JUNIOR SECONDARY SCHOOL, SOUTH HURSTVILLE, NSW 2221

Acoustic Report for Development Application

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CONTENTS

Document Control Sheet

Title	Acoustic Report for Development Application Junior Secondary School
Project	Junior Secondary School South Hurstville
Description	Acoustic Report for DA
Key Contact	CP

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	DATE	26/06/17							

1. EXECUTIVE SUMMARY

JHA has been engaged by Sydney Catholic Schools – SCS (formerly known as Catholic Education Office) to provide an acoustic report for the Development Application of the proposed Marist College project located at 29A Greenacre Road, South Hurstville NSW 2221.

This report addresses the noise criteria specified by the George River Council (Kogarah DCP 2013) and the NSW EPA Industrial Noise Policy (INP) 2000 pertaining to the environmental noise impact from the proposed development at the nearest affected receivers.

Noise impact from school activities can be classified as follow:

- Noise from students engaged in outdoors activities and sports activities
- Noise from Building Services including mechanical plants and air conditioning systems
- Noise from ingress and egress of vehicles, carpark and deliveries
- Use of the premises outside of normal school hours (if proposed) including sports activities.

This report identifies the noise impact of the proposed college on the surrounding and nearest affected residences and provides recommendations of measures, both physical and operational, such as the introduced noise from the development does not exceed $L_{Aeq,15min}$ by more than 5dB when assessed at the boundary of any affected residence, as required by the George River Council and the NSW Industrial Noise Policy (INP) 2000.

All architectural drawings have been prepared by MUNNS SLY MOORE ARCHITECTS PTY LTD.

2. PROJECT DESCRIPTION

2.1 Development Information

The proposed hours of operations for the school are:

-Monday to Friday 8am to 5pm
-Closed during weekends
-Parents and teachers will meet once per term between 5pm and 8pm

It is envisaged that a maximum of 430 students will be present on the campus.

Figure 1 Architectural Plan for the Proposed School Site

2.2 Site Description

The proposed site address is 29A Greenacre Road, South Hurstville NSW 2221. The proposed site was formerly known as South Hurstville Bowling Club and consists of a main building surrounded by green areas and a car park, covering 14000 m^2. The proposed site area is surrounded by low-to-medium density residential zones.

Numerous potential affected receivers are located on the perimeter of the site and are circled in red on the figure shown below. However, by necessity of establishing noise criteria, two locations for nearest affected receivers were chosen as they are expected to be the noisiest areas. Therefore 37 Greenacre Road (circled green on Figure 2 below) was chosen as it is directly located behind the main buildings, where mechanical plant noise emissions are predicted to be the loudest. Similarly, 5 Young Place (circled purple on Figure 2 below) was selected as it is located near the car park and driveway area, where background noise levels is expected to be substantial.

There are two accesses from Greenacre Road and one from Rickard Road. Northern access on Greenacre road will connect the site via the pedestrian footpath, public transport and student vehicles will access the site via the South entrance. Rickard Road entrance will be used for staff vehicle traffic.

Figure 2 Aerial View of the Site and Nearest Affected Receivers Locations

2.3 Land Zoning from Kogarah Local Environmental Plan 2012

NB: *It is understood that current Kogarah LEP has not been enacted yet, thus the most recent available LEP (i.e. Kogarah LEP 2012) has been used for this report.*

The proposed site circled in blue is located in a Private Recreational Zone labelled SP2 in the land zoning map section of Kogarah LEP 2012. It is surrounded by low density residential R2 and medium density residential R3 properties.

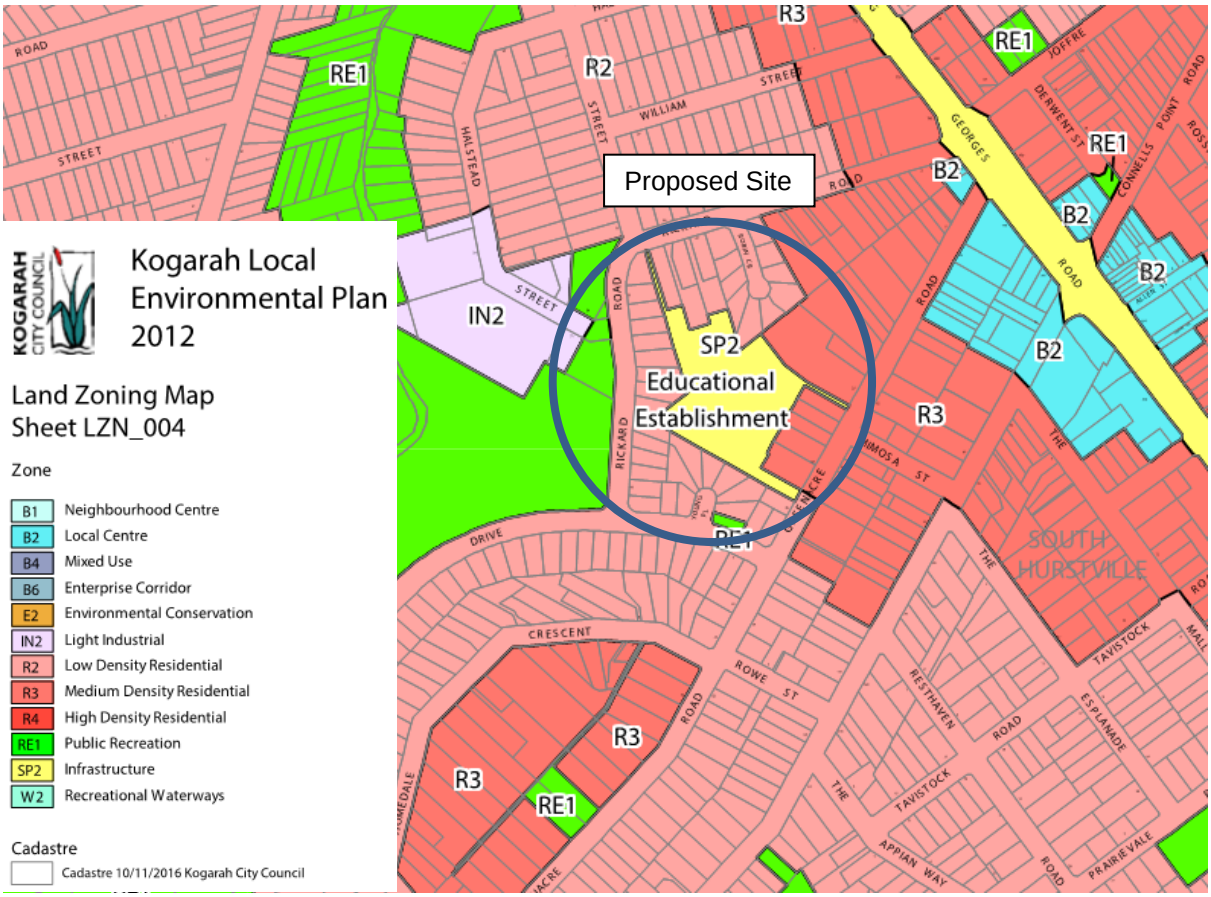


Figure 3 Proposed Site Location and Land Zoning Classification

2.4 Aircraft Noise

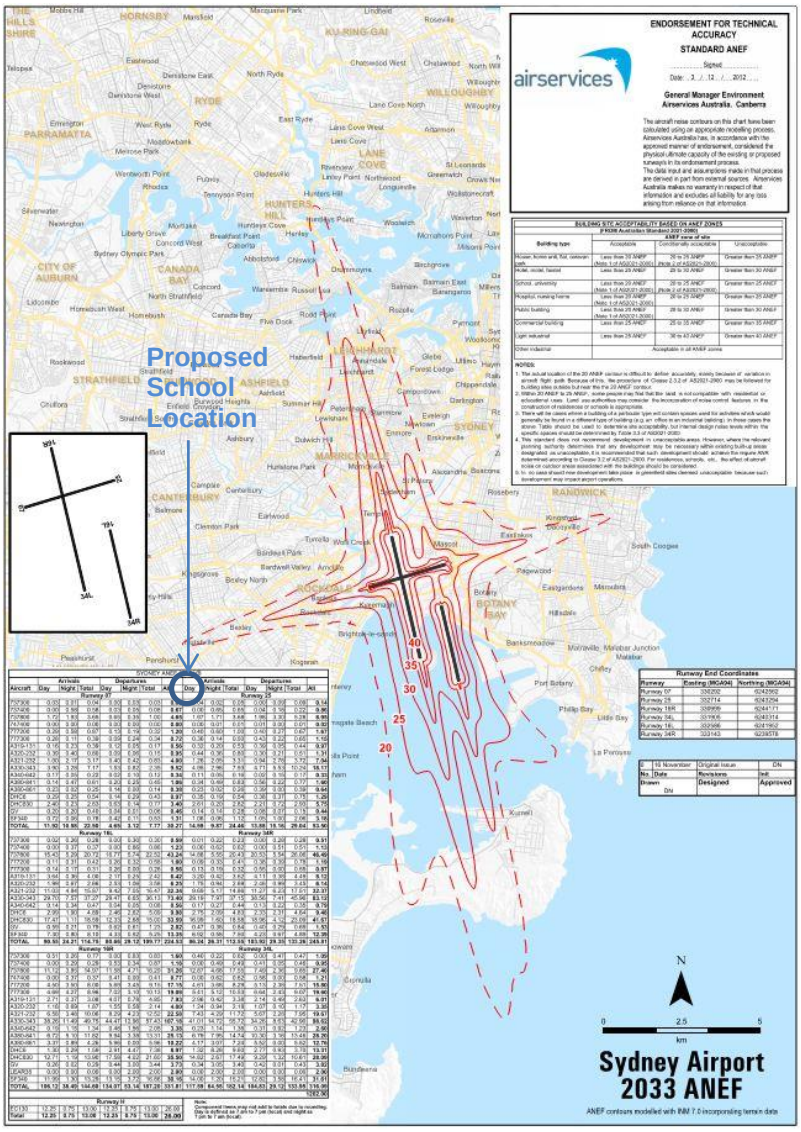


Figure 4 ANEF 2033 Contour Map and Proposed School Location

The propose school location remains outside of the ANEF 2033, as shown on the map above, and as such will not require assessment as per current regulations. However it should be noted that due to the close proximity of the location from the outward limit of the contour, aircraft noise might potentially be heard.

3. APPLICABLE NOISE CRITERIA

3.1 Noise Criteria Specified by George River Council (Kogarah DCP 2013)

From Kogarah DCP 2013 Part D3 Industrial Controls:

12.3 Noise

(1) Noise production does not exceed the following repeatable maximum L_{Aeq} (1 hour) level, on weekdays:

- Day 7am-6pm: 55dB(A)
- Evening 7pm-10pm: 45dB(A)
- Night 10pm-7am: 40dB(A)

And on weekends:

- Day 8am-7pm: 50dB(A)
- Evening 7pm-10pm: 45dB(A)
- Night 10pm-8am: 40dB(A)

(2) In any case not more than 5 dB(A) above the background level during the day and evening and not exceeding the background level at night when measured at the boundary of the property.

(3) Incorporate noise reduction measures on plant and machinery.

(4) Use design features or planning that will reduce noise.

(5) Incorporate adequate measures for tonal, low frequency, impulsive, or intermittent noise.

(6) Comply with EPA Industrial Noise Policy 2000 in particular the modification required for acceptable noise level (ANL).

3.2 NSW Industrial Noise Policy Criteria

The NSW Industrial Noise Policy (INP) (2000) assessment procedure for industrial noise sources consists of two components.
They are:

• Controlling intrusive noise impacts in the short term for residences

• Maintaining noise level amenity for particular land uses for residences and land users.

The intrusiveness of an industrial noise source is considered acceptable if the continuous (energy average) A-weighted level of noise from the source measured over a 15-minute period does not exceed the background noise level measured in the absence of the source by more than 5dB. The Rating Background Level (RBL) is the background level used for the assessment purposes and the $L_{A90,\ 15minute}$ measure as recommended in Table 3.1 of the INP is used in the determination.
To limit the continuing increases in noise levels and maintain noise level amenity, the INP has set recommended and maximum noise for the various land usages. The criteria for amenity noise applicable to this Development Application are as follows.

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable (ANL)	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
School Classroom (Internal)	All	Noisiest 1 Hour Period (when in use)	35 (see note 10*)	40

Table 1 INP Recommended Noise Levels

Note 10: In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable LAeq noise level maybe increased to 40 dB L_{Aeq}(1hr).

