Northern Beaches Hospital

Stage 1: Concept Design, Site Clearance & Preparatory Works

Appendix K

Noise Assessment

Northern Beaches Hospital

Site Vegetation Clearing - Acoustic Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy has been engaged to conduct a review of potential noise and vibration generation created as a result of vegetation clearing works prior to the commencement of primary building works at the Northern Beaches Hospital, Frenchs Forest.

In this report we will:

- Identify noise sensitive development in the vicinity of the site.
- Undertake a review of ambient noise conditions at the site.
- Determine noise/vibration emission goals for the works based on EPA Construction Noise Guidelines.
- Identify typical noise sources associated with the works and predict noise emissions at nearby sensitive development.
- Determine noise management strategies for the works.

2 SITE DESCRIPTION AND PROPOSED WORKS

The Northern Beaches Hospital development will be located on the corner of Warringah Road and the Wakehurst Parkway, Frenchs Forest.

The site is bounded as follows:

- To the north by Frenchs Forest Road West, which carries low-medium traffic volumes. Further to the north, on the opposite side of Frenchs Forest Road West is a mixture of one a two storey residential development.
- To the south by Warringah Road, which carries high traffic volumes. Further to the south, on the opposite side of Warringah Road is a mixture of one a two storey residential development.
- To the west by Frenchs Forest High School. We note that there is a two storey classroom building in the north-eastern corner of the school grounds, approximately 25m from the site bound with the hospital.
- To the east by Wakehurst Parkway, which carries high volumes of traffic.

The Northern Beaches Hospital site was divided into nine sectors for the purpose of the ecology survey design as shown in the aerial photograph below. This division has been adopted for this investigation as it is considered useful for assessment and management of noise and vibration impacts.

Clearing of vegetation and other activities is expected to take 2-3 months. A list of likely equipment is presented in section 5.

See aerial photograph below.


Frenchs Forest Road West
Potentially affected classroom building
Frenchs Forest High School
Bantry Bay Road
Wakehurst Parkway
Noise Logger A
Noise Logger B
Karingal Crescent
Warringah Road
Site
Bantry Bay Road
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 7
Zone 8
Frenchs Forest Rd West
Warringah Rd
Karingal Cres
Akora St
Primrose Ave
A38

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

4 SURVEY OF EXISTING AMBIENT NOISE

Both long term unattended noise logging, and attended noise measurements were conducted to quantify the existing acoustic environmental at the site.

Unattended noise monitoring was conducted between 2 and 9 July 2013 using an Acoustic Research Laboratories monitor set on A-weighted fast response mode. The monitor was calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded.

Two monitors were installed (refer to aerial photograph):

- One monitor ("Logger A") was installed next to the school building nearest the Hospital site. Noise levels at this logger will be indicative of ambient noise levels at the Frenchs Forest School and at the residential development on Frenchs Forest Road, to the north of the site.

- A second monitor (Logger B") was installed on the school property boundary, towards the southern end of the site. Noise levels at this logger will be indicative of ambient noise levels on Warringah Road.

In addition, attended measurements of average road traffic noise levels were made both on Warringah Road and Frenchs Forest Road West. These measurements were made using a Norsonic 140 Type 1 sound meter set on A-weighted fast response mode.

Measured noise levels are presented below.

Table 1 – Measured Background Noise Levels

Location	**Daytime Noise Levels (7am-6pm)**	
	Background Noise Level - dB(A)L_{90}	Average (Road Traffic) Noise Level (at residential property boundary) - dB(A)$L_{eq(15min)}$
Logger A (School/Frenchs Forest Road)	52	69
Logger B (Warringah Road)	44	64

5 ACOUSTIC CRITERIA

Given the scale of the proposed works and the proximity of noise sensitive development, the "quantitative" assessment procedure, as outlined in the Interim Construction Noise Guideline (INCG) will be used (as opposed to the more simple "qualitative" assessment method outlined in the Guidelines).

The quantitative assessment method requires:

- Determination of noise generation goals (based on ambient noise monitoring).
- Prediction of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission goals is not possible.

5.1 NOISE GOALS

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.
- "*Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary is presented below.

Table 2 – Noise Emission Goals
(Standard Hours – 7am-6pm weekdays, 8am-1pm Saturdays)

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residences – Frenchs Forest Road	62	75
Residences – Warringah Road	54	75
Frenchs Forest School - Classroom	45 (measured inside a classroom)	N/A
Frenchs Forest School - Playground	65	N/A

5.2 VIBRATION

Site clearing works are unlikely to create vibration with the potential for building damage.

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline.* These levels are presented below:

Table 3 – Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
Schools	When in use	0.56	1.12
Impulsive Vibration			
Residences	Daytime	8.6	17
Schools	When in use	18	36

6 ASSESSMENT/RECOMMENDATIONS

6.1 ASSESSMENT OF NOISE GENERATION

No significant vibration impacts are predicted as a result of the proposed works. It is only airborne noise impacts which are predicted to impact nearby properties.

Anticipated equipment to be used is set out below. In addition, the typical sound power (ie – the noise level at zero metres distance) created by each item will also be presented.

Table 4 – Equipment Sound Power Levels

Equipment Item	Sound Power Level – dB(A)$L_{eq(15min)}$
Backhoe	105
Chainsaw	115
Woodchipper	115
Front-End loader	105
4WD Truck	95

The majority of vegetation clearing is proposed to be done using a backhoe/bulldozer. It is only for larger trees where a backhoe cannot be used that chainsaws will be used.

Given the size of the site, noise levels at nearby developments will vary greatly depending on where the work is undertaken. A summary of work activity areas and predicted noise level at nearby receivers is set out in table 5, below. The predictions in table 5 are based on the assumption that there is *no* acoustic treatment/management undertaken.

Predictions are made at the following locations:

- For the school – the predictions are made *inside* the classroom nearest the property boundary with the Hospital (windows assumed to be open).
- For residential properties – the predictions is made at the property boundary of the residential dwelling.

Predicted levels are as follows:

Table 5 – Predicted Noise Levels

Noise Receiver Location	Work Area	Noise Source	Predicted Noise Level – dB(A)$L_{eq(15min)}$	Noise Emission Goal – dB(A)$L_{eq(15min)}$
School Classroom (internal level)	Zone 1 and 2	Chipper/Chainsaw Backhoe/Front-end loaders	55-67 45-57	45
	Zones 3, 4, 5	Chipper/Chainsaw Backhoe/Front-end loaders	50-55 40-45	45
School Playground	Zone 1, 2, 3	Chipper/Chainsaw Backhoe/Front-end loaders	65-85 55-75	65
	Zones 4, 5, 6	Chipper/Chainsaw Backhoe/Front-end loaders	40-65 30-55	65
Residences – Frenchs Forest Road	Zones 1, 4, 7	Chipper/Chainsaw Backhoe/Front-end loaders	65-80 55-70	54
	Zones 2, 5, 8	Chipper/Chainsaw Backhoe/Front-end loaders	55-65 45-55	54
Residences – South of Warringah Road (Karingal Crescent and Banrty Bay Road)	Zones 3, 6	Chipper/Chainsaw Backhoe/Front-end loaders	66-76 56-66	62
	Zones 2, 5, 8, 9	Chipper/Chainsaw Backhoe/Front-end loaders	58-66 48-56	62

Comments:

- Noise impact on classroom (nearest to eastern property boundary of school):
    - When working close to the property boundary (Zones 1 and 2) - Without acoustic treatment, noise levels in classrooms (windows open) are predicted to be 55-67dB(A) when using the chipper/chainsaw and 45-57 when using the backhoe, exceeding the target of 45dB(A).
    - When working further away from the boundary (zones 3-9) noise emissions are predicted to be 50-55dB(A) when using chainsaws or woodchippers. Compliant levels are expected when using dozers/front end loaders.
    - Potential acoustic treatments:
        - If the windows to the classrooms are closed, noise levels in the classroom are likely to be 45-55dB(A) in the classroom during use of the wood chipper/chainsaw and 35-45dB(A) from the dozer.
        - Through use of a noise screen (say, on the school property boundary), noise levels can be reduced approximately 7dB(A) for ground floor class rooms, and 3-5dB(A) on the upper floor.

  - By keeping the classroom windows closed and using a noise screen, noise levels of approximately 45-50dB(A) can be achieved inside the classrooms during use of the chainsaw/wood chipper.

- Noise impact on the school playground:
  - When working close to the property boundary (Zones 1, 2 and 3) - Without acoustic treatment, noise levels in playground are predicted to be 65-85dB(A) when using the chipper/chainsaw and 55-75dB(A) when using the backhoe, exceeding the target of 65dB(A).
  - Through use of a noise screen along the playground property boundary, noise levels of 60-80dB(A) are predicted in the playground.
  - When working further away from the boundary (zones 4-9) noise emissions are predicted to be compliant with the 65B(A) noise emission goal.
- Noise impact on the Frenchs Forest Road West residences:
  - When working close to the northern property boundary (Zones 1, 4 and 7) - Without acoustic treatment, noise levels at the residential property boundary are predicted to be 65-80dB(A) when using the chipper/chainsaw and 55-70dB(A) when using the backhoe, exceeding the target of 54dB(A).
  - When working further away from the boundary (zones 2, 5, 6) noise emissions are predicted to be 55-65dB(A)L_{eq} when using the woodchipper/chainsaw and 45-55dB(A) when using the backhoe/front end loader. Although higher than the 54dB(A) noise goal, this level is similar to the existing traffic noise level created on Frenchs Forest Road West.
- Noise impact on residences south of Warringah Road (on Karingal Crescent and Bantry Bay Road):
  - When working close to the southern property boundary (Zones 3 and 6) - Without acoustic treatment, noise levels residential property boundary are predicted to be 66-76dB(A) when using the chipper/chainsaw and 56-66dB(A) when using the backhoe, intermittently the target of 62dB(A).
  - When working further away from the boundary (zones 2, 5, 6) noise emissions are predicted to be less than 66dB(A)L_{eq}. Although marginally exceeding the 62dB(A) noise goal, this would still be similar in noise level (or quieter) and the noise level created by traffic on Warringah Road.

