NSW GOVERNMENT | Transport for NSW

Leura Station Upgrade
REF Appendices

April 2016

Appendix A Consideration of matters of National Environmental Significance

The table below demonstrates TfNSW's consideration of the matters of NES under the EPBC Act to be considered in order to determine whether the Proposal should be referred to Commonwealth Department of the Environment.

Matters of NES	Impacts
Any impact on a World Heritage property? The Greater Blue Mountains World Heritage Area occurs within the locality to the north and south of the Proposal and includes the Blue Mountains National Park which is more than one kilometre from the Proposal site. The Greater Blue Mountains World Heritage Area is unlikely to be impacted as it is separated by residential areas and the proposed activities are of a nature and scale that they are unlikely to impact the adjacent environment.	Nil
Any impact on a National Heritage place? The Blue Mountains National Park is listed a registered item on the Register of the National Estate (non-statutory). The Blue Mountains World Heritage Area is unlikely to be impacted as it is separated by residential areas, and the proposed activities are of a nature and scale that they are unlikely to impact the adjacent environment.	Nil
Any impact on a wetland of international importance? There are no wetlands of international significance in the vicinity of the Proposal.	Nil
Any impact on a listed threatened species or communities? It is unlikely that the Proposal would impact on any listed threatened species or communities as none were identified within the Proposal site.	Nil
Any impacts on listed migratory species? It is unlikely that the development of the Proposal would impact any listed migratory species.	Nil
Does the Proposal involve a nuclear action (including uranium mining)? The Proposal does not involve a nuclear action.	Nil
Any impact on a Commonwealth marine area? There are no Commonwealth marine areas in the vicinity of the Proposal.	Nil
Does the Proposal involve development of coal seam gas and/or large coal mine that has the potential to impact on water resources? The Proposal is for a transport facility and is not related to coal seam gas or mining.	Nil
Additionally, any impact (direct or indirect) on Commonwealth land? The Proposal would not be undertaken on or near any Commonwealth land.	Nil

Appendix B Consideration of clause 228

The table below demonstrates TfNSW's consideration of the specific factors of clause 228 of the EP&A Regulation in determining whether the Proposal would have a significant impact on the environment.

Factor	Impacts
(a) Any environmental impact on a community? There would be some temporary impacts to the community during construction, particularly in relation to noise, traffic and access and visual amenity. Mitigation measures outlined in Section 7 would be implemented to manage and minimise adverse impacts.	Minor
(b) Any transformation of a locality? The Proposal would result in an accessible train station, associated infrastructure and therefore, is unlikely to result in a transformation of the locality surrounding Leura Station. The station precinct would be enhanced by the Proposal.	Nil
(c) Any environmental impact on the ecosystem of the locality? The Proposal would require removal of some street trees but given the Proposal's location with an urbanised environment and the low habitat value of the trees to be removed, impacts to biodiversity and ecosystems are expected to be negligible.	Nil
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? There would be some temporary impacts during construction particularly in relation to noise, traffic and access and visual amenity. During operation the Proposal would have positive impacts to the community through providing improved access to Leura Station.	Minor
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There would be some temporary impacts during construction particularly in relation to noise, traffic and access and visual amenity. The station is listed on Sydney Trains s.170 Heritage Conservation Register and the Blue Mountains LEP. The Proposal would result in some impacts to parts of the station that are heritage listed. Measures to minimise impacts to heritage have been provided in Section 7. There is a low risk of encountering archaeological items/deposits. During operation the Proposal would have positive impacts to the community through providing improved access to Leura Station.	Minor
(f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The Proposal is unlikely to have any impact on the habitat of protected fauna.	Nil
(g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The Proposal is unlikely to endanger any species of animal, plant or other form of life, whether living on land, in water or in the air.	Nil
(h) Any long-term effects on the environment? The Proposal is unlikely to have any long term effects on the environment	Nil

Factor	Impacts
(i) Any degradation of the quality of the environment? The Proposal is unlikely to have any degradation on the quality of the environment.	Nil
(j) Any risk to the safety of the environment? The Proposal is unlikely to cause any pollution or safety risks to the environment provided the recommended mitigation measures are implemented.	Nil
(k) Any reduction in the range of beneficial uses of the environment? The Proposal is unlikely to have any reduction in the range of beneficial uses of the environment.	Nil
(l) Any pollution of the environment? The Proposal is unlikely to cause any pollution to the environment provided the recommended mitigation measures are implemented.	Nil
(m) Any environmental problems associated with the disposal of waste? The Proposal is unlikely to cause any environmental problems associated with the disposal of waste. Mitigation measures would be implemented to ensure waste is reduced, reused or recycled where practicable.	Nil
(n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The Proposal is unlikely increase demands on resources that are or are likely to become in short supply.	Nil
(o) Any cumulative environmental effect with other existing or likely future activities? Cumulative effects of the Proposal are described in Chapter 6. Where feasible, environmental management measures would be coordinated to reduce cumulative construction impacts. The Proposal is unlikely to have any significant long term impacts.	Minor
(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The Proposal would not affect or be affected by any coastal processes or hazards.	Nil

Appendix C Sustainable Design Guidelines checklist

Compulsory initiatives

Initiative	Theme	Description	Design (D) & Construction (C) Interface	Under consideration
C.11 Reduce cement	Materials and waste	Reduce the absolute quantity of Portland cement by at least 30 per cent, as an average across all concrete mixes, by substituting it with supplementary cementitious materials (such as a fly ash, ground granulated blast furnace slag or alkali activated cements) subject to meeting strength and durability requirements.	DC	Yes
C.13 Heritage conservation and enhancement	Biodiversity and heritage	100 per cent of significant heritage items are identified during project development and design and are protected or beneficially reused where practical. This will require consultation with all relevant Indigenous Heritage groups (where applicable).	DC	Yes
C.16 Water efficient fittings	Water	Ensure onsite amenities using potable water comply with the following criteria: Toilets to be WELS (max 4.5/3 L/min) dual flush toilets; Urinals to be waterless; All taps to be WELS (max 7.5 L/min); (see Green Star Office v3). Any other water fixtures should achieve at least a 5 Star WELS rating.	DC	Yes
C.17 Water efficient controls	Water	Specify sensors, timers or spring loaded devices for taps where possible to reduce water loss from taps that are left running.	D	Yes
C.20 Noise management	Pollution control	Project to comply with Transport Projects Construction Noise Strategy and related conditions of approval.	DC	Yes
C.23 Crime Prevention Through Environmental Design (CPTED)	Community benefit	Incorporate CPTED principles during design. This may include natural observation and use of CCTV. Natural observation is achieved through fence, landscape, streetscape and open space design in public or staff supervised areas. This is achieved by minimising narrow corridors, hidden corners and through the use of lighting.	D	Yes

Discretionary initiatives

Initiative	Theme	Description	Design (D) & Construction (C) Interface	Under consideration
1.3 Power factor correction	Energy and greenhouse	Install power factor correction (PFC) units to keep the power factor of the system as close to one as possible.	D	Yes
1.5 Sub-metering	Energy and greenhouse	Provide separate meters or sub-metering for all substantive energy uses (e.g. all energy uses of 100 kVa or greater – lighting, small power and individual tenancies). Make sure that metering can effectively separate tenant loads from base building loads.	D	Yes
1.13 Green travel plans	Energy and greenhouse	Develop and implement green or sustainable travel plans during construction for employees to get to site offices and construction sites.	C	Yes
1.15 Light coloured finishes	Energy and greenhouse	Use light coloured finishes on floors, walls and ceilings of offices, stations and platforms to help reflect ambient light. Within car parks, consider glare and safety issues that may arise.	D	Yes
1.20 LED lights	Energy and greenhouse	Incorporate energy efficient LED lighting.	D	Yes
2.8 Protection from extreme weather (sun, rain, wind)	Climate resilience	Consider design measures for protecting customers and electrical equipment from wind and rain during storm events.	D	Yes
2.9 Protect sensitive assets	Climate resilience	Protect sensitive assets (e.g. lifts, escalators) from the effects of extreme climate and weather.	D	Yes
3.4 Recycled / renewable materials	Materials and waste	Maximise the recycled content of construction materials, in particular those included in the Infrastructure Sustainability Council of Australia's IS Materials Calculator available from ISCA for free at www.isca.org.au.	DC	Yes
3.5 Optimise design	Materials and waste	Optimise design to minimise material consumption, mass/volume/space use and above ground land use.	D	Yes
3.6 Re-use of structures	Materials and waste	Retain or refurbish existing structures where possible.	DC	Yes
3.7 Recycled concrete	Materials and waste	Reuse concrete, bricks and other structural materials in construction on site where available and suitable.	DC	Yes
3.9 Recycled aggregate	Materials and waste	Use recycled aggregate in non-structural uses (e.g. building base course, sub-grade to any car parks and footpaths, backfilling to service trenches, kerb and gutter).	DC	Yes
3.14 Sustainable structural steel	Materials and waste	Source at least 60 per cent of structural steel (by weight) from a steel fabricator/contractor accredited by the Environmental Sustainability Charter of the Australian Steel Institute.	C	Yes
3.15 Lower embodied energy bar and mesh	Materials and waste	Source at least 60 per cent of bar and mesh that is produced through energy reduction processes such as Polymer Injection Technology.	C	Yes

Initiative	Theme	Description	Design (D) & Construction (C) Interface	Under consideration
3.16 Optimal preassembly of reinforcing steel	Materials and waste	Source at least 15 per cent of reinforcing steel from suppliers that use optimal off site fabrication techniques such as engineered reinforcing bar carpet, engineered/customised mesh or prefabricated reinforcing cages.	DC	Yes
3.17 Low VOC paints and finishes	Materials and waste	Specify low volatile organic compound (VOC) paints and finishes. Refer to Green Star – Office Interiors v1.1 available online.	DC	Yes
3.18 Low VOC adhesives and sealants	Materials and waste	Specify all adhesives and sealants as low VOC. Refer to Green Star – Office Interiors v1.1 available online.	DC	Yes
3.20 Timber	Materials and waste	95% of all timber products (by cost) comprise re-used or post-consumer recycled timber, Forest Stewardship Council (FSC) or Australian Forest Scheme (AFS) certified timber, and/or timber from NSW sustainably managed forests.	DC	Yes
3.25 Cut-fill balance	Materials and waste	Balance site works to avoid excess or import of spoil.	DC	Yes
3.29 Segregation of waste	Materials and waste	Enable waste segregation in the design process by including space for the collection and segregation of waste with appropriate marking (e.g. signage) and controls (e.g. lockable lids), located away from sensitive receptors (e.g. water courses). During construction, use facilities and procedures that maximise on-site separation of waste to maximise reuse/recycling.	DC	Yes
3.30 Reuse construction waste	Materials and waste	Maximise reuse of concrete, bricks, earthworks and other structural waste materials.	DC	Yes
3.36 Prefabrication	Materials and waste	Use prefabricated building and civil components (for bridges, walls (retaining, deflection, noise), culverts, platforms, level crossings and tunnel lining etc) to reduce construction waste material usage, pollution risks and travel.	DC	Yes
3.37 Low finish interiors	Materials and waste	Specify low-finish interiors (e.g. exposed brick/rock walls, unpainted galvanised steel, polished concrete walls and floors) to avoid the need for large quantities of paint and/or cement render. Consider graffiti removal in specifying surface textures.	D	Yes
3.40 Façade reuse	Materials and waste	Incorporate existing building facades in station upgrades.	D	Yes
3.41 Coordinate dimensions	Materials and waste	Design for standard material sizes and components to reduce waste and improve ease of assembly and disassembly.	D	Yes
3.47 Correct site layout	Materials and waste	Layout of construction sites (including plant and equipment) to be designed to reduce travel distances and double carrying.	C	Yes

Initiative	Theme	Description	Design (D) & Construction (C) Interface	Under consideration
4.2 Ecological value opportunities	Biodiversity and heritage	Maximise ecological values through landscape species choice, and planting density and configuration. Make sure that appropriate weed management strategies are undertaken to avoid migration or contamination on and offsite.	DC	
4.9 Heritage items in the vicinity	Biodiversity and heritage	Design for the interrelationship between new development/redevelopment and proximate buildings of heritage/cultural significance.	D	Yes
5.6 Water efficient systems	Water	Review alternate solutions that increase water use efficiency (e.g. avoid deluge systems). Refer to the Department of Environment and Heritage's Water Efficiency Guide: Office and Public Buildings 2006 for further guidance.	D	Yes
5.10 Planting	Water	Select plant species that require minimal or no irrigation after establishment.	DC	Yes
5.15 Permeable and porous surfaces	Water	Design for permeable and porous surfaces to allow for stormwater infiltration (preferably with other treatments such as vegetated swales).	D	Yes
6.4 Avoid dangerous goods and hazardous materials	Pollution control	Use Safety Data Sheets (SDS) to avoid the use of dangerous goods and hazardous materials. See the materials section in Appendix B for details.	DC	Yes
6.5 Apply noise control hierarchy	Pollution control	Apply a hierarchy of control by addressing noise at source first (e.g. orient equipment away from residential receivers), then propagation path (e.g. a noise barrier) and finally at the receiver (e.g. double glazed windows) as a last option (see Rail Infrastructure Noise Guidelines for further information).	D	Yes
6.17 Avoid glare and light pollution	Pollution control	Minimise ambient light levels and glare towards neighbouring properties (e.g. avoid or obstruct up lighting). Refer to ASA standard 3.11.3.3 for guidance and make sure that design complies with AS4282 Control of the Obtrusive Effects of Outdoor Lighting. Do not exceed minimum requirements of AS1158 for illuminance levels for 95 per cent of outdoor spaces.	D	Yes
7.13 Enhance visual interest of asset	Community benefit	Use lighting, landscaping and/or public art to direct visual interest towards the structure and enhance the visual amenity of the structure.	DC	Yes
7.28 Bicycle lockers and/ or racks	Community benefit	Provide sheltered bicycle lock ups and/or lockers in or near entrance to the station. Allow for at least 5% of staff use at maintenance facilities. See Section 3.9.3.1 of the ASA Station Design Standard Requirements for further information on bicycle parking requirements at stations.	D	Yes

