Arup**Acoustics**

Johnson Property Group

Trinity Point Marina and Mixed-Use Development

Acoustic Assessment Report

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REV E

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Acoustic Assessment Report

November 2008

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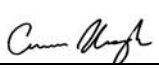
		Signature			
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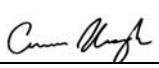
		Signature			
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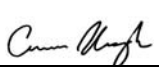
		Signature			
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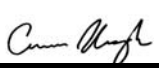
		Signature			

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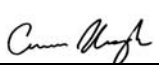
		Signature			
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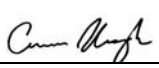
		Signature			
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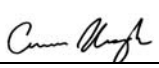
		Signature			
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Contents

Appendices

Executive Summary

The proposed development at Trinity Point has been evaluated against the acoustic assessment requirements set out in the Director-General's requirements, appropriate EPA policy, relevant Australian Standards and the Lake Macquarie City Council DCP No.1.

Design of the proposed development will be conducted in accordance with noise criteria and guidelines set from relevant Australian Standards and the NSW DECC Industrial Noise Policy.

Operational noise levels, road traffic noise levels and marine vessel noise levels from the Trinity Point site are generally expected to meet the criteria, subject to appropriate noise mitigation measures including treating equipment where necessary and managing traffic movements on site.

Helicopter noise levels from the development are not expected to cause an adverse noise impact on residential amenity or on land and aquatic flora and fauna.

Effective management of the construction process to minimise noise, including selection of equipment, work practices and work methods, will be necessary to minimise the noise impact of the construction works on surrounding noise-sensitive receivers. The guidance of the NSW DECC Draft Construction Noise Guideline has been followed in assessing noise impacts and formulating noise mitigation measures.

A process of community consultation will form an integral part of ameliorating the construction noise impact. A Construction Noise Management Plan is required to be produced in accordance with the requirements of Lake Macquarie City Council to facilitate the mitigation of construction noise from the development.

Providing that appropriate measures are adopted to manage construction and operational noise from the development, the proposed development is considered to be suitable based on the relevant requirements given by Director-General of the Department of Planning.

A summary of the relevant sections of the Director-General's requirements addressed in this assessment is presented in Table 1 below.

Requirement	Section(s) of Report
9.2	5.1 – 5.4; 6.1 – 6.6
15.1	4.6
15.2	6.7
15.3	4.6, 5.5, Appendix C, Appendix D

Table 1: Summary of Requirements covered in this report.

1 Introduction

1.1 Background

Johnson Property Group are proposing to develop a marina and mixed use resort within 'Trinity Point', a master-planned, lakefront residential community on the southwest edge of Lake Macquarie. The following acoustic assessment has been prepared by Arup Acoustics to address acoustic issues associated with the proposed development.

The acoustic assessment has been prepared for Johnson Property Group to form part of an application to NSW Department of Planning (DoP) for Concept Plan approval under Part 3A of *the Environmental Planning and Assessment Act, 1979*.

1.2 Scope of Assessment

Director General's Environmental Assessment Requirements (DGEARs) have been issued to Johnson Property Group by DoP for the Concept Plan for the development.

There are four requirements given under the Concept Plan DGEARs for acoustics, as follows:

9. Noise Impact

- 9.2. A Noise Assessment Report, prepared by a qualified acoustic consultant, is required to investigate potential noise impacts to more sensitive tourist and residential uses on the site and in the vicinity during the construction phase of the proposal and from the general operation of the marina facility and road transport to and from the site. Where necessary outline details of noise amelioration measures for the marina complex (refer to discussion under Section 15 in relation to helicopter noise).

15. Establishment of Helipad and Helicopter Noise Impacts

- 15.1 Address CASA's Guideline for Establishment and Use of Helicopter Landing Sites (HLS), in particular the "Recommended Criteria for a Basic and Standard HLS"
- 15.2 A Noise Assessment Report, prepared by a qualified acoustic consultant is required to investigate potential noise impacts associated with the taking off, approaching and en-route of helicopters to the helipad. The report shall address potential impacts on residential areas and other noise sensitive locations/uses; fauna and their habitats in particular threatened species, populations, or ecological communities of fish or marine vegetation and their critical habitat.
- 15.3 Identify all types of helicopters that are proposed to be used and include flight path, hours and frequency of operation, noise contours/levels, route, noise mitigation measures and/or acoustic treatments and need for such a facility. Best practice in the measurement and prevention/mitigation of noise impacts shall be adopted.