6.2 RECOMMENDATIONS

A number of noise mitigation strategies are outlined below.

Given the size of the site and the fact that the school classroom building and a number of residential properties are double storey, the potential acoustic benefit provided by noise screens is limited (as the screen would become impractically high to provide benefit to the first floor windows).

The most potential acoustic benefit will be achieved through careful scheduling of works in critical areas (ie when close to residential and school property boundaries). However, excessive use of respite periods should be avoided as this will simply result in prolonging the duration of the works.

Given the above – feasible and practicable strategies to minimise acoustic impacts include:

- Woodchipper:
    - Location of wood chipper as far as practicable from the School or residential properties. Zones 5, 8 or 9 would be ideal.
    - If located in zones 1, 2, 4 or 7 – localised noise screens are recommended around the northern and eastern side of the chipper (2.5m high plywood screen or similar).
- Use of chainsaws:
    - Chainsaws are only proposed to be used for larger trees that cannot be removed using a back hoe.
    - Use of chain saws is not recommended to be done during school hours in zones 1, 2.
    - If the school is prepared to close windows to classrooms, use of chainsaws in other zones during school hours would result in noise levels of less than 45dB(A) in classrooms, and would be acceptable.
    - If closing of classroom windows is not acceptable, use of chainsaws during school hours is recommended to be limited to zones 5-9.
    - Prior to 8.30am, use of chainsaws or the woodchipper in zones 1, 4, and 7 is not recommended to protect the amenity residences on Frenchs Forest Road North.
    - Prior to 8.00am, use of chainsaws or the woodchipper in zones 3, 6 is not recommended to protect the amenity residences on Warringah Road (given the higher ambient/traffic noise levels on Warringah Road compared to Frenchs Forest Road West).
- Use of backhoe/dozer/front end loader:
    - Use of the backhoe/dozer/front end loader in zones 1 and 2 is not recommended unless classroom windows are closed.

- Prior to 8.00am, use of backhoe/front end loaded in zones 1, 4, and 7 is not recommended to protect the amenity residences on Frenchs Forest Road North.

7 CONCLUSION

This report provides the results of an assessment of noise and vibration from the proposed vegetation clearing works at the Northern Beaches Hospital development.

Noise and vibration generation have been assessed with reference to applicable EPA acoustic guidelines.

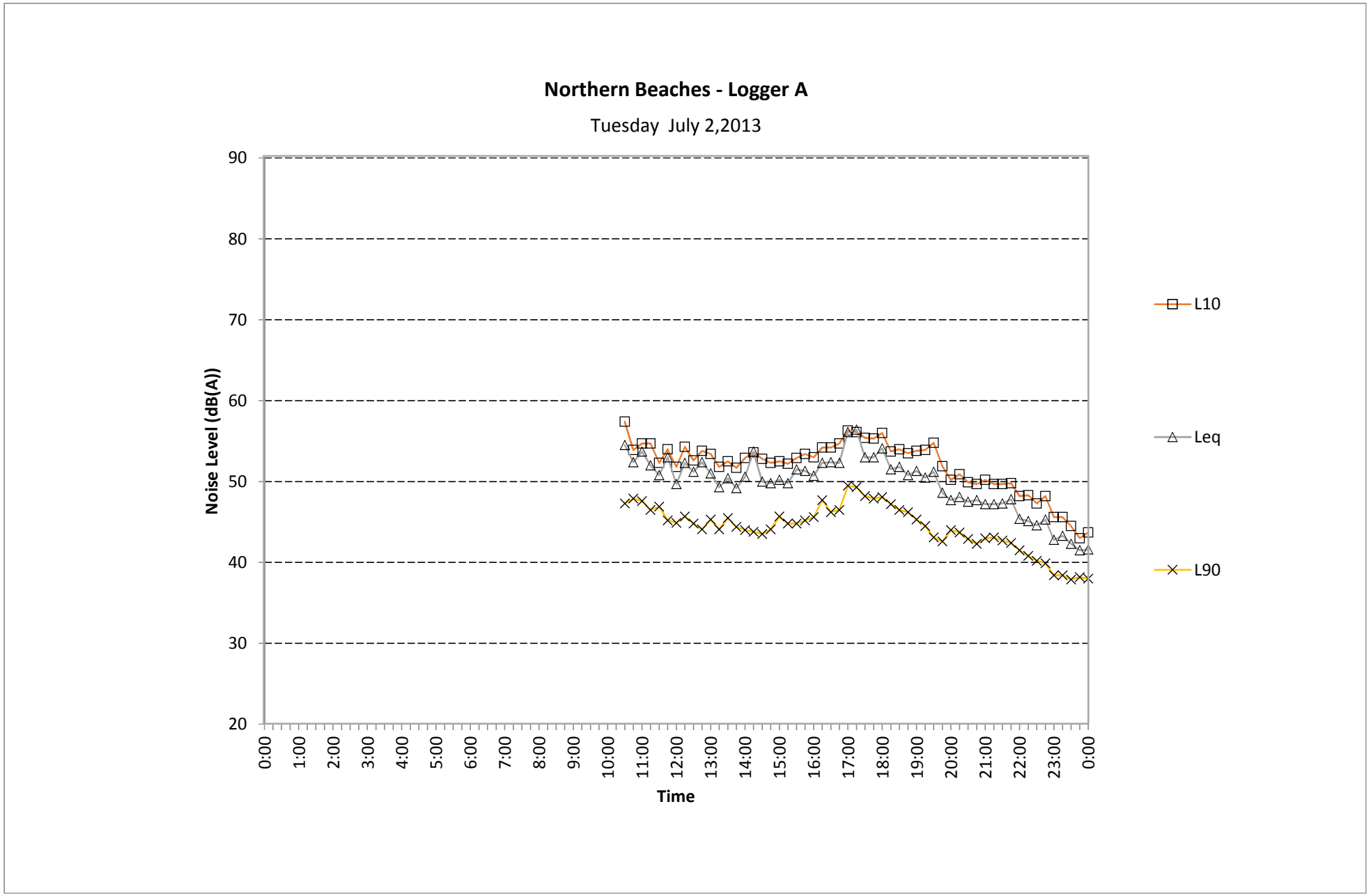
Provided that the recommendations set out in section 6 of this report are adopted, noise and vibration impacts will be mitigated as much as practicable.

