Fort Street Public School

Acoustics Report

Construction Noise and Vibration Management Sub-Plan

Prepared for: Lendlease

Attention: Christine Eberl

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Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	4/12/2020	Draft issue	James Ashpole	Meisha Stevens
002	21/12/2020	Updated as per comments	James Ashpole	Meisha Stevens
003	13/04/2021	Updated community consultation program	James Ashpole	Meisha Stevens
004	15/04/2021	Update as per comments	James Ashpole	Meisha Stevens
005	28/04/2021	Responses to community consultation program	James Ashpole	Meisha Stevens

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Contents

Contents

1. Introduction

Stantec have been engaged by Lendlease Building Pty Ltd to prepare a Construction Noise and Vibration Management Plan (CNVMP) for the proposed construction works at Fort Street Public School located at observatory Hill, Upper Fort St, NSW 2000.

This report addresses the requirements established by the City of Sydney Council and NSW Department of Planning, Industry, and Environment for the grant of the construction certificate allowing the work on site to commence.

The works are to be split into three periods which are:

- Demolition
- Excavation
- Structure/ Construction

Certain tasks will be carried out concurrently with other tasks for particular time periods that are significant in duration. In a given combination of events, the noise emitted by performing the tasks simultaneously will be considered.

This Construction Noise and Vibration Management Plan provides:

- Criteria for the noise and vibration generated during the Demolition, Excavation and Construction phases
- A quantitative assessment of the airborne and ground-borne noise generated by the work for the proposed development and its impact on nearby receivers
- Strategies to mitigate the noise and vibration generated during the construction works phases
- Complaints handling and community liaison procedures

This assessment discusses the predicted impact of the construction noise and vibration generated by the construction equipment on the nearest most-affected receivers.

This report has been prepared with the following references:

- City of Sydney Development Control Plan (DCP), 2012
- City of Sydney's Construction Hours/Noise within the Central Business District 1992
- Interim Construction Noise Guideline (ICNG), NSW DECC, 2009
- Construction Noise Strategy, Transport for NSW, 2013
- Noise Policy for Industry (NPI), NSW EPA, 2017
- Assessing Vibration: A Technical Guideline, NSW DEC, 2006
- AS 2436:2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*
- British Standard BS 5228: Part 1:1997 *Noise and Vibration Control on Construction and Open Sites*
- British Standard BS 7358:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground-borne Vibration*
- German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures*
- Fort Street Public School Redevelopment – SSDA Acoustic Assessment Report, prepared by Arup dated 20th December 2019
- Fort Street Public School Works Construction Management Plan, prepared by Lendlease dated 9th June 2020.

The predicted noise levels are based on the proposed construction program and equipment lists provided in this report.

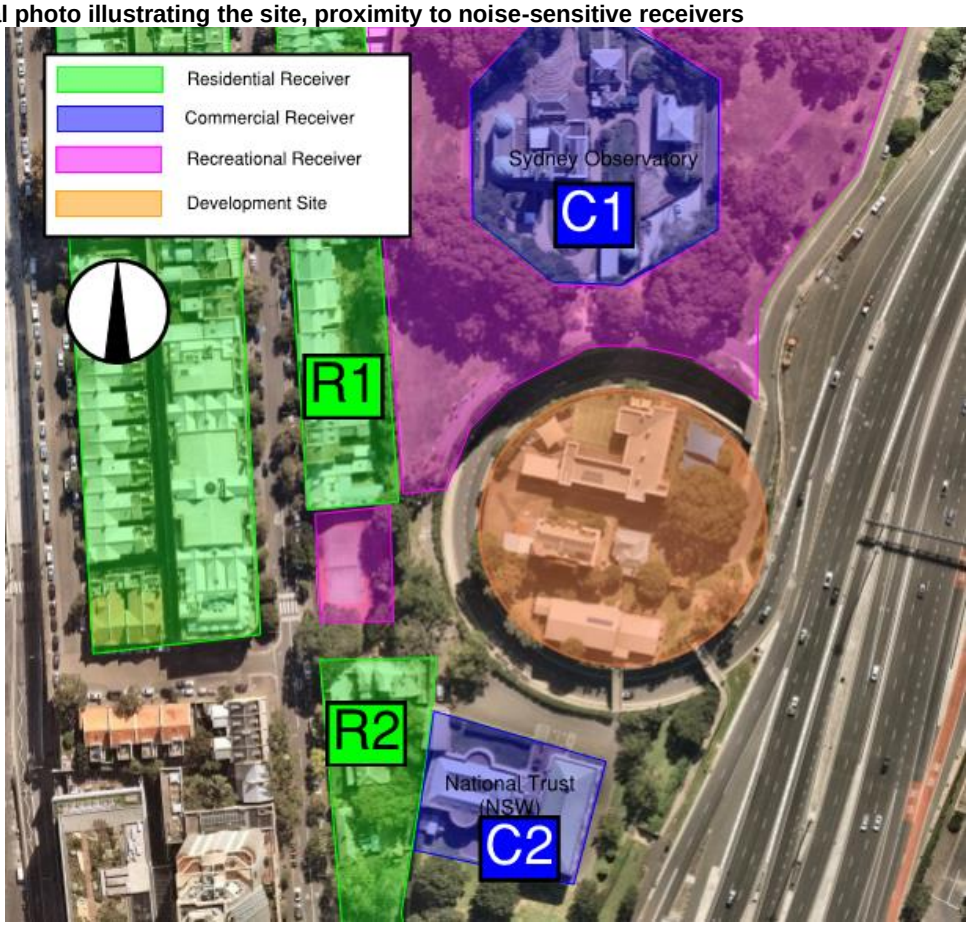
2. Project Description

2.1 Site Description and Noise & Vibration Sensitive Receivers

The proposed redevelopment of the Fort Street Public School is located at Observatory Hill, Upper Fort St, Millers Point. The site is adjacent to the Sydney Observatory and National Trust (NSW). The site is bound on all sides by high traffic motorways (Cahill Expressway and Western Distributor), and as such the ambient environment is characterized and dominated by high levels of road traffic noise. Additionally, there is a rail corridor which runs adjacent to the site under the nearby motorways.

The nearest noise sensitive receivers are considered to be the residential properties along Kent street, however, due to a cutaway, the landscape provides adequate shielding from noise emissions in relation to the operation of Fort Street Public School. With the addition of the high levels of road traffic noise, it is unlikely that the operational noise emissions from the site will adversely impact the amenity of the residential receivers.

Figure 1: Aerial photo illustrating the site, proximity to noise-sensitive receivers



Source: nearmap.com

2.2 Existing Noise & Vibration Environment

The existing noise environment around the site has been assessed and defined within the SSDA Acoustic Assessment Report prepared by Arup dated 20/12/2019. This report sets out the relative criteria with regard to noise emissions from the proposed development

3. Background and Ambient Noise Monitoring

Table 1 below presents the summary of the background noise monitoring relevant to the proposed redevelopment. It has been extracted from the Noise and Vibration Assessment Report SSD 10340 prepared by Arup, dated 20th December 2019.

Table 1: NPI project specific noise levels– Extract from Arup Report

Receiver	Time Period	Intrusive Noise Trigger Levels $L_{Aeq, 15min}$	Project Amenity Noise Level (PANL) $L_{Aeq, period}$	Project Noise Trigger Level $L_{Aeq, 15min}$
Nearest Residential receivers on Kent St and Agar Steps (R1 & R2)	Day	62	60	60
	Evening	61	50	50
	Night	51	45	45
Observatory Park (Recreational Receiver)	When in use	-	65	65
Sydney Observatory and National Trust (C1 & C2)	When in use	-	65	65

4. Acoustic Criteria

4.1 Construction Noise Criteria

The following subsections outline the Construction noise criteria for the proposed development. Note the state requirements below, however the more prescriptive requirement from The City of Sydney shall be adopted for this project.

4.1.1 Interim Construction Noise Guideline (ICNG)

The *Interim Construction Noise Guideline* (ICNG) by NSW DECC recommends the following standard hours of construction:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and public holidays: no work

The noise criteria associated with construction and its related activities are shown in Table 2, as presented in Section 4.1.1 Table 2 of the ICNG.

Table 2: Construction Noise Criteria at Residences

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours:	Noise Affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured **$L_{Aeq,15min}$** is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Outside Recommended Standard Hours	Noise Affected RBL + 5dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2. of the ICNG

Note: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30m away from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 3 below (Section 4.1.3 of the ICNG) sets out the noise management levels for other land uses, including commercial premises. The external noise levels should be assessed at the most affected occupied point for commercial and industrial uses, and at the most affected point within 50 metres of the area boundary for parks.

Table 3: Construction Noise Criteria for Other Land Uses

Land Use	Management Level, $L_{Aeq,15min}$ – applies when land use is being utilized
Passive recreation, parks	External noise level 60 dB(A)
Industrial premises	External noise level 75 dB(A)
Offices, retail outlets	External noise level 70 dB(A)

Based on the criteria in the tables above, the following noise management levels in Table 4 should be applied to the receivers C1, C2, R1, R2 and the surrounding recreational park located north of the proposed site.

Table 4: Project Specific Construction Noise Management Levels

Land Use	Receiver	Management Level, $L_{Aeq,15min}$
Offices, retail outlets	C1 & C2	External noise level **70 dB(A)**
Residential	R1 & R2	60 dB(A) + 10 dB = **70 dB(A)**
Residential (Outside Recommended Standard hours)	R1 & R2	60 dB(A) + 5 dB = **65 dB(A)**

It is important to note that operation falling outside the standard hours recommended within the ICNG will be assessed under the Outside Recommended Standard Hours criteria.

4.1.2 City of Sydney Construction Hours/Noise within the CBD

The City of Sydney's document *Construction Hours/Noise within the Central Business District* provides comprehensive guidelines to permit construction work during all hours of the day, seven days per week subject to compliance with noise criteria, and will allow construction to be planned and undertaken without affecting the amenity of residents, commercial operators, tourists and other city users.

The Code prescribes the obligations that an applicant accepts with regard to addressing:

- Construction hours to be worked
- Noise criteria applying to those hours of work
- Regular reporting by the firm's principals
- Site supervision needed to comply with the Code
- Special requirements if work is intended during Category 2, 3 and 4 hours.

