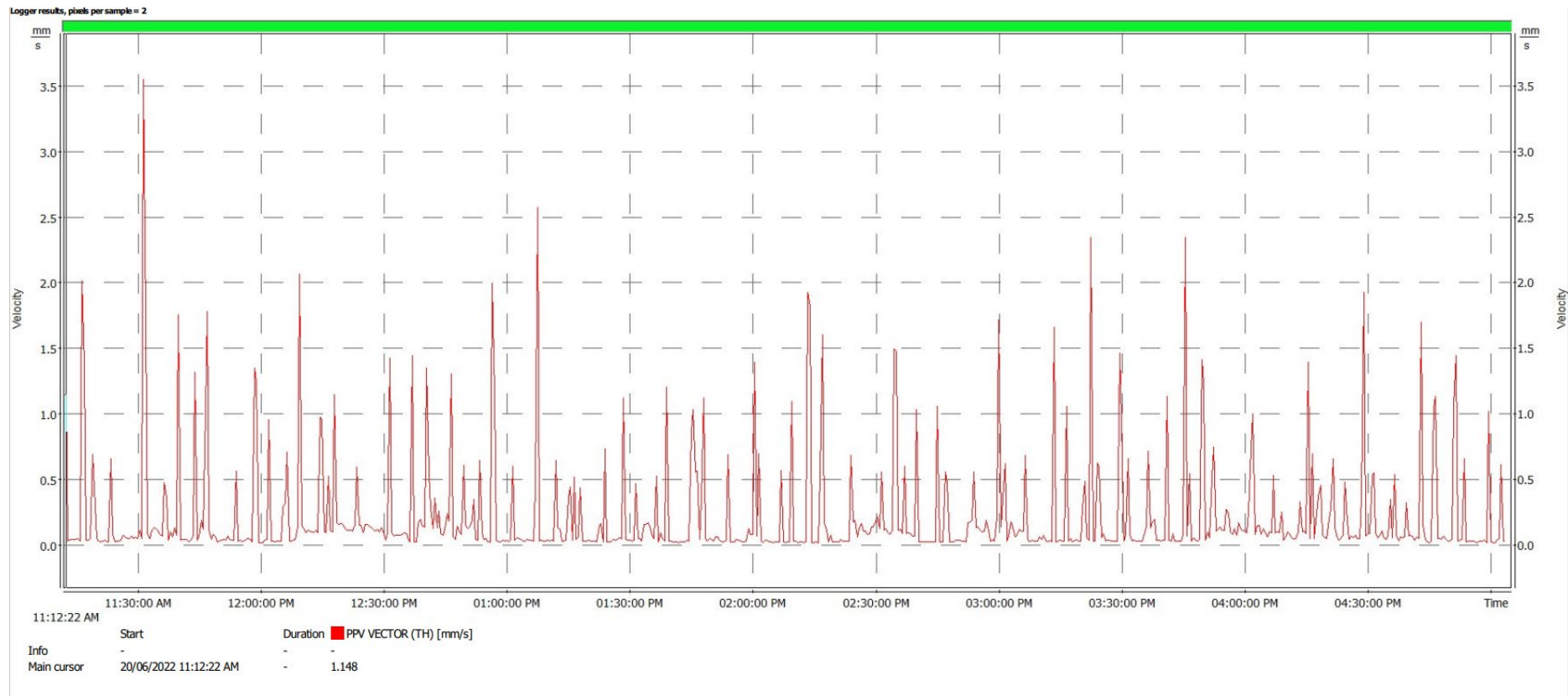
Above: Results from monitoring over 7hrs during piling at Station Street bridge on the 8th June 2022. Large and medium spikes represent the frequently passing Sydney passenger trains and SSFL freight trains. Velocity peaked at ~4.8mm/s during monitoring. The vibration from nearby piling activity was not discernible.



Above: Monitoring of the Station St heritage bridge over ~7hrs during piling on the 14th of June 2022. Velocity peaked at ~8.8mm/s.



