Noise and Sound Services

Road Traffic Noise Assessment

At:-

344-350 Caddens Road,
Claremont Meadows,
NSW 2747.

October 2015

Report No. nss22178 – Final Rev C

Prepared at the request of:-

Indesco Pty Ltd
Level 7, 80 George Street,
Parramatta,
NSW 2150

Prepared by:-

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Association of Australian Acoustical Consultants

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1. INTRODUCTION

Noise and Sound Services was requested by from Indesco Pty Ltd of Level 7, 80 George Street, Parramatta, NSW 2150, to carry out a road traffic noise assessment at a greenfield site off of 344-350 Caddens Road, Claremont Meadows, NSW 2171. During the site visit it was noted that new roads have been established but no works on the buildings had commenced. It is proposed to divide the site to create approximately fifty-one Torrens title lots to consist of either single-storey residential houses or double-storey residential houses.

The purpose of the survey is to assess road traffic noise levels and advise on the sound insulation requirements from external noise in line with the State Environmental Planning Policy (Infrastructure) 2007 Clause 102 - Impact of road noise or vibration on non-road development and the Australian Standards AS 3671 and AS 2107 – 2000 *'Acoustic – Recommended Design Sound Levels and Reverberation Times for Building Interiors'*.

2. SITE AND DEVELOPMENT DESCRIPTION

The proposed development is along newly extended roads namely Doncaster Road, Brushwood Street, Central Park and Lomandra off of 344-350 Caddens Road, Claremont Meadows. Doncaster Road backs onto an arterial road being the M4 Motorway, Claremont Meadows. The nearest façade on the development site is located approximately 70 metres from the M4 Motorway. On the site it is proposed to construct approximately fifty-one residential dwellings. Full details are given the outline drawing provided by Indesco Pty Ltd, see Figure 1 below.

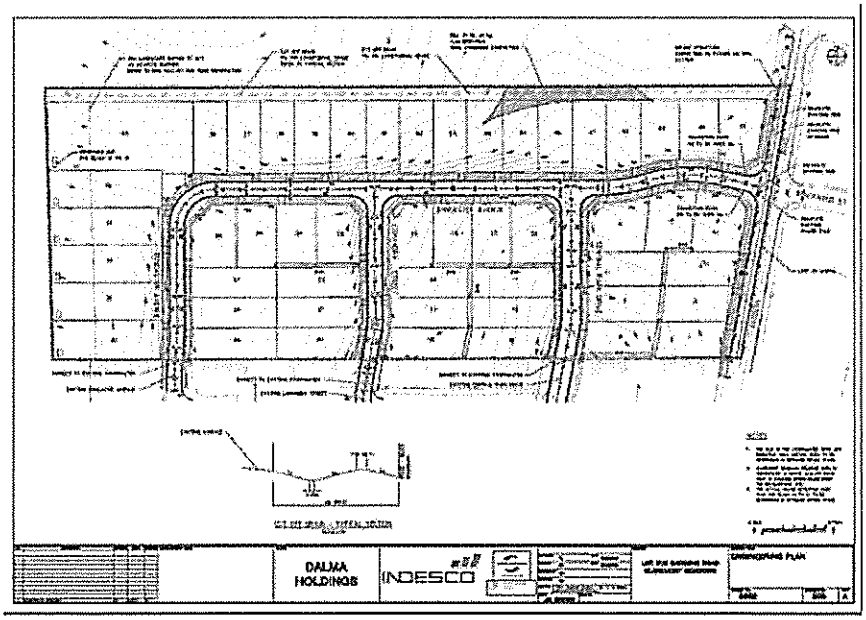

Figure 1. Outline Site Plan.

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There is an existing earth bund between the M4 and proposed site. The earth bund is of varying heights, however, due to the relatively large set back, it is not estimated that this will need to be modified at this stage. Changes to potential earth bunds and noise barriers have been taken into account.

