

TFNSW

TRANSPORT ACCESS PROGRAM WOLLSTONECRAFT STATION

NOISE AND VIBRATION IMPACT ASSESSMENT

APRIL 2020



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Transport Access Program Wollstonecraft Station Noise and Vibration Impact Assessment





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EXECUTIVE SUMMARY

WSP Australia Pty Ltd (WSP) has been engaged to undertake a noise and vibration impact assessment for the proposed Wollstonecraft Station upgrade (the proposal). This upgrade forms part of the Transport Access Program (TAP), and consistent with previous assessments, it has been conducted with reference to the *Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018) and the NSW Noise Policy for Industry (EPA, 2017).

The proposal is intended to improve accessibility and amenities for customers and include new lifts, walkways and upgrades to parking and vehicle access at Wollstonecraft Station. The potential for construction noise and vibration impacts to occur was assessed in line with TfNSW's *Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018) and the *Noise Policy for Industry* (NPfI) (EPA, 2017) was used to assess operational noise.

Sensitive receivers for both noise and vibration were identified in the area surrounding the proposal and were segregated into Noise Catchment Areas (NCAs) based on a similar noise environment within these areas. Potential sensitive receivers for both noise and vibration have been categorised as residences, commercial, child care centres (classified as a hospital) and passive recreational areas.

A site survey was carried out to establish the existing background noise levels in the areas surrounding Wollstonecraft station using two unattended noise monitors. The background noise levels were supplemented with historical and typical background noise levels to derive the project specific noise criteria for all receivers.

A total of eight worst-case construction activities were assessed, with all works being undertaken during standard construction working hours, with some scenarios requiring works to be undertaken during up to five weekend rail possessions. The total duration of work is expected to be up to around 18 months.

The assessment of construction noise impacts indicates that noise levels are predicted to exceed relevant Noise Management Levels (NMLs) at the nearest sensitive receivers in NCA01 and NCA02 during all activities, with Scenarios 3 (ramp upgrade), 6 (station building works) and 7 (platform stabilisation) presenting the greatest impact to sensitive receivers. It is noted that a number of the scenarios incorporate plant with annoying acoustic characteristics, which have resulted in the application of a noise penalty. This includes plant such as chainsaws and concrete saws. It is highly unlikely that these items of equipment will be fully utilised during works or be used throughout Out of hours work (OOHW), and where not used noise levels will be notably decreased in their impact to receivers.

Works are generally proposed during standard hours. Noise levels are predicted to result in exceedances of up to 29 dBA during Scenarios 1 (site establishment) and 8 (demobilisation), and 31 dBA during Scenario 7 at residences in NCA01. Exceedances of up to 36 dBA are predicted at residences in NCA02 during during Scenarios 1, 2 (lift work) and 8. The closest residences to the construction works are predicted to be highly noise affected when works are at their closest, particularly in NCA02.

Out of hours works (OOHW) are proposed during most construction scenarios, including during rail possessions. Up to five rail possessions are expected to occur over the duration of the proposal (i.e. up to around 18 months). Other works may also be required to occur outside of standard hours which are not part of rail possessions. The assessment of OOHw construction noise impacts at residential receivers indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers in NCA01 and NCA02 during all activities, with Scenarios 3, 6 and 7 presenting the greatest impact to sensitive receivers.

Noise levels are predicted to result in exceedances of the OOHw criteria by up to 38 dBA during Scenarios 1, 6, 7 and 8 at residences in NCA01. Exceedances of up to 41 dBA and 39 dBA are predicted at residences in NCA02 during Scenario 2 and Scenario 8. As a result of the magnitude of these predicted exceedances during OOHw, further noise mitigation and management measures would be required in the event of OOHw works being undertaken.

Construction noise levels are predicted to exceed relevant NMLs for the majority of non-residential receivers when works are at their closest, including commercial, passive recreation areas and the Tresillian centre.

Any night time works are likely to generate sleep disturbance impacts at residential receivers adjacent to the construction footprints. Noise management and mitigation measures would be required to manage OOHw.

Proposal-related construction traffic noise impacts are expected to be marginal during day time periods, however impacts will be noticeable on local roads during night time periods. It is recommended that heavy vehicle movements to and from the site be restricted to standard (daytime) hours where feasible. Mitigation and management measures are presented in this report.

The construction footprint is located approximately 10 metres from receivers in NCA01 and NCA02. The footprint is located adjacent commercial receivers within the Wollstonecraft station precinct itself (approximately five metres at closest).

Sensitive receivers not associated with the station itself are anticipated to be located outside the safe working distance limits for cosmetic damage and human response, therefore no further action is required. Management and mitigation measures are required as discussed in this report, particularly with regard to the commercial receivers adjacent to the works site.

Specifications for operational equipment has not yet been finalised for the proposal. Mechanical plant is not expected to significantly impact the existing environment, and standard noise controls are expected to reduce noise emissions to acceptable levels as outlined in the NPfI. Operational noise emissions should be designed to meet the NPfI noise triggers derived in this report.

Site specific noise mitigation and management measures have been outlined to reduce the potential noise impacts from construction noise and vibration associated with the proposal. These measures have been developed with reference to the Construction Noise and Vibration Guideline. Further noise mitigation and management measures would be required in the event of OOHw being proposed.

ABBREVIATIONS

CNVS	TfNSW <i>Construction Noise and Vibration Strategy</i> 2018
dB	Decibel
dBA	A-Weighted Decibel
DEC	(NSW) Department of Environment Conservation
DECCW	(NSW) Department of Environment, Climate Change and Water
DEFRA	UK Department for Environment, Food and Rural Affairs
EPA	(NSW) Environment Protection Authority
ICNG	<i>Interim Construction Noise Guideline</i> 2009
NPfI	<i>Noise Policy for Industry</i> 2017
NATA	National Association of Testing Authorities
NCA	Noise catchment area
NML	Noise Management Level
OOH	Out of hours
OOHW	Out of hours work
PPV	Peak Particle Velocity
RBL	Rating Background Level as defined in the NPfI
REF	Review of Environment Factors
RNP	<i>Road Noise Policy</i> 2011
SWL	Sound power level
TAP	Transport Access Program
TfNSW	Transport for NSW
VDV	Vibration Dose Value

1 INTRODUCTION

Transport for New South Wales (TfNSW) proposes to provide accessibility upgrades at Wollstonecraft Station ('the proposal'). WSP has been engaged to undertake a noise and vibration assessment to support the Review of Environment Factors (REF) for the proposal.

This document assesses noise and vibration impacts associated with the proposal. Consistent with previous assessments of similar TAP projects, the assessment has been conducted with reference to the *Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018) and the *NSW Noise Policy for Industry* (EPA, 2017).

1.1 PROPOSAL DESCRIPTION

Wollstonecraft Station has been identified for an accessibility upgrade as it does not currently meet key requirements of the *Commonwealth Disability Discrimination Act 1992* (DDA) and associated requirements of the *Disability Standards for Accessible Public Transport 2002* (DSAPT).

The Proposal is located in the suburb of Wollstonecraft in the North Sydney Council local government area (LGA) located approximately four kilometres north from Central Station.

The Proposal is generally within a medium to high density residential neighbourhood bounded by local roads on the south including Shirley Road, Telopea Street and Belmont Avenue.

Wollstonecraft Station is serviced by two lines for intercity and regional connections including North Shore and Western Line (T1) and Northern Line (T9). Platform 1 provides train services southbound towards Central Station. Platform 2 provides train services northbound to Gordon and Greater Newcastle region.

The Proposal would be located within the boundaries of the existing station as well as including the Shirley Road overbridge located on the southern side of the station. The layout of the proposal is provided in Figure 1.1.

The Proposal involves an Accessibility upgrade of Wollstonecraft Station as part of the Transport Access Program which would improve accessibility and amenity for customers. The Proposal would include the following key elements:

- Lifts and accessibility:
 - construction of a new lift on Platform 1 connecting the Shirley Road entry
 - accessible return ramp from Shirley Road and the Shirley Road Overbridge to Platform 1 lift
 - construction of a new lift on Platform 2 connecting Telopea Road and the Shirley Road Overbridge
 - accessible footbridge ramp from Shirley Road Overbridge to Platform 2 lift accessible path.
- Platform Works:
 - upgrading of the Boarding Assistance Zone on Platform 1 and 2 including new sheltered and wheelchair waiting areas
 - stabilising and grading Platform 1 and 2 including new TGSIs and yellow line marking.
- Station building works including:
 - reconfiguration of Platform 1 existing store room and toilets to accommodate one unisex family accessible toilet, two unisex ambulant toilets and maintaining the cleaners storeroom on Platform 1
 - construction of a new Mains Switch Room at the southern end of the Platform 1 station building
 - minor modification to upgrade the ventilation for the existing communications equipment room
 - modifications to the Platform 1 waiting area to provide level access entry to the station

- floor levelling of the existing waiting room on Platform 2 to provide accessible entry.
- Shirley Road and Overbridge works including:
 - widening and regrading of the footpath on the Shirley Road Overbridge into the carriageway
 - removal of existing billboard advertisements
 - reconfiguration and reduction in size of the existing overbridge traffic lanes and medians
 - installation of new compliant handrails to the roadside of the footpath
 - modifications to eastern and western access points on Shirley Road Overbridge approaches with ramps.
- Intermodal upgrades:
 - provision of one new compliant accessible car parking space and one kiss and ride bay on Shirley Road
 - relocation of existing mail zone further east two car spaces from current location
 - provision of new direct accessible path from the new kiss and ride bay and DDA car parking space to the proposed lifts
 - relocation of the existing bike racks on the Platform 1 side of the station to accommodate a new Mains Switch Board and enclosure.
- Ancillary works including;
 - provision of new TGSIs, safety zone markings, line marking and handrails
 - provision of accessible seating on the eastern station entrance
 - installation of additional CCTV cameras, hearing loops and upgrading of Public Address system to accommodate the new works
 - new wayfinding signage, Opal card readers, public telephones and rubbish bins
 - provision of electrical upgrade to support the operation of the new lifts and station operations with installation of AusGrid transformer (about 3600 square metres) near Shirley Road entrance of Platform 1.

Construction work is expected to take place over a period of up to around 18 months. Three temporary construction compounds are proposed to be established, including a site office, amenities, laydown and storage area for materials, construction plant and equipment. The locations of the construction compounds are presented in Figure 1.2.

The majority of work is anticipated to be undertaken during standard hours. However, out of hours works would be required in some cases to minimise disruptions to customers, pedestrians, motorists and nearby sensitive receivers; and to ensure the safety of railway workers and operational assets. It is estimated that up to five weekend rail shutdowns would be utilised to facilitate the following activities:

- site survey and services location investigations within and around the rail corridor
- piling, excavation of pits and installation of lift shafts
- stabilisation and grading of platforms
- installation of electrical containment
- services relocations.

All other work associated with the proposal would be completed during the standard construction working hours of:

- Monday to Friday, 7.00 am to 6.00 pm
- Saturday, 8.00 am to 1.00 pm.

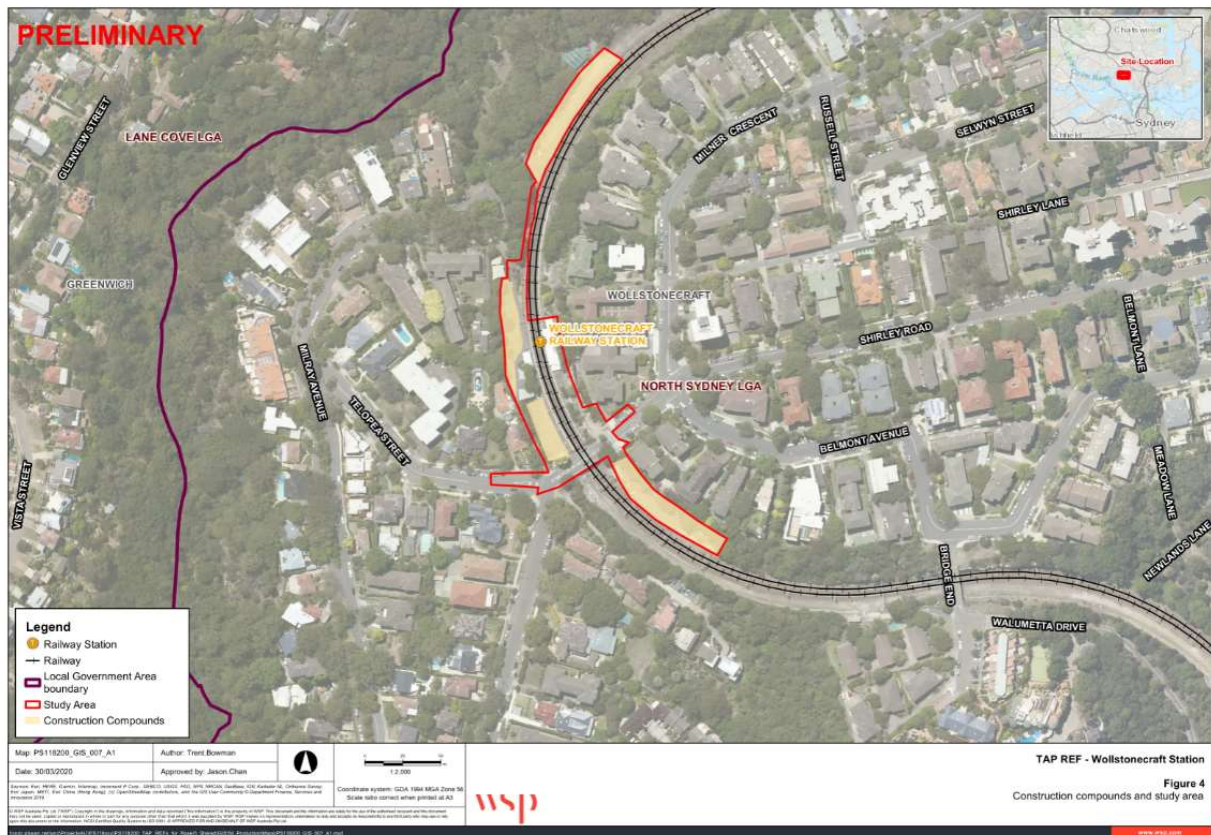


Figure 1.2 Location of construction compounds

1.2 SCOPE OF ASSESSMENT

The purpose of this assessment is to outline the potential noise and vibration impacts associated with the accessibility upgrades at Wollstonecraft Station.

The objectives of this study were to:

- Establish noise and vibration criteria at the nearest potentially affected sensitive receivers
- Determine acoustically significant plant required for the construction works and site operations and to predict noise levels at the nearest sensitive receivers
- From results of the noise predictions, assess construction and operational noise levels against relevant criteria
- Recommend impact mitigation and management, where necessary.

1.3 SENSITIVE RECEIVERS

The proposal has the potential to adversely impact nearby properties that are considered sensitive to construction noise and vibration. The proposal is located at Wollstonecraft Station, adjacent to residential receivers in Wollstonecraft, passive recreation receivers including Wollstonecraft Station Park, Smoothey Park, and near the Tresillian Family Care Centre. It is noted this centre operates 24 hours a day and its use involves sleep assessments and monitoring; as such it has been conservatively assessed as a hospital for the purpose of this assessment.

Identified sensitive receiver types surrounding the proposal were identified via review of aerial imagery and site inspection as follows:

- Residential receivers east and west of the station
- Non-residential receivers, including passive recreational areas, commercial and family centre
- Potential vibration sensitive receivers, including:
 - Wollstonecraft Station signage - within proposal boundary (S170 heritage listed)
 - Wollstonecraft Conservation Area - adjacent proposal boundary (local heritage)
 - Buildings at 46 Shirley Road, 2 Telopea Street, 3 Telopea Street, 4A Telopea Street, 11 Telopea Street – 35 metres to 100 metres (local heritage)
 - Structures including North Sydney bus shelter – 60 metres (local heritage).

Receivers have been categorised geographically into Noise Catchment Areas (NCAs) based on similar noise environments within these areas, to assist with assessment, consultation and notification. Receivers are assessed in terms of their land use types as these are assigned differing noise and vibration criteria.

The NCAs are described and minimum distances to nearby sensitive receivers outlined in Table 1.1. Figure 1.3 outlines the location of the proposal, Noise Catchment Areas (NCAs), noise monitoring locations and nearest representative noise sensitive receivers.

Table 1.1 Noise catchment areas and classification of representative receivers

NCA	RECEIVER TYPE	ADDRESS	RECEIVER ID	MINIMUM DISTANCE TO PROPOSAL (M)
1	RES1	45-47 Milray Ave, Wollstonecraft	Residential	20
2	RES2	2 Milner Cres, Wollstonecraft	Residential	15
2	RES3	50 Shirley Rd	Residential	10
1	PR1	Wollstonecraft Station Park	Passive Recreation	5
1	COM1	Wollstonecraft Cafe	Commercial	5
2	COM2	Wollstonecraft Shop and Laundromat	Commercial	5
1	HOS1	Tresillian Child Care Centre	Hospital	110

(1) Minimum distance of the sensitive receiver buildings to the limits of the construction footprint.



Figure 1.3 Site overview and NCA locations (Source: NSW SIX maps)

1.4 RELEVANT GUIDELINES

This report has been written with reference to the following documents:

- TfNSW *Construction Noise and Vibration Strategy* 2018 (CNVS)
- NSW EPA *Noise Policy for Industry* 2017 (NPfI)
- NSW DECC *Interim Construction Noise Guideline* 2009 (ICNG)
- NSW EPA *Road Noise Policy* 2011 (RNP)
- NSW DEC *Assessing Vibration: a technical guideline* 2005 (AVTG)

Furthermore, the following Standards are referenced in this report:

- Australian Standard AS 1055-1997- *Acoustics – Description and Measurement of Environmental Noise*
- Australian Standard (AS)1055.2 *Acoustics – Description and measurement of environmental noise. Part 2: Application to specific situations (1997)*
- British Standard BS 7385-2: *Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration*
- Australian Standard AS 2436:2010 - *Guide to noise and vibration control on construction, demolition and maintenance sites*
- Department for Environment Food and Rural Affairs (United Kingdom), *Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries*
- British Standard BS 7385 *Part 2-1993 Evaluation and measurement for vibration in buildings*
- German Standard DIN 4150: *Part 3 – 1999 Structural Vibration in Buildings: Effects on Structures.*

2 EXISTING ENVIRONMENT

Background and ambient noise levels surrounding the proposal were determined through a combination of unattended and operator attended noise surveys in accordance with the *Australian Standard 1055-1997- Acoustics-Description and Measurement of Environmental Noise* (AS 1055) and the *NSW Noise Policy for Industry* (NPfI) (EPA 2017). Additional data was sourced from *Australian Standard (AS)1055.2 Acoustics – Description and measurement of environmental noise. Part 2: Application to specific situations* (1997).

2.1 NOISE MONITORING LOCATIONS

Background noise monitoring locations were selected to be representative of the sensitive receivers with the potential to be impacted by noise from construction works. Monitoring locations were selected considering background noise influence, extraneous noise sources and logger security. Two noise monitoring locations were used to characterise the existing noise environment at representative residential receivers on either side of the station, and allocated to Noise Catchment Areas (NCAs) as presented in Table 2.1 and Figure 1.3.

Table 2.1 Noise monitoring locations

NOISE MONITORING LOCATION	SURVEY METHOD	ADDRESS	DATE
NM01	Unattended measurement and attended measurement	3 Telopea Street, Wollstonecraft	February/ April 2020
NM02	Unattended measurement and attended measurement	5A Milner Crescent, Wollstonecraft	February/ April 2020

2.2 NOISE MONITORING METHODOLOGY

Unattended noise monitoring was conducted between 18 and 24 February 2020. Each noise logger was set to record the L_{A1} , L_{A10} , L_{A90} and L_{Aeq} levels of ambient noise. (L_{A1} , L_{A10} , L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively.)

Operator attended monitoring of ambient noise levels was undertaken at both logger locations during the day time on 18 February and night time on 9 April 2020. These attended measurements were undertaken at times of no rain and where the speed of wind was less than five metres per second. Attended measurements were completed to qualify noise influences and identify their contribution of the various noise sources to the existing noise environment.

2.3 INSTRUMENTATION AND QUALITY CONTROL

The monitoring equipment was fitted with windshields and were field calibrated before and after monitoring. No significant drifts in calibration (± 0.5 dB) were noted. The weather conditions at the time of monitoring were recorded at Observatory Hill (Bureau of Meteorology station number 066062), which is located approximately 3.5 kilometres south of the proposal.

Monitoring data was excluded during periods of weather where wind speeds were greater than five metres per second or during rainfall that may have adversely affected the collected data.

All monitoring equipment has a current certified calibration certificate (National Association of Testing Authorities, NATA) at the time of use. Details of the WSP equipment used to conduct the noise survey are presented in Table 2.2. Copies of the calibration certificates can be provided upon request.

Table 2.2 Noise monitoring equipment

LOCATION	SURVEY METHOD	MANUFACTURER AND MODEL NO.	SERIAL NO.
NM01	Unattended measurement	Svan 958	36693
NM02	Unattended measurement	Svan 958	45586
NM01 and NM02	Attended measurement (day)	Norsonic 140	1406503
NM01 and NM02	Attended measurement (night)	Norsonic 140	1406503
NM01 and NM02	Attended measurement & unattended measurement	NC 73 (calibrator)	11248294

2.4 UNATTENDED NOISE SURVEY

A summary of the results of the unattended noise monitoring is summarised in Table 2.3. The rating background level (RBL) is the overall single figure background level representing each day, evening and night time period. The results of the survey are presented graphically in Appendix A.

Table 2.3 Summary of unattended noise monitoring results

LOCATION	RATING BACKGROUND LEVEL (RBL) dBA ¹			AMBIENT NOISE LEVELS LEQ dBA ²		
	DAY ³	EVE ³	NIGHT ³	DAY ³	EVE ³	NIGHT ³
NM01	42	- ⁴ (42)	- ⁴ (42)	55	56	52
NM02	40	- ⁴ (40)	- ⁴ (40)	52	51	47

- (1) Rating Background Level (RBL), the 10th percentile min L_{A90} noise level recorded over all day, evening and night time monitoring periods.
- (2) Ambient noise levels: the overall noise level over each assessment period (daytime/evening/night-time) as defined in the NPfI and ICNG.
- (3) Time periods defined as – Day: 7.00 am to 6.00 pm Monday to Saturday, .00 8am to 6.00 pm Sunday; Evening: 6.00 pm to 10.00 pm; Night: 10pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.
- (4) Due to the technical fault with the loggers, the RBLs for evening and night were not accurately reported.

Following the completion of monitoring, it became apparent that a technical issue was limiting the floor of the L₉₀ measurement during evening and night time periods for both locations.

At location NM01, west of the proposal, overall noise levels were found to increase from 55 and 56 dBA during the day and evening periods to 52 dBA at night. Background noise levels of 42 dBA were recorded during the daytime period. These levels were found to reduce during the evening and night time periods, however due to the technical fault with the logger these were not accurately reported; based on the trends in the Leq noise level however, values would be expected to be in the order of 41 dBA during the evening period and 39 dBA during the night time period. Dominant noise sources were associated with train passbys and urban hum.

At location NM02, located east of the station, overall noise levels were found to increase from 52 to 51 dBA during the day and night periods to 47 dBA. Background noise levels of 40 dBA were recorded during the daytime period. These levels were found to reduce during the evening and night time periods, however due to the technical fault with the logger these were not accurately reported; based on the trends in the Leq noise level however, values would be expected to be in the order of 39 dBA during the evening period and 35 dBA during the night time period. Dominant noise sources were associated with train passbys and urban hum.

2.4.1 HISTORICAL MONITORING BACKGROUND NOISE LEVELS

Additional historical data was provided by TfNSW to supplement the background noise investigations as a result of the logger failure during unattended noise monitoring. Unattended background noise data was provided for one location in the vicinity of Wollstonecraft station over the period 2 May to 6 May 2018, to confirm evening and night time monitoring trends RBLs and justify the adoption of default background noise data. The results of this historical monitoring are summarised in Table 2.3. This site would correspond with the NM02 monitoring location.

Table 2.4 Summary of historical unattended noise monitoring results

LOCATION	RATING BACKGROUND LEVEL (RBL) dBA ¹		
	DAY ³	EVE ³	NIGHT ³
Wollstonecraft Station	41	40	35

(1) Rating Background Level (RBL), the 10th percentile min L_{A90} noise level recorded over all day, evening and night time monitoring periods.

(2) Time periods defined as – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: .00 6pm to 10.00 pm; Night: 1.00 0pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Source: TfNSW.

Background noise levels of 41 dBA were recorded during the daytime period, 40 dBA during the evening period and 35 dBA during the night time period. This is consistent with the trends observed in the site specific noise monitoring reported in Section 2.4.

2.4.2 SUPPLEMENTARY BACKGROUND NOISE LEVELS

Recorded daytime background noise levels are considered acceptable, however in the absence of site-specific background noise levels for evening and night time periods, generic data have been adopted from AS1055.2 which provides standard background noise levels for residences depending upon the characteristic activities that occur within the neighbourhood. Table 2.5 provides an extract from Appendix A of AS1055.2-1997. The adoption of these data is considered conservative, providing a worst-case estimation of the noise environment in the vicinity of the proposal. Adopted noise levels are consistent with the trends in background monitoring data (Table 2.3).

Table 2.5 Average Background A-weighted Sound Pressure Levels for Residential Areas

NOISE AREA CATEGORY	DESCRIPTION OF NEIGHBOURHOOD	DAY ¹	EVE ¹	NIGHT ¹
R2	Areas with low density transportation	45	40	35

Source: AS1055.2. Acoustics – Description and measurements of environmental noise. Part 2: Application to specific situations (1997).

(3) Time periods defined as – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: .00 6pm to 10.00 pm; Night: 1.00 0pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.

It is anticipated that the area surrounding the site will reflect the conditions an R2 noise area based on land use type, therefore these noise levels have been conservatively adopted to be consistent with measured daytime background noise levels of 40-42 RBL. Adopted Rating Background Levels (RBLs) of 40 dBA for the day, 40 dBA for the evening and 35 dBA for the night have been adopted for the purpose of this assessment. These values are consistent with historical monitoring data for the area (refer to Section 2.4.1).

2.5 OPERATOR ATTENDED NOISE SURVEY

Short term attended measurements were taken at both logger locations to qualify the noise environment during day and night time periods. The objective of the night time measurements was to supplement night time unattended noise logger failure.

The results of the attended noise surveys and observations are detailed in Table 2.6. During the surveys, the weather was noted as being dry with light wind and suitable for noise monitoring.

At NM01, daytime background levels were characterised by urban noise sources. Ambient noise levels were controlled by train passbys, with contributions from birds and insect noise. Night time RBLs are in the order of 32 dBA at this location, which is largely consistent with the findings of this investigation.

At NM02, daytime background levels were characterised by urban noise sources. Ambient noise levels were controlled by train passbys, birds and insect noise, buses and aircraft fly-overs. Night time RBLs are in the order of 32 dBA at this location, which is largely consistent with the findings of this investigation.

Table 2.6 Summary of attended noise measurement results

PERIOD	TIME	dBA $L_{eq}(15min)$	dBA $L_{90}(15min)$	OBSERVATIONS
NM01				
Day	12:00pm – 12:15pm	57	38	Ambient: Cicadas up to 48 dBA, insects up to 53 dBA. Train approach (SB) up to 61 dBA, train approach (NB): up to 69 dBA. Train idle: ~54 dBA. Announcement and train doors audible. Background: Urban hum
Night	10:05pm – 10:20pm	45	32	Ambient: Train approach 45-50 dBA, Car passbys: 50 dBA. Typical background 32-35 dBA Background: Urban hum
NM02				
Day	13:00pm – 13:15pm	52	41	Ambient: Insects up to 43 dBA, birds up to 44dBA, airplane passby up to 44 dBA, train approach up to 52-65 dBA. Train departure: 52-57 dBA, bus passbys: 74 dBA Background: Urban hum
Night	10:26pm – 10:41pm	45	31	Ambient: Distant traffic: 40 dBA. Distant helicopter: 35-40 dBA, Typical background 33 dBA Background: Urban hum

The results of the attended noise survey are consistent with the results of the unattended noise monitoring with RBLs during the daytime period of 38 dBA and 41 dBA at NM01 and NM02 consistent with the results of the unattended monitoring campaign (Table 2.3). Night time RBLs are in the order of 32 dBA at this location, which is largely consistent with the findings of this investigation.

It is noted that the background is impacted by changes in traffic flows and ambient noise influences due to COVID-19 restrictions, however these values indicate that even during atypically quiet background conditions, noise levels were not observed to be lower than 30 dBA.

2.6 SUMMARY OF NOISE SURVEY FINDINGS

Background noise investigations identified that receivers in the vicinity of NM01 experience background noise levels of 42 dBA during the daytime period, and 40 dBA during the daytime period at NM02. Trends in the background data, and comparison with available historical monitoring, indicate that evening and night time period RBLs can be adequately characterized by AS1055.2 data for Rural Areas, being RBLs of 40 dBA during the evening period and 35 dBA during the night time period. Due to the limitations to field work during COVID-19, additional long term monitoring was unable to be completed at the time of writing of this report, however short term night time measurements indicated that even during atypically quiet background conditions, noise levels were not observed to be lower than 30 dBA. The adoption of 35 dBA night time RBLs is considered acceptable given the findings of historical background data. It is recommended that the contractor repeat monitoring of the background noise environment and update if required.

3 ASSESSMENT CRITERIA

3.1 CONSTRUCTION NOISE

The *TfNSW Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018) establishes assessment methods for construction noise impacts at sensitive receivers from TfNSW Infrastructure and Services (I&S) Division proposals. The strategy includes reference to objectives in the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009).

As the proposal duration will be greater than six weeks, a detailed assessment method has been adopted per the CNVS.