Above: Attended monitoring of the Station St arch bridge on the 16th June 2022 confirmed that the spikes in velocity are attributable to passing commuter trains – predominantly Sydney trains travelling across the bridge at moderate speeds appear to cause more vibration than the heavier, but significantly slower freight trains. Both forms of rolling stock present considerably more vibration on the bridge structure in comparison to the piling activity and this is attributable to the geology of the piling location with heavy clays comprising the bulk of the excavation with bedrock some 16-20 m below the structure.



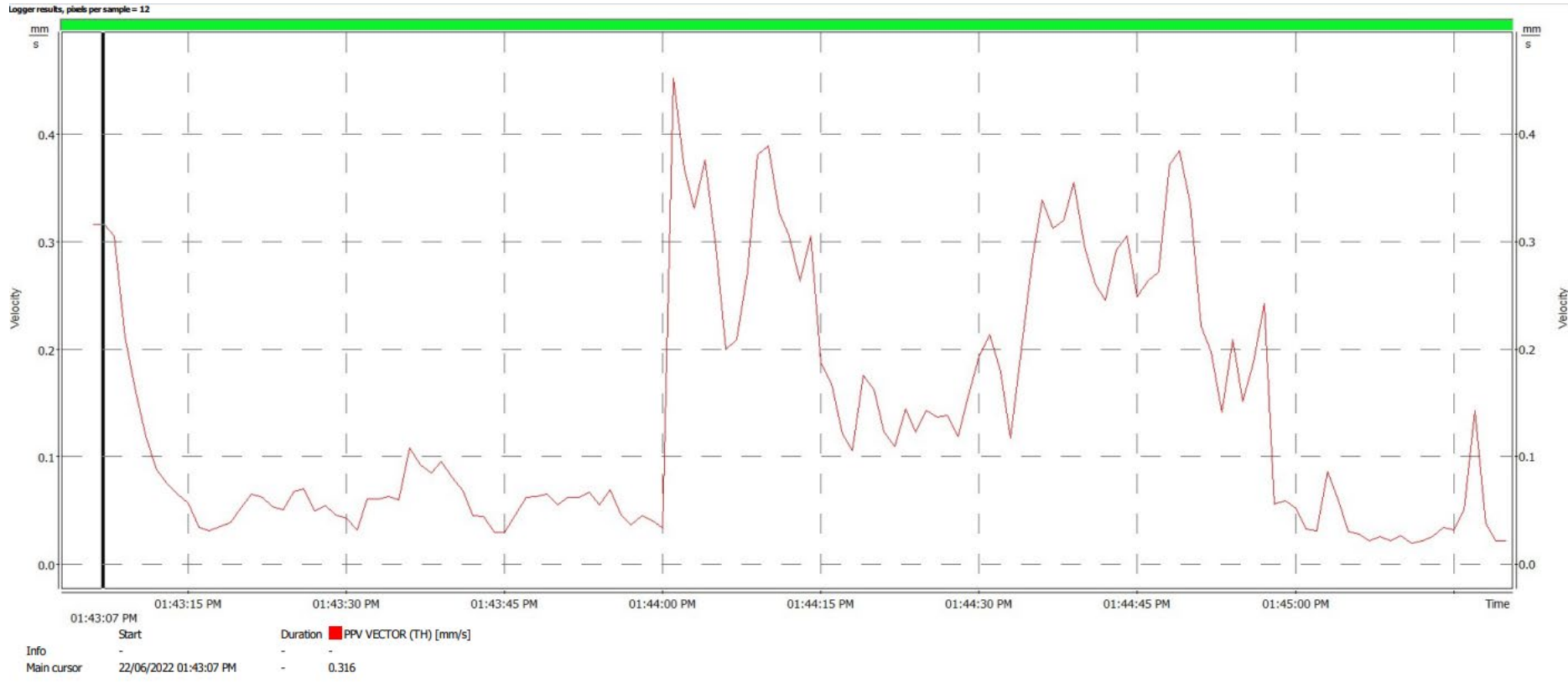
Above: Further monitoring data of Station St bridge during piling on the 20th of June 2022. Spikes and velocity is consistent with previous monitoring results.