3. CRITERIA

3.1 State Environmental Planning Policy (Infrastructure) 2007 Clause 102 - Impact of road noise or vibration on non-road development

The State Environmental Planning Policy (Infrastructure) 2007, Subdivision 2 Development in or adjacent to road corridors and road reservations, Clause 102, Impact of road noise or vibration on non-road development provides the following:-

1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:
   (a) a building for residential use,
   (b) a place of public worship,
   (c) a hospital,
   (d) an educational establishment or child care centre.

2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

   (a) in any bedroom in the building — 35 dBA at any time between 10 pm and 7 am,
   (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) — 40 dBA at any time.

4) In this clause, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.

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3.2 Australian Standards AS 3671 and AS 2107

The Australian Standard AS 3671-1989 *'Acoustics - Road traffic noise intrusion - building siting and construction'* refers to guideline limits in Australian Standard AS 2107. Australian Standard AS 2107 – 2000 *'Acoustic – Recommended Design Sound Levels and Reverberation Times for Building Interiors'* provides recommended design sound levels for different areas of occupancy in buildings. This includes recommended internal design sound levels from continuous road traffic noise for houses near major roads as shown in Table 1 below.

TABLE 1 - RECOMMENDED DESIGN SOUND LEVEL FOR RESIDENTIAL BUILDINGS INTERIORS. FROM AS 2107 (2000).

Type of Occupancy	Recommended Design Sound Level ($L_{Aeq,}$) dBA	
	Satisfactory	Maximum
Houses Near Major Roads		
Living Areas	35	45
Sleeping Areas	30	40
Work Areas	35	45
Kitchen, Laundry and Maintenance Areas	45	50

3.3 Site Specific Indoor Noise Goals

Site-specific indoor road traffic noise goals ($L_{Aeq,\ period}$) in line with the State Environmental Planning Policy (Infrastructure) 2007 and Australian Standard AS 2107 are set at 35 dBA for sleeping areas and 40 dBA for living/work areas.

3.4 Outdoor Noise Goals

Target outdoor noise level for existing freeways, arterial and sub arterial roads as given in the NSW Government's Road Noise Policy are: day time (7:00 am to 10:00 pm) $L_{Aeq,\ (15\ hour)}$ **60 dBA** and night time (10:00 pm to 7:00 am) $L_{Aeq,\ (9\ hour)}$ **55 dBA.**

4. NOISE MEASUREMENT RESULTS

4.1 Instrumentation – Noise

The instrumentation used during the noise source survey consisted of a Brüel and Kjær sound level meter model 2250 (serial no. 2446904). This meter conforms to

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Australian Standard AS IEC 61672.1-2004 : '*Electroacoustics - Sound level meters – Specifications*' as a class 1 precision sound level meter and has an accuracy suitable for both field and laboratory use. The calibration of the meter was checked before and after the measurement period with a Brüel and Kjær acoustical calibrator model 4231 (serial no. 2445349). No significant system drift occurred over the measurement period.

The sound level meter and calibrator were checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates within the last 24 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O., Lindfield, NSW, Australia.

4.2 Instrumentation – Vibration

The instrumentation used for the vibration survey consisted of a Texcel Pty Ltd., Compact monitor model CTM (serial no. 3114). This meter utilises a tri-axial geophone which has an accuracy of +/- 5% at 31.5 Hz and a band width of 4.5 to 500 Hz suitable for both field and laboratory use. The vibration meter was checked, adjusted and aligned to conform to the Texcel Pty Ltd, factory specifications and issued with a conformance certificate within the last two years.

4.3 Measurement Procedure – Noise

The acoustical measurements were carried out in accordance with Australian Standards AS 1055. '*Acoustics –Description and Measurement of Environmental Noise*', (1997) and AS 2702 '*Acoustics –Methods for the Measurement of Road Traffic Noise*', (1984) as required by Australian Standard AS 3671 '*Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*' (1989).

