



Transport for NSW

Western Harbour Tunnel and Warringah Freeway Upgrade

Appendix F –
Duration and frequency tables
and highly noise affected receivers



Transport for NSW

Western Harbour Tunnel and Warringah Freeway Upgrade

Appendix F1 –
Western Harbour Tunnel
construction support sites:
Duration and frequency tables

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com

Subject	Appendix F1 Western Harbour Tunnel construction support sites: Duration and frequency tables	Project Name	Western Harbour Tunnel and Warringah Freeway Upgrade project
Attention	Transport for NSW	Project No.	IA146500
From	Jacobs Arcadis		
Date	5 August 2020		

In response to submissions and Agency feedback received during the environmental impact exhibition period, a summary of worst case noise impacts associated with the construction support sites for the Western Harbour Tunnel component of the project has been developed and presented as tables in this Appendix.

Inputs to the tables that follow are based on details included in Appendix G (Technical working paper: Noise and vibration), with additional information provided on frequency and durations of assessed activities. The total indicative program for major construction stages presented in the tables is based on the construction methodology developed for the environmental impact statement.

The results presented in the tables are conservative and are based on a reasonable worst case noise set of plant and equipment operating simultaneously during the assessment period. These assessed scenarios are conservative and unlikely to typically occur. Construction noise levels during actual construction works at nearby receivers are likely to be lower than those predicted, considering factors such as the specific locations of plant and equipment relative to nearby receivers, and the length of time and intensity with which the plant and equipment are working. Actual frequency and duration of noise generating activities for major construction stages would be confirmed during further design development and once the construction contractor is selected and the construction methodology is confirmed. This would also enable a better understanding of the construction plant and equipment required for specific works, the locations they would likely operate, and the potential for concurrent activities.

The duration and frequency of worst case noise event tables include:

- Discussion/comments on likely assessed activity frequency and durations within the total indicative construction program timeframes for the major construction stages related to each construction support site
- Main controls likely to be implemented during construction to further minimise worst case noise impacts
- Identification of the number of highly noise affected receiver buildings where relevant as a result of the major construction stages.

Corresponding figures are also provided in Attachment A to Appendix F1 showing the location of highly noise affected (>75 dB(A)) receiver buildings in relation to the construction support site.

In addition to the controls identified in the tables, a number of other overarching management measures have been identified for the project to minimise noise impacts during construction. These include:

- A construction noise and vibration management plan to establish the required process for mitigating and managing noise and vibration impacts across the project
- Construction noise and vibration impact statements as part of the construction noise and vibration management plan, which will document all feasible and reasonable mitigation measures to minimise noise impacts on nearby receivers.

Rozelle Rail Yards construction support site (WHT 1)

Table 1: Indicative construction program for Rozelle Rail Yards construction support site (WHT1)

Stage	Representative activity	Reference	Indicative construction program timeframe															
			2023				2024				2025				2026			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Site establishment	1) Establish the site	ROZ_01																
	2) Establish the construction facilities	ROZ_02																
Tunnel fitout and finishing	3) Tunnel fitout and finishing	ROZ_03																
Integration road works	4) Surface road works	ROZ_04																
Tunnel commission and site rehabilitation	5) Restore site	ROZ_05																

Table 2: Duration and frequency of worst case noise events for Rozelle Rail Yards construction support site (WHT1)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Site establishment	39	1) Establish site	ROZ_01	Install environmental controls	◆				Likely duration for carrying out this activity would be about 26 weeks.
		2) Establishment of construction facilities	ROZ_02	Establish site offices and workshops	◆				Likely duration for carrying out this activity would be about 26 weeks.

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Tunnel fitout and finishing	143	3) Tunnelling support fitout	ROZ_03	General site activities	◆				Deliveries outside standard construction hours would be around 1 movement per hour.
				Deliveries to site	◆				
				Tunnelling support ³	◆				
				Spoil handling ³	◆				
				Deliveries to tunnel	◆	◆ ⁴	◆ ⁴	◆ ⁴	
				Laydown areas	◆				
Integration road works	52	4) Surface road works	ROZ_04	Line marking and road pavement	◆				-
Tunnel commissions and site rehabilitation	26	5) Restore site	ROZ_05	Decommission site	◆				-

Notes:

- Appendix E of the EIS Technical working paper: Noise and vibration describes the modelled plant for each activity
Day Standard is 7.00am to 6.00pm Monday to Friday and 8.00 am to 1.00 pm Saturday; Day Out-of-Hours Work is 1.00 pm to 6.00 pm Saturday and 8.00am to 6.00 pm Sunday/ Public holiday
Evening is 6.00 pm to 10.00 pm Monday to Friday and 6.00 pm to 10.00 pm Saturday/Sunday/ Public holiday; Night is 10.00 pm to 7.00 am Monday to Friday and 10.00 pm to 8.00 am Saturday/ Sunday/ Public holiday
- Tunnel fitout and finishing activities that take place sufficiently within the tunnel so that noise emissions achieve the NML would take place outside of standard construction hours.
- Heavy vehicle deliveries would move directly into the tunnel, and not move within the site for an extended period.

Victoria Road construction support sites (WHT2)

Table 3: Indicative construction program for Victoria Road construction support site (WHT2)

Stage	Construction activity	Reference	Indicative construction program timeframe																			
			2021				2022				2023				2024				2025			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Site establishment	1) Early works	VIC_01																				
	2) Establish the site	VIC_02																				
	3) Establishment of construction facilities	VIC_03																				
Acoustic shed and surface level tunnel access construction	4) Piling for acoustic shed	VIC_04																				
	5) Surface level decline construction	VIC_05																				
	6) Acoustic shed construction	VIC_06																				
Tunnel construction (access decline and mainline tunnels)	7) Tunnelling	VIC_07																				
Tunnel fitout	8) Tunnel fitout	VIC_08																				
Tunnel commissioning and site rehabilitation	9) Restore site	VIC_09																				

Table 4: Duration and frequency of worst case noise events for Victoria Road Construction support site (WHT2)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Site establishment	26	1) Early works	VIC_01	Utility works	◆				Utility adjustment works would occur on about 12 occasions during the 26 week period. Excavators with rock hammers would be used as part of utility adjustments intermittently, and likely be required for a total duration of only 10 days. These works within the site boundary are restricted to standard construction hours. When rock hammers are not used, noise levels are predicted to reduce by up to 8 dB(A). 27 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).
		2) Establish site	VIC_02	Install environmental controls	◆				Demolition of the existing building structures would likely take 12 weeks. As a worst case, this would be undertaken using excavators with rock hammers throughout this demolition period. These works within the site boundary are restricted to standard construction hours with periods of respite as required. When rock hammers are not used, noise levels are predicted to reduce by up to 8 dB(A). 22 highly noise affected receivers have been identified associated with the demolition works (see Figure 1 in Attachment A).
				Demolish existing structures.	◆				
		3) Establishment of construction facilities	VIC_03	Establish construction facilities (site offices and workshops)	◆				-
Acoustic shed and surface level tunnel access construction	26	4) Piling for decline and acoustic shed	VIC_04	Piling for decline and acoustic shed	◆				Piling works would only occur intermittently during this period. This would likely consist of 1 piling rig for about 8 weeks in the 26 week period. 3 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).
		5) Surface level decline construction	VIC_05	Surface level decline excavation and construction	◆				Excavators with rock hammers are proposed to be used before the construction of the acoustic shed. Works would be restricted to daytime hours only until the acoustic shed is place. The duration is likely to be for the length of the program duration (ie 26 weeks). 10 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
		6) Acoustic shed construction	VIC_06	Spoil shed construction	◆				-
Tunnel construction (access decline and mainline tunnels)	78	7) Tunnelling	VIC_07	General site activities	◆	◆	◆	◆	The majority of the works would be completed within the acoustic shed for works conducted outside standard construction hours. Spoil haulage at night would not occur.
				Deliveries	◆				
				Tunnelling and support	◆	◆	◆	◆	
				Tunnelling lining (concreting) deliveries	◆	◆	◆	◆	
				Spoil handling in an acoustic shed	◆	◆ ³	◆ ³	◆ ³	
				Spoil haulage	◆				
Tunnel fitout	117	8) Tunnel fitout	VIC_08	Deliveries	◆	◆	◆	◆	For works outside standard construction hours, only 1 heavy vehicle per hour is expected to deliver materials during this stage.
				Laydown areas	◆				
Tunnel commission and site rehabilitation	65	9) Restore site	VIC_09	Decommission site	◆				<p>In the worst case, excavators with rock hammers would be required on occasions as part of decommissioning the site. This is likely only required for a total duration of around 3 weeks. These noise emissions may also be shielded by site structures before they are removed as part of this stage.</p> <p>5 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).</p>

Notes:

- Appendix E of Technical working paper: Noise and vibration describes the modelled plant for each activity
Day Standard is 7.00am to 6.00pm Monday to Friday and 8.00 am to 1.00 pm Saturday; Day Out-of-Hours Work is 1.00 pm to 6.00 pm Saturday and 8.00am to 6.00 pm Sunday/ Public holiday
Evening is 6.00 pm to 10.00 pm Monday to Friday and 6.00 pm to 10.00 pm Saturday/Sunday/ Public holiday; Night is 10.00 pm to 7.00 am Monday to Friday and 10.00 pm to 8.00 am Saturday/ Sunday/ Public holiday
- Spoil haulage off the construction support site would occur during standard construction hours. OOHW spoil handling would occur inside acoustic shed.

White Bay construction support site (WHT3)

Table 5: Indicative construction program for White bay construction support site (WHT3)

Stage	Construction activity	Reference	Indicative construction program timeframe																			
			2021				2022				2023				2024				2025			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Site establishment	1) Early works	WHB_01																				
	2) Establish the site	WHB_02																				
	3) Establishment of construction facilities	WHB_03																				
Construction of wharf structure	4) Piling for the wharf structure	WHB_04																				
Casting of immersed tube tunnel units	5) Substructure - construction and placement	WHB_05																				
	6) Substructure - immersed tube tunnel production	WHB_06																				
Spoil handling and treatment, and support deliveries	7) Spoil handling	WHB_07																				
Site rehabilitation	8) Restore site	WHB_08																				

Table 6: Duration and frequency of worst case noise events for White bay construction support site (WHT3)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Site establishment	39	1) Early works	WHB_01	Utility works	◆				Utility adjustment works would occur for around 3 weeks during the 39 week period. Excavators with rock hammers would be used as part of utility adjustments intermittently, and likely be required for a total duration of only 20 days. When rock hammers are not used, noise levels will be substantially lower.
		2) Establish site	WHB_02	Install environmental controls	◆				Predicted noise levels are based on all plant operating simultaneously and continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels. In addition, it is likely the majority of works associated with this activity would occur within a 4 week period.
		3) Establishment of construction facilities	WHB_03	Establish construction facilities (site offices and workshops)	◆				Predicted noise levels are based on all plant operating simultaneously and continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels. In addition, it is likely the majority of works associated with this activity would occur within a 24 week period and involve the use of prefabricated buildings to minimise noise associated with establishment.
Construction of wharf structure	13	4) Piling for wharf structure	WHB_04	Piling for wharf structure	◆				-
Casting of immersed tube tunnel elements	52	5) Tunnel element production	WHB_05a	Concrete pours, bulkheads/ballast production	◆				-
			WHB_05b	Material deliveries	◆				
		6) Tunnel element fitout	WHB_06	Assemble and fitout immersed tube tunnel	◆				-

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Spoil handling and treatment; and support deliveries	156	7) Spoil handling and treatment	WHB_07a	Dredged spoil handling (White Bay north)	◆				Likely duration for carrying out dredge spoil handling would be about 32 weeks. For deliveries outside standard construction hours, only 1 heavy vehicle movement per hour is expected to deliver materials during this stage. While predicted L _{Amax} , noise levels are greater than the sleep disturbance screening level, potential sleep disturbance impacts can be managed considering the limited number of heavy vehicle movements.
				Tunnel spoil handling (Glebe Island)	◆				
			WHB_07b	Deliveries	◆				
		8) Construction site deliveries	WHB_07c	Support Berrys Bay and Yurulbin construction support sites	◆	◆ ³	◆ ³	◆ ³	
Site rehabilitation	52	9) Restore site	WHB_08	Commission tunnel, decommission site and restore site	◆				-

Notes:

- Appendix E of the EIS Technical working paper: Noise and vibration describes the modelled plant for each activity
Day Standard is 7.00am to 6.00pm Monday to Friday and 8.00 am to 1.00 pm Saturday; Day Out-of-Hours Work is 1.00 pm to 6.00 pm Saturday and 8.00am to 6.00 pm Sunday/ Public holiday
Evening is 6.00 pm to 10.00 pm Monday to Friday and 6.00 pm to 10.00 pm Saturday/Sunday/ Public holiday; Night is 10.00 pm to 7.00 am Monday to Friday and 10.00 pm to 8.00 am Saturday/ Sunday/ Public holiday.
- Deliveries by barge to Yurulbin construction support site during this period

Yurulbin Point construction support site (WHT4)

Table 7: Indicative construction program for Yurulbin Point construction support site (WHT4)

Stage	Construction activity	Reference	Indicative construction program timeframe																			
			2021				2022				2023				2024				2025			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Site establishment	1) Early works	YRB_01																				
	2) Establish site	YRB_02																				
	3) Establishment of construction facilities	YRB_03																				
	4) Piling for acoustic sheds	YRB_04																				
	5) Acoustic shed construction	YRB_05																				
Shaft construction	6) Shaft construction at surface level	YRB_06																				
Tunnel construction (shaft and mainline tunnels)	7) Tunnelling	YRB_07																				
Tunnel fitout	8) Tunnel fitout	YRB_08																				
Tunnel commission and site restoration	9) Restore site	YRB_09																				

Table 8 Duration and frequency of worst case noise events for Yurulbin Point construction support site (WHT4)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Site establishment	52	1) Early works	YRB_01	Utility works	◆				Utility adjustment works would occur on about 10 occasions during a likely 12 week period. Excavators with rock hammers would be used as part of utility adjustments intermittently, and likely be required for a total duration of around 5 days. These works within the site boundary are restricted to standard construction hours. When rock hammers are not used, noise levels will be substantially lower. 2 highly noise affected receivers have been identified for this activity (see Figure 2 in Attachment A).
		2) Establish site	YRB_02	Install environmental controls	◆				Likely duration for installing environmental controls would be about 8 weeks.
				Clearing and grubbing	◆				Due to the extent of vegetation that is proposed to be cleared, clearing and grubbing works would likely be only 1 week in duration.
		3) Establishment of construction facilities	YRB_03	Establishment of construction facilities	◆				Predicted noise levels are based on all plant operating simultaneously and continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels.
		4) Piling for acoustic sheds	YRB_04	Piling for excavation shaft and onshore acoustic shed	◆				As piles would only be required for the foundations of the acoustic shed structure, piling would likely be only required over a 2 week period. The piling methodology would likely be bored piling, which would minimise potential exceedances.
				Piling for water-based shed	◆				Similarly, as piles would only be required for the foundations of the water-based acoustic shed structure, piling would likely be only required over a 12 week period. Piling works would only occur intermittently during this period. The piling methodology would likely be screw piling, and so the high noise impacts from impact piling would not occur.
		5) Acoustic shed	YRB_05	Acoustic shed construction	◆				Predicted noise levels are based on all plant operating simultaneously and continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise
				Water-based acoustic shed construction	◆				

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
									levels. In addition, it is likely the majority of works associated with this activity would occur within a 26 week period.
Shaft construction	39	6) Shaft construction at surface level	YRB_06	Shaft excavation and construction	◆				Excavators with rock hammers are proposed to be used before the construction of the acoustic shed. Works would be restricted to daytime hours only. The duration is likely to be for the full total program duration.
Tunnel construction (shaft and mainline tunnels)	78	7) Tunnelling	YRB_07	General site activities	◆	◆	◆	◆	Only up to 4 barge movements are expected per night (or 2 barges). Exceedances of sleep disturbance would be managed through both work practice and physical mitigation.
				Deliveries	◆				
				Tunnelling and support	◆	◆	◆	◆	
				Tunnelling lining (concreting) deliveries	◆	◆	◆	◆	
				Spoil handling in acoustic shed	◆	◆ ³	◆ ³	◆ ³	
				Barge spoil haulage	◆				
Tunnel fitout	65	8) Tunnel fitout	YRB_08	Deliveries	◆	◆	◆	◆	-
				Laydown areas	◆				
Tunnel commission and site rehabilitation	78	9) Restore site	YRB_09	Decommission site	◆				Predicted noise levels are based on all plant operating simultaneously, louder plant in operation, and all items operating during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels.