This acoustic assessment specifically addresses these requirements.

2 Project Description

The Project relates to the marina, tourist village and helipad components of the overall Trinity Point Marina and Mixed Use Resort development including:

- staged 308 berth floating marina and associated services;
- a breakwater jetty structure;
- a floating helipad pontoon;
- repair and maintenance facilities; and
- commercial, residential and tourist accommodation.

The proposed layout of the project is presented in Figure 1.

Figure 1 Proposed Site Layout

2.1 Marina

The marina would comprise a 308 berth floating marina for craft in the length range of 8 m to 20 m. The marina will extend approximately 300 m from the shoreline with access to the berths via a floating system of walkway, with finger units at right angles creating the berthing pens. The floating walkway would be connected to the marina village via a 10 m aluminium gangway connecting to a fixed boardwalk. A sliding gate would be installed at the head of the access gangway for security.

The marina berths would be supplied with water, power, fire and lighting services, with the capacity for introduction of telephone and TV if required. These services would be available to the berths via service pedestals supplied from land-based infrastructure.

2.2 Helipad

A floating helicopter landing platform is proposed on a pontoon on the eastern side of the marina breakwater. The helipad would be a 25 m by 25 m floating steel pontoon anchored to the lake bed, with an access gangway directly from the breakwater walkway.

2.3 Repair and Maintenance Facilities

The repair and maintenance facilities would comprise a boat travel-lift, hardstand area and workshop and would be located on the western side of the site.

2.3.1 Boat Travel-lift

A boat travel lift is proposed for the marina and will consist of a large, movable steel frame outfitted with lifting and support mechanisms. The boat travel-lift facility would be situated at the north-western corner of the hardstand area, will have the capacity in the range of 70 to 75 tonnes, and be capable of lifting a vessel of up to approximately 25 m in length and 8 m beam. The travel-lift will be powered by either a diesel fuelled motor or an electric motor with a maximum power rating of 82 kW.

2.3.2 Hardstand Area

The hardstand area would be approximately 45 m by 25 m to accommodate 7 to 9 vessels at any one time. The hardstand area will also include a 50 m long and 15 m wide runway area for the boat travel-lift. Activities undertaken on the hardstand would include

- washing down and cleaning
- minor surface repairs including scraping down, abrasive blasting, sanding, painting as well as fibreglass, timber and metal work
- minor mechanical/electrical repairs and fit outs

The hardstand would be fenced for safety and security with a mesh wire fence.

2.3.3 Work Shop

A two storey work shop servicing the marina would be incorporated into the north western edge of the marina village building development adjacent to the hardstand area. Activities to be undertaken on the ground floor include any minor maintenance and repair activities which require protection from outdoor exposure and are likely to include mechanical and electrical repairs such as gear breakages and minor surface repairs. Any major repairs are to be conducted off-site.

A plant room and amenities are also proposed for the ground floor.

On the first floor of the workshop would be offices and amenities.

2.4 Breakwater Jetty

The breakwater would consist of two rows of parallel tubular steel piles driven in to the lake bed, with timber slats supported on outer side of each row of piles. This arrangement is designed to attenuate wave energy within the marina, as well as minimising the reflection of wave energy and subsequent impacts on surrounding foreshore areas.

The breakwater would also have a fixed timber walkway, allowing access around the perimeter of the marina approximately 300 m from the shoreline, and for access to the Helicopter Landing Platform.

2.5 Commercial, Residential and Tourist Accommodation

2.5.1 Village Centre

The village centre would incorporate restaurants, a function room, meeting rooms, cafes, commercial offices and retail, public and marina patron amenities, marina operations offices, maintenance workshop and offices, and a manager's residence (apartment).

2.5.2 Tourist Accommodation

Immediately to the south of the village centre, short term tourist accommodation would be provided including resort and serviced apartments style lodging.

2.5.3 Residential Accommodation

The southern precinct of the site will include residential accommodation blocks, located to the south of the tourist accommodation area.

3 Noise Survey

3.1 Purpose of the Noise Survey

A noise survey was carried out to assess the current ambient noise levels around the proposed Trinity Point development site and to identify noise sensitive receivers. This survey consisted of both attended and unattended noise monitoring.