Free field noise measurements were carried out in the vicinity of the proposed residential site, approximately 55 metres from the M4 Motorway. The measurements were carried out on Friday 5th December 2014 (see Appendix A below for full results). The 'A' frequency weighting and 'fast' time weighting were used exclusively. The weather was overcast with sunny periods and negligible wind. The time of the measurements was selected as representing a time when the traffic flows are considered to be high whilst maintaining free flow, i.e. without congestion. As such, noise levels are considered to be a worst-case scenario. Night time levels (from 10:00 pm to 7:00 am) are lower than the day time levels and hence meeting the criteria during the day time will also ensure that the night time criterion is met.

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4.4 Measurement Procedure – Vibration

Sample ground borne vibration measurements were taken on site on Friday 5th December 2014.

4.5 Measurement Results – Noise

The day time energy average road traffic noise level ($L_{Aeq,\ 1\ hour}$) was 55 dBA at approximately 55 metres from M4 Motorway. Full measurement results are shown in Appendix A. At 70 metres the noise level will reduce to 54 dBA (from $53 = 55 - 10\ \log_{10}(70/55)$).

4.6 Measurement Results - Vibration

The vibration magnitudes at the proposed site were less than 0.05 mm/s. This is below the level of perception (0.5 mm/s) for whole body vibration. Therefore no further action is required for road traffic vibration.

5. DISCUSSION AND CALCULATIONS

This section of the report discusses the measurement results at the site for the proposed residential houses which are likely to be single storey or double storey homes with three or four bedrooms. Detailed formula is used to predict external and internal noise levels for various rooms of the proposed residences.

5.1 External Noise Levels

5.1.1 Existing Road Traffic Flows

The free field external road traffic noise level ($L_{Aeq,\ 1\ hour}$) measurement at the vacant lot of the subject site was found to be 55 dBA at the measurement location of 55 metres from the M4 Motorway. The nearest façade of the residential houses facing the M4 Motorway is at a distance of approximately 70 metres. The distances of other rooms in other residences of the development from the measurement position have been taken into account. The 15 hour energy average ($L_{Aeq,\ 15\ hour}$) is calculated to be 53 dBA; however the assessment is based on **57 dBA** (54 dBA + 3 dB) to take the worst case hour into account.

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5.1.2 Predicted Road Traffic Flows

Predicted road traffic flows are based on the document by GHD for the Road and Maritime Services (RMS) entitled *"Report for Werrington Arterial Road Stage 1 (M4 Motorway to GWH) Corridor Traffic Impact Assessment"* (dated 25 December 2012). Road traffic noise prediction is based on formula given in the *"Calculation of Road Traffic Noise"* – UK Department of Transport 1988.

The predictions take into account the new on ramp which brings the road alignment closer to the rear boundary of the southern lots, the possible removal of the existing construction works earth bund and the road traffic noise impacts associated with the proposed upgrade of Gipps Street as part of Werrington Arterial Project. This is based on Roads and Maritime Services of NSW drawing number 0202 – aa005606-nsd-00.dwg, Issued for construction dated 6-02.15.

The free field external road traffic noise level worst case hour ($L_{Aeq,\ 1\ hour}$) at the vacant lot of the subject site was calculated to be **67 dBA** at the closest location of 19 metres from the nearest lane of the proposed Werrington Arterial. This is based on 1200 vehicles per hour, 5% heavy vehicles, 2% road gradient, 80 kilometres per hour traffic speed and 180° angle of view.

5.2 Internal Noise Levels

In addition to distance attenuation, the internal noise level (L_{p2}) in various rooms of the proposed development is found from the formula:

$$\mathbf{L_{p2} = L_{p1} - R_w + 10\ Log_{10}\ (S/A) - K + 6\ dBA}$$

Where: L_{p1} is the external noise level;
R_w is the weighted sound reduction index of the partition;
S is the area of the partition (window or glazed door);
A is the room acoustic absorption; and
K is an angle of view correction.