To determine the intrusive noise criteria in accordance with the INP, long term noise logger monitoring and short term (15-minutes) operator attended noise measurements were conducted at the proposed development site.

4. EXISTING NOISE ENVIRONMENT

4.1 Existing Noise Levels at Residential Boundaries

Loggers (L1 and L2) were positioned at locations that are expected to be impacted the most by vehicle traffic and mechanical plants from the proposed development design.

L1 logger was installed near the proposed driveway for motorised public access and car park. L2 was installed behind the proposed location of building 2 and building 3, which are expected to be fitted with mechanical plant equipment.

Operator attended noise measurements were performed at various locations around the property, as shown below.

Figure 5 Aerial View of the Site with Logger and Operator Attended Measurements Locations

4.1.1 Operator Attended Measurements

Operator attended noise measurements and long term sound logging measurements were performed on site to document the existing acoustic environment, including traffic noise.

Operator attended noise measurement survey was conducted with an integrating Type 1 sound level meter and windshield. Measurements were taken continuously and the microphone was set to receive direct frontal sound and facing the direction of sound emission.

Figure 6 Location M1

Figure 7 Location M2

Figure 8 Location M3

Figure 9 Location M4

Figure 10 Location M5

Figure 11 Location M6

Figure 12 Location M7

Figure 13 Location M8

The survey was conducted with the following instruments:

NTI Precision Integrating Octave Band Sound Level Meter, Type XL2 with 1/3 Oct band filter unit, which conforms to applicable standards of IEC 61672-1:2002-05 CLASS1 & IEC 60651 TYPE1.

The sound level meter calibration was verified before and after the measurements using a Bruel & Kjaer Acoustic Calibrator. No calibration deviations were recorded.

The operator attended noise measurements were performed on Tuesday 17 January 2017 between 10.00 am and 11.15 am at position labelled M1- M8 labelled on Figure 6 above. Results are presented in Table 2 below.

Date	Time	LAeq	LAF10	LAF90	Location	Notes
17/01/17	10.17	50	53	42	M1	Pedestrian Entrance
	10.23	54	57	41	M2	Building 3 Location
	10.29	56	60	45	M3	Sport Courts Location
	10.36	46	49	41	M4	Staff Driveway
	10.42	44	46	40	M5	Delivery Area
	10.49	41	43	38	M6	Public carpark
	10.55	46	49	40	M7	Public Driveway
	11.01	44	47	38	M8	Public Driveway Entrance

Table 2 Operator Attended Measurements Results and Corresponding Locations

4.1.2 Long Term Noise monitoring

Automatic logging noise measurements were performed at the site to document the existing acoustic environment, including traffic noise.

Figure 14 Logger Location L1

Figure 15 Logger Location L2

Long term noise monitoring with two Rion NL-52 Type 1 noise logging sound level meters were conducted between Tuesday 17th of January and Wednesday 25th of January 2017 at Logger locations L1 and L2 shown in Figure 5, 14 and 15. The sound level meter calibration was checked before and after the measurements using a Bruel & Kjaer Acoustic Calibrator. No calibration deviations were recorded. Detailed results of the logger measurements are shown in the Appendix section.

The $L_{Aeq,15min}$ and $L_{A90,15min}$ Rating Background Level derived from the long-term noise monitoring measurements carried out between Tuesday 17th of January and Wednesday 25th of January 2017 determined in accordance with the INP guidelines are listed in Table 4 below. Detailed results of the long-term noise monitoring measurements can be found in the Appendix section. Results from long term noise monitoring logger are presented in Table 4 below.

Start Date and Time	End Date and Time	Logging Period	Assessment Period	$L_{Aeq,15min}$ [dB]	$L_{A90,15min}$ [dB]	Notes
17/01/2017 at 9.30am	25/01/2017 at 1.40pm	Day	15 min	47	43	Logger L1
17/01/2017 at 6.00pm	24/01/2017 at 10.00pm	Evening	15 min	48	44	Logger L1
17/01/2017 at 10.00pm	25/01/2017 at 7.00am	Night	15 min	40	36	Logger L1
17/01/2017 at 9.30am	25/01/2017 at 1.40pm	Day	15 min	49	43	Logger L2
17/01/2017 at 6.00pm	24/01/2017 at 10.00pm	Evening	15 min	47	41	Logger L2
17/01/2017 at 10.00pm	25/01/2017 at 7.00am	Night	15 min	40	35	Logger L2

Table 3 Long Term Noise Monitoring Results for Logger L1 and L2

4.2 Noise Criteria at the Nearest Residential Boundary

Based on the above measurements and assessment in accordance with the NSW INP, the criteria for the development intrusiveness and amenity noise criteria (in bold) at the nearest affected residential

property boundary for logger location L1 at 29A Greenacre Road, South Hurstville is shown in Table 4 below.

Time of Day	Intrusiveness Criterion	Amenity Criterion (ANL)	Recommended Maximum
Day Period (7am-6pm Mon to Sat) (8am-6pm Sunday)	**52 $L_{Aeq,15min}$ (47+5)**	55 $L_{Aeq, Day}$	60 $L_{Aeq, Day}$
Evening Period (6pm-10pm Mon to Sun)	53 $L_{Aeq,15min}$ (48+5)	45 $L_{Aeq, evening}$	**50 $L_{Aeq, evening}$**
Night Period (10pm-7am Mon to Sat) (10pm-8am Sunday)	45 $L_{Aeq,15min}$ (40+5)	40 $L_{Aeq, nigh}$	**45 $L_{Aeq, nigh}$**

Table 4 Intrusiveness and Amenity Criteria Results

Based on the above measurements and assessment in accordance with the NSW INP, the criteria for the development intrusiveness and amenity noise criteria (in bold) at the nearest affected residential property boundary for logger location L2 at 29A Greenacre Road, South Hurstville is shown in Table 4 below.

Time of Day	Intrusiveness Criterion	Amenity Criterion	Recommended Maximum
Day Period (7am-6pm Mon to Sat) (8am-6pm Sunday)	**54 $L_{Aeq,15min}$ (49+5)**	55 $L_{Aeq, Day}$	60 $L_{Aeq, Day}$
Evening Period (6pm-10pm Mon to Sun)	52 $L_{Aeq,15min}$ (47+5)	45 $L_{Aeq, evening}$	**50 $L_{Aeq, evening}$**
Night Period (10pm-7am Mon to Sat) (10pm-8am Sunday)	45 $L_{Aeq,15min}$ (40+5)	40 $L_{Aeq, nigh}$	**45 $L_{Aeq, nigh}$**

Table 5 Intrusiveness and Amenity Criteria Results

5. MANAGING NOISE IMPACT

The noise impact of the various activities at the proposed school extension includes the following activities:

- Noise emissions from students engaged in outdoor recreational activities
- Noise from mechanical plant, carpark and cleaning and maintenance issues
- Use of the premises outside of normal school hours (if proposed) i.e. sporting activities

To achieve the satisfactory noise outcomes at the nearby residences, the following noise management strategies shall be implemented.

5.1 Noise Emission from Students

Students engaged in outdoor recreational activities shall be supervised to limit noisy behaviour during outdoors activities. All outdoor student activities areas and sport courts located on the proposed college development site shall be separated from nearby residential buildings by a 2.1 metre high acoustic fencing with no air gaps.

5.2 Noise from Mechanical Services

Mechanical plants and air conditioning systems within the school site shall be designed and acoustically treated so that the noise generated from the systems achieve compliance with specified criteria presented in Table 1 at the nearest affected receiver position and inside learning spaces.

5.3 Noise from Vehicles and Access

Traffic noise will be generated on site from vehicle access on both staff and visitor driveways (Greenacre and Rickard Roads accesses). To comply with the specified noise criteria at the nearest affected receiver boundary, acoustic barriers of 2.1m minimum height and attenuation value no less than R_W 13 (i.e. no air gaps are allowed) shall be installed between vehicle accesses, delivery areas, car parks and adjoining properties to limit the impact of vehicle traffic noise on nearby residences from vehicle access via driveways.

In order to limit noise from vehicles, maximum speed limitation shall be established on campus.

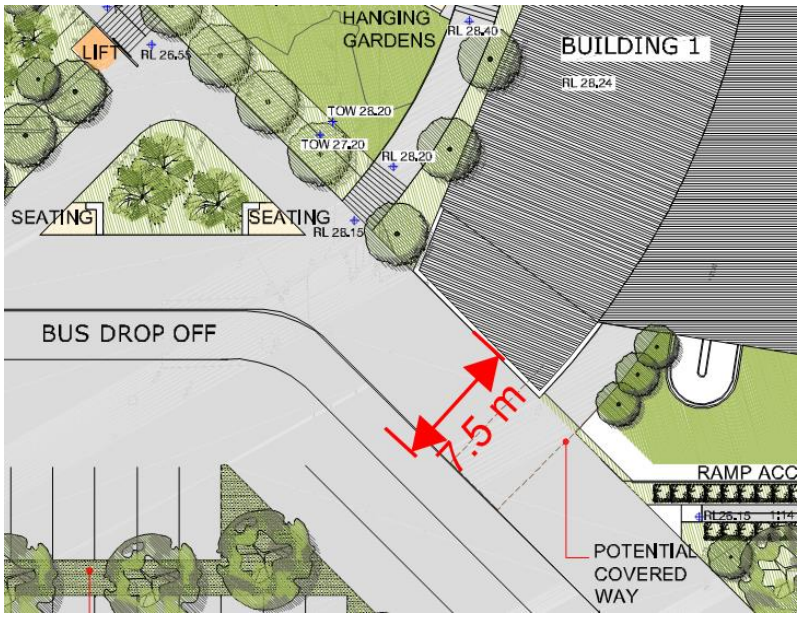


Figure 16 Bus Drop-off Zone and Building 1 Detail

As shown in Figure 16, the closest distance separating the bus drop-off zone and building 1 is approximated 7.5m metres based on the architectural drawings provided.

Idle parked buses generate steady noise with sound pressure level estimated to be 75dB(A) at 1m. Resulting SPL at 7.5m, including wall reflection effect, is therefore 58+3 =61dB(A).

To comply with INP specification for internal level in classroom L_{Aeq} 35dB(A) over the noisiest 1 hour period, it is recommended that busses should switch off engine when parked for an extended period of time.

The recommended sound insulation of glazing is a minimum $R_W + C_{tr}$ 30, which can be achieved with a laminated glazing system of 6.38mm. This applies to any façade in close distance and directly facing the drop-off bus area to meet the specified INP criteria for learning spaces of L_{Aeq} 35dB(A) over the noisiest 1 hour period.

5.4 Noise from Premises outside Operation Hours

There are no scheduled activities outside operation hours at the time of the report aside from parents and teachers meetings, which will occur once each term between the hours of 5pm and 8pm. It is expected that no major acoustic disturbances will occur due to parents and teachers meetings.

5.5 Point of Contact and Management of Noise Complaints

It is recommended that a Noise Management Policy is developed by the school. The Noise Management Policy shall formalise the school's objective as good neighbours and willingness to communicate with its neighbours, and informing the neighbours of future activities and events likely to increase noise levels at the residence. Neighbouring residents shall also be provided with a name and contact number of a school staff member who could be contacted in the event of a noise issue.

6. COMPLIANCE WITH GEORGE RIVER COUNCIL (KOGARAH DCP 2013) AND NSW INDUSTRIAL NOISE POLICY

The following sub-chapter addresses compliance with the George River Council as presented in section 3.1.

(1) Noise production does not exceed the following repeatable maximum L_{Aeq} (1 hour) level, on weekdays.

Long term measurement results are presented below:

Period	Time	Measured Logger 1 $L_{Aeq,1hour}$	Measured Logger 2 $L_{Aeq,1hour}$	Recommended $L_{Aeq,1hour}$
Week	Day (7am-6pm)	47	49	55
	Evening (7pm-10pm)	48*	47*	45
	Night (10pm-7am)	40	40	40
Weekend	Day (8am-7pm)	46	47	50
	Evening (7pm-10pm)	47*	47*	45
	Night (10pm-8am)	40	40	40

Table 6 Long Term Measurement Results for Council Conditions

*Background noise on site for evening period (week and weekend) has been measured at 48dB(A) for logger position L1 and 47dB(A) for logger position L2, which already exceeds the recommended value from council. However the mechanical plant will be designed and calculated to not exceed the council criteria of 45dB(A) at the nearest affected receiver boundary.

