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Event Noise Modelling

General Events – Scarborough Beach

Reference: 24018679-01A

Prepared for:
City of Stirling

Reference: 24018679-01A

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9-Oct-24	A	Updated C-Levels	Matt Moyle	-

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1. INTRODUCTION

Lloyd George Acoustics was engaged by City of Stirling to prepare noise mapping for various music events, within the Scarborough Beach Precinct. Modelling has been prepared for the following scenarios:

- Amphitheatre Stage – facing eastward at sound levels of 90 dB(A), 100 dB(C) at 30m;
- Marketplace DJs – at three locations (simultaneously) at sound levels of 85 dB(A), 95 dB(C) at 5m;
- Laneway Stage – Facing South at sound levels of 90 dB(A), 100 dB(C) at 25m;
- Laneway Stage – Facing North at sound levels of 90 dB(A), 100 dB(C) at 25m;

2. VENUE LAYOUT

A series of outdoor stage and speaker locations are proposed for each event type. This, together with the PA direction is illustrated in the below Figure.

Event Locations and Orientations

3. PREDICTED NOISE LEVELS AT NOISE SENSITIVE PREMISES

Computer modelling has been used to predict the noise emissions from the event types. The predictions take into account meteorological conditions, topographical data including barrier effects from buildings, expected music volumes and design of the public address system. Details of these are discussed in *Section 3.1* to *Section 3.3*:

3.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Value[2]
Temperature (°C)	15
Humidity (%)	50
Wind Speed (m/s)	3
Wind Direction[1]	All
Pasquil Stability Factor	F

Notes:

1. The modelling package allows for all wind directions to be modelled simultaneously.
2. The conditions above are as defined in *Guideline: Assessment of Environmental Noise Emissions*; May 2021

3.2. Topographical Data

The barrier effects from buildings and landforms were incorporated in the calculations by constructing a 3-dimentional model of the buildings and ground levels around the venue. The ground levels and building heights were obtained from Landgate, the City of Stirling and from our own file data.

3.3. Source Sound Levels

The sound power levels have been provided by City of Stirling:

- Amphitheatre Stage – facing eastward at sound levels of 90 dB(A), 100 dB(C) at 30m;
- Marketplace DJs – at three locations (simultaneously) at sound levels of 85 dB(A), 95 dB(C) at 5m;
- Laneway Stage – Facing South at sound levels of 90 dB(A), 100 dB(C) at 25m;
- Laneway Stage – Facing North at sound levels of 90 dB(A), 100 dB(C) at 25m;

DJ speaker configurations consist of a single Sub and twin speaker PA on elevated stands (at 2m above ground level). Where larger stages are modelled, additional speakers and subs are incorporated, and speakers are elevation at 4m above ground level. Speaker directivity is based on generic manufacturer's data.

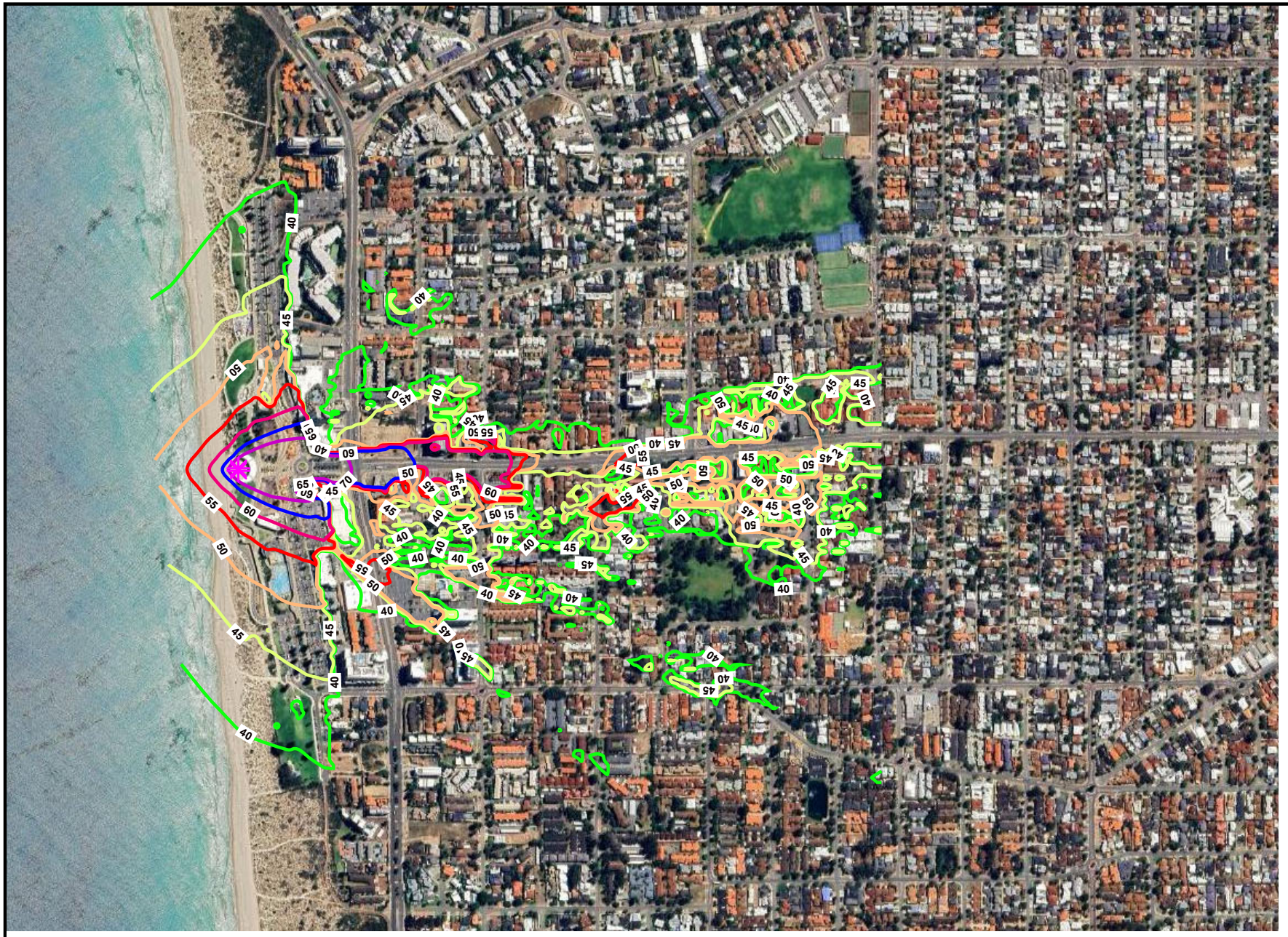
In line with typical music industry practice in WA, a 5-minute L_{eq} is assumed for both A-weighted and C-weighted sound levels, this averaging period is considered suitable for assessing the dynamic nature of music.

3.4. Results

The results of the noise modelling are presented in *Figure 1 to Figure 8,* being the A-weighted $L_{eq,5min}$ and C-weighted $L_{eq,\ 5min}$ plots for all four scenarios at ground level.

Additionally, noise modelling was repeated at 6-storeys high (17m above ground), with these results being presented in *Figure 9* to *Figure 16*.