3.1.1 CONSTRUCTION NOISE ASSESSMENT PERIODS

Table 3.1 outlines the CNVS assessment periods applicable to the proposal.

Table 3.1 CNVS assessment periods

NAME	RBL PERIOD	TIME PERIODS
Standard Hours (SH)	Day	Monday to Friday – 7.00 am to 6.00 pm Saturday - 8.00 am to 1.00 pm Sunday/Public Holiday - Nil
Out of Hours Works (OOHW) Period 1	Day	Saturday - 7.00 am to 8.00 am and 1.00 pm to 6.00 pm Sunday and public holidays - 8.00 am to 6.00 pm
	Evening	Monday to Saturday - 6.00 pm to 10.00 pm
Out of Hours Works (OOHW) Period 2	Day	Sunday and public holidays - 7.00 am to 8.00 am
	Evening	Sunday and public holidays - 6.00 pm to 10.00 pm
	Night	All days 10.00 pm to 7.00 am

3.1.2 CONSTRUCTION NOISE MANAGEMENT LEVELS

The CNVS provides the methodology by which noise and vibration from construction projects can be assessed and mitigation measures identified and applied. The strategy specifies that construction NMLs are to be defined using the method specified in the ICNG. This requires the development of noise management levels (NML) based on existing RBLs and a comparison of predicted construction noise levels with the NML for identified work periods.

Recommended standard hours represent the times of the day when receivers are likely to be less sensitive to noise impacts. Where work is proposed outside of standard hours, justification is required and more stringent NMLs apply. For non residential receiver types, the NMLs only apply when the receiver is being used. Table 3.2 sets out the application of the management levels for noise at residential receivers.

Table 3.2 Application of the ICNG noise management levels for residential receivers

TIME OF DAY	NML, dBA L _{eq} , 15 minute	HOW TO APPLY
<p>Recommended standard hours: Monday to Friday 7.00 am to 6.00 pm Saturday 8.00 am to 1.00 pm No work on Sundays or public holidays</p>	<p>Noise affected RBL + 10 dB</p>	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <p>Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p>
	<p>Highly noise affected 75 dBA</p>	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>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, 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</p> <p>if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</p>
<p>Outside recommended standard hours</p>	<p>Noise affected RBL + 5 dB</p>	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should consult with the community.</p>

Table 3.3 presents the NMLs for each assessment period residential receivers in each NCA. The NMLs have been calculated from the measured and adopted RBLs in each NCA as shown in Table 2.3.

Table 3.3 Noise management levels at residential receivers

NCA	NOISE MONITORING LOCATION	DBA RBL			NML DBA L _{EQ(15MIN)} ¹			
		DAY	EVENING	NIGHT	SH	OOHW 1	OOHW 2	HNA ²
NCA01	NM01	42	40	35	52	45	40	75
NCA02	NM02	40	40	35	50	45	40	75

(1) Time periods as defined in Table 3.1.

(2) HNA - Highly Noise Affected

Table 3.4 lists the NMLs that have been adopted for non-residential sensitive receivers. The NMLs apply when the premises are in use during any assessment period.

Table 3.4 Noise management levels for non-residential sensitive receivers

LAND USE	NOISE MANAGEMENT LEVEL (EXTERNAL) DBA L _{EQ, 15 MINUTE}
Passive Recreation	External noise level – 60
Commercial (offices)	External noise level – 70
Hospital wards and operating theatres ¹	Internal noise level – 45

(1) An internal to external correction of 10 dB has been applied as per the ICNG.

Some non-residential receiver types are assessed using criteria specified as internal (rather than external) NMLs, such as the Tresillian centre. As the acoustic performance of the building envelopes of these receivers is not known accurately, an external to internal correction of 10 dB has been applied. This is generally accepted as the minimum noise reduction that is typically provided by standard building facades, allowing for windows being open for ventilation.

3.1.3 SITE SPECIFIC CONSTRUCTION NOISE MANAGEMENT LEVELS

The specific NMLs for construction activities at surrounding receivers are presented in Table 3.5. These NMLs have been determined from the background noise levels provided in Table 3.3 for residential receivers.

NMLs have been presented for OOHW periods as it is expected that construction works will be undertaken outside of standard hours.

Table 3.5 Site Specific Noise Management Levels (NML)

NCA	NML dBA L _{eq(15min)} ¹			
	SH	OOHW 1	OOHW 2	HNA
Residential receivers NCA01	52	45	40	75
Residential receivers NCA02	50	45	40	75
Passive recreation ²	60	n/a	n/a	n/a

NCA	NML dBA $L_{eq(15min)}$ ¹			
	SH	OOHW 1	OOHW 2	HNA
Commercial ²	70	n/a	n/a	n/a
Hospital wards ^{2,3}	55	55	55	55

(1) Time periods as defined in Section 3.1.1.

(2) When in use.

(3) Hospital ward criteria adopted for Tresillian centre with a 10 dB addition for an external criterion. As facility is in use 24 hours a day, criteria has been applied for all periods.

3.1.4 SLEEP DISTURBANCE

Some of the proposed construction work would be required to take place during the night-time periods (10.00 pm to 7.00 am), which has the potential to lower sleep quality of the residents adjacent to the work due to maximum noise level events. Potential impacts include sleep disturbance and sleep awakening reactions.

Section 4.3 of the ICNG discusses the method for quantifying and assessing sleep disturbance (sleep awakening). This guidance references the NSW Road Noise Policy (RNP) (EPA, 2013) that discusses criteria for the assessment of sleep disturbance.

The RNP suggests a screening level of $L_{1,1min}$ dBA, equivalent to the RBL + 15 dB. Where this level is exceeded, further analysis should be carried out. Section 5.4 of the RNP also states that:

- Maximum internal noise levels below 50 to 55 dBA would be unlikely to result in people's sleep being disturbed
- If the noise exceeds 65 to 70 dBA once or twice each night the disturbance would be unlikely to have any notable health or wellbeing effects.

The guidance within the RNP indicates that internal noise levels of 50 to 55 dBA are unlikely to cause sleep awakening reactions. Therefore, at levels above 55 dBA, sleep disturbance would be considered likely. Assuming that receivers may have windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicated in the ICNG.

Based on the above, the noise level 65 dBA L_{max} (external) has been adopted as sleep disturbance screening criterion for assessment purposes. Feasible and reasonable safeguards should be considered where there are night-time predicted exceedances above this limit.

It should be noted that this assessment method (sleep disturbance criteria based on guidance for sleep awakening) may not capture the full extent of impacts during the early and late stage of sleep (difficulty falling asleep and waking up early). However, this assessment method would provide an indication of the potential sleep disturbance when works occur in the night-time period. The night-time impacts due to construction works are quantified and managed through the $L_{eq(15 min)}$ assessment.

Based on this guidance, site specific sleep disturbance noise goals used to assess the likelihood for sleep disturbance within residences due to night time construction activity are presented in Table 3.6.

Table 3.6 Sleep disturbance noise management levels at residential receivers

NCA	NOISE MONITORING LOCATION	SLEEP DISTURBANCE CRITERIA, $L_{A1,1MIN}$ DBA RBL	
		RNP SCREENING CRITERION	RNP AWAKENING GOAL
NCA01 to NCA02	n/a	50	65

3.2 CONSTRUCTION TRAFFIC NOISE

The RNP provides guidance on the assessment of noise impacts from road traffic noise on sensitive receivers.

The RNP criteria apply to traffic generated by construction activities. The existing roads immediately surrounding the proposal are local roads which are assessed over a one hour period (typically the peak hour) within the respective day and night periods. Table 3.7 presents a summary of the applicable criteria for residences.

Table 3.7 Road traffic noise criteria for residential receivers on existing roads affected by additional traffic from land use developments

ROAD TYPE	ROAD TRAFFIC NOISE CRITERIA	
	DAY	NIGHT
Local Roads	55 L _{eq} 1hr dBA	50 L _{eq} 1hr dBA

The RNP application notes state that ‘for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dBA above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dBA of, or exceeds, the relevant day or night noise assessment criterion.’

Therefore, if the road traffic noise levels increase by more than 2 dBA as a result of the proposed construction traffic and the criteria in Table 3.7 are exceeded, investigation of mitigation options would be required.

3.3 CONSTRUCTION VIBRATION

Vibration associated with construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two impacts have different criteria, with the effects of vibration on human comfort having a lower threshold.

Regarding human comfort, vibration arising from construction activities must comply with criteria presented in *Assessing Vibration: a technical guideline*, (DECC, February 2006) and *British Standard 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting* (BS 6472 1 2008).

Section J4.4.3 of *Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives* provides frequency-dependent guide levels for cosmetic damage to structures arising from vibration. These levels are adopted from *British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundbourne vibration* (BS7385-2:1993). In addition, further guidance on ground vibration assessment is contained in the German Standard 4150-3 *Structural Vibration, Part 3: Effects of Vibration on Structures* (DIN 4150-3).

Section 7 of the CNVG recommends safe working distances for achieving human comfort (*Assessing Vibration: a technical guideline* (DECC, February 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. These are discussed further in Section 4.3.

Building structures classified as being of heritage significance are to be considered on a case by case basis, as a heritage listed structure may not be assumed to be more sensitive to vibration unless it is structurally unsound, which is unlikely for a regularly maintained structure. Guidance for the protection of vibration-sensitive heritage significant structures is presented in the German Guideline, *DIN 4150-3 Structural Vibration Part 3: Effects of vibration on structures* (DIN 4150-3). Structural damage within such structures may be reasonably expected to be avoided where vibration velocities within the structure do not exceed 3 millimetres per second (mm/s) for vibration frequencies between 1 to 10 Hz.

Structures that are potentially at risk of the threshold (3 mm/s) or cosmetic damage would be identified by the contractor prior to the commencement of construction works. A Construction Noise and Vibration Management Plan (CNVMP) should include management at these locations before the commencement of construction activities and after construction is completed.

3.4 OPERATIONAL NOISE

The installation of new plant and equipment associated with the upgrade to Wollstonecraft Station has the potential to generate operational noise impacts at receivers. Operational noise emissions from the proposal to surrounding noise sensitive areas are assessed according to the NPfL.

3.4.1 OPERATIONAL NOISE CRITERIA

The *NSW Noise Policy for Industry* (NPI) provides the framework and process for deriving the noise limits for assessments under the *Protection of the Environment Operations Act 1997*.

The procedure specifies that there are two aspects of environmental noise that require assessment. The first relates to the intrusiveness of a noise source and allows for the noise under assessment to be a margin above the background, whilst the other procedure relates to the acceptability of the resulting noise, in relation to maintaining the amenity of the surrounding area. The more stringent of the amenity or intrusive criteria would define the appropriate criteria for a project. Further, consideration of sleep disturbance is required in terms of night time operations of noise sources.

3.4.2 PROPOSAL INTRUSIVENESS NOISE LEVEL

A noise source would be deemed to be non-intrusive if the monitored $L_{Aeq, (period)}$ noise level of the development does not exceed the RBL by more than 5 dBA at residential receivers. The RBL is the median of the measured L_{A90} noise level during the day, evening and night periods during periods when the development is not in operation.

Based on the results of monitoring outlined in Section 2.4, Table 3.8 presents the proposal intrusiveness levels.

Table 3.8 Proposal Intrusiveness Noise Level

MONITORING LOCATION	NCA	TIME PERIOD	RBL dBA	PROPOSAL INTRUSIVENESS NOISE LEVEL (RBL + 5dB) dBA $L_{eq, 15 \text{ minute}}$
NM01	NCA 1	Day	42	47
		Evening	40	45
		Night	35	40
NM02	NCA 2	Day	40	45
		Evening	40	45
		Night	35	40

(1) Intrusiveness criteria apply to residential receivers only.

3.4.3 PROPOSAL AMENITY NOISE LEVELS

To limit continuing increases in noise levels, the amenity noise level within an area from industrial noise sources should not normally exceed the recommended amenity noise levels prescribed in the NPfI.

The recommended amenity noise levels represent the objective for **total** industrial noise at a receiver location, whereas the **proposal amenity noise level** represents the objective for noise from a **single** industrial development at a receiver location, defined as the **recommended noise levels** listed below (Table 2.2 of NPfI) **minus 5 dB(A)**.

The amenity criteria have been established at the identified receivers based on the results of the unattended noise survey. The established amenity criteria applicable to the proposal are presented in Table 3.9.

Residential receivers with a similar noise environment to observed across the proposal site have been classified as an urban noise environment based on existing noise levels in the immediate surrounding area during the more sensitive night-time hours and the description of noise environments in the NPI.

Table 3.9 Proposal Amenity Noise Levels

TYPE OF RECEIVER ¹	RECOMMENDED AMENITY NOISE LEVEL (ANL) dBA L _{eq, period}	PROPOSAL AMENITY NOISE LEVEL (ANL -5dB) dBA L _{eq, period}	PROPOSAL ADJUSTED ANL ² dBA L _{eq period}		
			DAY	EVENING	NIGHT
Residential (Urban) (NML01, NML02)	Day: 60 Evening: 50 Night: 45	Day: 55 Evening: 45 Night: 40	55	45	40
Passive recreation	50	45	45	45	45
Commercial	65	60	60	60	60
Hospital ward	50 (1-hr)	45 (1-hr)	45	45	45

- (1) Amenity levels for non-residential receivers apply when the premises are in use.
- (2) Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00pm; night: the remaining periods.
- (3) A 10dB internal to external correction has been applied, in accordance with Section 2.6 of the NPfI.

3.4.4 PROPOSAL NOISE TRIGGER LEVELS

In assessing the noise impact of the proposal on residential receivers, both intrusiveness and amenity criteria must be considered. The most stringent trigger level forms the proposal noise trigger level (PNTL) for the proposal.

As required in Section 2.2 of the NPfI, all proposal noise trigger levels and limits are expressed as L_{eq, 15 minute}, unless otherwise expressed. In accordance with the NPfI, to standardise the time periods for the intrusiveness and amenity noise levels, the following conversion between L_{eq, period} and L_{eq, 15 minute} has been applied (as per Section 2.2 of the NPfI):

$$\text{dBA } L_{eq, 15 \text{ minute}} = \text{dBA } L_{eq, \text{period}} + 3 \text{ dB}$$

A summary of the PNTL applicable to the proposal is presented in Table 3.3.

Table 3.10 NPfI Proposal Noise Trigger Levels (PNTL)

RECEIVER TYPE	NCA	TIME PERIOD ^{1,2}	NOISE LEVEL dBA L _{eq} , 15 minute		
			INTRUSIVENESS	AMENITY	PTNL
Residential (Urban), (NM01,)	NCA 1	Day	47	58	47
		Evening	45	48	45
		Night	40	43	40
Residential (Urban), (NM02)	NCA 2	Day	45	58	45
		Evening	45	48	45
		Night	40	43	40
Passive recreation	All	When in use	-	48	48
Commercial	All	When in use	-	63	63
Hospital ward	All	When in use	-	48	48

- (1) Trigger levels for non-residential receivers apply when the premises are in use.
- (2) Time periods defined as Day: the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening: the period from 6:00 pm to 10:00 pm; night: the remaining periods.

3.4.5 SLEEP DISTURBANCE

Due to the continual operation of new plant and equipment, the potential for sleep disturbance to residences from noise events from the premises during the night period needs to be considered. Potential impacts include sleep disturbance and sleep awakening reactions. As outlined in the NPfI, where the development night time noise levels at a residential location exceed the following, a detailed maximum noise level event assessment should be undertaken:

- “ $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.”

Table 3.11 summarises the operational noise sleep disturbance screening criteria for this proposal.

Table 3.11 Sleep disturbance proposal screening criteria (operations)¹

NCA	NPFI SCREENING CRITERIA	RBL BASED SCREENING CRITERIA	PROPOSAL SCREENING CRITERIA
NCA 1 and NCA 2	40 $L_{Aeq, 15 \text{ minute}}$ dBA	$(35 + 5)^2$ 40	40 $L_{eq, 15 \text{ minute}}$ dBA
	52 L_{AFmax} dBA	$(35 + 15)^3$ 50	52 L_{Fmax} dBA

(1) Sleep disturbance criteria apply to residential receivers only

(2) RBL + 5 as outlined in the NPfI

(3) RBL + 15 as outlined in the NPfI

4 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

This section outlines the assessment of construction noise and vibration impacts from the proposal.

4.1 CONSTRUCTION NOISE ASSESSMENT

To assess the potential noise impacts during construction, scenarios comprising typical plant and equipment have been developed based on indicative staging information.

4.1.1 CONSTRUCTION STAGES AND DURATION

The Proposal would be constructed in stages with the stages occurring at different times depending on the activity. Table 4.1 presents the assessed construction scenarios and working periods developed in consultation with TfNSW.

Out of hours work is expected to occur during up to five weekend rail possessions of between 8 to 72 hours. Details of these possessions are presented in Appendix B.

Table 4.1 Modelling scenarios

SCENARIO ID	STAGE	ACTIVITIES	TIMING	DURATION (TOTAL)
1	Site establishment and enabling works	<ul style="list-style-type: none"> — establish site compounds (i.e. erecting fencing, tree protection zones, site offices, amenities and plant/material storage areas) — establish temporary facilities as required (e.g. temporary access stairs, temporary toilets, temporary construction lights etc.) — erect site hoarding / fencing as required — service location and relocation. 	Standard hours, OOHW	4 days
2	Lift work	<ul style="list-style-type: none"> — excavate and jackhammer for lift pits/foundations — waterproof (as required), install reinforcement, formwork and concrete to form the lift pit — erect glass and steel shaft structure — lift installation and commissioning — implement architectural fit-out around lift shaft including new awning over the lift. 	Standard hours, OOHW and 48-hour rail shutdown periods	10 months (intermittent, most works during possession)
3	Ramp upgrade	<ul style="list-style-type: none"> — perform earthworks for new ramp grading — install ramp formwork and structure — install ramp fitout of new hand rails, seating and TGSI's 	Standard hours, OOHW	14 months (intermittent, most works during possession)

SCENARIO ID	STAGE	ACTIVITIES	TIMING	DURATION (TOTAL)
4	Kiss and ride space and accessible parking space	<ul style="list-style-type: none"> reconfigure the existing roadway (kerb, line marking, etc.) to accommodate the upgraded accessible parking and kiss and ride bays 	Standard hours, OOHW and 48-hour rail shutdown periods	5 days (2 days during possessions)
5	Shirley Road Overbridge work	<ul style="list-style-type: none"> realign traffic lane markings on Shirley Road Overbridge and tie in with west and east approaches widen northern side footpath on bridge 	Standard hours, OOHW and 48-hour rail shutdown periods	10 months (intermittent, most works during possession)
6	Station building works	<p>Platform 1</p> <ul style="list-style-type: none"> install new family accessible toilet, one ambulant female toilet, one ambulant male toilet and one storeroom in place of existing toilet and storeroom facilities install new SSER in the place of existing communications room upgrade the general station infrastructure including DDA signage, CCTV etc. where applicable install a new Switch Board room <p>Platform 2</p> <ul style="list-style-type: none"> install new shelters for Boarding Assistance Zones <p>Platform 1 and 2</p> <ul style="list-style-type: none"> upgrade the general station infrastructure including DDA signage, CCTV etc. where applicable 	Standard hours, OOHW and 48-hour rail shutdown periods	8 months (intermittent, most works during possession)
7	Platform stabilisation and upgrade work	<p>Platform 1</p> <ul style="list-style-type: none"> re-build platform <p>Platform 2</p> <ul style="list-style-type: none"> install new shelters <p>Platform 1 and 2</p> <ul style="list-style-type: none"> Excavate platforms and construct in-situ concrete surfaces, grading platform surface as required for accessible path relocate platform furniture along accessible paths install new yellow line and tactiles along platforms 	Standard hours, OOHW and 48-hour rail shutdown periods	13 months (during and outside possession)

SCENARIO ID	STAGE	ACTIVITIES	TIMING	DURATION (TOTAL)
8	Demobilisation	<ul style="list-style-type: none"> — install other ancillary features and landscaping — remove hoardings — clear site — remove environmental, safety and traffic controls 	Standard hours	1 week

Construction work is expected to take place over a period of up to around 18 months, beginning in 2020. Works will occur during standard and outside standard hours.

Construction compound(s) will be established within the construction boundary to contain site sheds, construction amenities and materials laydown. Figure 1.2 presents the indicative locations for the construction compounds and working areas. The exact location of these will be finalised by the construction contractor and approved by TfNSW.

4.1.2 NOISE SOURCE LEVELS

The nominated equipment for the construction work scenarios and the sound power level (SWL) of each item are detailed in Table 4.2. SWLs have been sourced from the CNVS, *AS 2436:2010 - Guide to noise and vibration control on construction, demolition and maintenance sites*, and the *Department for Environment Food and Rural Affairs (United Kingdom), Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries* (DEFRA noise database).

Table 4.2 Sound power levels

EQUIPMENT	SOUND POWER LEVEL, dBA	NO. OF EQUIPMENT PER SCENARIO							
		S01	S02	S03	S04	S05	S06	S07	S08
Chainsaw ¹	119	1		1					
Concrete pump	109			1	1	1	1		
Concrete saw ¹	123		1	1	1	1	1		
Concrete truck	112			1	1	1	1		
Concrete Vibrator ¹	118		1					1	
Coring machine	113					1			
Crane	110	1	1				1	1	
EWP	98						1		
Excavator (1.7 to 10 tonne)	100							1	
Excavator (10 tonne)	100		1	1	1	1	1		
FEL	111								1
Forklift	111	1							
Generator	104	1							1
Grinders	110		1	1		1	1		
Hammer drills	113					1			
Hand tools	102	1	1	1	1	1	1	1	1

EQUIPMENT	SOUND POWER LEVEL, dBA	NO. OF EQUIPMENT PER SCENARIO							
		S01	S02	S03	S04	S05	S06	S07	S08
Hi rail EWP	98							1	
Hi-Rail Truck	103		1					1	
Impact wrenches	111		1						
Jack hammers ¹	113		1	1	1	1	1		
Lighting Tower	80					1	1	1	
Mobile crane	110							1	
Pavement laying machine	114				1				
Piling (bored)	112		1			1			
Sucker truck	109			1	1				
Trucks (medium rigid)	103	1		1	1	1	1		1
Vibrating roller	114				1			1	
Water truck	107				1				
Scenario total SWL, dBA		117	122	120	121	121	120	121	115

(1) A +5 penalty has been applied for special audible characteristics as per the CNVS.

4.1.3 NOISE MODELLING METHODOLOGY

Prediction of construction noise impacts from the Proposal has been completed using SoundPLAN noise modelling software (version 8) using the Industrial Module and the ISO 9613-2 calculation method.

A three-dimensional model of the proposal was developed, including elevation contours, locations of sensitive receivers, noise-generating equipment and intervening buildings. The model considered noise sources, receivers and the effect of distance, ground topography, atmospheric attenuation and obstacles such as barriers and buildings.

The parameters used and values adopted in the noise modelling are presented in Table 4.3.

Table 4.3 Modelling parameters

PARAMETER	INPUT
Buildings	Building footprints and storeys taken from aerial photography. Building heights and number of floors were estimated from Google Street as follows: per floor 3 m, pitched roof 2.5 m.
Topography	Sourced from SIXMaps NSW (1 m contour intervals)
Façade calculation	Impacts calculated at the most affected facade of nearby receivers
Prediction algorithm	ISO9613-2 1996
Meteorological conditions	Default meteorological conditions used for all periods, representative of downwind propagation conditions of 1 to 5m/s, equivalent to moderate temperature inversion.
Ground surface / absorption	Vegetated areas modelled assuming ground absorption coefficient of 0.6. Bodies of water and large hard surfaced areas modelled assuming ground absorption of 1.

PARAMETER	INPUT
Sources	All equipment has been modelled as point sources and all equipment per work stage has been modelled to operate simultaneously.
Source heights	Construction plant and equipment heights are modelled to be 2 m above ground
NCA impacts	NCA noise impacts assessed at the most affected representative receiver

The noise modelling is considered to be conservative as it assumes all equipment operating simultaneously at their closest point within the work area to the receivers. Actual measured noise levels would be expected to be lower.

4.1.4 PREDICTED NOISE LEVELS

The predicted noise levels for each scenario are presented in Table 4.4 outlining the noise level within each NCA for each representative receiver type. As plant with special audible characteristics, such as the concrete saw or chainsaw, are not expected to operate for the majority of the construction works, values are included in brackets which indicate the predicted noise levels for each scenario excluding the plant with special noise characteristics. Predicted noise levels at buildings within each NCA were assessed and the results presented graphically in the form of exceedances of NMLs during Standard hours and OOHW in Appendix B.

The calculations are conservative as they include all equipment operating simultaneously at their closest point to the receiver in a worst case 15-minute period. Actual noise levels from the construction site would be expected to be lower. Where a predicted noise level exceeds a less stringent management level (SH), it follows that the more stringent (OOHW) management levels are also exceeded.

The formatting of the construction noise assessment results (Table 4.4) indicates the following:

- The orange shaded cells show exceedances of the standard-hours day period.
- The green shaded cells show exceedances of the out-of-hours 1 period.
- The blue shaded cells show exceedances of the out-of-hours 2 period.
- The cells with red text show exceedances of highly noise affected noise management levels.

Table 4.4 Maximum predicted construction noise levels and indicative exceedances per scenario

NCA	RECEIVER ID	RECEIVER TYPE	NML, DBA L _{EQ(15MIN)} ^{1,2}				MODELLED MAXIMUM NOISE LEVEL PER SCENARIO AT CLOSEST POINT TO RECEIVER, DBA L _{EQ(15MIN)} ²							
			SH	OOHW 1	OOHW 2	HNA	S01	S02	S03	S04	S05	S06	S07	S08
1	RES1	Residential	52	45	40	75	81 (83)	73 (75)	77 (80)	67 (69)	70 (72)	82 (86)	83 (87)	81 (81)
2	RES2	Residential	50	45	40	75	81 (83)	72 (75)	83 (86)	68 (71)	62 (64)	80 (84)	80 (85)	81 (81)
2	RES3	Residential	50	45	40	75	84 (87)	86 (88)	82 (85)	69 (71)	79 (81)	79 (83)	81 (86)	84 (84)
1	AR1	AR1	60	n/a	n/a	n/a	87 (89)	69 (72)	77 (80)	67 (69)	66 (68)	79 (84)	88 (>90)	87 (87)
1	COM1	COM	70	n/a	n/a	n/a	>90 (>90)	80 (83)	83 (86)	73 (76)	75 (77)	>90 (>90)	>90 (>90)	>90 (>90)
2	COM2	COM	70	n/a	n/a	n/a	>90 (>90)	74 (77)	82 (86)	68 (70)	70 (72)	>90 (>90)	>90 (>90)	>90 (>90)
1	HOS1	HOS	55	55	55	75	66 (68)	68 (71)	65 (68)	61 (64)	65 (67)	62 (66)	60 (64)	66 (66)

(1) Time periods as defined in Section 3.1.1, HNA – Highly noise affected

(2) Predicted noise levels are represented by a single point for each receiver type and noise catchment area for this preliminary assessment

(3) Where a predicted noise level exceeds a less stringent management level (SH), it follows that the more stringent (OOHW) management levels are also exceeded. OOHW activities are Scenarios 2, 4 and 5 only.

(4) Values in brackets indicate predicted noise levels excluding plant items with special audible characteristics (concrete saw, chainsaw)

4.1.5 STANDARD HOURS

The majority of construction activities are proposed to be completed within standard hours (Scenario 1 to 8).

The assessment of construction noise impacts at the nearest sensitive receivers indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers in NCA01 and NCA02 during all activities, with Scenarios 3 and 7 presenting the greatest impact to sensitive receivers.

Noise levels are predicted to result in exceedances of the standard hours criteria by up to 29 dBA during Scenarios 1 (site establishment) and 8 (demobilisation), and 31 dBA during Scenario 7 (platform stabilisation) at residences in NCA01; this is due to the close proximity of residential buildings overlooking the boundary of the construction works areas, particularly in Milner Crescent. Exceedances of up to 36 dBA are predicted at residences in NCA02 during Scenarios 1, 2 (lift work) and 8. The closest residences to the construction works are predicted to be highly noise affected when works are at their closest, particularly in NCA02.

Exceedances of relevant criteria are predicted in the passive recreation areas adjacent the proposal in NCA01 during all scenarios, with exceedances up to 27 dBA predicted during Scenarios 1 and 8, and 28 dB during Scenario 7.

For the nearest commercial receivers, noise levels are predicted to exceed relevant criteria in NCA01 and NCA02 for all scenarios, with exceedances up to 30 dBA above criteria for Scenarios 1, 6 (station building), 7 and 8.

The Tresillian child care centre in NCA01 is predicted to experience noise levels above relevant criteria for all scenarios, with exceedances of up to 13 dBA in Scenario 2; exceedances for remaining scenarios are in the order of 5 to 11 dBA. Levels assume noisiest plant operating at the closest offset to the receiver, however when high intensity works such as concrete saws, jackhammers or drills are not operational, noise levels would be expected to reduce by 3 dB. Noise levels are expected to remain below relevant management levels for the majority of the works during standard hours when mitigation measures are in place and considering the spatial distribution of noise sources.

Noise levels presented in this assessment are conservative, with noise sources assumed to operate simultaneously at the nearest point to receivers. In reality noise impacts are likely to be lower as plant items may not be operating simultaneously at all times and will likely be offset from some receivers. Works are expected to take place intermittently over the construction period, so these exceedances would not be expected to occur continuously over the duration of the proposal.

Based on the available proposal information, noise impacts will be noticeable during standard hours at the nearest receivers to the works areas; Scenarios 1 and 8 include construction compound access, which are located adjacent some residences. It is noted that activities such as Scenario 1 (site establishment), Scenario 4 (kiss and ride reconfiguration) and Scenario 8 (demobilisation) will be of relatively short duration (in the order of several days or weeks). Additionally, noise impacts from the use of the construction compounds will be similar to those for Scenario 1 and 8; however, will likely only occur for short periods of one hour each morning and afternoon.