Initiative	Theme	Description	Design (D) & Construction (C) Interface	Under consideration
7.29 Bicycle storage security	Community benefit	Locate bicycle storage area in an area with a high level of passive surveillance and/or prominent CCTV.	D	Yes
7.33 Safe pedestrian movement	Community benefit	Make sure that safe movement is promoted for pedestrians and cyclists by minimising vehicle crossings of paths, providing clear signage, and providing freedom from obstacles such as poles, trees etc.	D	Yes
7.36 Safe hot water	Community benefit	Use safe hot water fittings (instead of mixing valves) to control water temperature at the tap and prevent scalding.	DC	Yes
7.37 Create station identity	Community benefit	Create a station identity using public art, architecture, use of colour and materials etc.	D	Yes
7.38 Reduce vandalism	Community benefit	Minimise risks from vandalism during design, such as designing pedestrian bridges and walkways with a high degree of surveillance or railings, restrict window openings and limit to a maximum 80mm opening.	D	Yes
7.39 Reduce graffiti	Community benefit	Minimise graffiti risks such as through treatment of fencing and other surfaces with anti-graffiti paint or coatings, vegetation cover to deter graffiti or providing designated walls for graffiti.	D	Yes
7.50 Shading	Community benefit	Provide shade through vegetation or structures over platform, concourse, car parks and pedestrian pathway areas and work/lunch areas.	D	Yes

Appendix D Neutral or Beneficial Effect Assessment

As required by Clause 12 of the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011, the table below outlines the Neutral or Beneficial Effect Assessment for the Proposal to be undertaken by public authorities and that is being assessed under Part 5 of the EP&A Act.

Criteria	Assessment
1. Are there any identifiable potential impacts on water quality? What pollutants are likely? Major potential pollutants are sediments (fine and coarse), nitrogen, phosphorus, pathogens and hazardous chemicals and contaminants such as oil/fuel. During construction and/or post construction?	During construction there is potential for: • sediment from excavations and stockpiles to enter waterways through nearby drains • oil spills from operation of equipment/machinery. There would be no operational risks to water quality.
2. For each pollutant list the safeguards needed to prevent or mitigate potential impacts on water quality (these may be SCA endorsed current recommended practices and/or equally effective other practices)?	Excavation works for the Proposal are minor and the risks to water quality have been assessed as low provided the mitigation measures identified in this REF are followed (refer to Section 6.8 and Section 6.9). Erosion and Sediment Control Plan/s would be prepared for the Proposal that would specify controls that are consistent with the 'Blue Book' *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004). Dewatering would be undertaken in accordance with TfNSW procedures. Refuelling of equipment and maintenance would take place away from drains and spill kits would be available on site. These mitigation measures are to be included in the CEMP for the Proposal.
3. Will the safeguards be adequate for the time required? How will they need to be maintained?	Erosion and sedimentation controls would be established prior to commencement of works and would be maintained throughout the construction period.
4. Will all impacts on water quality be effectively contained on the site by the identified safeguards (above) and not reach any watercourse, waterbody or drainage depression? Or will impacts on water quality be transferred outside the site for treatment? How? Why?	It is considered that the proposed mitigation measures prescribed in this REF would be adequate to prevent impacts to other water bodies or water courses.
5. Is it likely that a neutral or beneficial effect on water quality will occur? Why?	The Proposal would have a neutral effect on water quality. The risks to water quality from the construction of the Proposal would be managed through the implementation of the soil and water mitigation measures contained in the CEMP. Operational effects would be managed through provision of new kerb and gutter infrastructure which would link into the existing stormwater network.

Appendix E Noise assessment

E.1 Acoustic terms

Term	Description
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
$L_{A90(period)}$	The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90(15\ min)}$.
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{Amax(period)}$	The maximum sound pressure level over a specified period of time.
Mitigation	Reduction in severity.
OOHW	Out of hours work as defined in the *Construction Noise Strategy* (TfNSW 2012)
Noise sensitive receiver	An area or place potentially affected by noise which includes: • a residential dwelling • an educational institution, library, childcare centre or kindergarten • a hospital, surgery or other medical institution • an active (e.g. sports field, golf course) or passive (e.g. national park) recreational area • commercial or industrial premises • a place of worship.
Rating Background Level	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. This is the level used for assessment purposes.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.
V_{rms}	The vibration velocity presented as a root mean square value.
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).
VDV	Vibration dose value - As defined in BS6472 – 1992, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.

E.2 Background monitoring methodology

Noise monitoring was undertaken using a calibrated Rion NL-52 environmental noise logger between the 15 February and 22 February 2016. The instrument was programmed to accumulate environmental noise data continuously over sampling periods of 15 minutes for the entire monitoring period. Sensitive receivers are listed in Table E-1. The noise monitoring location equipment details are summarised in Table E-2.

Table E-1 Representative sensitive receiver locations

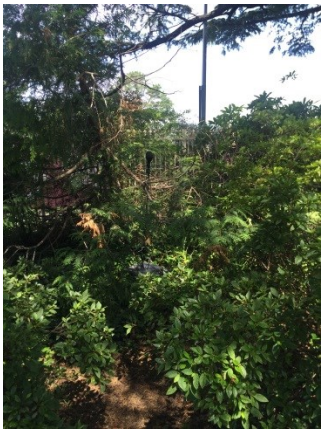
Receiver ID	Receiver address	Receiver type
R1	117 Leura Mall, Leura NSW 2780	Commercial
R2	100 Leura Mall – Leisure Inn Spires Building	Hotel accommodation
R3	100 Leura Mall – Leisure Inn Spires Building	Hotel accommodation
R4	100 Leura Mall – Leisure Inn Spires Building	Hotel accommodation
R5	100 Leura Mall – Leisure Inn Spires Building	Hotel accommodation
R6	100 Leura Mall – Leisure Inn Spires Building	Hotel accommodation
R7	100 Leura Mall – Leisure Inn Spires Building	Hotel accommodation
R8	2/118-124 Leura Mall, Leura NSW 2780 - building	Hotel accommodation
R9	121 Leura Mall, Leura NSW 2780	Commercial
R10	2/118-124 Leura Mall, Leura NSW 2780 - tower	Commercial
R11	111-115 Leura Mall, Leura NSW 2780	Commercial
R12	62 Great Western Highway, Leura NSW 2780	Commercial
R13	131-134 Leura Mall, Leura NSW 2780	Commercial
R14	135-139 Leura Mall, Leura NSW 2780	Commercial
R15	140-143 Leura Mall, Leura NSW 2780	Commercial
R16	144-149 Leura Mall, Leura NSW 2780	Commercial
R17	151-155 Leura Mall, Leura NSW 2780	Commercial
R18	159 Leura Mall, Leura NSW 2780	Commercial
R19	169 Leura Mall, Leura NSW 2780	Commercial
R20	173 Leura Mall, Leura NSW 2780	Commercial
R21	175-179 Leura Mall, Leura NSW 2780	Commercial
R22	181 Leura Mall, Leura NSW 2780	Commercial
R23	126 Leura Mall, Leura NSW 2780	Commercial
R24	130 Leura Mall, Leura NSW 2780	Commercial
R25	132 Leura Mall, Leura NSW 2780	Commercial
R26	138 Leura Mall, Leura NSW 2780	Commercial
R27	142-144 Leura Mall, Leura NSW 2780	Commercial
R28	152-170 Leura Mall, Leura NSW 2780	Commercial
R29	178 Leura Mall, Leura NSW 2780	Commercial
R30	66 Railway Parade, Leura NSW 2780	Residential
R31	69 Railway Parade, Leura NSW 2780	Residential

Receiver ID	Receiver address	Receiver type
R32	70 Railway Parade, Leura NSW 2780	Residential
R33	3 Wascoe Street, Leura NSW 2780 shed	Residential
R34	3 Wascoe Street, Leura NSW 2780	Residential
R35	5 Wascoe Street, Leura NSW 2780 shed	Residential
R36	5 Wascoe Street, Leura NSW 2780	Residential
R37	7 Wascoe Street, Leura NSW 2780	Residential
R38	9-15(1) Wascoe Street, Leura NSW 2780	Residential
R39	9-15(2) Wascoe Street, Leura NSW 2780	Residential
R40	8 Quinns Avenue, Leura NSW 2780	Residential
R41	7 Quinns Avenue, Leura NSW 2780	Residential
R42	8 Wascoe Street, Leura NSW 2780	Residential
R43	8 Wascoe Street, Leura NSW 2780 shed	Residential
R44	10 Wascoe Street, Leura NSW 2780	Residential
R45	5 Quinns Avenue, Leura NSW 2780	Residential
R46	3 Quinns Avenue, Leura NSW 2780	Residential
R47	1 Quinns Avenue, Leura NSW 2780	Residential
R48	12 Wascoe Street, Leura NSW 2780	Residential
R49	12 Wascoe Street, Leura NSW 2780 shed	Residential
R50	120 Megalong Street, Leura NSW 2780	Residential
R51	17 Wascoe Street, Leura NSW 2780	Residential
R52	1 Wascoe Street, Leura NSW 2780	Residential
R53	70 Great Western Highway, Leura NSW 2780	Commercial
R54	85 Railway Parade, Leura NSW 2780	Residential
R55	87 Railway Parade, Leura NSW 2780	Residential
R56	88 Railway Parade, Leura NSW 2780	Residential
R57	89 Railway Parade, Leura NSW 2780	Residential
R58	90 Railway Parade, Leura NSW 2780	Residential
R59	91 Railway Parade, Leura NSW 2780	Residential

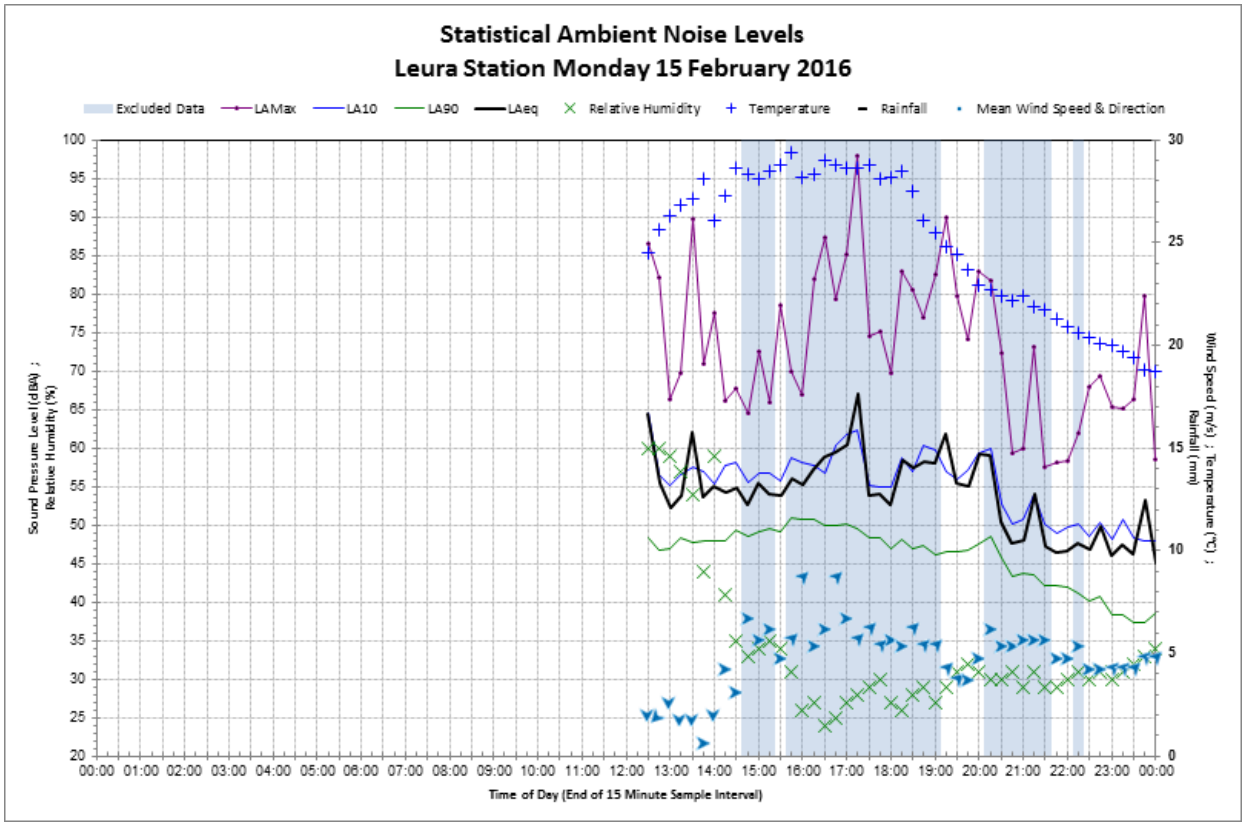
Prior to deployment, a calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dB(A) at 1kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 0.5 dB(A).