Figure 1



Beachfront Ampitheatre Stage (Speakers facing East) - Scarborough Beach
Predicted $L_{Aeq,(5\ min)}$ Noise Levels - Assumes 90 dB(A) at 30m from the Stage - Ground Level
Wind - Worst-case From All Directions

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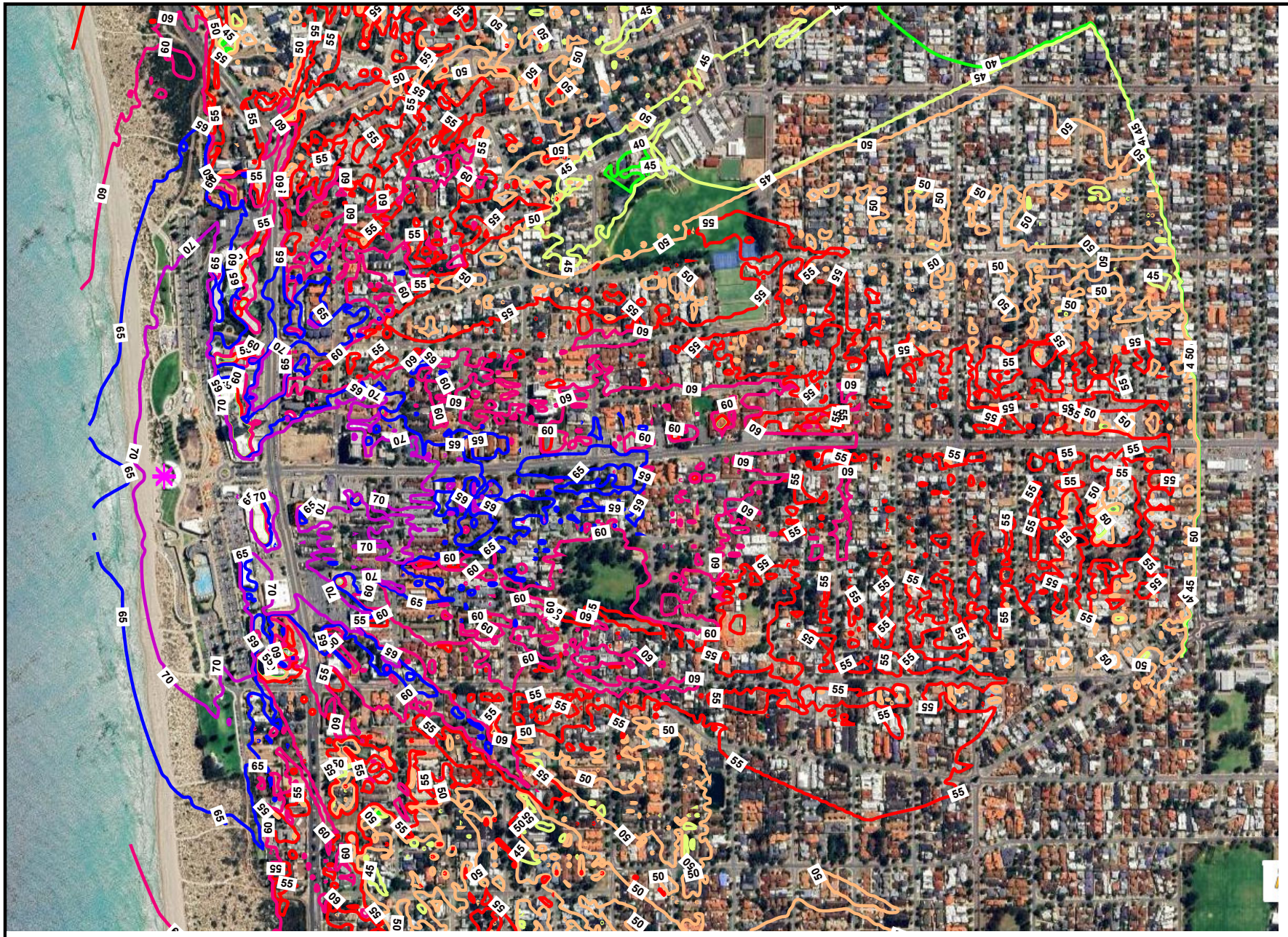
Figure 2



Signs and symbols

PA

N

Length Scale

0 45 90 180 270 360 45

Beachfront Ampitheatre Stage (Speakers facing East) - Scarborough Beach

Predicted $L_{Ceq,(5\ min)}$ Noise Levels - Assumes 100 dB(C) at 30m from the Stage - Ground Level

Wind - Worst-case From All Directions

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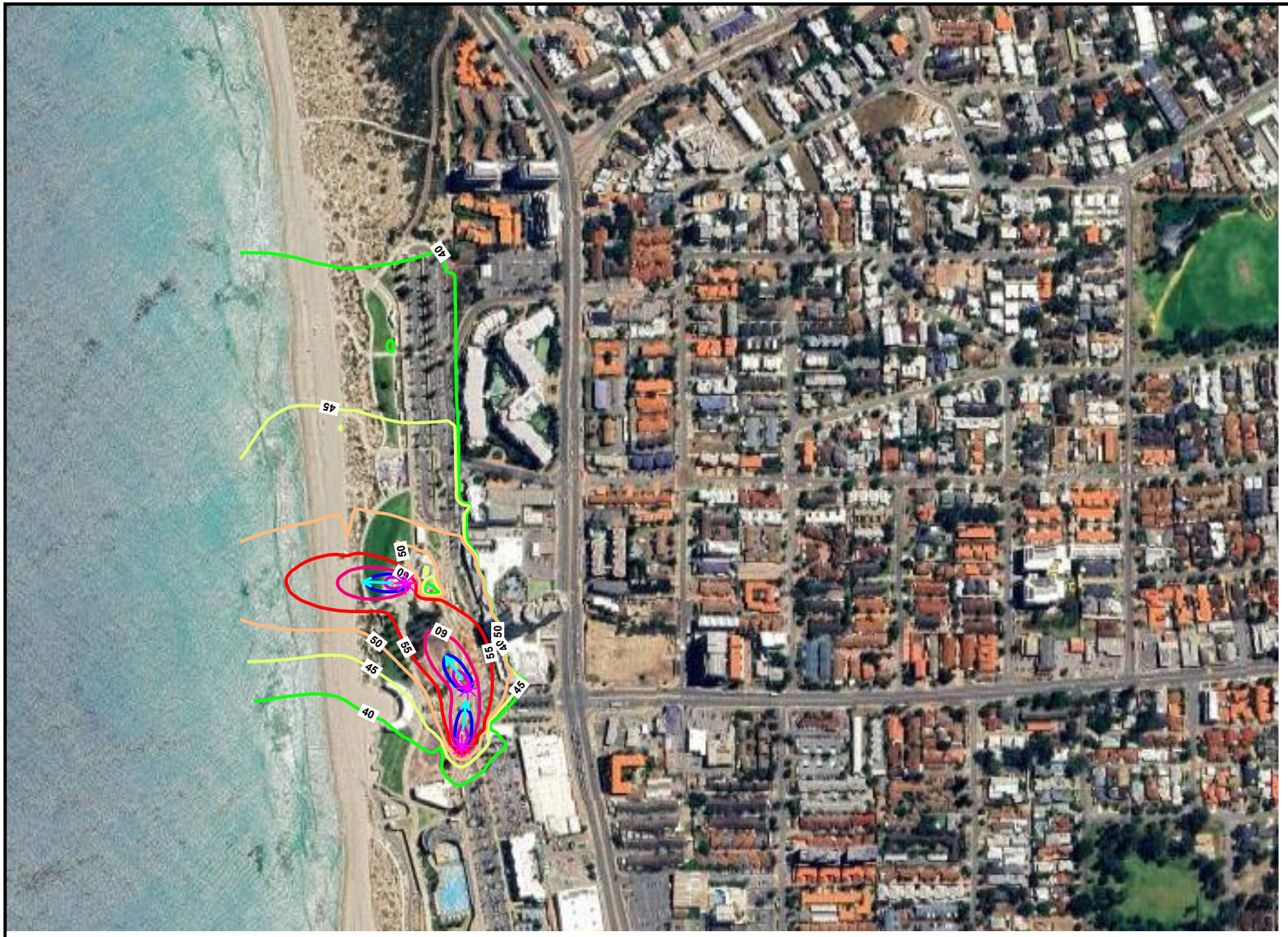
Figure 3



Market DJs (Speakers facing as Indicated) - Scarborough Beach

Predicted $L_{Aeq,(5\ min)}$ Noise Levels - Assumes 85 dB(A) at 5m from the Stage - Ground Level