Table 5 summarises the categories of working hours and noise criteria specific to the proposed development.

Table 5: Categories of Working Hours, and Noise Criteria

Day	Time Period	Category	Noise Criteria	Project Specific Noise Criteria
Monday to Friday	00.00 – 07.00	4	Background + 0 dBA	45 (used night-time period)
	07.00 – 08.00	1	Background + 5 dBA	65 (used daytime period)
	08.00 – 19.00	1	Background + 10 dBA	70 (used daytime period)
	19.00 – 23.00	2	Background + 3 dBA	48 (used night-time period)
	23.00 – 24.00	4	Background + 0 dBA	45 (used night-time period)
Saturday	00.00 – 07.00	4	Background + 0 dBA	45 (used night-time period)
	07.00 – 08.00	1	Background + 5 dBA	65 (used daytime period)
	08.00 – 17.00	1	Background + 10 dBA	70 (used daytime period)
	17.00 – 23.00	2	Background + 3 dBA	48 (used night-time period)
	23.00 – 24.00	4	Background + 0 dBA	45 (used night-time period)
Sundays and Public Holidays	00.00 – 07.00	4	Background + 0 dBA	45 (used night-time period)
	07.00 – 17.00	3	Background + 3 dBA	63 (used daytime period)
	17.00 – 24.00	4	Background + 0 dBA	45 (used night-time period)

Notes

1. All noise levels to be $L_{A,average,max,15min}$ measured at the nearest Nominated Occupancy.
2. The permissible noise level is to be complied with during each fifteen (15) minute period during the relevant Category of Hours.
3. The guidelines for control of construction noise as outlined in AS2436 shall be applied, where appropriate.
4. Background is "Background Noise Level" as defined in para 18.j (page 5) of the Code.

4.2 Construction Vibration Criteria

4.2.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and also their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day. The vibration emitted from construction works should be such that it does not exceed the maximum limits set out in the criteria presented in Table 6 to Table 9. The guide on preferred values for human comfort have been extracted from the NSW DEC *Assessing Vibration: A Technical Guideline* (2006). The criteria for continuous and impulsive vibration are summarized in Table 6.

Table 6: Criteria for Exposure to Continuous and Impulsive Vibration

Place	Time	Vibration Acceleration (mm/s^2)			
		Preferred		Maximum	
Continuous Vibration		z axis	x and y axis	z axis	x and y axis
Critical working areas (e.g. hospital operating theatres precision laboratories)	Day or night time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Offices	Day or night time	0.020	0.014	0.040	0.028
Workshops	Day or night time	0.040	0.029	0.080	0.058
Impulsive Vibration		z axis	x and y axis	z axis	x and y axis
Critical working areas (e.g. hospital operating theatres precision laboratories)	Day or night time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14
Offices	Day or night time	0.64	0.46	1.28	0.92
Workshops	Day or night time	0.64	0.46	1.28	0.92

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the cumulative effects of intermittent vibration. The criteria applicable when considering periods of intermittent vibration are presented in Table 7.

Table 7: Acceptable Vibration Dose Values for Intermittent Vibration (1.75 m/s)

Location	Daytime		Night time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

4.2.2 Structural Damage – Vibration Criteria

Ground vibration criteria are defined in terms of levels of vibration emission from construction activities that will not damage surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity. The human comfort criteria are also often exceeded before a risk of structural damage.

Structural damage criteria are presented in German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures* and British Standard BS 7385-2:1993 *Evaluation and Measurement for Vibration in Buildings*. The British Standard BS 7385-2:1993 establishes vibration values for buildings based on the lowest vibration levels above which damage has been credibly demonstrated. These values are evaluated to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as 95% probability of no effect. The aforementioned values are summarised in Table 8.

Table 8: Transient Vibration Guide Values for Cosmetic Damage – BS 7385-2:1993

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial or light commercial type buildings	50mm/s	N/A
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s	20mm/s (50mm/s at 40Hz and above)

Table 9 indicates the vibration limits presented in DIN 4150-Part 3 to ensure structural damage does not occur.

Table 9: Guideline Value of Vibration Velocity (vi) for Evaluating the Effects of Short-Term Vibration – DIN 4150-Part 3

Line	Type of Structure	Vibration velocity, v_i, in mm/s			
		Foundation At a frequency of			Plane of floor of uppermost full storey
		Less than 10Hz	10 to 50Hz	50 to 100Hz *	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
*For frequencies above 100Hz, at least the values specified in this column shall be applied.					

5. Construction Noise Assessment

5.1 Proposed Construction Activities

In this assessment, the noise impact from the early construction works are considered. The proposed early construction will consist of the following stages

- Demolition
- Excavation
- Structure

The hours of work are expected to occur during the daytime hours, as follows:

- Monday to Friday: 7am to 7pm
- Saturday: 8am to 4pm
- Sunday and public holidays: no work

The worst case scenarios for both commercial and residential receivers are covered. This means construction works concentrated along the southern barrier for the nearby receivers. Appendix C presents figures detailing the layout of equipment noise sources on site used for the assessment purposes.

Note that 7:00am to 8:00am works has a reduced noise allowance, see Table 5. Works taking place between these hours should reflect these restrictions. i.e. small hand tools, painting, site arrivals, etc. If any additional works are to be conducted outside of the hours shown above, Table 5 should be consulted to determine the allowance of noise and works conducted should be limited in order to minimise the impact of noise generated.

5.2 Expected Construction Equipment

The noise sources likely to be associated with the works listed in the previous section of this report are presented in Table 10. The equipment noise levels have been extracted from AS 2436:2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites* and *Construction Noise Strategy, Transport for NSW.*.

Table 10: Construction Equipment Noise Levels

Stages	Equipment	Sound Power Level dB(A)
Demolition	Jackhammer	113
	Powered hand tools	102
	Bobcat	107
	Cherry picker	102
	Truck	108
Excavation	Excavator (30-40t))	110
	Powered hand tools	102
	Concrete pump	109
	Mobile Crane	110
	Bored piling	110
	Generator	104
	Truck	108
	Vibratory Roller	114
Construction	Mobile Crane	110
	Powered hand tools	102
	Concrete pump	108
	Truck	107
	Concrete Vibrator	105

5.3 Noise Modelling & Assumptions

In order to assess the noise impact from the site during the various construction stages, a noise model was established in the commercial software SoundPLAN v8.1, which is a comprehensive software package for estimating noise impacts in varying situations. In the software, a 3D model of the site and its surroundings was constructed, including the nearby buildings and the construction plant and equipment as the relevant noise sources. Within the model, the effects of the environment (built and natural) on propagation of sound were taken into account to reliably estimate the resulting noise effects on the surrounding noise sensitive receivers.

The noise model represents the 'reasonable' worst case periods of construction activities, meaning that all the equipment of each stage are operating simultaneously during a 15-minute observation period.

The assumptions that were made within the assessment include the following:

- The predicted noise levels represent the worst case scenario for each receiver
- Noise produced from vehicle movements along Upper Fort Street expected from construction vehicles accessing the site were included in the assessment.
- The predicted noise levels at the nearby sensitive receivers have been assessed with the concrete barriers and Class A Hoarding as outlined in the Fort Street Public School Works Construction Management Plan, prepared by Lendlease, dated 9th June 2020.
- The predicted noise levels at the nearby sensitive receivers have been assessed with additional hoarding implemented in the project specific noise mitigation measures provided in Section 7.1 as recommended by Stantec.
- The effect of other mitigation measures (respite periods, flexshield barriers to the scaffolding) has **not** been included within the model, however respite periods and such should be implemented as part of the management plan. This modelling only reflects those worst-case periods.
- The height of the receivers has been assumed as 1.5m from ground level, with the exception of the residential receivers located at R1 & R2 (where it was assumed higher in line with the top floor of the building to represent a worst case scenario as the lower levels are heavily shielded by the terrain). The heights of these receivers were set to 5.5m for R1 and 3m for R2, relative height from ground based on the worse case affected receiver window/ balcony of the apartment building.
- The noise levels have been assessed using neutral weather conditions. i.e. no rain or strong wind.
- As detailed construction plan is still to be developed with equipment, vehicles etc. to be selected, Stantec has made typical assumptions on equipment to be used on site for each stage of the demolition and construction.

The noise levels at the surrounding sensitive receivers have been based on the assumptions and aforementioned sound power levels of the equipment. The results of the predicted noise levels are presented in the following section.

5.4 Predicted Noise Levels

5.4.1 City of Sydney Construction Hour/Noise

The predicted construction noise levels have been presented in Table 11, Table 12, and Table 13 and have been compared with the requirements of the City of Sydney Construction Hours/Noise. The noise contour maps produced by the three-dimensional noise propagation modelling are provided in Appendix B. Each receiver location has been assessed for demolition, excavation, and construction stages respectively.

For the purpose of the assessment, worst case location of equipment and receiver height was assumed. It should be noted that for some periods of out of hours construction show minor exceedances of a maximum of 2dB(A). However, it is noted that a 2dB increase is not a perceivable change. Furthermore, the noise modelling assumes a worst-case scenario and additional mitigation measurements implemented by the Principal Contractor that have not been accounted for in the noise modelling (e.g. respite periods and reducing the amount of simultaneous activities taking place on site at any given time). It is expected that with the acoustic measures shown in Section 7 as well as any other feasible and reasonable measures (e.g. no piling after standard hours, limited amount of sources active on site after standard hours) compliance will be achieved at the nearest most sensitive receivers.