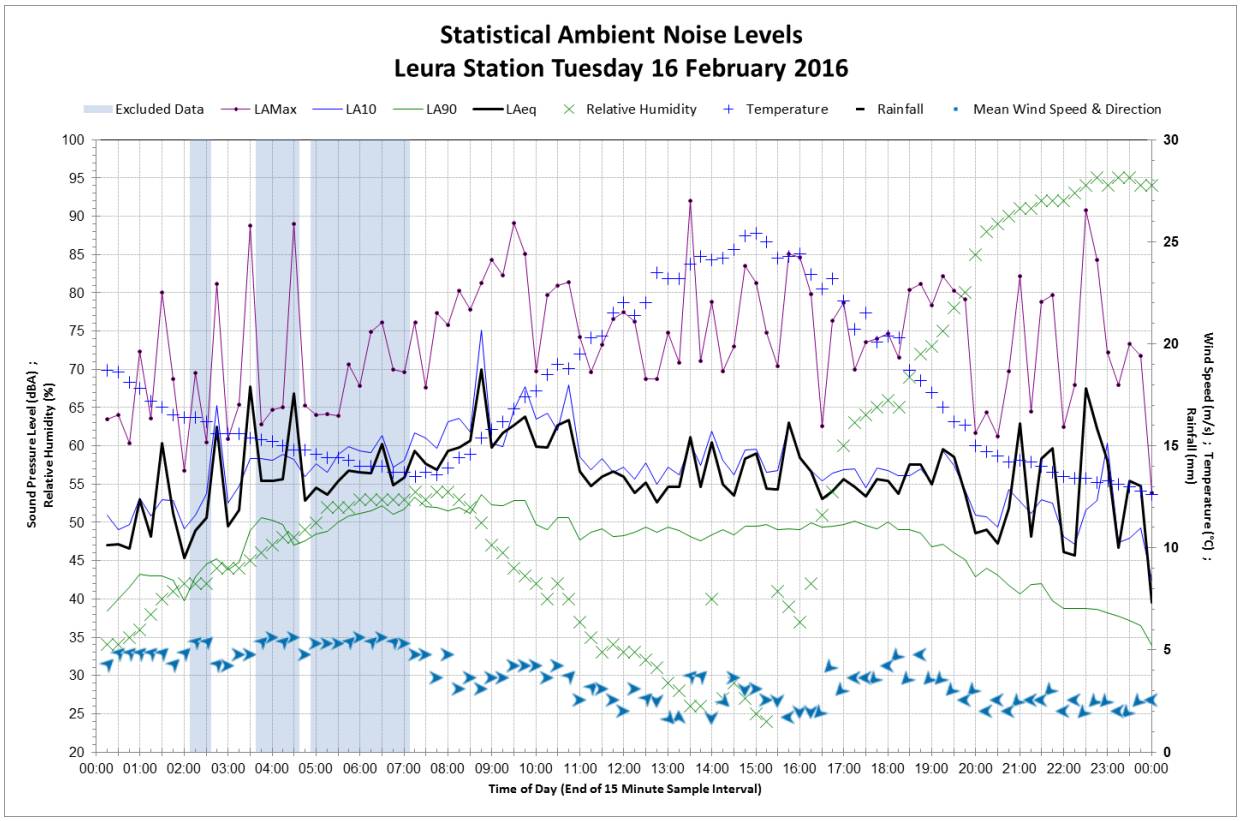
The data collected by the loggers was downloaded and analysed, and any invalid data was removed. Invalid data generally refers to periods of time where average wind speeds were greater than 5 m/s, or when rainfall occurred. Meteorological data for the monitoring period was sourced from the nearest Bureau of Meteorology Weather Station to the site, at 063292, located approximately 12 kilometres north-west of the Proposal site.

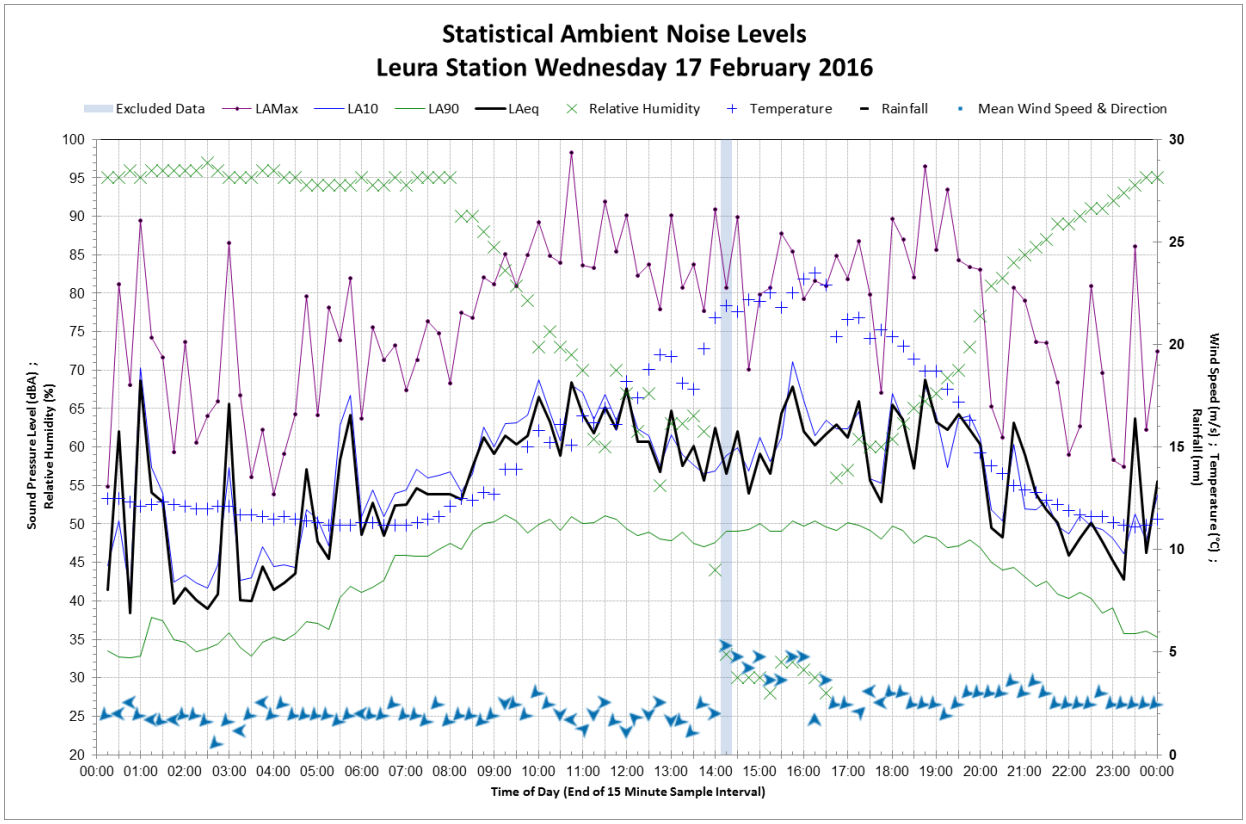
Table E-2 Noise monitoring locations and equipment details

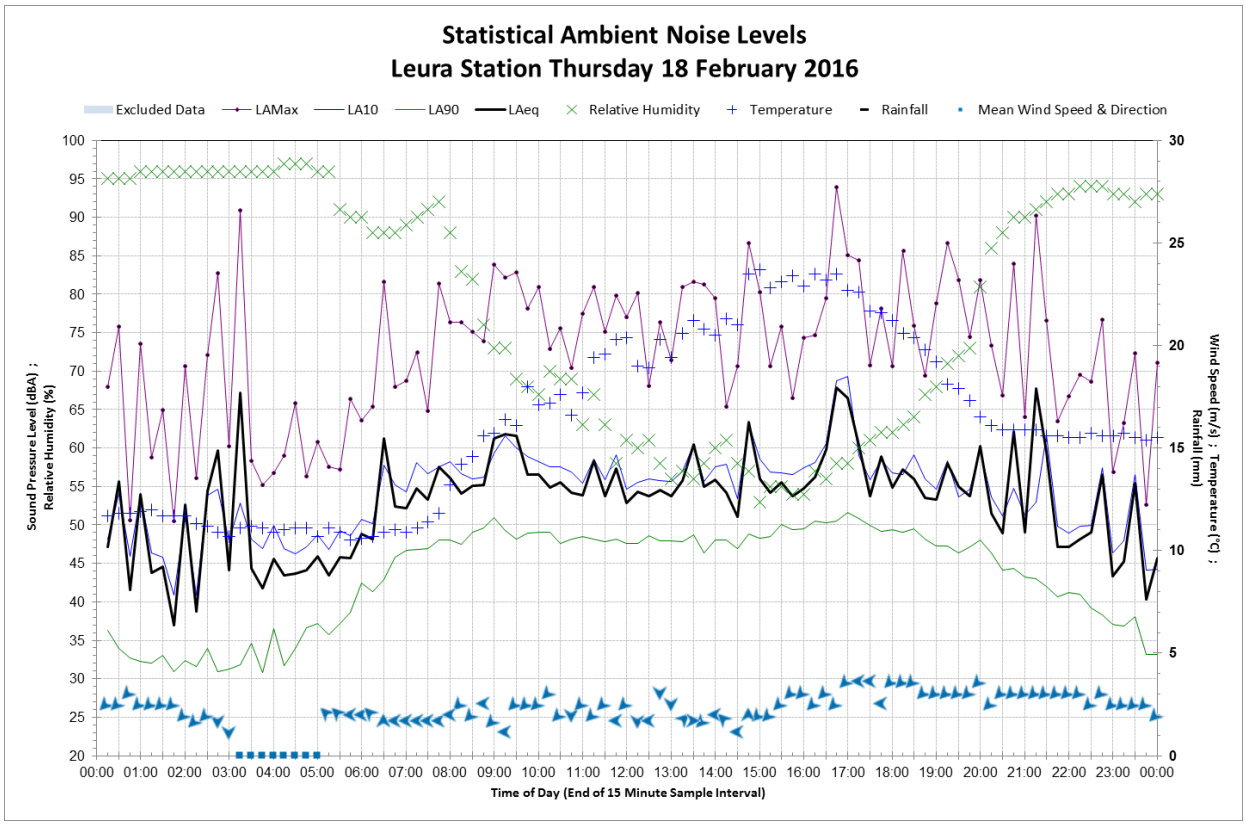
Location	Equipment details	Equipment settings	Site photo
Leura Station in the garden of the Flemish Flavours restaurant on Leura Mall	Rion NL-52 Type 1 SN: 131629 Calibrated to SPL of 94 dB(A) at 1 kHz	A-weighted Fast tune response 15 minute intervals	