The impacts associated with standard hours works during Scenario 2 (lift work) and Scenario 5 (overbridge works) are likely to occur intermittently over a 10-month period and are predicted to result in noticeable noise impacts at the nearest receivers in all NCAs. Scenario 3 (ramp upgrade) works are anticipated to occur intermittently over a 14-month period and are predicted to result in noise impacts at in most NCAs. Scenario 6 activities (station building works) are anticipated to occur over a period of eight months, generally within the rail possession periods and will generate notable impacts at receivers. Scenario 7 activities (platform stabilisation works) are anticipated to occur over a period of 13 months, generally within standard hours and will generate notable impacts at receivers. While noise levels are considered to be noticeable and intrusive when works are at their nearest to receivers, the use of high intensity plant such as concrete saws, jackhammers or drills is not expected to be continuous. Where these plant are not operational, noise levels would be expected to reduce by 3 dB as presented in Table 4.4. As a result of the predicted exceedances, noise mitigation and management measures have been outlined in Section 5 to reduce the potential noise impacts.

It is noted that a number of the scenarios incorporate plant with annoying acoustic characteristics, which have resulted in the application of a noise penalty (refer to Section 4.1.2). This includes plant such as chainsaws, concrete saws. It is highly unlikely that these items of equipment will be fully utilised during works, and where not used noise levels will be notably decreased in their impact to receivers (refer to Section 5).

4.1.6 OUTSIDE STANDARD HOURS

Out of hours works are proposed during all construction scenarios, including during rail possession, with the exception of Scenario 8 (demobilization). The assessment of OOHW construction noise impacts at residential receivers indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers in NCA01 and NCA02 during all activities, with Scenarios 3 (ramp upgrade) and 7 (platform stabilisation works) presenting the greatest impact to sensitive receivers, and Scenarios 1 and 8 due to the proximity of construction compounds to residences.

Noise levels are predicted to result in exceedances of the OOHW criteria by up to 38 dBA during Scenarios 1, 6, 7 and 8 at residences in NCA01. Exceedances of up to 41 dBA and 39 dBA are predicted at residences in NCA02 during Scenario 2 (lift work) and Scenario 8 (demobilisation).

The Tresillian child care centre in NCA01 is predicted to experience noise levels above relevant criteria for all scenarios, with exceedances of up to 13 dBA in Scenario 2 (lift work); exceedances for remaining scenarios are in the order of 5 to 11 dBA. Where high intensity works such as concrete saws, jackhammers or drills are not operational, noise levels would be expected to reduce by 3 dB. Noise levels will exceed OOHW management levels for the majority of the works, however the implementation of mitigation measures and considering the spatial distribution of noise sources, impacts will be significantly lower than presented.

Noise levels presented in this assessment are conservative, with noise sources assumed to operate simultaneously at the nearest point to receivers. In reality noise impacts are likely to be lower as plant items may not be operating simultaneously at all times and will likely be offset from some receivers. Works are expected to take place intermittently over a construction period, so these exceedances would not be expected to occur continuously over the duration of the proposal.

Out of hours works will take place during rail possessions (typically occurring over a weekend) with up to five rail possessions expected to occur over the duration of the proposal (i.e. up to around 18 months). Other works may also be required to occur outside of standard hours which are not part of rail possessions.

Based on the available project information, noise impacts will be noticeable outside standard hours at the nearest receivers to the works areas; Scenarios 1 (site establishment) and 8 (demobilisation) include construction compound access, which are located adjacent some residences. It is noted that activities such as Scenario 1 (site establishment) and Scenario 4 (kiss and ride reconfiguration) and Scenario 8 will be of relatively short duration (in the order of several days or weeks).

The impacts associated with OOHW during Scenario 2 (lift work) and Scenario 5 (overbridge works) are likely to occur intermittently over a 10-month period and are predicted to result in noticeable noise impacts at the nearest receivers in all NCAs. Scenario 3 (ramp upgrade) works are anticipated to occur intermittently over a 14-month period and are predicted to result in noise impacts at in most NCAs. Scenario 6 activities (station building works) are anticipated to occur over a period of 8 months, generally within the rail possession periods and will generate notable impacts at receivers. Scenario activities (platform stabilisation works) are anticipated to occur over a period of 13 months, generally within standard hours and will generate notable impacts at receivers.

As a result of the predicted exceedances during OOHW, further noise mitigation and management measures would be required in the event of OOHW being undertaken, and an overview has been outlined in Section 5 to reduce the potential noise impacts for consideration.

Several scenarios incorporate plant with annoying acoustic characteristics, which have resulted in the application of a noise penalty (refer to Section 4.1.2). This includes plant such as chainsaws, concrete saws. It is highly unlikely that these items of equipment will be fully utilised during works, and where not used noise levels will be notably decreased in their impact to receivers (refer to Section 5). Where equipment with annoying acoustic characteristics are in use, exceedances of relevant noise levels are notably above management levels, as a result it is recommended that works involving this equipment be strictly limited to standard hours where possible.

4.1.7 SLEEP DISTURBANCE

The maximum noise level assessment is presented in Table 4.5. The predicted noise levels have been assessed at the closest affected representative receiver within each NCA. Values are included in brackets which indicate the maximum noise level assessment for each scenario excluding the plant with special noise characteristics.

The formatting within the maximum noise level results (Table 4.5) indicates the following:

- The grey shaded cells show exceedances of the $L_{eq(15min)}$ criteria.
- The blue shaded cells show exceedances L_{max} and $L_{eq(15min)}$ criteria.

The predicted maximum noise levels calculated in Table 4.5 indicate that sleep disturbance for residential receivers is likely to occur at receivers adjacent to the construction footprints. Noise levels are predicted to result in exceedances of both the RNP screening criteria and the awakening goal.

The potential for work to generate maximum noise level events should be considered as part of the construction noise management plan for the works. Mitigation measures are discussed further in Section 5.

Table 4.5 Predicted sleep disturbance noise impacts (residences only)

NC A	RECEIVE R ID	RECEIVER TYPE	NML, DBA L _{EQ(15MIN)} ^{1,2}		MODELLED MAXIMUM NOISE LEVEL PER SCENARIO, DBA L _{EQ(15MIN)} ²						
			RNP SCREENING CRITERION	RNP AWAKENING GOAL	S01	S02	S03	S04	S05	S06	S07
1	RES1	Residential	52	65	81 (87)	75 (78)	77 (84)	68 (73)	71 (71)	82 (>90)	87 (88)
2	RES2	Residential	52	65	81 (87)	74 (78)	83 (>90)	69 (75)	63 (63)	80 (88)	85 (86)
2	RES3	Residential	52	65	84 (90)	88 (>90)	82 (89)	70 (75)	80 (80)	79 (87)	85 (86)
1	HOS1	Hospital	52	65	66 (72)	70 (74)	65 (72)	62 (68)	66 (66)	62 (70)	64 (65)

(1) Sleep disturbance criteria applicable to residential / hospital receivers only.

(2) Predicted noise levels are represented by a single point for each receiver type and noise catchment area for this preliminary assessment

4.2 CONSTRUCTION TRAFFIC NOISE

4.2.1 INTRODUCTION

A temporary construction compound, including laydown area and parking, is proposed to be established south of Shirley Road at the location of the existing commuter carpark.

4.2.2 HAULAGE ROUTES AND TRAFFIC VOLUMES

Construction traffic is expected to travel along Shirley Road to reach the proposal site and associated construction compound. Shirley Road is a two-lane road, with a speed limit of 50 kilometres per hour.

The road network near the proposal is restricted and will not easily accommodate large construction vehicles. In the absence of defined haulage routes, the traffic assessment prepared for the proposal (WSP 2020) has identified two haulage routes for heavy vehicles via Shirley Road, Falcon Street and the Warringah Freeway. The final construction haulage route would be determined by the nominated construction contractor during the detailed design of the proposal, however these routes have been adopted for the purpose of this assessment.

The traffic assessment (WSP 2020) has identified that traffic flows in the vicinity of the proposal are limited to local and commuter traffic. Traffic generated during general construction activities is not expected to exceed 15 light vehicles and two heavy vehicles per day. During rail possessions, up to 20 light and 15 heavy vehicle movements would be generated. During rail possessions, the 100-person construction workforce would be transported to and from site via shuttle buses or similar due to carparking limitations.

4.2.3 TRAFFIC NOISE IMPACTS

The potential for noise impacts to occur due to light and heavy vehicle movements on public roads generated by the construction work as a result of additional vehicle movements has been assessed.

Based on available information, construction vehicle movement estimates over the duration of the proposal will include 10 light vehicle movements and 5 heavy vehicle movements per week throughout the duration of proposal. During rail possessions (overnight), 20 light vehicle movements and 15 heavy vehicle movements are anticipated. The construction workforce will be 15 staff per day during the proposal, and 100 staff during rail possessions.

A worst-case scenario of 10 heavy vehicle and 20 light vehicle movements generated by the construction work occurring within a one hour period was assessed. As a 60 per cent increase in traffic is required to increase traffic noise levels by more than 2 dB, it is expected that construction traffic due to the proposal would comply with the RNP criteria where shift changes occur during daytime hours (7.00 am to 10.00 pm). Exact timings of these movements are yet to be confirmed, however where deliveries are made during night works (10.00 pm to 7.00 am), notable impacts are anticipated at the nearest residences.

Noise levels generated by construction vehicles are anticipated to comply with relevant road noise criteria during the day period, with notable impacts anticipated during the night time period and during possessions. As a result, mitigation and measures are recommended, which should be outlined in a Traffic Management Plan for the proposal. It is recommended that heavy vehicle movements to and from the site be restricted to standard (daytime) hours where feasible. Other mitigation measures are presented in Section 5.

It is anticipated that traffic management will be required on Shirley Road involving closure of one lane for residential traffic. Management of these impacts would be determined by the construction contractor during detailed design.

4.3 CONSTRUCTION VIBRATION ASSESSMENT

The major potential sources of vibration from the proposed construction activities are during pile boring, jackhammering and smooth drum (vibratory) roller equipment (Scenarios 2, 3, 4, 5 and 6).

4.3.1 SAFE WORKING DISTANCES FOR VIBRATION INTENSIVE PLANT

Table 4.6 presents the indicative minimum working distances for the nominated construction plant to minimise the risk of structural damage and human comfort for sensitive receivers, based on the data provided in the CNVS. It is understood that no vibration sensitive heritage receivers are located in the vicinity of the proposal.

The distances are based on the typical distance from receivers, with work permitted to be carried out to meet the limits set out in Section 3.3.

Table 4.6 Recommended minimum working distances for vibration intensive plant

PLANT ITEM	RATING/ DESCRIPTION	MINIMUM WORKING DISTANCE (M)		
		COSMETIC DAMAGE	HUMAN RESPONSE	HERITAGE
Piling Rig - Bored	≤ 800mm	2 metres (nominal)	N/A	5 metres
Vibratory roller	< 200 kN (typically 4-6 t)	12 metres	40 metres	15 metres
Jackhammer	Hand held	1 metres (nominal)	Avoid contact with structure	3 metres

The distances are indicative only and results may vary depending on the activity, equipment, local geotechnical conditions. They apply to typical buildings under typical geotechnical conditions.

The construction footprint is located approximately 10 metres from residential dwellings in NCA01 and within 15 metres of residential receivers in NCA02. The footprint is located adjacent commercial receivers within the Wollstonecraft station precinct itself (within five metres at closest), and S170 heritage listed Wollstonecraft Station signage.

Given the distances and potential work areas of vibratory intensive plant, sensitive receivers in NCA01 and NCA02 that are not associated with the station itself are generally anticipated to be located outside the safe working distance limits for cosmetic damage and human response, therefore no further action is required. However where compaction or vibratory rolling works in are located within the safe working distances described in Table 4.6, further management and mitigation measures are required as discussed in Section 5, particularly with regard to the commercial receivers adjacent the works site. If minimum working distances are complied with, no adverse impacts are expected for cosmetic damage or human response on nearby sensitive receivers. If works occur within these minimum working distances, mitigation measures outlined in Section 5 should be considered.

Wollstonecraft Station signage and Wollstonecraft Conservation Area are classified as having heritage significance, as do several local residences and structures in the surrounding area (refer to Section 1.3). It is noted that neither the signage nor conservation area comprise a formal building structure which may be susceptible to structural damage. Further, all other heritage receivers are located outside relevant safe working distances for the proposed works.

Where piling is to occur within 30 metres of a vibration-sensitive heritage receiver, more detailed investigations would be warranted to confirm the potential for vibration impact.

No other heritage items or buildings with the potential for structural damage were identified within the safe working distances of the footprint, therefore vibration impacts to heritage structures are not considered further in this assessment. This should be confirmed as part of a Construction Noise and Vibration Management Plan (CNVMP) should include management at these locations before the commencement of construction activities and after construction is completed. Structures that are potentially at risk of threshold or cosmetic damage would be identified by the contractor prior to the commencement of construction works.

5 CONSTRUCTION NOISE AND VIBRATION MITIGATION AND MANAGEMENT

5.1 STANDARD CONSTRUCTION NOISE AND VIBRATION MITIGATION

The CNVS outlines standard measures for mitigating and managing construction noise and vibration to be implemented across all TfNSW I&S construction proposals where reasonable and feasible. These standard measures are outlined in Appendix D.

Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the ICNG and CNVS. The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable. Due to the high-level nature of construction staging information this assessment represents a highly conservative prediction of potential impacts. As such the CNVMP should include a detailed noise assessment updated to consider potential noise impacts at all affected properties.

The CNVMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which would be considered include:

- avoiding any unnecessary noise when carrying out manual operations and when operating plant
- ensuring spoil is placed and not dropped into awaiting trucks
- avoiding/limiting simultaneous operation of noisy plant in discernible range of a sensitive receiver where practicable
- switching off any equipment not in use for extended periods e.g. heavy vehicles engines would be switched off whilst being unloaded
- restriction of heavy vehicle movements to and from the site to standard (daytime) hours where feasible and avoiding deliveries at night/evenings wherever practicable
- no idling of delivery trucks
- keeping truck drivers informed of designated routes, parking locations and acceptable delivery hours for the site
- compounds, refuelling areas and work areas designed to promote one-way traffic so that vehicle reversing movements are minimised.
- minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.
- maximising offset distances between noisy plant and adjacent sensitive receivers and determining safe working distances
- using the most suitable equipment necessary for the construction works at any one time
- directing noise-emitting plant away from sensitive receivers
- regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc

- using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works
- use of quieter and less vibration emitting construction methods where feasible and reasonable.

The most applicable standard management measures are outlined as follows:

- construction hours and scheduling:
 - works would generally be carried out during standard construction hours (i.e. 7.00 am to 6.00 pm Monday to Friday; 8.00 am to 1.00 pm Saturdays). Any works outside these hours may be undertaken if approved by TfNSW and the community is notified prior to these works commencing. An Out of Hours Work application form would need to be prepared by the Contractor and submitted to the TfNSW Environment and Planning Manager for approval prior to any works outside normal hours.
- respite periods:
 - where the $L_{Aeq(15\text{minute})}$ construction noise levels are predicted to exceed 75 dBA and/or 30 dB above the Rating Background Level at nearby affected sensitive receivers, respite periods would be observed, where practicable, and in accordance with the CNVS. This would include restricting the hours that very noisy activities can occur.
- vibration monitoring:
 - to avoid structural impacts as a result of vibration or direct contact with structures, the proposed works would be undertaken in accordance with the safe work distances and attended vibration monitoring or vibration trials would be undertaken where these distances are required to be challenged
 - vibration resulting from construction and received at any structure outside of the proposal would be managed in accordance with:
 - for structural damage vibration - British Standard *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings*.
 - for human exposure to vibration the acceptable vibration - values set out in the *Environmental Noise Management Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006) which includes British Standard *BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*.
 - property conditions surveys would be completed prior to any vibration intensive work being carried out at or within the minimum distances set out in the CNVS. Minimum working distances should be confirmed prior to carrying out any vibration intensive work on site.
 - Vibration-sensitive heritage structures that are potentially at risk of threshold or cosmetic damage would be identified by the contractor prior to the commencement of construction works, and confirmed as part of a CNVMP.

Table 5.1 provides indicative benefits of typical engineering control mitigation measures for construction activities, based on guidance in AS 2436 and experience on similar construction proposals.

Table 5.1 - Indicative noise reduction from construction controls

ENGINEERING CONTROLS	POSSIBLE NOISE REDUCTION, DBA
Portable temporary screens	5-10
Screen or enclosure for stationary equipment	10-15
Maximising the offset distance between noisy plant items and sensitive receivers.	3-6
Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.	2-5
Orienting equipment away from sensitive receivers.	3-5
Carrying out loading and unloading away from sensitive receivers.	3-5
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5-10
Selecting site access points and roads as far as possible away from sensitive receivers	3-6

5.2 SITE SPECIFIC CONSTRUCTION NOISE MITIGATION

The following site specific construction noise mitigation measures should be considered:

- During site establishment (Scenario 1), temporary barriers should be erected to ensure that work would be conducted behind temporary hoardings/screens wherever practicable. The installation of construction hoarding would take into consideration the location of sensitive receivers to ensure that 'line of sight' is broken, where feasible. This has the potential to reduce noise levels between 5 and 10 dB.
- During Scenarios 1 to 6, use of the concrete saw and/or chainsaw is the main contributor to construction noise. Both the chainsaw and concrete saw are particularly loud construction plant items which produces a noise the CNVS identifies as having 'special audible characteristics' and incurs a +5 dB penalty.

Without the concrete saw and chainsaw, the total activity noise level is reduced by 8-10 dB. It is recommended that the use of these plant items is limited where possible, and works are limited to standard hours as far as possible, and outside sensitive time periods (particularly with regard to the Tresillian centre). Where work is required outside of standard hours, the use of this equipment is to avoid sensitive periods such as after midnight and before 7am.
- Due to the high exceedances of NMLs during Scenarios 2 to 6, when a concrete saw is to be used near sensitive receivers it is recommended that a temporary screen or enclosure (10-15 dB reduction) is placed around the works in conjunction with temporary barriers.
- the Tresillian centre is likely to be more sensitive during certain times of the day, such as when the sleep clinic is in use. Therefore, it is recommended that consultation be undertaken with the Tresillian centre to determine feasible construction staging to manage impacts, effectively communicate likely impacts, potential periods of high intensity works, and to develop a schedule of consultation to program intensive works outside the most sensitive night time periods. Respite periods should be negotiated and a community consultation strategy developed to ensure a complaints hotline and feedback pathway is established.
- Noise intensive construction works near the Tresillian centre is to be minimised as far as reasonably possible. It is also recommended that where reasonable and feasible the use of the concrete saw is limited to standard hours or when the premises are not in use as a sleep clinic (e.g. between 7.00 am and 9.00 am, and 5.00 pm and 6.00 pm), to minimise the impact on this receiver.

- A traffic management plan is to be prepared to manage construction noise impacts, particularly during rail possessions. This should include speed limits and circulation recommendations, measures to promote one-way traffic.

5.3 ADDITIONAL CONSTRUCTION NOISE MITIGATION

Where all reasonable and feasible standard mitigation measures have been applied and exceedances are still predicted to occur, the CNVS provides guidance on additional mitigation measures to be implemented for each receiver depending on level of exceedance for the predicted noise level above the NML. Additional mitigation measures and their associated acronyms are outlined in Appendix D. Table 5.2 outlines when to implement the additional noise management measures.

Table 5.2 Implementation of additional management measures

CONSTRUCTION HOURS	RECEIVER PERCEPTION	DBA ABOVE RBL	DBA ABOVE NML	ADDITIONAL MANAGEMENT MEASURES ¹
Standard Hours	Noticeable	5 to 10	0	-
Monday-Friday (7am-6pm)	Clearly audible	> 10 to 20	< 10	-
Saturday (8am-1pm)	Moderately intrusive	> 20 to 30	> 10 to 20	PN, V
	Highly intrusive	> 30	> 30	PN, V
	75dBA or greater	N/A	N/A	PN, V, SN
OOHW Period 1	Noticeable	5 to 10	< 5	-
Monday-Friday (6pm-10pm)	Clearly audible	> 10 to 20	5 to 15	PN
Saturday (7am-8am, 1pm-10pm)	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RO
Sunday/PH (8am-6pm)	Highly intrusive	> 30	> 25	PN, V, SN, RP ² , DR ²
OOHW Period 2	Noticeable	0 to 10	< 5	PN
Monday-Saturday (12am-7am, 10pm-12am)	Clearly audible	> 10 to 20	5 to 15	PN, V
Sunday/PH (12am-8am, 6pm-12am)	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RP, DR
	Highly intrusive	> 30	> 25	PN, V, SN, AA, RP, DR

(1) AA = alternative accommodation, V = verification, IB = individual briefing, N = notification, R2 = respite period, DR = duration respite, R1 = respite period 1, PC = phone calls, SN = specific notifications

(2) Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only

5.4 ADDITIONAL CONSTRUCTION VIBRATION MITIGATION

Where vibration intensive activities occur within the minimum working distances, all reasonable and feasible standard mitigation measures have been applied, and exceedances of vibration management levels are expected, the CNVS provides guidance on additional mitigation measures to be implemented for each receiver. Additional mitigation measures and the associated acronyms are outlined in Appendix D. Table 5.3 outlines how to implement the additional vibration management measures.

Table 5.3 Implementation of additional vibration management measures

CONSTRUCTION HOURS	RECEIVER PERCEPTION	ABOVE VIBRATION LIMIT	ADDITIONAL MANAGEMENT MEASURES ³
Standard hours	Human disturbance	> HVML ¹	PN, V, RO
	Building damage	> DVML ²	V, AC
OOHW Period 1	Human disturbance	> HVML ¹	PN, V, SN, RO, RP, DR
	Building damage	> DVML ²	V, AC
OOHW Period 2	Human disturbance	> HVML ¹	PN, V, SN, RO, AA, RP, DR
	Building damage	> DVML ²	V, AC

(1) Human vibration management level – see maximum vibration dose values for human comfort outlined in Section 3.3

(2) Damage vibration management level – see screening criteria for cosmetic damage outlined in Section 3.3

(3) AA = alternative accommodation, V = verification, IB = individual briefing, N = notification, R2 = respite period, DR = duration respite, R1 = respite period 1, PC = phone calls, SN = specific notifications

6 OPERATIONAL NOISE ASSESSMENT

6.1 OPERATIONAL NOISE ASSESSMENT

With the exception of the proposed reconfiguration, the operation of Wollstonecraft Station would remain unchanged as a result of the proposal. There would be no expected changes to the operation of the rail and, as such, this has not been assessed.

New plant and equipment associated with the upgrade to Wollstonecraft Station would include a new lift, equipment for the communications/equipment room and provision of a family accessible toilet and ambulant toilets.

Operational noise from the proposal would need to be designed to meet the NPfI noise goals presented in Section 3.4.

6.2 OPERATIONAL NOISE MITIGATION MEASURES

Mechanical plant details are yet to be finalised. It is expected that mechanical noise emissions would not have a significant impact on the surrounding environment, and that the use of standard controls such as quiet plant selection, and duct lining and/or attenuators, would allow mechanical plant noise to be reduced to acceptable levels.

If required, operational noise emissions shall be addressed during the detailed design phase in order to comply with operational noise criteria as per the NPfI.

7 CONCLUSION

WSP has undertaken a noise and vibration assessment for the proposed Wollstonecraft Station upgrade. The assessment was conducted with reference to the Construction Noise and Vibration Strategy (CNVS) (TfNSW, 2016). A qualitative assessment of operational noise has been completed.

Sensitive receivers surrounding the proposal included residences, commercial, hospitals and passive recreational areas; these receivers have been categorised into noise catchment areas for assessment purposes.

Background noise levels surrounding the proposal were determined using unattended noise surveys. These background noise levels were supplemented with historical and typical background noise levels to derive the project specific noise criteria for residential and non-residential receivers.

To assess the potential noise impacts during construction, eight representative construction scenarios were developed based on indicative staging information. Precise construction methodology would be confirmed by the construction contractor, however potential noise impacts associated with an indicative construction staging has been conservatively assessed to facilitate community consultation and effective noise management and mitigation prioritisation.

The assessment of construction noise impacts indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers will exceed relevant NMLs at the nearest sensitive receivers in NCA01 and NCA02 during all activities, with Scenarios 3 and 7 presenting the greatest impact to sensitive receivers. The closest residences to the construction works are predicted to be highly noise affected when works are at their closest, particularly in NCA02.

Out of hours works are proposed during most construction scenarios, including during rail possession. Up to five rail possessions expected to occur over the duration of the proposal (i.e. up to around 18 months). Other works may also be required to occur outside of standard hours which are not part of rail possessions. The assessment of OOHW construction noise impacts at residential receivers indicates that noise levels are predicted to exceed relevant NMLs at the nearest sensitive receivers in NCA01 and NCA02 during all activities, with Scenarios 3, 6 and 7 presenting the greatest impact to sensitive receivers, as well as Scenarios 1 and 8 due to the proximity of construction compounds to residences. As a result of the magnitude of these predicted exceedances during OOHW, further noise mitigation and management measures would be required in the event of OOHW being undertaken.

Construction noise levels are predicted to exceed relevant NMLs for the majority of non-residential receivers when works are at their closest, including commercial, passive recreation areas and the Tresillian centre.

Any night time works are likely to generate sleep disturbance impacts at residential receivers adjacent to the construction footprints. Noise management and mitigation measures would be required to manage OOHW, and it is recommended that noise intensive works and deliveries be limited to standard hours and less sensitive OOHW periods as far as possible.

Proposal-related construction traffic noise impacts on are expected to be marginal during day time periods, however impacts will be noticeable on local roads during night time periods. It is recommended that heavy vehicle movements to and from the site be restricted to standard (daytime) hours where feasible. Mitigation and management measures are presented in this report.

The construction footprint is located approximately 10 metres from receivers in NCA01 and NCA02. The footprint is located adjacent commercial receivers within the Wollstonecraft station precinct itself (approximately five metres at closest). Sensitive receivers not associated with the station itself are anticipated to be located outside the safe working distance limits for cosmetic damage and human response, therefore no further action is required. Management and mitigation measures are required as discussed in this report, particularly with regard to the commercial receivers adjacent the works site.

Noise mitigation and management measures have been outlined to reduce the potential noise impacts from construction noise and vibration associated with the proposal.

Specifications for operational equipment has not yet been finalised for the proposal. Mechanical plant is not expected to significantly impact the existing environment, and standard noise controls are expected to reduce noise emissions to acceptable levels as outlined in the NPfI. Operational noise emissions should be designed to meet the NPfI noise triggers derived in this report.