Table 11: Predicted Noise Levels - Demolition

ID	Receiver	Day	Time	Predicted Noise Level $L_{Aeq,\ 15min}$	Noise Management Level $L_{eq,15min}$ dB(A)	Noise Management Level Exceedance (dB)	Complies? (Y/N)
R1	Residential	Monday - Friday	07.00 – 08.00	53.9	65	-	Yes
			08.00 – 19.00	53.9	70	-	Yes
		Saturday	07.00 – 08.00	53.9	65	-	Yes
			08.00 – 17.00	53.9	70	-	Yes
R2	Residential	Monday - Friday	07.00 – 08.00	60.6	65	-	Yes
			08.00 – 19.00	60.6	70	-	Yes
		Saturday	07.00 – 08.00	60.6	65	-	Yes
			08.00 – 17.00	60.6	70	-	Yes
C1	Industrial	Monday - Friday	07.00 – 08.00	52.8	65	-	Yes
			08.00 – 19.00	52.8	70	-	Yes
		Saturday	07.00 – 08.00	52.8	65	-	Yes
			08.00 – 17.00	52.8	70	-	Yes
C2	Commercial	Monday - Friday	07.00 – 08.00	57.1	65	-	Yes
			08.00 – 19.00	57.1	70	-	Yes
		Saturday	07.00 – 08.00	57.1	65	-	Yes
			08.00 – 17.00	57.1	70	-	Yes

Table 12: Predicted Noise Levels – Excavation

ID	Receiver	Day	Time	Predicted Noise Level $L_{Aeq,\ 15min}$	Noise Management Level $L_{eq,15min}$ dB(A)	Noise Management Level Exceedance (dB)	Complies? (Y/N)
R1	Residential	Monday - Friday	07.00 – 08.00	59.3	65	-	Yes
			08.00 – 19.00	59.3	70	-	Yes
		Saturday	07.00 – 08.00	59.3	65	-	Yes
			08.00 – 17.00	59.3	70	-	Yes
R2	Residential	Monday - Friday	07.00 – 08.00	67	65	2	Yes*
			08.00 – 19.00	67	70	-	Yes
		Saturday	07.00 – 08.00	67	65	2	Yes*
			08.00 – 17.00	67	70	-	Yes
C1	Industrial	Monday - Friday	07.00 – 08.00	64	65	-	Yes
			08.00 – 19.00	64	70	-	Yes
		Saturday	07.00 – 08.00	64	65	-	Yes
			08.00 – 17.00	64	70	-	Yes
C2	Commercial	Monday - Friday	07.00 – 08.00	66	65	1	Yes*
			08.00 – 19.00	66	70	-	Yes
		Saturday	07.00 – 08.00	66	65	1	Yes*
			08.00 – 17.00	66	70	-	Yes

Table 13: Predicted Noise Levels - Construction

ID	Receiver	Day	Time	Predicted Noise Level $L_{Aeq,\ 15min}$	Noise Management Level $L_{eq,15min}$ dB(A)	Noise Management Level Exceedance (dB)	Complies? (Y/N)
R1	Residential	Monday - Friday	07.00 – 08.00	57.5	65	-	Yes
			08.00 – 19.00	57.5	70	-	Yes
		Saturday	07.00 – 08.00	57.5	65	-	Yes
			08.00 – 17.00	57.5	70	-	Yes
R2	Residential	Monday - Friday	07.00 – 08.00	64.4	65	-	Yes
			08.00 – 19.00	64.4	70	-	Yes
		Saturday	07.00 – 08.00	64.4	65	-	Yes
			08.00 – 17.00	64.4	70	-	Yes
C1	Industrial	Monday - Friday	07.00 – 08.00	66.5	65	1.5	Yes*
			08.00 – 19.00	66.5	70	-	Yes
		Saturday	07.00 – 08.00	66.5	65	1.5	Yes*
			08.00 – 17.00	66.5	70	-	Yes
C2	Commercial	Monday - Friday	07.00 – 08.00	61.2	65	-	Yes
			08.00 – 19.00	61.2	70	-	Yes
		Saturday	07.00 – 08.00	61.2	65	-	Yes
			08.00 – 17.00	61.2	70	-	Yes

* Compliance is achieved through implementation of acoustic mitigation measures. The Principal contractor is to implement the acoustic measures shown in Section 7 as well as any other feasible and reasonable measures in order to reduce any potential adverse noise impact. Worst case modelling shows a maximum 2dB increase in the noise levels. It should be noted that 2dB change is not considered a significant increase and is not a perceivable audible change

5.4.2 Interim Construction Noise Guideline

The predicted noise levels during all phases for each receiver location have been presented in Table 14 to Table 16 have been compared with the requirements of the Interim Construction Noise Guideline (ICNG). The noise contour maps produced by the three-dimensional noise propagation modelling are provided in Appendix B

Table 14: Predicted Noise Levels - Demolition

ID	Receiver	Predicted Noise Level $L_{Aeq,15min}$	Noise Management Level $L_{eq,15min}$ dB(A)	Noise Management Level Exceedance (dB)	Compliance with Highly Noise Affected Level?
R1	Residential	53.9	70	-	Yes
			65 (Outside Standard Hours)	-	Yes
R2	Residential	60.6	70	-	Yes
			65 (Outside Standard Hours)	-	Yes
C1	Commercial	52.8	70	-	Yes
C2	Commercial	57.1	70	-	Yes

Table 15: Predicted Noise Levels - Excavation

ID	Receiver	Predicted Noise Level $L_{Aeq,15min}$	Noise Management Level $L_{eq,15min}$ dB(A)	Noise Management Level Exceedance (dB)	Compliance with Highly Noise Affected Level?
R1	Residential	59.3	70	-	Yes
			65 (Outside Standard Hours)	-	Yes
R2	Residential	67	70	-	Yes
			65 (Outside Standard Hours)	2	Yes*
C1	Commercial	64	70	-	Yes
C2	Commercial	66	70	-	Yes

* Compliance is achieved through implementation of acoustic mitigation measures. The Principal contractor is to implement the acoustic measures shown in Section 7 as well as any other feasible and reasonable measures in order to reduce any potential adverse noise impact. Worst case modelling shows a maximum 2dB increase in the noise levels. It should be noted that 2dB change is not considered an significant increase and is not a perceivable audible change

Table 16: Predicted Noise Levels – Construction

ID	Receiver	Predicted Noise Level $L_{Aeq,15min}$	Noise Management Level $L_{eq,15min}$ dB(A)	Noise Management Level Exceedance (dB)	Compliance with Highly Noise Affected Level?
R1	Residential	57.5	70	-	Yes
			65 (Outside Standard Hours)	-	Yes
R2	Residential	64.4	70	-	Yes
			65 (Outside Standard Hours)	-	Yes
C1	Commercial	66.5	70	-	Yes
C2	Commercial	61.2	70	-	Yes

5.4.3 Summary of Predicted Noise Levels

The resultant site noise levels as a result of construction works are not likely to exceed the noise criteria stated within the City of Sydney Construction Hours / Noise Code of Practice 1992 for the typical construction hours of 07.00am to 07.00pm during specific scenarios and at various surrounding noise-sensitive receivers. See Table 11 to Table 16 for specific scenarios and receiver locations where the predicted noise levels do not comply with the noise criteria.

Where resultant site noise levels are likely to exceed the noise criteria outlined in the City of Sydney Construction Hours / Noise Code of Practice 1992, the noise mitigation measures proposed in Section 7 of this report are recommended to be implemented.

Exceedances between 0.5 to 2 dB are shown during the hours of 7:00am to 8:00am under the City of Sydney Construction Hours / Noise Code of Practice 1992. This would be easily mitigated by managing equipment in use during this 1-hour period.

5.5 Discussion

Based on the results of this assessment, the following conclusions were made:

- Residential receiver R1 experiences noise levels at or below the noise management level during all stages, the predicted value being relatively independent of where the equipment and plant are located.
- Commercial receivers C1 & C2 experiences exceeded noise levels during the excavation and construction stages (without a noise barrier). The criterion is exceeded by approximately 1 to 2 dB after the noise barrier is introduced between the hours of 7:00am to 8:00am.
- Highest noise levels are produced during Excavation phase, Vibratory Rollers being the main noise contributors. Lowest noise levels are associated with the demolition stage. Use of Vibratory Rollers should be limited during the hours of 7:00am to 8:00am.
- The noise levels in Observatory Hill Park are expected to exceed the criterion of 60 dB(A) within approximately 70 metres from the construction equipment during excavation and construction stages. Demolition phase is not expected to exceed criteria.
    - Options to mitigate noise in the park include temporary acoustic barriers (i.e. Flexsheild attached to fencing) to the boundary of the park
    - Consultation with local council in regards to noise emissions and respite periods.
    - Provide notice to the public in regards to construction hours and noise implications to the park.

6. Construction Vibration Assessment

The vibration intensive plant that are assumed to be used in each of the construction stages are:

- Bored Piling Rig
- 30-40t Excavator (with hammer)
- Jackhammer
- Vibratory Roller

The Transport for NSW's *Construction Noise Strategy* (2013) provides safe working distances for vibration intensive plant and are quoted for both "cosmetic" damage (in accordance with BS 7385) and human comfort (in accordance with *Assessing Vibration – a technical guideline*). The recommended safe working distances for each of the plant listed above are provided in Table 17.

Table 17: Recommended safe working distances for vibration intensive plant

Plant Item	Safe Working Distance (metres)	
	Cosmetic Damage (BS 7385)	Human Response (OH&E Vibration Guideline)
Pile Boring	2m (nominal)	N/A
900kg – 12 to 18t excavator	7m	23m
1600kg – 18 to 34t excavator	22m	73m

It is expected that 22t excavator is to be used on site during the construction stages, which would fall between the second category. However, it is noted that the vibrations as a result of a 22t excavator in comparison to a 18t excavator would not be a drastic increase. In addition to this, the Cahill expressway cutaway, effectively isolates the site from the surrounding receivers and should assist in further mitigating potential vibrations propagating through the ground. Therefore, it is unlikely that there will be exceedances in the vibration criteria for nearby sensitive receivers.

The nearest sensitive receivers are the commercial premises to the south of the site, and they are located at least 25 m from the site border. This is within the safe working distance for cosmetic damage and human response when the excavators with rock breakers are used during demolition stages. All residential properties are at approximately 30 m from the construction works.

For works near any heritage building, caution should be taken and an appropriately sized excavator selected based on the distance of the works from the buildings. The smaller the excavator the closer distance is allowed prior to cosmetic damage becoming a risk. The 12t – 18t excavators can operate up to 7m of a structure, although depending on the integrity of the heritage structure, distance should be maximised where ever possible.As such, attended vibration monitoring shall be conducted at the commencement of work in order to verify the safe working distances. If the levels are compliant with the vibration limits as listed in Section 4.2, then work may proceed based on the implementation of the measures as detailed in this report. If there are exceedances, reasonable and feasible mitigation measures and additional vibration monitoring should be conducted. These measures to prevent cosmetic damage to surrounding structures are provided in Section 7.