Wind - Worst-case From All Directions

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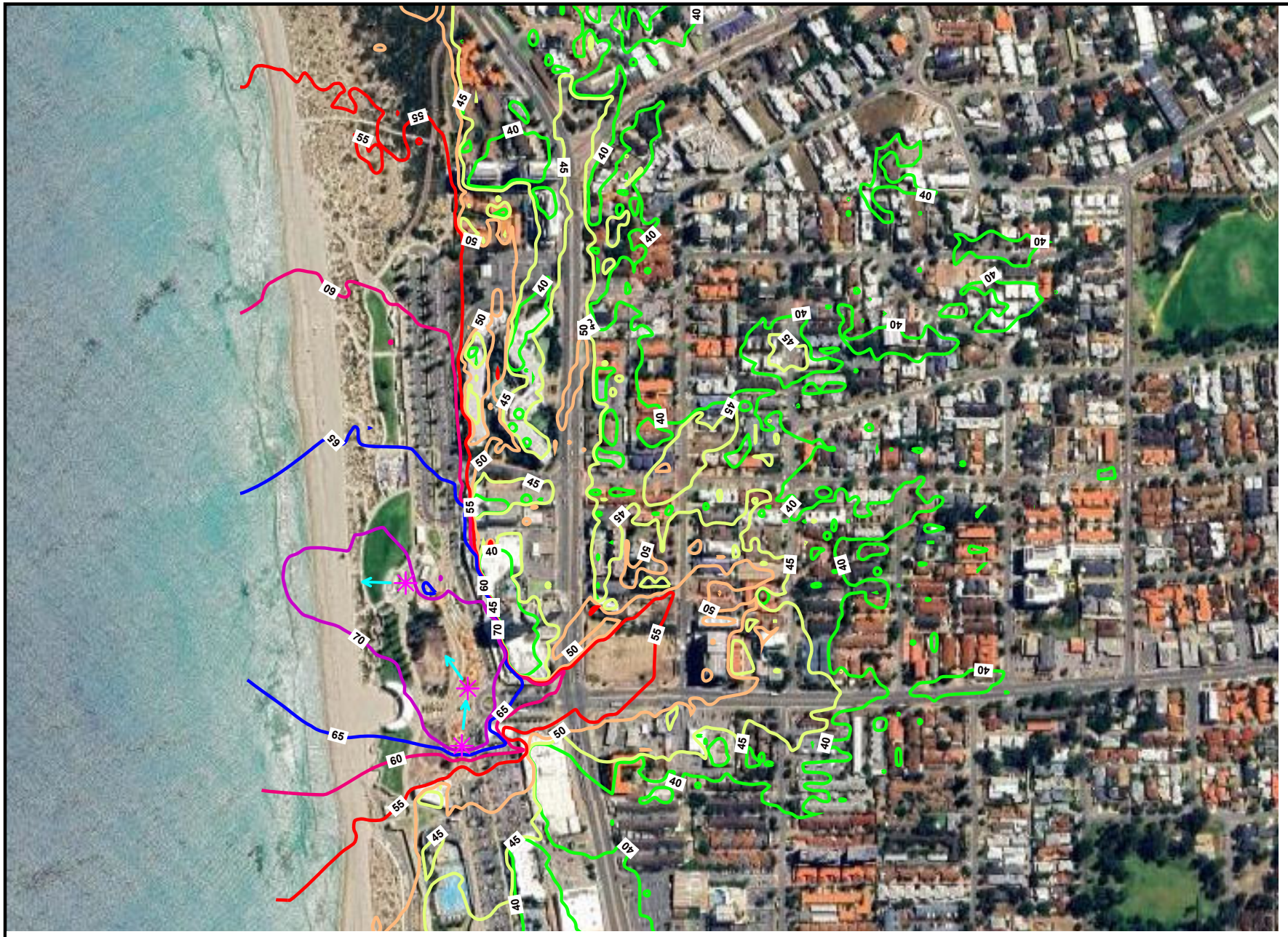
Figure 4



Market DJs (Speakers facing as Indicated) - Scarborough Beach
Predicted $L_{Ceq,(5\ min)}$ Noise Levels - Assumes 95 dB(C) at 5m from the Stage - Ground Level
Wind - Worst-case From All Directions

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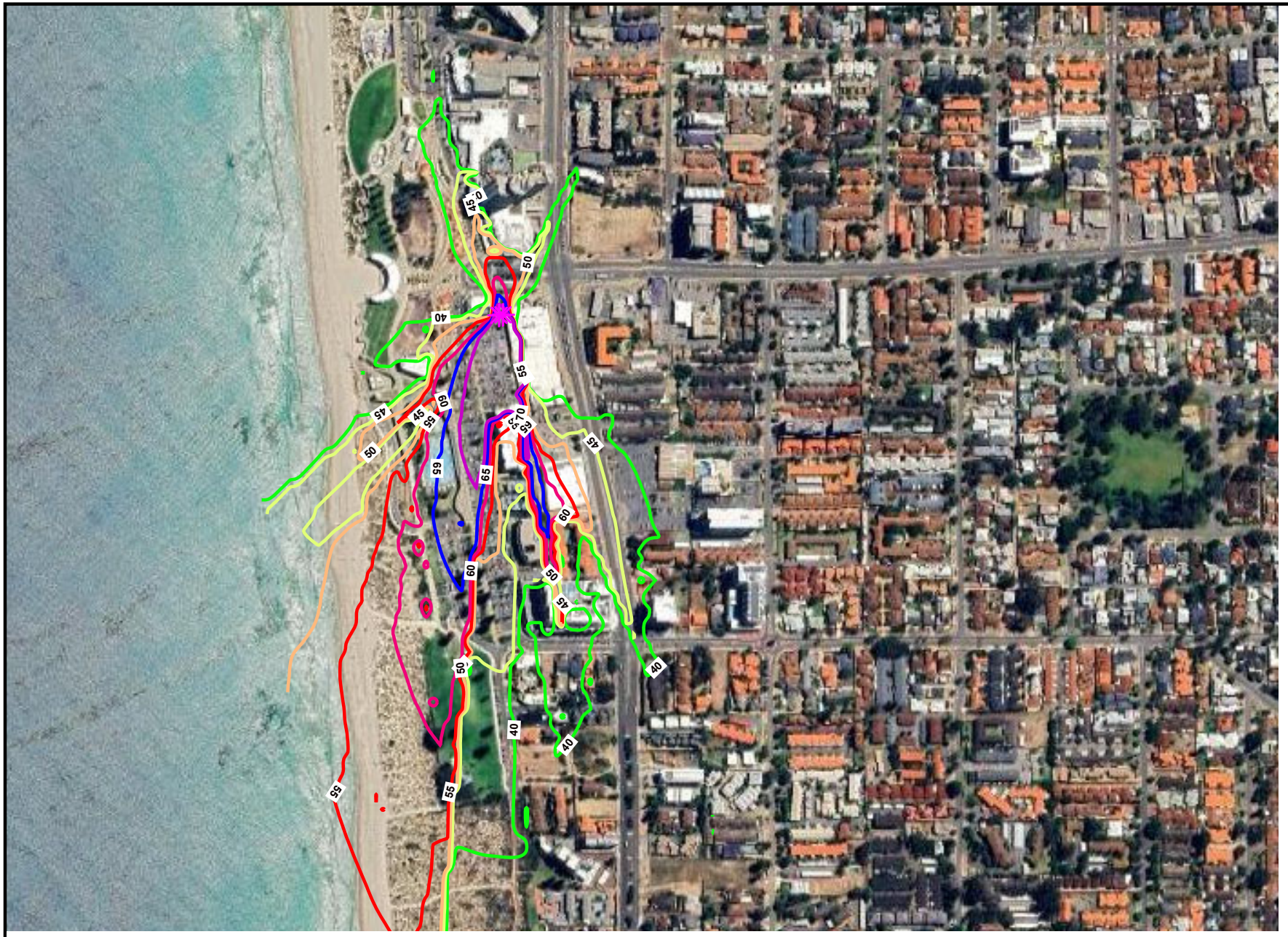
Figure 5



Laneway Concert (Speakers facing South) - Scarborough Beach
Predicted $L_{Aeq,(5\ min)}$ Noise Levels - Assumes 90 dB(A) at 25m from the Stage - Ground Level
Wind - Worst-case From All Directions