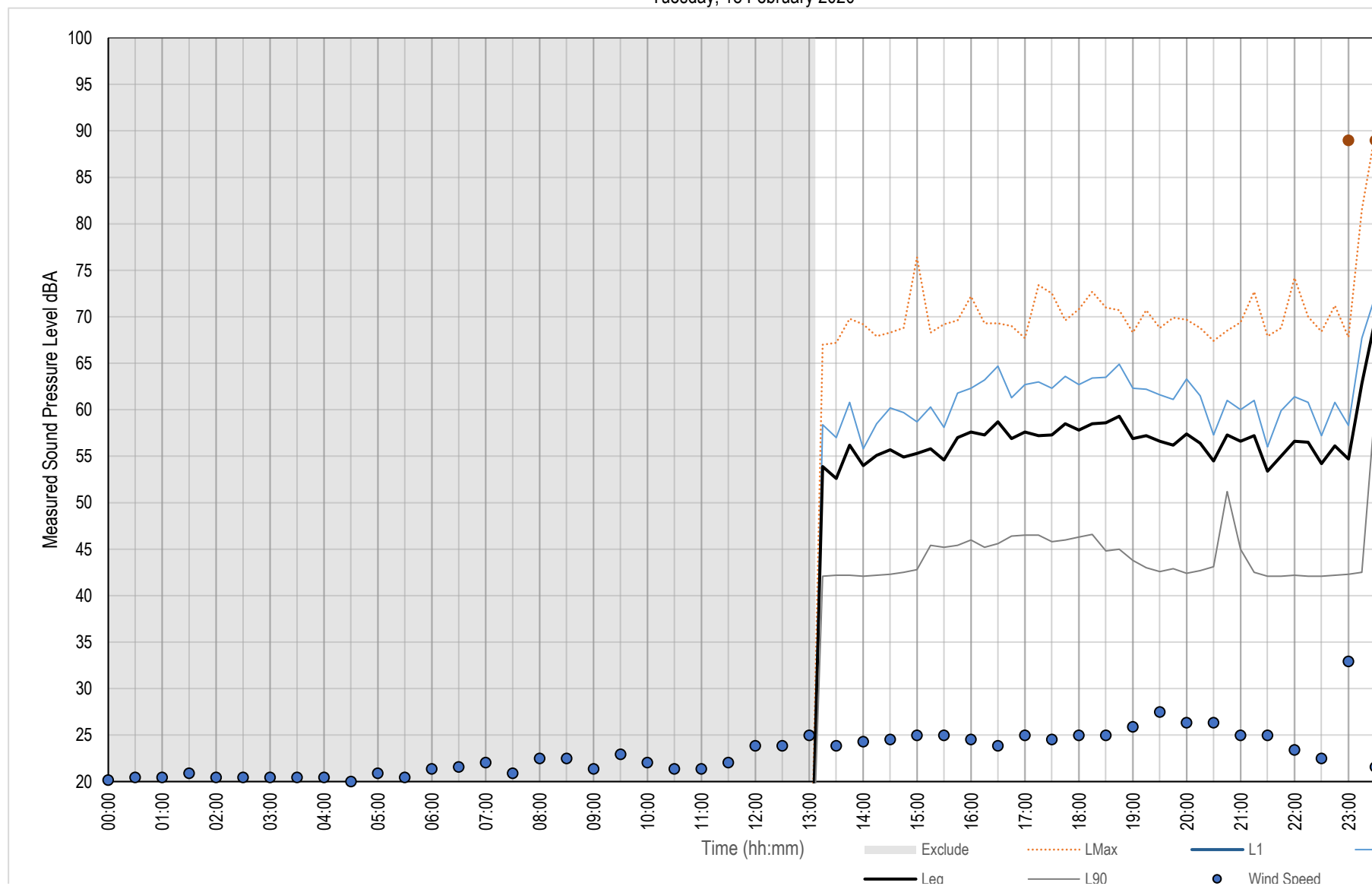
APPENDIX A

NOISE MONITORING GRAPHS

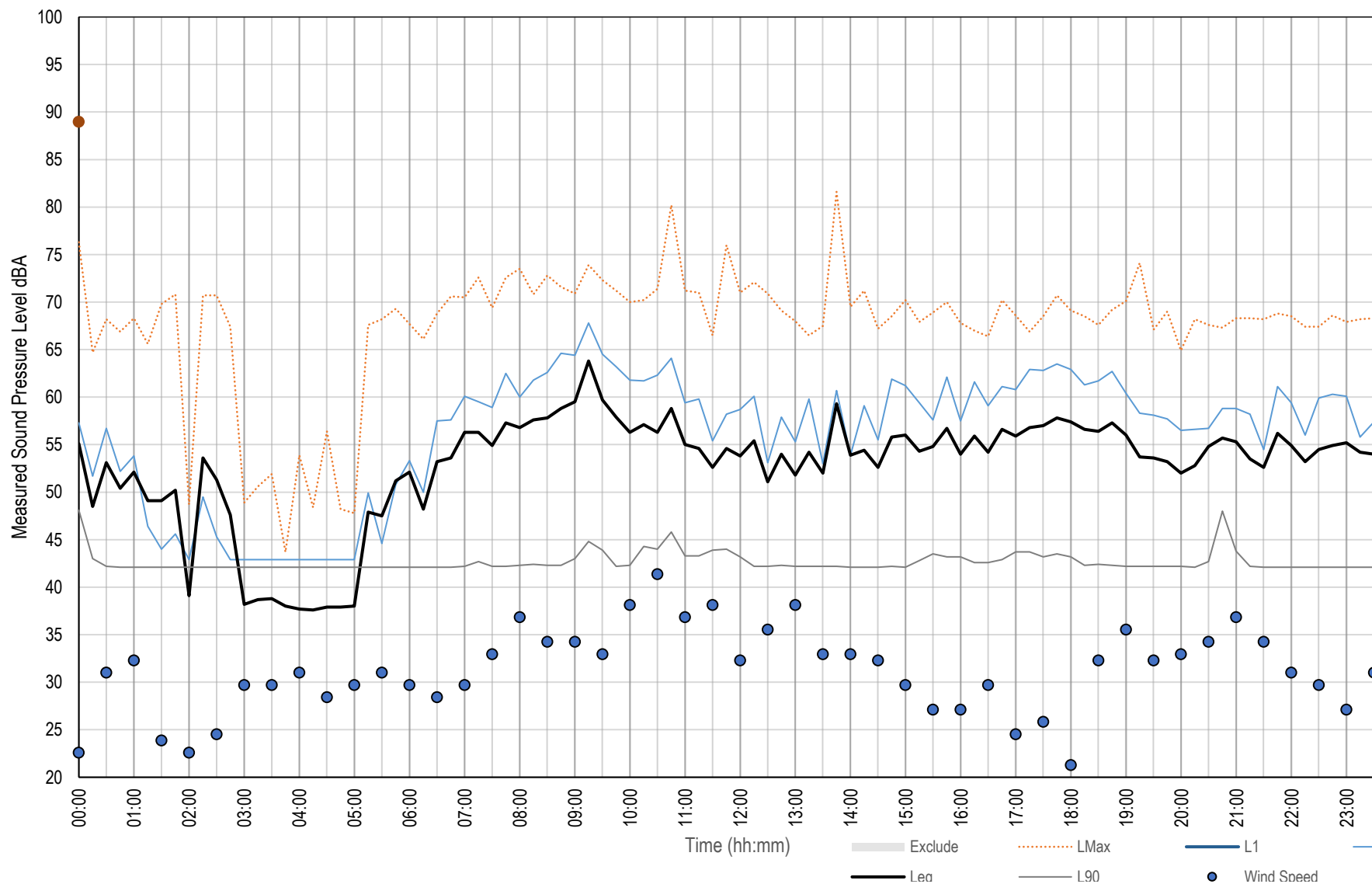


Measured Noise Levels -

Tuesday, 18 February 2020

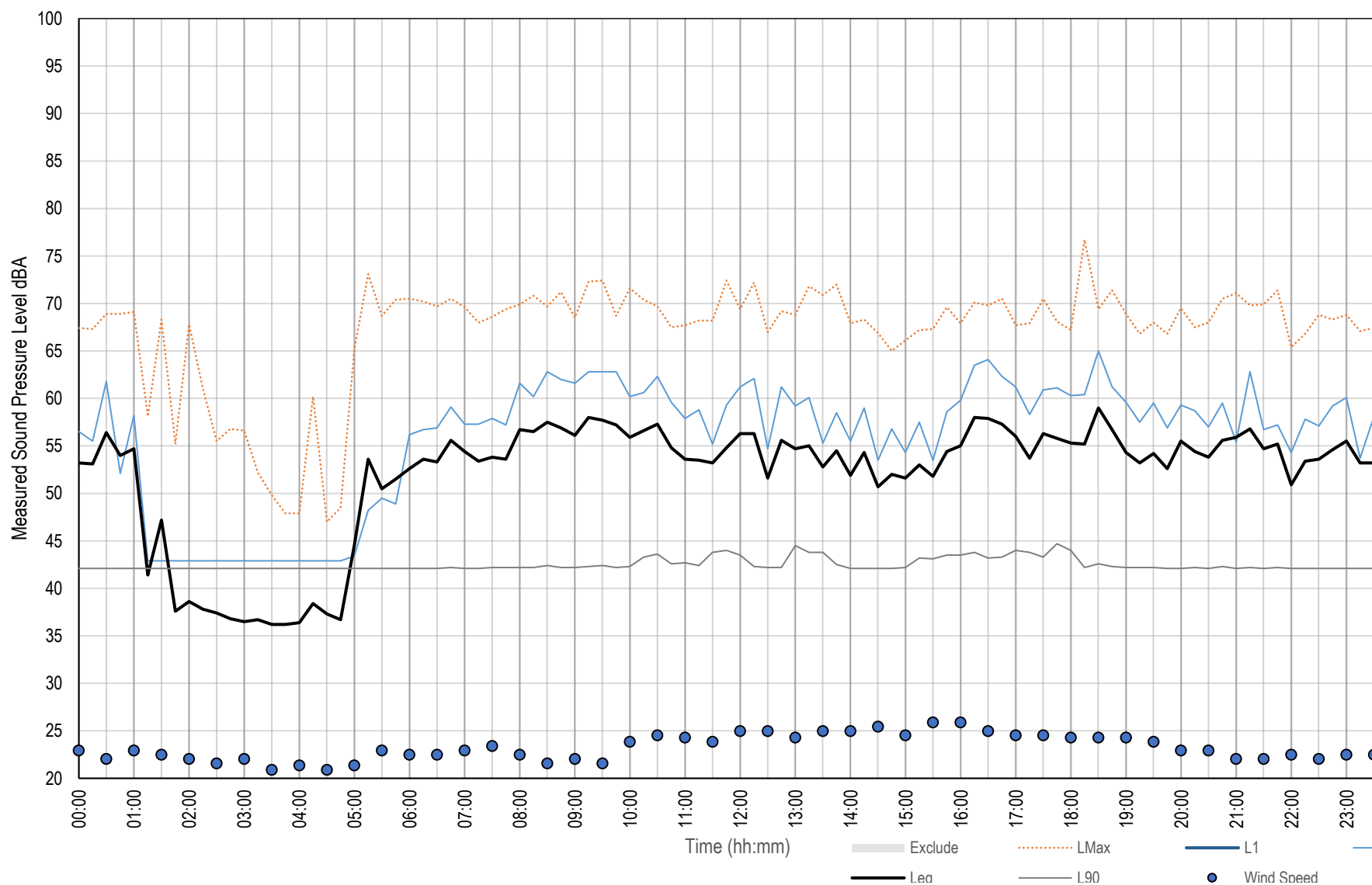


Measured Noise Levels -
Wednesday, 19 February 2020



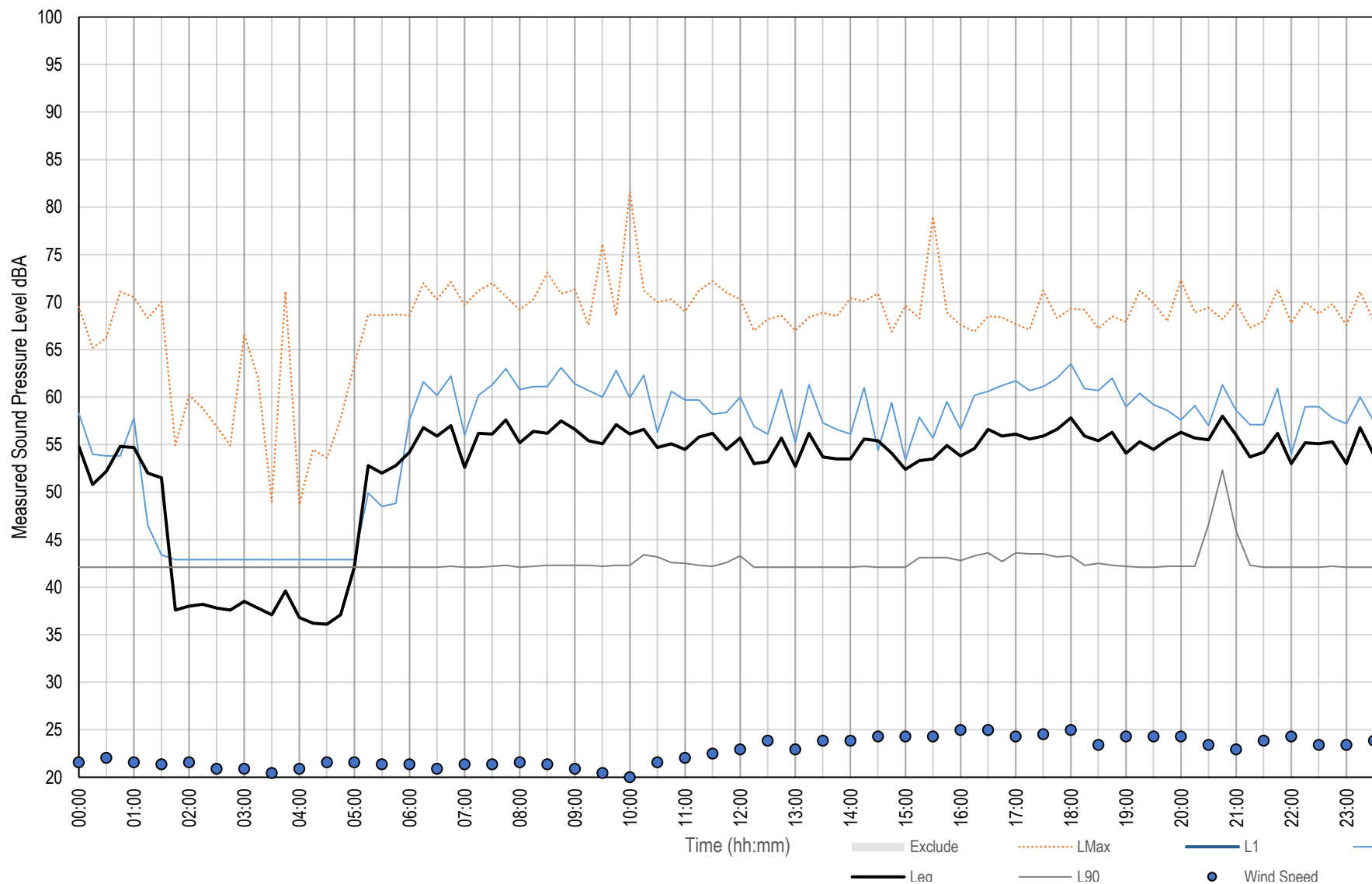
Measured Noise Levels -

Thursday, 20 February 2020



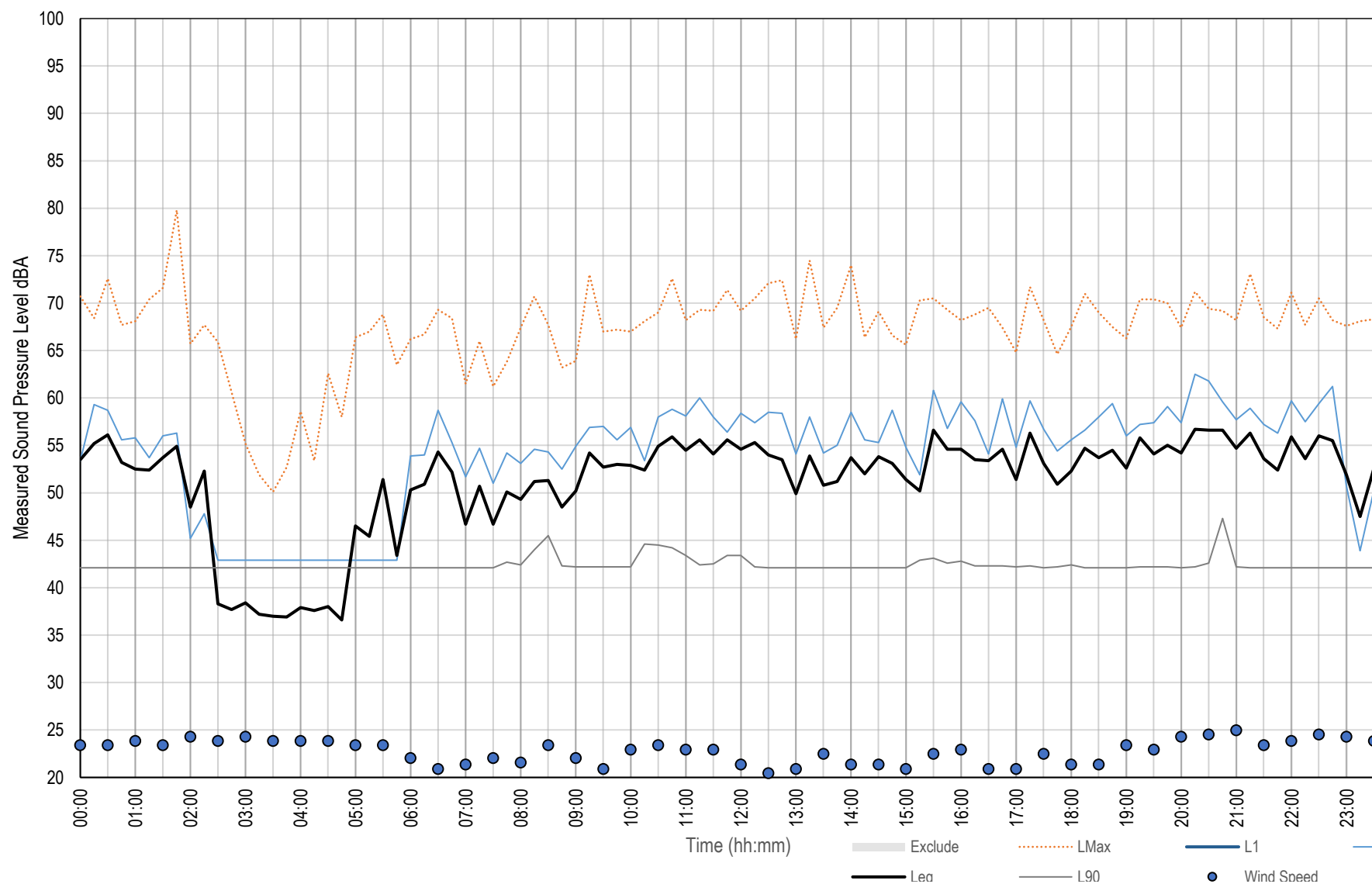
Measured Noise Levels -

Friday, 21 February 2020



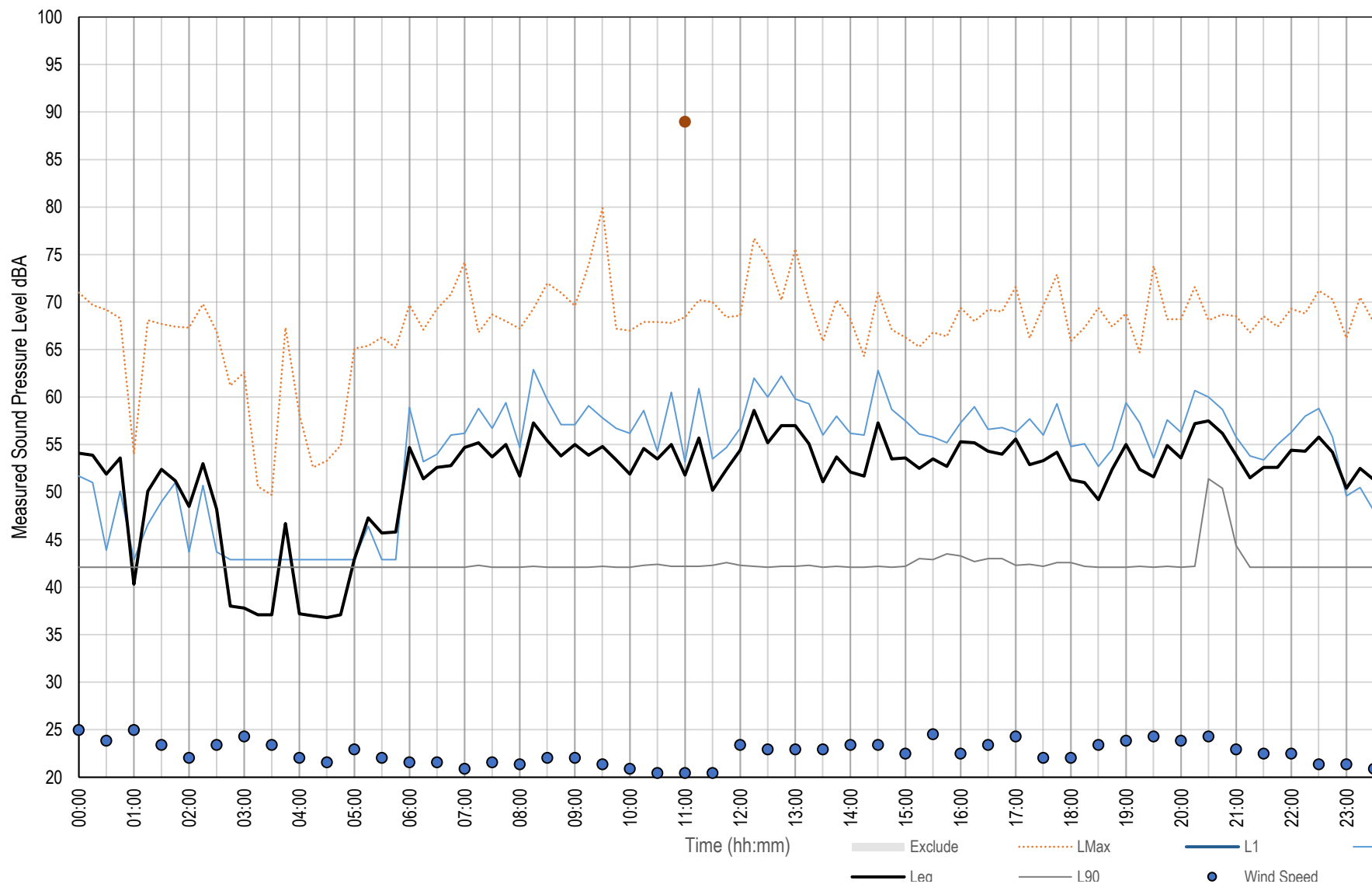
Measured Noise Levels -

Saturday, 22 February 2020



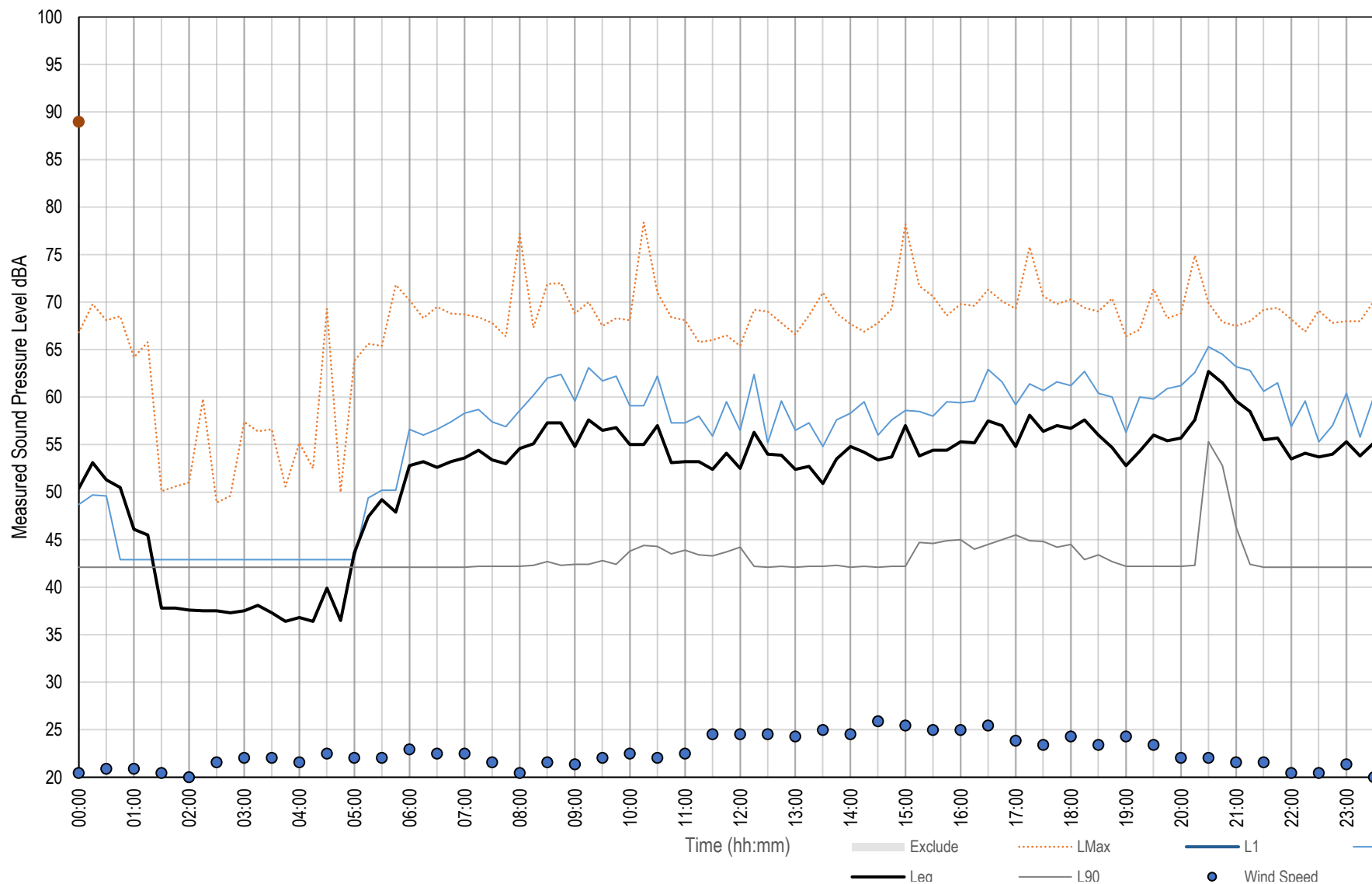
Measured Noise Levels -

Sunday, 23 February 2020



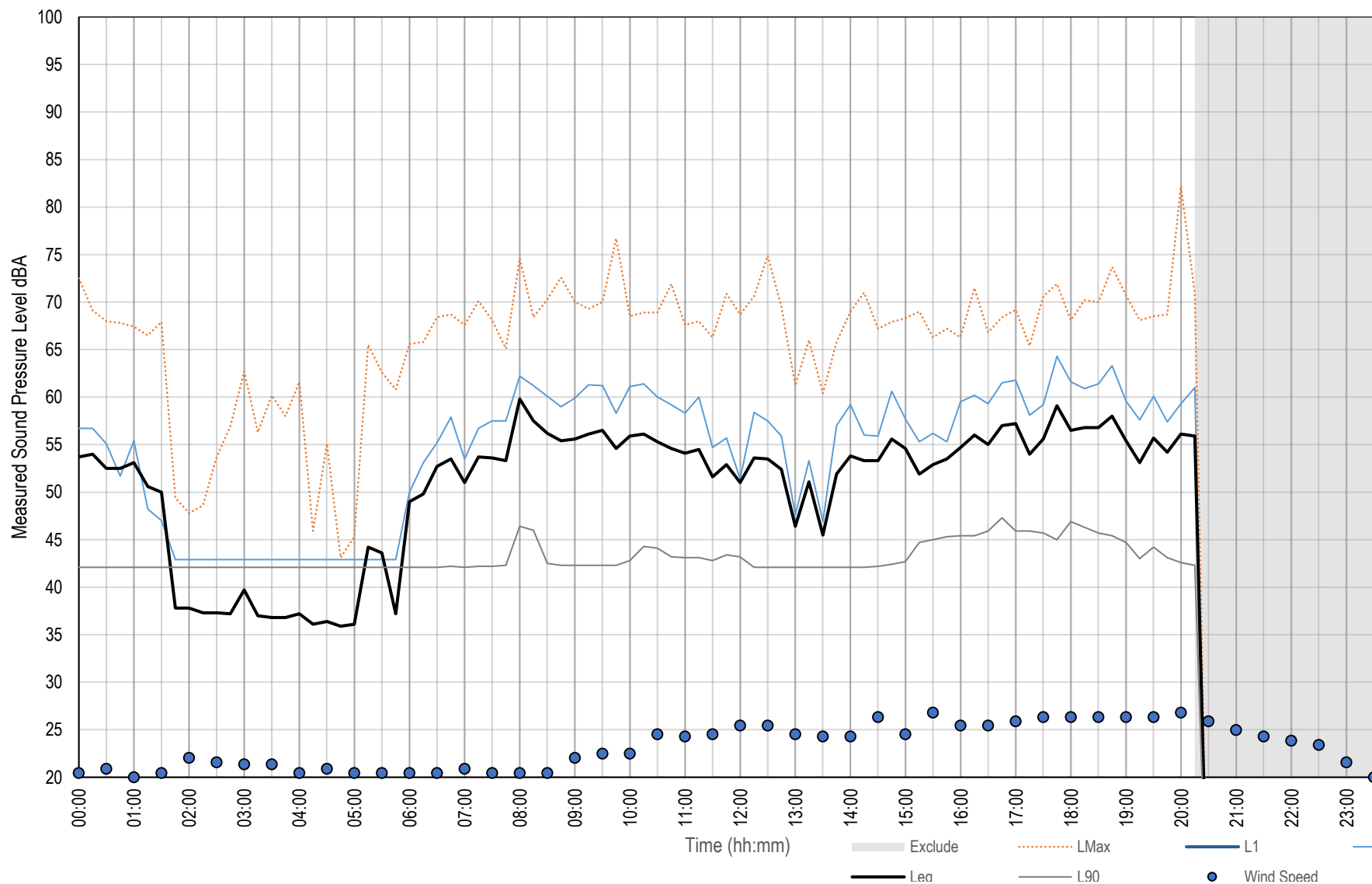
Measured Noise Levels -

Monday, 24 February 2020



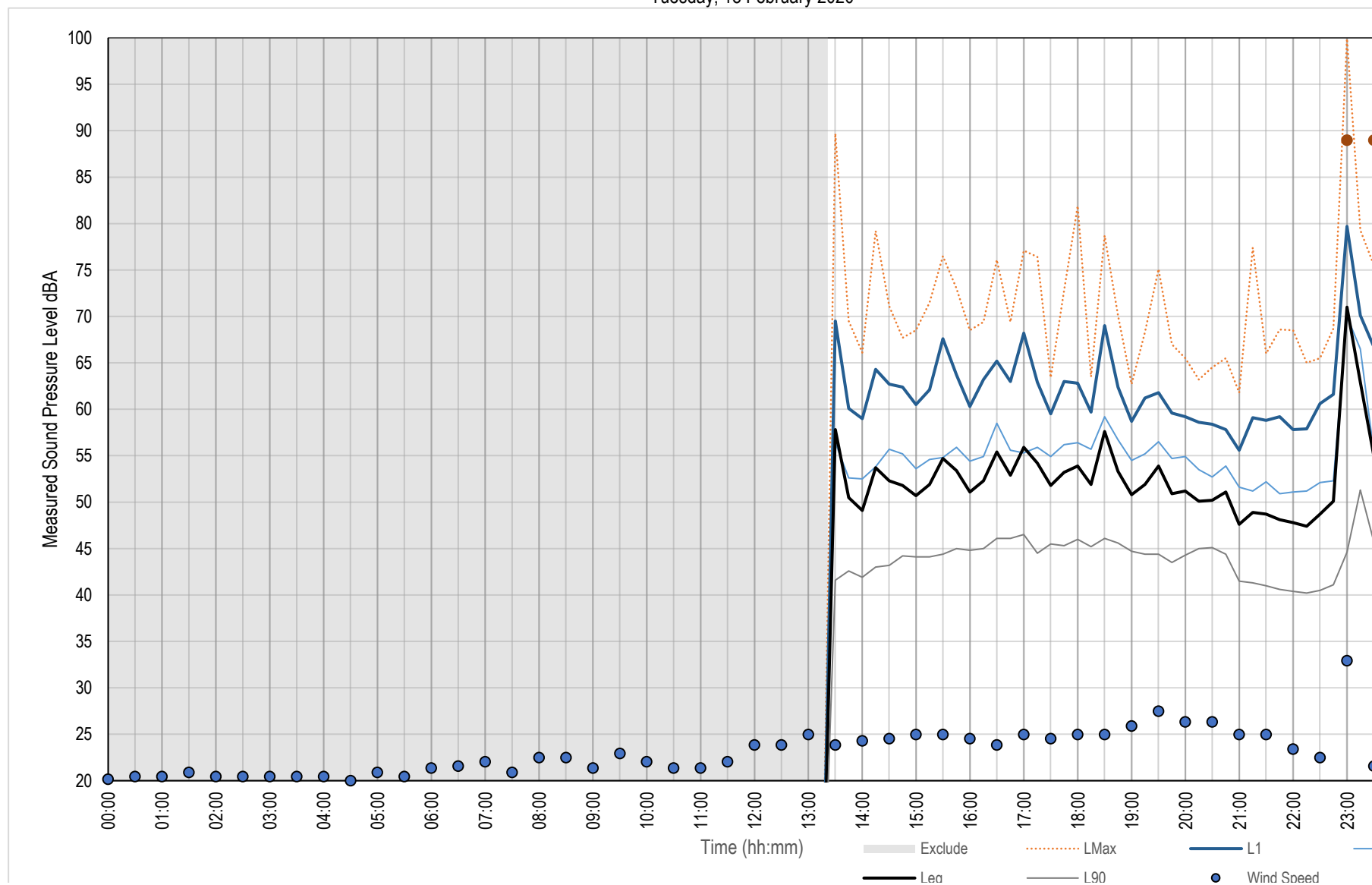
Measured Noise Levels -

Tuesday, 25 February 2020

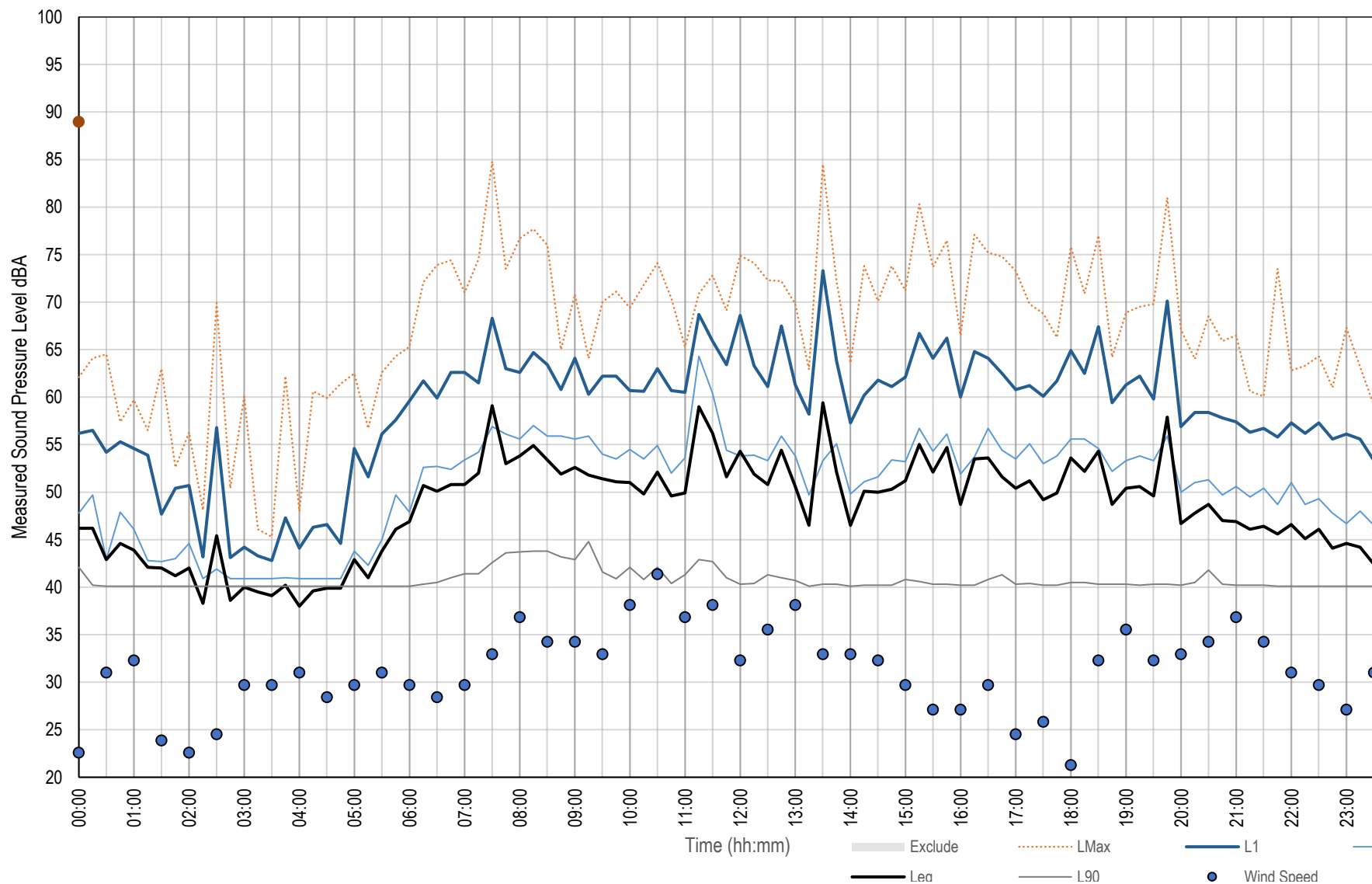


Measured Noise Levels -

Tuesday, 18 February 2020

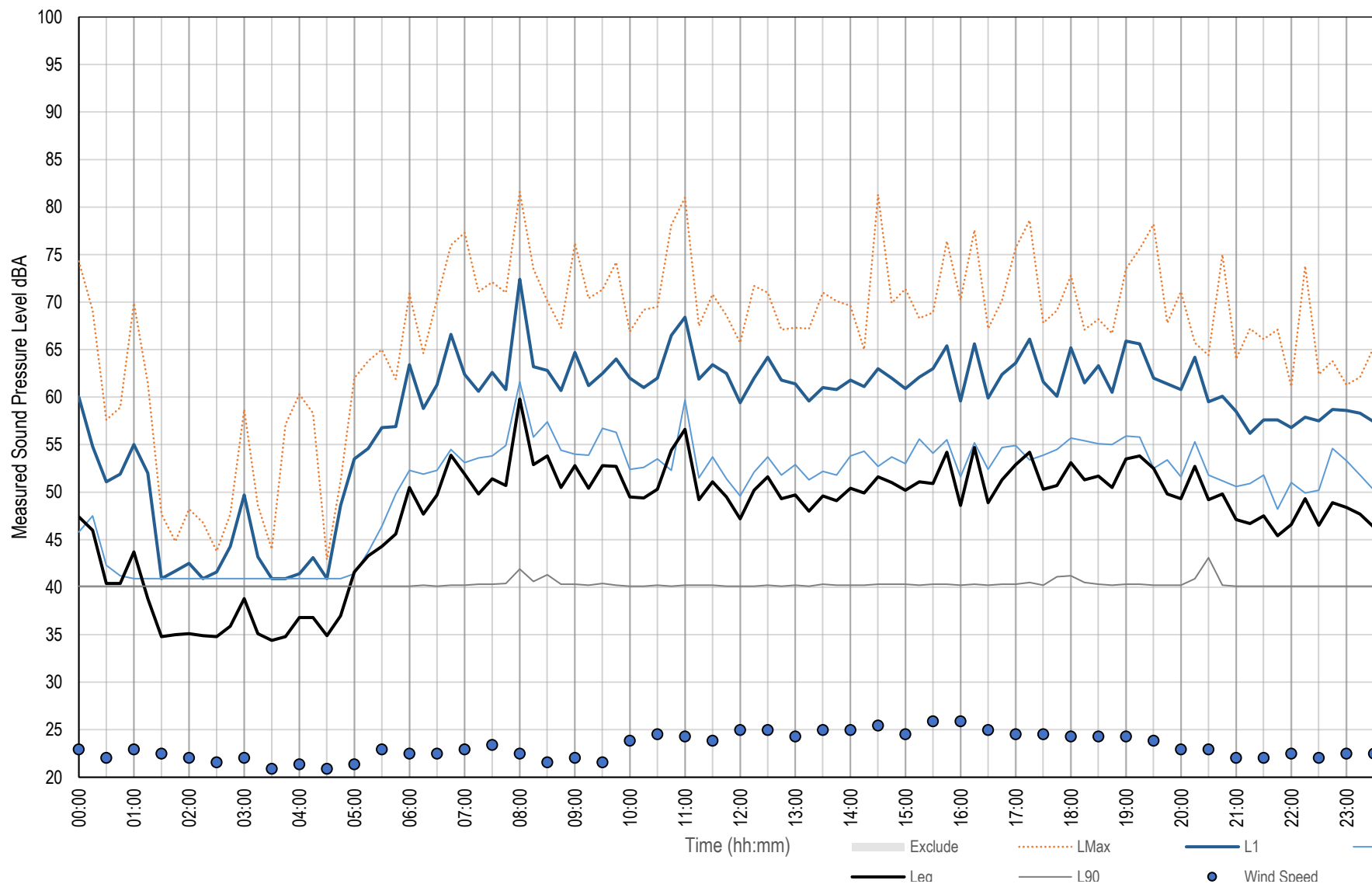


Measured Noise Levels -