The hours of operation for the school are between 8am and 5pm during week days, thus relevant noise criteria condition for the project is during the period:

- *Monday to Friday during daytime: 7am-6pm: 55dB(A).*

From the results presented in Table 4 and Table 5, the maximum L_{Aeq} value for intrusiveness criterion is 54dB(A), which complies with the aforementioned conditions.

(2) In any case not more than 5 dB(A) above background level during day and evening and not exceeding background level at night when measured at the boundary of the property.

Adequate building design, combined with effective acoustic treatment will limit the transmission of noise from sources such as vehicular traffic, sports activities and mechanical plant, towards adjacent properties and maintain noise levels below the specified criteria of 5dB(A) above existing background noise levels.

(3) Incorporate noise reduction measures on plant and machinery.

Noise reduction measures will be introduced at design stage for mechanical plant and machinery locations, which may include attenuators, acoustic screens, acoustic louvers and acoustic lining, pending mechanical plant noise level review.

(4) Use design features or planning that will reduce noise.

Acoustic enclosures and acoustic barriers will be introduced at design stage to limit noise impact on adjacent properties as well as maintain recommended noise level within the building.

(5) Incorporate adequate measures for tonal, low frequency, impulsive, or intermittent noise.

Adequate measures will be introduced during design stage to limit tonal, low frequency, impulsive, or intermittent noise, by careful selection and review of plant item sound spectrum.

(6) Comply with EPA Industrial Noise Policy 2000 in particular the modification required for acceptable noise level (ANL).

Based on the existing levels, the specified criteria from INP 2000 for ANL cannot be used as the level measured from long term noise monitoring already exceeds the specified value of 45dB(A). Thus, the maximum recommended level specified in Table 1 will be used as the modified ANL to comply with item 6 of Kogarah DCP 2013.

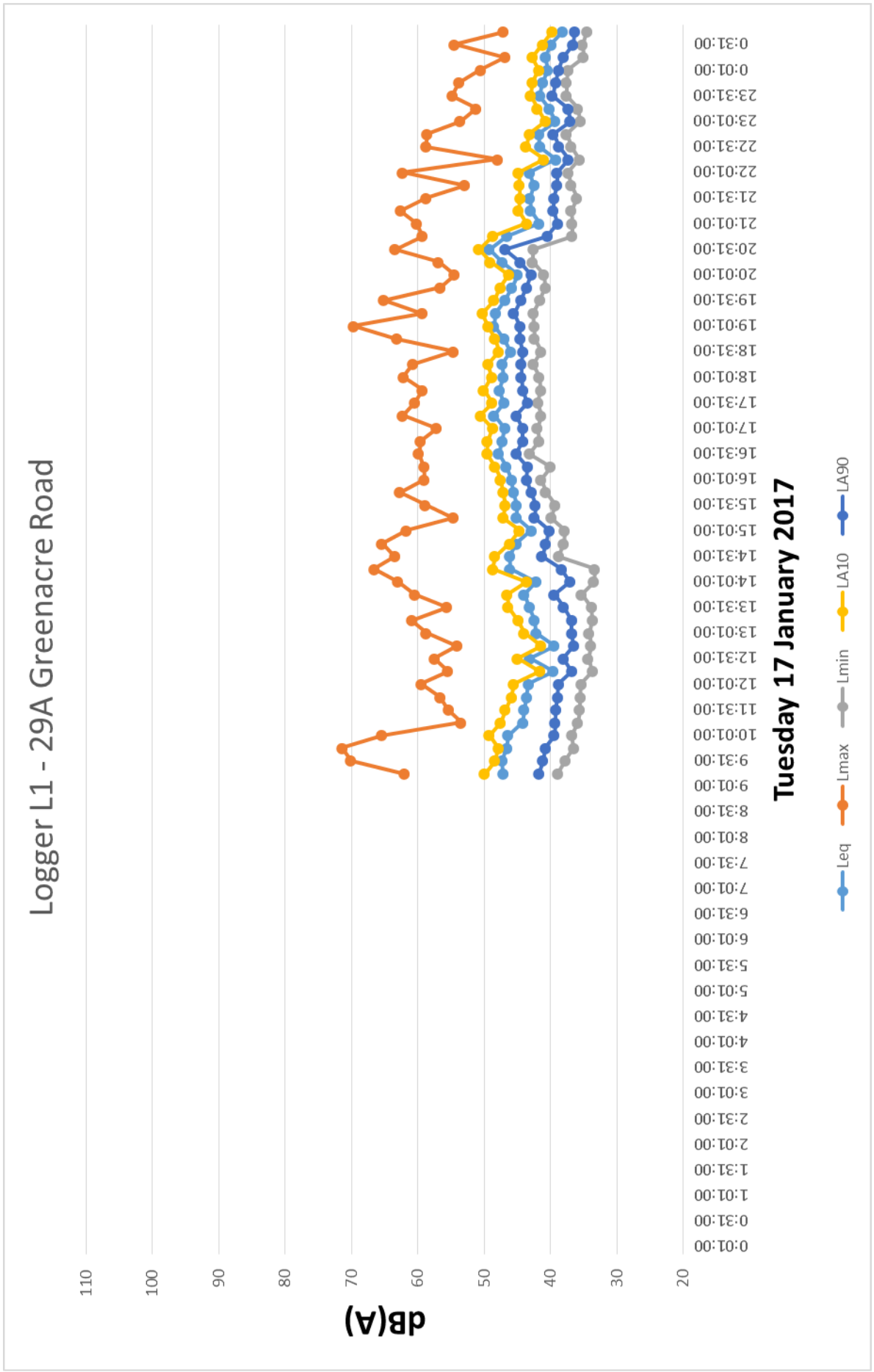
7. CONCLUSION

Noise criteria specified by the George River Council, more specifically Kogarah DCP 2013 Part D3 and NSW Industrial Noise Policy (INP) 2000 requirements pertaining to the environmental noise impact on the proposed development at 29A Greenacre Road, South Hurstville for the noise impact of the development at the nearest affected residence has been assessed. The noise impact of the various activities at the proposed school including the following activities has been addressed:

- Noise from students engaged in outdoors activities and sports activities
- Noise from Building Services including mechanical plants and air conditioning systems
- Noise from ingress and egress of vehicles, carpark and deliveries
- Use of the premises outside of normal school hours (if proposed) including sports activities.

The recommended noise mitigation management strategies including glazing, noise barriers and noise management strategies have been provided for the proposed school development to meet the criteria outlined in Kogarah DCP 2013 Part D3 and the NSW Industrial Noise Policy (INP) 2000. Detailed design of the building glazing, envelope and acoustic barriers will be provided during the design development phase.