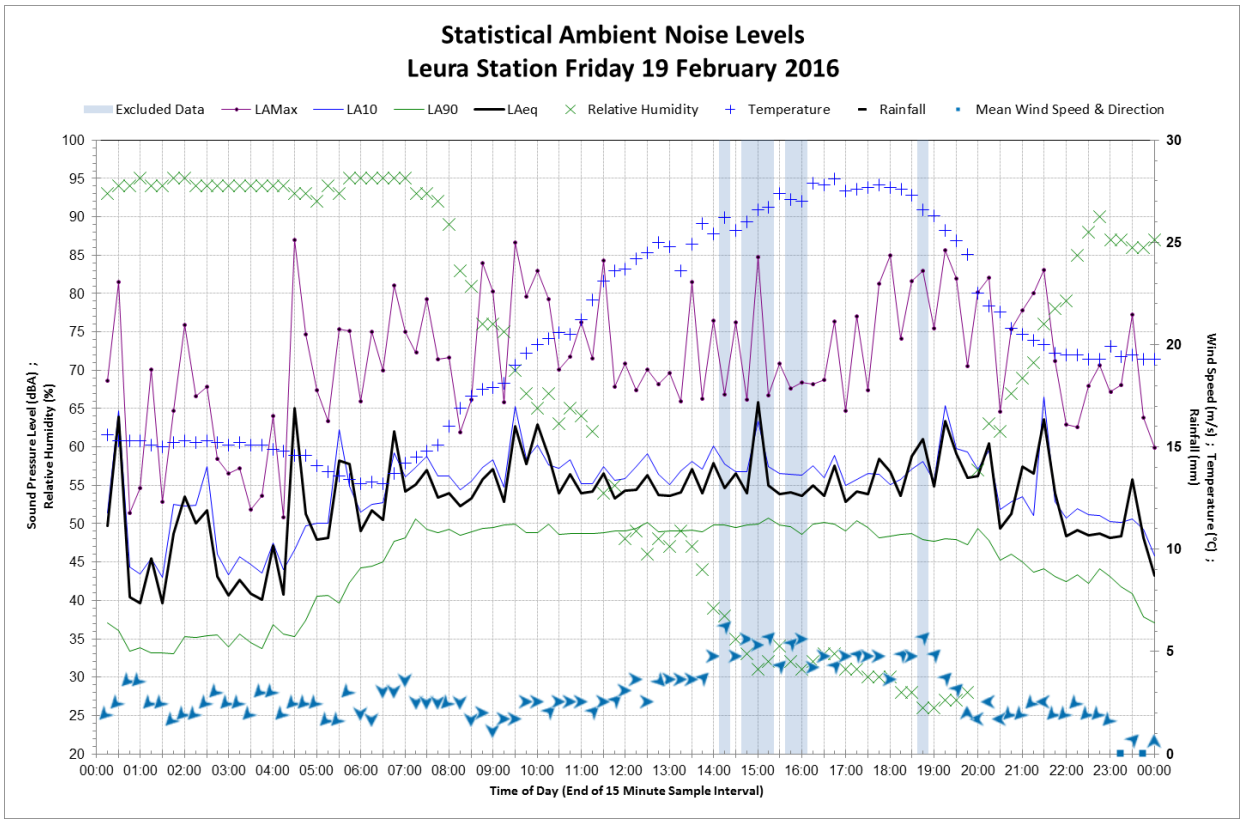
E.3 Noise monitoring charts

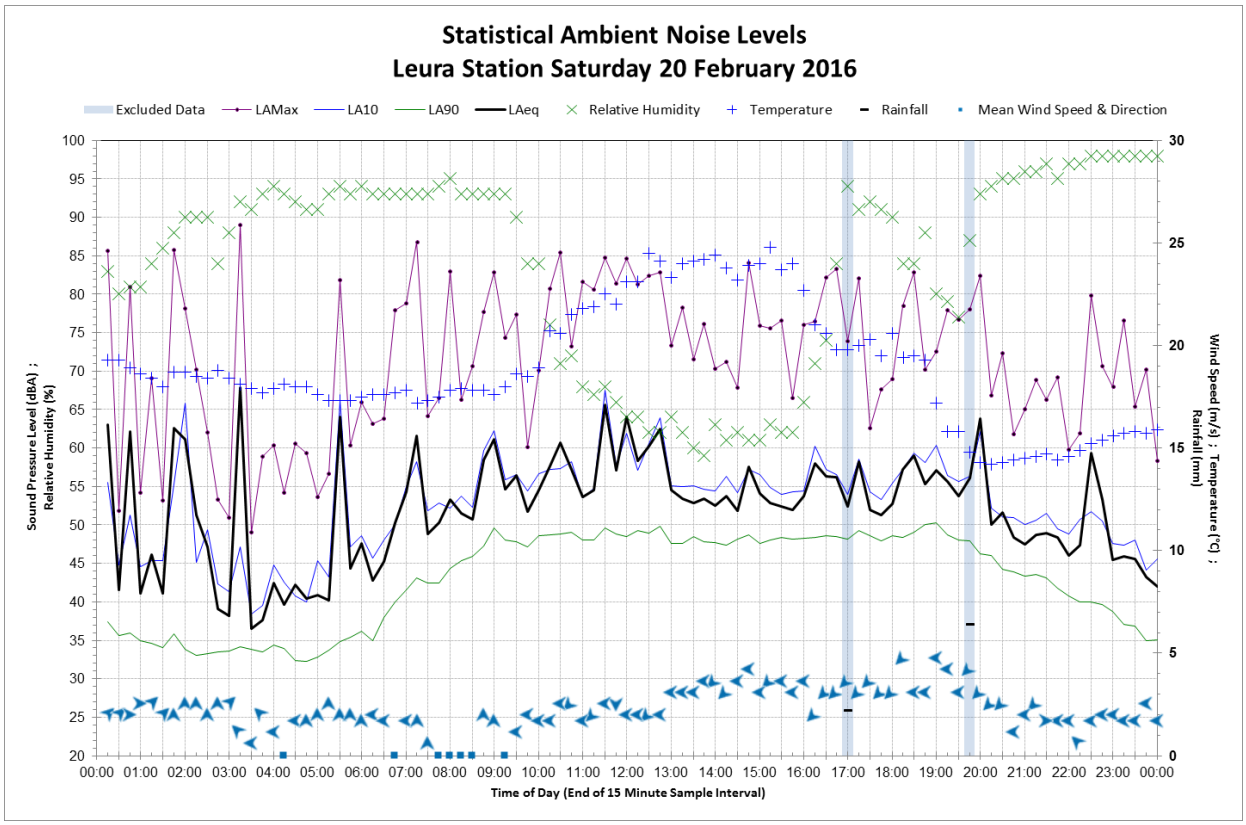


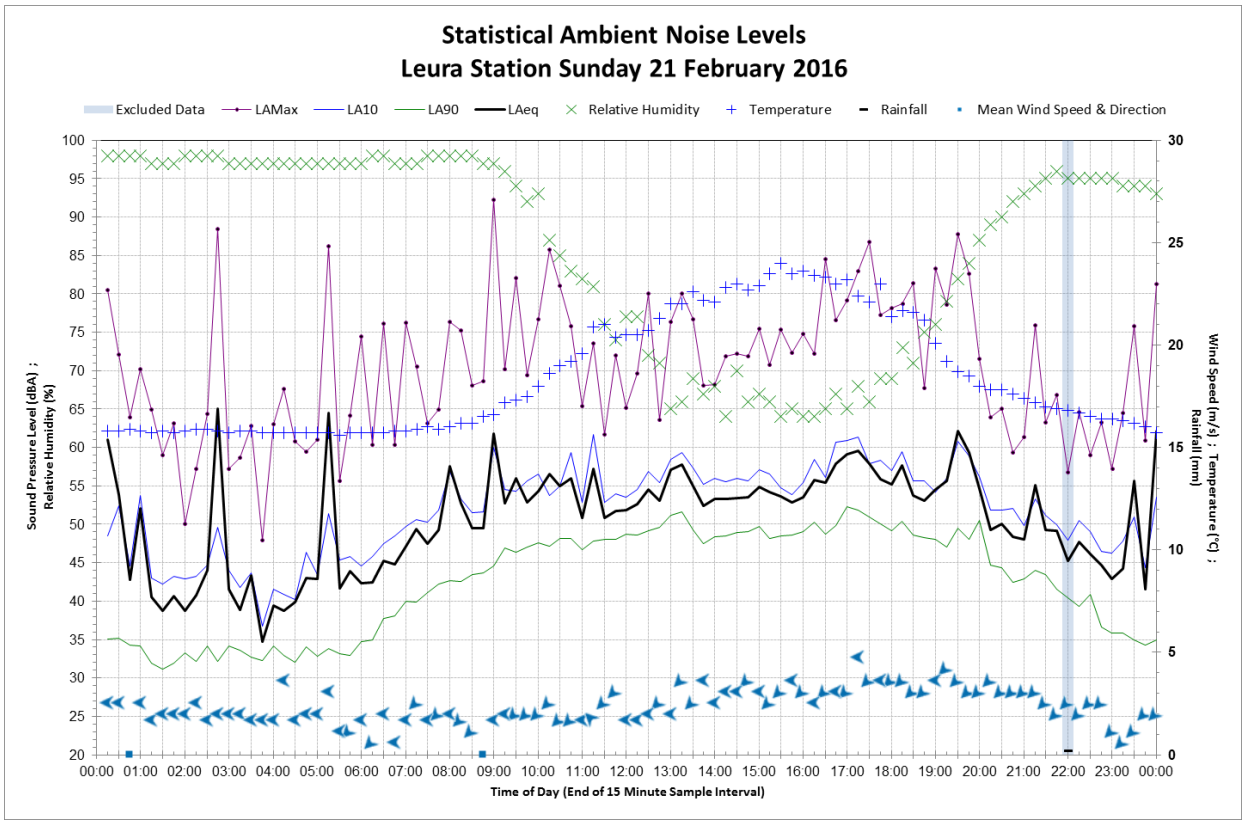

Statistical Ambient Noise Levels
Leura Station Tuesday 16 February 2016
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Leura Station Wednesday 17 February 2016
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Leura Station Thursday 18 February 2016
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Leura Station Friday 19 February 2016
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Leura Station Saturday 20 February 2016
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Leura Station Sunday 21 February 2016
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

E.4 Compliance Criteria

E.4.1 Construction noise criteria

Construction noise management levels

The ICNG outlines standard hours for construction activities as Monday to Friday: 7 am to 6 pm, Saturday: 8 am to 1 pm and no work on Sundays or public holidays. The ICNG acknowledges that the following activities have justification to be undertaken outside the recommended standard construction hours assuming that all reasonable and feasible mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- the delivery of oversized plant or structures that police or other authorities determine to require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels at receivers to below the noise management levels outside of the recommended standard construction hours.

The Construction Noise Strategy (TfNSW, 2012) separates out of hours works (OOHW) into two periods:

- OOHW Period 1: Monday to Friday 6 pm to 10 pm, Saturday 7 am to 8 am and 1 pm to 10 pm and Sunday/Public Holidays 8 am to 6 pm.
- OOHW Period 2: Monday to Friday 10 pm to 7 pm, Saturday 10 pm to 8 am and Sunday/Public Holidays 6 pm to 7 am.

It is anticipated that some construction activities would be required to be undertaken during OOHW Period 1 and OOHW Period 2. These would be classified as works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours due to the busy nature of the railway station.

Table E-3 and Table E-4 detail the ICNG construction noise management levels at sensitive land uses and residences near the proposal, respectively, where:

- The noise affected noise management level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
- The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:
    - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences
    - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

For transient receivers, the external noise level of 75 dB(A) could be considered acceptable as the receiver would be exposed to the noise source for a short duration.

Table E-3 Construction noise management levels at residences

Time of day	Management level $L_{Aeq(15min)}$
Recommended standard hours: • Monday to Friday 7 am to 6 pm • Saturday 8 am to 1 pm • No work on Sundays or public holidays	Noise affected Rating background level plus 10 dB(A) Highly noise affected 75 dB(A)
Outside recommended standard hours	Noise affected Rating background level plus 5 dB(A)

Table E-4 Construction noise management levels at sensitive land uses

Land use	Management level, $L_{Aeq(15min)}$ (when in use)
Industrial premises	External noise level 75 dB(A)
Offices and retail outlets	External noise level 70 dB(A)
Classrooms at schools and educational institutes	Internal noise level 45 dB(A)
Health buildings[1]	Internal noise level 45 to 50 dB(A)

Note 1: Based on AS2107:2000 maximum internal levels for waiting rooms, reception areas and consulting rooms.

Sleep disturbance during construction

The ICNG states that where construction works are planned to extend over more than two consecutive nights, the noise impact assessment should include maximum noise levels and the extent and number of times the maximum exceeds the rating background levels.

The INP application notes regarding sleep disturbance recommend that where the LA1(1min) or LAmax exceeds the LA90(15min) by more than 15 dB(A) outside the bedroom window, a more detailed analysis is required.

The ICNG also refers to the Environmental Criteria for Road Traffic Noise (EPA, 1999) for more guidance on sleep disturbance from maximum noise level events. This guideline has since been superseded by the Road Noise Policy. Both guidelines provide a discussion on research into the effects of maximum noise events on sleep disturbance. The results of this research is aimed at limiting the level of sleep disturbance due to environmental noise and concludes that the LAmax or LA1(1min) level of any noise should not exceed the ambient LA90(15min) noise level by more than 15 dB(A). This guideline takes into account the

emergence of noise events, but does not directly limit the number of such events or their highest level, which are also found to affect sleep disturbance.

The Road Noise Policy provides further guidance, which indicates that:

- maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions
- one or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to significantly affect health and wellbeing.

For this assessment the background level plus 15 dB(A) has been used as a screening level assessment of sleep disturbance which is consistent with the Industrial Noise Policy (application notes and the *Sydney Trains Environmental Management System Guide Noise and Vibration from Rail Facilities* (refer to Table 11 of the REF).

Construction road traffic noise

The Road Noise Policy provides traffic noise target levels for residential receivers in the vicinity of existing roads (Table E-5). These levels are applied to construction works to identify potential impacts as a result of noise produced by construction traffic and the potential for reasonable and feasible mitigation measures to be applied.

The application notes for the Road Noise Policy 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 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.*"

If road traffic noise increases as a result of construction work lies within 2 dB(A) of current levels then the objectives of the Road Noise Policy are met and no specific mitigation measures would be required.

Table E-5 Construction traffic noise criteria, LAeq(period), dB(A)

Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$
School classrooms	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (When in use)	-
Places of worship	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (when in use)	Internal noise level 40 $L_{Aeq(1hr)}$ dB(A) (when in use)
Open space (active use)	External noise level 60 $L_{Aeq(15hr)}$ dB(A) (when in use)	-
Open space (passive use)	External noise level	-

Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
	55 $L_{Aeq(15hr)}$ dB(A) (when in use)	

E.4.2 Construction vibration criteria

Human comfort

Vibration has been assessed based on the criteria in Assessing Vibration: a technical guideline. British Standard (BS) 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) is recognised by the guideline as the preferred standard for assessing the 'human comfort criteria'.

Typically, construction activities generate ground vibration of an intermittent nature. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in Table E-6 for sensitive receivers.

Whilst the assessment of response to vibration in BS 6472-1:1992 is based on vibration dose value and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of a peak value, since this parameter is likely to be more routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration, as shown below in Table E-7.

Table E-6 Human comfort intermittent vibration limits (BS 6472-1992)

Receiver type	Period[1]	Intermittent vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residential	Day	0.2	0.4
	Night	0.13	0.26
Educational institutes	When in use	0.4	0.8

Note 1: Day is between 7 am and 10 pm and night is between 10 pm and 7 am

Table E-7 Guidance on effects of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

Structural damage

Currently, there are no Australian Standards that sets criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to German Standard DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures (refer to Table E-8).