7. Noise & Vibration Management Strategies

7.1 Project Specific Recommendations

Project specific recommendations and required mitigation methods have been listed below. For further noise mitigation and management measures refer to Section 7.2 in order to comply with the standards outlined in this report.

7.1.1 Noise

The excavation works are predicted to produce the highest noise levels the surrounding most affected sensitive receivers. The excavators and vibratory rollers are predicted to produce the highest noise levels during these works phases. Methods should be sought to manage the noise emanating from the construction site to the surrounding most affected sensitive receivers.

The following recommendations have been provided to reduce the noise impact of construction on the surrounding noise-sensitive receivers:

- A one hour respite period, for example between 12:00pm – 1:00pm (or other period to coincide with construction workers lunch time(s)) may be recommended during high impact noise generating activities such as demolition, rock breaking, jackhammering and rock sawing.
- The use of a standard A-class hoarding (or combination of both) to mitigate the impact of the highest predicted noise levels, installed to the extent illustrated in Figure 2 in conjunction with the barriers outlined in the Fort Street Public School Works Construction Management Plan, prepared by Lendlease, dated 9th June 2020. This will mitigate noise impacts to surrounding noise-sensitive receivers on the ground floor.
- In the event of noise complaints from the public, alternate construction methods will be adopted to reduce noise emissions associated with excavation and construction.
- Avoid the use of Vibratory Rollers between the hours of 7:00am and 8:00am.
- Noise monitoring should be conducted for high risk construction activities as per the noise and vibration monitoring strategy outlined in Section 7.4 of this report. Automated alerts to the site manager when exceedances have occurred can help identify intrusive activities and potentially halt works if required.

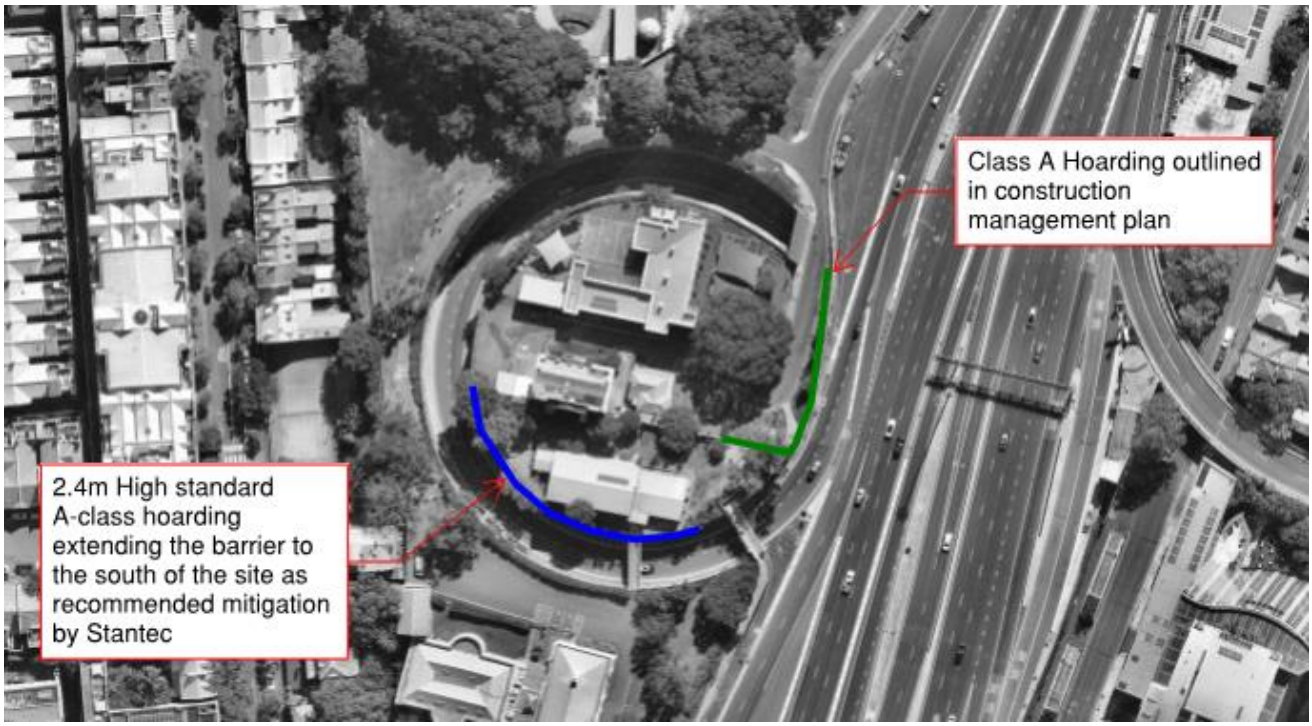
If a period of respite is required as a result of high impact noise generating activities, then this should be relative to the particular receiver/s that the noise impacting activities emit noise levels beyond requirements of the City of Sydney Construction Hours/Noise. Any construction activity that does not impact the noise receivers can continue.

While modelling was undertaken with consideration of assumptions provided in Sections 5.1 to Section 5.3 of this report, the following elements will further assist in reducing noise impacts during high impact noise generating activities (such as demolition, rock breaking, jackhammering and rock sawing):

- Depth of excavation; and
- Potential option for top-down construction method reducing noise at surrounding sensitive receivers during the period of high impact noise generating activities.

Construction vehicles must not arrive and depart the site or surrounding residential precincts outside of the established construction hours. Frequent and proactive communication with the surrounding tenants is also encouraged, thus enabling tuning of the works schedule to accommodate possible important business meetings and allowing the tenants to prepare their expectations on the changing noise environment. More details regarding communication with the community can be found in Section 7.3.

Figure 2 Extent of Acoustic Barriers



7.1.2 Vibration

Due to the proximity of demolition works to the surrounding, there may be exceedances of the cosmetic damage and human comfort criteria. Prior to the use of the excavators with rock breakers on the southern and western boundaries during demolition and the use of vibratory rollers, attended vibration measurements should be conducted to determine if there is an exceedance of the vibration limits set out in Section 4.2.

Upon any exceedances in vibration levels, reasonable and feasible measures should be considered to lessen the impact, such as alternative means of demolishing or reducing the capacity of the excavator to achieve a safe working distance. Using an excavator less than 18t would mean the safe working distance for structural damage can be achieved but the human comfort might still be exceeded. However, this would only occur for a small portion of work within the safe working distance. As noted in Section 6, it is expect that 22t excavators will be used on site, and the cutaway for the Cahill express way which surrounds the site will assist in mitigating vibrations to the nearby sensitive receivers.

To further diminish the vibration impact, the respite period from 12:00pm – 1:00pm recommended for noise impact reasons should also apply for vibration.

- Vibration monitoring should be conducted as per the noise and vibration monitoring strategy outlined in Section 7.4 of this report. Automated alerts to the site manager when exceedances have occurred can help identify intrusive activities and potentially halt works if required.
- Avoid the use of large excavators i.e. 34t to prevent exceeding human comfort criteria at neighbouring sensitive receivers.

7.2 General Acoustic Recommendations for Construction

According to AS 2436 – 2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* the following techniques could be applied to minimize the spread of noise and vibrations to the potential receivers.

7.2.1 Noise

Figure 3 demonstrates the preferred order of actions taken to mitigate excessive construction noise emissions. If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimized. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportables can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose built noise barriers, acoustic sheds and enclosures.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. A few of these methods have been introduced below.

Figure 3: Noise Mitigation Management Flow Chart

Screening

On sites where distance is limited, screening of noise may be beneficial or even the only way to reduce construction noise impacts on the nearby receivers. Below, screening options for various situations have been introduced. Constructing and utilising these screening methods should be taken into account already during the planning stages.

Temporary buildings: One option to introduce screening is to position structures such as stores, storage piles, site offices and other temporary buildings between the noisiest part of the site and the nearest dwellings. Due to shielding provided by these buildings, some of the noise emission from the site can be reduced. If the buildings are occupied, however, sound insulation measures may be necessary to protect site workers inside the buildings.

Hoarding: Another way of implementing screening is to build hoarding that includes a site office on an elevated structure. This option offers superior noise reduction when compared with a standard, simple hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

Partial building structures: On some sites, partially completed or demolished buildings can be used as noise shields for certain equipment. A noisy, stationary plant can be placed in a basement, the shell of which has been completed, provided reverberant noise can be controlled. Where compressors or generators are used in closed areas, it is also necessary to ensure that the exhaust gases are discharged directly to the outside air and that there is good cross-ventilation to prevent the build-up of poisonous carbon monoxide fumes and to allow an adequate air supply to maintain efficiency when operating the equipment.

Earth mounds and embankments: Where constructing noise barriers and using partial building shells is not practical, a worthwhile reduction in noise can be obtained by siting the plant behind and as close as possible to mounds of earth, which may effectively screen any noise sensitive areas from the plant. These mounds can often be designed into the construction schedule or site arrangement for future landscaping.

Long, temporary earth embankments can provide quite an effective noise screen for mobile equipment moving, for example, on a haulage road. When the earthworks are complete, the earth mounds should be removed, if possible, with smaller quieter excavators. A noise barrier like this may be a more reliable method of noise control than the imposition of restrictions on throttle settings.

Where earth noise barriers are not practical due to lack of space, consideration should be given to the possibility of constructing temporary screens from wood or any equivalent material in surface density.

Equipment operating 24h: When it comes to water pumps, fans and other plant equipment that operate on a 24-hour basis, they may not be an irritating source of noise during the day but can be problematic at night. They should therefore be effectively screened by either situating them behind a noise barrier or by being positioned in a trench or a hollow in the ground. Again, generated reverberant noise must be minimised and adequate ventilation should be ensured.

General remarks:

In many cases, it is not practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant at the early stages of the project with protective features required to screen traffic noise.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and the receiver, and the material of which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected by at least ten times the shortest distance from the said property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend beyond the direct line of sight between the noise source and the receiver by a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are already predominantly located within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

Crane (diesel operated)

An appropriate silencer on the muffler and acoustic screen around the engine bay are recommended to attenuate the noise from the machine.

Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional "beeper", while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate:

- Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal-frequency 'beep') are less intrusive when heard in the neighbourhood.
- Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.
- Non-audible warning systems (e.g. flashing lights, reversing cameras) may also be employed, provided that safety considerations are not compromised.
- Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.
- Spotters or observers.