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Figure 6

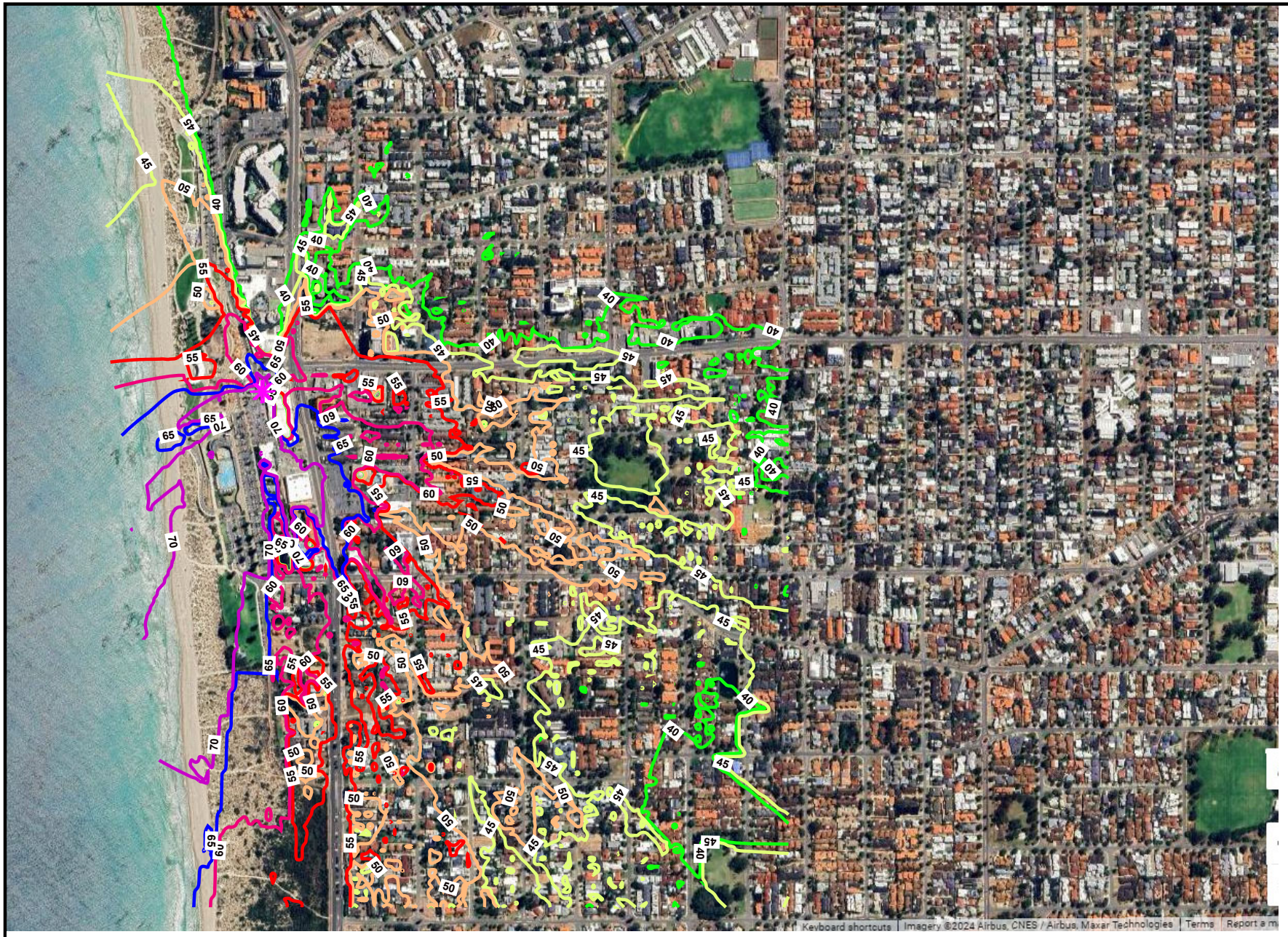

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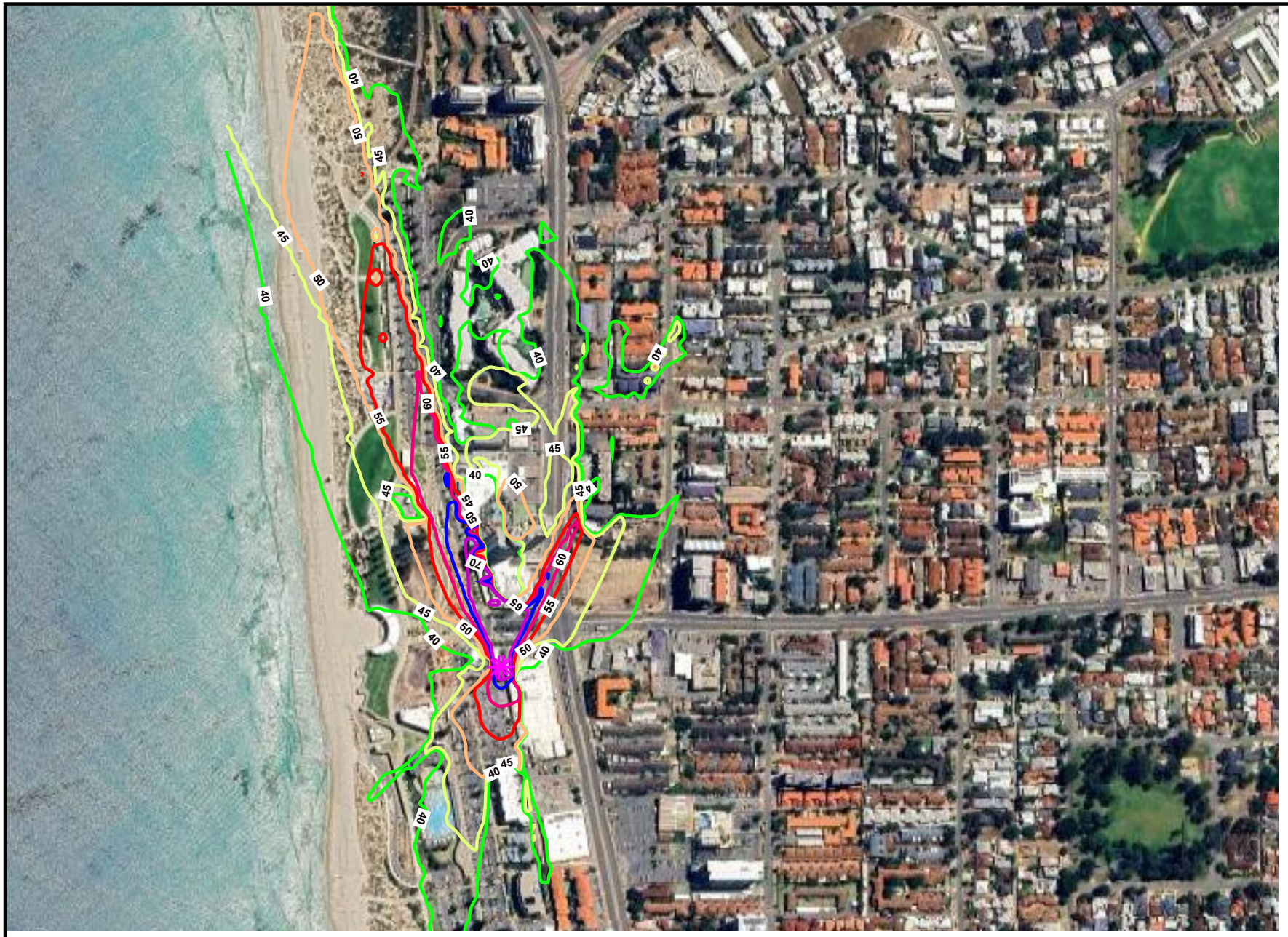
Figure 7



Signs and symbols

PA

N

Length Scale

0 25 50 100 150 200 250 m

Laneway Concert (Speakers facing North) - Scarborough Beach

Predicted $L_{Aeq,(5\ min)}$ Noise Levels - Assumes 90 dB(A) at 25m from the Stage - Ground Level