Report prepared by

ACOUSTIC LOGIC CONSULTANCY PTY LTD
Thomas Taylor

Appendix 1

Noise Monitoring Data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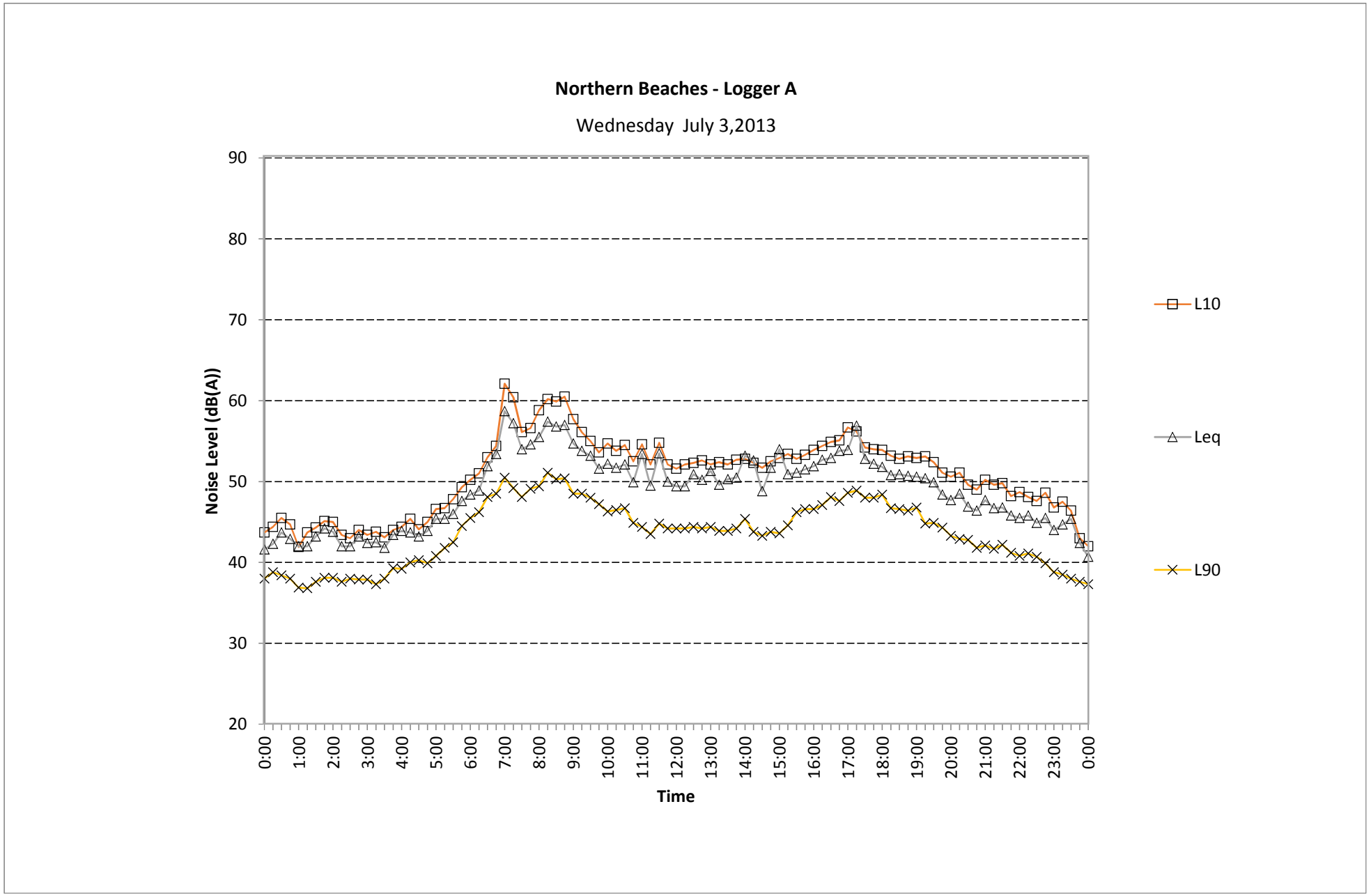
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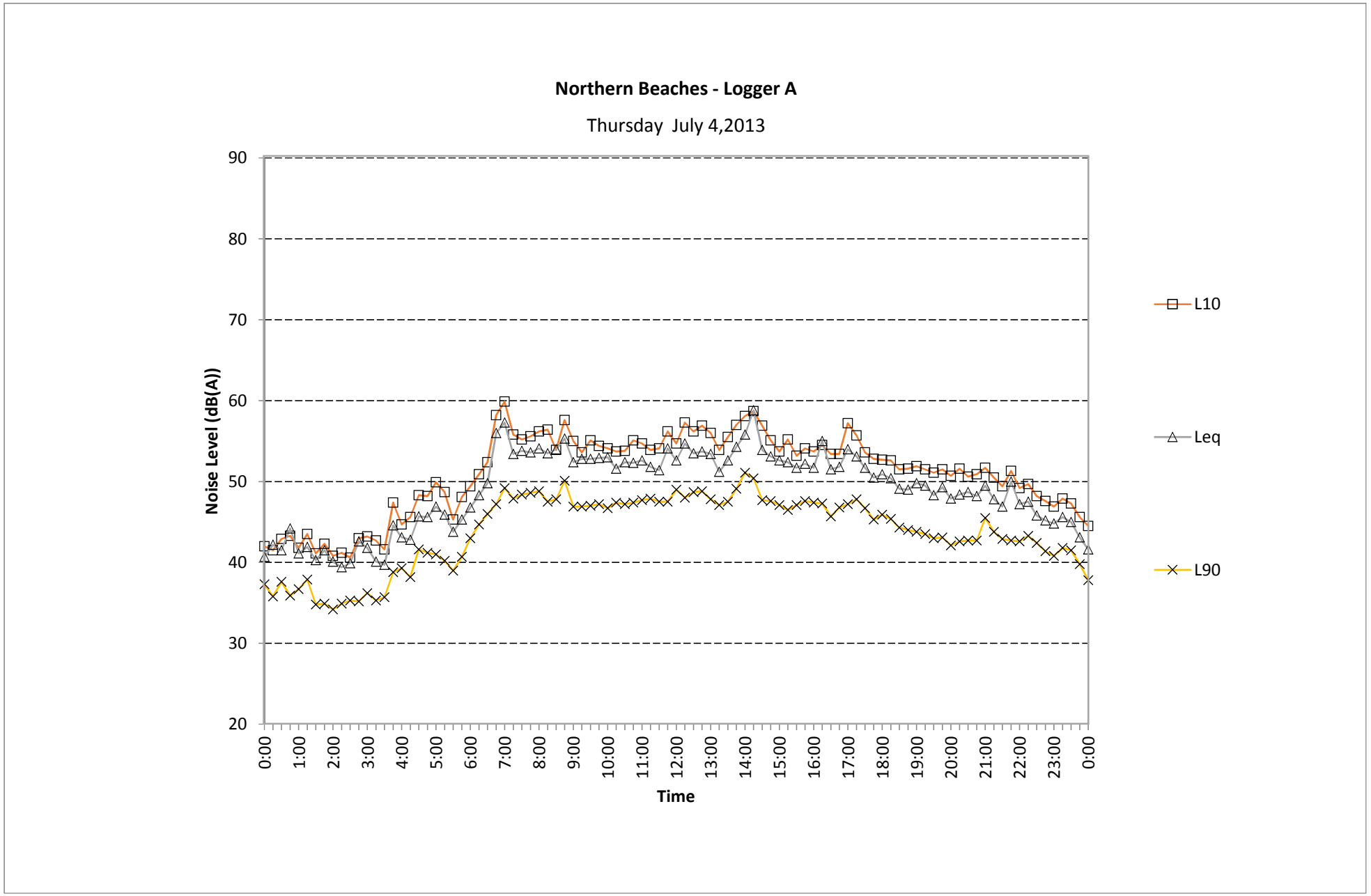