Notes:

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- Day Standard is 7.00am to 6.00pm Monday to Friday and 8.00 am to 1.00 pm Saturday; Day Out-of-Hours Work is 1.00 pm to 6.00 pm Saturday and 8.00am to 6.00 pm Sunday/ Public holiday
Evening is 6.00 pm to 10.00 pm Monday to Friday and 6.00 pm to 10.00 pm Saturday/Sunday/ Public holiday; Night is 10.00 pm to 7.00 am Monday to Friday and 10.00 pm to 8.00 am Saturday/ Sunday/ Public holiday
- Spoil haulage by barge off the construction support site would occur during standard construction hours. OOHW spoil handling would occur inside acoustic shed.

Sydney Harbour Crossing construction support sites (WHT5 and WHT6)

Table 9: Indicative construction program for Sydney harbour Crossing construction support sites (WHT5 and WHT6)

Stage	Construction activity	Reference	Indicative construction program timeframe																			
			2021				2022				2023				2024				2025			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Installation of temporary cofferdam structure	1) Build Sydney Harbour north cofferdam	SHC_01																				
	2) Build Sydney Harbour south cofferdam	SHC_02																				
	3) Dewater cofferdams	SHC_03																				
Excavation of rock within cofferdam and trench	4) Excavate cofferdams	SHC_04																				
Construction of interface structure	5) Cast transition structures	SHC_05																				
Removal of cofferdam structure and site rehabilitation	6) Remove cofferdams	SHC_06																				
Dredging and gravel placement	7) Prepare foundations	SHC_07																				
Tunnel element immersion	8) Immerse elements	SHC_08																				

Table 10: Duration and frequency of worst case noise events for Sydney Harbour Crossing construction support site (WHT5 and WHT6)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Installation of temporary cofferdam structure	78	1) Build Sydney Harbour north cofferdam 2) Build Sydney Harbour south cofferdam	SHC_01 SHC_02	Piling for cofferdams	◆				Impact piling high noise generating activities would typically only occur for part of the day, with setup activities, piling preparation and vibratory piling occurring during other parts of the day. The piling preparation and setup activities associated with the impact piling would provide receivers with respite periods. When vibratory piling takes place, it would occur throughout the day but would contribute lower noise levels than impact piling. These works would be limited to standard construction hours, and respite would still be provided where required. 6 highly noise affected receivers have been identified for SHC_02 (see Figure 3 in Attachment A).
		3) Dewater cofferdams	SHC_03	Pump water out of cofferdams	◆	◆ ³	◆ ³	◆ ³	Dewatering of cofferdams would occur 24 hours a day, seven days a week. Pumps would be enclosed or otherwise treated so that noise management levels are not exceeded.
Excavation of rock within cofferdam and trench	26	4) Excavate cofferdams	SHC_04	Remove soil and rock from cofferdams	◆				Excavators with rock hammers are proposed to be used for these works. Works would be restricted to daytime hours only. The duration is likely to be for the full program duration indicated. Noise levels would also reduce over the excavation period as the rock hammer goes deeper into the cofferdam, due to increased shielding from the cofferdam.
Construction of interface structure	52	5) Cast transition structures	SHC_05	Cast concrete transition structures	◆				Predicted noise levels are based on all plant operating simultaneously and continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels.
Removal of cofferdam structure and site rehabilitation	26	6) Remove cofferdams	SHC_06	Inundate and remove cofferdams	◆	◆ ³	◆ ³	◆ ³	Inundation of cofferdams would occur 24 hours a day, seven days a week. If this work is needed, pumps would be enclosed or otherwise treated so that noise management levels are not exceeded.

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Dredging and gravel placement	52	7) Prepare foundations	SHC_07	Dredge and place gravel foundations	◆	◆	◆	◆	Dredging (trailer suction hopper dredging) of the Sydney Harbour Crossing would occur 3 times a night for only 25 minutes at a time. This represents about 10% of the night time. Most of the time the dredge would be travelling between the Sydney Harbour Crossing and the disposal site.
Tunnel element immersion	65	8) Immerse elements	SHC_08	Immerse and connect tube tunnel elements	◆	◆	◆	◆	Tunnel element immersion would occur 24 hours a day during harbour closures, to allow work to take place safely without impacting normal harbour traffic. It would typically take between 24 and 48 hours to safely sink each of the tunnel units. This activity would occur on up to seven occasions.

Notes:

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Evening is 6.00 pm to 10.00 pm Monday to Friday and 6.00 pm to 10.00 pm Saturday/Sunday/ Public holiday; Night is 10.00 pm to 7.00 am Monday to Friday and 10.00 pm to 8.00 am Saturday/ Sunday/ Public holiday
- Pumps are to remain operating, no other activities proposed.

Berrys Bay construction support site (WHT7)

Table 11: Indicative construction program for Berrys Bay construction support site (WHT7)

Stage	Construction activity	Reference	Indicative construction program timeframe																			
			2021				2022				2023				2024				2025			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Site establishment	1) Early works	BRY_01																				
	2) Establish site	BRY_02																				
	3) Establishment of construction facilities	BRY_03																				
Acoustic shed and surface level tunnel access construction	4) Piling for acoustic sheds	BRY_04																				
	5) Surface level decline construction	BRY_05																				
	6) Acoustic shed construction	BRY_06																				
Tunnel construction (access decline and mainline tunnels)	7) Tunnelling	BRY_07																				
Tunnel fitout	8) Tunnel fitout	BRY_08																				
Tunnel commission and site rehabilitation	9) Restore site	BRY_09																				

Table 12 Duration and frequency of worst case noise events for Berrys Bay construction support site (WHT7)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Site establishment	26	1) Early works	BRY_01	Utility works	◆				Utility adjustment works would occur on about 12 occasions during the 26 week period. Excavators with rock hammers would be used as part of utility adjustments intermittently, and likely be required for a total duration of only 10 days. These works within the site boundary are restricted to standard construction hours. When rock hammers are not used, noise levels are predicted to reduce by up to 8 dB(A). 27 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).
		2) Establish site	BRY_02	Install environmental controls	◆				Demolition of the existing building structures would likely take 12 weeks. As a worst case, this would be undertaken using excavators with rock hammers throughout this demolition period. These works within the site boundary are restricted to standard construction hours with periods of respite as required. When rock hammers are not used, noise levels are predicted to reduce by up to 8 dB(A). 22 highly noise affected receivers have been identified associated with the demolition works (see Figure 1 in Attachment A).
				Demolish existing structures.	◆				
		3) Establishment of construction facilities	BRY_03	Establish construction facilities (site offices and workshops)	◆				-
Acoustic shed and surface level tunnel access construction	26	4) Piling for decline and acoustic shed	BRY_04	Piling for decline and acoustic shed	◆				Piling works would only occur intermittently during this period. This would likely consist of 1 piling rig for about 8 weeks in the 26 week period. 3 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).
		5) Surface level decline construction	BRY_05	Surface level decline excavation and construction	◆				Excavators with rock hammers are proposed to be used before the construction of the acoustic shed. Works would be restricted to daytime hours only until the acoustic shed is place. The duration is likely to be for the length of the program duration (ie 26 weeks). 10 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
		6) Acoustic shed construction	BRY_06	Spoil shed construction	◆				-
Tunnel construction (access decline and mainline tunnels)	78	7) Tunnelling	BRY_07	General site activities	◆	◆	◆	◆	The majority of the works would be completed within the acoustic shed for works conducted outside standard construction hours. Spoil haulage at night would not occur.
				Deliveries	◆				
				Tunnelling and support	◆	◆	◆	◆	
				Tunnelling lining (concreting) deliveries	◆	◆	◆	◆	
				Spoil handling in an acoustic shed	◆	◆ ³	◆ ³	◆ ³	
				Spoil haulage	◆				
Tunnel fitout	117	8) Tunnel fitout	BRY_08	Deliveries	◆	◆	◆	◆	For works outside standard construction hours, only 1 heavy vehicle per hour is expected to deliver materials during this stage.
				Laydown areas	◆				
Tunnel commission and site rehabilitation	65	9) Restore site	BRY_09	Decommission site	◆				<p>In the worst case, excavators with rock hammers would be required on occasions as part of decommissioning the site. This is likely only required for a total duration of around 3 weeks. These noise emissions may also be shielded by site structures before they are removed as part of this stage.</p> <p>5 highly noise affected receivers have been identified for this activity (see Figure 1 in Attachment A).</p>

Cammeray Golf Course construction support site (WHT10)

Table 13: Indicative construction program for Cammeray Golf Course construction support site (WHT10)

Stage	Construction activity	Reference	Indicative construction program timeframe																			
			2021				2022				2023				2024				2025			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Site establishment	1) Early works	CGC_01	■	■	■	■																
	2) Establish site	CGC_02	■	■	■	■																
Acoustic shed and surface level shaft and tunnel excavation	3) Acoustic shed and surface level shaft and tunnel excavation	CGC_03				■	■															
Surface work support	4) Support Warringah Freeway Upgrade	CGC_04		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Tunnel construction (decline, ventilation and mainline tunnels) and rock crushing	5) Tunnelling	CGC_05						■	■	■	■	■	■	■								
Tunnel fitout	6) Tunnel fitout	CGC_06								■	■	■	■	■	■	■	■	■	■	■	■	
Permanent motorway facilities construction	7) Remove spoil shed, construct motorway facilities building	CGC_07								■	■	■	■	■	■	■	■					
Fitout of motorway facilities and ventilation outlet	8) Motorway facilities building fitout and ventilation outlet	CGC_08										■	■	■	■	■	■					
Tunnel commission and site rehabilitation	9) Restore site	CGC_09															■	■	■	■	■	

Table 14 Duration and frequency of worst case noise events for Cammeray Golf Course construction site (WHT10)

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Site establishment	52	1) Early works	CGC_01	Utility works	◆				Utility adjustment works would occur on around 12 occasions during the 52 week period. Excavators with rock hammers would be used as part of utility adjustments intermittently, and likely be required for a total duration of only 20 days. These works within the site boundary are restricted to standard construction hours. When rock hammers are not used, noise levels will be substantially lower.
		2) Establish site	CGC_02	Install environmental controls	◆				<p>Impacts of >75 dB(A) caused by construction of vehicle access points to the site near Morden Street. The duration of the constructing the access points would likely only be for about 12 weeks within the total duration.</p> <p>11 highly noise affected receivers have been identified for the construction of vehicle access points to the site near Morden Street (see Figure 5 in Attachment A)⁶.</p> <p>Existing structures are located in the middle of the Golf Course, and so demolition works do not control construction noise levels. Demolition of the existing building structures would likely take around 1 week. These works within the site boundary are restricted to standard construction hours with periods of respite as required. If rock hammers are not used, noise levels will be substantially lower.</p> <p>High predicted noise levels are from vegetation clearing activities near Ernest Street and Morden Street/Bells Avenue/Warringah Road receivers. The duration of the vegetation clearing activities is likely to be short-term only (about 5 weeks) and high impacts only occur when chainsaw/tub grinder/mulchers are in use.</p> <p>Earthworks would be required across the construction support site. Earthworks using loud plant items such as bulldozers, graders, rollers and dump trucks would be required for a period of around 20 weeks. Predicted noise levels are based on all plant operating simultaneously, the louder plant in operation, and all items continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels.</p>
				Construction of vehicle access points via the Warringah Freeway	◆				
				Demolition	◆				
				Clearing and grubbing	◆				
				Bulk earthworks	◆				
				Establish construction facilities	◆				

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Acoustic shed and surface level shaft and tunnel excavation	26	3) Acoustic shed and surface level shaft and tunnel excavation	CGC_03	Piling shed and motorway facility building, and hammering for shaft construction		◆			-
				Surface level access and ventilation shaft and tunnel construction		◆			
				Acoustic shed construction		◆			
Surface work support	221	4) Support Warringah Freeway Upgrade	CGC_04	General support site activities	◆	◆	◆	◆	Works outside of standard construction hours have the potential to result in sleep disturbance as a result of occasional clangs and bangs from general site activities in laydown areas, and maximum noise level events could occur from occasional heavy vehicle movements into and out of the site from the Warringah Freeway. Standard mitigation measures would minimise risks of these occurrences.
				Deliveries to site	◆ ⁵				
				Surface work support - hardstand areas	◆ ⁵				
Tunnel construction (decline, ventilation and mainline tunnels) and rock crushing	104	5) Tunnelling	CGC_05	General site activities	◆	◆	◆	◆	Concrete delivery heavy vehicles occasionally accessing the site outside of standard construction hours could result in high instantaneous noise impacts during arrival or departure.
				Tunnel support - deliveries	◆	◆ ³	◆ ³	◆ ³	
				Tunnelling and support	◆	◆	◆	◆	
				Tunnel lining (concreting)	◆	◆	◆	◆	
				Rock crushing in an acoustic shed	◆				
				Spoil handling in an acoustic shed	◆	◆ ⁴	◆ ⁴	◆ ⁴	
				Spoil haulage	◆				

Stage	Total indicative program duration (weeks)	Representative activity	Reference	Assessed activities ¹	Work hours ²				Comments on representative activities
					Day (standard)	Day (OOHW)	Evening	Night	
Tunnel fitout	130	6) Tunnel fitout	CGC_06	Tunnel fitout - deliveries	◆	◆ ³	◆ ³	◆ ³	Works outside of standard construction hours have the potential to result in sleep disturbance as a result of occasional clangs and bangs from general site activities in laydown areas, and maximum noise level events could occur from occasional heavy vehicle movements into and out of the site from the Warringah Freeway. Standard mitigation measures would minimise risks of these occurrences.
				Tunnel fitout – laydown areas	◆				
Permanent motorway facilities construction	104	7) Remove spoil shed, construct motorway facilities building	CGC_07	Motorway facilities structure construction	◆				-
				Demolition of structures (no rock hammer)	◆				
Fitout of motorway facilities and ventilation outlet	65	8) Motorway facilities building fitout and ventilation outlet	CGC_08	Deliveries to site	◆				-
Tunnel commission and site rehabilitation	65	9) Restore site	CGC_09	Decommission and restore site		◆			Exceedances of noise management levels are expected during site restoration works during standard construction hours. This would be largely occur when works are required at the furthest north or south points on the site near to receivers on Ernest Street or Morden Street/Bells Avenue/Warringah Road. Predicted noise levels are based on all plant operating simultaneously, louder plant in operation, and all items continuously during the works. However, in practice not all plant would typically operate all the time, meaning that for a substantial part of the time actual noise levels would be less than the predicted noise levels.