Table E-8 Guideline values for short term vibration on structures

Type of structure	Guideline values for velocity, (mm/s)		
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]
Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy.	5	5 to 15	15 to 20
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example heritage listed buildings).	3	3 to 8	8 to 10

Note 1: At frequencies above 100 Hz the values given in this column may be used as minimum values.

E.4.3 Operational noise criteria

The INP provides guidance on the assessment of operational noise impacts. The guidelines include both intrusive and amenity criteria that are designed to protect receivers from noise significantly louder than the background level and to limit the total noise level from all sources near a receiver.

The intrusive noise criteria controls the relative audibility of operational noise compared to the background level at residential receivers. The intrusive criteria are determined by a 5 dB(A) addition to the measured (or adopted) background level with a minimum of 35 dB(A). The INP recommends that the intrusive noise criteria for the evening period should not exceed the daytime period and the night-time period should not exceed the evening period. The intrusive noise criteria are only applicable to residential receivers.

The amenity criteria limits the total level of extraneous noise for all receiver types. The amenity criteria are determined based on the overall acoustic characteristics of the receiver area, the receiver type and the existing level of noise from commercial or industry in the area. Amenity criteria are also provided for residential receiver areas and other sensitive land uses such as schools, hospitals, places of worship and recreational areas.

Both the intrusive and amenity criteria are calculated and, in the case of continuous noise sources, the lower of the two in each time period (day, evening and night) normally apply.

E.4.4 Construction noise and vibration modelling methodology

Noise modelling was undertaken using SoundPlan (v7.4). SoundPlan is a computer program for the calculation, assessment and prognosis of noise exposure. SoundPlan calculates environmental noise propagation according to ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoors'.

The following noise modelling assumptions were made:

- surrounding land was modelled assuming a mixture of hard and soft ground with a ground absorption coefficient of 0.5
- a dense area of trees located south-west of the station was assumed to be soft ground with a ground absorption coefficient of 1.0
- atmospheric absorption was based on an average temperature of 10°C and an average humidity of 70 per cent
- atmospheric propagation conditions were modelled with noise enhancing wind conditions for noise propagation (downwind conditions) or equivalently a well-developed moderate ground based temperature inversions
- modelled scenarios take into account the shielding effect from surrounding buildings and structures on and adjacent to the site. Attenuation from built up areas was included away from the site
- noise sources were modelled assuming noise propagation in the 500 Hz octave band frequency as per ISO 9613-2
- noise sources for each scenario are in some cases modelled at different locations. As such the noise modelling assesses the noise source at multiple locations and takes the maximum LAeq received noise level
- besides the generators it is assumed that each item of equipment would operate simultaneously on average for 20 per cent of the time during each 15 minute period.

Table E-9 Construction equipment noise levels

Equipment	Adopted sound power level, dBA	Data source
Bobcat	107	AS2436 – 2010
Chainsaw	105	Based on a 2.5 kW chainsaw
Concrete pump and truck	108	AS2436 – 2010
Coring machine	113	AS2436 – 2010
Crane (mobile)	104	AS2436 – 2010
Crane (tower)	105	AS2436 – 2010
Demolition saw	117+5[1]	AS2436 – 2010
Excavator	107	AS2436 – 2010
Excavator (with auger)	111	AS2436 – 2010 based on bored piling
Excavator (small)	100	AS2436 – 2010
Franna crane	104	AS2436 – 2010 based on a mobile crane

Equipment	Adopted sound power level, dBA	Data source
Generator with acoustic enclosure	89	AS2436 – 2010 with acoustic enclosure
Grinder	102	AS2436 – 2010 based on hand tools (electric)
Hand tools (electric)	102	AS2436 – 2010
Jack hammer	121+5[1]	AS2436 – 2010
Lighting tower	70	Based on Lighting tower specification sheet
Manitou	106	AS2436 – 2010 based on forklift
Mulcher	115	*Noise emissions and exposure from mobile woodchippers* (HSE, 2008)
Nail gun	116	AS2436 – 2010 based on hand tools (pneumatic)
Piling rig	111	AS2436 – 2010 based on bored piling
Scissor lift	105	AS2436 – based on a cherry picker
Trucks (>20 tonne)	107	AS2436 – 2010
Trucks (dump)	117	AS2436 – 2010
Wacker packer	113	Based on Wacker technical data sheet

Note 1: The ICNG considers some activities to be particularly annoying to residents, such as jackhammering, concrete sawing, rock breaking, compacting and vibratory rolling. Hence, a +5 dBA modifying factor adjustment has been applied.

Table E-10 Typical construction equipment vibration levels

Item	Peak particle velocity	Data source
Wacker compactor	1 to 3 mm/s at 10 m	No source data available however assumed similar to a small roller
Jackhammer	0.5 mm/s at 10 m	*Environmental Noise Management Manual* (RTA, 2001)
Piling (bored)	0.5 mm/s at 10 m	Calculated based on *Construction Noise Strategy*

Table E-11 Indicative construction activity summary

Scenario	Construction activity	Timing	Equipment
S1	Establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas etc.) Establishment of temporary facilities as required (temporary pedestrian access to station, temporary toilets)	Standard hours Out of hours: Periods 1	Trucks, Generator with acoustic enclosure, Excavator (small), Hand tools (electric)
S2	Removal of vegetation to allow for new lifts/stairs	Standard hours	Mulcher, Chainsaw, Excavator (small), Trucks, Hand tools (electric)
S3	Services, seats and bins relocation	Standard hours	Excavator (medium), Truck, Hand tools (electric)
S4	Demolition of existing structures including stairs on the platform	Standard hours Out of hours: Periods 1 and 2	Trucks, Demolition saw, Generator with acoustic enclosure, Jack hammer, Excavator (with auger), Grinder, Bobcat, Manitou, Scissor lift, Franna crane, Hand tools (electric), Lighting tower, Crane (mobile)
S5	Platform modification, platform extension, lift shaft including piling and foundations for lift shaft	Standard hours Out of hours: Periods 1 and 2	Trucks, Demolition saw, Generator with acoustic enclosure, Jack hammer, Excavator, Concrete pump and truck, Piling rig, Franna crane, Hand tools (electric), Lighting tower, Hirail
S6	Construction of lift shaft, stairs, fencing and new canopies	Standard hours Out of hours: Periods 1 and 2	Trucks, Crane (mobile), Demolition saw, Generator with acoustic enclosure, Jack hammer, Excavator, Concrete pump and truck, Grinder, Hirail, Manitou, Scissor lift, Franna crane, Hand tools (electric), Lighting tower
S7	Installation of lifts Installation of fixtures, lighting, signage and CCTV cameras for the station areas	Standard hours Out of hours: Periods 1	Lighting tower, Trucks, Hand tools (electric), Crane (tower)
S8	Platform resurfacing including hearing protection loop installation (only 20% of the platform areas are required to be resurfaced)	Out of hours: Periods 1 and 2	Trucks, Bobcat, Jack hammer, Excavator, Grinder, Generator with acoustic enclosure, Hirail, Wacker packer, Hand tools (electric)

Scenario	Construction activity	Timing	Equipment
S9	Reconfiguration of internal station buildings to allow for communications/equipment room, staff facilities and toilets including a family accessible toilet	Standard hours	Trucks, Demolition saw, Jack hammer, Excavator, Grinder, Nail gun, Hand tools (electric)
S10	Refresh of station building including painting works	Standard hours Out of hours: Periods 1 and 2	Crane (mobile), Scissor lift, Hand tools (electric), Lighting tower
S11	Modifications and making good the existing footbridge including new access ramps, lighting, landscaping, seating and anti-throw screens installation on the bridge	Standard hours	Trucks, Demolition saw, Jack hammer, Excavator, Concrete pump and truck, Hand tools (electric)
S12	Taxi zone, kiss and ride, bike racks and accessible car spaces (final scope subject to detail design)	Standard hours	Hand tools (electric), Excavator (small)
S13	Installation of wayfinding signage Electrical and power supply upgrade works Replanting/landscaping, fencing adjustments and bollards	Standard hours	Trucks, Coring machine, Hand tools (electric)
S14	Establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas etc.)	Standard hours Out of hours: Periods 1	Trucks, Generator with acoustic enclosure, Excavator (small), Hand tools (electric)
S15	Establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas etc.)	Standard hours Out of hours: Periods 1	Trucks, Generator with acoustic enclosure, Excavator (small), Hand tools (electric)
S16	Establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas etc.)	Standard hours Out of hours: Periods 1	Trucks, Generator with acoustic enclosure, Excavator (small), Hand tools (electric)

E.5 Construction noise predictions

Table E-12 and Table E-13 outline construction noise levels during standard construction hours and outside of standard construction hours at modelled sensitive receivers for each construction scenario. The cells have been shaded (as per the key) where the noise management levels for each time period are exceeded. Impacts to sensitive receivers have the potential to occur where sensitive receivers experience noise higher than the relevant construction noise management level.

Table E-12 Predicted construction noise levels at representative sensitive receivers during standard construction hours, dBA

Exceedence to noise management level cell shading key
75 dBA highly noise affected level
70 dBA for commercial receivers[1]
55 dBA during standard construction hours

Receiver ID	Floor	Receiver type	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16
R1	F 1	Commercial	44	52	50	64	65	67	48	64	64	49	62	39	48	42	50	49
R1	GF	Commercial	50	58	53	71	67	72	54	69	71	54	69	45	55	49	54	51
R2	GF	Residential	30	39	29	50	50	50	32	48	49	29	51	26	36	27	24	29
R2	F 1	Residential	30	39	29	50	50	50	32	48	49	30	51	27	36	29	25	30
R2	F 2	Residential	34	42	33	54	54	55	37	52	54	34	56	31	40	33	27	32
R3	GF	Residential	31	40	31	52	52	52	34	50	51	32	53	28	38	31	28	26
R3	F 1	Residential	31	41	32	52	52	53	35	51	51	33	54	29	38	33	28	27
R3	F 2	Residential	34	44	36	56	56	56	38	54	54	35	57	33	42	36	29	28
R4	GF	Residential	27	36	27	47	49	48	29	45	48	28	47	23	33	27	24	32
R4	F 1	Residential	29	37	28	48	51	49	30	46	49	28	49	24	34	29	24	35
R4	F 2	Residential	34	43	34	54	54	55	36	52	54	34	55	31	40	33	26	41
R5	GF	Residential	26	34	27	45	45	45	27	44	46	27	46	22	32	25	22	23
R5	F 1	Residential	27	35	27	46	46	46	28	44	46	27	47	22	33	26	24	24
R5	F 2	Residential	31	39	32	52	50	52	33	50	49	30	52	27	37	29	25	25
R6	GF	Residential	28	36	28	48	48	48	30	45	47	28	48	24	34	28	22	25

Exceedence to noise management level cell shading key																		
75 dBA highly noise affected level																		
70 dBA for commercial receivers[1]																		
55 dBA during standard construction hours																		
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R6	F 1	Residential	29	37	29	49	49	49	31	47	48	28	50	25	35	28	22	26
R6	F 2	Residential	32	40	31	52	52	52	34	50	50	30	53	28	37	28	24	27
R7	GF	Residential	25	34	24	44	44	45	26	43	45	26	46	21	31	25	21	21
R7	F 1	Residential	27	35	27	46	46	47	28	45	47	28	47	23	32	26	22	23
R7	F 2	Residential	30	39	30	50	49	50	32	48	50	30	50	26	36	29	23	24
R8	F 1	Residential	52	62	53	75	75	76	58	73	67	45	77	52	62	41	33	31
R8	GF	Residential	53	64	55	77	77	77	59	75	68	46	79	55	63	47	35	33
R8	F 2	Residential	54	64	54	78	78	79	61	76	67	48	81	56	65	48	37	35
R9	GF	Commercial	49	59	49	69	69	70	51	68	56	37	71	46	56	34	37	46
R9	F 1	Commercial	47	58	47	69	69	70	52	68	63	45	71	46	57	39	34	44
R9	F 2	Commercial	49	59	50	70	70	72	53	69	65	48	72	47	57	42	36	46
R10	GF	Commercial	54	65	55	79	79	79	61	76	69	49	81	56	66	48	35	32
R10	F 1	Commercial	55	66	57	81	81	82	63	78	71	50	83	59	68	49	38	35
R10	F 2	Commercial	56	67	58	82	81	82	64	78	73	51	83	59	68	50	44	39
R11	GF	Commercial	31	39	38	54	59	50	32	48	54	37	50	26	36	28	47	39
R12	GF	Commercial	38	53	55	74	74	68	49	65	74	55	64	41	49	49	61	66