8. APPENDIX 1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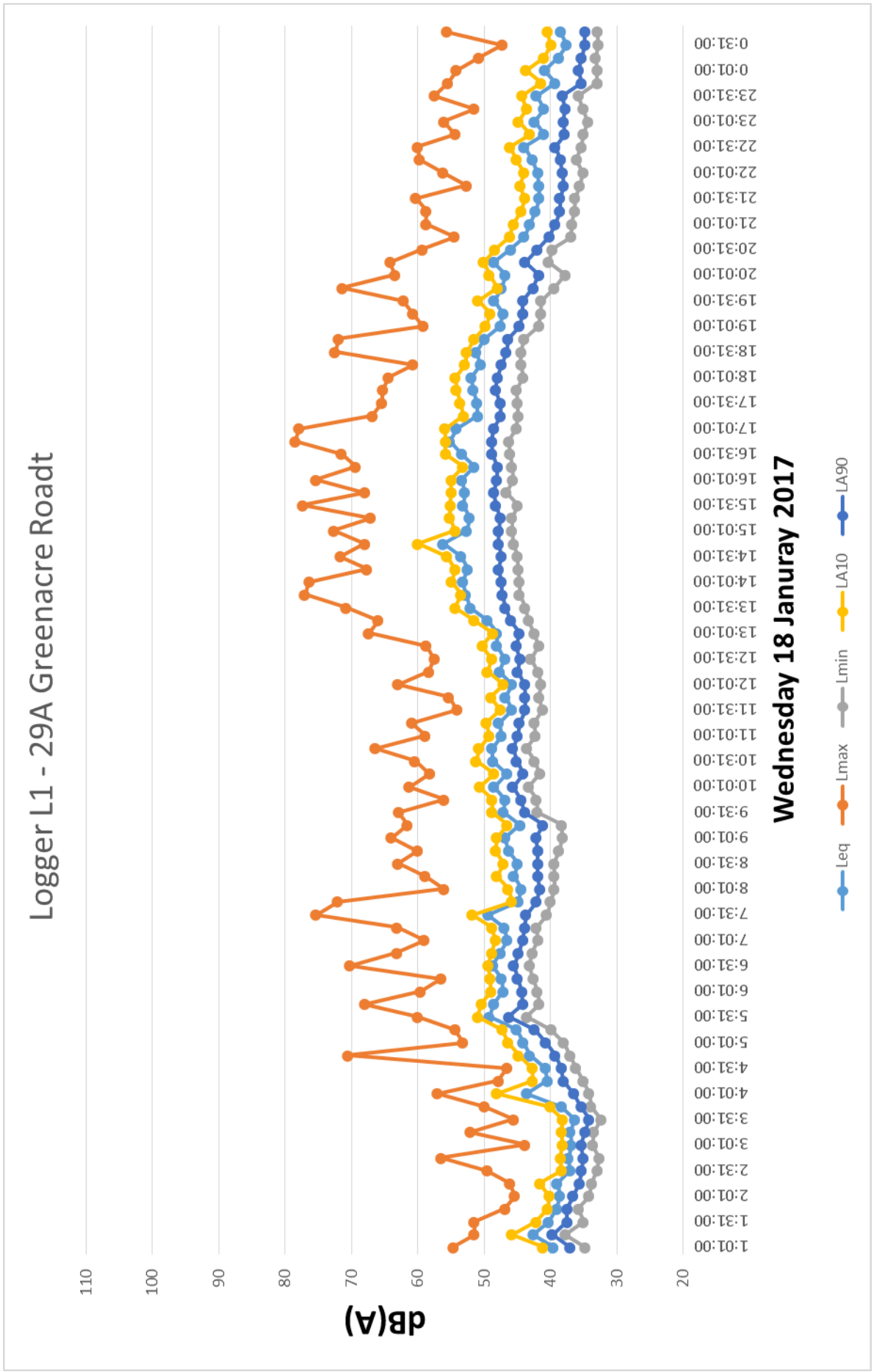
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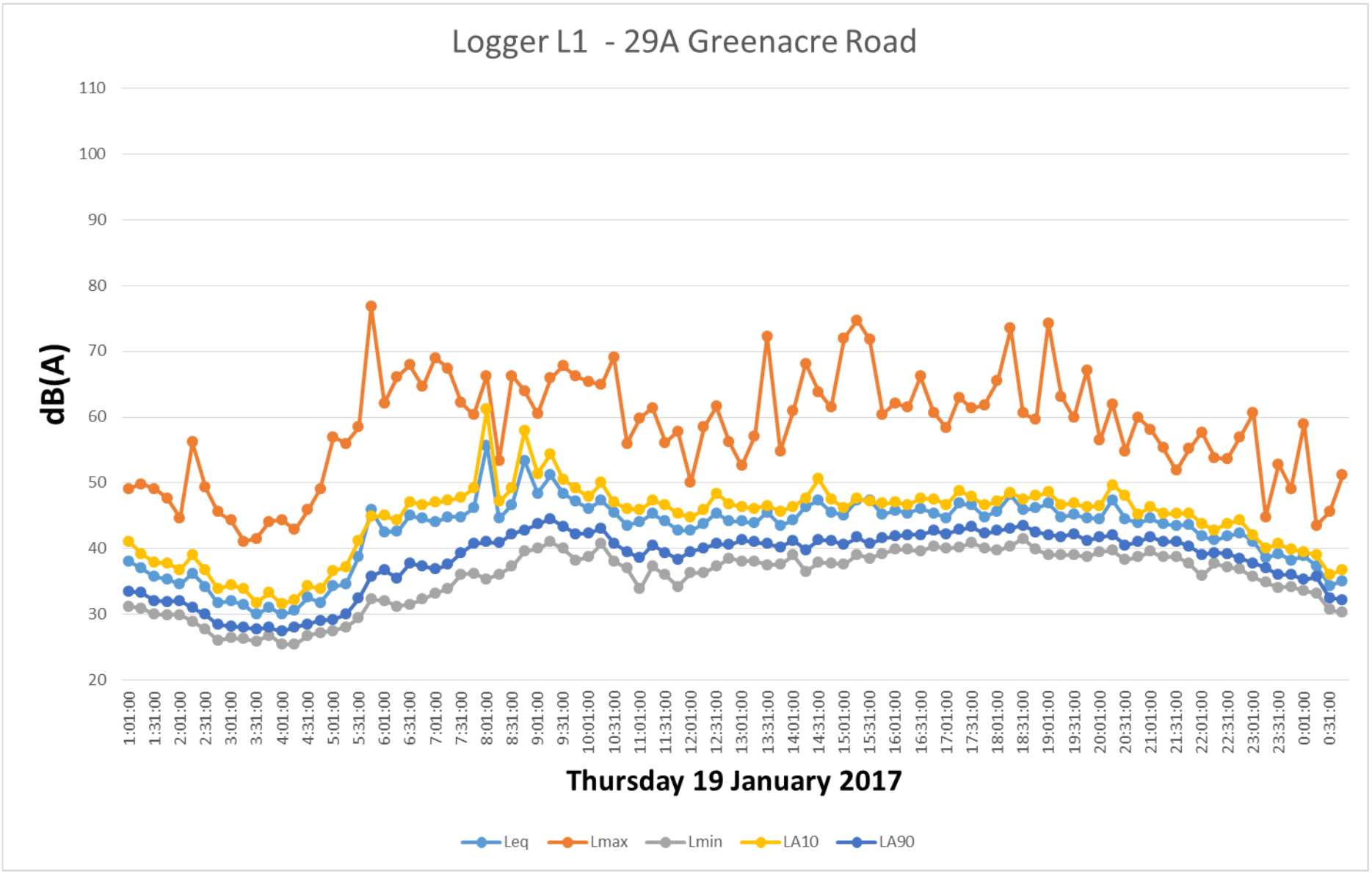
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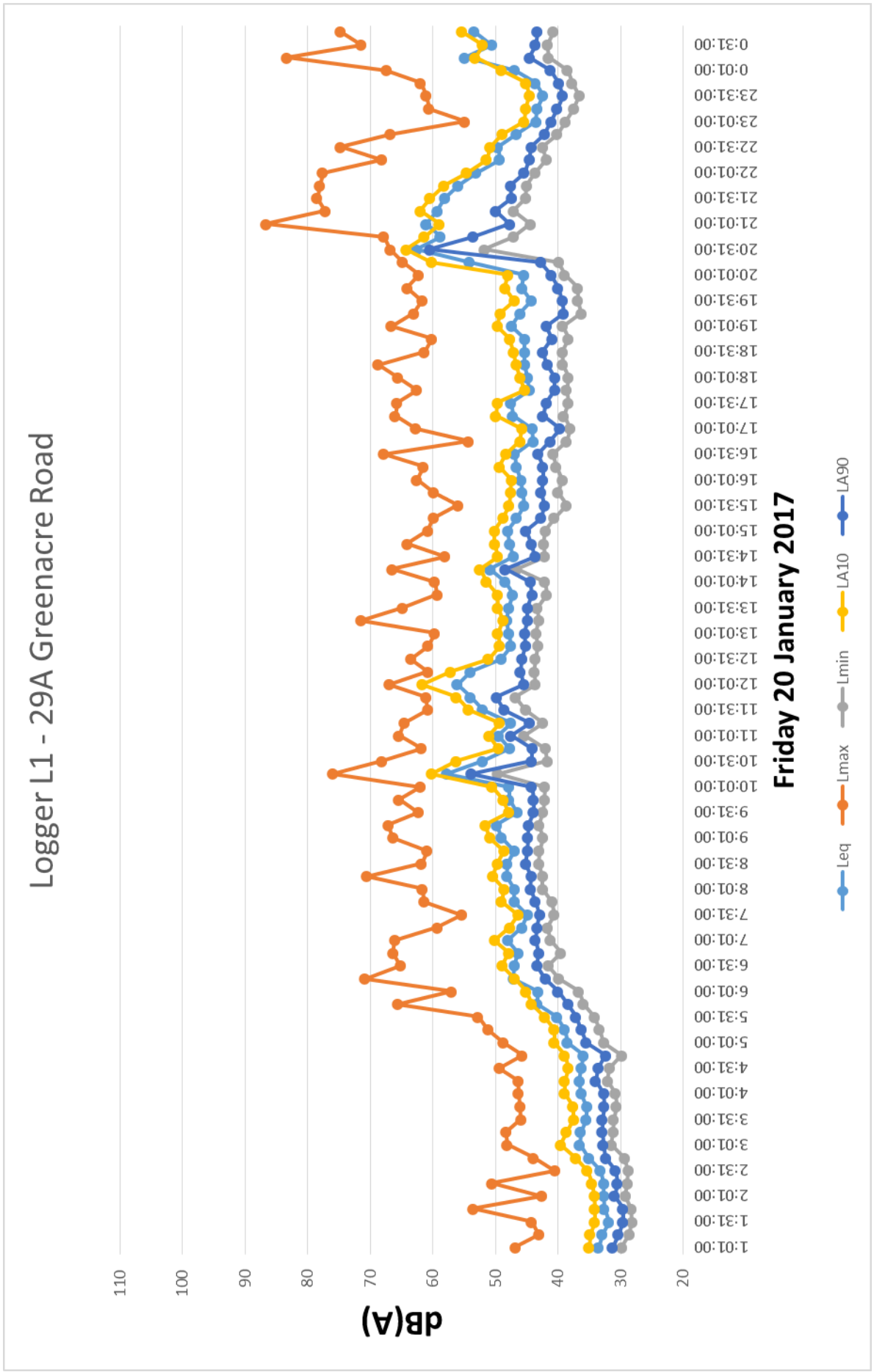
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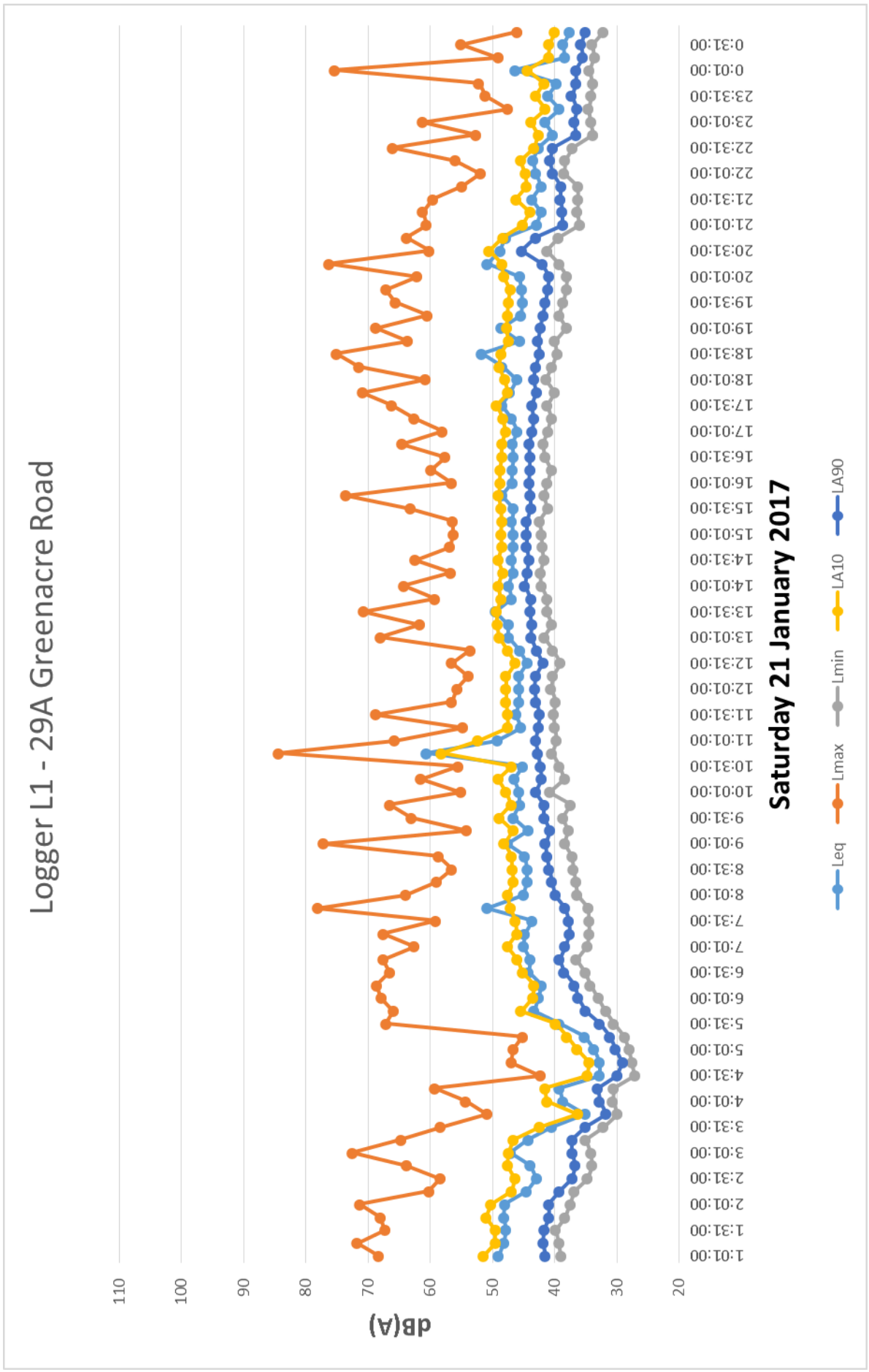
Logger L1 - 29A Greenacre Road
Saturday 21 January 2017
dB(A)
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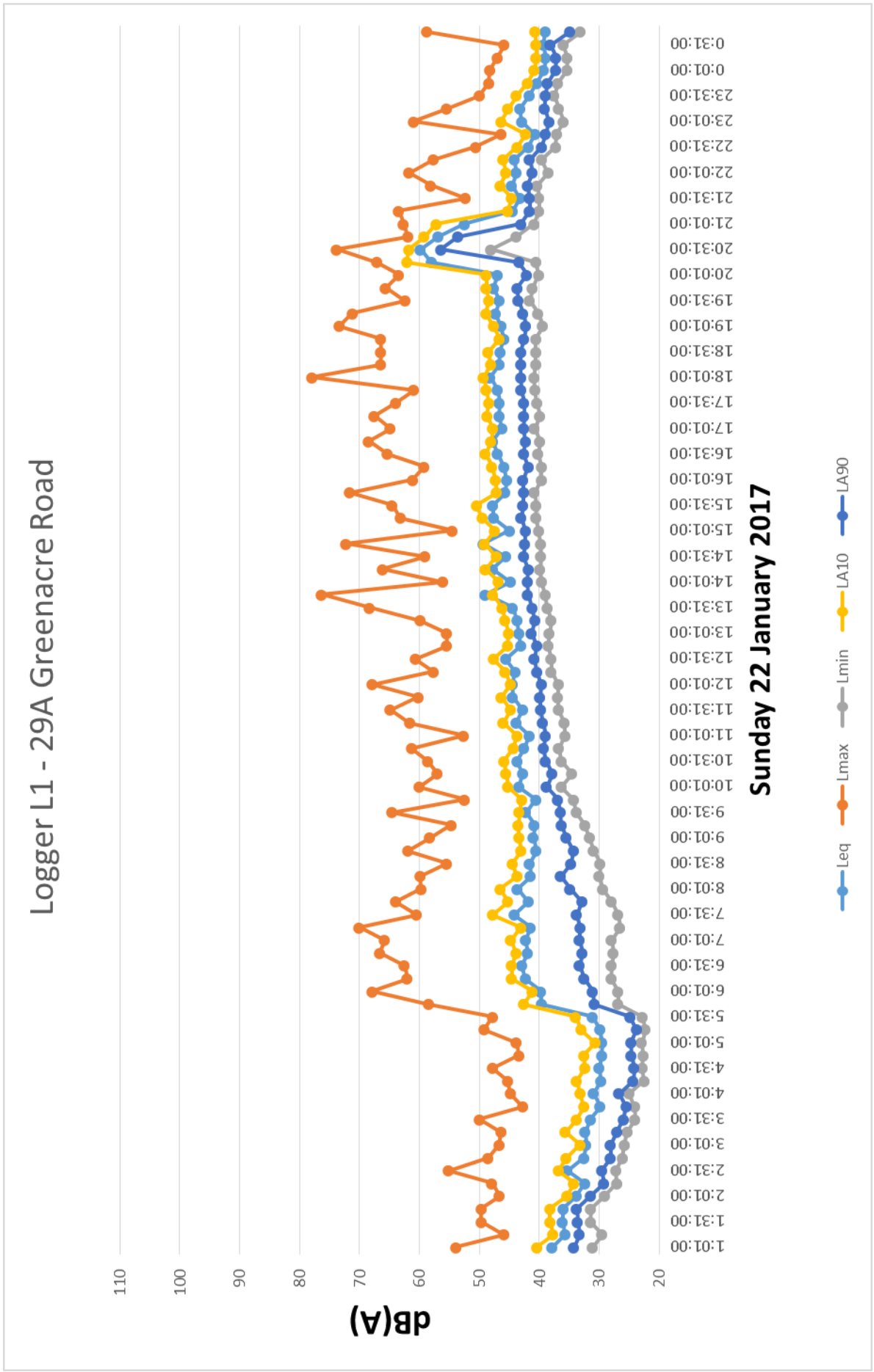
Logger L1 - 29A Greenacre Road
Sunday 22 January 2017