The purpose of the noise survey was to identify:

- Existing ambient noise levels, in order to assess the impact of the development on the surroundings and develop noise criteria.
- Potential noise-sensitive receivers in the vicinity.

3.2 Methodology

A noise survey was carried out to establish the current ambient noise levels around the proposed development site and to identify noise sensitive receivers. This included both attended and unattended monitoring.

From Tuesday 9 October 2007 to Friday 19 October 2007, two unattended noise loggers were set up within the grounds of the former St. John of God site at Trinity Point as shown in Figure 2.

One noise logger was located at the north end of the site, adjacent to Bardens Bay and the proposed marina location. A second noise logger was located in the centre of the site, in the vicinity of the proposed residential area of the development. Measurement locations used for the unattended noise survey are shown in Figure 2:

Figure 2: Noise Measurement Locations

Although it is preferable to conduct unattended noise measurements at noise-sensitive premises, at the time of the initial survey access to private property to position the loggers was not available, and therefore they were located on the subject site.

However, to verify the results, supplementary unattended measurements were conducted from 23 October 2008 to 31 October 2008 at three residential locations – 37 Trinity Point Drive, Morisset Park; 13 Henry Road, Morisset Park; and 9 Lake View Avenue, Brightwaters.

The loggers recorded L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} statistical noise level parameters at 15 minute intervals continuously for the week long measurement period (See Appendix A for a glossary of acoustic terminology). Weather patterns were noted during this period and where noise levels were affected the data was not used. The loggers were checked for calibration before and after the monitoring period, and no significant drift in calibration occurred.

The average hourly noise levels throughout the day have been determined from the total measurement period for both logger locations. The data from Logger 1 at the northern end of the site was used for setting noise criteria, as this logger is located closer to the nearest noise sensitive receivers and is therefore considered to be more representative of the acoustic environment at these receivers.

Averaged noise data from Logger 1 is presented graphically in Appendix B. The raw data from the loggers is available upon request.

The measured Rating Background Levels from the supplementary logger data were comparable (within 2 dB(A)) to those obtained from the data from Logger 1 at the northern end of the Trinity Point site. Therefore, the noise data from Logger 1 is considered to be representative of the ambient noise environment in the vicinity of Trinity Point.

To supplement and verify the unattended measurements some attended measurements were also undertaken at the logger locations. Further attended measurements were also made adjacent to the property boundary of 57C Lakeview Road, Morisset Park, which is the nearest noise sensitive receiver to the Trinity Point site, and at other noise-sensitive receivers located around Bardens Bay and on the Morisset Peninsula, as detailed in Table 2. See Plot 1 in Appendix D for approximate locations of these receivers.

To verify that the background noise levels at the other receivers are comparable to the logger data, the L_{A90} statistical noise level parameter was measured at these locations over 15 minute measurement periods, during the daytime period of the INP (measurements were taken approximately between 11:00 am and 3:00 pm).

Since these attended measurements were taken only at one time during the day, they do not necessarily represent the typical minimum background noise level at the measurement locations, and therefore were not used to set noise criteria. Rather, these measurements are useful in allowing the ambient noise environment at these locations to be compared.

A Brüel and Kjær Type 2236 Sound Level Meter was used to take the measurements. This was checked for calibration before and after the measurements using a Brüel & Kjær Type 4231 Sound Level Calibrator. No deviation occurred. Measured background noise levels at other locations are presented in Table 2.

Measurement Location	Measured Daytime L_{A90}	Comments
57C Lakeview Road, Morisset Park	44 dB	Background noise primarily of natural origin; intermittent light traffic on Lakeview Road.
28 Pillipai Road, Windermere Park	46 dB	Light intermittent traffic on Pillapai Road. Natural background noise. No industrial noise audible
5 Lakeside Close, Bonnells Bay	42 dB	Intermittent traffic (local only); natural background noise; cicadas, birds
6 Lakeview Road, Morisset Park	45 dB	Natural background (birds, wind rustling leaves; waves). Low traffic flow
13 Henry Road, Morisset Park	42 dB	Natural background (wind and birds); sporadic traffic, domestic noise
37 Trinity Point Drive, Morisset Park	43 dB	Natural background, intermittent traffic, domestic noise
9 Lake View Avenue, Brightwaters	43 dB	Natural background noise (wind, birds) main contributor to background. Light traffic flow

Table 2: Attended Background Noise Measurements, dB re 20μPa

3.3 Ambient Noise Environment

The area surrounding Trinity Point has a prevailing noise environment dominated by natural sounds, with little road traffic noise. The area is generally characterised by low background noise levels, and there is little existing industrial noise exposure, with the nearest major industrial noise source observed being the Vales Point Power Station across Lake Macquarie to the south of the development; however noise levels from this source were inaudible or just perceptible at the measurement locations.