1. Appendix E of the EIS Technical working paper: Noise and vibration describes the modelled plant for each activity

2. Day (S) Standard is 7.00am to 6.00pm Monday to Friday and 8.00 am to 1.00 pm Saturday; Day (O) Out-of-Hours Work is 1.00 pm to 6.00 pm Saturday and 8.00am to 6.00 pm Sunday/ Public holiday

Evening is 6.00 pm to 10.00 pm Monday to Friday and 6.00 pm to 10.00 pm Saturday/Sunday/ Public holiday; Night is 10.00 pm to 7.00 am Monday to Friday and 10.00 pm to 8.00 am Saturday/ Sunday/ Public holiday

3. Laydown activities would occur inside acoustic shed.

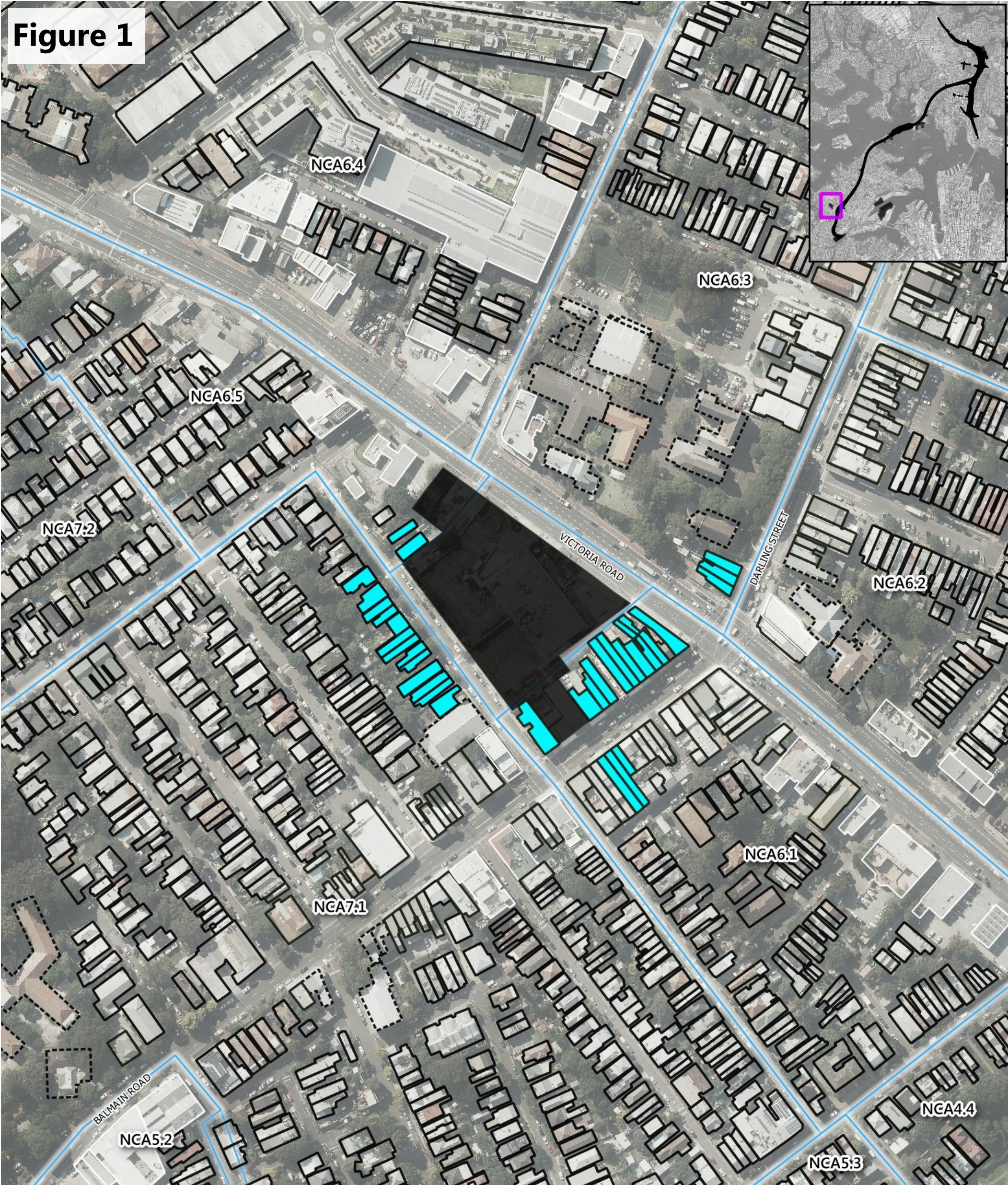
4. Spoil haulage off the construction support site would occur during standard construction hours. OOHW spoil handling would occur inside acoustic shed.

5. It is assumed that deliveries to the Warringah Freeway Upgrade construction works areas within the Warringah Freeway road corridor would either be carried out directly to the construction works areas or deliveries to and from hardstand areas within the Cammeray construction support site would occur during standard construction hours, moving equipment and materials to locations near to the construction work areas within the Warringah Freeway road corridor.

6. Previously reported as 12 highly noise affected receivers however since exhibition of the EIS, one receiver has been acquired by Transport for NSW

Attachment A – Figures

Figure 1



Legend

Construction support site

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

Residential receiver building

During any stage

L_{Aeq} (15min), dB(A) [count]

Highly noise affected [32]

Notes:

1. Highly noise affected (ie. > 75dB(A) L_{Aeq} 15minute) applies to residential receivers only (including mixed use)

2. Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.

3. Predicted noise levels may change as part of detailed design. As the specific construction methodology is not yet known until a contractor is appointed, construction equipment, detailed mitigation and mangement measures, and the frequency, timing and duration of noise impacts are not known. These would be determined as part of the preparation of a site-specific CNVIS during detailed design to assist in reducing construction noise impacts to receiver buildings.

Consultant:

RENZO TONIN & ASSOCIATES
inspired to achieve

1/418A Elizabeth Street, SURRY HILLS NSW 2010
P: 02 8218 0500 F: 02 8218 0501

Client:

Transport for NSW

Project:

Western Harbour Tunnel and Warringah Freeway Upgrade

Description:

Highly noise affected residential receiver buildings
During any stage of works
Victoria Road

Figure No: TJ500-01-6-1-3-1 039-CSS-1

Date: 30-07-2020

Created by: ALE

Rev: R6

Sheet: A3

Scale: 1:2000

15 0 15 30 45 m

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Figure 2



Legend

Construction support site

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

Residential receiver building

During any stage

LAeq (15min), dB(A) [count]

Highly noise affected [2]

Notes:

1. Highly noise affected (ie. > 75dB(A) LAeq 15minute) applies to residential receivers only (including mixed use)

2. Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.

3. Predicted noise levels may change as part of detailed design. As the specific construction methodology is not yet known until a contractor is appointed, construction equipment, detailed mitigation and mangement measures, and the frequency, timing and duration of noise impacts are not known. These would be determined as part of the preparation of a site-specific CNVIS during detailed design to assist in reducing construction noise impacts to receiver buildings.

Figure 3



Legend

Construction support site

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

Residential receiver building

During any stage

L_{Aeq} (15min), dB(A) [count]

Highly noise affected [6]

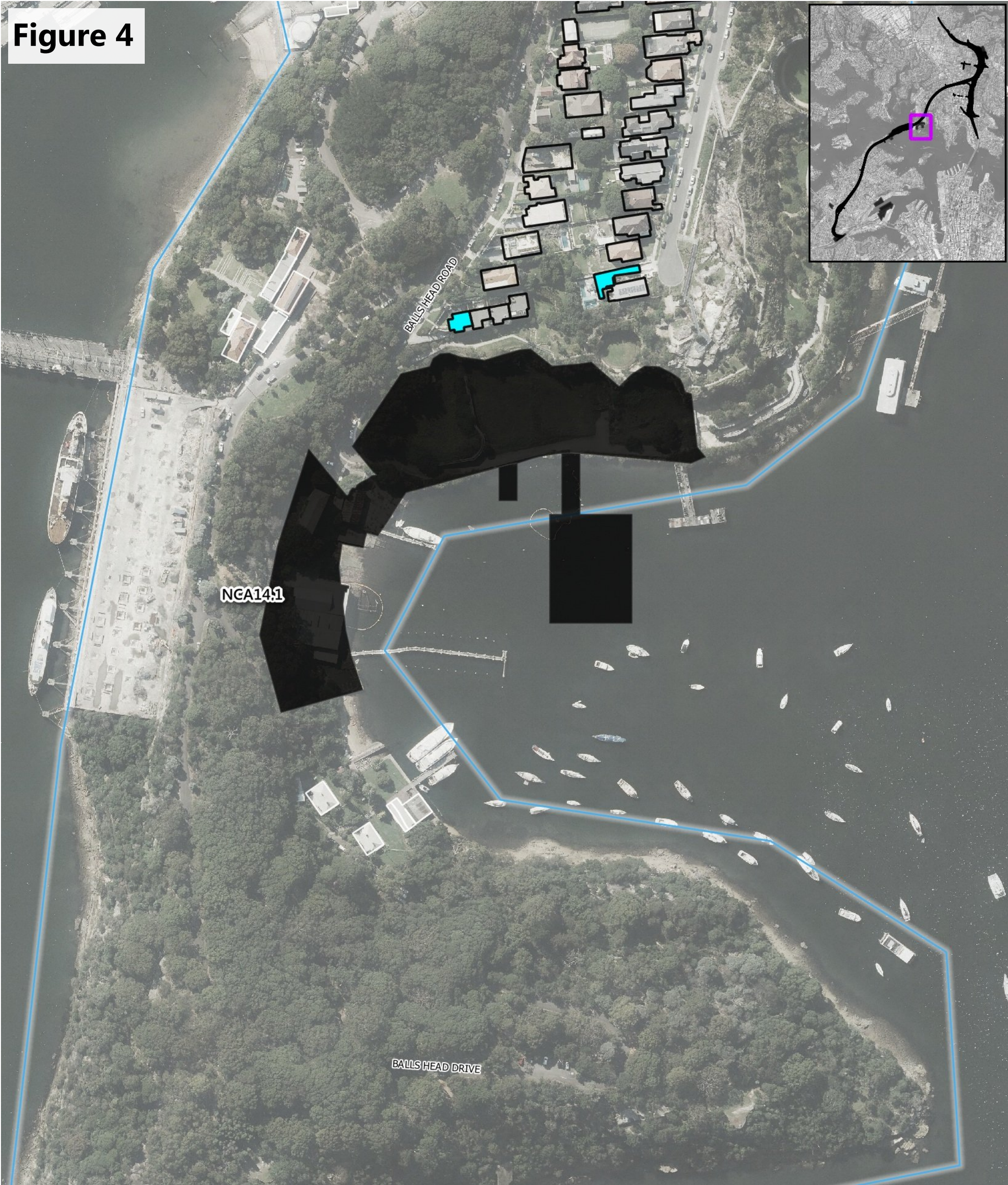
Notes:

1. Highly noise affected (ie. > 75dB(A) L_{Aeq} 15minute) applies to residential receivers only (including mixed use)

2. Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.

3. Predicted noise levels may change as part of detailed design. As the specific construction methodology is not yet known until a contractor is appointed, construction equipment, detailed mitigation and mangement measures, and the frequency, timing and duration of noise impacts are not known. These would be determined as part of the preparation of a site-specific CNVIS during detailed design to assist in reducing construction noise impacts to receiver buildings.

Figure 4



Legend

Construction support site

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

Residential receiver building

During any stage

L_{Aeq} (15min), dB(A) [count]

Highly noise affected [2]

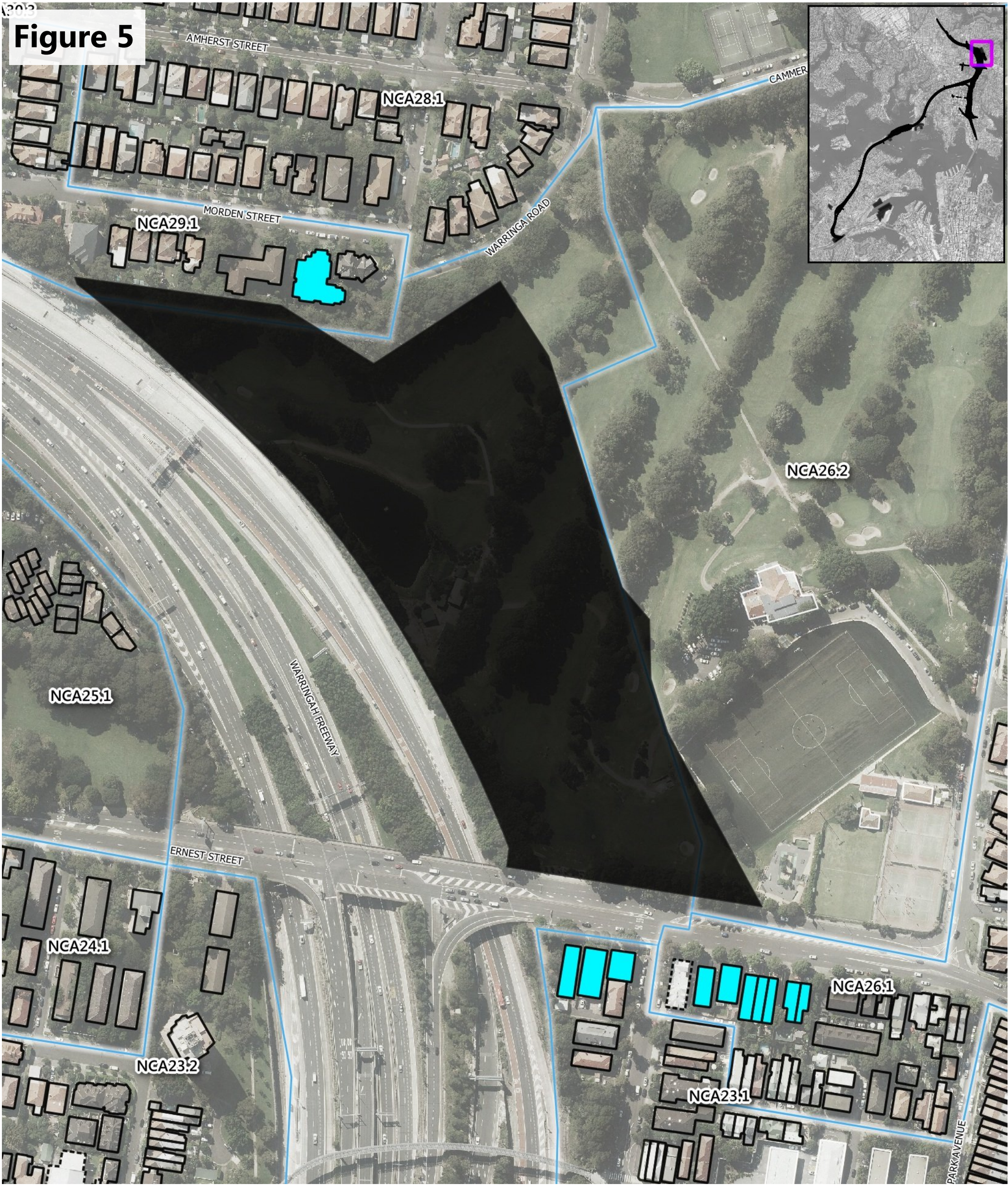
Notes:

1. Highly noise affected (ie. > 75dB(A) L_{Aeq} 15minute) applies to residential receivers only (including mixed use)

2. Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.