The above methods should be combined, where appropriate.

7.2.2 Vibration

Vibration can be more difficult to control than noise, and there are few generalizations that can be made about its control. It should be kept in mind that vibration may cause disturbance by causing structures to vibrate and radiate noise in addition to perceptible movement. Impulsive vibration can, in some cases, provide a trigger mechanism that could result in the failure of building components that had previously been in a stable state.

During the demolition works and the erection of new structures, some vibrations (transmitted through the structure from the demolition sites) are expected, being more of a concern for the surrounding sensitive receivers. Vibrations can also trigger annoyance, which might get elevated into action by occupants of exposed buildings, and should therefore be included in the planning of communication with impacted communities.

It should be remembered that failures, sometimes catastrophic, can occur as a result of conditions not directly connected with the transmission of vibrations, e.g. the removal of supports from retaining structures to facilitate site access. BS 7385-2 provides more information on managing ground-borne vibration and its potential effects on buildings. Where site activities may affect existing structures, a thorough engineering appraisal should be made at the planning stage.

General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Predictions of vibration levels likely to occur at sensitive receivers are recommended when they are relatively close, depending on the magnitude of the source of the vibration or the distance associated. Relatively simple prediction methods are available in textbooks, codes of practice and standards, however, it is preferable to assess site transmission and propagation characteristics between source and receiver locations through measurements.

Guidance for measures available for the mitigation of vibration transmitted can be sought in more detailed standards, such as BS 5228-2 or policy documents, such as the NSW DEC *Assessing Vibration: A technical guideline*. Identifying the strategy best suited to the control of vibration follows a similar approach to that of noise: avoidance, control at the source, control along the propagation path, control at the receiver, or a combination of these. It is noted that vibration sources can include stationary plants (pumps and compressors), portable plants (jackhammers and pavement vibrators), mobile plants, pile-drivers, tunnelling machines and activities, and blasting, amongst others. Unusual ground conditions, such as a high water-table, can also cause a difference to expected or predicted results, especially when considering the noise propagated from piling.

7.3 Complaint Handling Procedures and Community Liaison

It is recommended that the builder directly contact adjacent noise sensitive receivers and provide them with the following information:

- The contact details for a nominated representative in order to make noise / vibration complaints.
- Explain the timeframe for the construction works and the proposed activities, i.e. the proposed start / stop dates of work and a description of the noise producing equipment that will be used.
- Notify the noise sensitive receivers and City of Sydney in a timely manner should there be any need for an extension to the proposed arrangements.
- Provide them with a copy of this report as approved by the City of Sydney.
- City of Sydney should be notified of the nature and details of complaints received (time, complainant etc.) and what remedial action has taken place, if any.
- Where noise is demonstrated as being compliant with criteria, this should not limit the proponent in undertaking further additional reasonable and feasible steps to reduce noise emissions.

To assist in the management of noise and vibration complaints various procedures are to be followed. These include:

- Clearly visible signage identifying any key personnel along with their contact details to be erected along the perimeter of the building site including;
    - A 24 hour contact name, phone number and email address provided for the resident to address any complaint. The signage will declare; “For any enquiry, complaint or emergency relating to this site at any time please contact…”
- Give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complaint is not satisfied there is a clear path to follow.
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night time only if requested by the complainant to avoid further disturbance.
- Implement all feasible and reasonable measures to address the source of the complaint.
- A register is to be kept by the contractor to keep a record of complaints and detail any information associated with them. The contents of the register will include:
    - The name and the address of the complainant
    - Time and date of the complaint
    - The nature of the complaint (Noise/Vibration)
    - Subsequent details
    - Remedial action undertaken

The contents of the register will be maintained and updated with any new complaint without delay. The complaints will be reported to both City of Sydney and the Contractor. The investigation of the complaint and any remedial actions will be performed by the builder and/or client representative.

In the event of noisy works scheduled, the builder will notify residents 5 business days in advance.

NSW Schools Infrastructure have set up a community hotline for the project, details of which should be shared with community and relevant stakeholders. Ph: 1300 482 651, Email: schoolinfrastructure@det.nsw.edu.au

7.3.1 Community Consultation Requirement

School Infrastructure NSW (SINSW) have provided the following information to address the community consultation requirement for consent condition B19 (g), (h) and (i). Information regarding the Community Communication Strategy outlined by SINSW can be found in Appendix D and can be summarised as follows:

- Information Pack issued to the affected local community/residents detailing the Noise and Vibration mitigation strategies.
- 7 calendar day period, in which local community/residents are invited to provide response.
- Documentation of local community response, review and updates to the CNVMSP

Responses and findings from the community consultation program have been detailed in Section 7.3.2.

7.3.2 Community Responses

The following subsection outlines the review of responses from the community consultation process and any proposed actions / strategies required to ensure community complaints are addressed and compliance with consent conditions are achieved.

SINSW has notified that no responses were received from the community consultation program process. Therefore, no additional strategies have been proposed as part of the CNVMSP and the requirements of consent condition B19 (g), (h) and (i) have been addressed. However, the CNVMSP includes other strategies to capture any future response as result of the construction works.

7.4 Noise & Vibration Monitoring Strategy

7.4.1 General Methodology

Noise and vibration levels should be monitored from time to time to ensure that noise generated as a result of remediation and construction activities does not disturb local businesses and residents.

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed inside the premises of the affected property and on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise and vibration monitoring professional or an acoustic consultant. The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

- Short-term monitoring
- Long-term monitoring

Both of these approaches are elaborated below.

Short-term monitoring

Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site, telling them when the noise and vibration criteria are exceeded. Thus, the selection of alternative method on construction or equipment selection is allowed in order to minimise noise and vibration impacts.

Long-term monitoring

Similarly to short-term monitoring, long-term monitoring provides real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded. Instead of someone being on site measuring, noise and vibration loggers are used.

Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise and vibration monitoring is dictated by the local authorities through the DA conditions.

Both methodologies are complementary and normally used simultaneously providing a significant amount of data via the long-term monitoring, but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

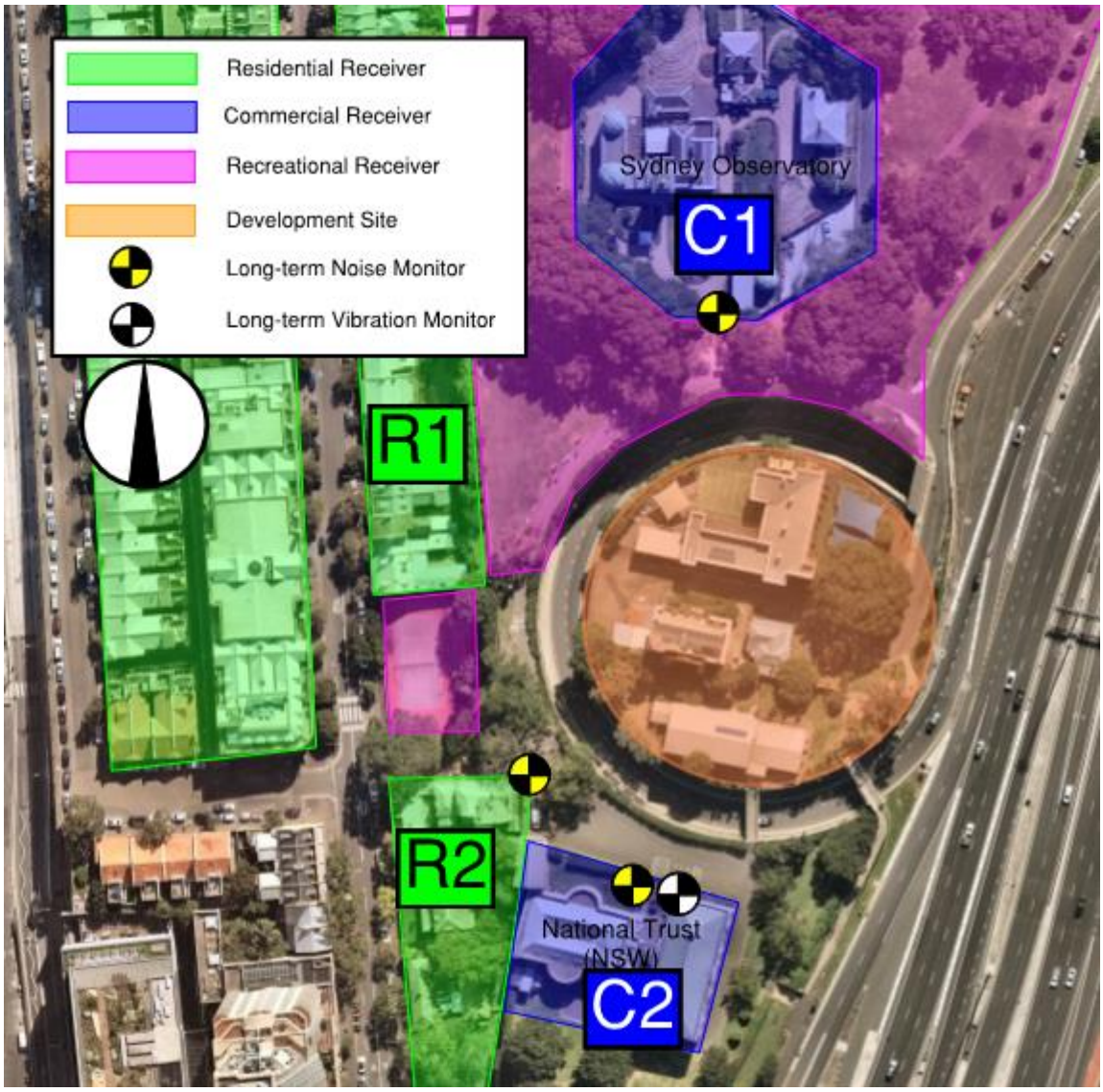
7.4.2 Noise & Vibration Monitoring Program

The following monitoring program is proposed for this project. Refer to Figure 4 for the approximate monitoring locations:

- Attended vibration monitoring with the excavator with rock breaker on the southern boundary at C2 for demolition and excavation works
- Unattended noise monitor installed at R2 & C2 during the excavation stages, at least for a time period representing the typical works
- Unattended noise monitor installed at C1 during the construction stages, at least for a time period representing the typical works

The monitoring programme as shown above is to be carried out during the likely noisiest stages as agreed with the Acoustic engineer and Contractor.