LOCATION: 172 Broomfield Street, Cabramatta

ACTIVITY: Compaction of backfill material using a 12T vibration roller (Stage 1 works) – 22nd June 2022



Above: Monitoring at 172 Broomfield St during compaction rolling.



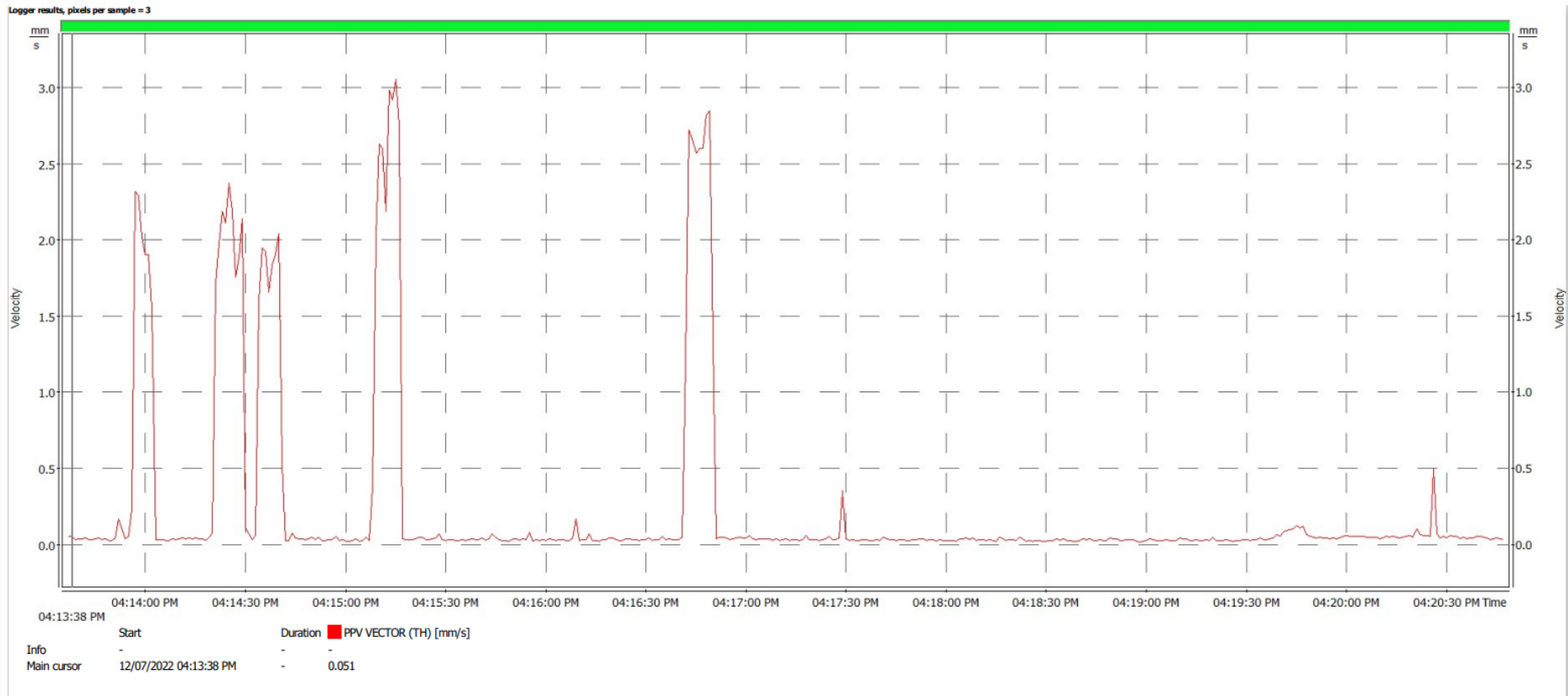
Above: Vibration monitoring of compaction roller at 172 Broomfield St on 22nd June 2022. Velocity peaked at 0.45mm/s.

LOCATION: 168 Broomfield Street, Cabramatta

ACTIVITY: Compaction of backfill material using a 12T vibration roller (Stage 1 works) – 12th July 2022



Above: Monitoring of 12T vibration roller at 168 Broomfield St on the 12th July 2022.