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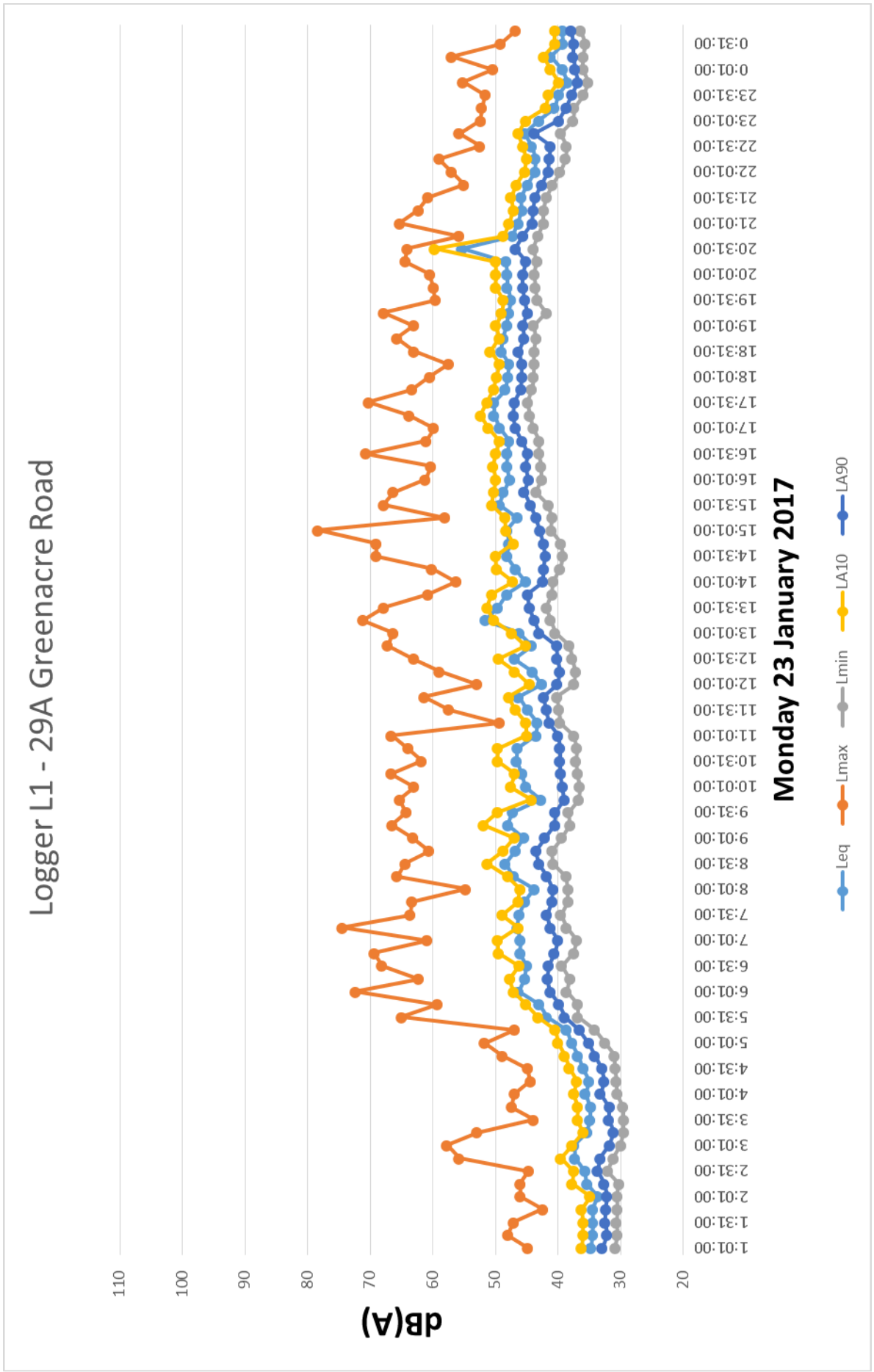
Logger L1 - 29A Greenacre Road
dB(A)
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Monday 23 January 2017
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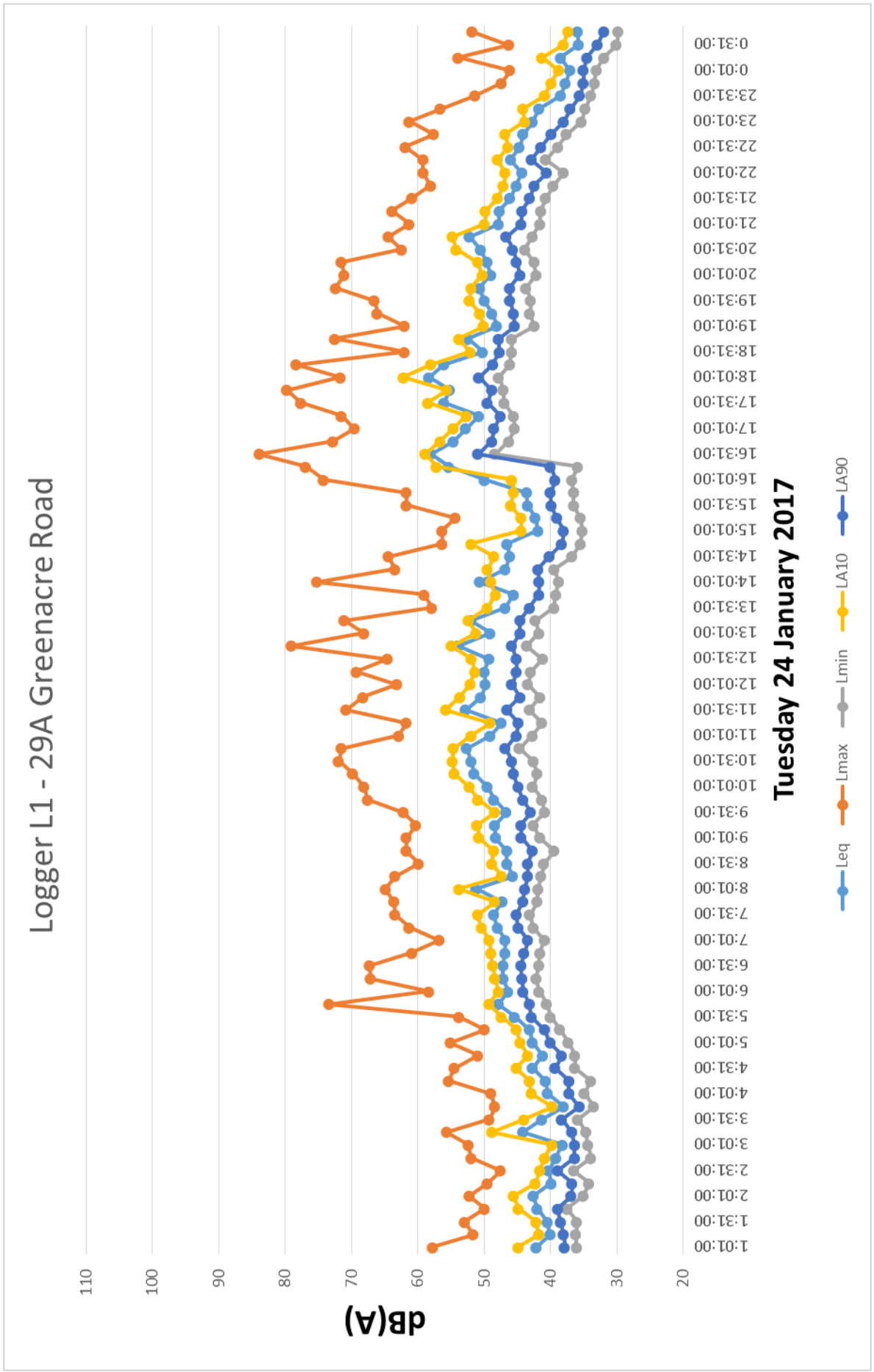
Logger L1 - 29A Greenacre Road
dB(A)
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Tuesday 24 January 2017
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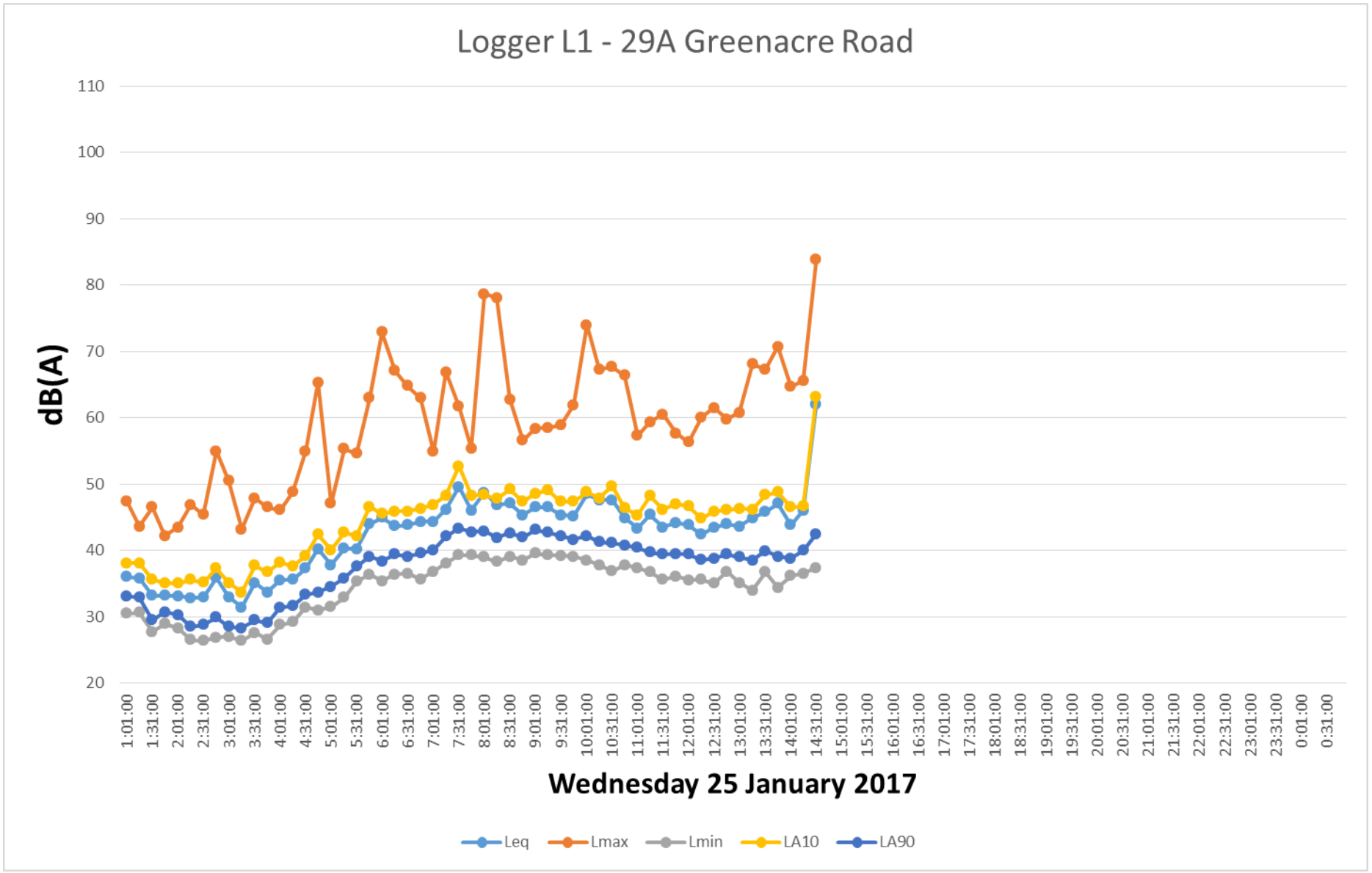
Logger L1 - 29A Greenacre Road
dB(A)
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Wednesday 25 January 2017