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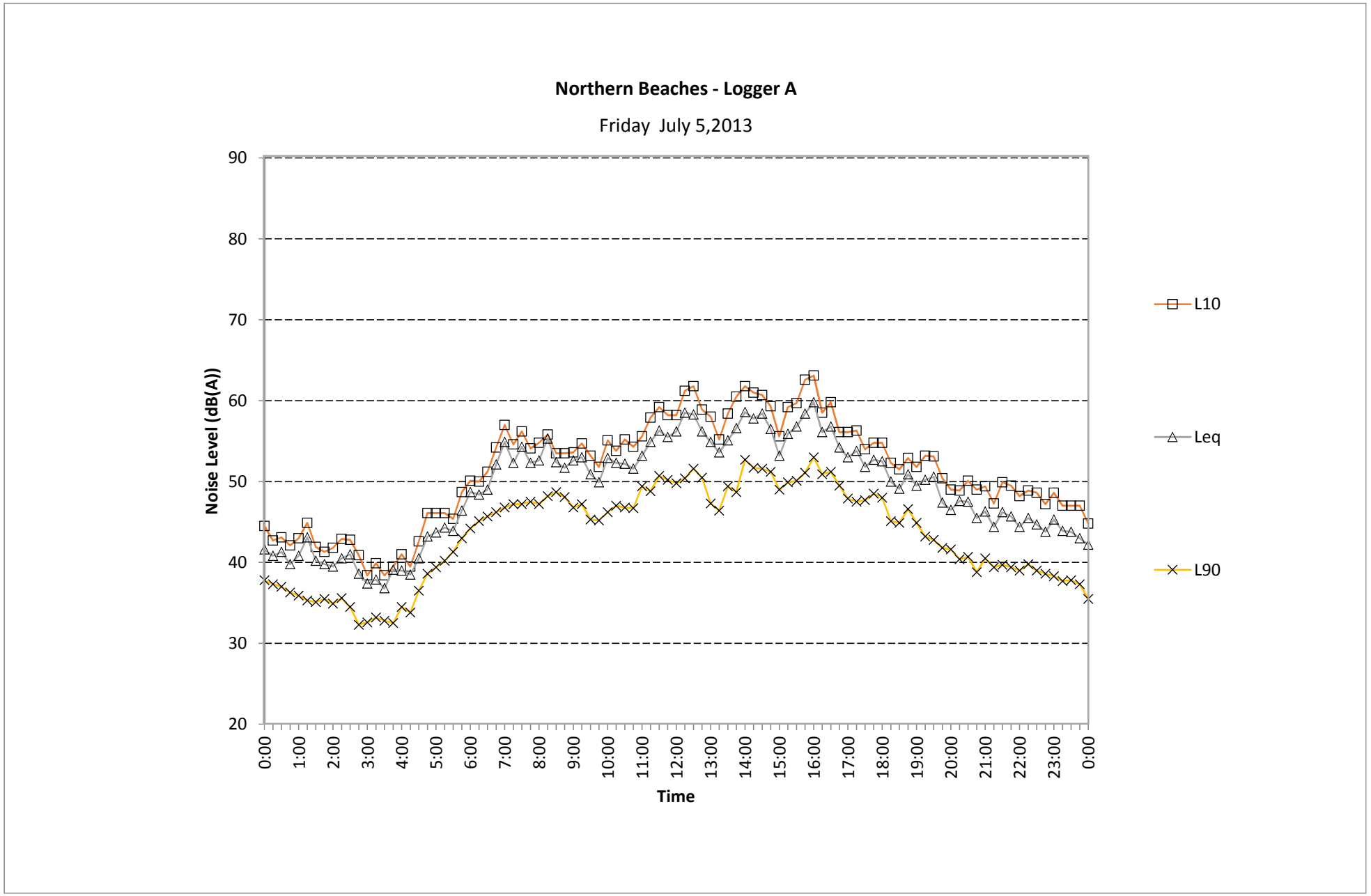
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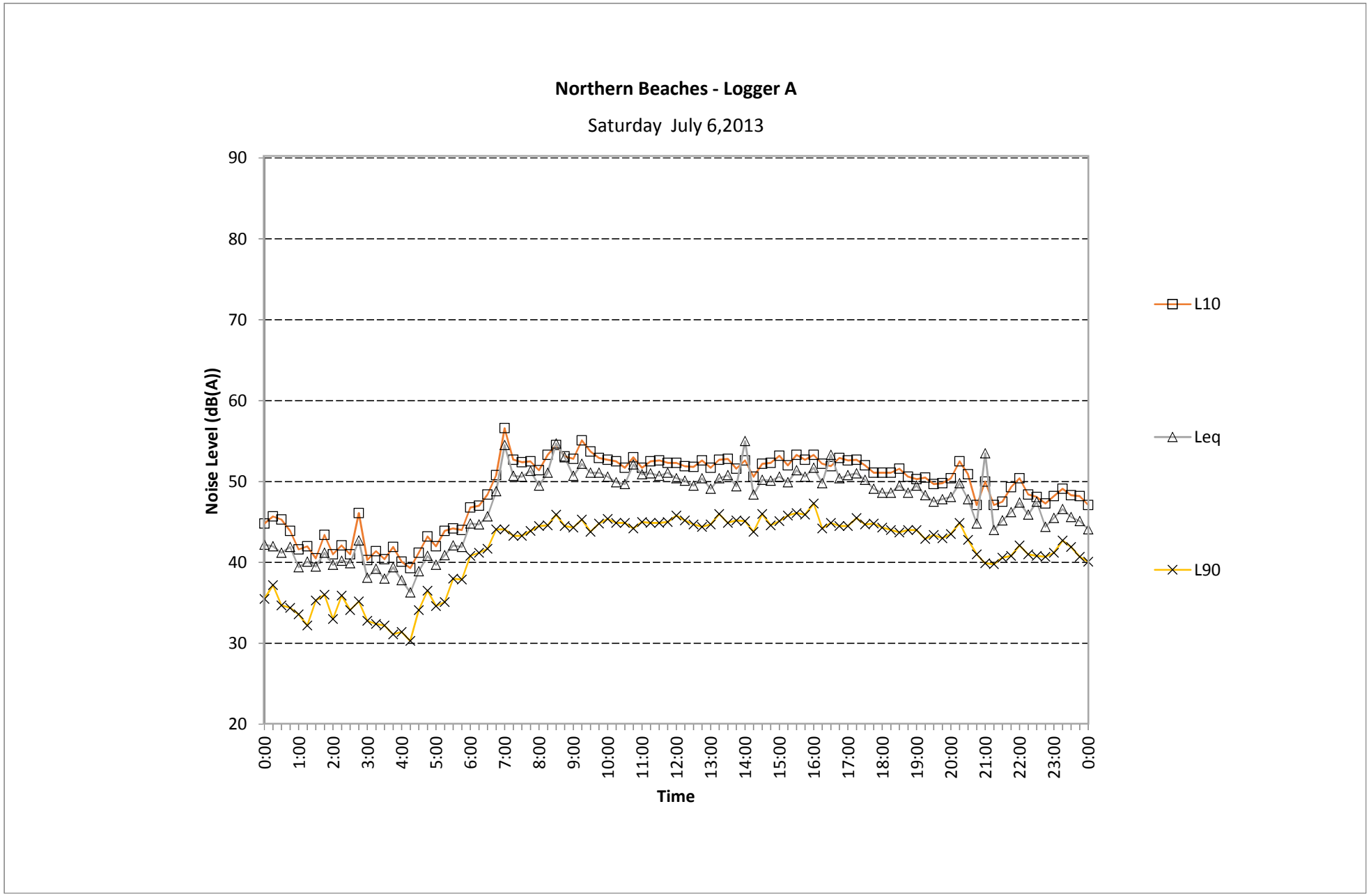
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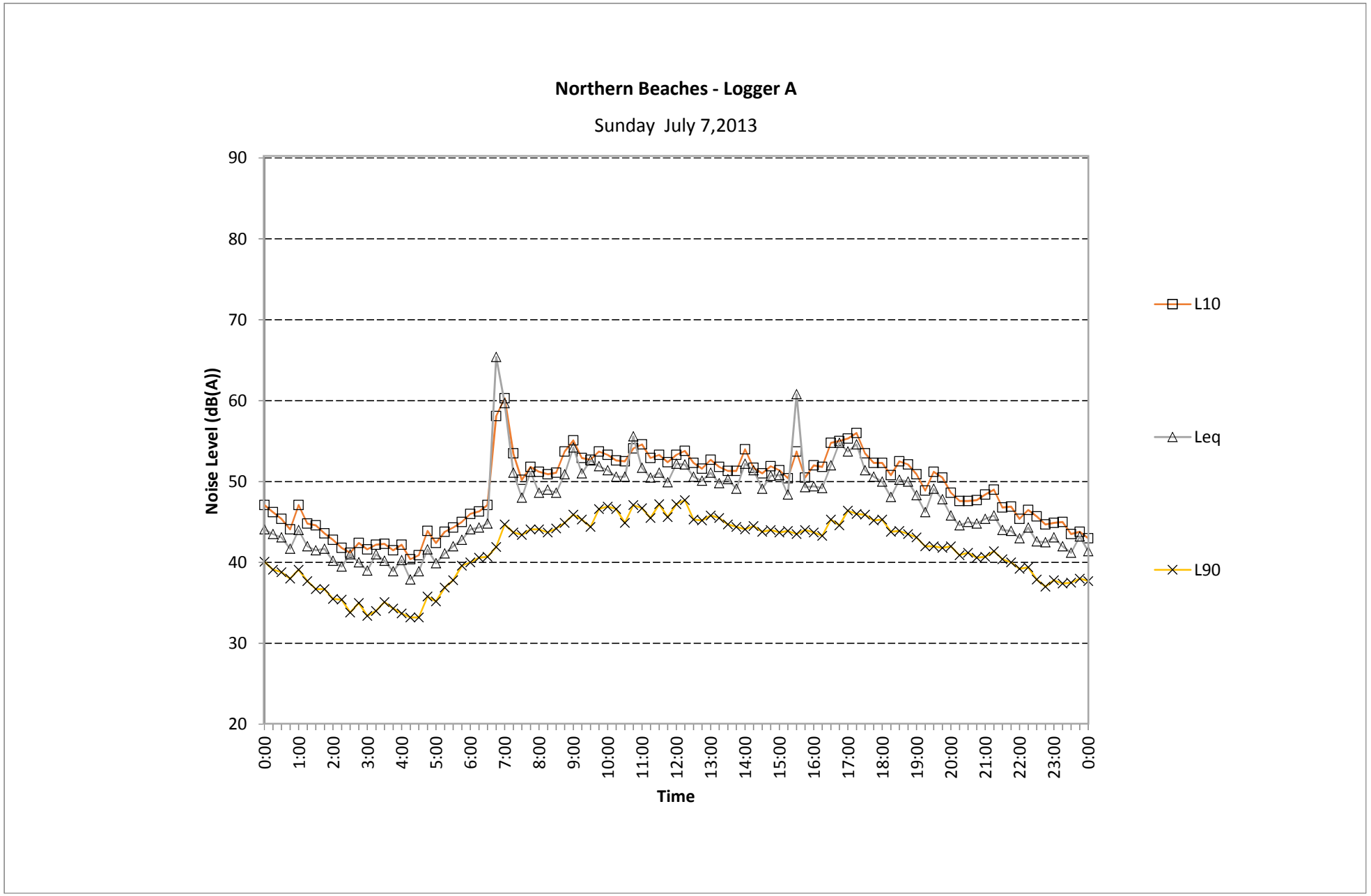
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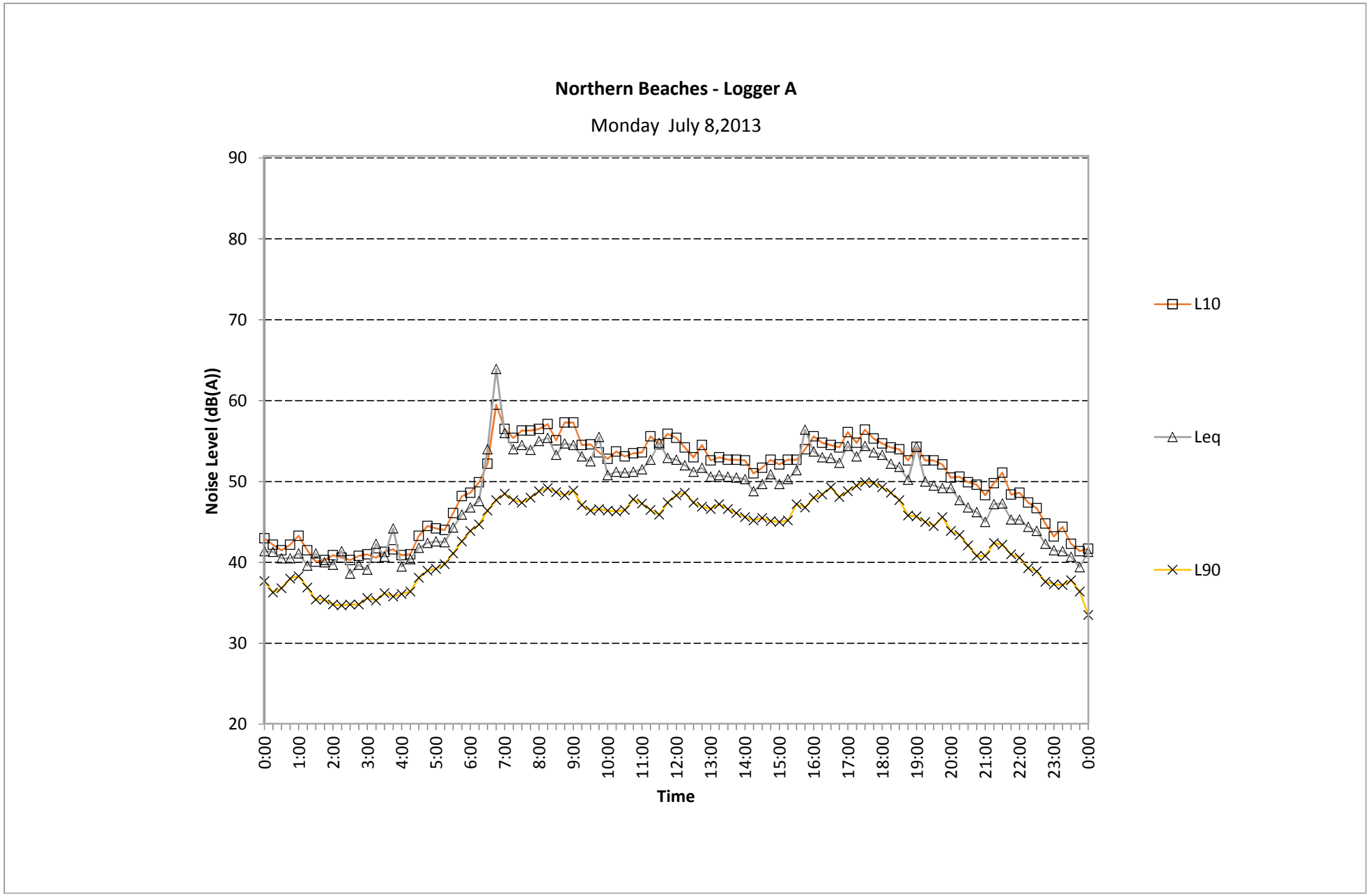