By applying this formula the selection of the weighted sound reduction index (R_w) for the windows and glazed doors in the external façades for the proposed residential dwellings can be found. The glazed areas are normally the weakest acoustic partition in the room façades.

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6. RECOMMENDATIONS

This section provides the minimum construction requirements to meet the internal noise goals.

6.1 External Wall Construction

The external walls must have a minimum R_w of approximately 45 dB, which is standard for:-

- brick veneer consisting of 110 mm thick exterior face brick, with 90 mm deep timber stud or 92 mm metal stud, at least 40 mm clearance between the masonry and stud frame and 10 mm thick plasterboard internal wall constructions; or

- double brick of 110 mm brickwork separated by at least a 40 mm gap; or

- timber frame cladding consisting of 6 mm thick fibre cement sheeting or weatherboard or plank cladding externally, 90 mm deep timber stud or 92 mm metal stud 13 mm thick standard plasterboard internally with R1.5 thermal insulation in the wall cavity.

6.2 Roof / Ceiling Construction

The roof/ceilings must have a minimum R_w of 48 dB, which is standard for a pitched sheet metal or concrete tiled roof with sarking and one layer of 13 mm thick plasterboard ceiling fixed to the ceiling joists and R2 (or greater) thermal insulation in the roof cavity. The plasterboard walls and ceiling should be well sealed. The joint between the wall and ceiling can be sealed, for example, with a resilient layer such as mastic and covered with a plasterboard cornice or the joint can be sealed with tape and cornice cement.

6.3 Minimum Glazing Thickness and R_w Ratings

Detailed designs for the proposed dwellings have not yet been finalised, hence assumptions have been made for typical glazing sizes and locations for the residences. To meet the internal design goals, as given in Section 3.3 above, and based on assumptions of typical constructions, the glazing for the rooms will require the glass thicknesses specified in:-

- Table 2 below for typical desistance from the roadway: and
- Table 3 below for worst-case distances from the roadway.

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This is to give the recommended R_w ratings. Once the final architectural plans have been produced a final design in window thicknesses will need to be provided as this is dependent upon room sizes, room orientations, room uses, window areas, any existing and/or proposed noise barrier length and height.

TABLE 2 - TYPICAL CASE SCENARIO MINIMUM GLAZING THICKNESS AND R_W RATINGS – 334-350 CADDENS ROAD, CLAREMONT MEADOWS, NSW 2747.

Room	Assumed Size of Glazing (mm)	Recommended Glazing Minimum Thickness	Required Minimum R_w or STC (dB)
Typical Double Storey House			
Lounge / Family / Dining	2100 x 2700 1000 x 1500 x 2	6.38 mm Laminated sliding door with Fin Seals 4 mm Float awning windows	29 28
Bedroom 1	2100 x 1800	6.38 mm Laminated awning window with Qlon Seals	33
Bedrooms 2, 3 and 4	1800 x 1200	6.38 mm Laminated awning window with Qlon Seals	33
Typical Single Storey House			
Lounge / Family / Dining	2100 x 2700 1000 x 1500 x 2	6.38 mm Laminated sliding door with Fin Seals 4 mm Float awning windows	29 28
Bedroom 1	2100 x 1800	6.38 mm Laminated awning window with Qlon Seals	31
Bedrooms 2, 3 and 4	1800 x 1200	6.38 mm Laminated awning window with Qlon Seals	31

Notes:-

- *All other glazing to be a minimum of 4 mm thick float glass for habitable rooms with a minimum R_w or STC rating of 22 dB;*
- *R_w = Weighted Sound Reduction Index, covers a frequency range from 100 Hz to 3.15 kHz;*
- *STC = Sound Transmission Class, covers a frequency range from 120 Hz to 4 kHz;*
- *Glazing systems recommended are minimum requirements for acoustic purposes. In some cases thicker glass may be required for safety or other reasons.*

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TABLE 3 - WORST-CASE SCENARIO - MINIMUM GLAZING THICKNESS AND R_W RATINGS – 334-350 CADDENS ROAD, CLAREMONT MEADOWS, NSW 2747.