Wednesday, 19 February 2020



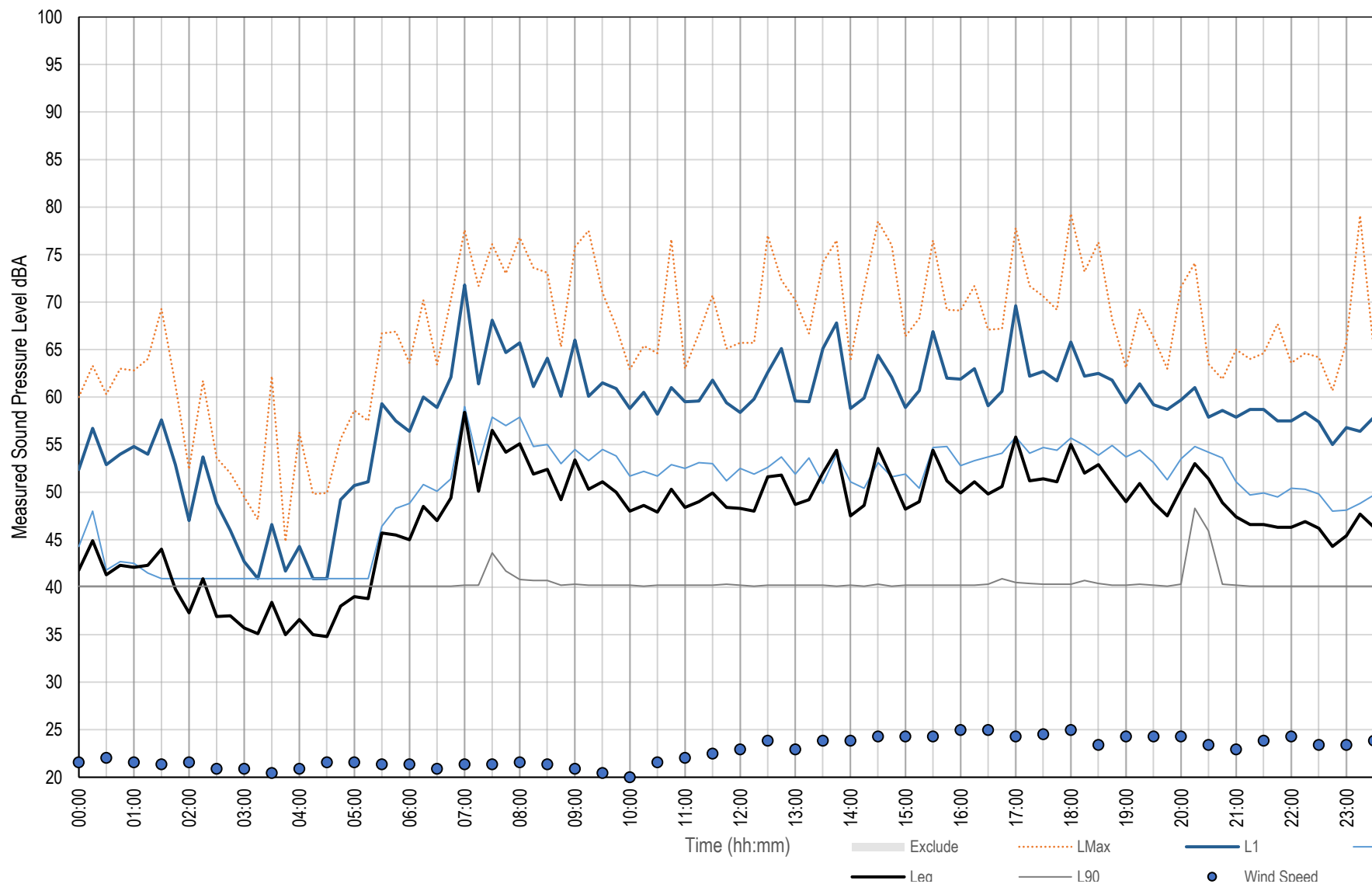
Measured Noise Levels -

Thursday, 20 February 2020



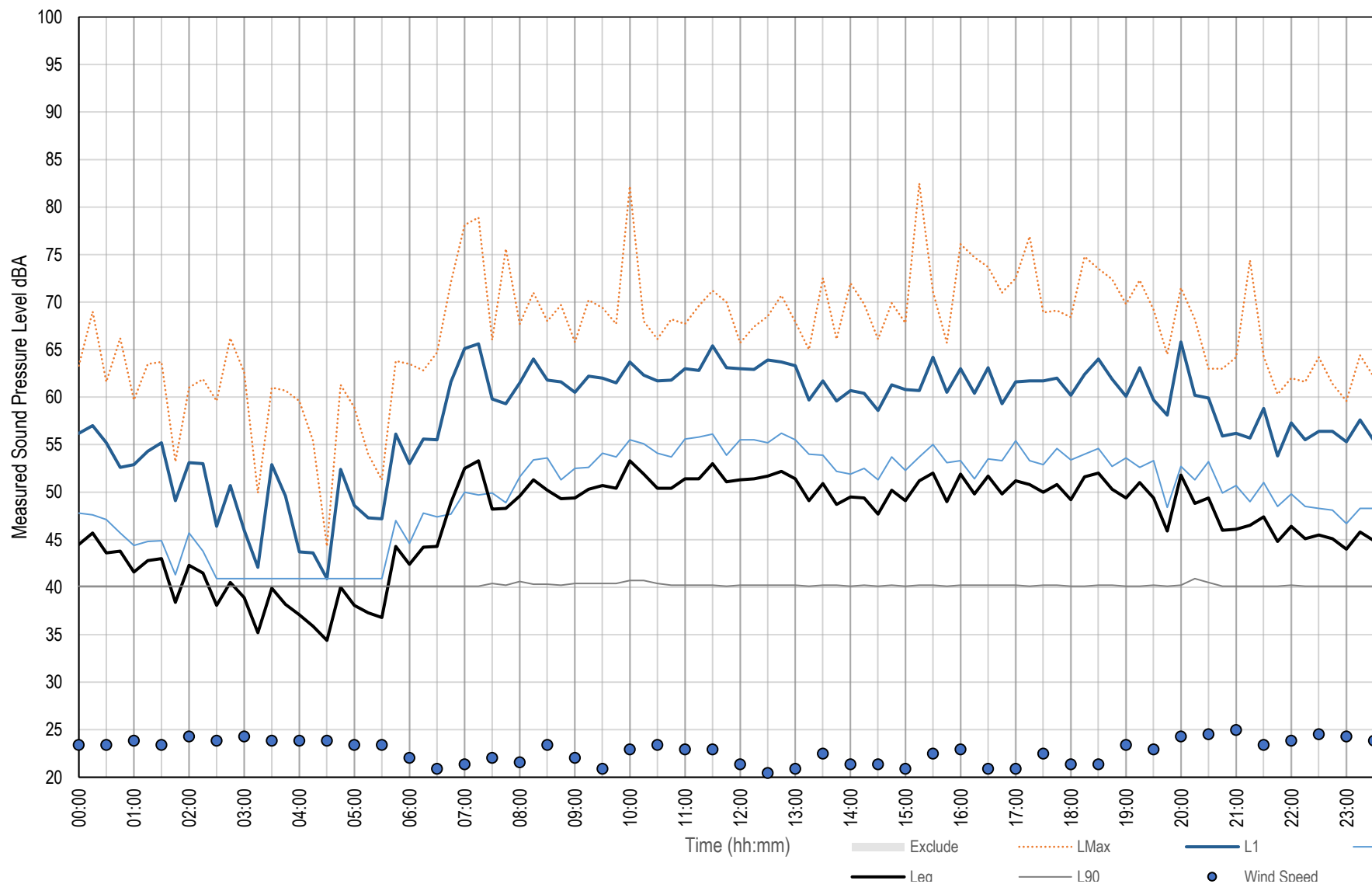
Measured Noise Levels -

Friday, 21 February 2020



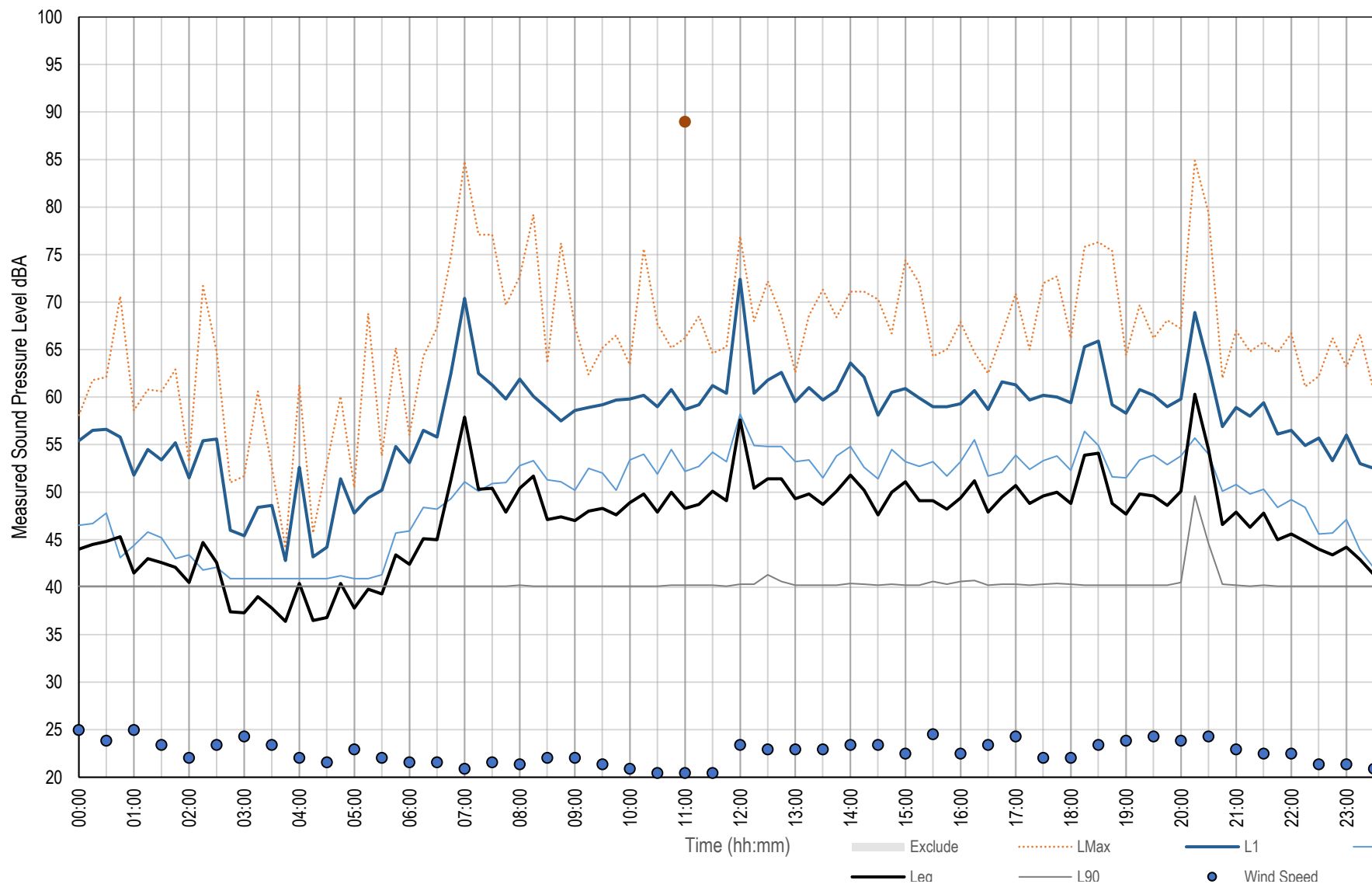
Measured Noise Levels -

Saturday, 22 February 2020



Measured Noise Levels -

Sunday, 23 February 2020

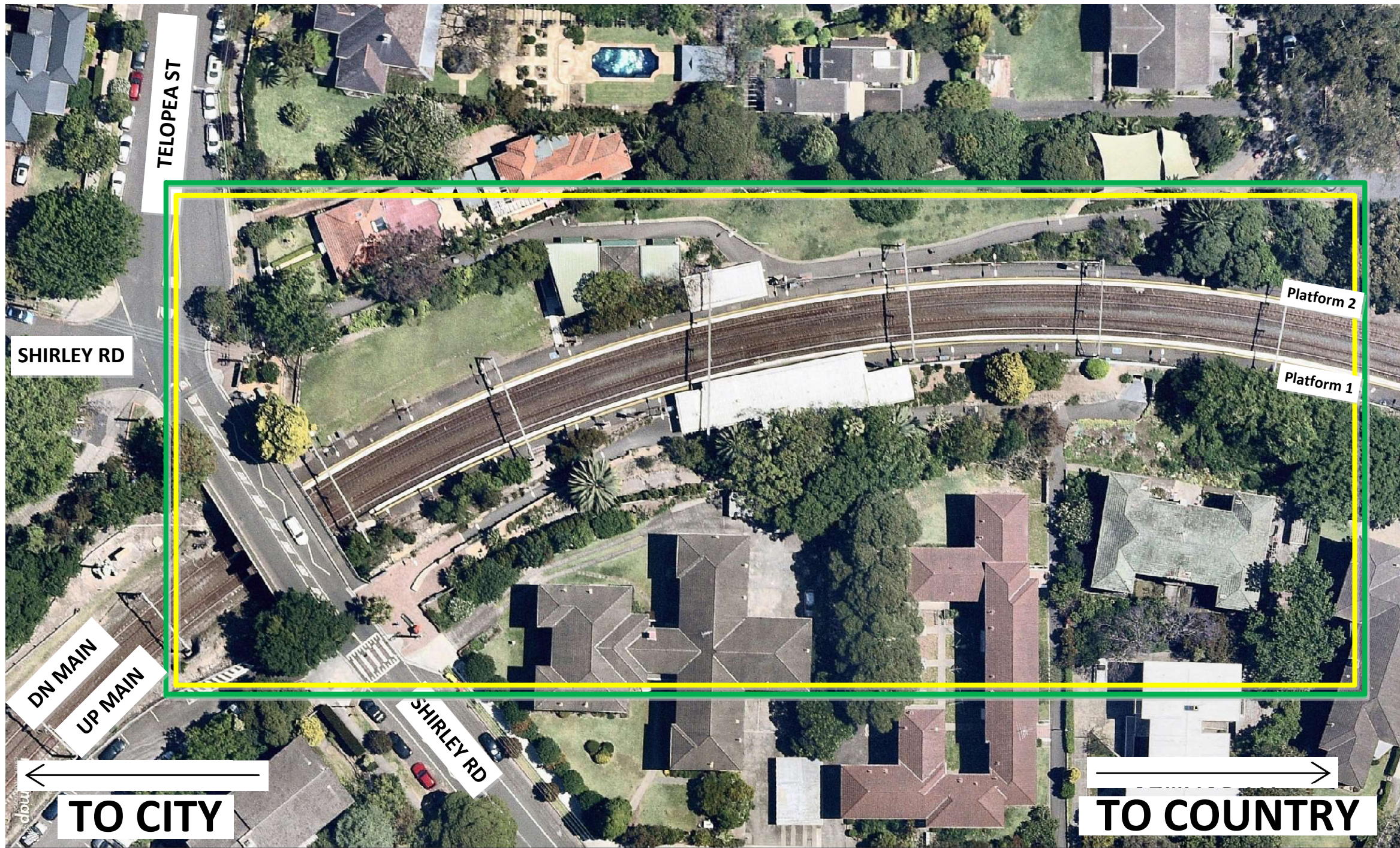
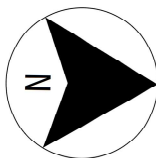


APPENDIX B

RAIL POSSESSION INFORMATION



TAP3.3 Wollstonecraft Station Staging



Enabling Works – Prior to July 2020

- Site Preparation
- Site Establishment
- Station Services
- Service Relocation and Protection (Service Disruption Notice)

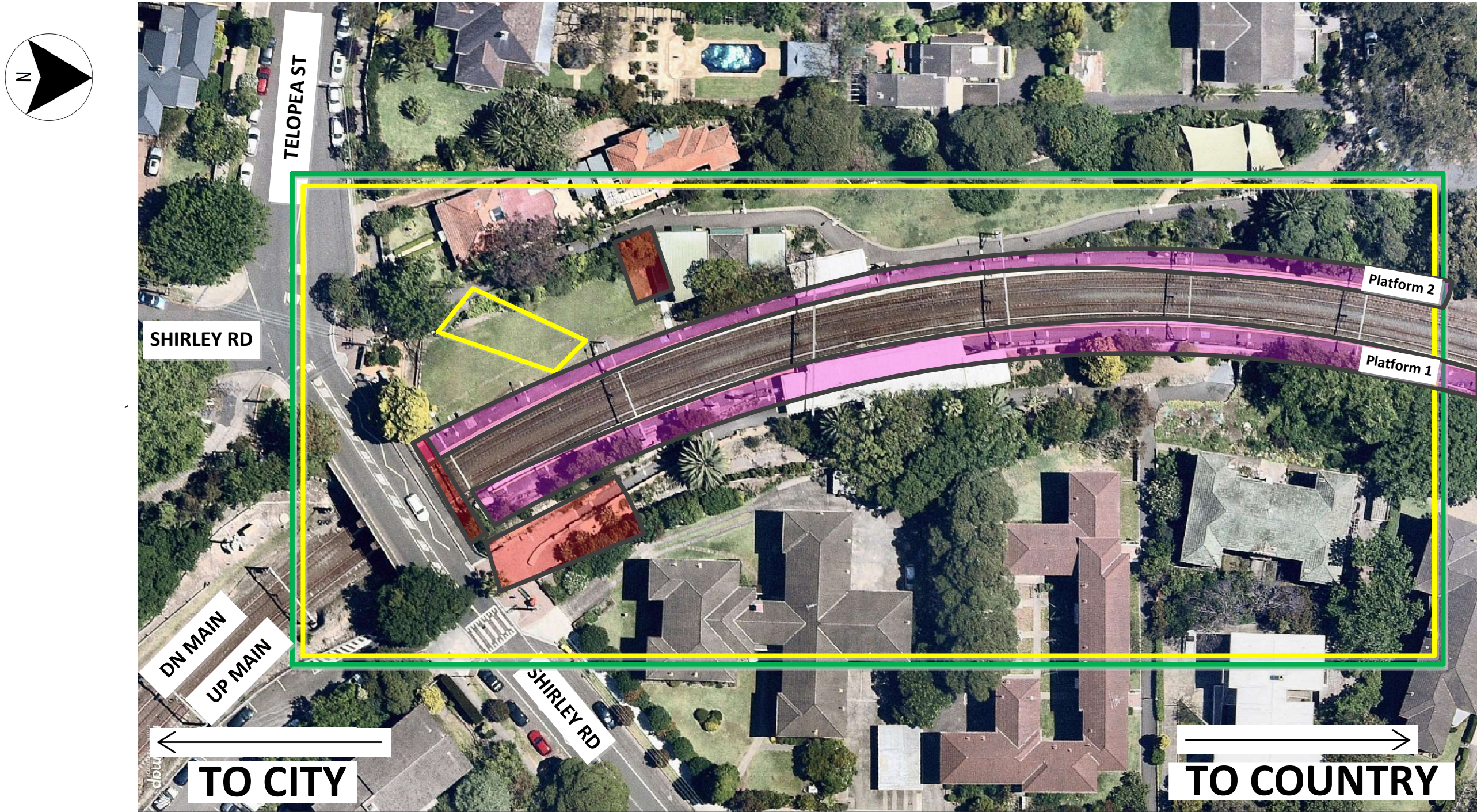
Site Access

- DN Side
- Approx. 100m in Direction of Country
- Access Gate N30 7.362 D

ST Calendar Revision

- 2019 2020 Version No.8
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- 2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 1 – WE03 (18/07/2020 – 19/07/2020)