3. Predicted noise levels may change as part of detailed design. As the specific construction methodology is not yet known until a contractor is appointed, construction equipment, detailed mitigation and mangement measures, and the frequency, timing and duration of noise impacts are not known. These would be determined as part of the preparation of a site-specific CNVIS during detailed design to assist in reducing construction noise impacts to receiver buildings.

2013
Figure 5



Legend

Construction support site

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

Residential receiver building

During any stage

LAeq (15min), dB(A) [count]

Highly noise affected [11]

Notes:

1. Highly noise affected (ie. > 75dB(A) LAeq 15minute) applies to residential receivers only (including mixed use)

2. Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.

3. Predicted noise levels may change as part of detailed design. As the specific construction methodology is not yet known until a contractor is appointed, construction equipment, detailed mitigation and mangement measures, and the frequency, timing and duration of noise impacts are not known. These would be determined as part of the preparation of a site-specific CNVIS during detailed design to assist in reducing construction noise impacts to receiver buildings.



Transport for NSW

Western Harbour Tunnel and Warringah Freeway Upgrade

Appendix F2 –
Warringah Freeway Upgrade
surface roadworks:
Highly noise affected receivers

4 August 2020

Appendix F2 - Warringah Freeway surface road works - Highly noise affected receivers

Transport for NSW

Western Harbour Tunnel and Warringah Freeway Upgrade project

[via Jacobs Arcadis]

From: Angus Leslie [Angus.Leslie@renzotonin.com.au]

Western Harbour Tunnel and Warringah Freeway Upgrade – Memorandum for inclusion in Submissions Report – Highly Noise Affected Receivers

1 Introduction

This memorandum provides a summary of additional information for inclusion in the Western Harbour Tunnel and Warringah Freeway Upgrade project submissions report.

In particular, this memorandum provides information to supplement the environmental impact statement Appendix G (Technical working paper: Noise and vibration) and includes further information regarding how many properties would be highly noise affected, where these properties are, which compounds/sites would affect the properties, and considerations around how long the properties would be highly noise affected.

It should be noted that this memorandum only applies to highly noise affected properties for the Warringah Freeway minor construction support sites and surface road works component of the project.

It should also be noted that the results presented in this memorandum for highly noise affected receivers are conservative and based on a reasonable worst case noise scenario, with all plant and equipment operating at the same time in a similar location and the loudest plant items (eg rock hammers) being used. The predictions are also based on when the construction works are at the closest location to each receiver. The potential for the worst case noise scenario to occur during construction is unlikely to typically occur. The construction noise levels at that receiver would reduce when construction activities move further away, if less plant are operating, or where the loudest plant items are not in use. The construction contractor, once appointed, would refine the proposed construction methodology, providing a better understanding of the construction plant and equipment required for specific works, the locations they would likely operate and the potential for concurrent activities.

2 Warringah Freeway surface road works highly noise affected predictions

Number of properties that are highly noise affected

Table 2-1 provides a list of how many properties are predicted to be highly noise affected for each major works area and minor construction support site along the Warringah Freeway surface road works component of the project. These counts have been separated into standard construction hours and outside of (standard construction) hours work (OOHW). Appendix G (Technical working paper: Noise and vibration) did not include counts for highly affected receiver buildings for works outside of standard construction hours, and so these have been included in Table 2-1.

Table 2-1 – Number of residential receiver buildings predicted to be highly noise affected (> 75 dB(A) L_{Aeq} 15 minute) at a point during the project (Worst case activity noise intensity) for the Warringah Freeway surface road works component of the project

Zone	Construction works area	Work area reference	Number of highly noise affected residential receiver buildings (Worst case activity noise intensity) > 75 dB(A), L _{Aeq} 15 minute	
			Standard construction hours	OOHW
Major works area				
Zone 1	Ridge Street shared user bridge	WFU1A	9	19
	Berry Street entry on ramp works	WFU1B	19	20
	Alfred Street north and Mount Street interchange modification and grade separation works	WFU1C	62	55
	Warringah Freeway northbound widening	WFU1D	-	-
	Falcon Street interchange upgrade	WFU1E	27	26
	High Street interchange upgrade	WFU1F	-	-
	Warringah Freeway southbound widening	WFU1G	49	30
	Western Harbour Tunnel Falcon Street off ramp cut and cover	WFU3J	-	-
Zone 2	Falcon Street to Miller Street construction works	WFU2H	24	16
Zone 3	Miller Street to Willoughby Road construction works	WFU3I	92	79
	Western Harbour Tunnel motorway control centre	WFU3K	-	-
Minor construction support sites				
	Blue Street (WFU1)	WFU1	-	-
	High Street south (WFU2)	WFU2	-	-
	High Street north (WFU3)	WFU3	-	-
	Arthur Street east (WFU4)	WFU4	-	-
	Berry Street east (WFU5)	WFU5	-	-
	Berry Street north (WHT8)	WHT8	1	-
	Ridge Street east (WFU6)	WFU6	1	-
	Ridge Street north (WHT9)	WHT9	-	-

Zone	Construction works area	Work area reference	Number of highly noise affected residential receiver buildings (Worst case activity noise intensity) > 75 dB(A), L _{Aeq} 15 minute	
			Standard construction hours	OOHW
	Merlin Street (WFU7)	WFU7	1	-
	Jeaffreson Jackson Reserve construction area	-	1	-
	Merlin Street (north) construction area	-	-	-
	Rosalind Street east (WFU9)	WFU9	-	-

Location of highly noise affected receivers and construction support sites which would affect the properties

The maps included in Attachment A show the locations of receiver buildings that are predicted to be highly noise affected from worst case construction activities within the major works areas affected by the Warringah Freeway surface road works during the project. The highly noise affected receiver buildings have been presented as separate major works areas in order to show which construction works are predicted to result in highly noise affected construction noise levels at nearby receivers. Only major work areas where receivers are predicted to be highly noise affected have been mapped. For the minor construction support sites, predicted noise levels are only > 75 dB(A) L_{Aeq} 15 minute for some properties directly adjacent, and so these receiver buildings are presented on the minor construction support sites map.

Duration for which properties would be highly noise affected

For the Warringah Freeway surface road works, it should be noted that the duration and frequency of receivers exposed to noise levels above 75 dB(A) L_{Aeq} 15 minute from the surface road works activities cannot be determined at this stage but will be confirmed during further design development and once the construction contractor is selected and the construction methodology is confirmed.

For assessment of the duration that properties would be highly noise affected, it is noted the frequency and duration of noise impacts are not only reliant on when and how long the works will occur for. An example of this would be two sets of works occurring over the same physical extent over a 2 week period:

- one uses noise intensive equipment such as a rock hammer for short periods of time moving around the site to various locations along the works extent
- the other requires multiple rock hammers operating continuously for excavation works over the same extent.

Both sets of work would generate the same worst case highest noise level at receivers when equipment is operating at the closest location to any one receiver. However, individual receivers would experience very different durations of impact during each work set.

There are a range of factors that impact the frequency and duration of noise impacts at a receiver, some inherent to the noise source/activity; others based upon the location of the receiver compared to the various works areas. For example, factors that need to be considered are if the activities are static or intermittent in nature, what detailed mitigation and management measures that have been implemented, and how much reliance there is on the worst case plant and equipment.

Receiver buildings with the potential to be highly noise affected from construction works in the major works areas are highlighted in the maps included in Attachment A. These are based upon the:

- worst case set of construction equipment that is expected to occur within works area, and
- when the worst case activity is occurring at the closest point to each receiver.

When this equipment is not operating, or the works are occurring at a location further away, then the noise level at the receiver would be less.

The project is not currently able to identify the actual duration and frequency of impacts on the vast majority of receivers potentially $> 75 \text{ dB(A)} L_{Aeq 15 \text{ minute}}$. While there can be greater certainty around the general nature and duration of impacts for construction support sites as these sites are fixed, and are required to be functional for the duration of construction, the nature and duration impacts from the majority of surface work sites are more difficult to confirm as they will move and change over time. The construction contractor, once appointed, would further revise the project design during the design development phase and would also refine their proposed construction methodology. This process would seek to reduce the nature and extent of noise impacts predicted in the environmental impact statement. The contractor would complete additional modelling and analysis with a better understanding of the construction plant and equipment required for specific works, the locations they would likely operate, the potential for concurrent activities in order to make more accurate predictions of the nature and duration of impacts, which would then be communicated to the community and the regulators in the construction noise and vibration impact statements that would be prepared for the project.

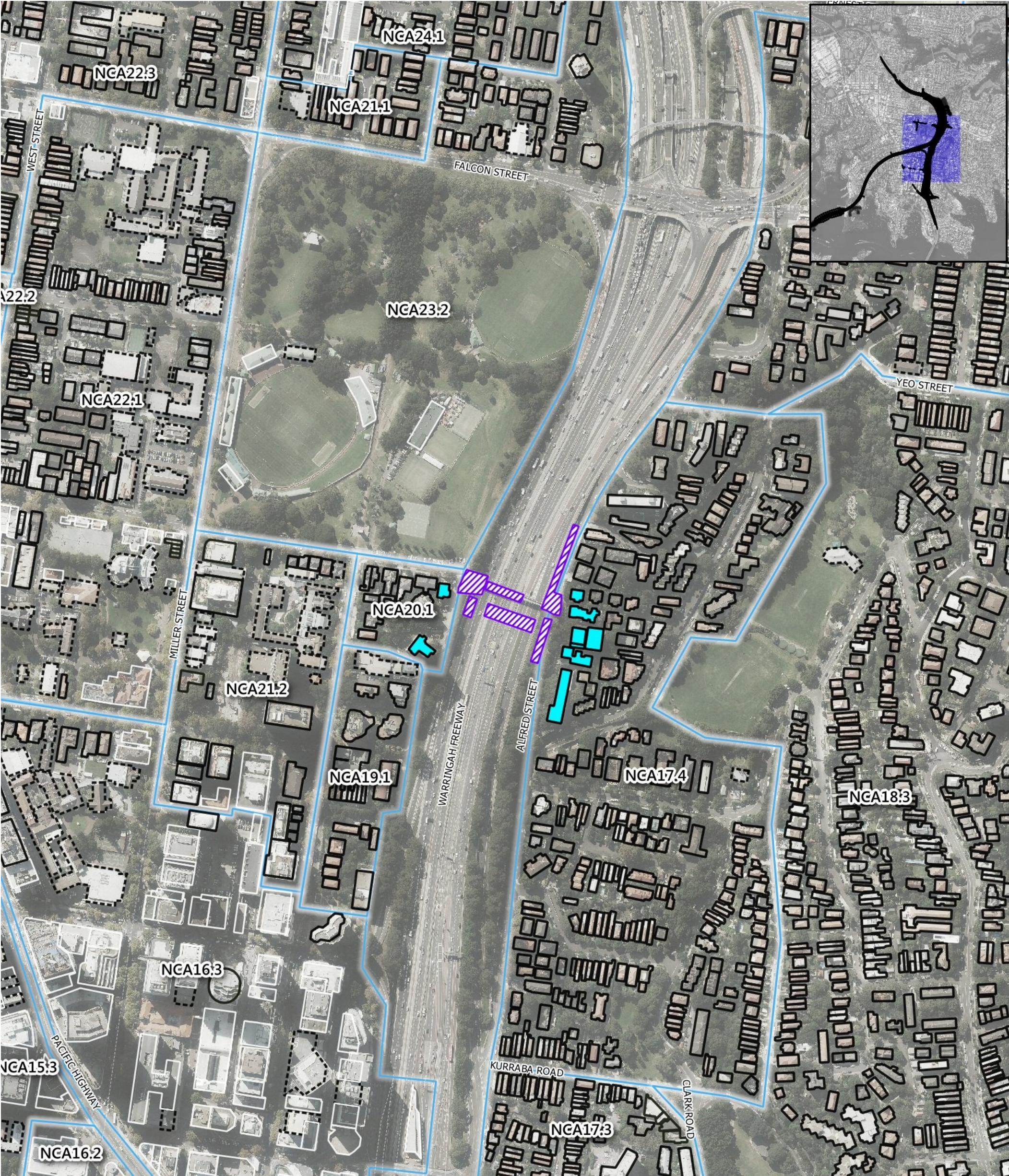
Management of noise impacts

In order to ensure that noise impacts are minimised and managed, the project would implement the following controls to ensure impacts on nearby receivers, including:

- **Construction Noise and Vibration Management Plan (CNMVP)**, to establish the required process for mitigating and managing noise and vibration impacts across the project. This process will include consideration of construction noise impacts from multiple sets of construction works, either from the project or from unrelated projects
- **Construction Noise and Vibration Impact Statements (CNVIS)**, as part of preparation of a site-specific CNVIS during detailed design. The CNVIS would be prepared in accordance with the CNMVP, and all feasible and reasonable mitigation measures would be determined to minimise noise impacts on nearby receivers

- **Noise Insulation Program (NIP)**, to enable the proactive implementation of noise treatment at eligible properties. The NIP outlines the process and criteria for treating properties for both operational and construction noise, and includes assumptions about the expected construction noise impacts to enable noise treatment to be delivered as early as possible in the construction program
- **Construction Noise Management Framework.** As there is a high population density along the Warringah Freeway corridor, including many apartment buildings, there is a large number of receivers that will potentially be affected during works outside of standard hours. Transport for NSW is preparing a Construction Noise Management Framework document in consultation with both the Department of Planning, Industry and Environment (DPIE) and the NSW Environment Protection Authority (EPA) which describes the approach the project will take to mitigating and managing construction noise impacts for out of hours work. The Construction Noise Management Framework will be publicly available during construction, will outline the process for implementing the hierarchy of additional noise mitigation measures and will ensure that there is a consistent approach to the management of noise impacts along this corridor so this is clear to the community.