Wind - Worst-case From All Directions

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Figure 8

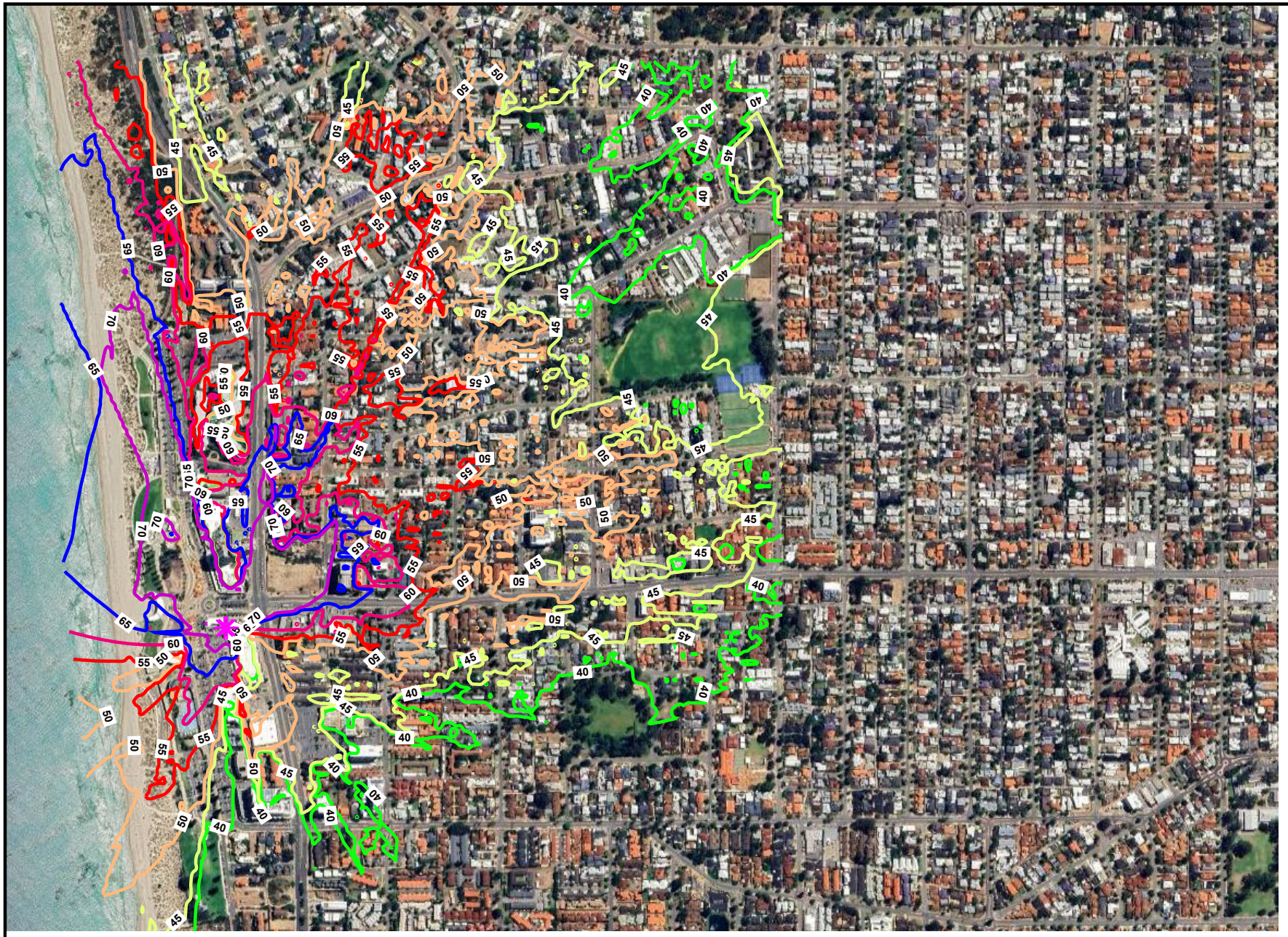

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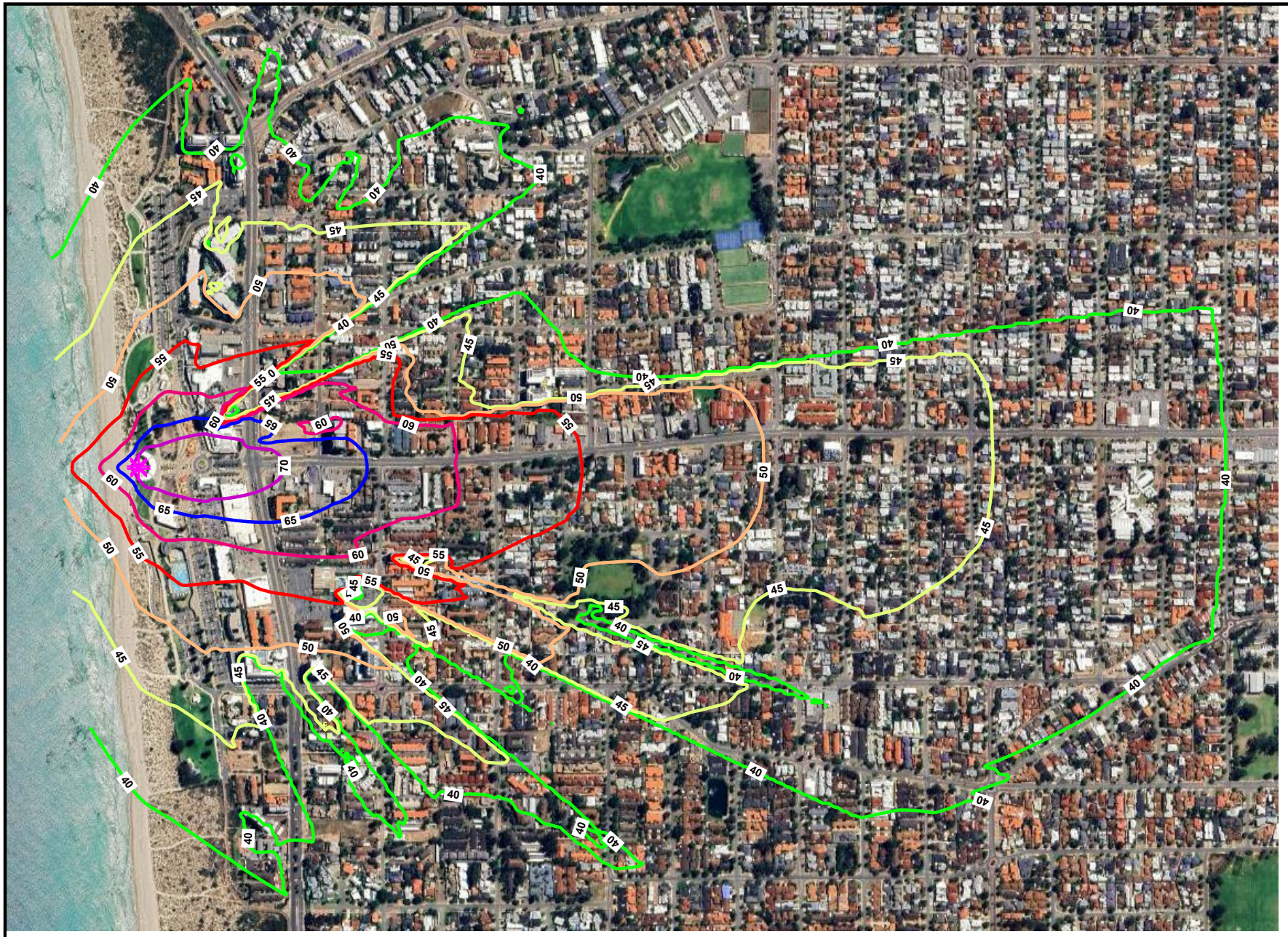
Figure 9



Beachfront Ampitheatre Stage (Speakers facing East) - Scarborough Beach
Predicted $L_{Aeq,(5\ min)}$ Noise Levels - Assumes 90 dB(A) at 30m from the Stage - 17m above Ground
Wind - Worst-case From All Directions