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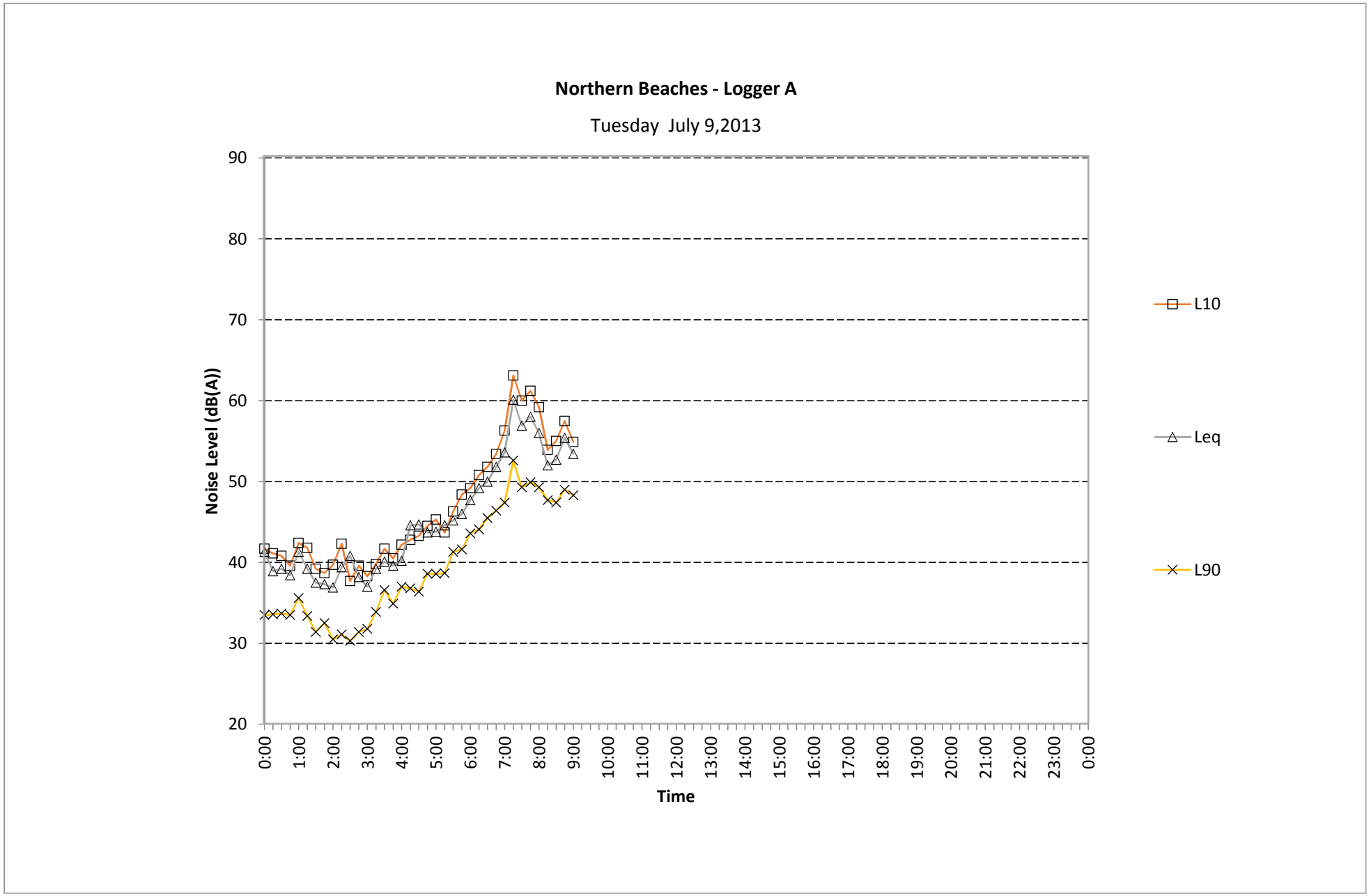
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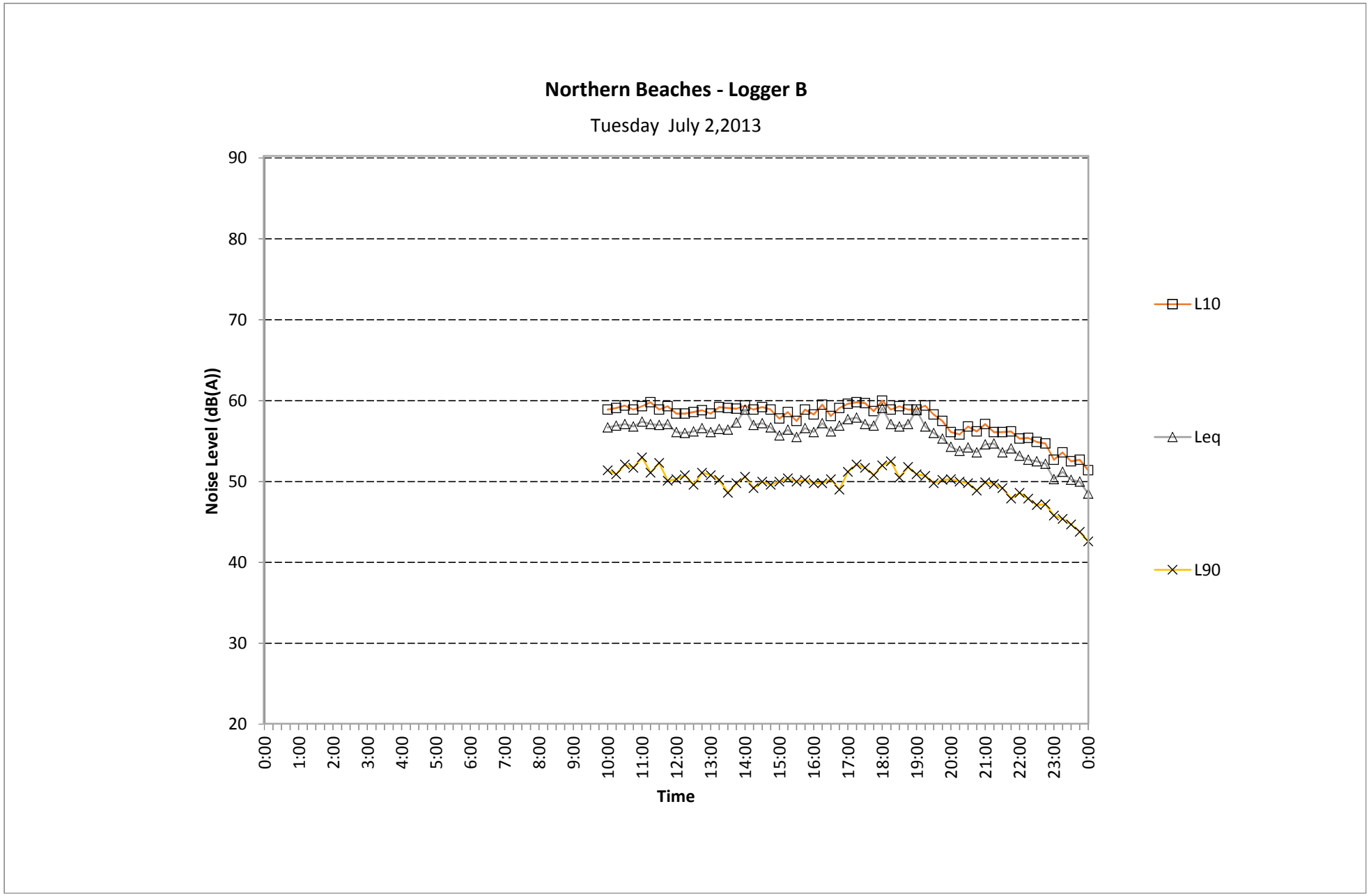
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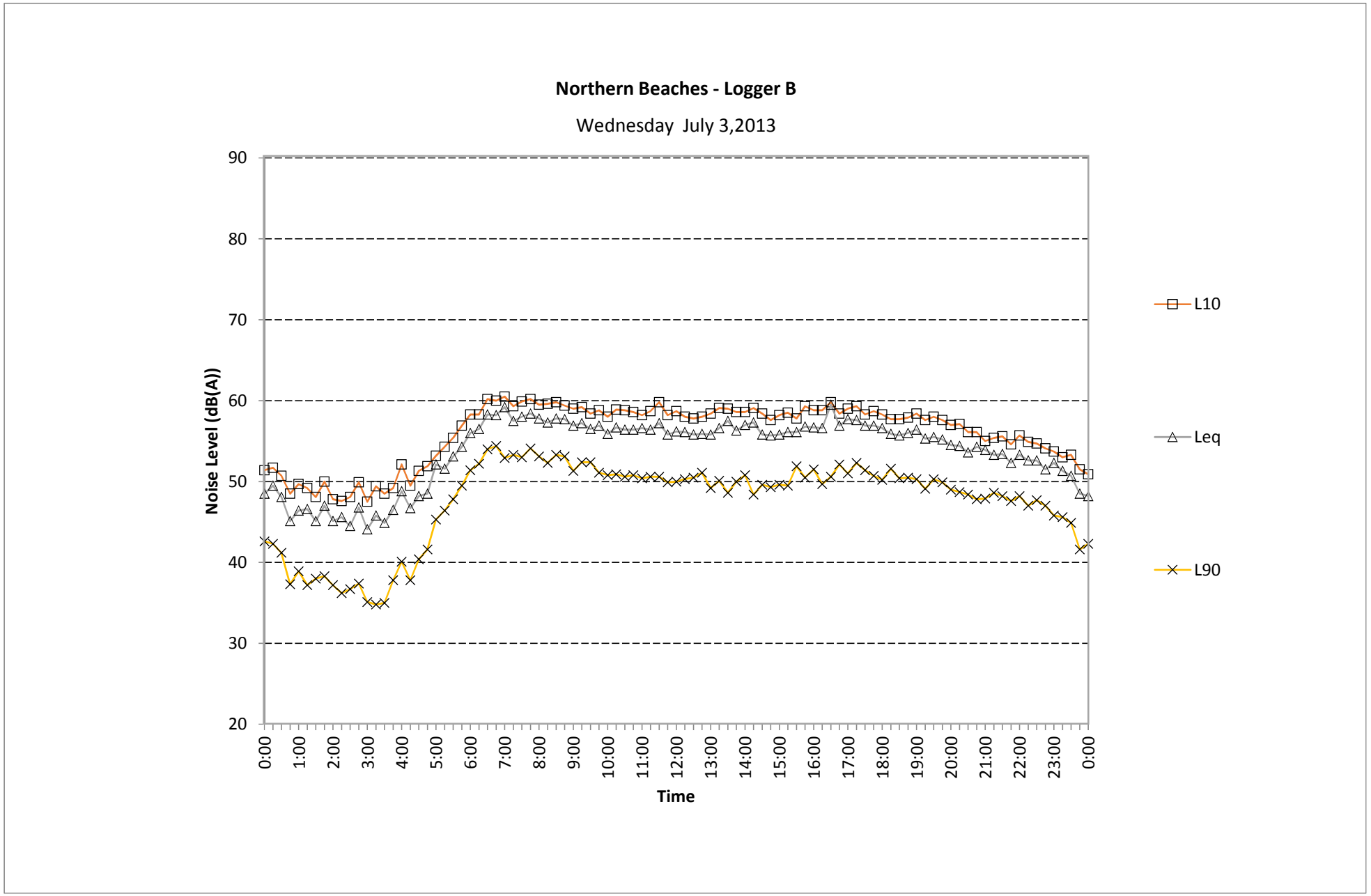