These characteristics are consistent with a 'Rural' area as defined in the NSW Industrial Noise Policy (INP)[1].

3.4 Noise Sensitive Receivers

The nearest noise-sensitive receivers to the development are the residential properties surrounding Bardens Bay, with the most sensitive receivers located on Lakeview Road, Morisset Park.

The ambient noise environment at these receivers is characterised by natural noise sources, with intermittent traffic noise from Morisset Park Road and local roads and no significant industrial noise sources. From Table 2, it can be seen that the ambient noise environment at all the attended measurement locations are also characterised by natural

[1] NSW EPA (2000) Industrial Noise Policy

noise sources, with little traffic noise, and that the L_{A90} levels measured during the attended noise survey are quite consistent (within 3 dB(A) across all measurement locations).

Accordingly, the unattended noise measurements taken at the Trinity Point site are considered to be representative of the noise environment at the noise sensitive receivers at Lakeview Road, and have been used in the establishment of noise criteria.

In order to assess the impact of helicopter noise from the helipad operations on the surrounding area, additional noise sensitive receivers adjacent to the helicopter flight path have been adopted. In total, twenty three representative noise-sensitive receivers were used for this acoustic assessment, as detailed in Table 3 and shown in Plot 1 in Appendix D.

Receiver Number	Receiver Address	Approximate Direction from Trinity Point Site
1	Internal Receivers, Trinity Point Development	N/A
2	57C Lakeview Road, Morisset Park	W
3	6 Macquarie Road, Morisset Park	W
4	6 Lakeview Road, Morisset Park	NW
5	28 Pillapai Road, Windermere Park	N
6	Brightwaters Christian College	N
7	34 Bulgonia Road, Brightwaters	NE
8	52 Buttaba Road, Brightwaters	E
9	6 Dandaraga Road, Brightwaters	E
10	11 Omaru Place, Summerland Point	SE
11	14 Scott Road, Vales Point	S
12	39 Henry Road, Morisset Park	W
13	34 Rhodes Parade, Windermere Park	NW
14	57 Asquith Avenue, Windermere Park	NW
15	117 Grand Parade, Bonnells Bay	NW
16	21 Riesling Road, Bonnells Bay	NW
17	16 Wilson Street, Bonnells Bay	NW
18	5 Lakeside Close, Bonnells Bay	N
19	63 Waikiki Road, Yarrawonga Park	N
20	2 Yoorala Road, Yarrawonga Park	N
21	4 Kimbul Road, Brightwaters	NE
22	30 Mirrabooka Road, Mirrabooka	NE
23	205 Dandaraga Road, Mirrabooka	E

Table 3: Noise Sensitive Receivers

Once the Trinity Point development is operational, the tourist and residential areas of the site will become noise-sensitive receivers and noise from operation of the Trinity Point site will be assessed at these internal receivers. In general, Blocks A, B and C will be the most sensitive areas of the Trinity Point site, as they are located closest to the noise-generating areas of the marina, workshop/hardstand and the helipad.

Residential receivers are sensitive to noise 24 hours a day, seven days a week; however, the majority of noise generating activities from the Trinity Point development are proposed to be limited in hours of operation.

Construction noise from the construction of the development will be restricted to the standard construction hours given by the Department of Environment and Climate Change (Monday to Friday 7 am to 6 pm; Saturday 8 am to 1 pm, No work Sundays or Public Holidays).

Similarly, boat repair activities at the workshop and operation of the boat lift would generally only occur during the day time period of the INP as specified in Secition 5.2 of this report (i.e. 7 am to 6 pm).

Operation of helipad is proposed during daylight hours 8am – 6pm Monday to Friday and 10 am – 4 pm Saturday, Sunday and Public Holidays.

Noise from the mechanical services system (i.e. the heating/ventilation/air-conditioning (HVAC) system and associated plant/equipment) for the development is likely to be present for longer time periods, including the evening and night time periods defined in the INP, and therefore noise from these sources will be assessed for all time periods.