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Figure 10

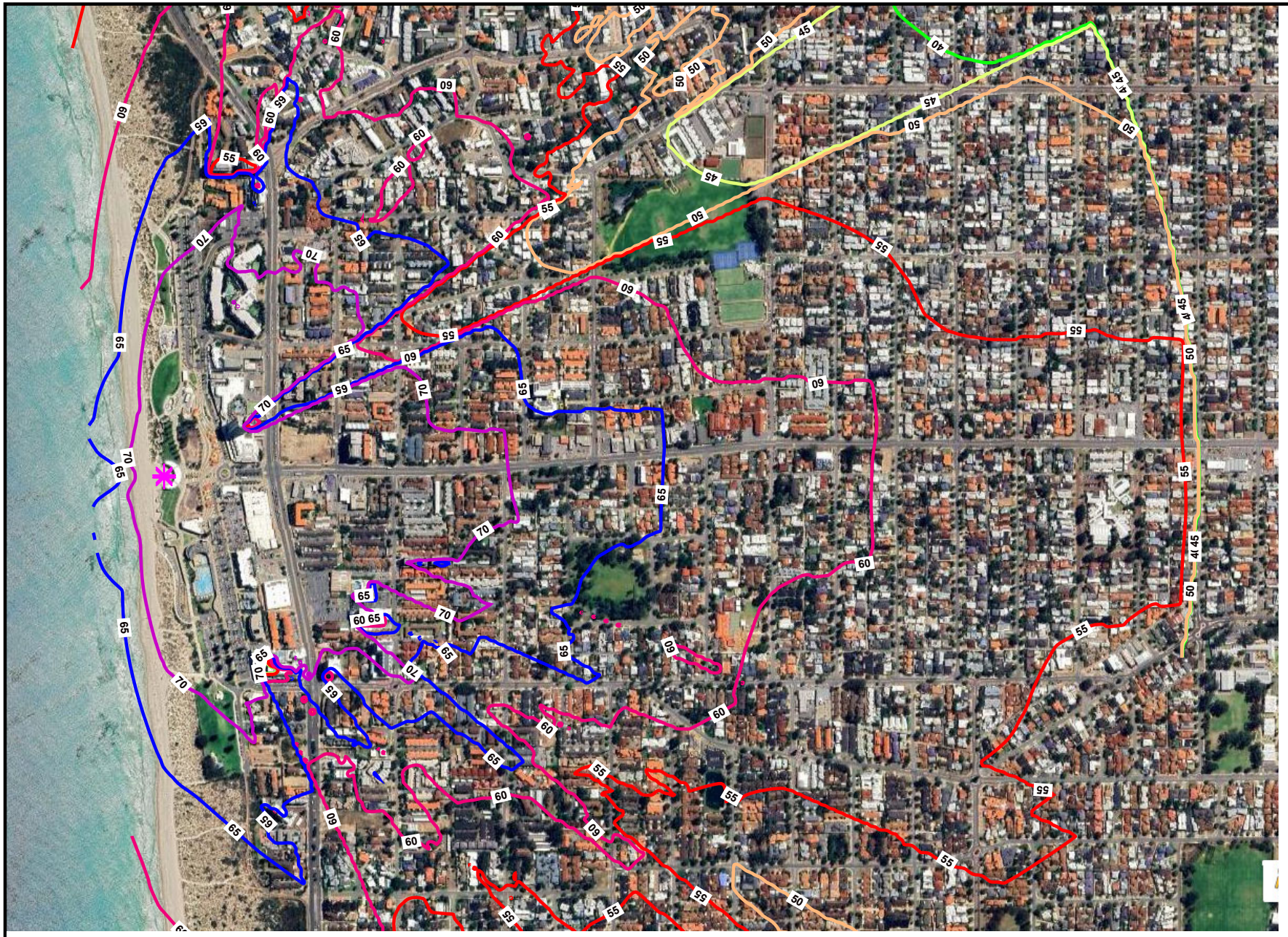

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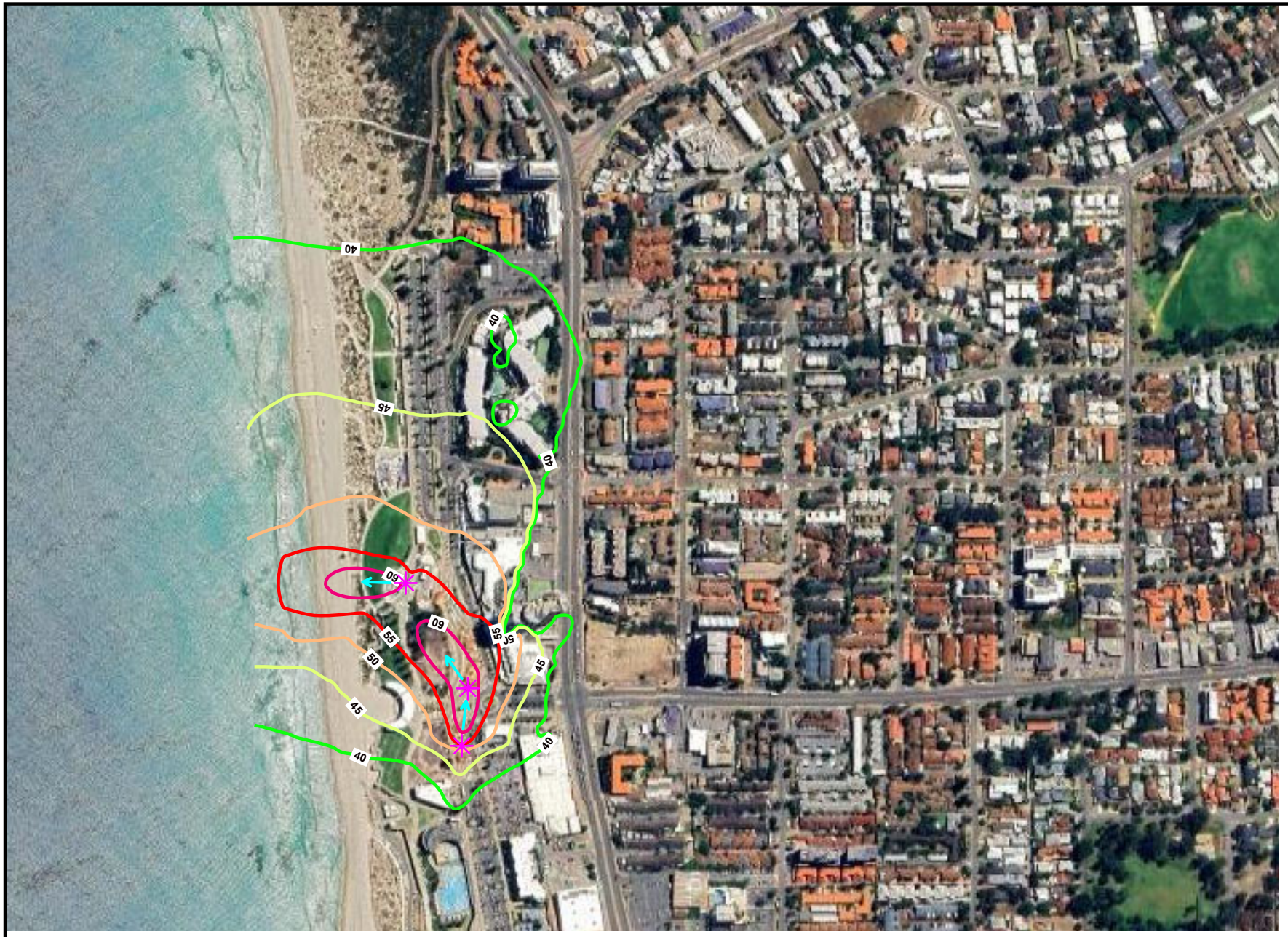
Figure 11