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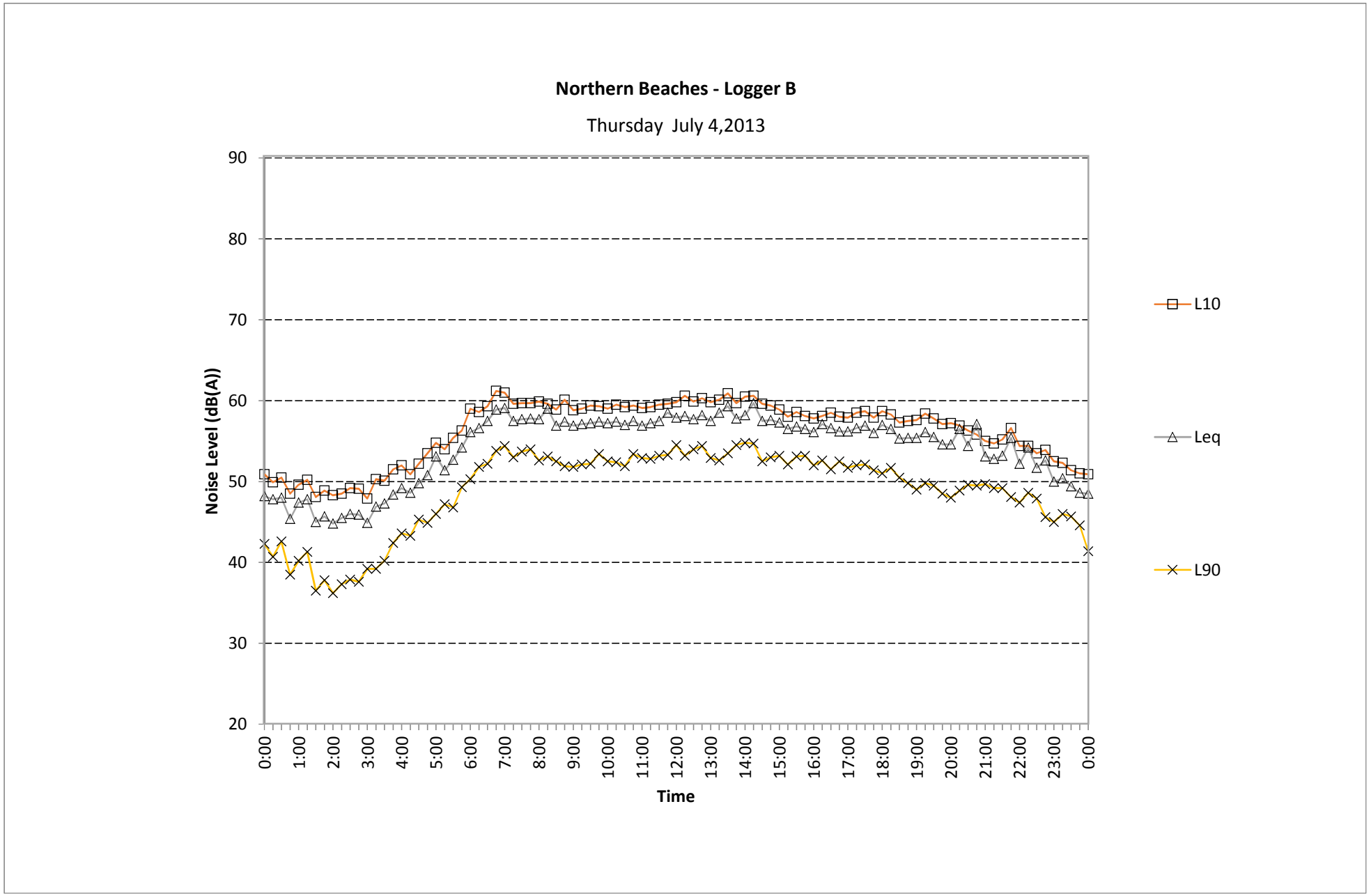
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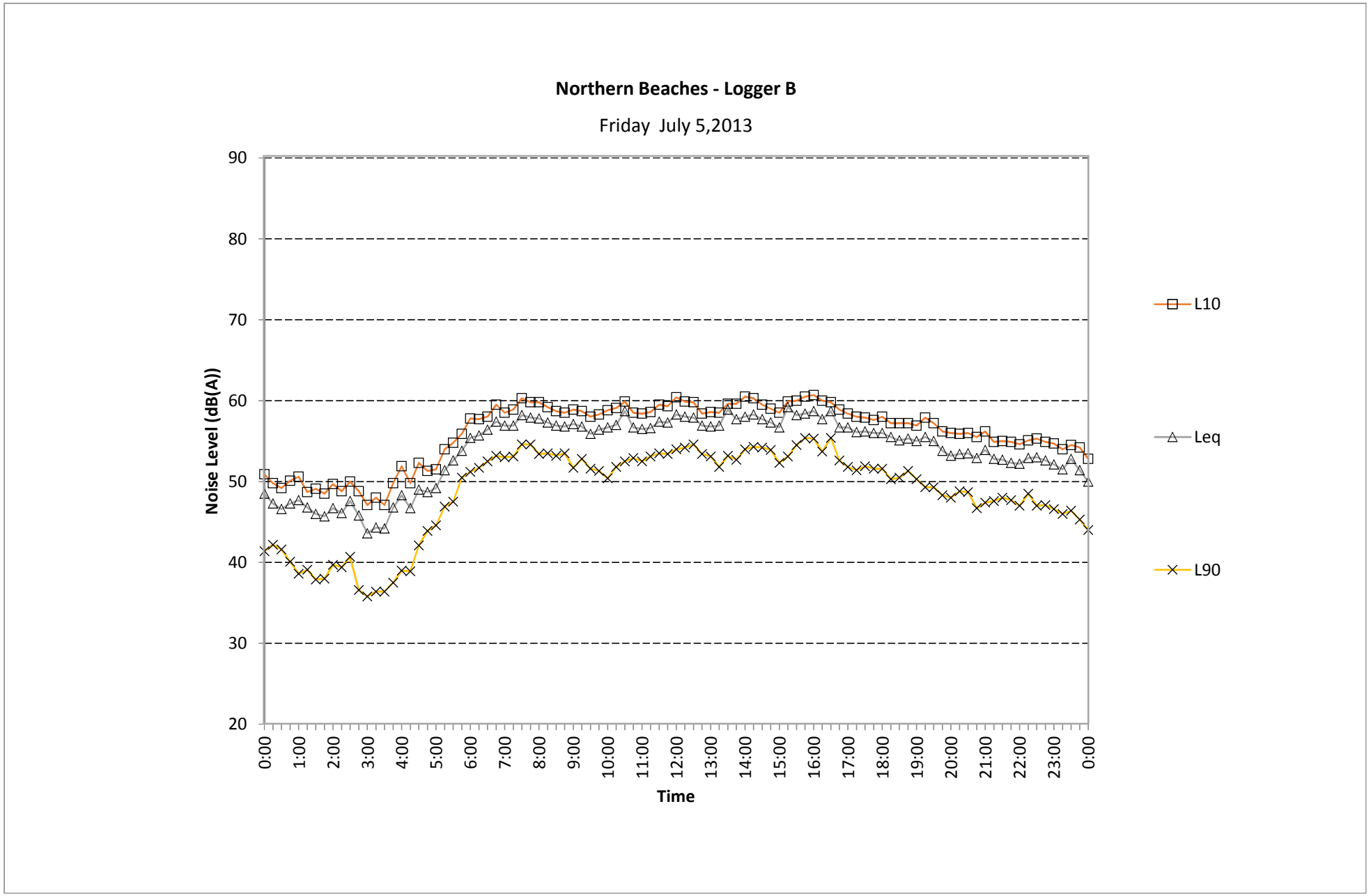
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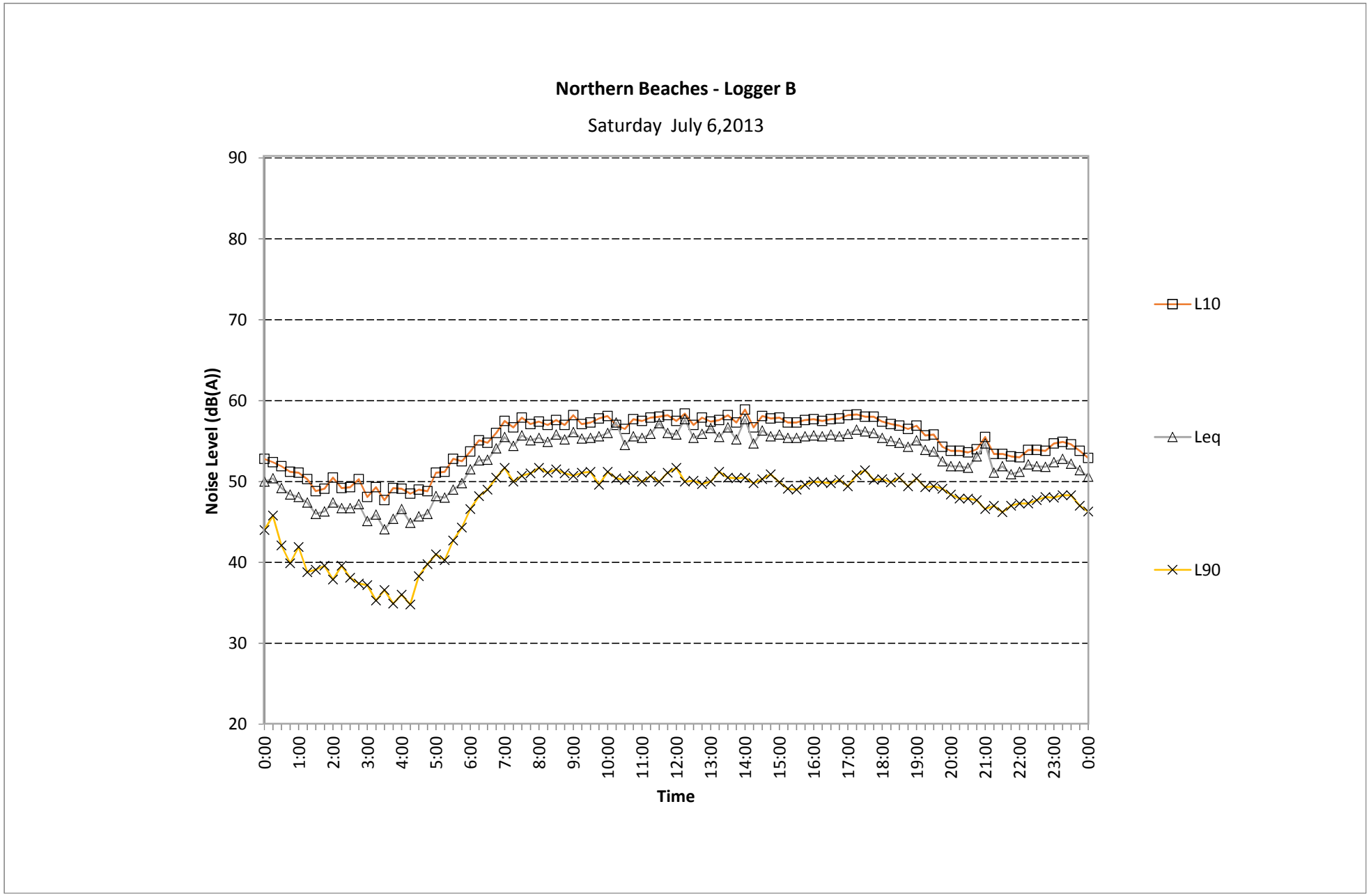
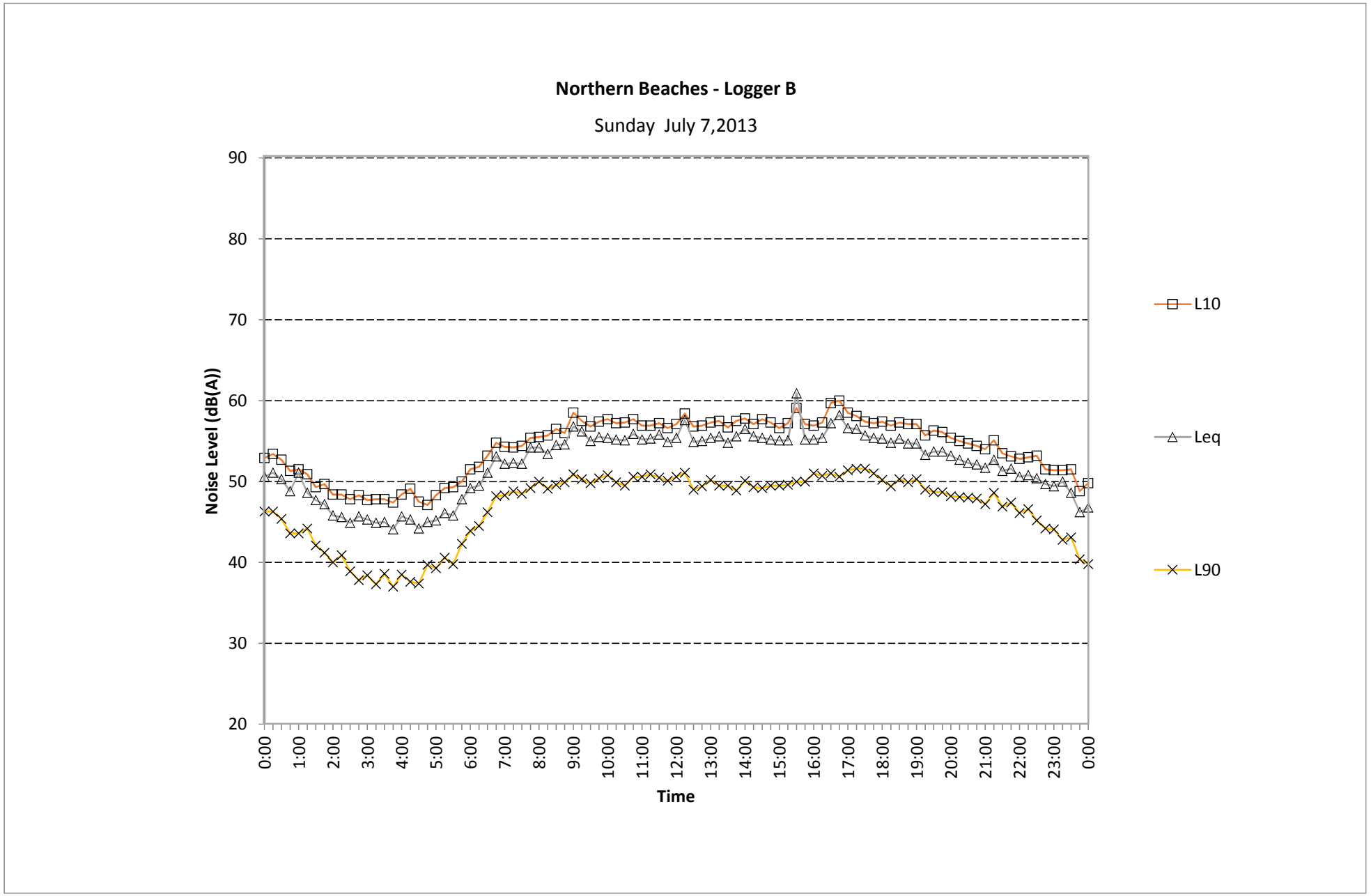
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Northern Beaches - Logger B