Site Preparation	Footbridge/Stairs/Ramps/Lifts	Platforms	Station Services
<ul style="list-style-type: none">- Site Mobilisation- Install Lift to Deliver Materials on Platform 2 (DN Side)	<ul style="list-style-type: none">- Rock Excavation for Platform 1 Lift – Stage 1 of 2- Piling, Excavation and Shoring and for Platform 2 Lift- Hoarding for Platform 1 Lift- Hoarding for Platform 2 Lift	<ul style="list-style-type: none">- Install Temporary Ramp on UP Main Footpath- Install Catch Deck on Existing Shirley Road Overbridge	<ul style="list-style-type: none">- Platform Raising and Regrading – Stage 1 of 5- Remove Vegetation at Proposed Platform 2 Lift- Service Relocation and Protection

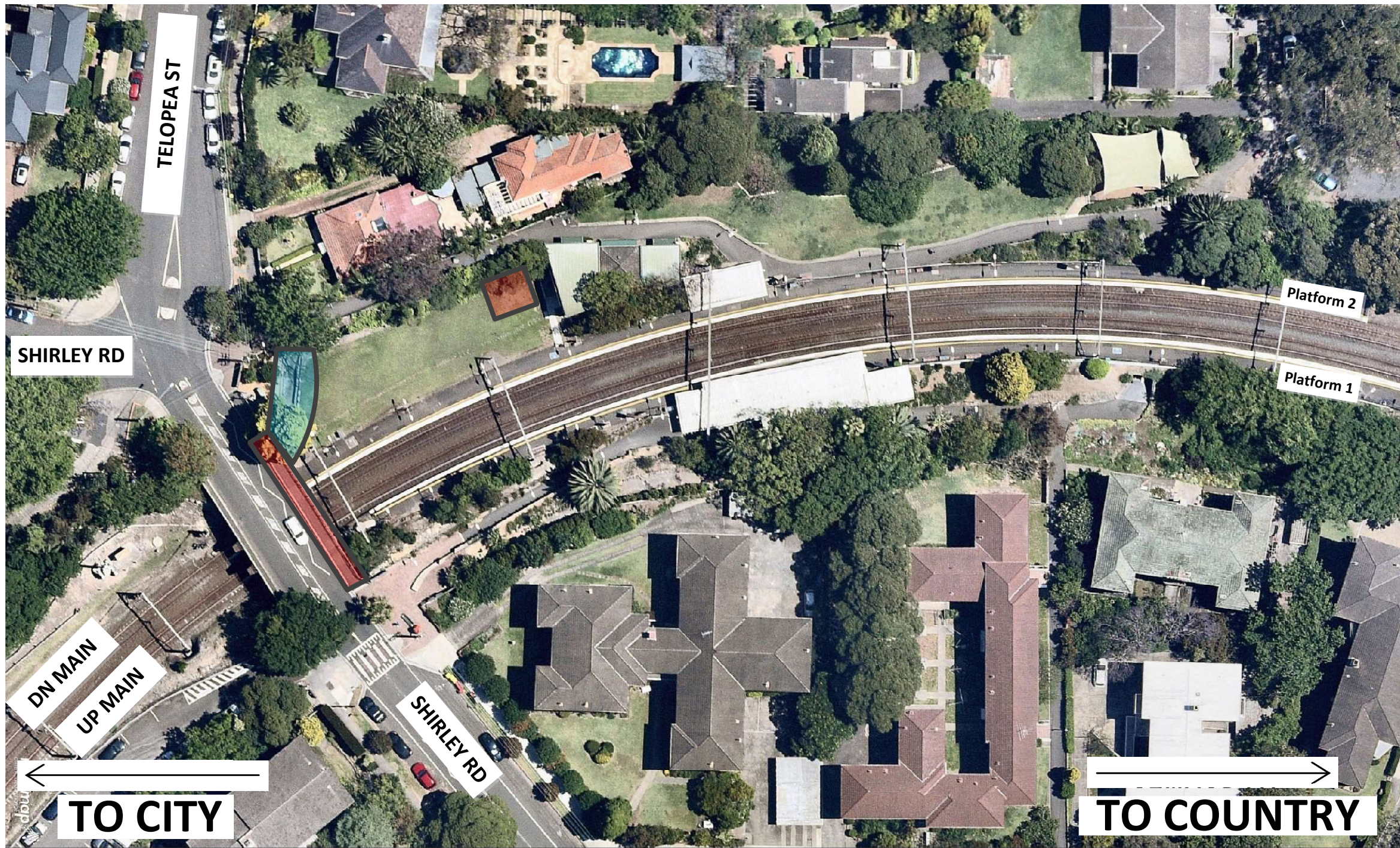
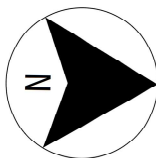
Site Access

DN Side
– Approx. 100m in Direction of Country
– Access Gate N30 7.362 D

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2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 1 to Possession 2 – July 2020 to October 2020

- Footbridge/Stairs/Ramps/Lifts

Precinct

- Hoarding for Footpath Works
- Pile Cap for Platform 2 Lift
 - Lift Pit FRP, Waterproofing for Platform 2 Lift
 - Overbridge Footpath Widening – Stage 1 of 4

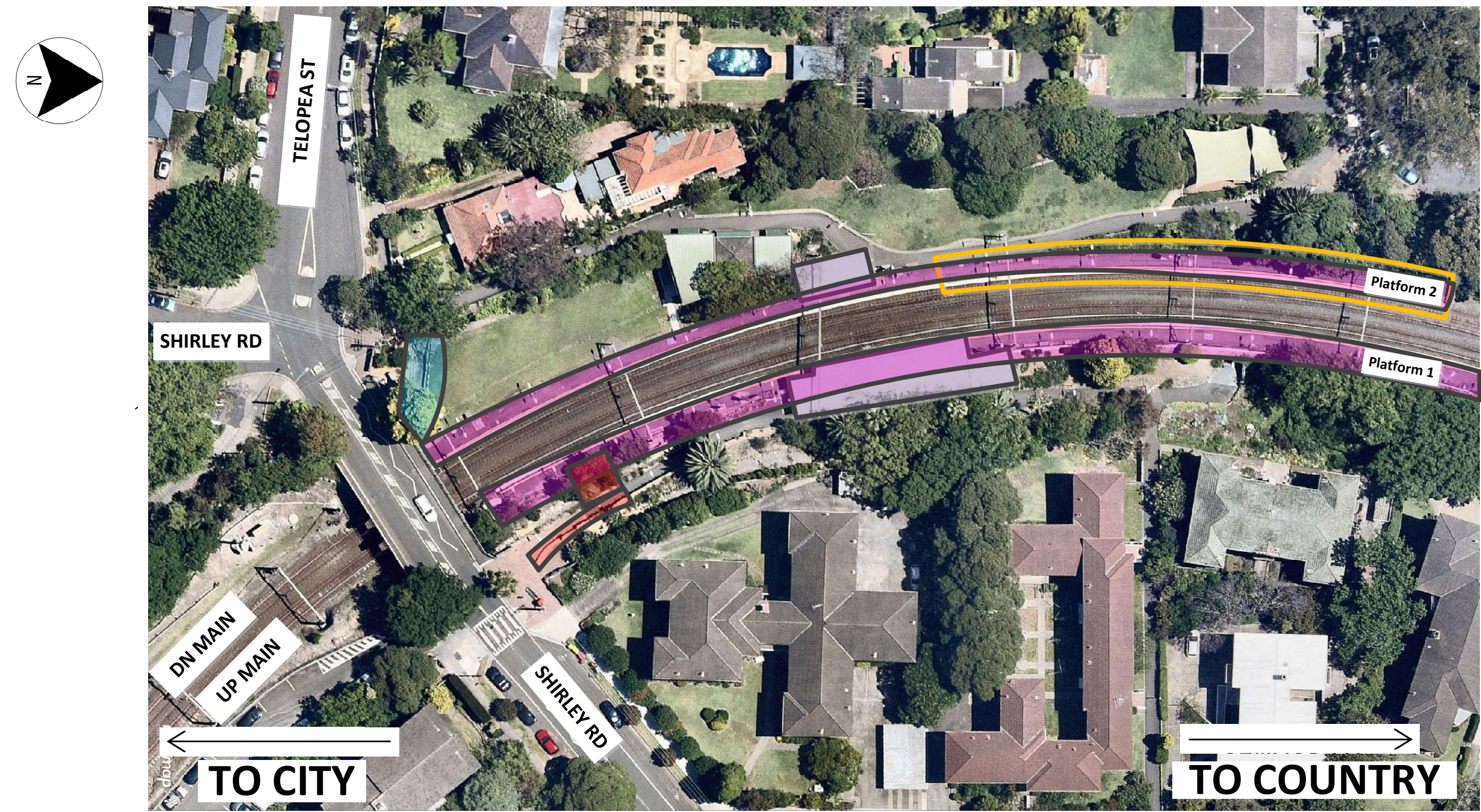
Site Access

- DN Side
- Approx. 100m in Direction of Country
 - Access Gate N30 7.362 D

ST Calendar Revision

- 2019 2020 Version No.8
2020 2021 Draft No.6
2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 2 – WE17 (24/10/2020 – 25/10/2020)

Footbridge/Stairs/Ramps/Lifts	Precinct	Platforms	LV and HV	Station Building
<ul style="list-style-type: none">- Rock Excavation for Platform 1 Lift – Stage 2 of 2- Piling, Excavation and Shoring for Platform 1 Lift- Demolish Existing Walls at Shirley Road Entrance to Platform 1	<ul style="list-style-type: none">- Piling for new footpath (DN Side)- Footpath Works UP Side (Eastern Entrance)	<ul style="list-style-type: none">- Platform Raising and Regrading – Stage 2 of 5- CSR Platform 1 – Stage 1 of 3- CSR Platform 2 – Stage 1 of 3	<ul style="list-style-type: none">- Commence HV Cable Route	<ul style="list-style-type: none">- Waiting Room Platform 1 – Stage 1 of 2- Waiting Room Platform 2 – Stage 1 of 2

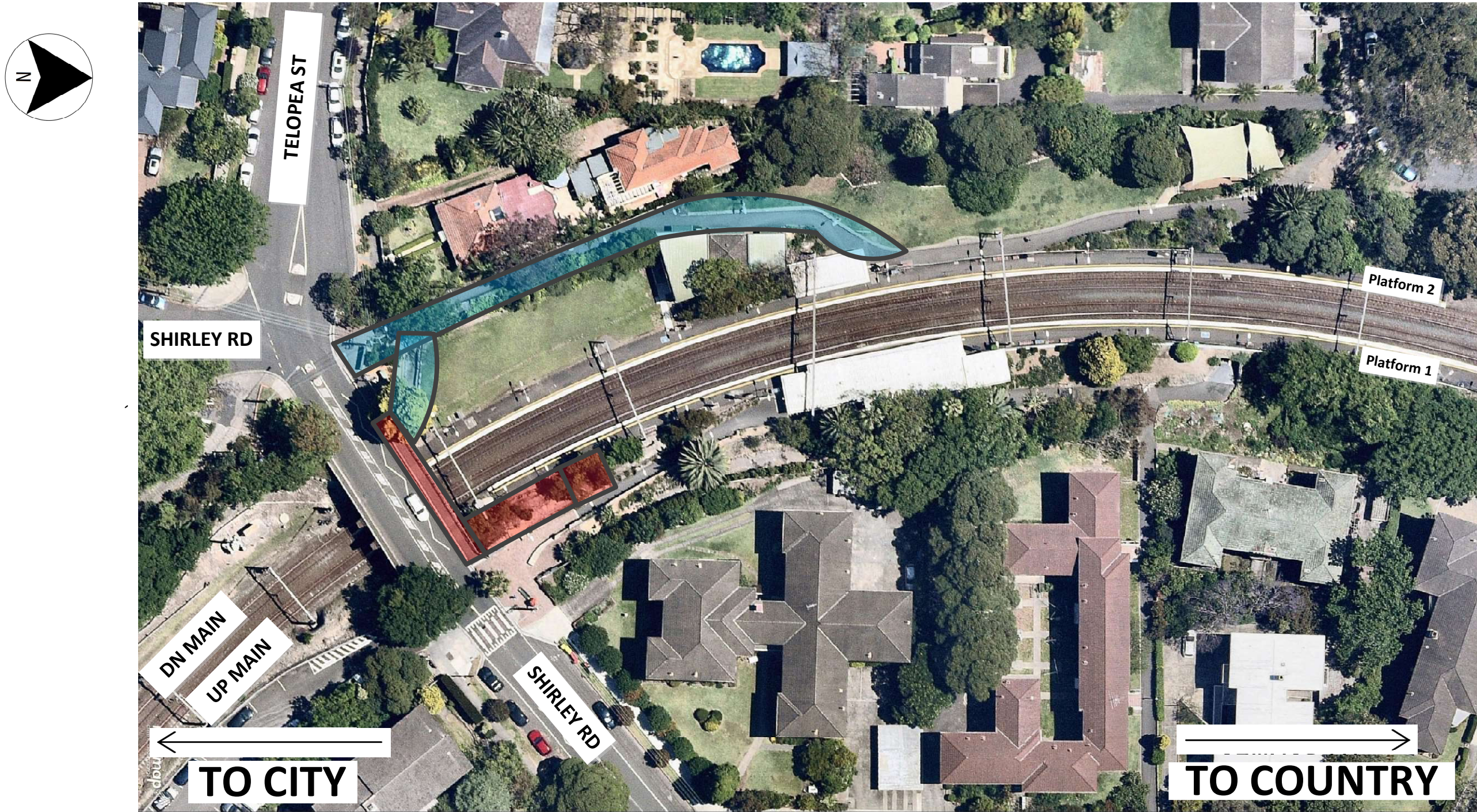
Site Access

DN Side
– Approx. 100m in Direction of Country
– Access Gate N30 7.362 D

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2019 2020 Version No.8
2020 2021 Draft No.6
2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 2 to Possession 3 – October 2020 to March 2021

Footbridge/Stairs/Ramps/Lifts	Station Building	Precinct
<ul style="list-style-type: none">- Shotcrete to Stabilise Wall Around Lift 1- Pile Cap for Platform 1 Lift- Lift Pit FRP for Platform 1 Lift- Overbridge Footpath Widening – Stage 2 of 4- False work for Accessibility Ramp from Lift 1 to Shirley Road	<ul style="list-style-type: none">- Demolish Male Toilet and Cleaners Store- FAT Works- Female Toilet Works- DB Room Works- Cleaners Store Works	<ul style="list-style-type: none">- False Work and Scaffolding DN Side Elevated Footpath- FRP Columns DN Side Elevated Footpath- Footpath in Front of Stores – Stage 1 of 5

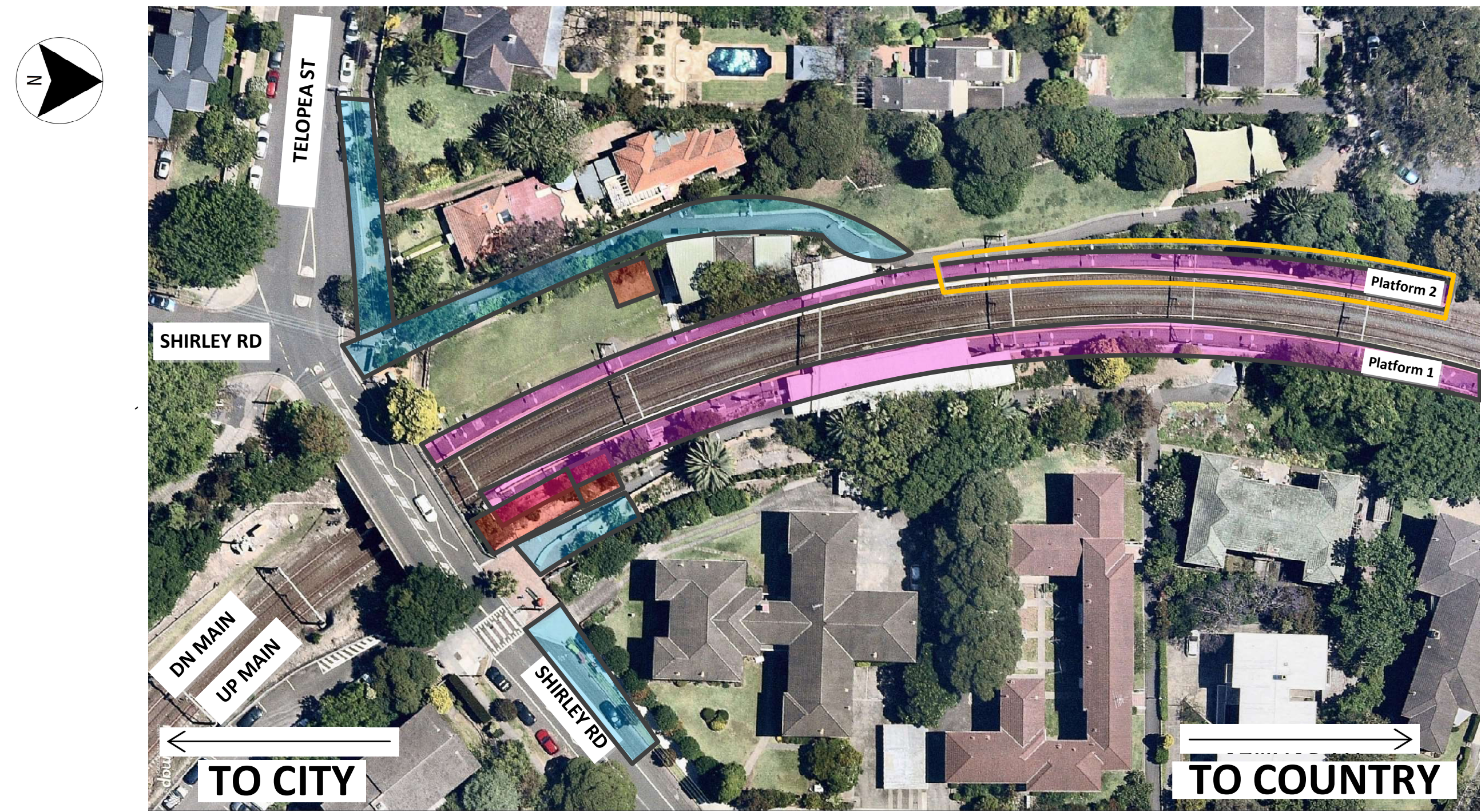
Site Access

- DN Side
- Approx. 100m in Direction of Country
 - Access Gate N30 7.362 D

ST Calendar Revision

- 2019 2020 Version No.8
- 2020 2021 Draft No.6
- 2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 3 – WE38 (20/03/2021 – 21/03/2021)

Footbridge/Stairs/Ramps/Lifts	Platform	Precinct	LV and HV	Station Building
<ul style="list-style-type: none">- Lift 1 Shaft Structure – Stage 1 of 2- Lift 2 Shaft Structure – Stage 1 of 2	<ul style="list-style-type: none">- Platform Raising and Regrading – Stage 3 of 5- CSR Platform 1 – Stage 2 of 3- CSR Platform 2 – Stage 2 of 3	<ul style="list-style-type: none">- Footpath works DN Side (Ramps)- Footpath Works DN Side in Front of Stores – Stage 2 of 5- Footpath Works UP Side – Stage 1 of 5	<ul style="list-style-type: none">- Continue HV Cable Route- Deliver new Transformer	<ul style="list-style-type: none">- Waiting Room Works Platform 1 – Stage 2 of 2- Waiting Room Works Platform 2 – Stage 2 of 2

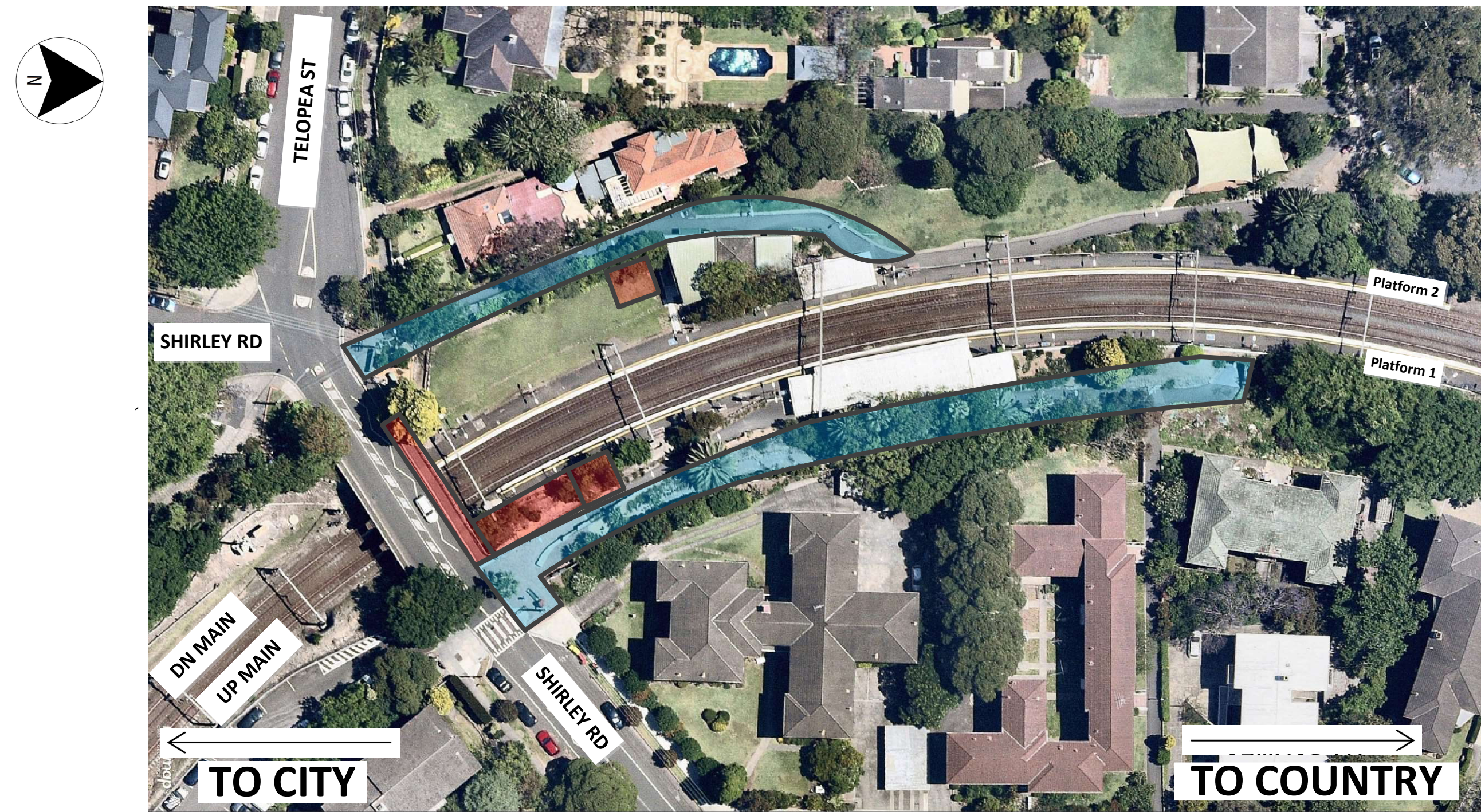
Site Access

DN Side
– Approx. 100m in Direction of Country
– Access Gate N30 7.362 D

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2019 2020 Version No.8
2020 2021 Draft No.6
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TAP3.3 Wollstonecraft Station Staging



Possession 3 to Possession 4 – March 2021 to June 2021

Footbridge/Stairs/Ramps/Lifts	Precinct	Station Building	LV and HV
<ul style="list-style-type: none">- Lift 1 Shaft Structure – Stage 2 of 2- Lift 2 Shaft Structure – Stage 2 of 2- Deliver Lifts (Liftronic)- FRP Accessible Ramp to Lift 1 - Stage 1 of 2- Install Lifts (Liftronic)- Overbridge Footpath Widening – Stage 3 of 4	<ul style="list-style-type: none">- Footpath works UP Side – Stage 2 of 5- Footpath Works In front of Stores – Stage 3 of 5- Footpath Works DN Side – Shirley Road Entrance – Non-Poss Stage 1 of 2	<ul style="list-style-type: none">- Commission FAT- Demolish Female Toilets- Female Toilet Works- Male Toilet Works- Commission New Male and Female Toilets- Station Staff Offices	<ul style="list-style-type: none">- ISMSB Works- Delivery of Revenue Metering Board, DSMSB, ATS- Install Lift Mains

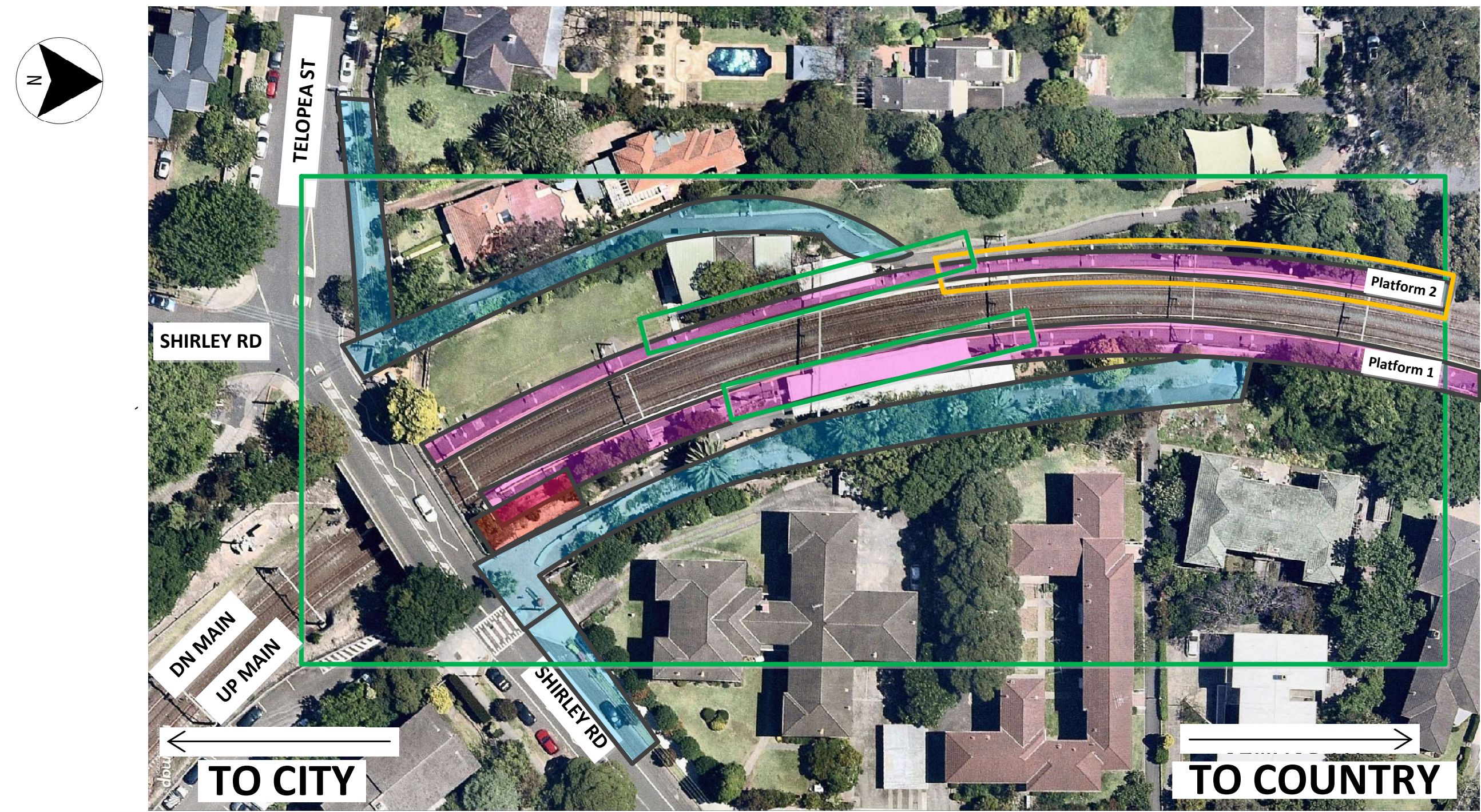
Site Access

- DN Side
- Approx. 100m in Direction of Country
 - Access Gate N30 7.362 D

ST Calendar Revision

- 2019 2020 Version No.8
- 2020 2021 Draft No.6
- 2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 4 – WE51 (20/06/2021 – Sunday ONLY)

Footbridge/Stairs/Ramps/Lifts	Precinct	Platforms	Station Services	LV and HV
<ul style="list-style-type: none">- FRP Accessible Ramp to Lift 1 – Stage 2 of 2	<ul style="list-style-type: none">- Footpath Works In front of Stores – Stage 4 of 5- Footpath works UP Side – Stage 3 of 5- Footpath works DN Side – Regrade from Shirley Road to Lift 2- Stairs x 2 at Shirley Road Entrance to Platform 1	<ul style="list-style-type: none">- Platform Raising and Regrading – Stage 4 of 5- CSR Platform 1 – Stage 3 of 3- CSR Platform 2 – Stage 3 of 3- Install Canopies over BAZ – Stage 1 of 2- Tactiles, Handrails, Stair Treads, Line Marking – Stage 1 of 2	<ul style="list-style-type: none">- Upgrade/Adjust Hearing Loops – Stage 1 of 2- Lighting Upgrades (Possession)- OPAL FLRs on Platforms 1 and 2- CCTV Upgrades	<ul style="list-style-type: none">- Complete HV Cable Route- Commission Transformer- Commission ISMSB- Commission Lift Mains