Signs and symbols

PA

Length Scale

0 25 50 100 150 200 250 m

Market DJs (Speakers facing as Indicated) - Scarborough Beach

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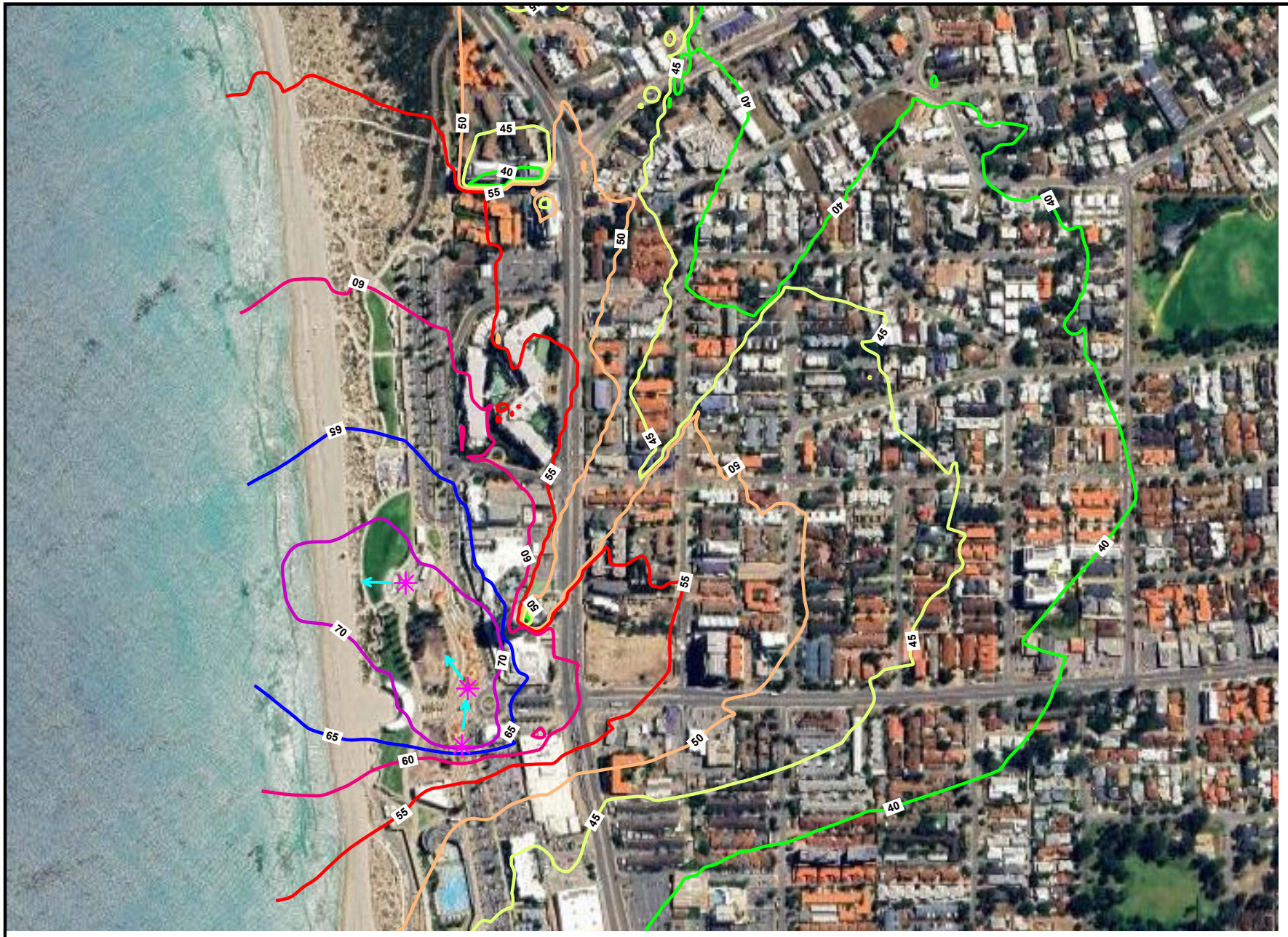
Figure 12



Market DJs (Speakers facing as Indicated) - Scarborough Beach
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Wind - Worst-case From All Directions

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Figure 13

Laneway Concert (Speakers facing South) - Scarborough Beach

Predicted $L_{Aeq,(5\ min)}$ Noise Levels - Assumes 90 dB(A) at 25m from the Stage - 17m above Ground