Noise from boats is considered to be ‘industrial noise’ while they are in the marina area itself (i.e. within the area enclosed by the marina breakwater, as shown in Figure 1), and would be subject to the INP criteria.

Once boats exit the marina and pass into open waters, noise from boats on open water would be covered by the Protection of the Environment (Operations) Regulation (2008), and would be considered under the provisions of “offensive noise” as defined in the Protection of the Environment (Operations) Act 1997. Therefore, the INP criteria would not apply for vessels once they have left the immediate marina area.

Noise from helicopters using the helipad at Trinity Point is governed by the INP while the helicopter is on the ground, and therefore the helipad is considered to be an “industrial” noise source. As operation of the helipad will be restricted to (at most) 8 am to 6 pm, only the day time period of the INP is applicable to helicopter noise while on the ground.

Due to the size of the Trinity Point site, the nearest affected noise-sensitive receiver varies between noise sources. An overview of the noise sensitive receivers for construction and industrial noise sources is presented in Table 4. ”Internal” receivers indicate “residential” receivers located within the Trinity Point development, such as the residential and tourist accommodation buildings. The nearest affected area of the Trinity Point development for noise from the boat repair operations is Block A.

Noise Source	Nearest Affected Residential Receiver	Approximate Distance to Nearest Affected Residential Receiver
Construction Noise – Workshop/Hardstand	57C Lakeview Road, Morisset Park	180 m
Construction Noise – Marina	52 Buttaba Road, Brightwaters	390 m
Construction Noise – Tourist/ Residential / Resort Buildings	57C Lakeview Road, Morisset Park	250 m
Vessels in Marina	57C Lakeview Road, Morisset Park	425 m
Helicopters on Helipad	52 Buttaba Road, Brightwaters	380 m
Mechanical Plant	57C Lakeview Road, Morisset Park Trinity Point Block A	20 m
Function Room Events	57C Lakeview Road, Morisset Park Trinity Point Block A	10 m
Workshop	57C Lakeview Road, Morisset Park Trinity Point Block A	70 m
Boat Lift	57C Lakeview Road, Morisset Park Trinity Point Block A	120 m
Boat Repair – Hardstand	57C Lakeview Road, Morisset Park Trinity Point Block A	95 m

Table 4: Summary of Noise Sensitive Receivers for Industrial Noise Sources.

3.5 Background Noise Levels

The nearest residential properties that may be adversely affected by operational and construction noise sources are properties along Lakeview Road Morisset Park, as well as the internal receivers within the Trinity Point development.

These residential properties are located across Bardens Bay to the north-west of the development, and the attended noise measurements show that these receivers are likely to have similar ambient noise levels to those measured at the logger locations within the subject site. Accordingly, the unattended noise measurements from Logger 1 have been used to determine the background noise levels for these receivers, as this logger is the closest logger to the receivers.

Due to the existing low traffic noise exposure of the Trinity Point site, background levels at the other noise sensitive receivers around Bardens Bay and Lake Macquarie are likely to be similar to or slightly higher than the levels measured by Logger 1, and therefore using the noise criteria developed for Receiver 2 at these other receivers is likely to result in a conservative assessment.

4 Noise Criteria

Noise criteria for the Trinity Point development have been determined from several relevant sources, including legislation, EPA policy, relevant Australian Standards and guidelines. For environmental noise from the site, each individual use of the site may have its own specific noise criteria, and therefore several sets of criteria must be considered and developed.

The Lake Macquarie City Council Development Control Plan No.1, 2006[2] (DCP No.1) stipulates that developments are to follow the requirements of several NSW Department of Environment and Climate Change documents and Australian Standards, including the Industrial Noise Policy[1] (INP), the Environmental Noise Control Manual[3], the Environmental Criteria for Road Traffic Noise (ECRTN)[4], and Australian Standard AS2107:2000[5] as appropriate.

In general, the DCP requirements will result in acoustic criteria that are in keeping with industry-standard best practice, and have been followed in determining acoustic criteria for the Trinity Point development.

4.1 Internal Design Criteria

4.1.1 Internal Sound Levels

Recommended satisfactory and maximum internal noise levels and reverberation times for various types of building occupancy are given in AS2107. The AS2107 internal noise levels apply to steady-state background noise within the building occupancy, such as mechanical services noise.