Site Access

DN Side

- Approx. 100m in Direction of Country
- Access Gate N30 7.362 D

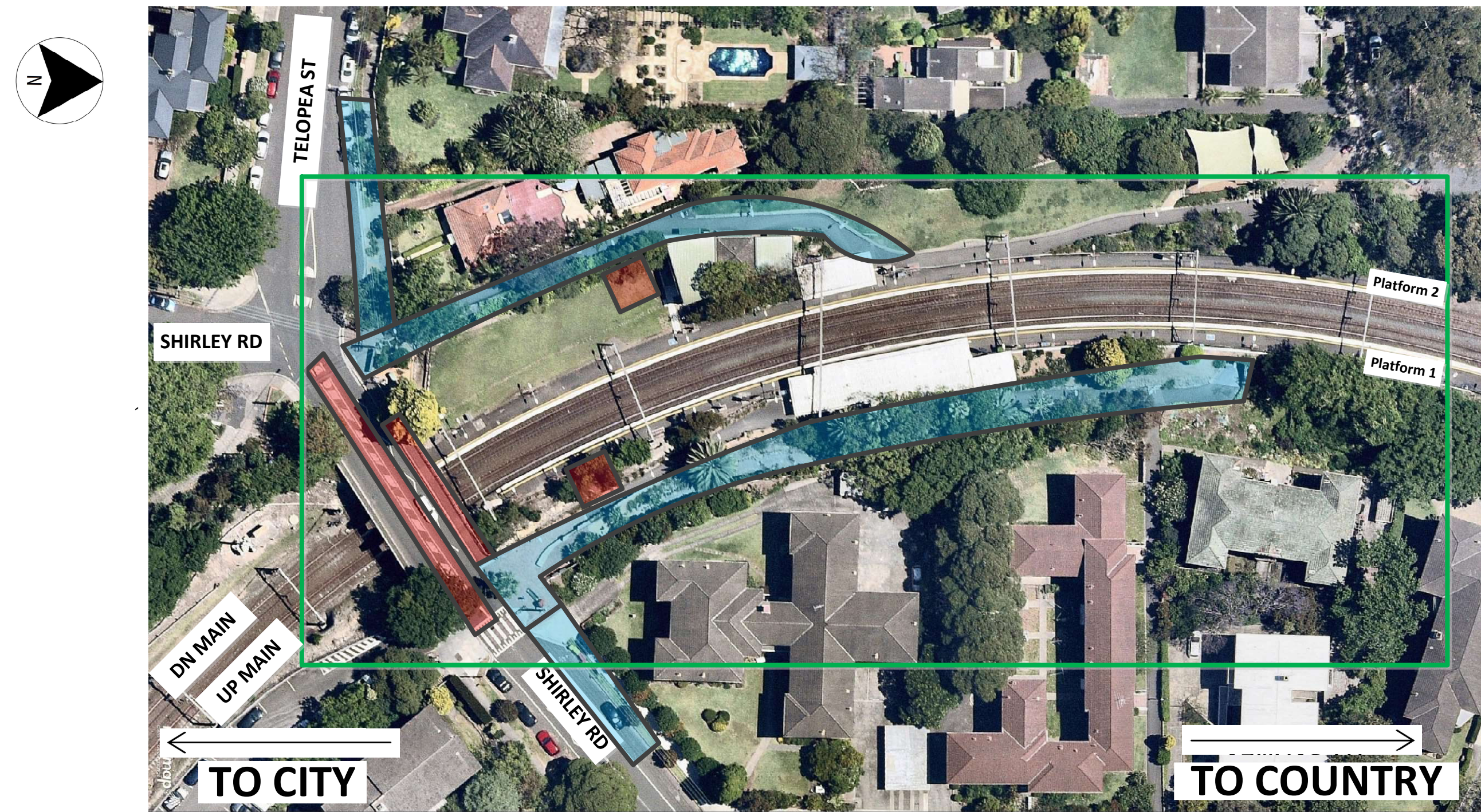
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2020 2021 Draft No.6

2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 4 to Possession 5 – June 2021 to July 2021

- | | | |
|---|--|--|
| Footbridge/Stairs/Ramps/Lifts  | Precinct  | Station Services  |
| <ul style="list-style-type: none">- Install Lifts (Liftronic)- Overbridge Footpath Widening – Stage 4 of 4- Barrier works on Footbridge- Line Marking Bridge Works- Modify Shirley Road Overbridge Balustrade and Handrails | <ul style="list-style-type: none">- Footpath Works In front of Stores – Stage 5 of 5- Footpath works UP Side – Stage 4 of 5- Footpath works DN Side – Shirley Road Entrance – Non-Poss Stage 1 of 2- Lighting Upgrades (Non-Possession) | <ul style="list-style-type: none">- Kiss and Ride and Disabled Parking- Accessible Path from DDA Parking Space and Kiss and Ride Locations- CCTV, Speakers, PID, Lighting, Help Points Upgrades- LED Lighting |

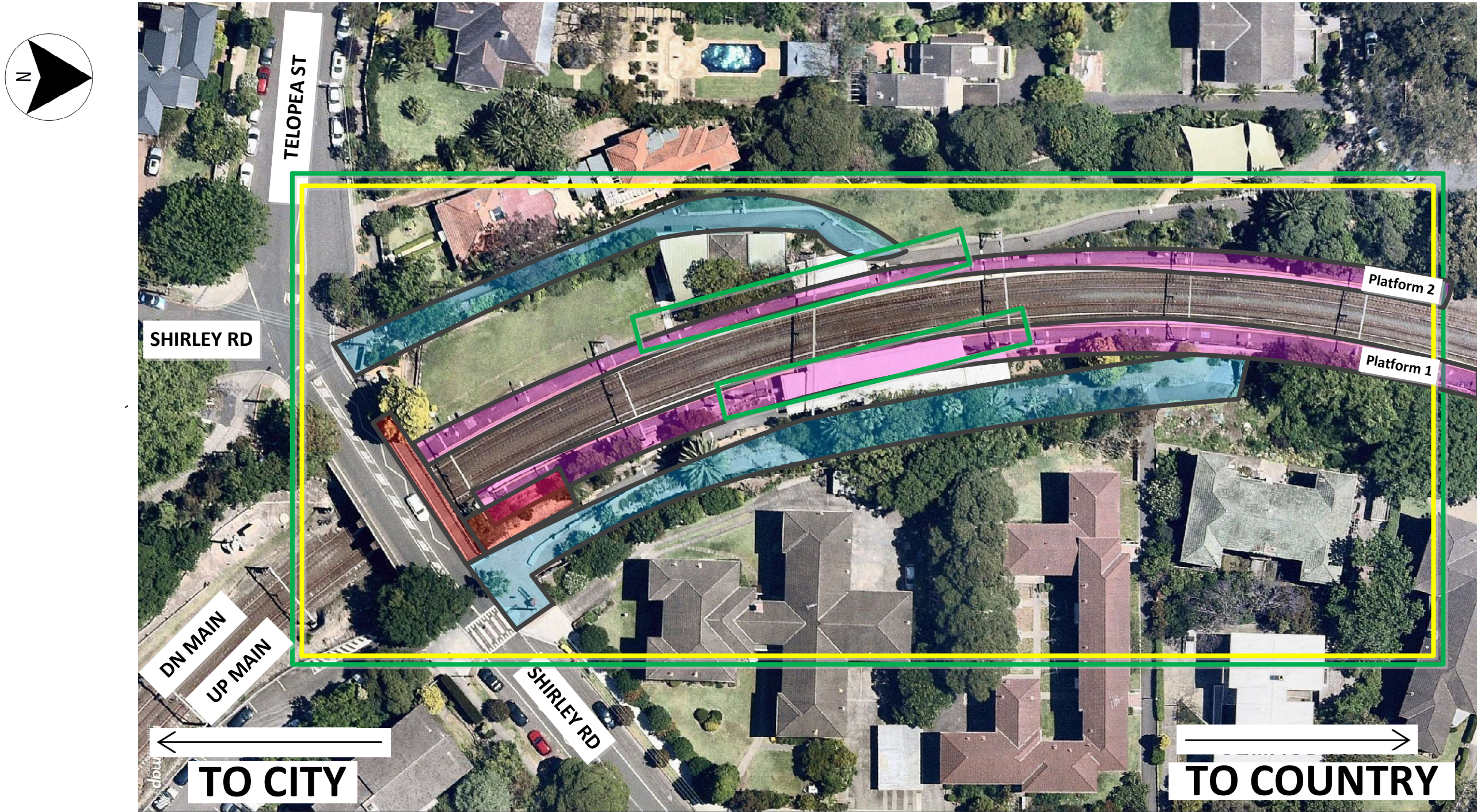
Site Access

- DN Side
- Approx. 100m in Direction of Country
 - Access Gate N30 7.362 D

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2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



Possession 5 – WE05 (31/07/21 – 01/08/21)

Footbridge/Stairs/Ramps/Lifts	Precinct	Platforms	Station Services	Site Preparation
<ul style="list-style-type: none">- Remove Temporary Ramp on UP Main Footpath- Remove Catch Deck	<ul style="list-style-type: none">- Footpath works DN Side (Finishes)- Footpath works UP Side – Stage 5 of 5- Lighting Upgrades (Possession)	<ul style="list-style-type: none">- Platform Raising and Regrading – Stage 5 of 5- Replace vegetation adjacent to Platform 2 Lift- Install Canopies over BAZ – Stage 2 of 2- Tactiles, Handrails, Stair Treads, Line Marking – Stage 2 of 2	<ul style="list-style-type: none">- Upgrade/Adjust Hearing Loops – Stage 2 of 2- Lighting Upgrades (Possession)- OPAL FLRs on Platforms 1 and 2- CCTV Upgrades- Commission Station Services	<ul style="list-style-type: none">- Site Demobilisation

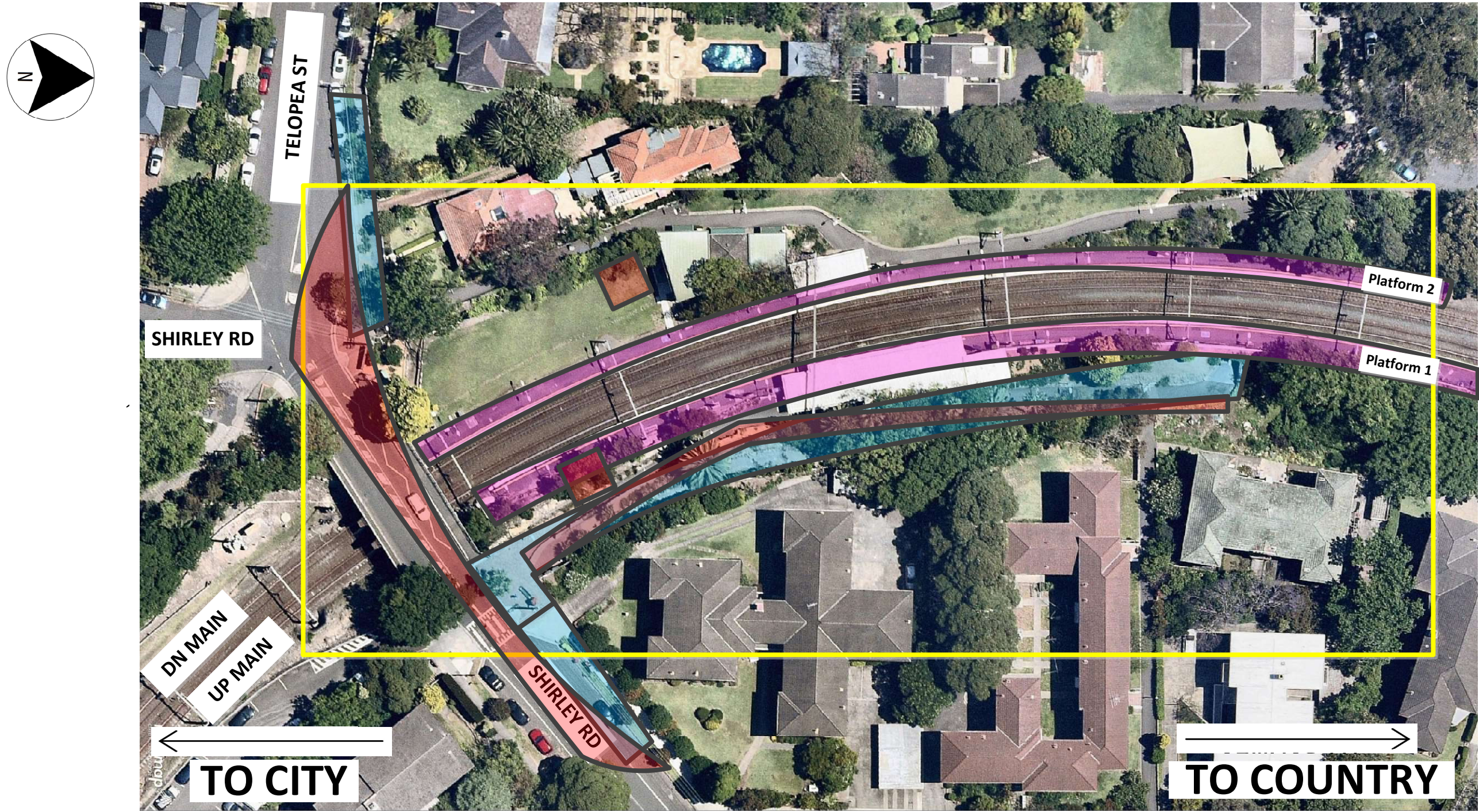
Site Access

DN Side
– Approx. 100m in Direction of Country
– Access Gate N30 7.362 D

ST Calendar Revision

2019 2020 Version No.8
2020 2021 Draft No.6
2021 2022 Draft No.1

TAP3.3 Wollstonecraft Station Staging



After Possession 5 – August 2021 to Mid-September 2021

- | | | | |
|--|--|---|---|
| Footbridge/Stairs/Ramps/Lifts | Precinct | Platforms | Site Preparation |
| <ul style="list-style-type: none"> - Roadwork Shirley Road - Install Lifts (Liftronic) - Commission Lifts - Brick Wall Along Platform Rear | <ul style="list-style-type: none"> - Kiss and Ride and Disabled Parking - Accessible Path from DDA Parking Space and Kiss and Ride Locations | <ul style="list-style-type: none"> - Linemarking for Boarding Assistance Zones | <ul style="list-style-type: none"> - Site Demobilisation |

Site Access

- DN Side
- Approx. 100m in Direction of Country
 - Access Gate N30 7.362 D

ST Calendar Revision








- 2019 2020 Version No.8
- 2020 2021 Draft No.6
- 2021 2022 Draft No.1

APPENDIX C

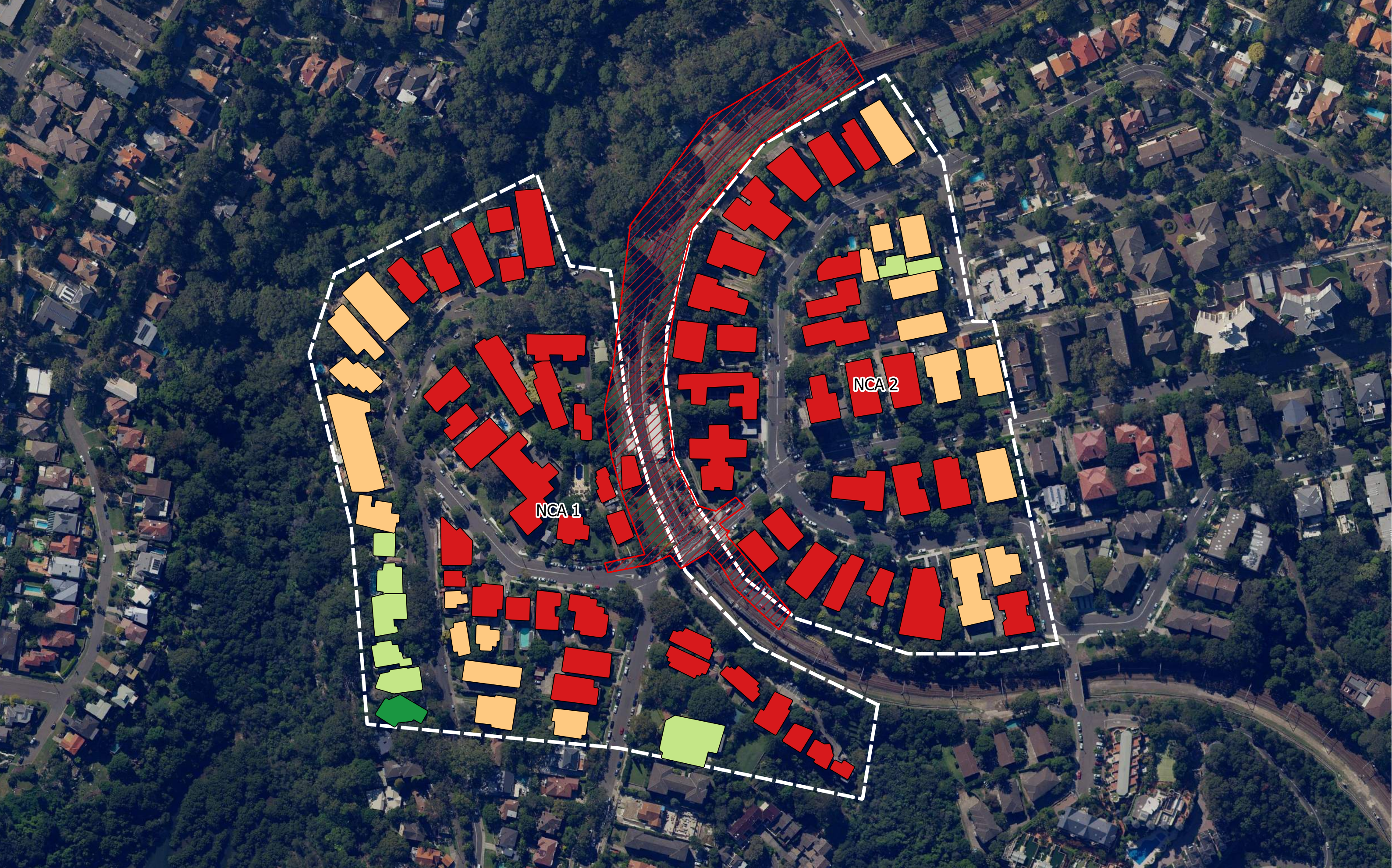
PREDICTED NOISE MAPS












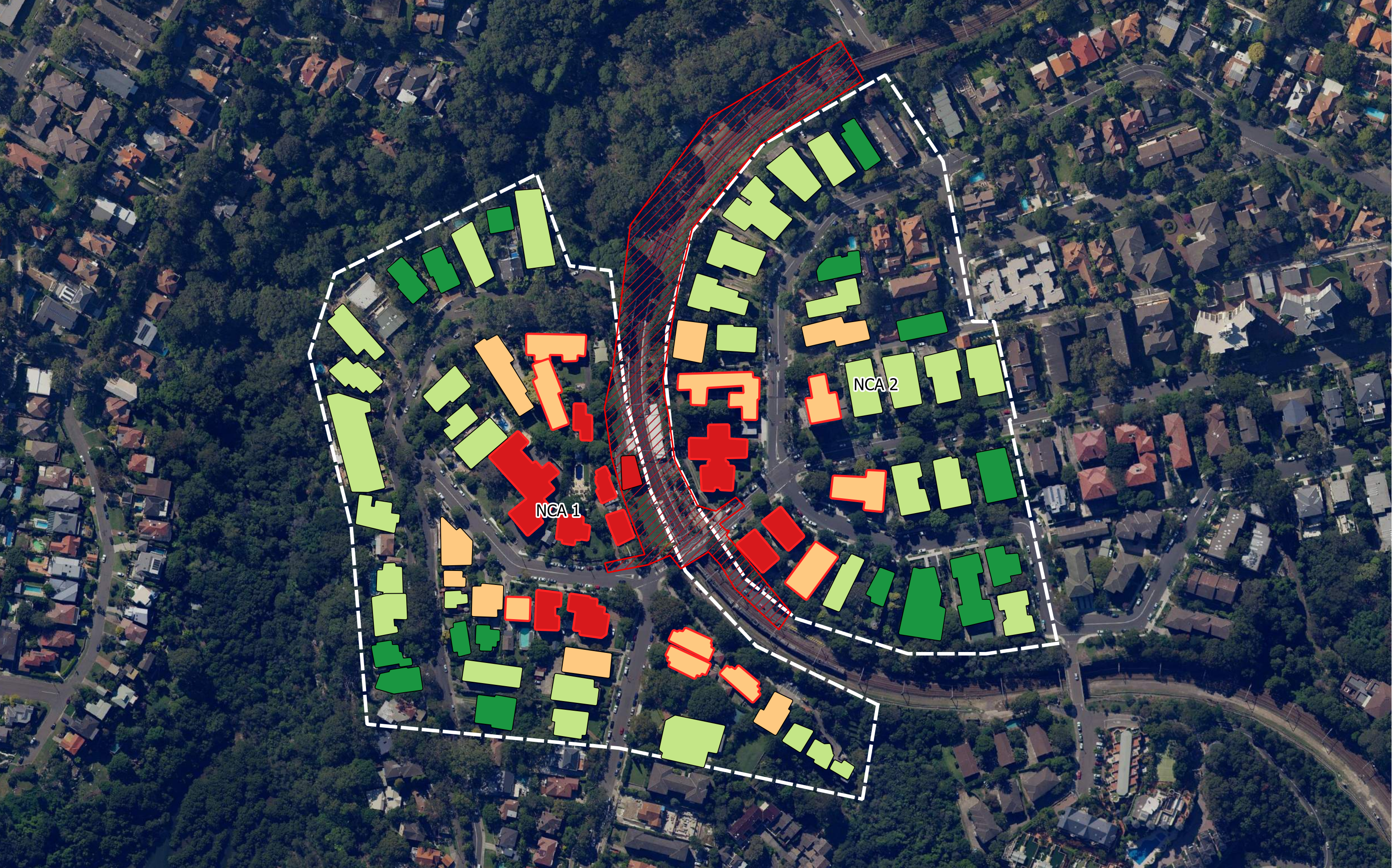
Map: MAP_1	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  >30  10 - 20  HNA  20 - 30	Transport Access Program - Wollstonecraft Site establishment, enabling works, site compounds 
Date: 08/04/2020	Reviewed by: RW					








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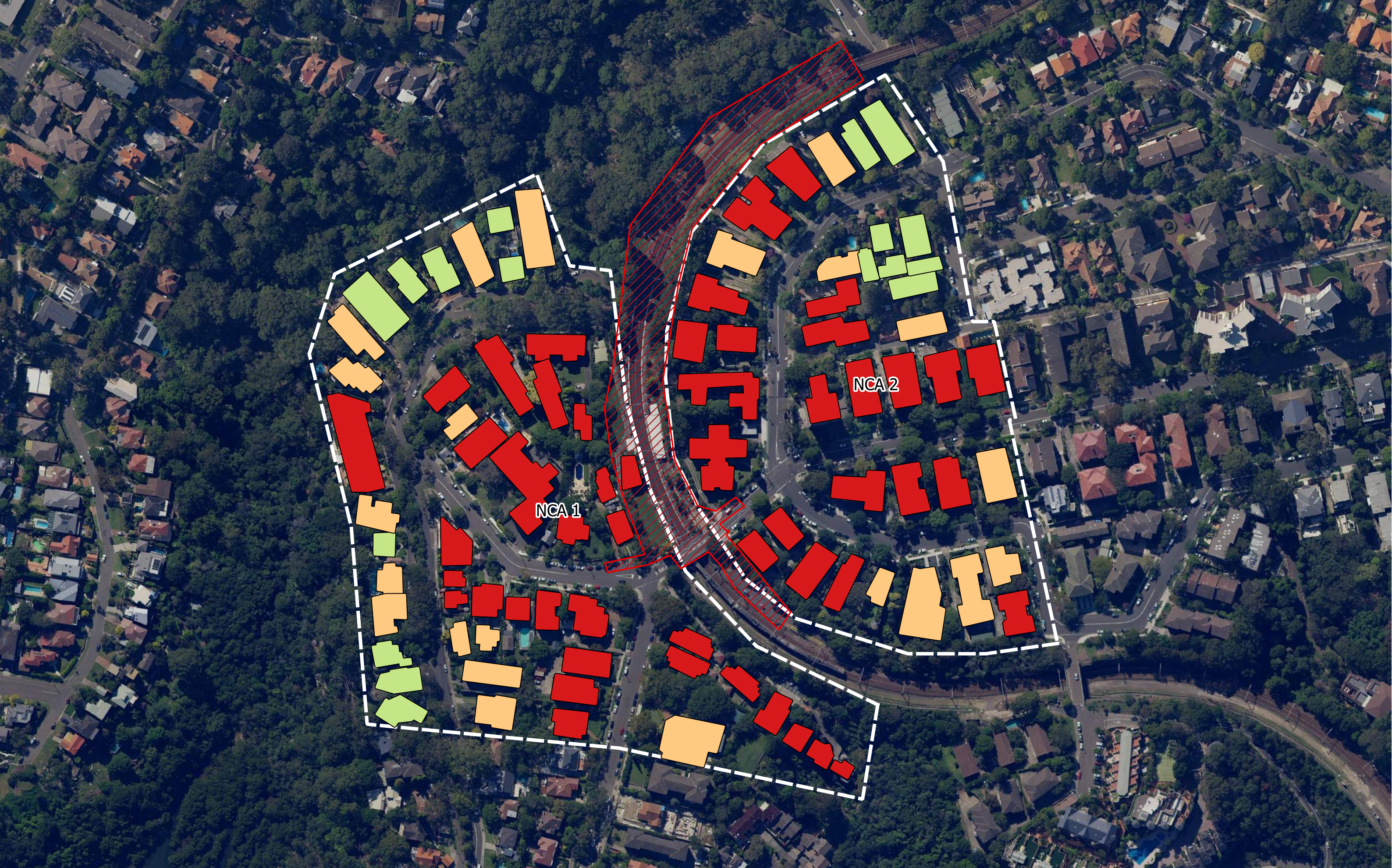


Map: MAP_2	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 5  15 - 25  5 - 15  >25	Transport Access Program - Wollstonecraft Site establishment, enabling works, site compounds (Out of 
Date: 08/04/2020	Reviewed by: RW					
To be read in conjunction with WSP document: Map Source: NSW SIX Maps		<REPORT_ID>	1:2090 at A3			

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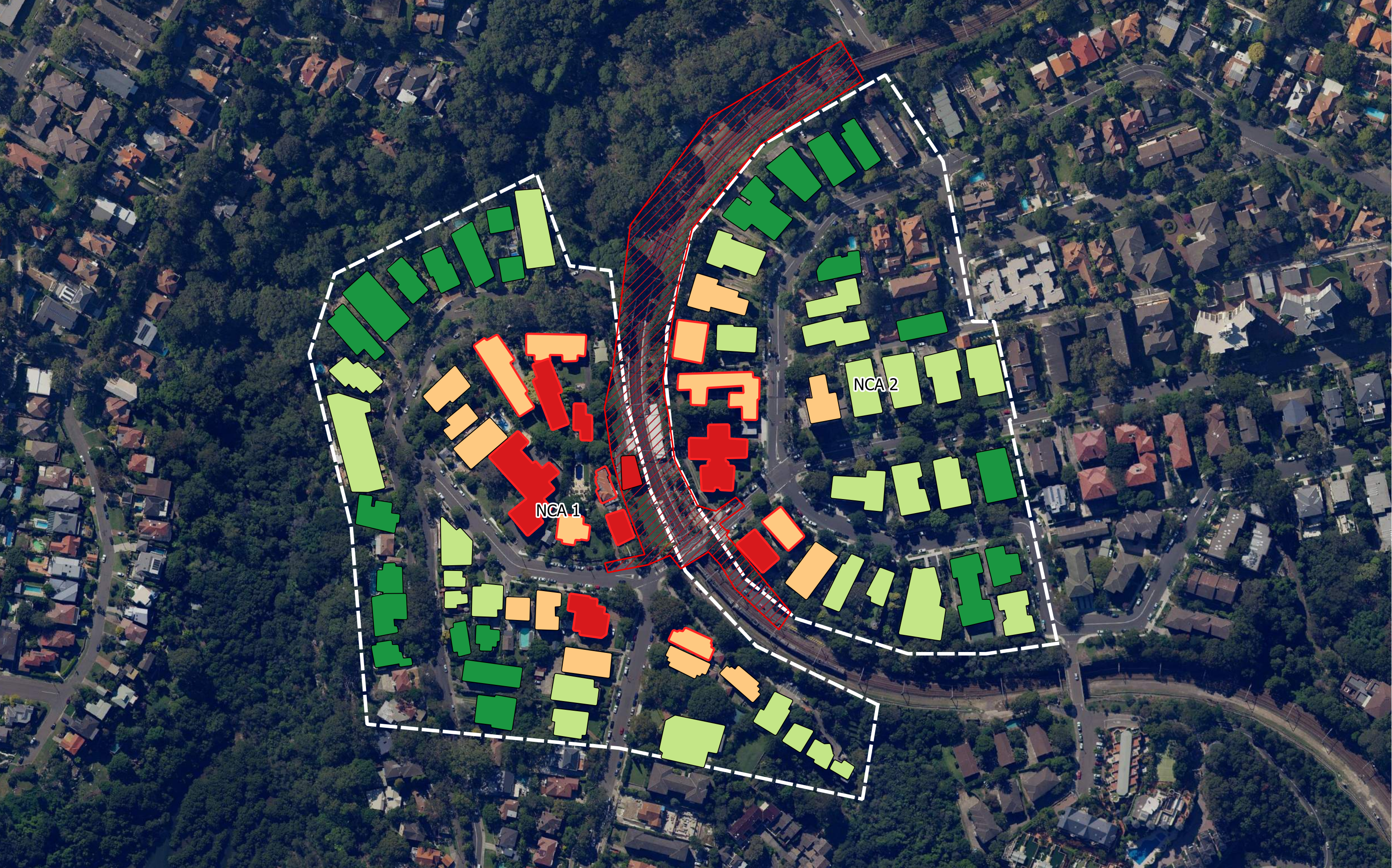