Above: Results from monitoring at residential property in Broomfield St. The peak velocity reached 3mm/s during maximum vibration.

LOCATION: 170 Broomfield Street, Cabramatta

ACTIVITY: Compaction of backfill material using a 12T vibration roller (Stage 1 works)



Above: Monitoring at 170 Broomfield St on July 12th 2022 during compaction rolling.

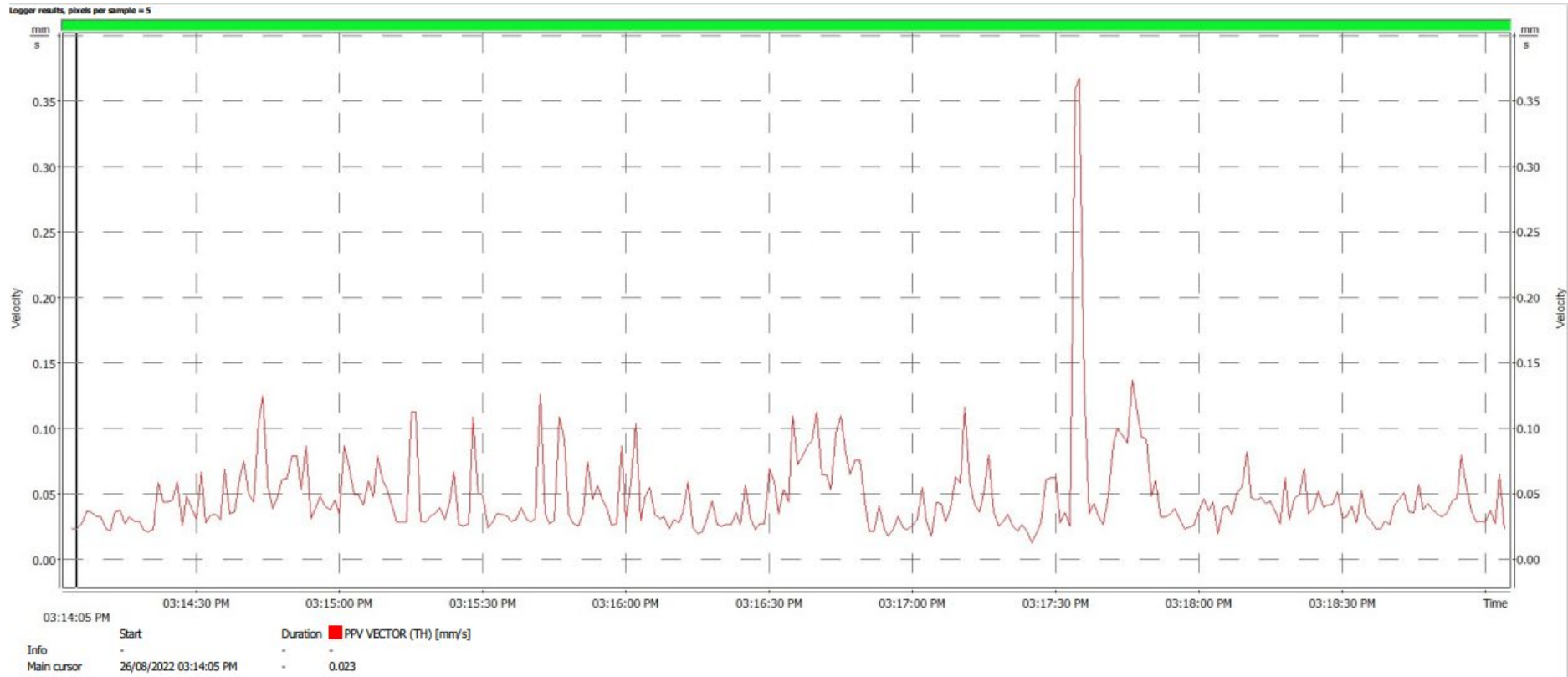


Above: Monitoring results from 170 Broomfield Street on the 12th July 2022. Vibration peaked at 2.5mm/s.