Room	Assumed Size of Glazing (mm)	Recommended Glazing Minimum Thickness	Required Minimum R_w or STC (dB)
Typical Double Storey House			
Lounge / Family / Dining	2100 x 2700 1000 x 1500 x 2	10.38 mm Laminated sliding door with Fin Seals 10.38 mm Laminated awning windows with Qlon Seals	33 32
Bedroom 1	2100 x 1800	10.38 mm Laminated awning window with Qlon Seals	36
Bedrooms 2, 3 and 4	1800 x 1200	10.38 mm Laminated awning window with Qlon Seals	34
Typical Single Storey House			
Lounge / Family / Dining	2100 x 2700 1000 x 1500 x 2	10.38 mm Laminated sliding door with Fin Seals 10.38 mm Laminated awning windows with Qlon Seals	33 32
Bedroom 1	2100 x 1800	10.38 mm Laminated awning window with Qlon Seals	34
Bedrooms 2, 3 and 4	1800 x 1200	10.38 mm Laminated awning window with Qlon Seals	33

Notes:-

- *All other glazing to be a minimum of 4 mm thick float glass for habitable rooms with a minimum R_w or STC rating of 26 dB;*
- *R_w = Weighted Sound Reduction Index, covers a frequency range from 100 Hz to 3.15 kHz;*
- *STC = Sound Transmission Class, covers a frequency range from 120 Hz to 4 kHz;*
- *Glazing systems recommended are minimum requirements for acoustic purposes. In some cases thicker glass may be required for safety or other reasons.*

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6.4 Entry Doors

The external entry doors (including from garages to habitable rooms) should be at least 35 mm thick and of solid-core construction. The doors should also be fitted with acoustic seals (e.g. *'Lorient'* IS7025 and IS8011si or *'Raven' RP47* frame and *RP38* bottom seals) to give a certified R_w rating of at least 32 dB.

6.5 Ventilation

An acoustically insulated building must be kept virtually air tight to exclude external noise. Therefore for the windows requiring laminated glazing in Table 2 above, and to achieve the required R_w ratings, the windows must be kept closed. Hence there is a requirement for mechanical ventilation or air-conditioning to provide fresh air to control odours. Specific ventilation requirements are outside of our scope of expertise, however requirements for indoor-air quality are given in Australian Standard AS 1668.2 -2002, *"The use of ventilation and air-conditioning in buildings - Ventilation design for indoor air contaminant control"*. Internal noise levels from mechanical ventilation or air-conditioning should not exceed 35 dBA for bedroom areas and 40 dBA for all other habitable areas. External noise levels from mechanical ventilation or air-conditioning should not exceed 5 dB over the lowest existing background noise level (L_{A90}) when in day time use and when measured at the neighbouring boundary. Night time noise levels must meet the requirements of the Protection of the Environment Operations (Noise Control) Regulation 2008.

6.6 External Road Traffic Noise Levels

For most areas the external road traffic noise levels will be below the targets for existing freeways, arterial and sub arterial roads as given in the NSW Government's Road Noise Policy as given in Section 3.4 above. However a for some areas a noise barrier of between 1.8 and 2.1 metres high between the outdoor areas facing the motorway, Gipps Road and Werrington Arterial Road will be required to meet the NSW Government's Road Noise Policy. It is recommend that a noise barrier of between 1.8 and 2.1 metres high between the outdoor areas facing the motorway is constructed for all areas. These barriers may be constructed by the RMS or others. Vegetation buffers will reduce visual impacts but will not provide any significant noise attenuation for this site.