Map: MAP_3	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  10 - 20  20 - 30  >30  HNA	Transport Access Program - Wollstonecraft Lift works 
Date: 08/04/2020	Reviewed by: RW					

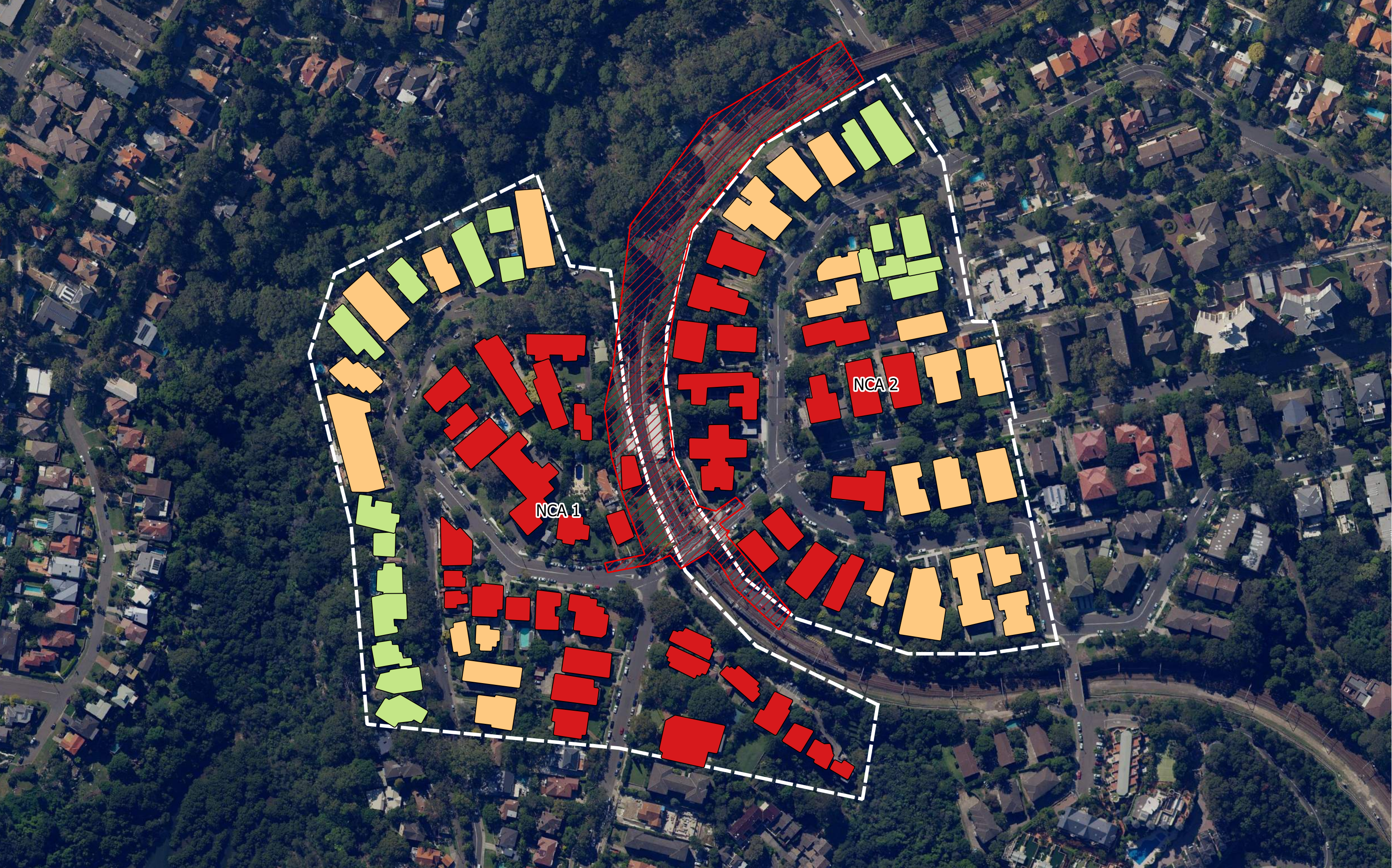








Map: MAP_4	Author: TG			Legend Project area	Noise level, dBA Leq period 5 - 15 >25 15 - 25	Transport Access Program - Wollstonecraft Lift works (Out of hours)
Date: 08/04/2020	Reviewed by: RW					
To be read in conjunction with WSP document: Map Source: NSW SIX Maps		<REPORT_ID>	1:2090 at A3			

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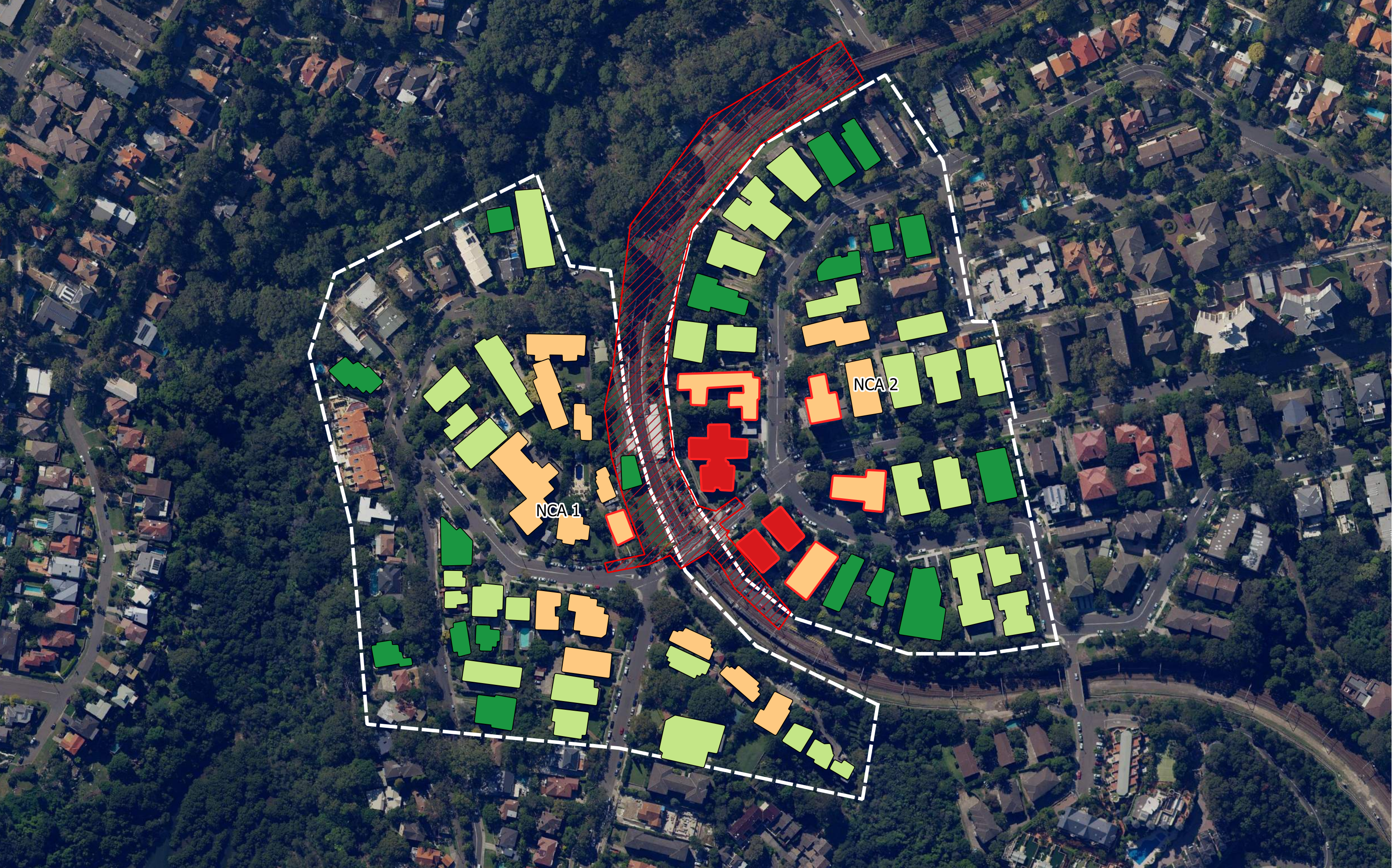
Map: MAP_5	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  >30  10 - 20  HNA  20 - 30	Transport Access Program - Wollstonecraft Ramp upgrade 
Date: 08/04/2020	Reviewed by: RW					










Map: MAP_6	Author: TG			Legend  Project area	Noise level, dBA Leq period  5 - 15  >25  15 - 25	Transport Access Program - Wollstonecraft Ramp upgrade (Out of hours)
Date: 08/04/2020	Reviewed by: RW					
To be read in conjunction with WSP document: Map Source: NSW SIX Maps		<REPORT_ID>	1:2090 at A3			









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Map: MAP_7	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  10 - 20  20 - 30  >30  HNA	Transport Access Program - Wollstonecraft Kiss and ride bay and accessible car parking space 
Date: 08/04/2020	Reviewed by: RW					



Map: MAP_8	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 5  15 - 25  5 - 15  >25	Transport Access Program - Wollstonecraft Kiss and ride bay and accessible car parking space (Out of hours) 
Date: 08/04/2020	Reviewed by: RW					

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Map: MAP_9	Author: TG			Legend Project area	Noise level, dBA Leq period 0 - 10 20 - 30 10 - 20 HNA	Transport Access Program - Wollstonecraft Shirley Road overbridge work
Date: 08/04/2020	Reviewed by: RW					
To be read in conjunction with WSP document: Map Source: NSW SIX Maps		<REPORT_ID>	1:2090 at A3			








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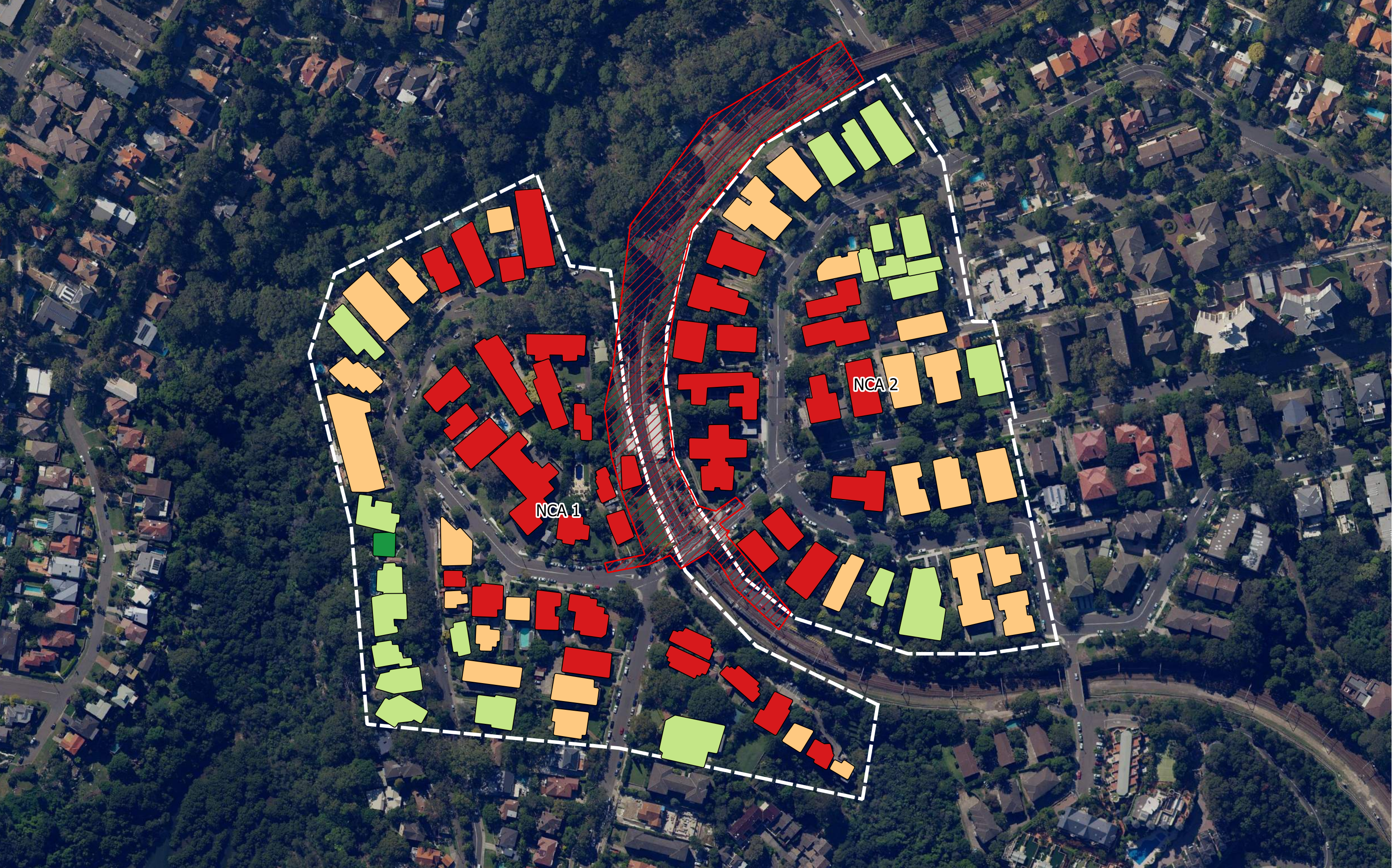










Map: MAP_10		Author: TG				1:2090 at A3	Legend Project area	Noise level, dBA Leq period 0 - 5 5 - 15 15 - 25 >25	Transport Access Program - Wollstonecraft Shirley Road overbridge work (Out of hours)
Date: 08/04/2020		Reviewed by: RW							
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Map: MAP_11	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  10 - 20  20 - 30  >30  HNA	Transport Access Program - Wollstonecraft Station building works 
Date: 08/04/2020	Reviewed by: RW					



Map: MAP_12	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 5  15 - 25  5 - 15  >25	Transport Access Program - Wollstonecraft Station building works (Out of hours) 
Date: 08/04/2020	Reviewed by: RW					









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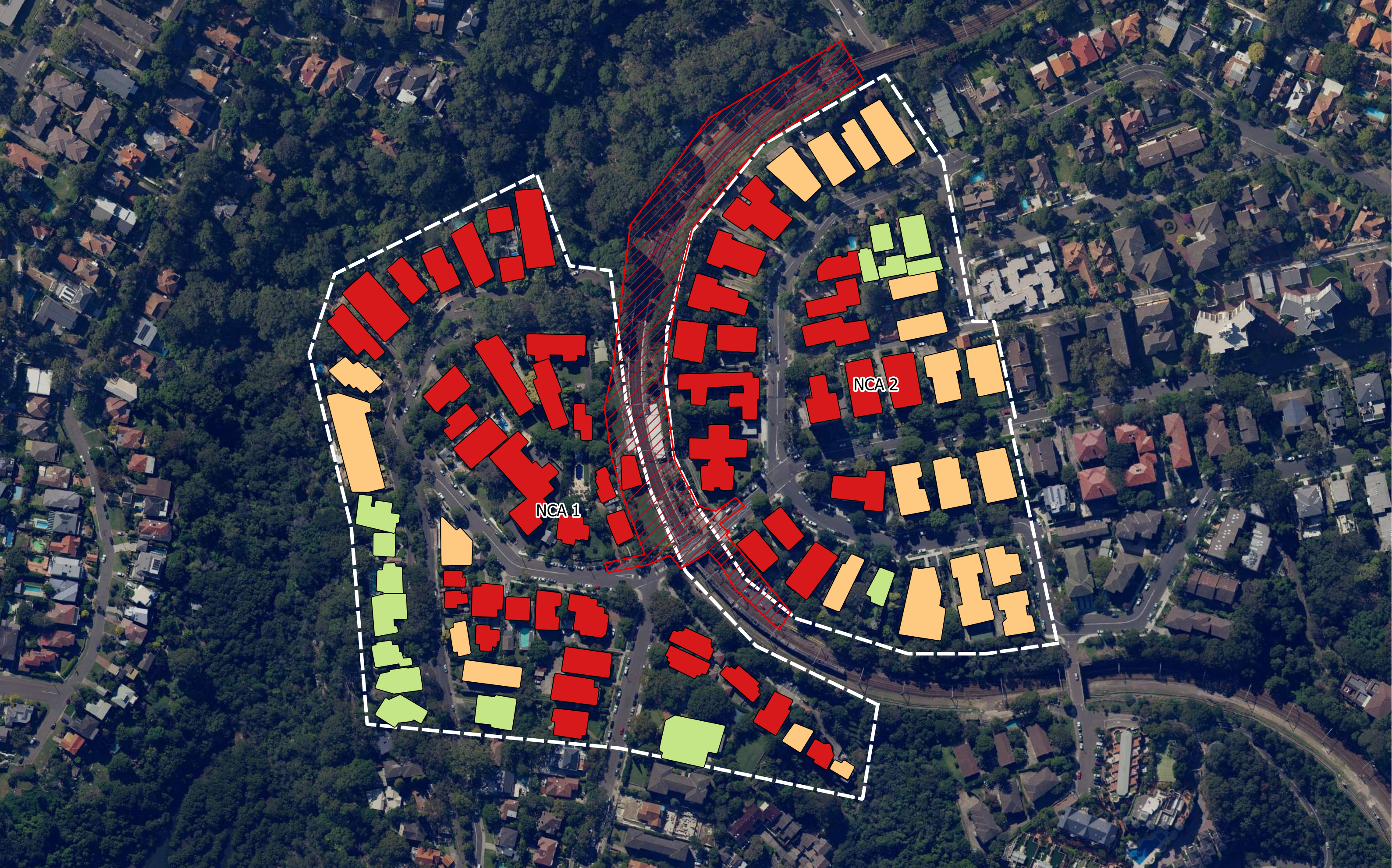
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Map: MAP_13	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  10 - 20  20 - 30  >30  HNA	Transport Access Program - Wollstonecraft Platform stabilisation and upgrade work 
Date: 08/04/2020	Reviewed by: RW					

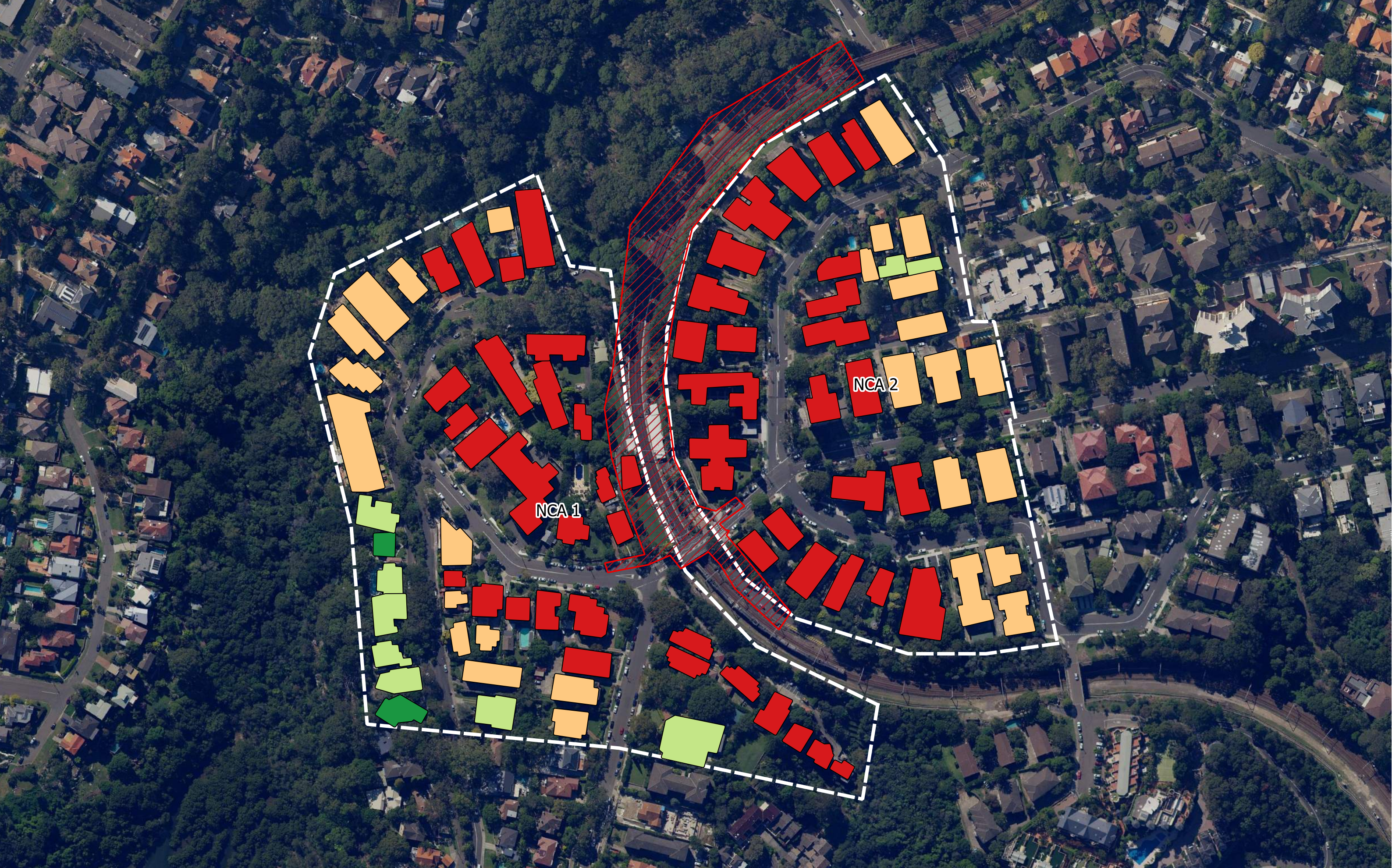








Map: MAP_14	Author: TG			Legend  Project area	Noise level, dBA Leq period  5 - 15  >25  15 - 25	Transport Access Program - Wollstonecraft Platform stabilisation and upgrade work (Out of hours) 
Date: 08/04/2020	Reviewed by: RW					

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Map: MAP_15	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 10  >30  10 - 20  HNA  20 - 30	Transport Access Program - Wollstonecraft Demobilisation 
Date: 08/04/2020	Reviewed by: RW					



Map: MAP_16	Author: TG			Legend  Project area	Noise level, dBA Leq period  0 - 5  15 - 25  5 - 15  >25	Transport Access Program - Wollstonecraft Demobilisation (Out of hours) 
Date: 08/04/2020	Reviewed by: RW					

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APPENDIX D

STANDARD AND ADDITIONAL NOISE AND VIBRATION MITIGATION MEASURES



D1 STANDARD MITIGATION MEASURES

Table D.1 Standard management measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Implementation of any proposal specific mitigation measures required	Airborne noise Ground-borne noise & vibration	In addition to the measures set out in this table, any project specific mitigation measures identified in the EIA documentation (e.g. REF, submissions or representations report) or approval or licence conditions must be implemented.
Implement stakeholder consultation measures (refer to Sections 8.2.1 and 8.3 for further details of community consultation measures)	Airborne noise Ground-borne noise & vibration	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers within 500m at least 7 days prior to commencement of relevant works. In addition to Periodic Notification, the following strategies may be adopted on a case-by-case basis: <ul style="list-style-type: none"> • Project Specific Website • Project Infoline • Construction Response Line • Email Distribution List • Web-based Surveys • Social Media • Community and Stakeholder Meetings and • Community Based Forums (if required by approval conditions).
Register of noise and vibration sensitive receivers	Airborne noise Ground-borne noise & vibration	A register of most affected noise and vibration sensitive receivers (NVSRS) would be kept on site. The register would include the following details for each NVSR: <ul style="list-style-type: none"> • Address of receiver • Category of receiver (e.g. Residential, Commercial etc.) • Contact name and phone number. The register may be included as part of the Project's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.
Construction hours and scheduling	Airborne noise Ground-borne noise & vibration	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	Ground-borne noise & vibration Airborne noise	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.
Site inductions	Airborne noise Ground-borne noise & vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: <ul style="list-style-type: none"> • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics
Site inductions continued		<ul style="list-style-type: none"> • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.

ACTION REQUIRED	APPLIES TO	DETAILS
Behavioural practices	Airborne noise	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.
Monitoring	Airborne noise Ground-borne noise & vibration	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Ground-borne vibration	Attended vibration measurements shall be undertaken at all buildings within 25 m of vibration generating activities when these activities commence to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	Airborne noise Ground-borne noise & vibration	The CEMP must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Vibration Blasting	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to major project construction activities with the potential to cause property damage.

Table D.2 Standard source measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Plan worksites and activities to minimise noise and vibration	Airborne noise Ground-borne vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Airborne noise Ground-borne noise & vibration	Use quieter and less vibration emitting construction methods where feasible and reasonable, see APPENDIX C. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits.
Maximum noise levels	Airborne-noise	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the allowable noise levels in APPENDIX C.
Rental plant and equipment	Airborne-noise	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the allowable noise levels in APPENDIX C.
Use and siting of plant	Airborne-noise	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Non-tonal reversing alarms	Airborne noise	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work, including delivery vehicles.
Minimise disturbance arising from delivery of goods to construction sites	Airborne noise	Loading and unloading of materials/deliveries is to occur <i>as far as possible</i> from sensitive receivers.

ACTION REQUIRED	APPLIES TO	DETAILS
Minimise disturbance arising from delivery of goods to construction sites <i>continued</i>		Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Construction Related Traffic	Airborne noise	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.
Silencers on Mobile Plant	Airborne noise	Where possible reduce noise from mobile plant through additional fittings including: Residential grade mufflers Damped hammers such as “City” Model Rammer Hammers Air Parking brake engagement is silenced.
Prefabrication of materials off-site	Airborne noise	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.
Engine compression brakes	Airborne noise	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer or a silencer that complies with the National Transport Commission’s ‘In-service test procedure’ and standard.

Table D.3 Standard path measures to reduce construction noise and vibration

ACTION REQUIRED	APPLIES TO	DETAILS
Shield stationary noise sources such as pumps, compressors, fans etc	Airborne noise	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.
Shield sensitive receivers from noisy activities	Airborne noise	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when siting plant.

D2 ADDITIONAL MITIGATION MEASURES

Table D.4 Additional mitigation measures

MEASURE	DESCRIPTION	ABBREVIATION
Periodic Notification	<p>For each TAP project, a notification entitled 'Project Update' is produced and distributed to stakeholders within a 500m radius of the station via letterbox drop and distributed to the project postal and/or email mailing lists. The same information will be published on the TfNSW website (www.transport.nsw.gov.au). Periodic notifications provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on stakeholders. The approval conditions for projects specify requirements for notification to sensitive receivers where works may impact on them.</p> <p>Content and length is determined on a project-by-project basis and must be approved by TfNSW prior to distribution.</p> <p>Most projects distribute notifications on a monthly basis. Each notification is graphically designed within a branded template.</p> <p>In certain circumstances media advertising may also be used to supplement Periodic Notifications, where considered effective.</p> <p>Periodic Notification may be advised by the Infrastructure Delivery (ID) Community Engagement Team in cases where AMMM are not triggered as shown in Tables 9 to 11, for example where community impacts extend beyond noise and vibration (traffic, light spill, parking etc). In these circumstances the ID Community Engagement Team will determine the community engagement strategy on a case-by-case basis.</p>	PN
Verification Monitoring	<p>Verification monitoring of noise and/or vibration during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended logging (i.e. for vibration provided there is an immediate feedback mechanism such as SMS capabilities) or operator attended surveys (i.e. for specific periods of construction noise).</p> <p>The purpose of monitoring is to confirm that:</p> <ul style="list-style-type: none"> • construction noise and vibration from the project are consistent with the predictions in the noise assessment • mitigation and management of construction noise and vibration is appropriate for receivers affected by the works <p>Where noise monitoring finds that the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required and the CNVIS amended. Refer to Section 8.4 for more details.</p>	V
Specific Notification	<p>Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. Alternatively (or in addition to), communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing.</p> <ul style="list-style-type: none"> • Letters may be letterbox dropped or hand distributed • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project <p>Specific notifications are used to support periodic notifications, or to advertise unscheduled works and must be approved by TfNSW prior to implementation/distribution.</p>	SN
Respite Offer	<p>The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact. The offer could comprise pre-purchased movie tickets, bowling activities, meal vouchers or similar offer. This measure is determined on a case-by-case basis, and may not be applicable to all TAP projects.</p>	RO

MEASURE	DESCRIPTION	ABBREVIATION
Alternative Accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts. Alternative accommodation will be determined on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.	AA
Alternative construction methodology	Where the vibration assessment identifies that the proposed construction method has a high risk of causing structural damage to buildings near the works, the proponent will need to consider alternative construction options that achieve compliance with the VMLs for building damage. For example, replace large rock breaker with smaller rock breakers or rock saws.	AC
Respite Period	OOHW during evening and night periods will be restricted so that receivers are impacted for no more than 3 consecutive evenings and no more than 2 consecutive nights in the same NCA in any one week. A minimum respite period of 4 evenings/5 nights shall be implemented between periods of consecutive evening and/or night works. Strong justification must be provided where it is not reasonable and feasible to implement these period restrictions (e.g. to minimise impacts to rail operations), and approval must be given by TfNSW through the OOHV Approval Protocol (Section 6). Note; this management measure does not apply to OOHV Period 1 – Days (See Table 1).	RP
Duration Reduction	Where Respite Periods (see management measure above) are considered to be counterproductive to reducing noise and vibration impacts to the community it may be beneficial to increase the number of consecutive evenings and/or nights through Duration Reduction to minimise the duration of the activity. This measure is determined on a project-by-project basis, and may not be applicable to all ID projects. Impacted receivers must be consulted and evidence of community support for the Duration Reduction must be provided as justification for the Duration Reduction. A community engagement strategy must be agreed with and implemented in consultation with ID Community Engagement Representatives.	DR