Attachment A : Highly Noise Affected Receiver Maps



Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

(Worst case - All works areas during any stage)

Residential receiver building

L_{Aeq} (15min), dB(A) [count]

Highly noise affected [9]

Notes:

1. Only residential buildings (including mixed use) have been highlighted. Highly noise affected (ie. > 75dB(A) L_{Aeq} 15minute) applies to residential receivers only (including mixed use).
2. Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.
3. The modelled activities across each major works area are for the highest "Worst-case" impacts and when works are at the closest point to each receiver for the entire major works area.
4. Predicted noise levels may change as part of detailed design. As the specific construction methodology is not yet known until a contractor is appointed, the final locations, construction equipment, detailed mitigation and mangement measures, and the frequency, timing and duration of noise impacts are not known. These would be determined as part of the preparation of a site-specific CNVIS during detailed design to assist in reducing construction noise impacts to receiver buildings.

Consultant:

RENZO TONIN & ASSOCIATES
inspired to achieve

Client:

Transport for NSW

Project:

Western Harbour Tunnel and Warringah Freeway Upgrade

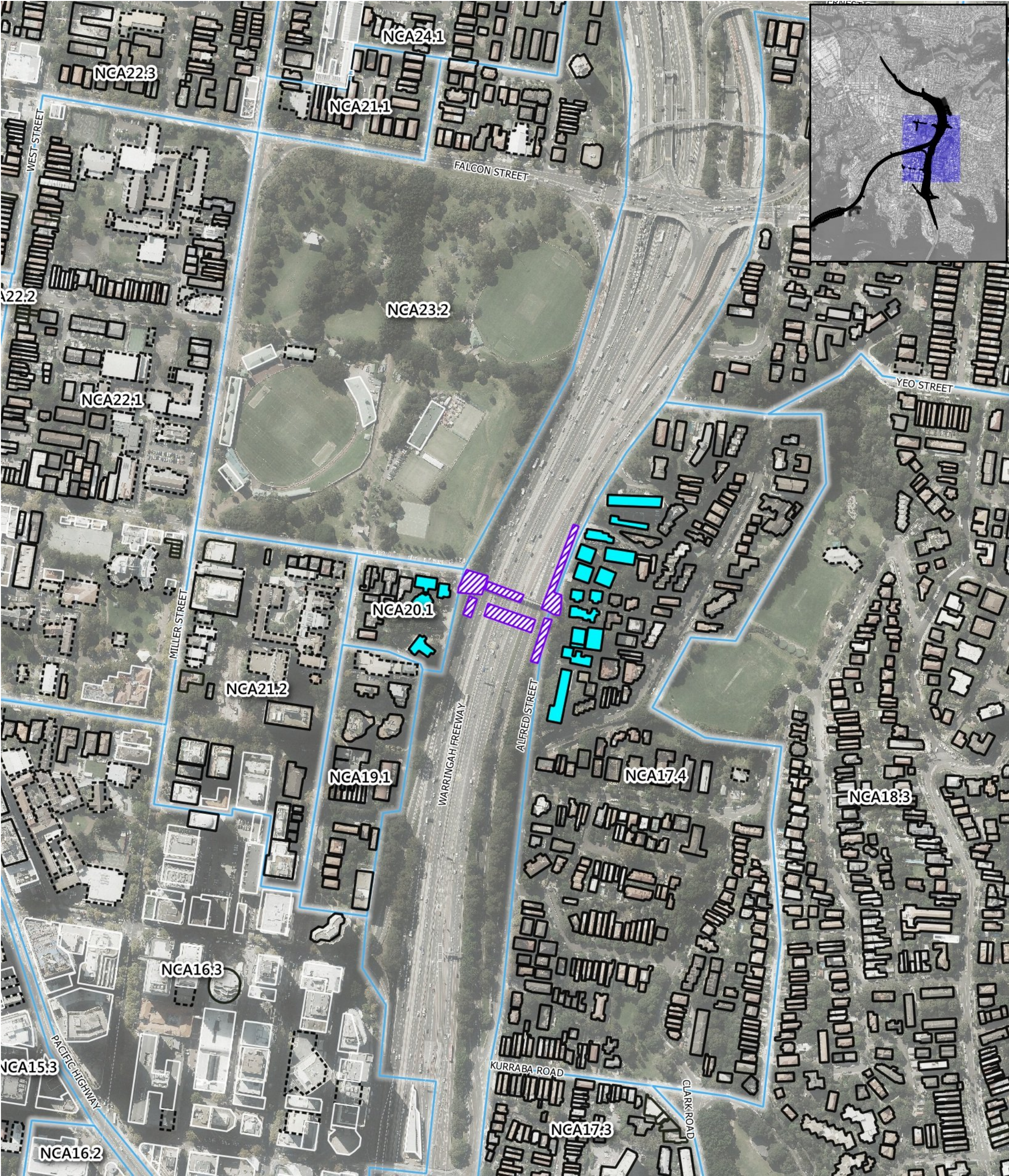
Description:

Residential buildings predicted to be highly noise affected


Standard construction hours


Warringah Freeway surface road works major work area - WFU1A







Legend


 Major works area

 NCA boundary


Receiver type

 Residential

 Other sensitive receiver

 Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

 Highly noise affected [19]

Consultant:



Client:

Transport for NSW

Project:

Western Harbour Tunnel and Warringah Freeway Upgrade

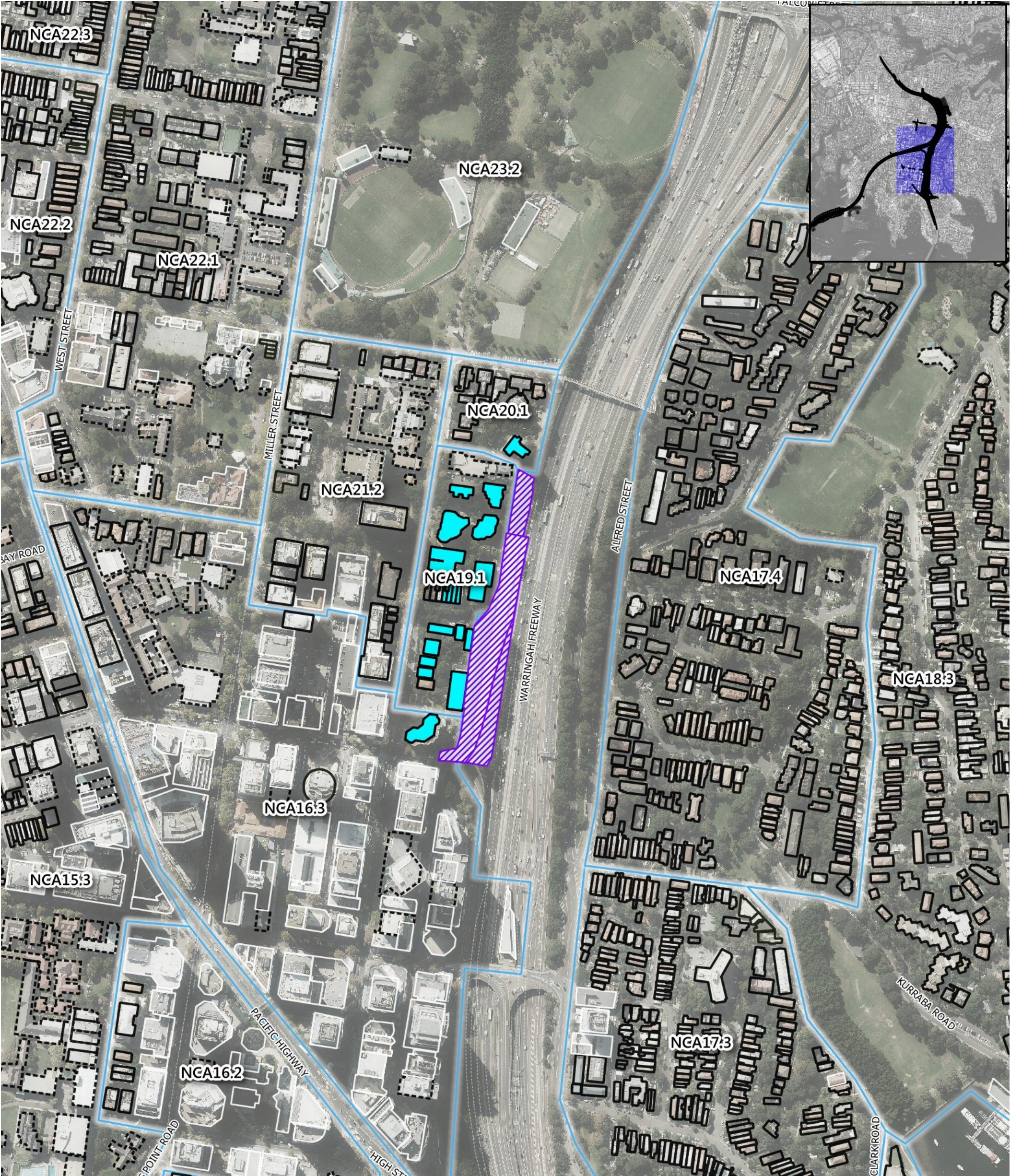
Notes:

- Only residential buildings (including mixed use) have been highlighted. Highly noise affected (ie. > 75dB(A) L_{Aeq} 15minute) applies to residential receivers only (including mixed use).
- Buildings are identified based upon the highest predicted construction noise level for the entire building, considering all floors and facades of the building. Noise levels may be less at other locations on the building.
- The modelled activities across each major works area are for the highest "Worst-case" impacts and when works are at the closest point to each receiver for the entire major works area.
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Description:

Residential buildings predicted to be highly noise affected
Outside standard construction hours
Warringah Freeway surface road works major work area - WFU1A





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

(Worst case - All works areas during any stage)

Residential receiver building

LAeq (15min), dB(A) [count]

Highly noise affected [19]

Notes:

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Client:

Transport for NSW

Project:

Western Harbour Tunnel and Warringah Freeway Upgrade

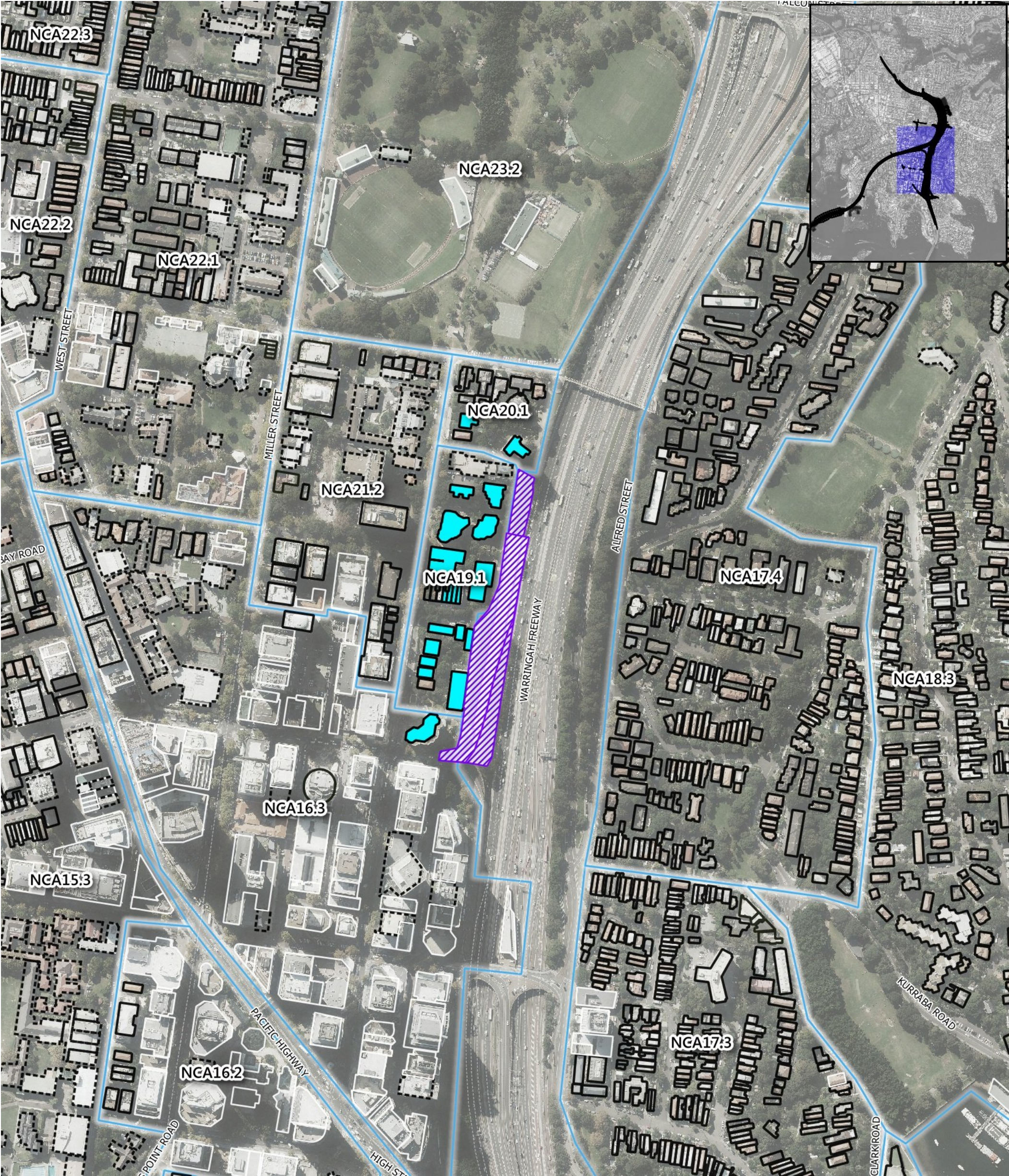
Description:

Residential buildings predicted to be highly noise affected

Standard construction hours

Warringah Freeway surface road works major work area - WFU1B





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

(Worst case - All works areas during any stage)

Residential receiver building

L_{Aeq} (15min), dB(A) [count]

Highly noise affected [20]

Notes:

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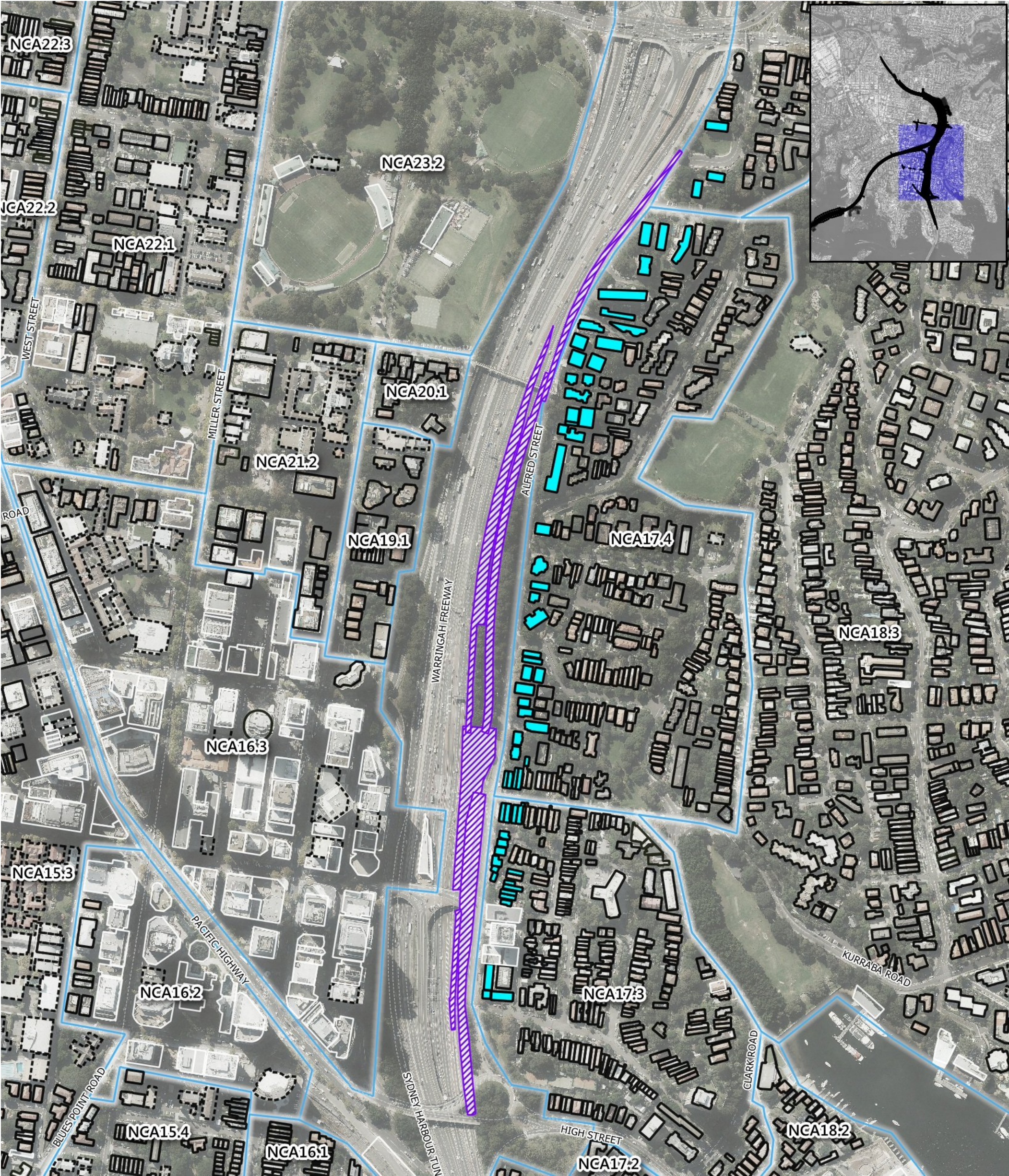
Description:

Residential buildings predicted to be highly noise affected

Outside standard construction hours

Warringah Freeway surface road works major work area - WFU1B





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)

Residential receiver building
L_{Aeq} (15min), dB(A) [count]

Highly noise affected [62]

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Description:

Residential buildings predicted to be highly noise affected

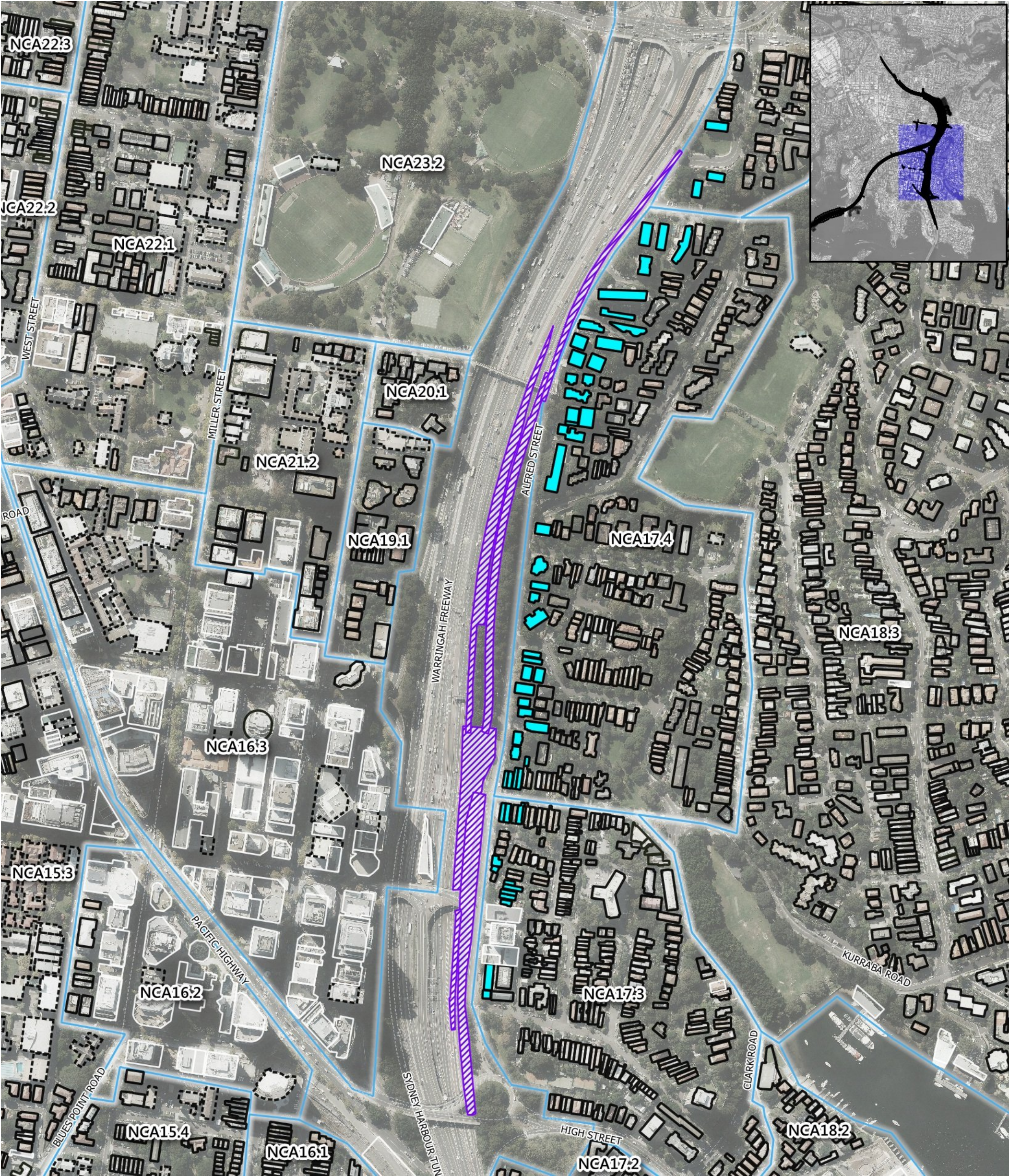
Standard construction hours

Warringah Freeway surface road works major work area - WFU1C

Figure No: TJ500-01-6-1-3-1 039-42-SH
Scale: 1:4500
Date: 30-07-2020

Created by: ALE
Rev: R7
Sheet: A3





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))

(Worst case - All works areas during any stage)

Residential receiver building

L_{Aeq} (15min), dB(A) [count]

Highly noise affected [55]

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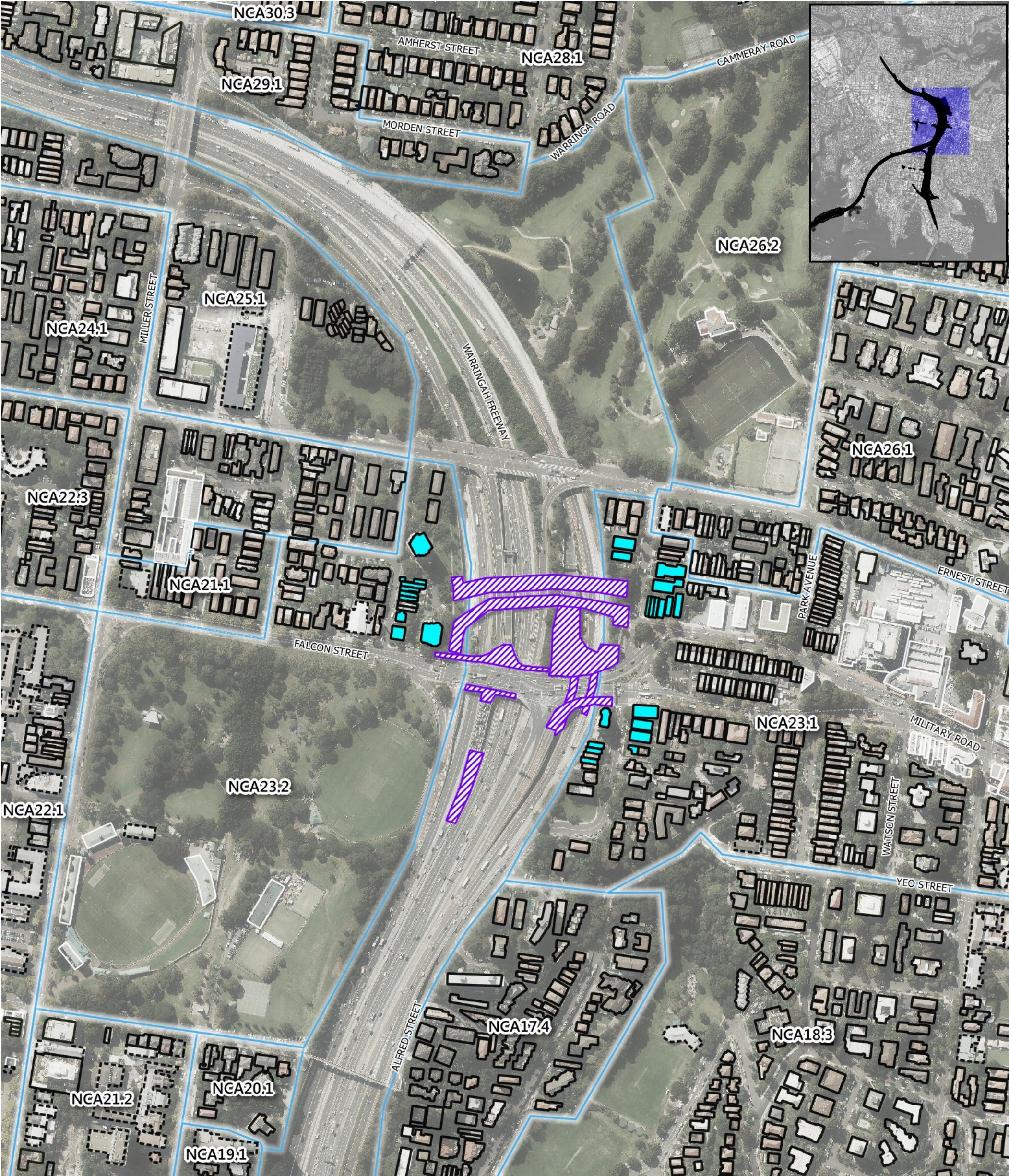
Description:

Residential buildings predicted to be highly noise affected
Outside standard construction hours
Warringah Freeway surface road works major work area - WFU1C


Figure No: TJ500-01-6-1-3-1 039-42-OH
Scale: 1:4500
Date: 30-07-2020


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
Legend


 Major works area


 NCA boundary

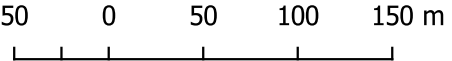
Receiver type

 Residential

 Other sensitive receiver

 Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]
 Highly noise affected [27]



Notes:

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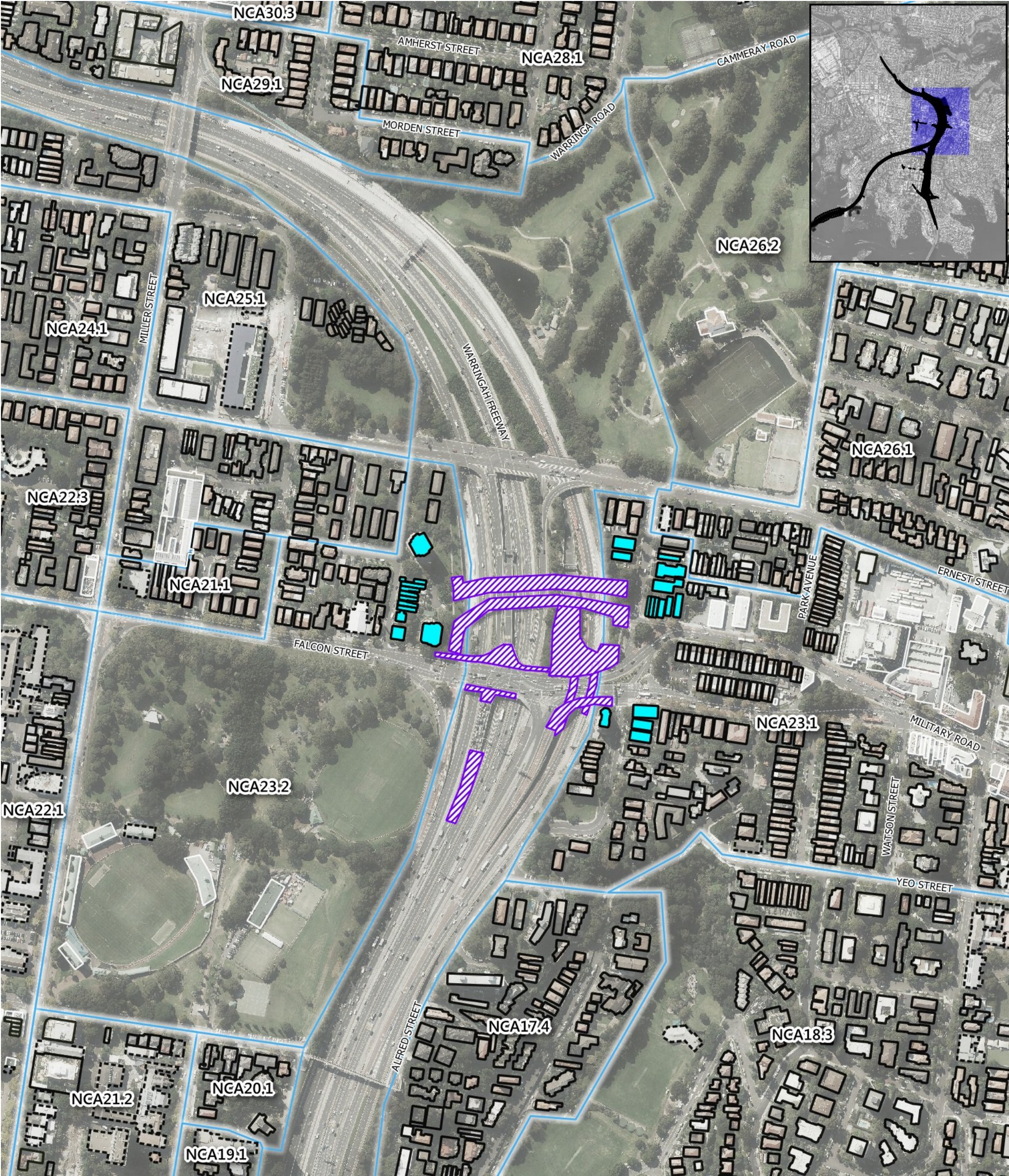