Exceedence to noise management level cell shading key																	
75 dBA highly noise affected level																	
70 dBA for commercial receivers[1]																	
55 dBA during standard construction hours																	
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R13	GF	Commercial	67	72	60	71	65	80	61	77	79	60	82	61	68	60	49	46
R13	F 1	Commercial	67	73	62	72	67	81	62	79	81	61	83	61	69	62	50	47
R14	GF	Commercial	46	55	48	56	62	64	43	60	73	54	65	45	50	55	47	45
R15	GF	Commercial	48	61	52	55	62	73	44	67	72	54	72	49	49	54	47	45
R16	GF	Commercial	48	60	53	56	61	72	51	67	72	53	71	48	57	52	46	45
R17	GF	Commercial	53	60	51	55	61	70	50	66	70	51	69	46	55	51	45	44
R18	GF	Commercial	49	57	50	55	61	69	49	65	69	50	68	44	54	50	45	44
R19	GF	Commercial	46	56	49	54	60	68	44	64	68	49	67	43	53	49	44	43
R19	F 1	Commercial	48	56	49	58	61	69	48	64	69	50	67	43	53	49	44	44
R20	GF	Commercial	49	57	49	56	60	69	49	65	68	50	68	44	54	48	44	43
R20	F 1	Commercial	50	57	50	60	60	69	49	65	69	50	68	44	54	48	44	44
R21	GF	Commercial	49	56	49	52	60	68	49	65	68	49	67	44	53	49	46	45
R21	F 1	Commercial	49	57	49	56	60	69	49	65	68	50	68	44	54	50	46	46
R22	GF	Commercial	46	54	47	55	60	66	46	62	66	47	65	41	50	47	43	43
R22	F 1	Commercial	46	54	48	57	60	67	46	62	67	48	65	41	51	47	43	43
R23	GF	Commercial	54	65	54	75	75	75	57	72	72	53	77	52	64	36	40	40

Exceedence to noise management level cell shading key																	
75 dBA highly noise affected level																	
70 dBA for commercial receivers[1]																	
55 dBA during standard construction hours																	
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R24	GF	Commercial	40	63	52	73	73	73	55	70	71	49	74	50	61	34	34	37
R25	GF	Commercial	37	62	51	71	71	71	53	69	60	43	72	49	59	38	34	33
R26	GF	Commercial	36	60	44	69	69	69	51	67	59	42	70	45	57	43	38	36
R26	F 1	Commercial	39	60	47	70	70	70	52	68	63	45	71	46	57	48	42	41
R27	GF	Commercial	35	51	40	61	58	61	45	58	59	42	62	33	47	43	42	41
R28	GF	Commercial	32	51	42	64	64	64	46	62	64	45	65	40	51	44	41	42
R29	GF	Commercial	31	49	37	61	61	62	43	59	60	43	62	37	48	36	36	37
R30	GF	Residential	33	42	37	56	68	51	32	48	58	40	52	33	38	39	42	43
R31	GF	Residential	33	42	46	58	71	53	33	49	58	43	53	29	39	39	49	45
R32	GF	Residential	43	52	47	62	72	61	42	58	66	48	63	40	49	47	51	46
R33	GF	Residential	29	39	44	61	65	48	30	46	61	34	48	24	34	37	46	41
R34	GF	Residential	43	48	45	63	66	59	42	57	63	47	59	37	44	48	47	42
R35	GF	Residential	26	34	28	49	58	45	26	43	49	30	45	23	31	35	35	40
R36	GF	Residential	44	49	45	65	65	63	44	58	65	48	59	38	45	48	47	42
R37	GF	Residential	43	49	41	58	62	61	43	58	59	45	59	38	45	46	38	33
R38	GF	Residential	41	49	42	63	62	59	41	58	63	44	60	36	45	43	43	40

Exceedence to noise management level cell shading key																		
75 dBA highly noise affected level																		
70 dBA for commercial receivers[1]																		
55 dBA during standard construction hours																		
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R39	GF	Residential	40	47	43	60	62	61	43	57	62	45	58	37	43	46	44	36
R40	GF	Residential	27	35	45	49	62	50	32	47	49	36	46	27	32	42	45	42
R40	F 1	Residential	45	52	46	63	62	65	47	63	66	49	62	42	48	51	46	43
R41	GF	Residential	46	54	46	54	61	67	47	62	67	48	64	41	51	48	44	43
R41	F 1	Residential	47	55	46	55	61	68	47	63	67	48	66	42	51	49	44	43
R42	GF	Residential	28	36	35	49	63	51	33	45	51	32	47	24	33	38	38	44
R43	GF	Residential	28	36	34	48	62	51	33	45	50	35	47	23	33	36	41	43
R44	GF	Residential	28	36	35	49	63	54	34	49	51	37	47	28	33	40	44	41
R45	GF	Residential	45	52	44	62	61	65	46	61	65	47	63	41	49	47	44	42
R45	F 1	Residential	45	53	45	63	61	66	46	62	65	48	63	40	49	48	44	42
R46	GF	Residential	44	52	44	62	61	63	45	61	65	47	63	39	49	47	44	41
R47	GF	Residential	43	51	44	61	61	62	45	60	64	47	62	39	48	46	44	41
R48	GF	Residential	30	38	36	49	63	50	33	49	51	35	48	27	34	35	38	42
R48	F 1	Residential	43	51	42	61	63	61	43	59	64	45	62	38	48	44	42	43
R49	GF	Residential	32	40	40	53	60	53	36	52	54	39	51	30	37	38	43	41
R50	GF	Residential	43	51	43	61	61	62	44	60	64	46	61	38	47	45	43	40

Exceedence to noise management level cell shading key																		
75 dBA highly noise affected level																		
70 dBA for commercial receivers[1]																		
55 dBA during standard construction hours																		
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R51	GF	Residential	42	49	43	60	62	61	43	59	63	46	60	38	46	44	43	41
R52	GF	Residential	39	47	42	61	68	57	41	55	61	46	58	35	44	48	47	42
R53	GF	Commercial	36	47	50	69	84	65	46	62	69	49	62	33	49	45	53	72
R54	GF	Residential	35	43	32	52	52	52	34	50	54	37	54	30	40	32	34	32
R55	GF	Residential	46	56	48	68	68	68	50	65	67	45	68	44	56	41	36	30
R56	GF	Residential	45	56	46	66	66	67	48	65	65	43	68	43	54	38	33	29
R57	GF	Residential	44	54	45	65	65	66	47	64	64	41	66	41	52	37	31	27
R58	GF	Residential	42	52	44	64	64	64	46	62	63	38	64	40	50	36	24	24
R59	GF	Residential	41	51	43	63	63	63	45	61	61	38	63	39	49	35	23	23

Note 1: 70 dBA external noise management level applies to commercial receiver R1, R9 – R29 and R53 when in use.

Table E-13 Predicted construction noise levels at representative sensitive receivers outside of standard construction hours, dBA

Exceedence to noise management level cell shading key
70 dBA for commercial receivers
52 dBA during the day time (OOHW) Period 1
47 dBA during the evening (OOHW) Period 1 and 2
38 dBA during the night (OOHW) Period 2

Receiver ID	Floor	Receiver type	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16
R1	F 1	Commercial	44	52	50	64	65	67	48	64	64	49	62	39	48	42	50	49
R1	GF	Commercial	50	58	53	71	67	72	54	69	71	54	69	45	55	49	54	51
R2	GF	Residential	30	39	29	50	50	50	32	48	49	29	51	26	36	27	24	29
R2	F 1	Residential	30	39	29	50	50	50	32	48	49	30	51	27	36	29	25	30
R2	F 2	Residential	34	42	33	54	54	55	37	52	54	34	56	31	40	33	27	32
R3	GF	Residential	31	40	31	52	52	52	34	50	51	32	53	28	38	31	28	26
R3	F 1	Residential	31	41	32	52	52	53	35	51	51	33	54	29	38	33	28	27
R3	F 2	Residential	34	44	36	56	56	56	38	54	54	35	57	33	42	36	29	28
R4	GF	Residential	27	36	27	47	49	48	29	45	48	28	47	23	33	27	24	32
R4	F 1	Residential	29	37	28	48	51	49	30	46	49	28	49	24	34	29	24	35
R4	F 2	Residential	34	43	34	54	54	55	36	52	54	34	55	31	40	33	26	41
R5	GF	Residential	26	34	27	45	45	45	27	44	46	27	46	22	32	25	22	23
R5	F 1	Residential	27	35	27	46	46	46	28	44	46	27	47	22	33	26	24	24
R5	F 2	Residential	31	39	32	52	50	52	33	50	49	30	52	27	37	29	25	25
R6	GF	Residential	28	36	28	48	48	48	30	45	47	28	48	24	34	28	22	25

Exceedence to noise management level cell shading key
70 dBA for commercial receivers
52 dBA during the day time (OOHW) Period 1
47 dBA during the evening (OOHW) Period 1 and 2
38 dBA during the night (OOHW) Period 2

Receiver ID	Floor	Receiver type	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16
R6	F 1	Residential	29	37	29	49	49	49	31	47	48	28	50	25	35	28	22	26
R6	F 2	Residential	32	40	31	52	52	52	34	50	50	30	53	28	37	28	24	27
R7	GF	Residential	25	34	24	44	44	45	26	43	45	26	46	21	31	25	21	21
R7	F 1	Residential	27	35	27	46	46	47	28	45	47	28	47	23	32	26	22	23
R7	F 2	Residential	30	39	30	50	49	50	32	48	50	30	50	26	36	29	23	24
R8	F 1	Residential	52	62	53	75	75	76	58	73	67	45	77	52	62	41	33	31
R8	GF	Residential	53	64	55	77	77	77	59	75	68	46	79	55	63	47	35	33
R8	F 2	Residential	54	64	54	78	78	79	61	76	67	48	81	56	65	48	37	35
R9	GF	Commercial	49	59	49	69	69	70	51	68	56	37	71	46	56	34	37	46
R9	F 1	Commercial	47	58	47	69	69	70	52	68	63	45	71	46	57	39	34	44
R9	F 2	Commercial	49	59	50	70	70	72	53	69	65	48	72	47	57	42	36	46
R10	GF	Commercial	54	65	55	79	79	79	61	76	69	49	81	56	66	48	35	32
R10	F 1	Commercial	55	66	57	81	81	82	63	78	71	50	83	59	68	49	38	35
R10	F 2	Commercial	56	67	58	82	81	82	64	78	73	51	83	59	68	50	44	39
R11	GF	Commercial	31	39	38	54	59	50	32	48	54	37	50	26	36	28	47	39

Exceedence to noise management level cell shading key																	
70 dBA for commercial receivers																	
52 dBA during the day time (OOHW) Period 1																	
47 dBA during the evening (OOHW) Period 1 and 2																	
38 dBA during the night (OOHW) Period 2																	
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R12	GF	Commercial	38	53	55	74	74	68	49	65	74	55	64	41	49	49	61	66
R13	GF	Commercial	67	72	60	71	65	80	61	77	79	60	82	61	68	60	49	46
R13	F 1	Commercial	67	73	62	72	67	81	62	79	81	61	83	61	69	62	50	47
R14	GF	Commercial	46	55	48	56	62	64	43	60	73	54	65	45	50	55	47	45
R15	GF	Commercial	48	61	52	55	62	73	44	67	72	54	72	49	49	54	47	45
R16	GF	Commercial	48	60	53	56	61	72	51	67	72	53	71	48	57	52	46	45
R17	GF	Commercial	53	60	51	55	61	70	50	66	70	51	69	46	55	51	45	44
R18	GF	Commercial	49	57	50	55	61	69	49	65	69	50	68	44	54	50	45	44
R19	GF	Commercial	46	56	49	54	60	68	44	64	68	49	67	43	53	49	44	43
R19	F 1	Commercial	48	56	49	58	61	69	48	64	69	50	67	43	53	49	44	44
R20	GF	Commercial	49	57	49	56	60	69	49	65	68	50	68	44	54	48	44	43
R20	F 1	Commercial	50	57	50	60	60	69	49	65	69	50	68	44	54	48	44	44
R21	GF	Commercial	49	56	49	52	60	68	49	65	68	49	67	44	53	49	46	45
R21	F 1	Commercial	49	57	49	56	60	69	49	65	68	50	68	44	54	50	46	46
R22	GF	Commercial	46	54	47	55	60	66	46	62	66	47	65	41	50	47	43	43

Exceedence to noise management level cell shading key
70 dBA for commercial receivers
52 dBA during the day time (OOHW) Period 1
47 dBA during the evening (OOHW) Period 1 and 2
38 dBA during the night (OOHW) Period 2

Receiver ID	Floor	Receiver type	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16
R22	F 1	Commercial	46	54	48	57	60	67	46	62	67	48	65	41	51	47	43	43
R23	GF	Commercial	54	65	54	75	75	75	57	72	72	53	77	52	64	36	40	40
R24	GF	Commercial	40	63	52	73	73	73	55	70	71	49	74	50	61	34	34	37
R25	GF	Commercial	37	62	51	71	71	71	53	69	60	43	72	49	59	38	34	33
R26	GF	Commercial	36	60	44	69	69	69	51	67	59	42	70	45	57	43	38	36
R26	F 1	Commercial	39	60	47	70	70	70	52	68	63	45	71	46	57	48	42	41
R27	GF	Commercial	35	51	40	61	58	61	45	58	59	42	62	33	47	43	42	41
R28	GF	Commercial	32	51	42	64	64	64	46	62	64	45	65	40	51	44	41	42
R29	GF	Commercial	31	49	37	61	61	62	43	59	60	43	62	37	48	36	36	37
R30	GF	Residential	33	42	37	56	68	51	32	48	58	40	52	33	38	39	42	43
R31	GF	Residential	33	42	46	58	71	53	33	49	58	43	53	29	39	39	49	45
R32	GF	Residential	43	52	47	62	72	61	42	58	66	48	63	40	49	47	51	46
R33	GF	Residential	29	39	44	61	65	48	30	46	61	34	48	24	34	37	46	41
R34	GF	Residential	43	48	45	63	66	59	42	57	63	47	59	37	44	48	47	42
R35	GF	Residential	26	34	28	49	58	45	26	43	49	30	45	23	31	35	35	40