Saturday July 6,2013
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Northern Beaches - Logger B
Sunday July 7,2013
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
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13:00
14:00
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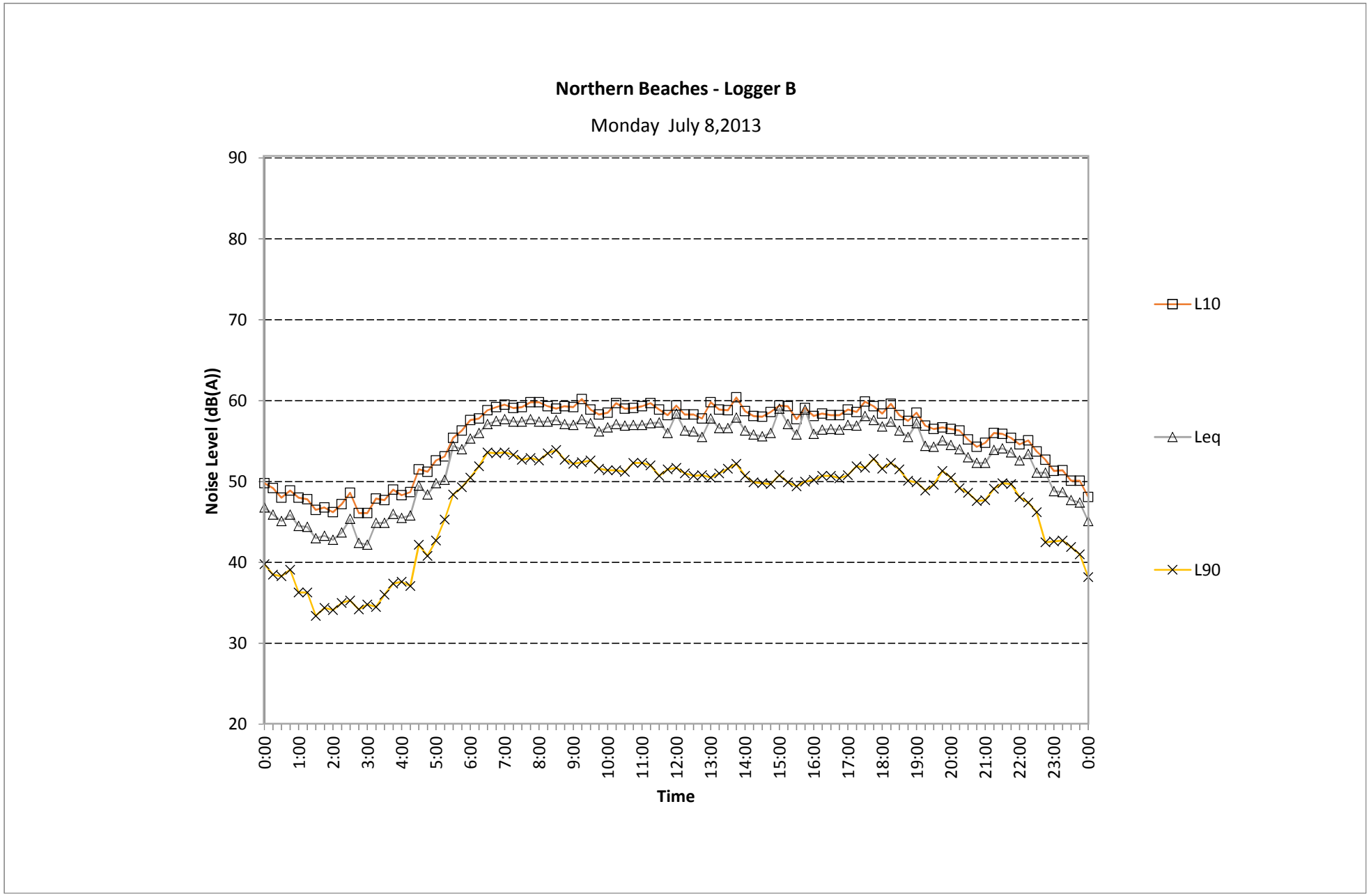