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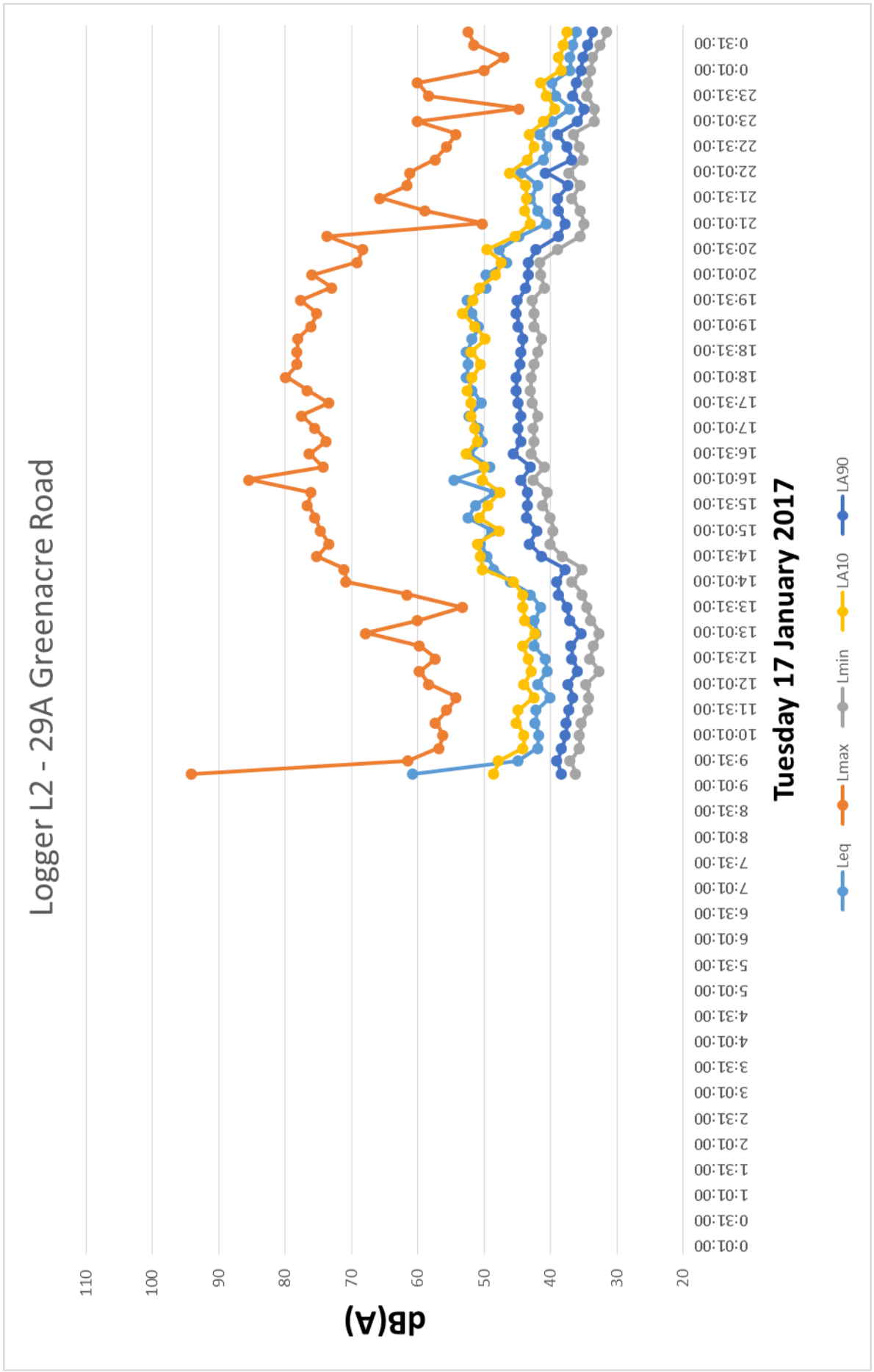
Logger L2 - 29A Greenacre Road
dB(A)
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Tuesday 17 January 2017
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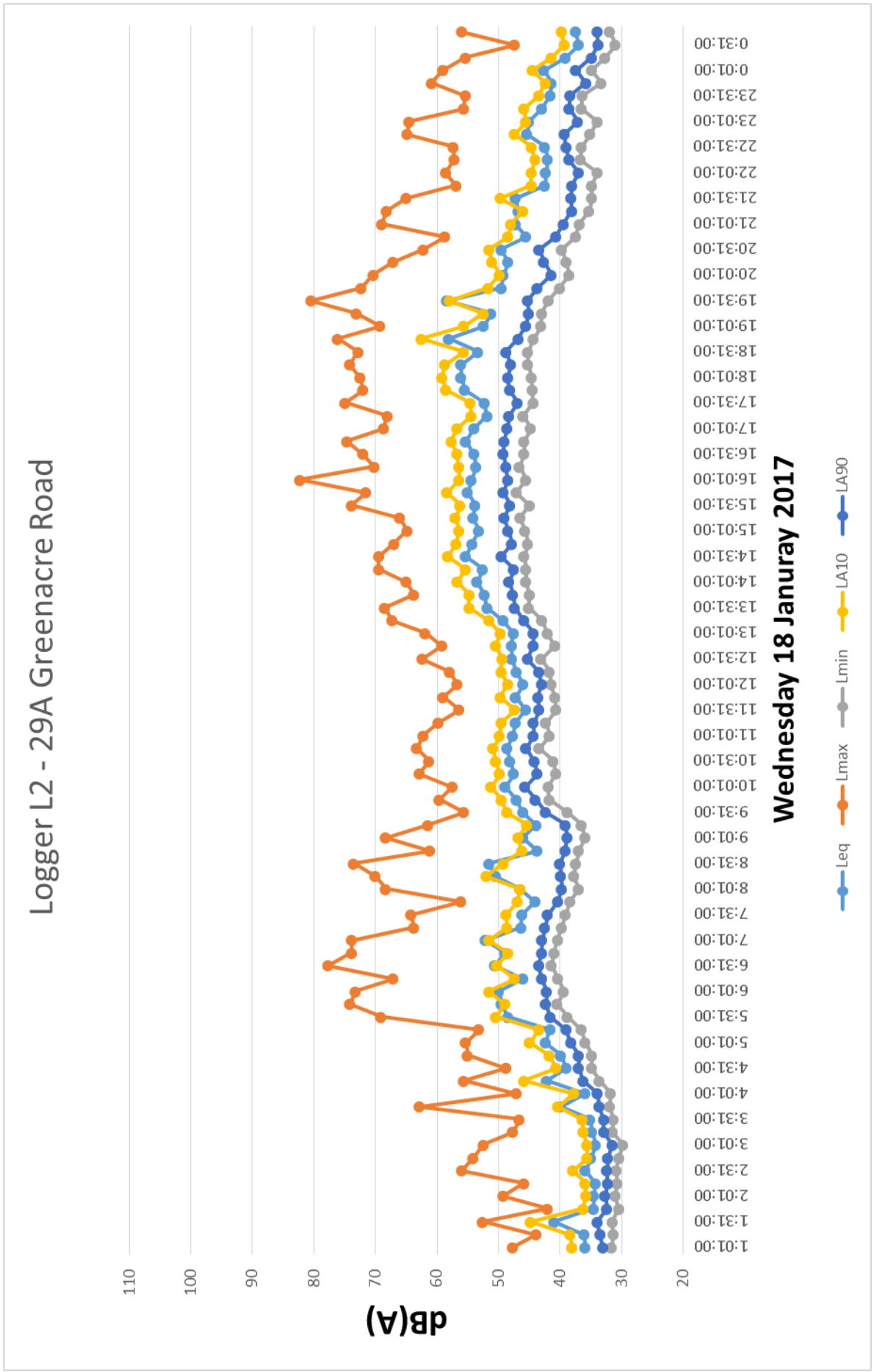
Logger L2 - 29A Greenacre Road
dB(A)
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Wednesday 18 Januray 2017
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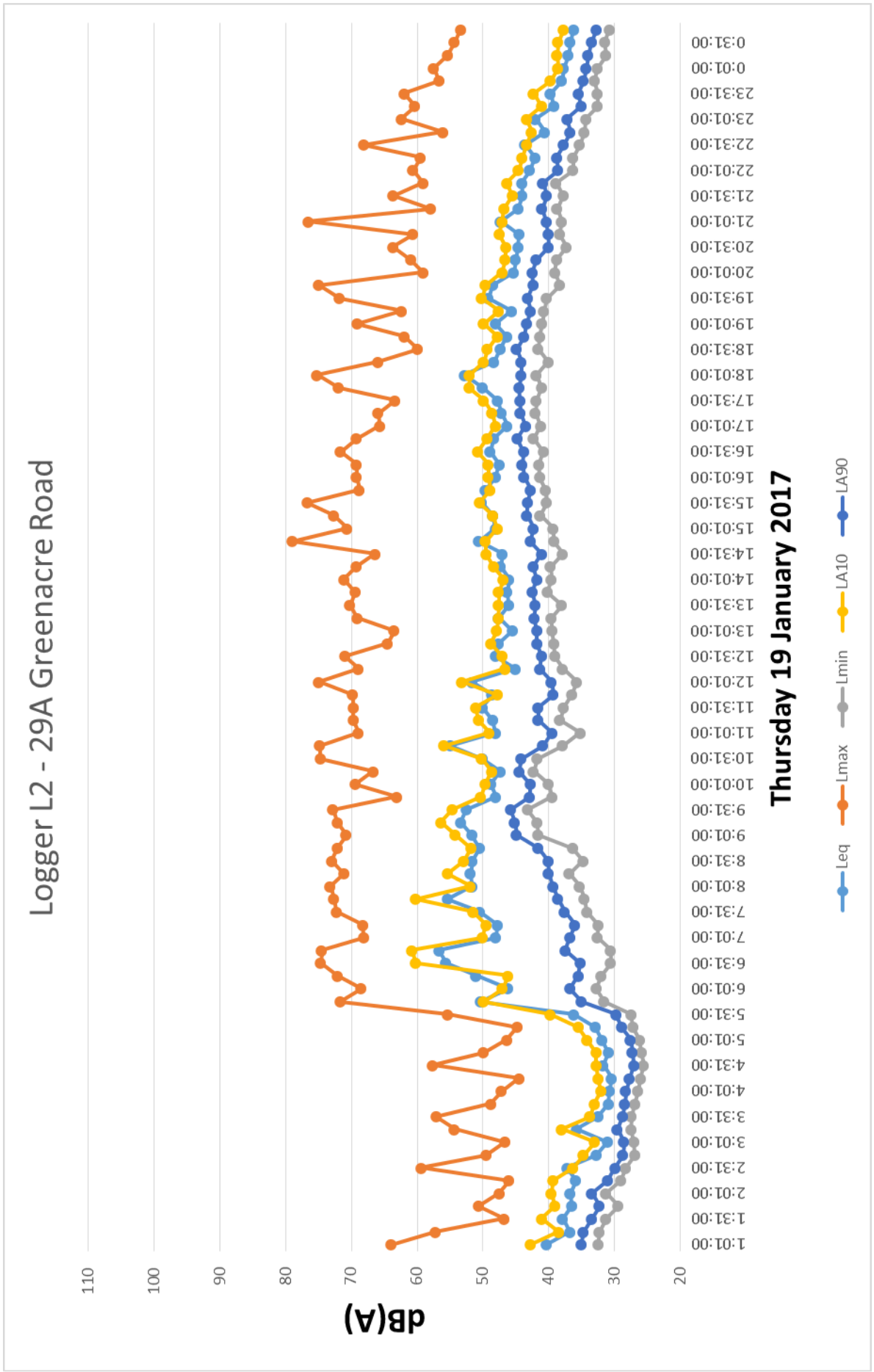
Logger L2 - 29A Greenacre Road
dB(A)
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Leq
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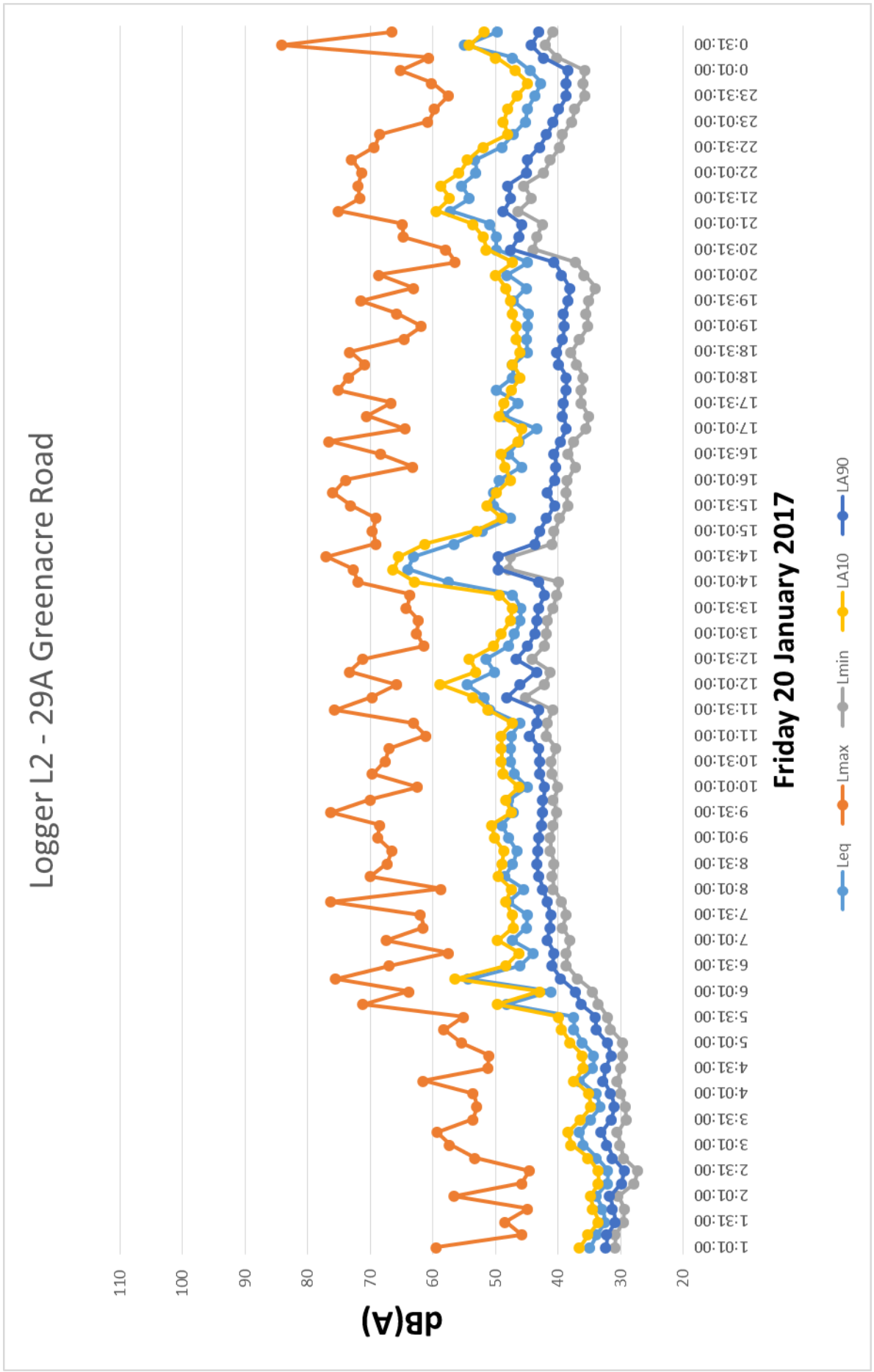