Wind - Worst-case From All Directions

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Figure 14

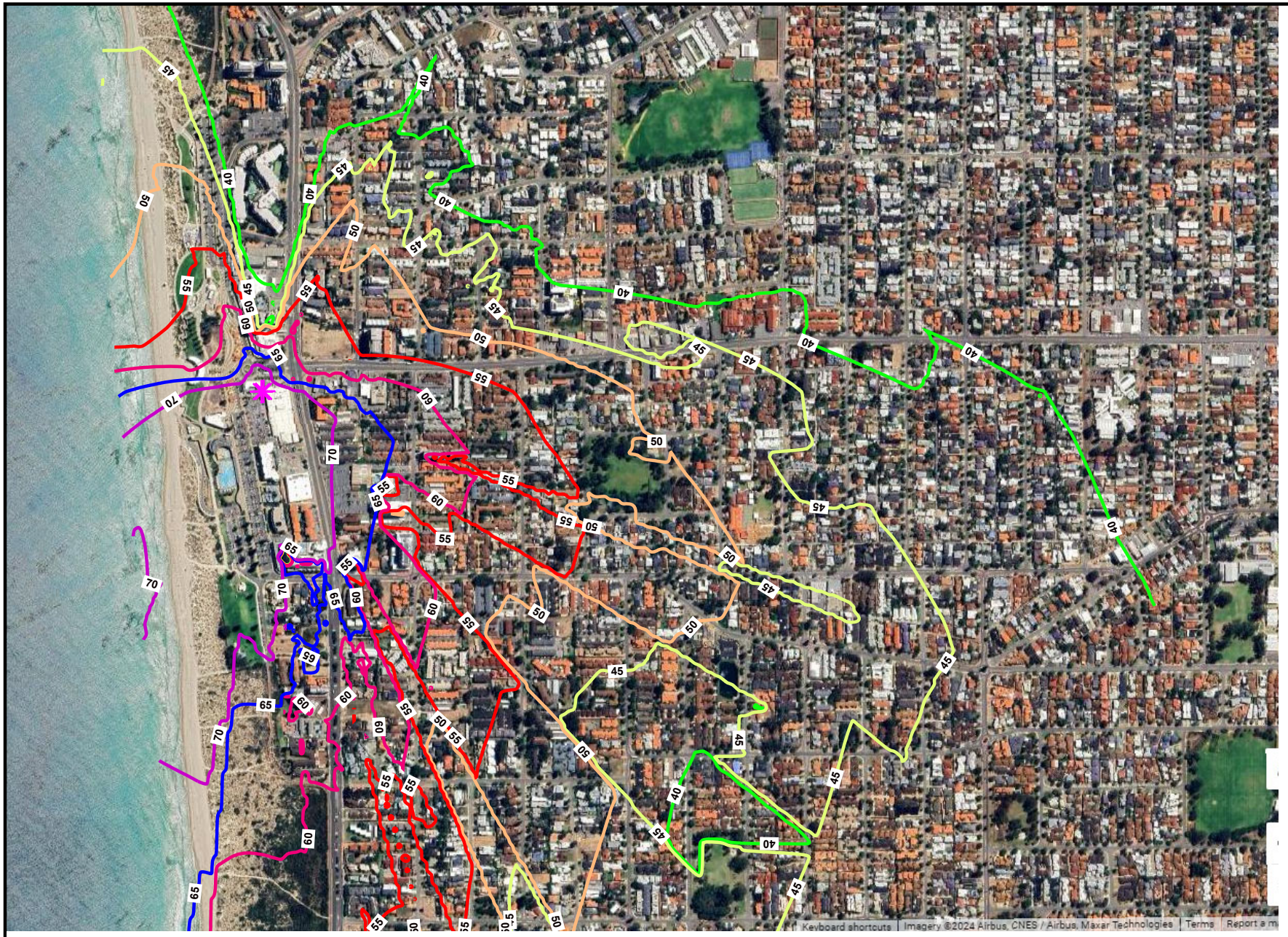

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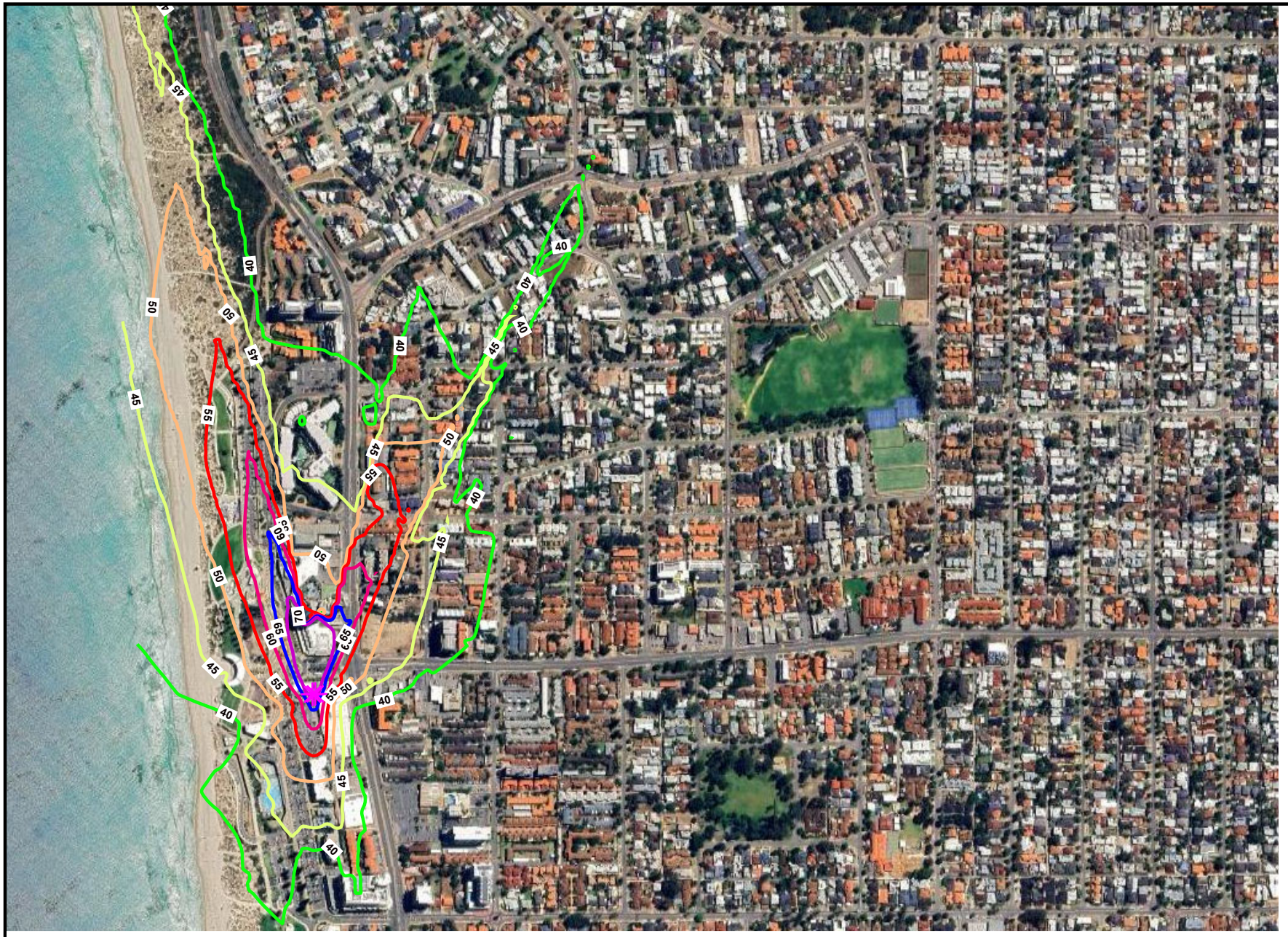
Figure 15



Laneway Concert (Speakers facing North) - Scarborough Beach
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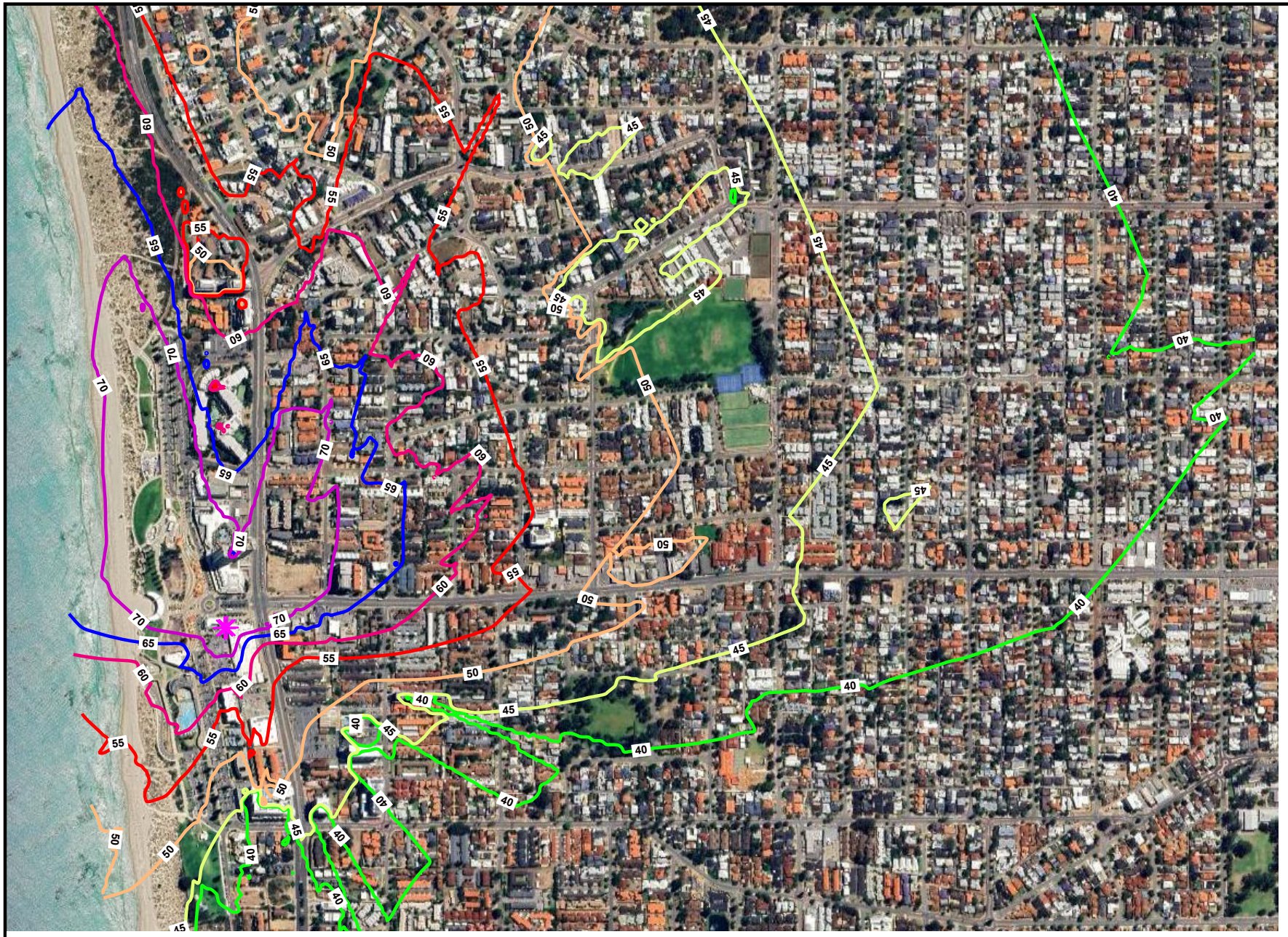
Figure 16



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Appendix A – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- **L_{Aeq}**

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

- **Chart of Noise Level Descriptors**