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7. SUMMARY AND CONCLUSIONS

Noise and vibration from road traffic movements using the M4 Motorway has been measured in the vicinity of 344-350, Caddens Road, Claremont Meadows, NSW 2747. The measurements have been used to predict internal noise levels for the proposed residential dwellings development. Providing that the recommendation details shown in Section 6 above are fully complied with no exceedences of the internal noise or vibration levels are predicted. Mechanical ventilation or air conditioning is required.

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Draft	15th December 2014	Mark Scannell *BA (Planning)* MAAS
Status	**Date**	**Checked by:**
Draft	16th December 2014	Ken Scannell MSc MAAS MIOA.
Status	**Date**	**Issued by:**
Final	27th January 2015	Ken Scannell MSc MAAS MIOA.
Status	**Date**	**Issued by:**
Final Rev A	10th July 2015	Ken Scannell MSc MAAS MIOA.
Status	**Date**	**Issued by:**
Final Rev B	22nd July 2015	Ken Scannell MSc MAAS MIOA.
Status	**Date**	**Issued by:**
Final Rev C	27th October 2015	Ken Scannell MSc MAAS MIOA.

Important Note. *All products and materials suggested by 'Noise and Sound Services' are selected for their acoustical properties only. All other properties such as airflow, aesthetics, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, grout or tile cracking, loading, shrinkage, ventilation, etc are outside of 'Noise and Sound Services' field of expertise and* ***must be*** *checked with the supplier or suitably qualified specialist before purchase.*

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APPENDIX A – MEASURED SOUND PRESSURE LEVELS

Environmental noise levels can vary considerably with time; therefore it is not adequate to use a single number to fully describe the acoustic environment. The preferred, and now generally accepted, method of recording and presenting noise measurements is based upon a statistical approach. For example, the L_{AF10} noise level is the level exceeded for 10% of the time, and is approximately the average maximum noise level. The L_{AF90} level is the level that is exceeded for 90% of the time, and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the 'background' noise level. The L_{Aeq} level represents the average noise energy during the measurement period.

The measurement procedure and the equipment used for the noise survey are given in section 4 of this report. The measurement results are shown in Table A1 below. All sound pressure levels in Table A1 below are rounded to the nearest whole decibel.

TABLE A1 – 344-350 CADDENS ROAD, CLAREMONT MEADOWS, NSW 2747, 5th DECEMBER 2014 – 55 METRES FROM THE M4 MOTORWAY.

Time		Sound Pressure Level (dBA)					
Start	Finish	L_{Aeq}	L_{AF1}	L_{AF10}	L_{AF50}	L_{AF90}	L_{AF99}
14:40	14:55	54	61	57	53	50	49
14:55	15:10	55	60	58	54	53	52
15:10	15:25	56	60	58	55	53	52
15:25	15:40	56	60	58	56	54	53
14:40	**15:40**	**55**	**61**	**58**	**55**	**50**	**49**

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APPENDIX B - EXAMPLE MATERIAL SUPPLIERS

Acoustic Glazing Suppliers

Windows

''Trend Windows & Doors Pty Ltd' telephone (02) 9840 2000.
www.trendwindows.com.au
'Wideline Pty Ltd' telephone (02) 8304 6400.
www.windowline.com.au
'Vantage Windows' telephone 1300 026 189
http://www.awsaustralia.com.au
'Christoffel Pty Ltd' telephone (02) 9627 4811
www.christoffel.com.au/contact.htm
'Sound Barrier Systems Pty. Ltd' telephone (02) 9540 4333
www.soundbarrier.com.au

Acoustic Absorbent Material

Pyroteck - telephone 13 17 44.
Tontine Website: www.spec-net.com.au/tontine/acoustic/acousorb.htm

Acoustic Door Seals

Lorient, Australia. Now called Kilargo. www.kilargo.com.au

Raven – telephone 1800 888 123 www.raven.com.au

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