Client:
Transport for NSW

Project:
Western Harbour Tunnel and
Warringah Freeway Upgrade

Description:
Residential buildings predicted to be highly noise affected
Standard construction hours
Warringah Freeway surface road works major work area - WFU1E





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
LAeq (15min), dB(A) [count]

Highly noise affected [26]

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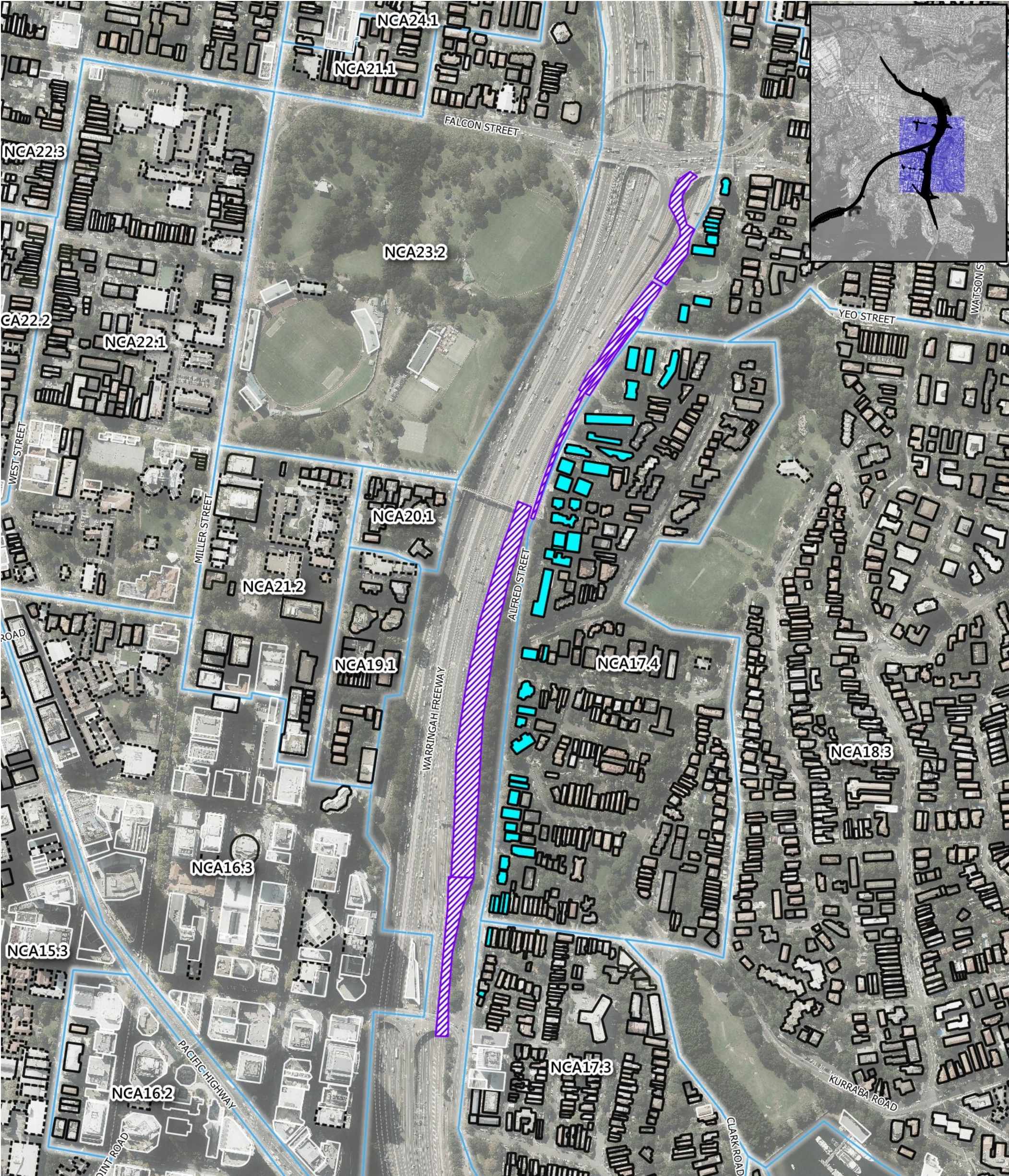
Description:

Residential buildings predicted to be highly noise affected
Outside standard construction hours
Warringah Freeway surface road works major work area - WFU1E


Figure No: TJ500-01-6-1-3-1 039-44-OH
Scale: 1:4000
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



Legend


 Major works area

 NCA boundary


Receiver type

 Residential

 Other sensitive receiver

 Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

 Highly noise affected [49]

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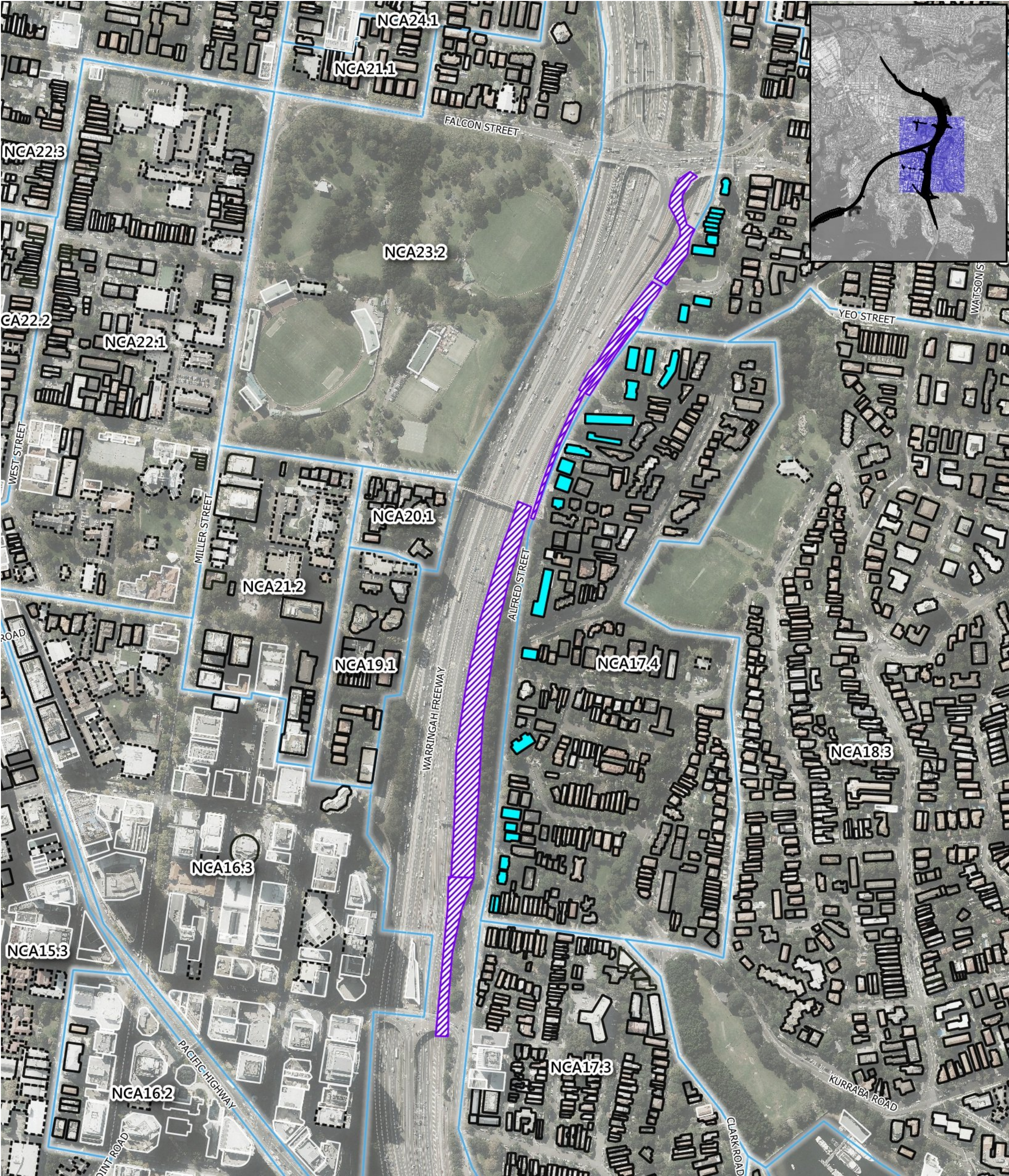


Client:
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Project:
Western Harbour Tunnel and
Warringah Freeway Upgrade

Description:
Residential buildings predicted to be highly noise affected
Standard construction hours
Warringah Freeway surface road works major work area - WFU1G





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

Highly noise affected [30]

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Project:

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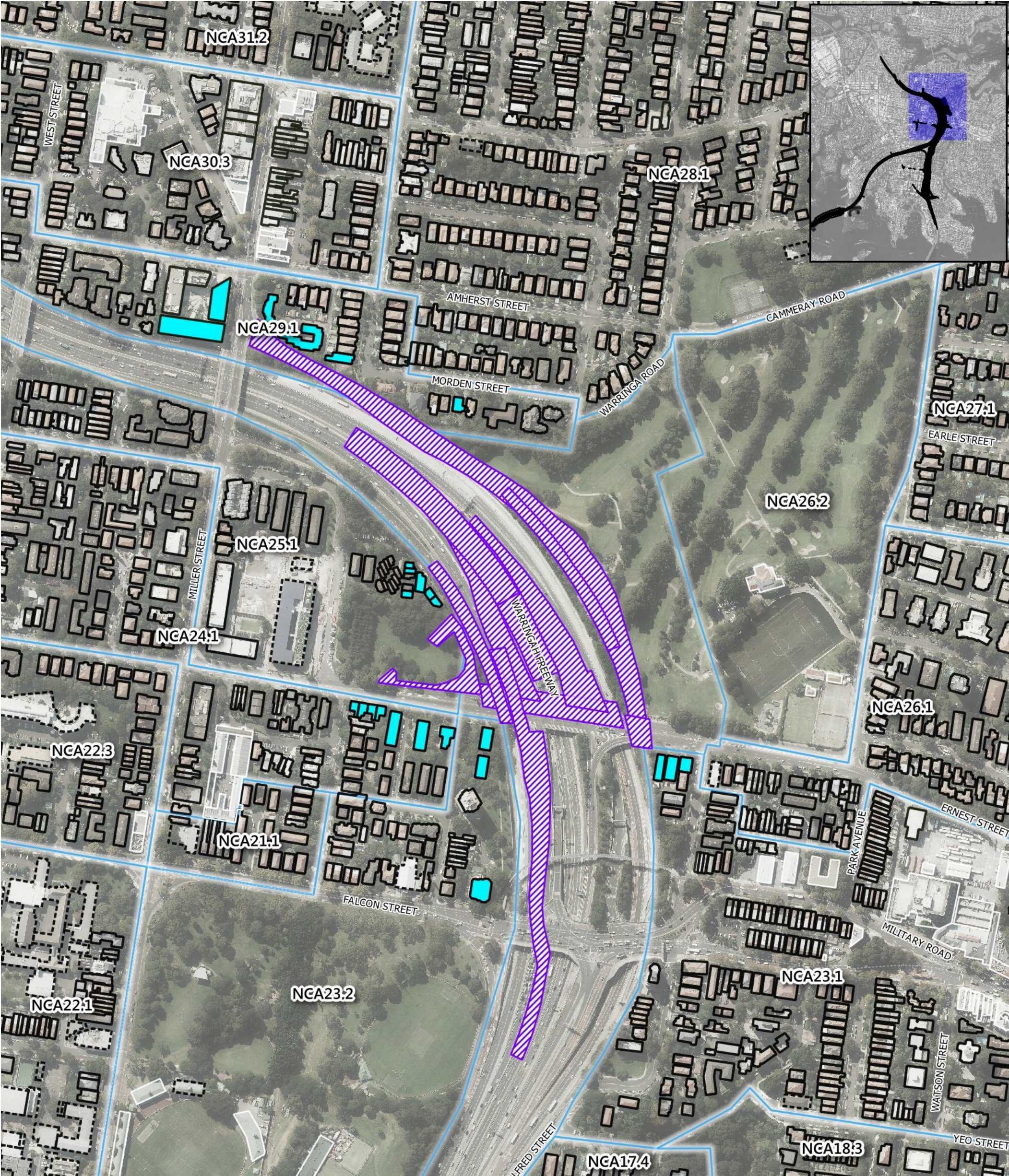
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Description:

Residential buildings predicted to be highly noise affected
Outside standard construction hours
Warringah Freeway surface road works major work area - WFU1G





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

Highly noise affected [24]

Notes:

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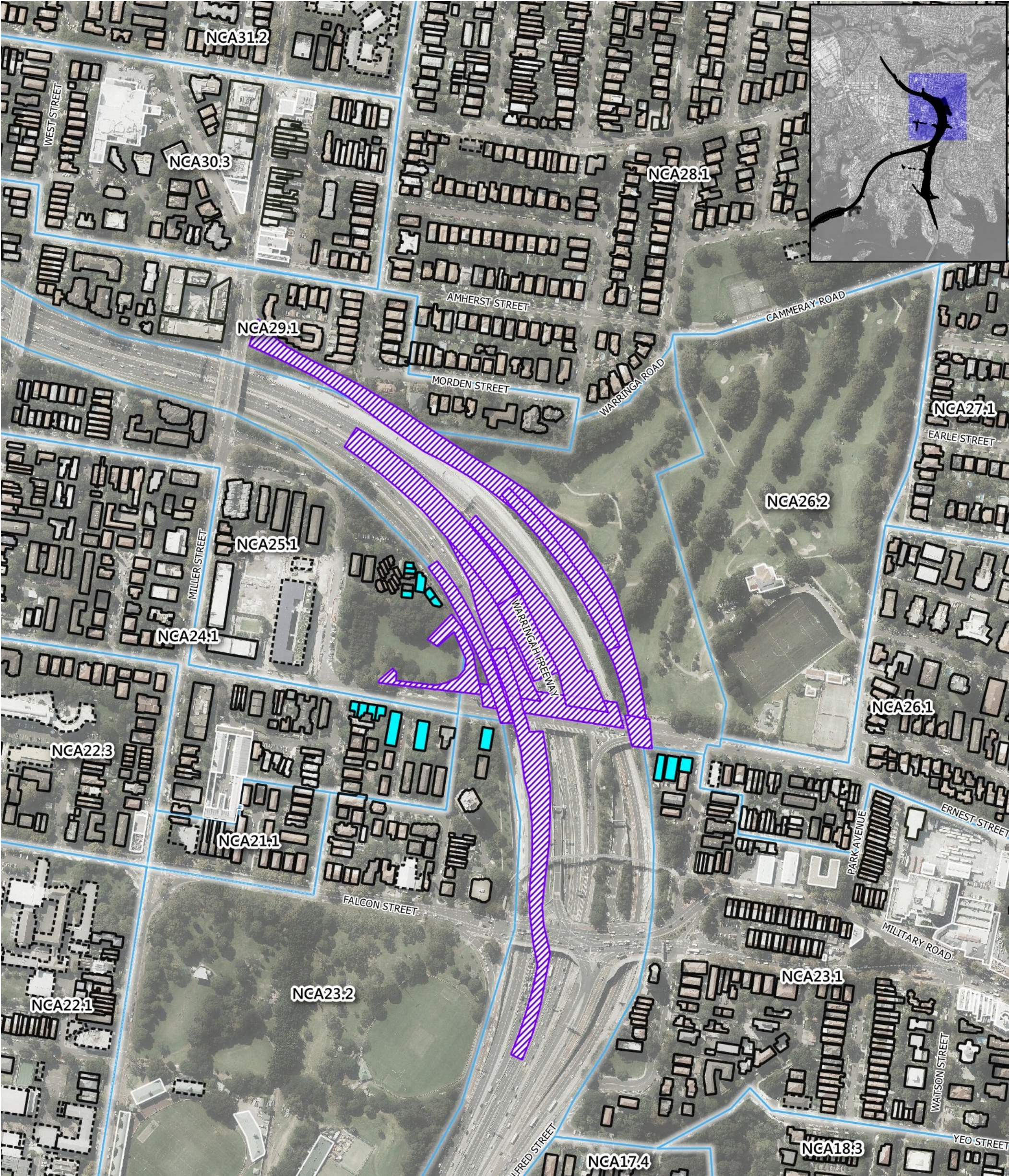
Project:

Western Harbour Tunnel and Warringah Freeway Upgrade

Description:

Residential buildings predicted to be highly noise affected
Standard construction hours
Warringah Freeway surface road works major work area - WFU2H





Legend

Major works area

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

Highly noise affected [16]

Notes:

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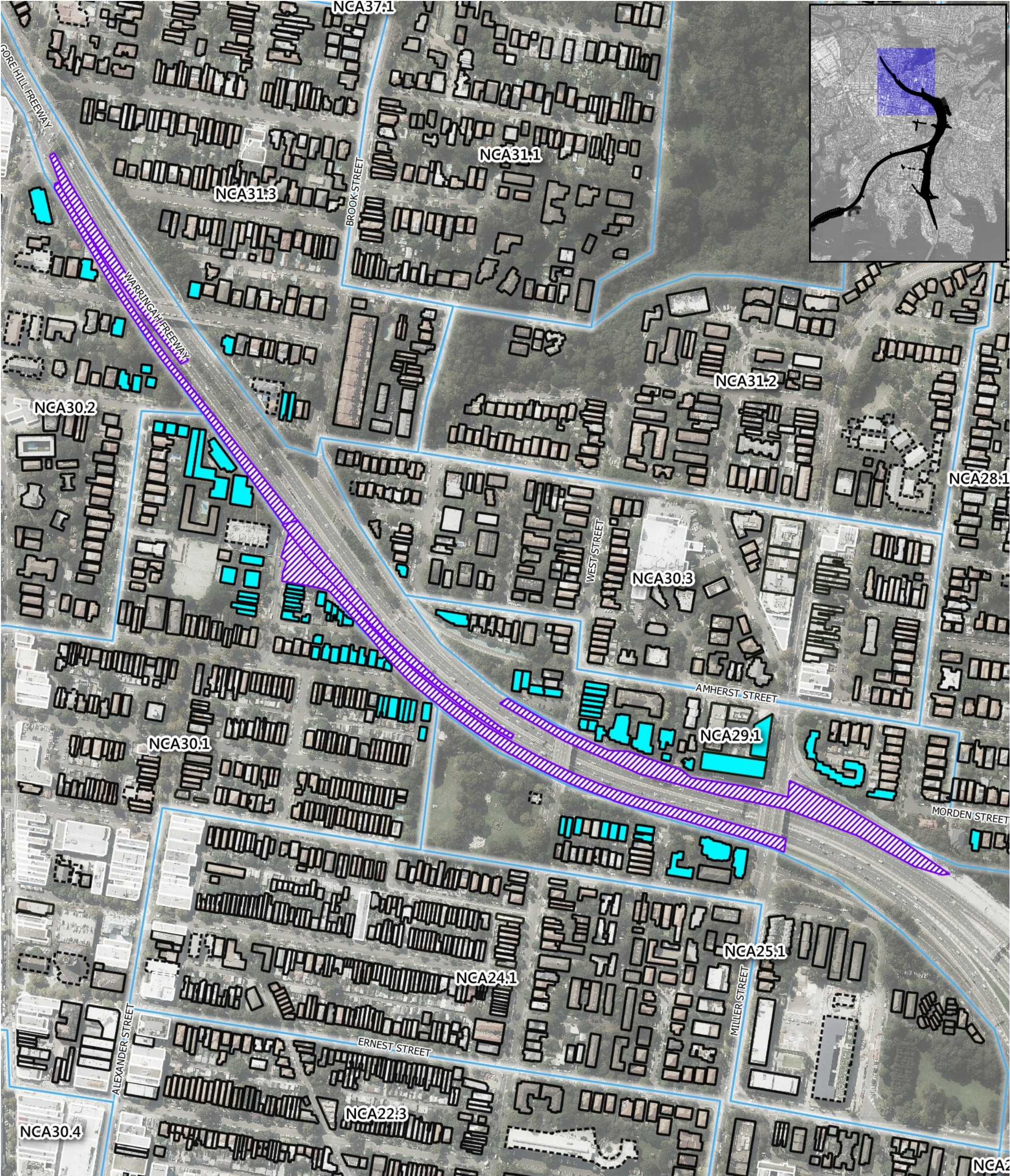
Client: Transport for NSW

Project: Western Harbour Tunnel and Warringah Freeway Upgrade

Description:

Residential buildings predicted to be highly noise affected
Outside standard construction hours
Warringah Freeway surface road works major work area - WFU2H





Legend

Major works area

NCA boundary

Receiver type

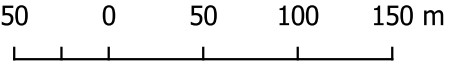
Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

Highly noise affected [92]



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Project:

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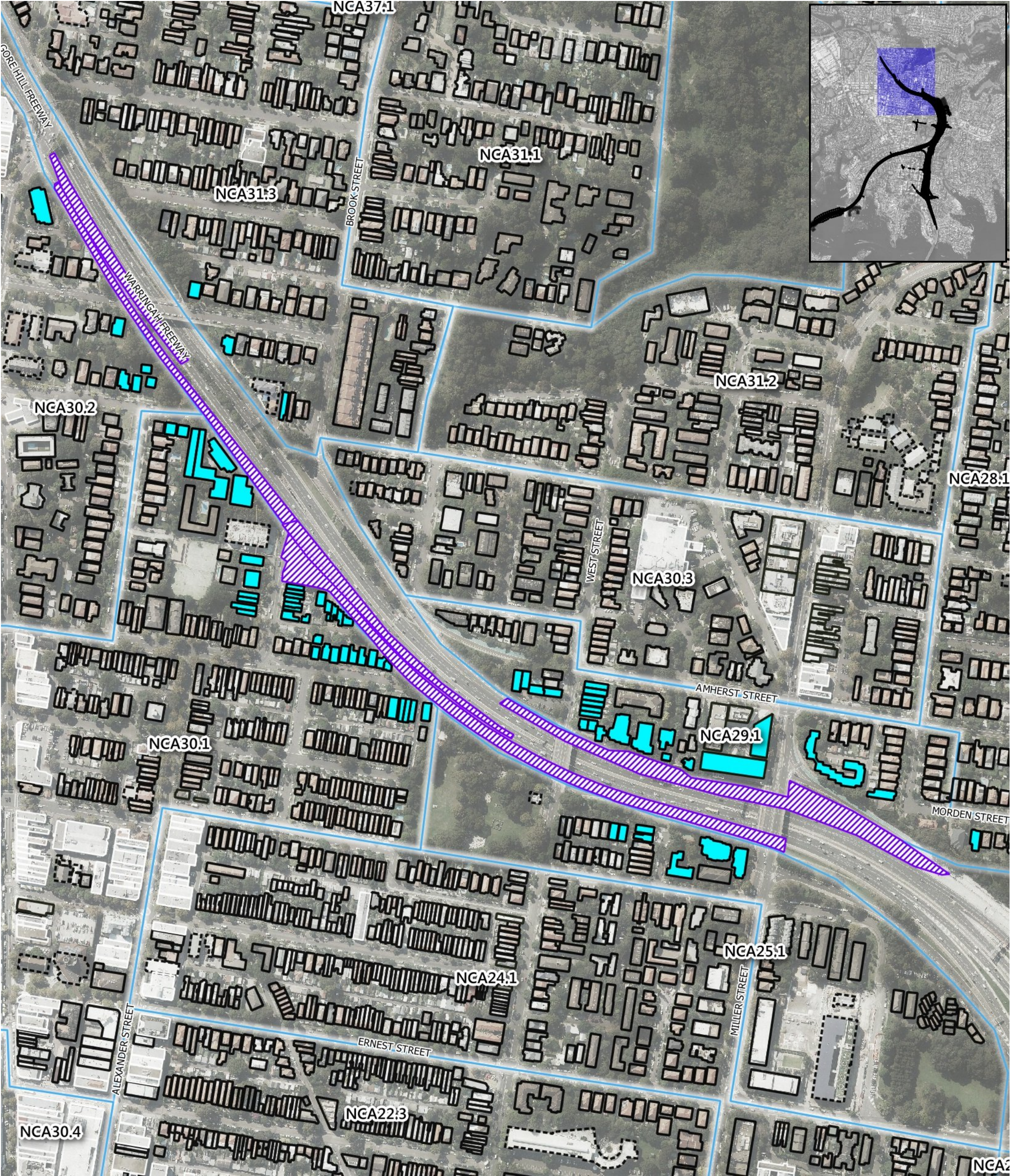
Description:

Residential buildings predicted to be highly noise affected

Standard construction hours

Warringah Freeway surface road works major work area - WFU3I





Legend

Major works area

NCA boundary

Receiver type

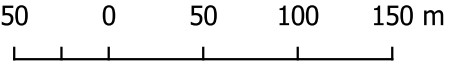
Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
L_{Aeq} (15min), dB(A) [count]

Highly noise affected [79]



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Description:


Residential buildings predicted to be highly noise affected
Outside standard construction hours
Warringah Freeway surface road works major work area - WFU3I







Legend


 Minor construction support site

 NCA boundary

Receiver type

 Residential

 Other sensitive receiver


 Commercial

Highly noise affected (> 75 dB(A))


(Worst case - All works areas during any stage)

Residential receiver building

LAeq (15min), dB(A)

 Highly noise affected

Consultant:



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Project:

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Residential buildings predicted to be highly noise affected

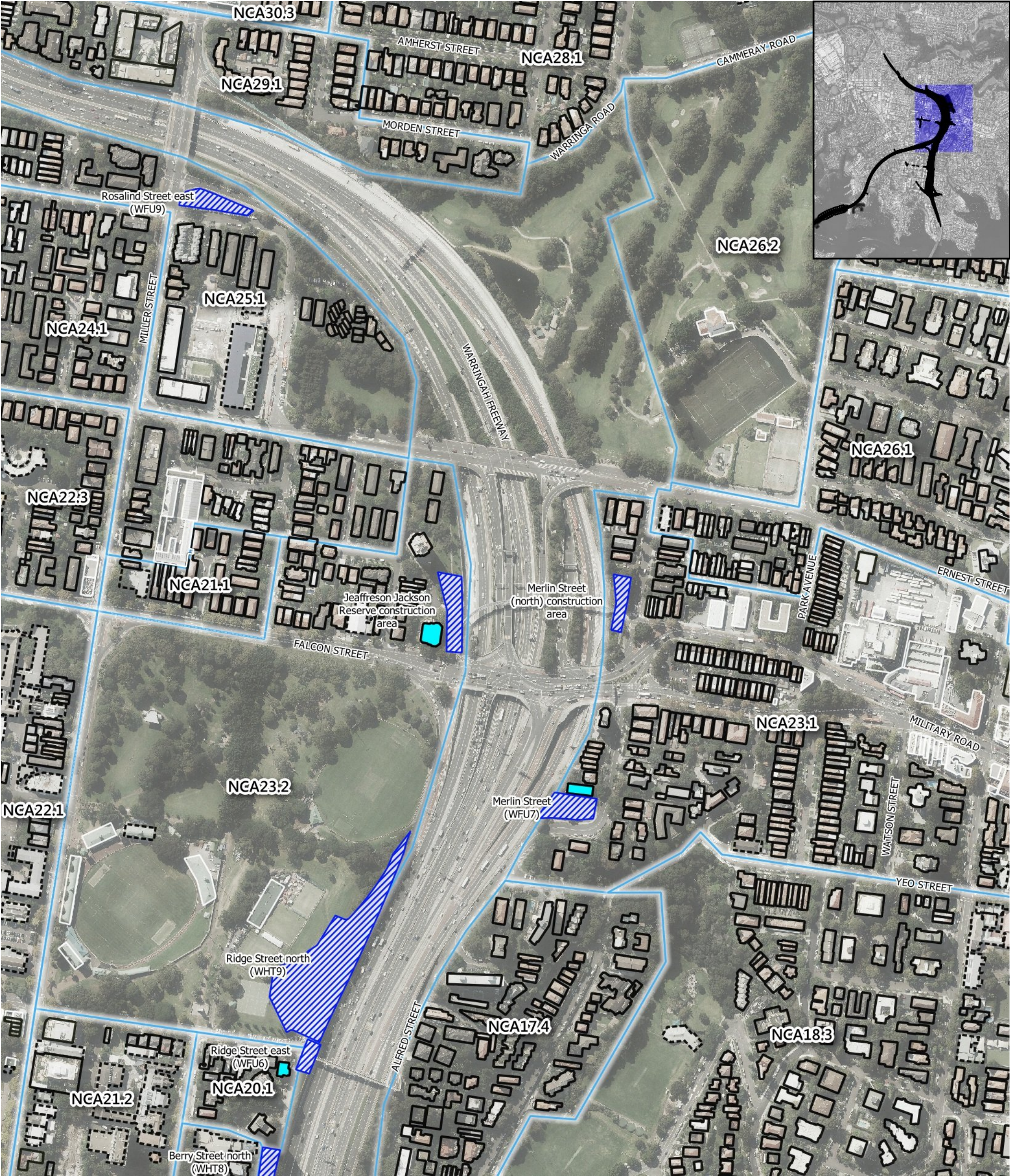
Standard construction hours

Warringah Freeway surface road works minor construction support sites

Figure No: TJ500-01-6-1-3-1 039-41-MIN
Scale: 1:4000
Date: 30-07-2020

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Rev: R7
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Legend

Minor construction support site

NCA boundary

Receiver type

Residential

Other sensitive receiver

Commercial

Highly noise affected (> 75 dB(A))
(Worst case - All works areas during any stage)
Residential receiver building
LAeq (15min), dB(A)

Highly noise affected

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Description:

Residential buildings predicted to be highly noise affected

Standard construction hours

Warringah Freeway surface road works minor construction support sites

Figure No:	TJ500-01-6-1-3-1 039-44-MIN	Created by:	ALE
Scale:	1:4000	Rev:	R7
Date:	30-07-2020	Sheet:	A3



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