Figure 4: Attended Noise and Vibration Monitoring Location



8. Conclusion

A Construction Noise and Vibration Management Plan has been provided for the construction works to be conducted at Fort Street Public School located at Observatory Hill, Upper Fort St, Millers Point.

The details of the noise and vibration assessments undertaken to predict the impacts on sensitive receivers have been presented in Sections 5 and 6. As shown in Section 5.4, the noise levels are expected to exceed the noise management levels by a maximum of 2dB during 7:00am to 8:00am of the proposed construction hours at the surrounding receivers. The vibration levels are predicted to comply with the cosmetic damage criteria but the human comfort levels are likely to be exceeded occasionally during works if larger (34t) excavators are to be used.

To reduce the noise and vibration impacts on the sensitive receivers, noise and vibration management strategies have been proposed in Section 7. Erecting an additional 2.4-metre sound attenuating barrier along the southern border of the site is recommended, in addition to the proposed barriers outline in the Fort Street Public School Works Construction Management Plan, prepared by Lendlease, dated 9th June 2020.

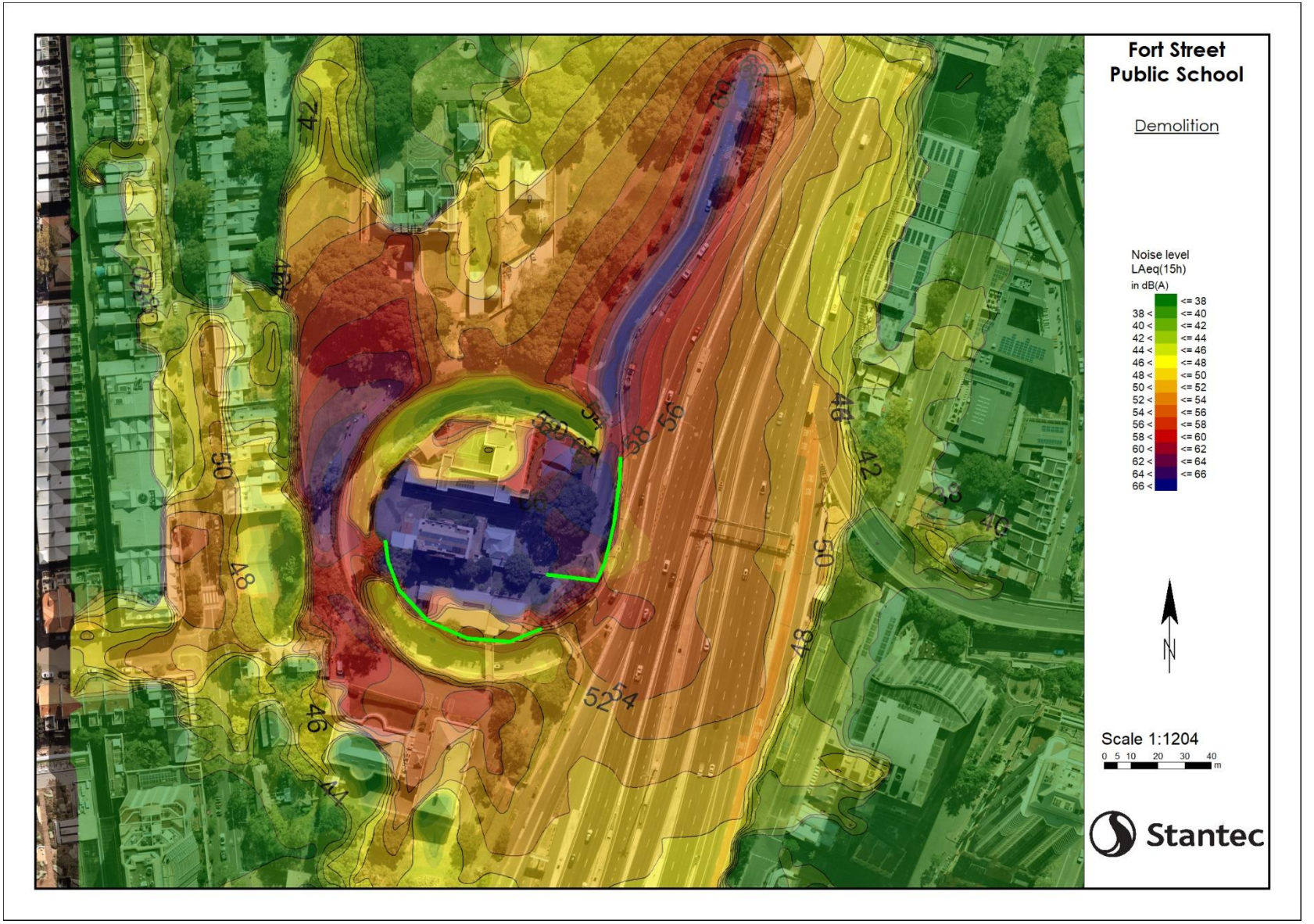
The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of equipment/machinery and modifications to the construction program.