Exceedence to noise management level cell shading key																	
70 dBA for commercial receivers																	
52 dBA during the day time (OOHW) Period 1																	
47 dBA during the evening (OOHW) Period 1 and 2																	
38 dBA during the night (OOHW) Period 2																	
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R36	GF	Residential	44	49	45	65	65	63	44	58	65	48	59	38	45	48	47	42
R37	GF	Residential	43	49	41	58	62	61	43	58	59	45	59	38	45	46	38	33
R38	GF	Residential	41	49	42	63	62	59	41	58	63	44	60	36	45	43	43	40
R39	GF	Residential	40	47	43	60	62	61	43	57	62	45	58	37	43	46	44	36
R40	GF	Residential	27	35	45	49	62	50	32	47	49	36	46	27	32	42	45	42
R40	F 1	Residential	45	52	46	63	62	65	47	63	66	49	62	42	48	51	46	43
R41	GF	Residential	46	54	46	54	61	67	47	62	67	48	64	41	51	48	44	43
R41	F 1	Residential	47	55	46	55	61	68	47	63	67	48	66	42	51	49	44	43
R42	GF	Residential	28	36	35	49	63	51	33	45	51	32	47	24	33	38	38	44
R43	GF	Residential	28	36	34	48	62	51	33	45	50	35	47	23	33	36	41	43
R44	GF	Residential	28	36	35	49	63	54	34	49	51	37	47	28	33	40	44	41
R45	GF	Residential	45	52	44	62	61	65	46	61	65	47	63	41	49	47	44	42
R45	F 1	Residential	45	53	45	63	61	66	46	62	65	48	63	40	49	48	44	42
R46	GF	Residential	44	52	44	62	61	63	45	61	65	47	63	39	49	47	44	41
R47	GF	Residential	43	51	44	61	61	62	45	60	64	47	62	39	48	46	44	41

Exceedence to noise management level cell shading key																	
70 dBA for commercial receivers																	
52 dBA during the day time (OOHW) Period 1																	
47 dBA during the evening (OOHW) Period 1 and 2																	
38 dBA during the night (OOHW) Period 2																	
Receiver ID	**Floor**	**Receiver type**	**S01**	**S02**	**S03**	**S04**	**S05**	**S06**	**S07**	**S08**	**S09**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
R48	GF	Residential	30	38	36	49	63	50	33	49	51	35	48	27	34	35	38	42
R48	F 1	Residential	43	51	42	61	63	61	43	59	64	45	62	38	48	44	42	43
R49	GF	Residential	32	40	40	53	60	53	36	52	54	39	51	30	37	38	43	41
R50	GF	Residential	43	51	43	61	61	62	44	60	64	46	61	38	47	45	43	40
R51	GF	Residential	42	49	43	60	62	61	43	59	63	46	60	38	46	44	43	41
R52	GF	Residential	39	47	42	61	68	57	41	55	61	46	58	35	44	48	47	42
R53	GF	Commercial	36	47	50	69	84	65	46	62	69	49	62	33	49	45	53	72
R54	GF	Residential	35	43	32	52	52	52	34	50	54	37	54	30	40	32	34	32
R55	GF	Residential	46	56	48	68	68	68	50	65	67	45	68	44	56	41	36	30
R56	GF	Residential	45	56	46	66	66	67	48	65	65	43	68	43	54	38	33	29
R57	GF	Residential	44	54	45	65	65	66	47	64	64	41	66	41	52	37	31	27
R58	GF	Residential	42	52	44	64	64	64	46	62	63	38	64	40	50	36	24	24
R59	GF	Residential	41	51	43	63	63	63	45	61	61	38	63	39	49	35	23	23

Note: Where activities are scheduled potentially during both OOHW Period 1 and Period 2, if noise levels are predicted to exceed the Period 1 criteria, they will automatically exceed the OOHW Period 2 criteria.

E.6 Additional mitigation measures

In circumstances where the noise levels are predicted to exceed construction noise management levels after implementation of the general work practices, the relevant additional mitigation measures detailed in the Table E-14 should be considered. Based on the predicted noise levels, additional mitigation measures are likely to be required for works during standard construction hours and any activities outside of standard construction hours. The noise management zones show the additional mitigation measures recommended by the Construction Noise Strategy (TfNSW, 2012). Noise management zones have been calculated for each scenario showing the recommended additional mitigation measure for each time period. Noise management zones are shown in Section E.7 and are shown for levels that are moderately intrusive and highly intrusive for distances up to 1000 m from the site as it is assumed distances greater that this would not be feasible or reasonable to implement in practice.

Table E-14 Additional mitigation measures

Criteria	Time period	$L_{Aeq(15\ min)}$	Noise level	Above rating	Background level
		0 to 10 dBA	10 to 20 dBA	20 to 30 dBA	>30 dBA
		Noticeable	Clearly audible	Moderately intrusive	Highly intrusive
Standard	Weekday (7 am– 6 pm)	-	-	LB, M	LB, M
	Saturday (8 am – 1 pm)				
OOHW Period 1	Weekday (6 pm–10 pm)	-	LB	M, LB	M, IB, LB, PC, SN
	Saturday (1 pm – 10 pm)				
	Sunday (8 am – 6 pm)				
OOHW Period 2	Weekday (10 pm–7 am)	LB[1]	M, LB	M, IB, LB, PC, SN	AA, M, IB, LB, PC, SN
	Saturday (10 pm – 8 am)				
	Sunday (6 pm – 7 am)				

Monitoring (M): Compliance noise monitoring

Individual Briefings (IB): Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the Proposal.

Letter box drops (LB): Letter box drops or media advertisements.

Phone Calls (PC): Phone calls detailing relevant information would be made to identified/affected stakeholders within seven days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs.

Specific Notifications (SN): Specific notifications are letterbox dropped or hand distributed to identified stakeholders no later than seven days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications.

Alternative accommodation (AA): Alternative accommodation options would be offered to residents.

Note 1: The minimum level was set at the ICNG background + 5 dBA criteria for determining the noise management zones

Source: Construction Noise Strategy (Rail Projects), (TfNSW, 2012)

E.7 Noise management zones

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 3]

Noise monitoring location

land use map and representative sensitive receivers

Figure 1

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 4]

Figure 2

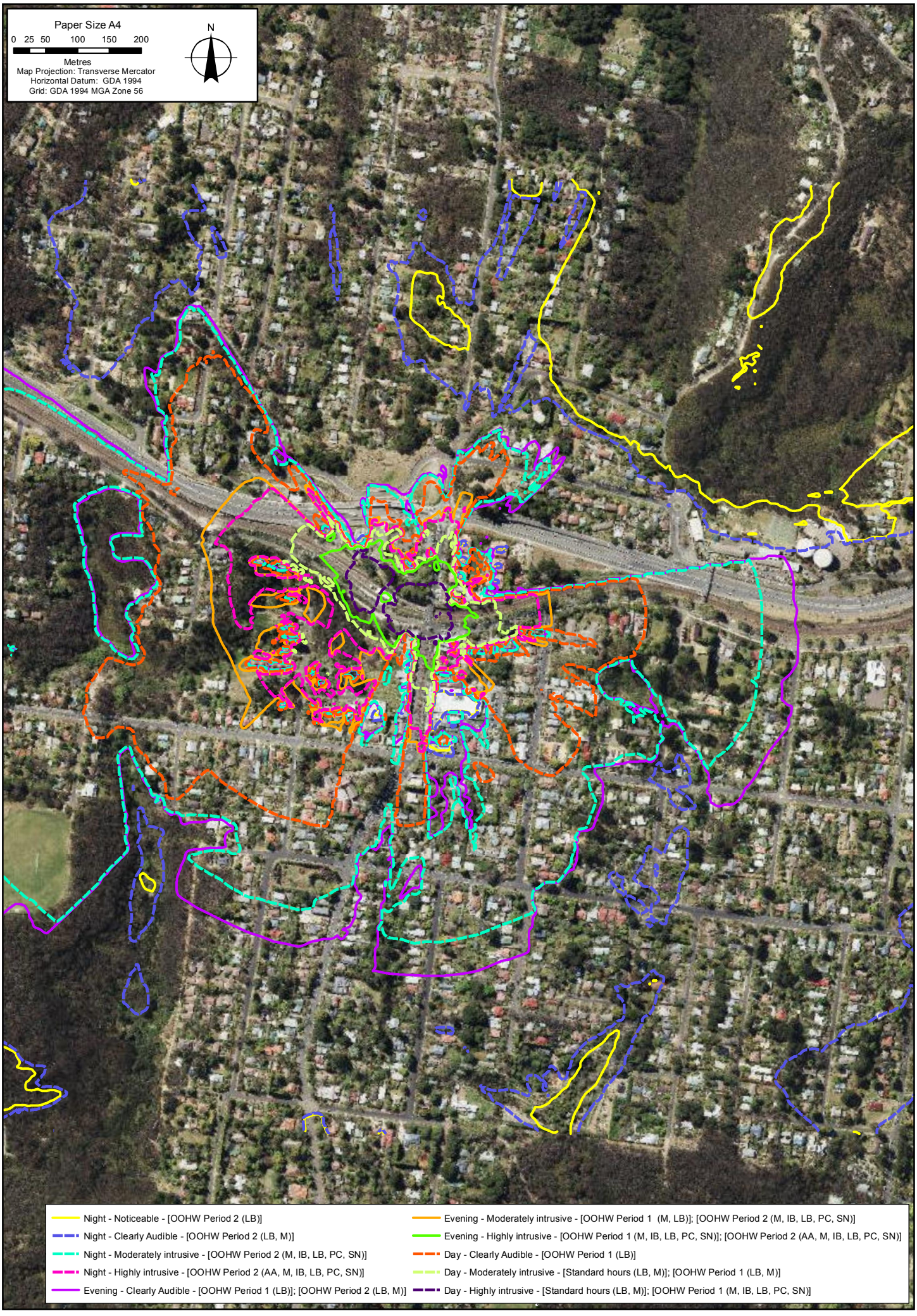
S1 noise management zones

Figure 3

S2 noise management zones

Figure 4

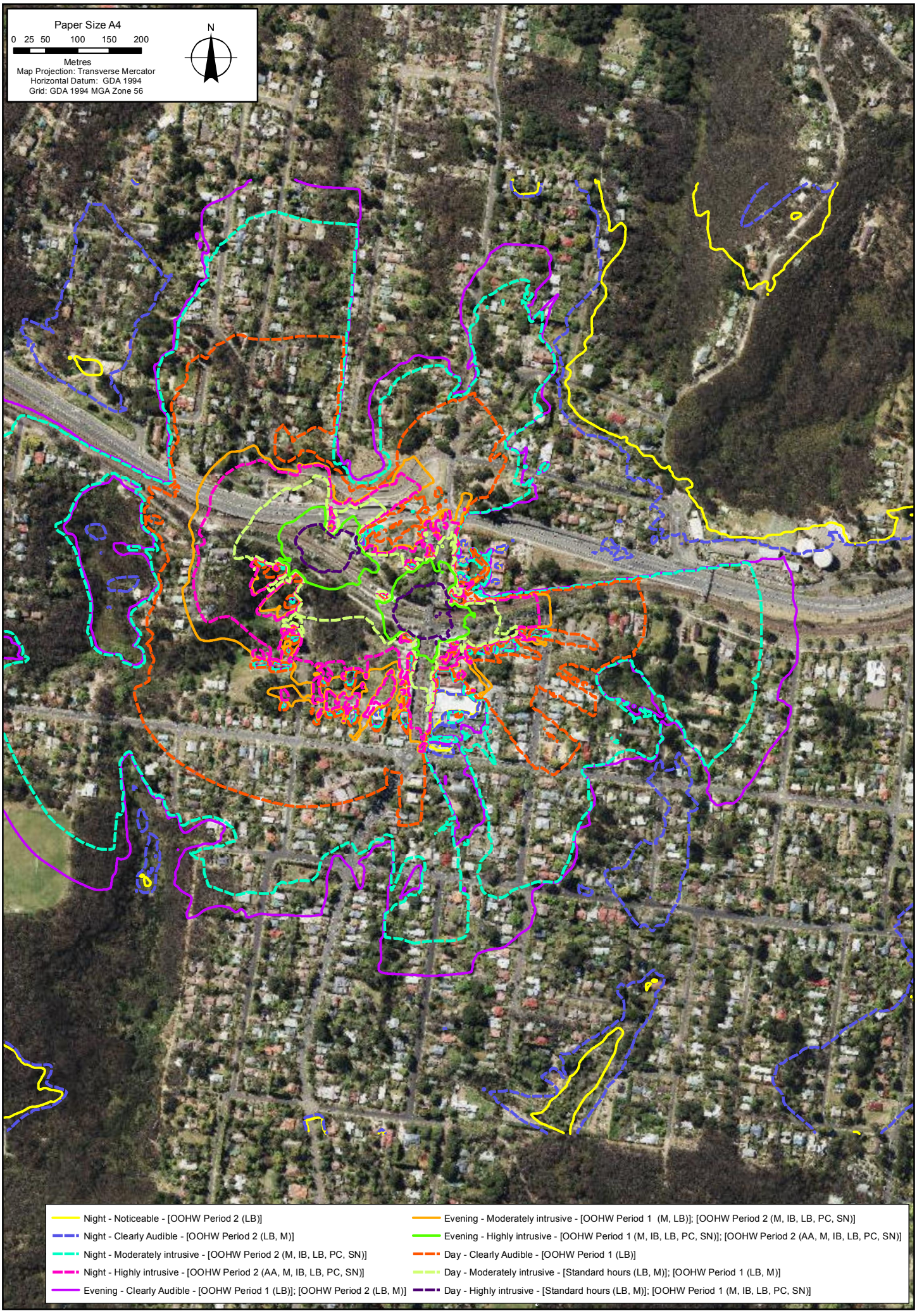
S3 noise management zones



G:\21\25241\GIS\Resources\KBM\IBULKMAPPER\KBM_OC_JOB.mxd [KBM: 7]