LOCATION: 10 Sussex Street, Cabramatta

ACTIVITY: Piling for Sussex Street bridge – 26th August 2022



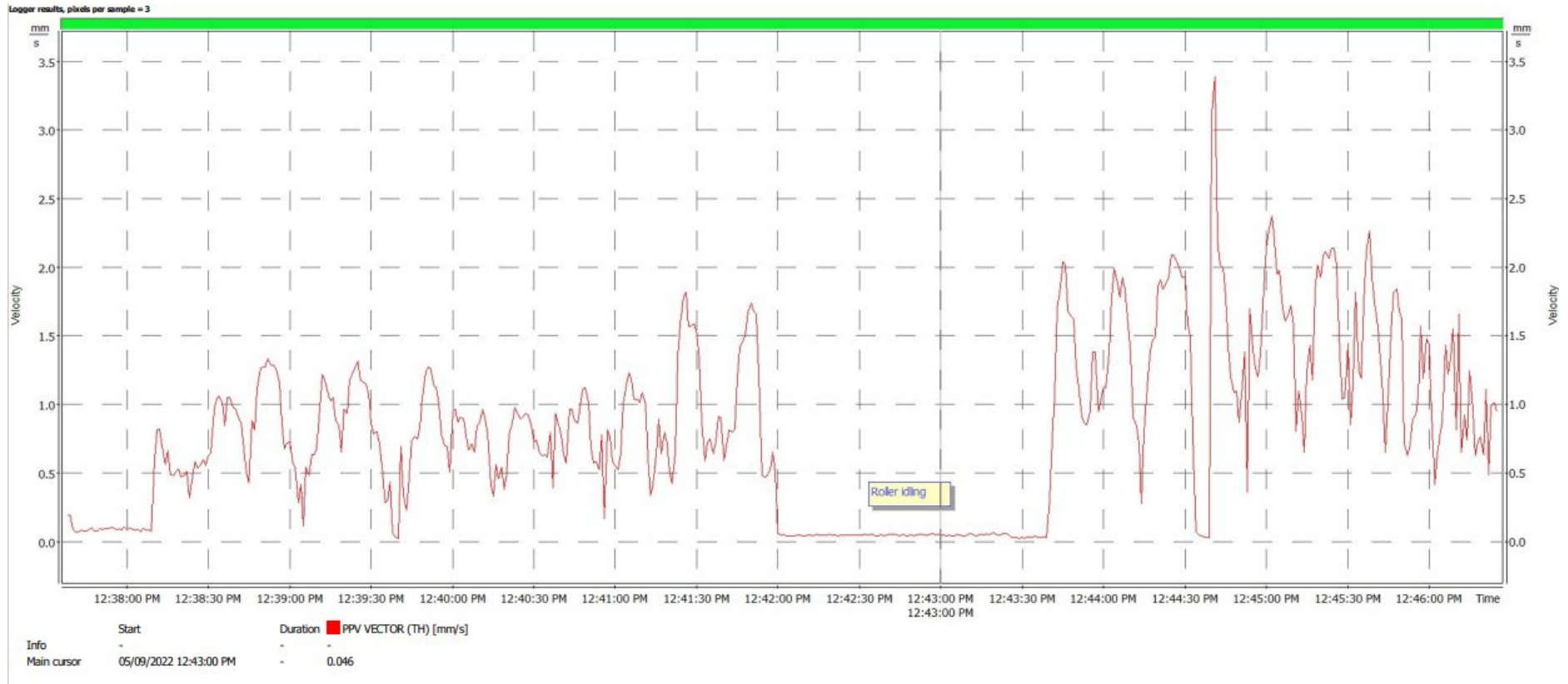


Above: Attended monitoring results of piling at Sussex Street bridge on the 26th August 2022. Velocity peaked at 0.35mm/s.

LOCATION: 124 Broomfield Street, Cabramatta

ACTIVITY: Compaction of backfill material using 6T roller (Stage 2 works) – 5th September 2022





Above: Attended monitoring results of compaction rolling at 124 Broomfield Street on the 5th of September 2022. Velocity peaked at ~3.4mm/s during monitoring.