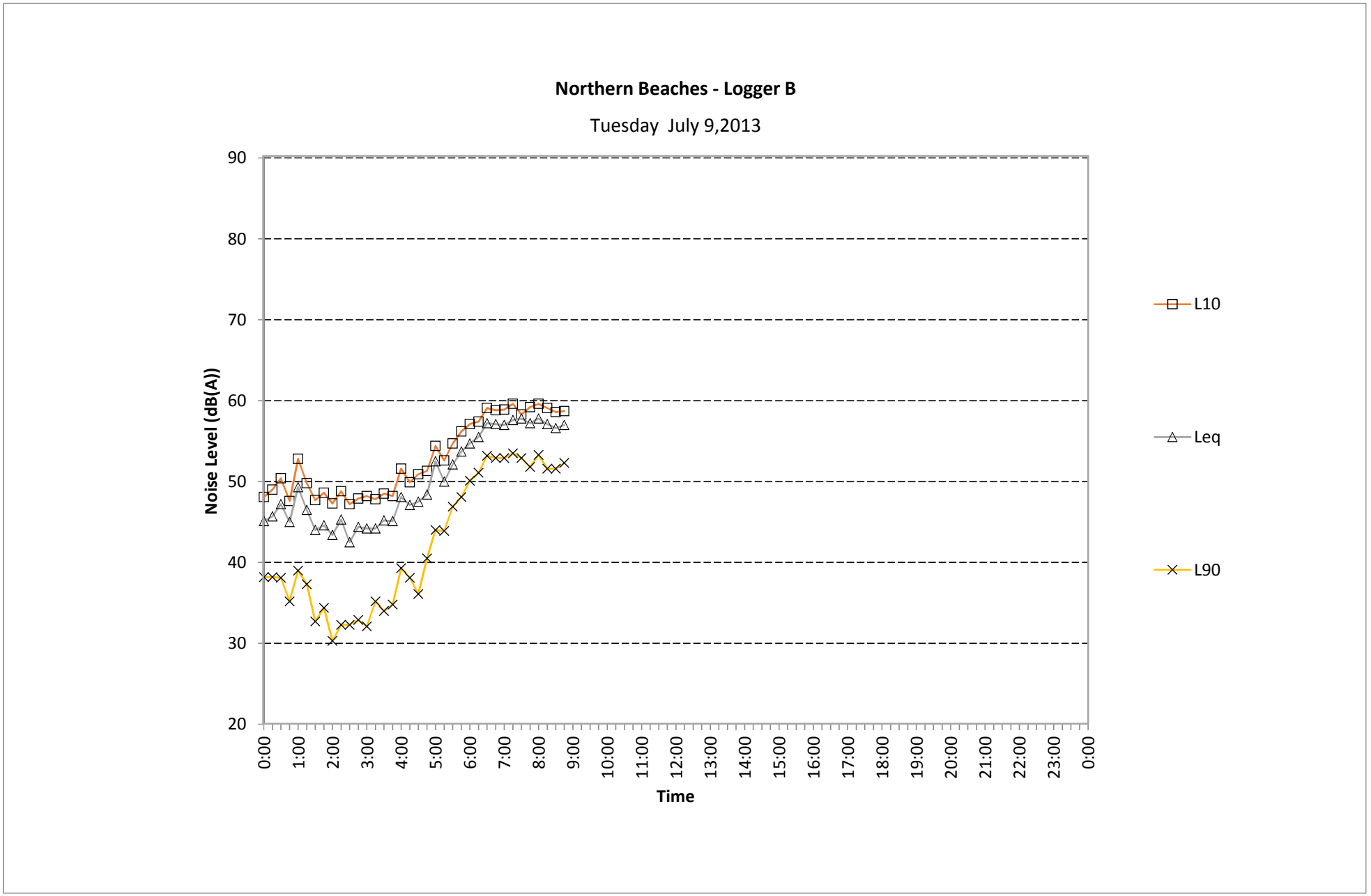
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Northern Beaches - Logger B
Monday July 8,2013
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Northern Beaches - Logger B
Tuesday July 9,2013
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90