Logger L2 - 29A Greenacre Road
dB(A)
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Friday 20 January 2017
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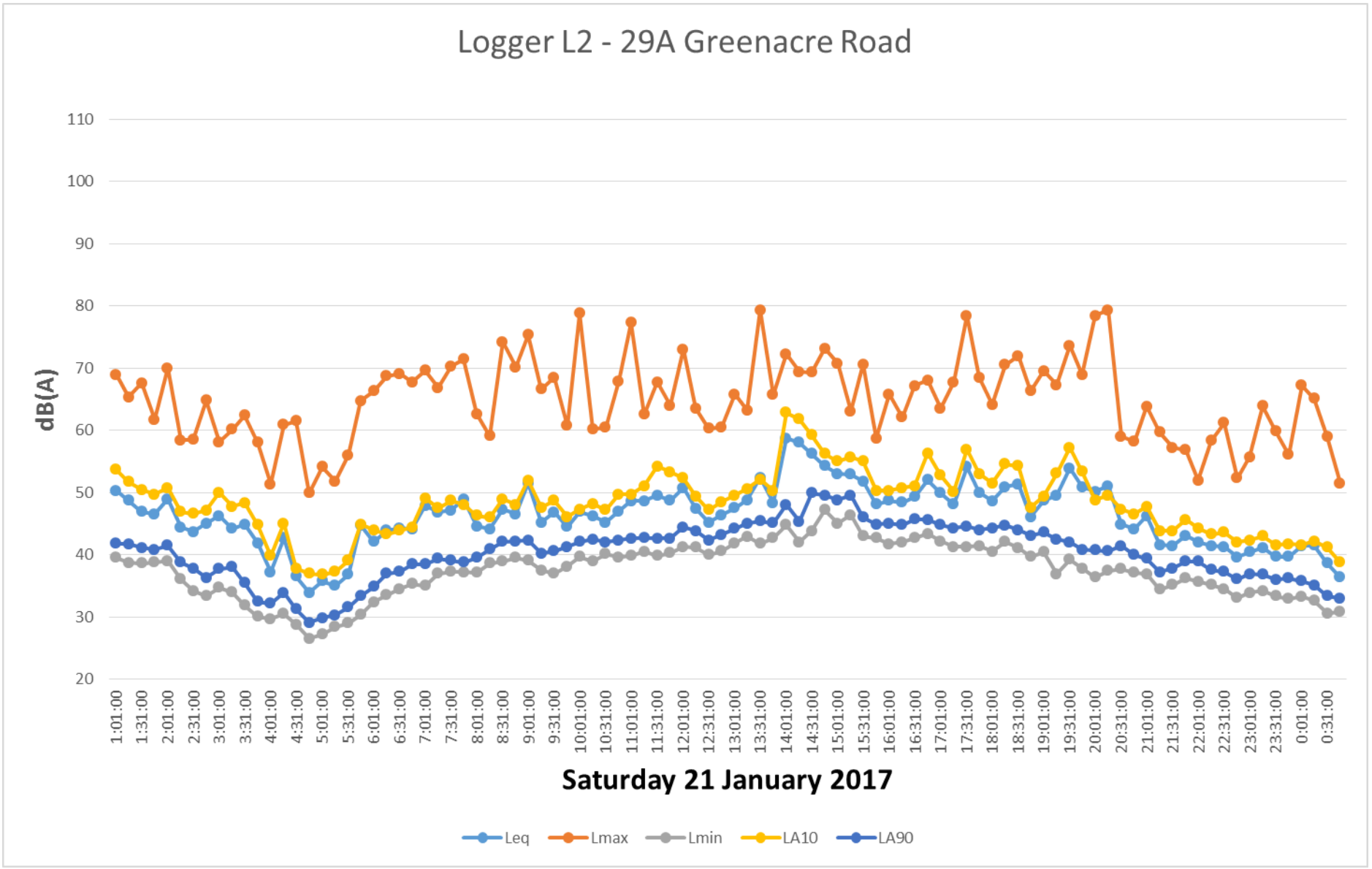
Logger L2 - 29A Greenacre Road
dB(A)
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Saturday 21 January 2017
Leq
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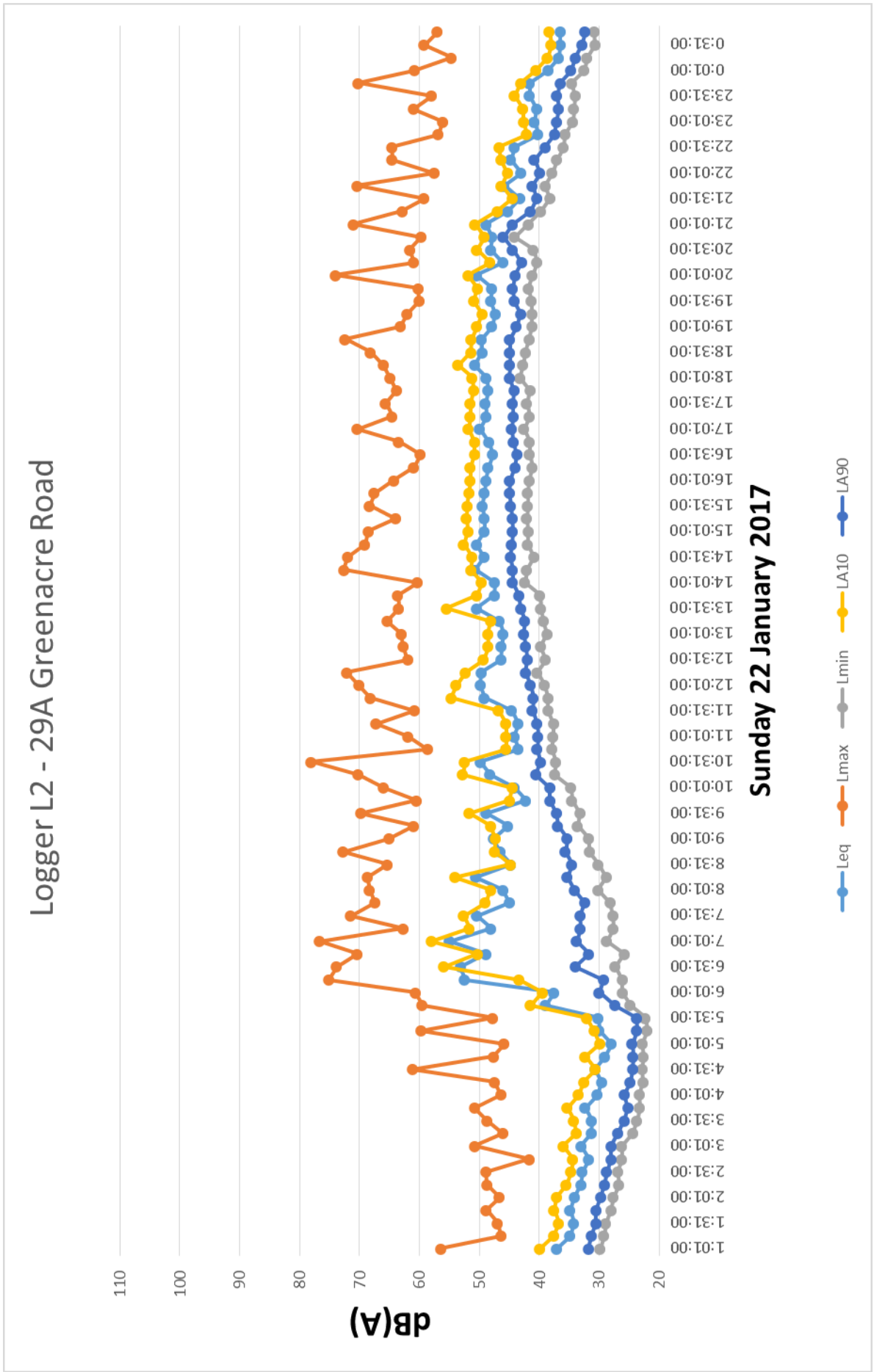
Logger L2 - 29A Greenacre Road
dB(A)
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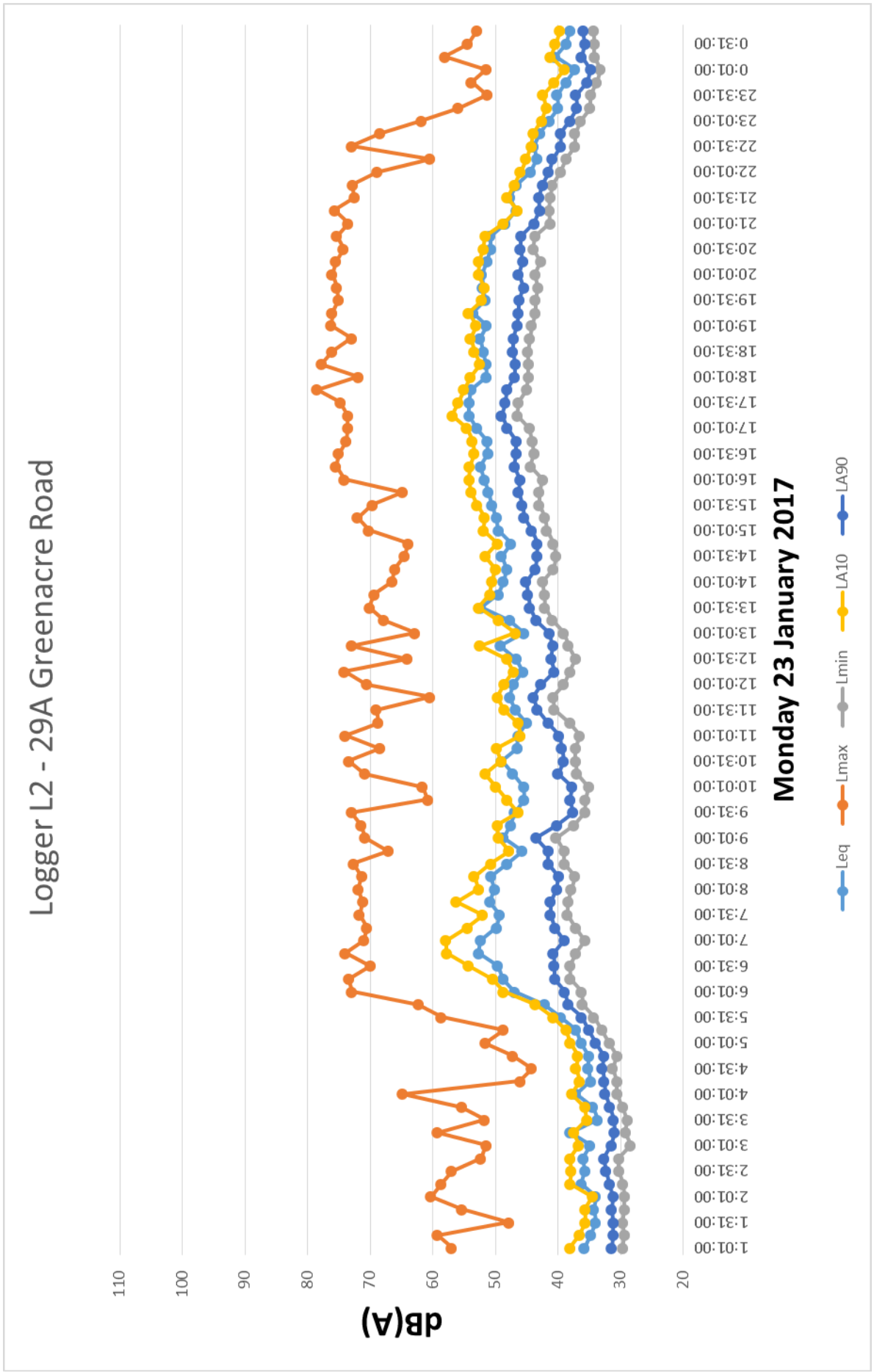
Sunday 22 January 2017
Leq
Lmax
Lmin
LA10
LA90