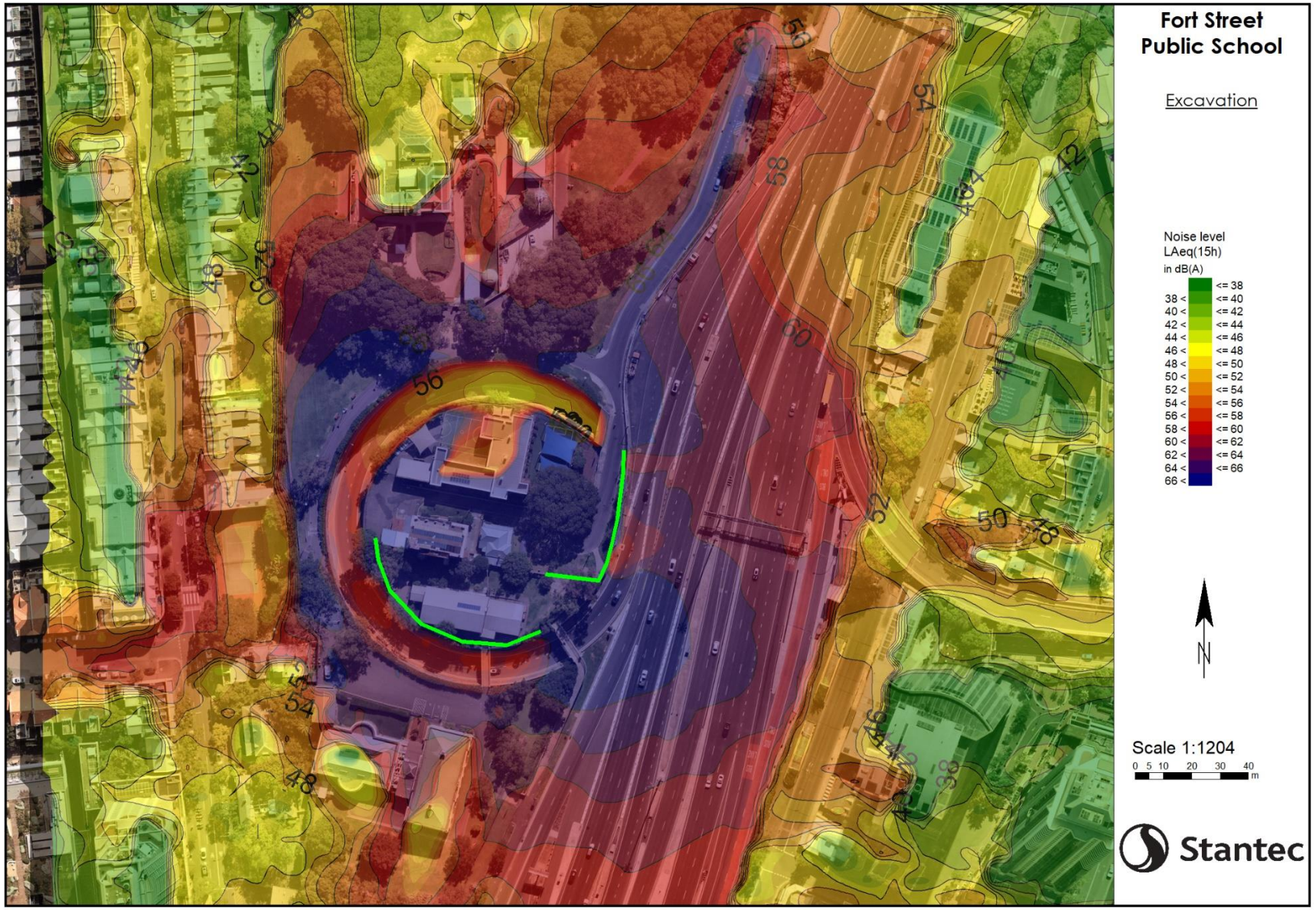
Appendix A Glossary of Acoustic Terms

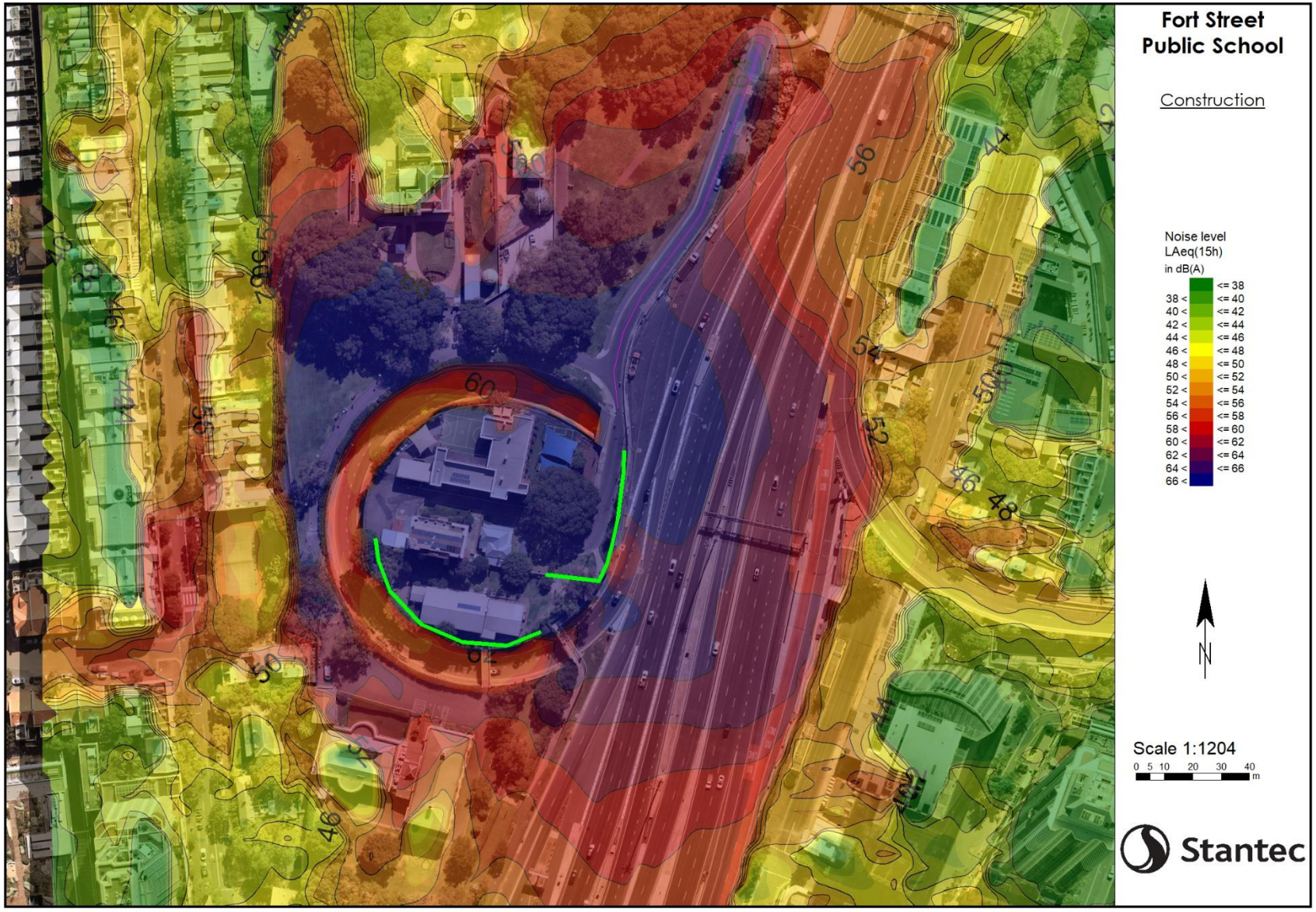
NOISE	
Acceptable Noise Level:	The acceptable L_{Aeq} noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{A90} noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A-filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
L_{Amax}	The maximum A-weighted sound pressure level measured over a period.
L_{Amin}	The minimum A-weighted sound pressure level measured over a period.
L_{A1}	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
L_{A10}	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
L_{A90}	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{A90} noise level expressed in units of dB(A).
L_{Aeq}	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.

$L_{Aeq,T}$	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R_w:	The Sound Insulation Rating R_w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L_{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