Figure 5

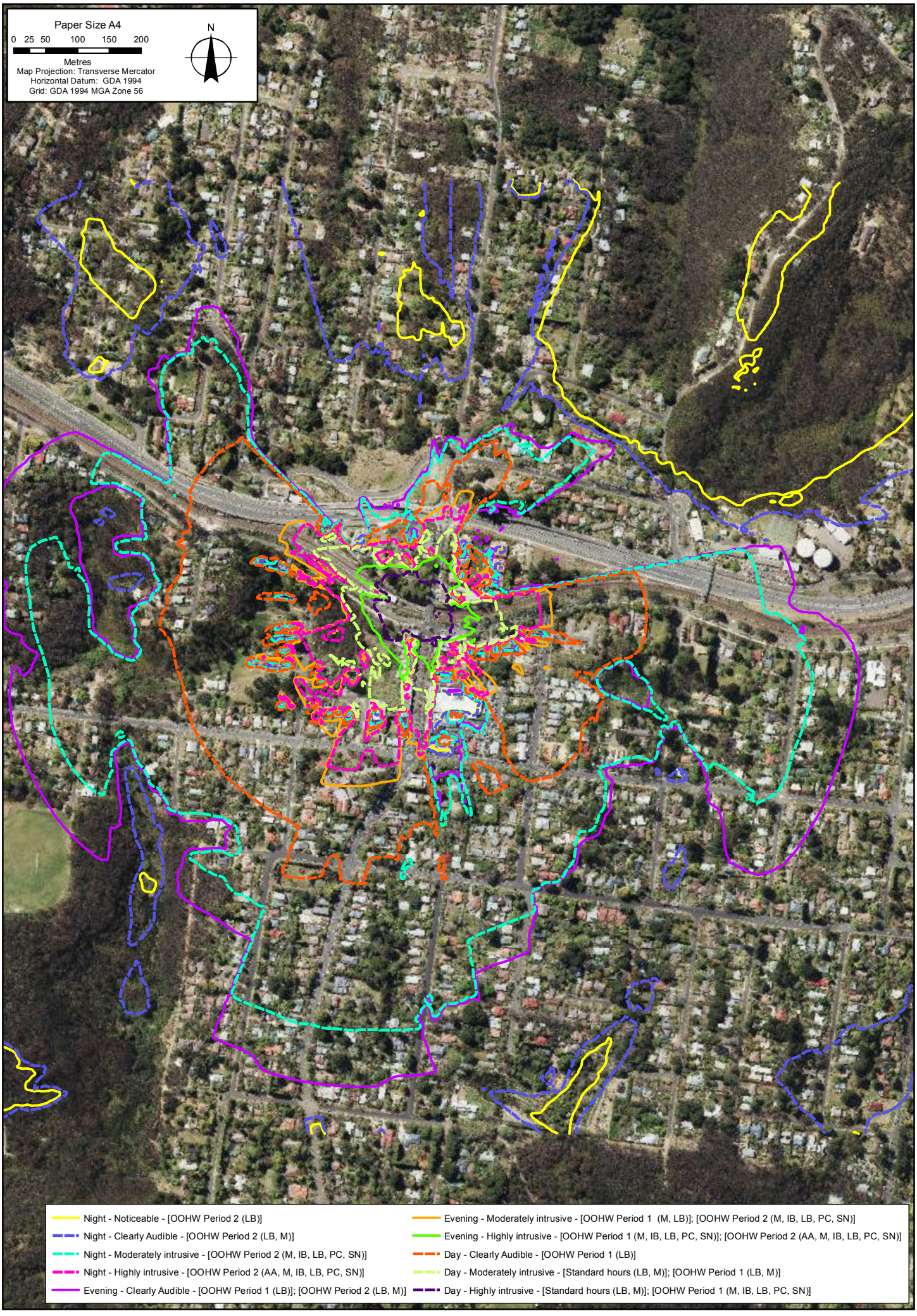
S4 noise management zones



G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 8]

Figure 6

S5 noise management zones



G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 9]

Figure 7

S6 noise management zones

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 10]

Figure 8

S7 noise management zones

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 11]

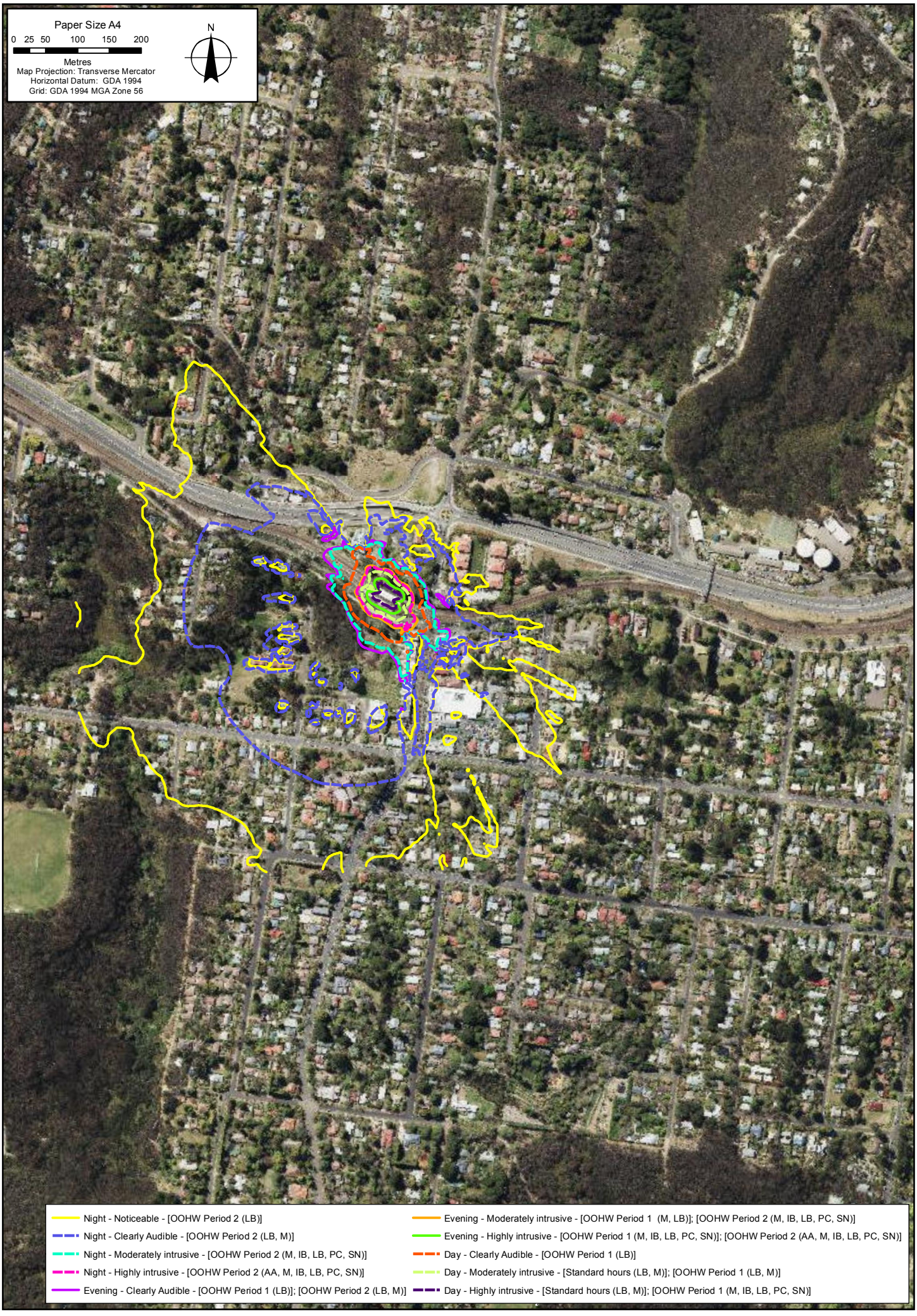
Figure 9

S8 noise management zones

G:\21\25241\GIS\Resources\KBM\BU\KMAPPER\KBM_OC_JOB.mxd [KBM: 12]

Figure 10

S9 noise management zones



G:\21\25241\GIS\Resources\KBM\BU\LKMAPPER\KBM_OC_JOB.mxd [KBM: 13]

Figure 11

S10 noise management zones

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 14]

Figure 12

S11 noise management zones

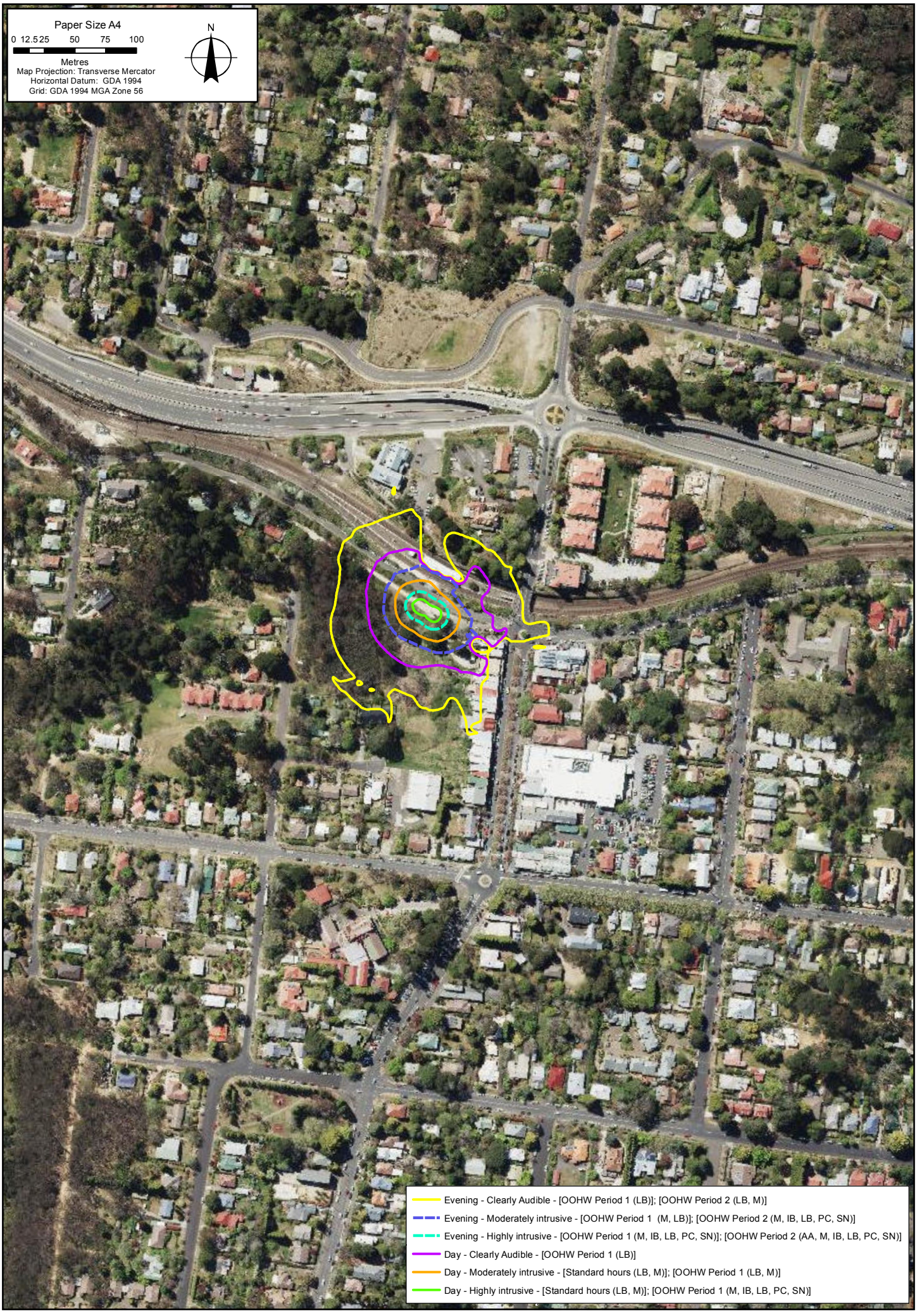
Figure 13

S12 noise management zones

G:\21\25241\GIS\Resources\KBM\BU\KMAPPER\KBM_OC_JOB.mxd [KBM: 16]

Figure 14

S13 noise management zones



G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 17]

Figure 15

S14 noise management zones

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 18]

Figure 16

S15 noise management zones

G:\21\25241\GIS\Resources\KBM\BULKMAPPER\KBM_OC_JOB.mxd [KBM: 19]

Figure 17

S16 noise management zones