Logger L2 - 29A Greenacre Road
dB(A)
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Monday 23 January 2017
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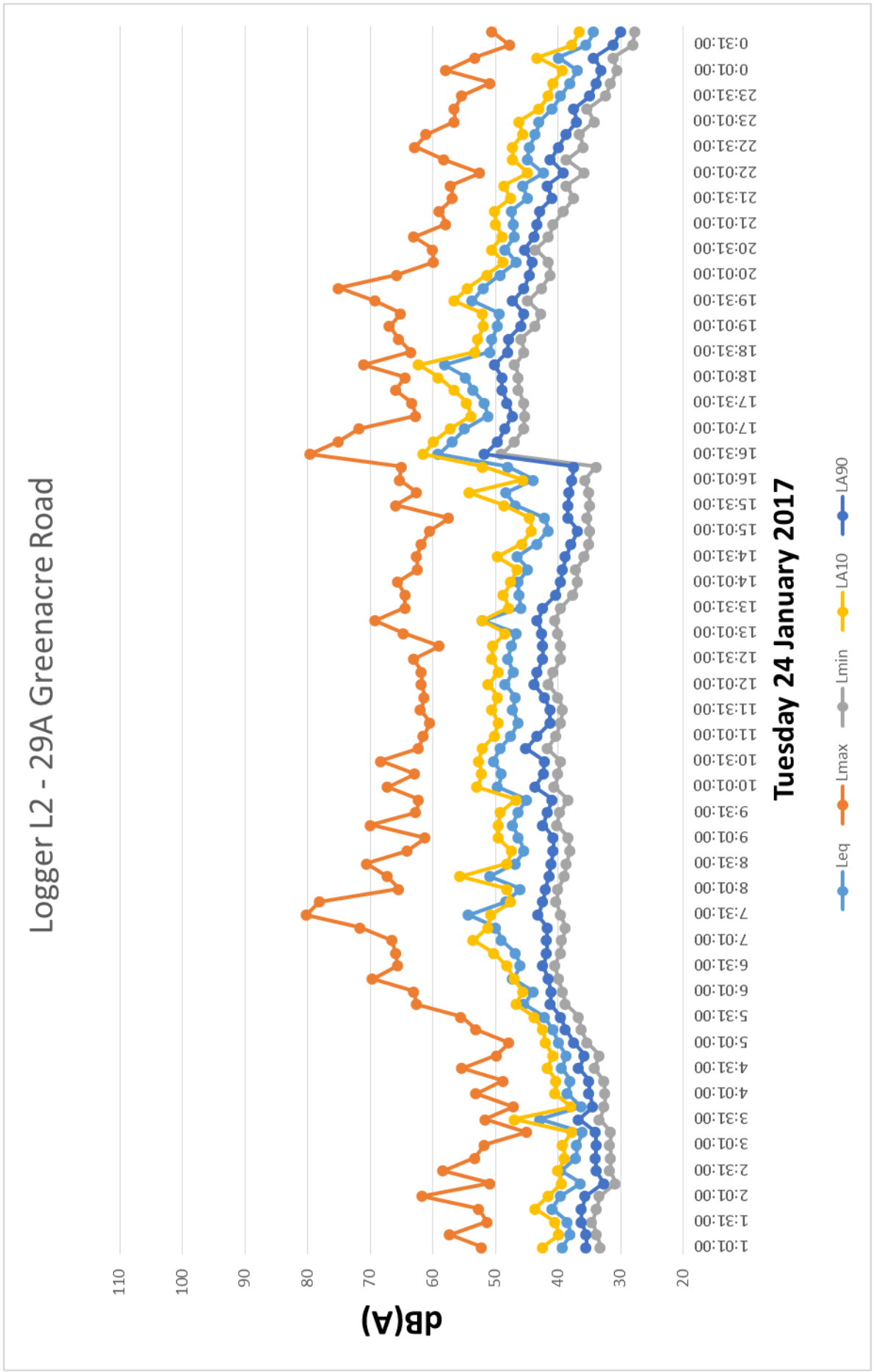
Logger L2 - 29A Greenacre Road
dB(A)
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Tuesday 24 January 2017
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Leq
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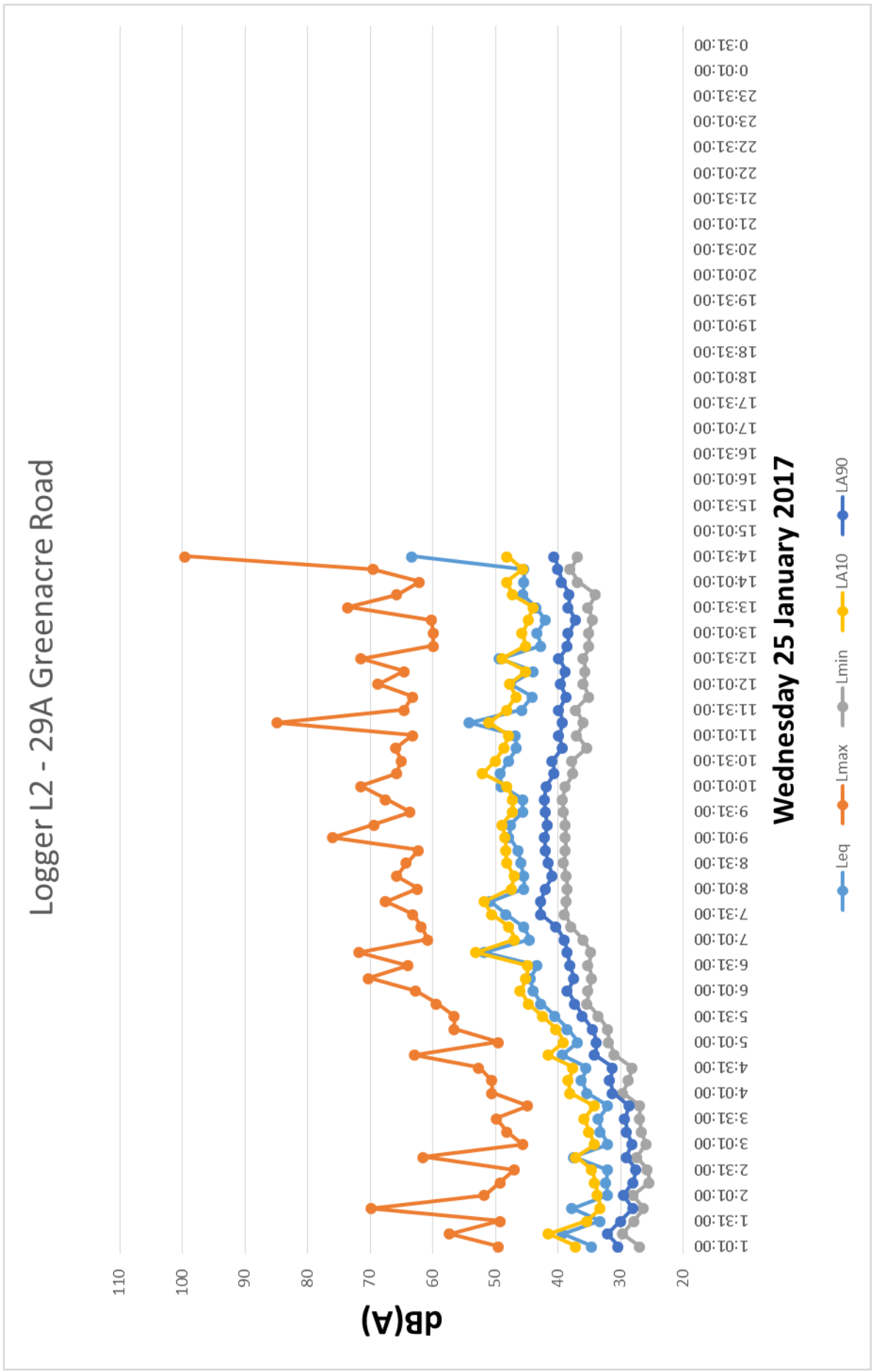
Logger L2 - 29A Greenacre Road
Wednesday 25 January 2017
dB(A)
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9. APPENDIX 2

Appendix 2 presents the principles of barrier sound attenuation. The following show various degrees of attenuation based on the height of the barrier. The height of the barrier is the single most important determining factor for sound attenuation (the higher the barrier, the better the attenuation). The composition of the barrier material is less important, as the sound diffraction over the barrier is the determining factor.

The following 4 models exemplify a typical bus passing and resulting attenuation levels with various barrier heights, at constant distance.

As a conclusion we recommend a minimum height of 2.1m, and 2.4m in sensitive areas. The construction can be a colourbond fence, with all gaps sealed, including the bottom of the fence with the ground.

Results are shown in table below, and the figure is the calculation of a fence with height of 1m.

Barrier height - metres	Source SWL – dB(A)	Measured SPL at receiver – dB(A)
1	85	62.7
1.8	85	50.7
2.1	85	47.6
2.4	85	45.3