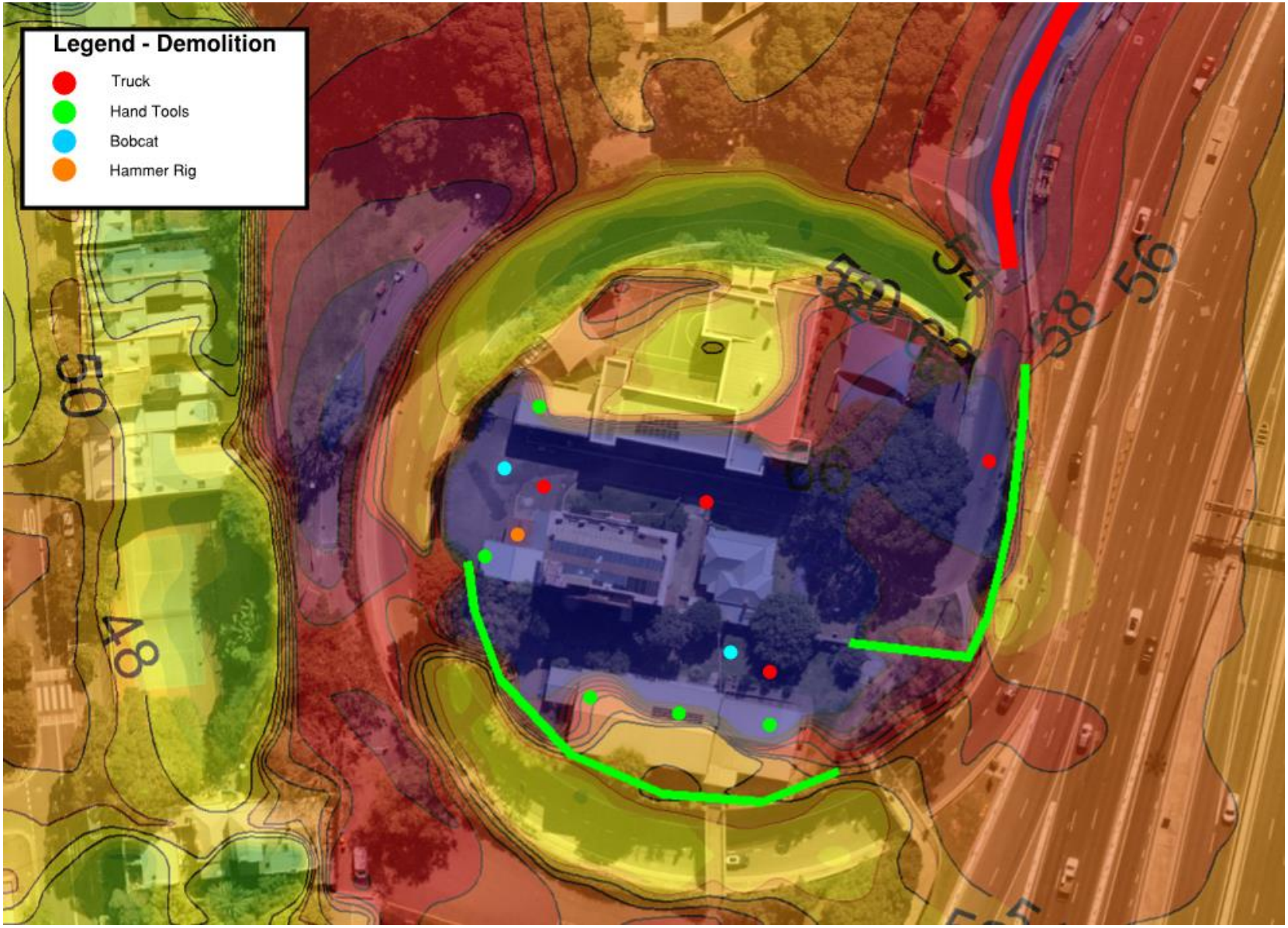
Appendix B Noise Contour Maps

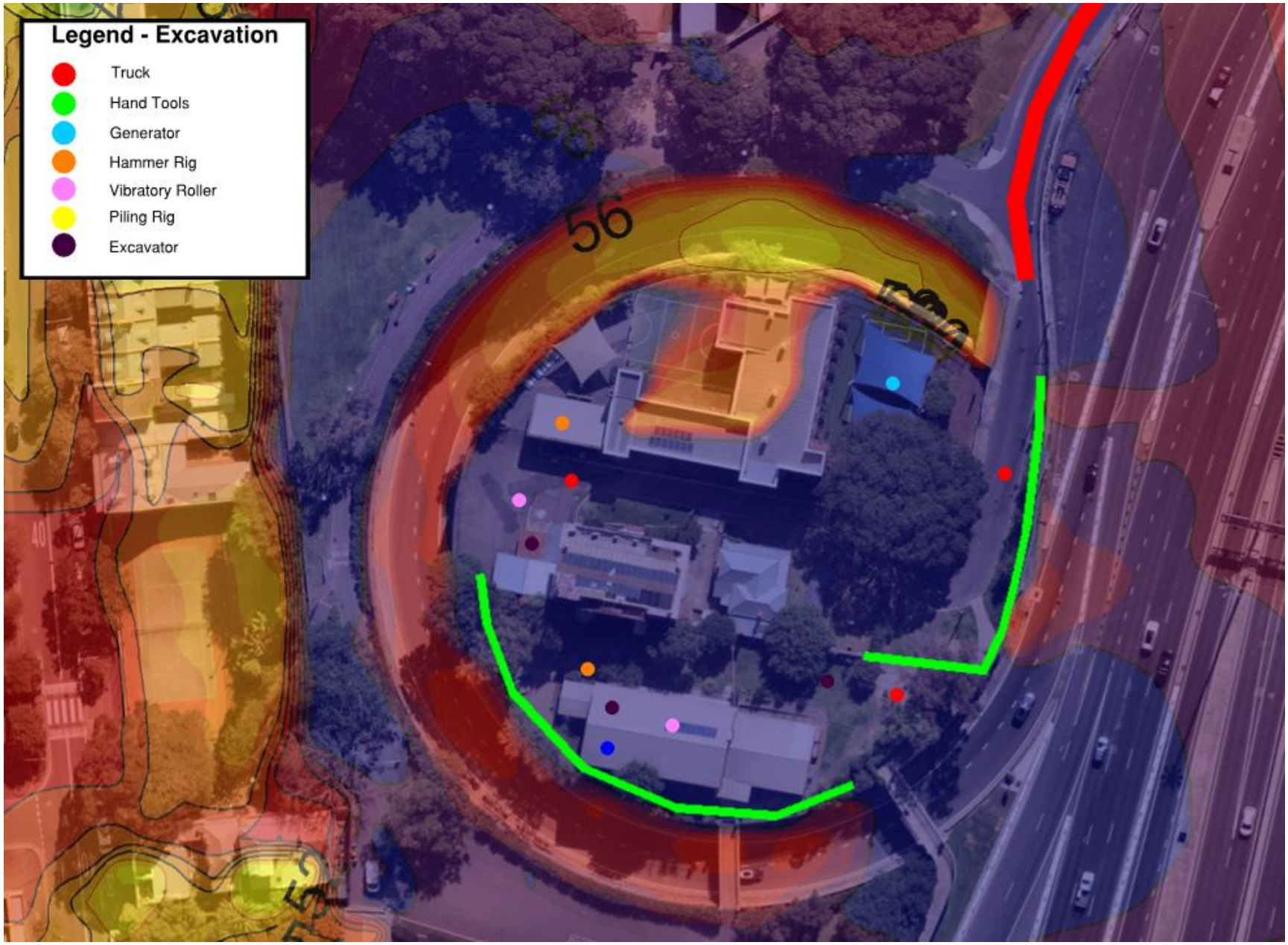


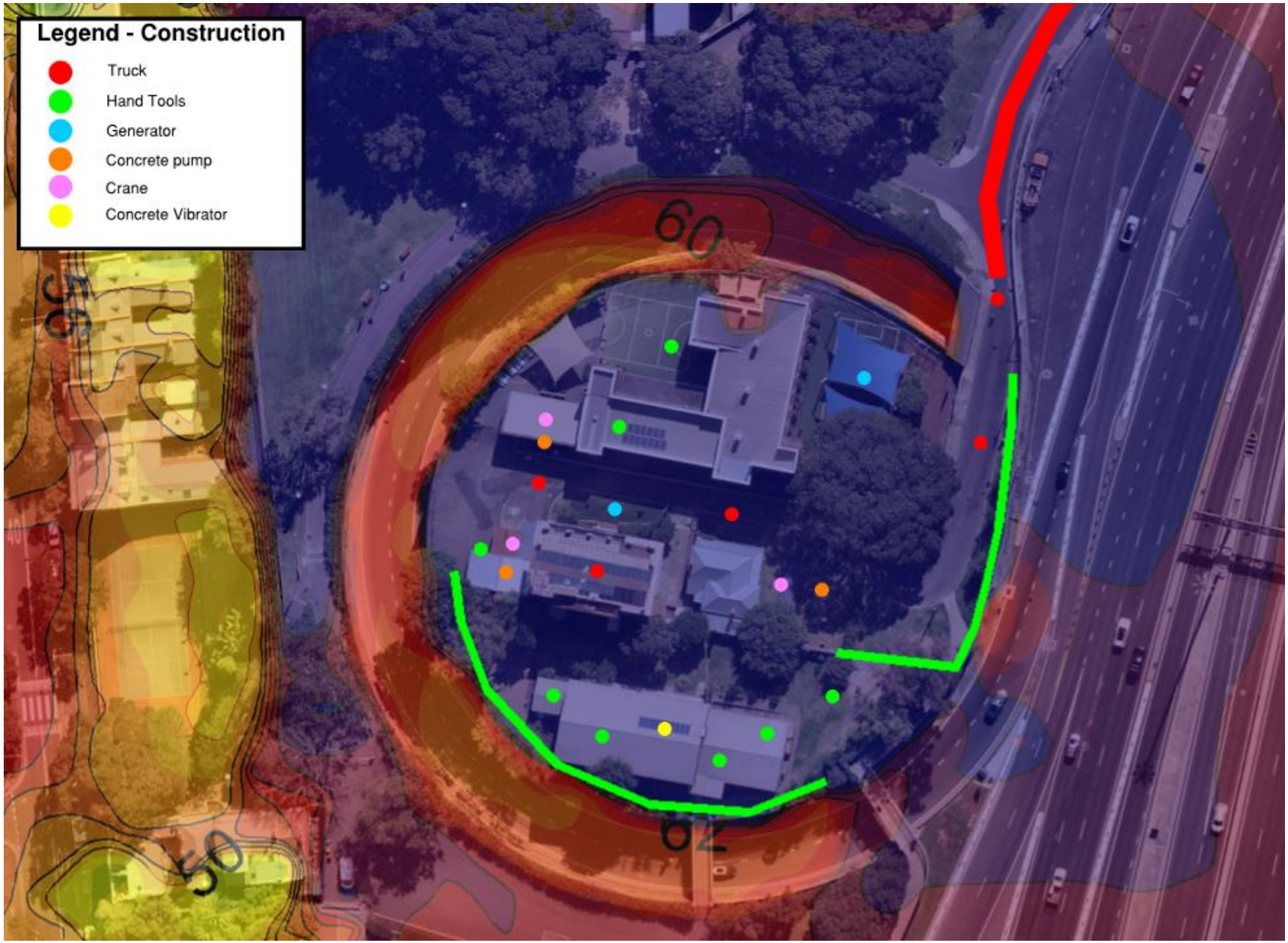

Fort Street
Public School
Excavation
Noise level
LAeq(15h)
in dB(A)
<= 38
38 < <= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
60 < <= 62
62 < <= 64
64 < <= 66
N
Scale 1:1204
0 5 10 20 30 40 m
Stantec


Fort Street
Public School
Construction
Noise level
LAeq(15h)
in dB(A)
<= 38
38 < <= 40
40 < <= 42
42 < <= 44
44 < <= 46
46 < <= 48
48 < <= 50
50 < <= 52
52 < <= 54
54 < <= 56
56 < <= 58
58 < <= 60
60 < <= 62
62 < <= 64
64 < <= 66
N
Scale 1:1204
0 5 10 20 30 40 m
Stantec

Appendix C Equipment Layout




Legend - Excavation
Truck
Hand Tools
Generator
Hammer Rig
Vibratory Roller
Piling Rig
Excavator
66
56


Legend - Construction
Truck
Hand Tools
Generator
Concrete pump
Crane
Concrete Vibrator
60
55
50

Appendix D SINSW Community Consultation

Artist impression of the Fort Street Public School upgrade

Fort Street Public School

Project update

April 2021

Investing in our schools

The NSW Government is investing $7 billion over four years, continuing its program to deliver more than 200 new and upgraded schools to support communities across NSW. This is the largest investment in public education infrastructure in the history of NSW.

The NSW Department of Education is committed to delivering new and upgraded schools for communities across NSW. The delivery of these important projects is essential to the future learning needs of our students and supports growth in the local economy.

Project overview

The Fort Street Public School upgrade will cater to growing enrolments and provide exciting new spaces for learning and teaching.

The project will deliver new flexible learning spaces within existing and new buildings as well as upgrades to core facilities, including a new school hall, new library, a covered outdoor learning area (COLA), as well as new play spaces and out of hours school care.

Progress summary

The State Significant Development application was approved by the Department of Planning, Industry and Environment on 7 October 2020.

Site establishment and early works are expected to start in early 2021. Nearby residents and businesses will be notified prior to any work starting on site.

Managing construction impacts

As part of the consent to carry out the work, the main contractor is required to develop plans that details how construction impacts on nearby local residents will be minimised. These impacts include noise, vibration and vehicle movements.

You can view the consent conditions, including those required for managing construction impacts via the Department of Planning, Industry and the Environment's Major Projects portal at planningportal.nsw.gov.au/major-projects/project/13596.

Your feedback

You can contribute to the development of strategies to effectively manage construction impacts. Your feedback is sought on how we propose to manage construction activities listed in the table below. Please provide your feedback by 26 April 2021 via email or phone.

Email: schoolinfrastructure@det.nsw.edu.au Phone: 1300 482 65

For more information contact:

School Infrastructure NSW
Email: schoolinfrastructure@det.nsw.edu.au
Phone: 1300 482 651
www.schoolinfrastructure.nsw.gov.au

NSW GOVERNMENT

Activity	Consent condition and proposed activities
General	**Proposed actions:** ▪ We will provide advance notice of work to the local community, particularly when we anticipate high noise generating works. ▪ Noise levels on site will not exceed the noise control guidelines that are outline in the EPA Environmental Noise Control Manual for construction and demolition works. ▪ Construction works, including the delivery of materials to and from the site, are currently approved to take place between 7:00am and 6:00pm Mondays to Fridays and between 8:00am and 1:00pm on Saturdays. No night work is currently approved for this project and no work is currently approved on Sundays or public holidays. ▪ Provided noise levels do not exceed the existing background noise level plus 5dB, works may also be undertaken between 6:00pm and 7:00pm, Mondays to Fridays and between 1:00pm and 4:00pm on Saturdays.
Construction	**Consent condition:** ▪ All reasonable steps must be taken to minimise dust generated during all works. **Proposed actions:** ▪ Exposed surfaces and stockpiles will be managed with regular watering to minimise dust. ▪ Public roads will be kept clean. ▪ All trucks entering or leaving the site with loads will have their loads covered.
Construction	**Consent condition:** ▪ Measures are to be implemented to ensure road safety and network efficiency during construction. **Proposed actions:** ▪ Trucks will be well maintained and will be required to observe speed limits. ▪ Trucks will only use approved truck routes to and from the site. ▪ A Construction Worker Transportation Strategy will be implemented to assist in the minimisation of the use of private vehicles. Any parking requirements for workers or construction vehicles will be contained within the site.
Construction	**Consent condition:** ▪ Achieve the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009). ▪ Measures are to be implemented to manage high noise generating works, in close proximity to sensitive receivers.

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NSW GOVERNMENT

Activity	Consent condition and proposed activities
Construction (cont.)	**Proposed actions:** ▪ If high noise generating works are planned, neighbours will be notified of this before work starts. ▪ If rock breaking, rock hammering, sheet piling, pile driving and similar activities are required, effective equipment will be chosen and respite periods for local residents be put in place. These activities will be strictly limited to approved hours of: o 9:00am to 12:00pm, Monday to Friday o 2:00pm to 5:00pm Monday to Friday; and o 9:00am to 12:00pm, Saturday. ▪ For high noise generating works, if complaints are received, work may be managed to reduce the impact to local residents by implementing shorter time periods, or alternating with quieter work methods were practical.
Construction	**Consent condition:** ▪ Include a complaints management system that would be implemented for the duration of the construction. **Proposed actions:** ▪ The community information phone line and email address will be available throughout the project and for a minimum of 12 months following completion of the project: o Phone: 1300 482 651 o Email: schoolinfrastructure@det.nsw.edu.au ▪ If a phone call, email or face-to-face complaint is received during construction, it will be logged in our CRM, actively managed, closed out and resolved by SINSW within 24-48 hours. ▪ A detailed complaints process is outlined in the Community Communication Strategy, which will be publically available on the SINSW project page prior to work commencing on site.

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Design with
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www.stantec.com

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