Arup Acoustics recommends that external noise break-in from noise sources such road traffic and boat traffic be designed to meet these internal noise level criteria.

Although these sources are not steady state, designing the building envelope with sufficient sound insulation so that noise from these sources meets the overall internal noise levels is considered to be reasonable so that the internal noise amenity of occupants is maintained at all times.

Section 2.1.15 (requirement A4) of the Lake Macquarie DCP No.1 states that developments are to comply with AS2107 or equivalent to control “offensive noise impacts” to the work and living spaces of buildings.

This is in keeping with the character of the Trinity Point development of high-quality residential and tourist buildings and assists in the establishment of an appropriate degree of acoustic amenity for the users of the development. Design of the building elements should also be made with reference to AS3671[6].

Recommended AS2107 internal design levels for various spaces for the Trinity Point development are presented in Table 5. In general, Arup Acoustics recommends designing to the satisfactory AS2107 sound levels for residential/tourist developments.

2 Lake Macquarie City Council (2008), Development Control Plan (Rev01) – Part 2- General Principles of Development, Revision 2
3 NSW Environmental Protection Agency (1994)- *Environmental Noise Control Manual*
4 NSW Environmental Protection Agency (1999) – *Environmental Criteria for Road Traffic Noise*
5 Australian Standard AS2107 (2000) – Acoustics – Recommended design sound levels and reverberation times for building interiors
6 Australian Standard AS3671 (1989) – Acoustics – Road traffic noise intrusion – Building siting and construction

Type of Occupancy	Recommended Sound Level	
	Satisfactory	Maximum
Function Rooms	30	35
Meeting Rooms	30	40
Private Offices	35	40
Gymnasiums	45	55
Small retail stores	45	50
Parking Areas	55	65
Restaurants and Cafes	45	50
Residential/Tourist Accommodation – Living Areas	30	40
Residential/Tourist Accommodation – Sleeping Areas	30	35
Residential/Tourist Accommodation – Common Areas	45	55
Bars and Lounges, Games Rooms	45	50

Table 5: AS2107 Internal Design Sound Levels, dB L_{Aeq}.

4.1.2 Room Acoustics

Recommended mid-frequency internal reverberation times for various spaces for the Trinity Point development are given in AS2107. Table 6 presents a summary of applicable reverberation time criteria for internal areas of the Trinity Point development.

Type of Occupancy	Recommended Mid-Frequency Reverberation Times, s
Function Rooms	0.6 to 0.8
Meeting Rooms	0.6 to 0.8
Private Offices	0.6 to 0.8
Marina Building - Public Spaces	0.4 to 0.6
Small retail stores	Minimised as far as possible
Restaurants and Cafes	Minimised as far as possible
Tourist Accommodation – Common Areas	Minimised as far as possible
Bars and Lounges	Minimised as far as possible
Games Rooms	< 1.0

Table 6: AS2107 Internal Design Reverberation Times.

4.2 Industrial Noise Criteria

The New South Wales environmental noise policy relating to industrial noise is the *New South Wales Environment Protection Authority Industrial Noise Policy* (INP)[1], dated January 2000. Noise emission from plant and equipment on the subject site is required[7] to comply with the noise limits assessed in accordance with the INP

The objective of the INP is to protect residential areas from noise generated by commercial, industrial or trade premises. Noise limits are set based on land use in the area and existing background noise levels. Compliance is achieved if the adjusted L_{Aeq} noise level at any residence affected by noise from the facility is below the noise limit. The adjusted L_{Aeq} is determined by applying corrections for such noise characteristics as duration, intermittency, tonality, and impulsiveness.

The assessment of noise emission under the INP is based on the calculation of a noise limit at a receiver position, taking into account the land-use in the surrounding area and the background noise level.

The INP separates the day into three different time periods – day, evening and night. These time periods are detailed in Table 7.

Period	Day of Week	Time period
Day	Monday-Saturday	0700-1800hrs
	Sunday, Public Holidays	0800-1800hrs
Evening	Monday-Sunday	1800-2200hrs
Night	Monday-Saturday	2200-0700hrs
	Sunday, Public Holidays	2200-0800hrs

Table 7: Industrial Noise Policy Time Periods

The INP provides guidance on acceptable noise levels from the introduction of new industrial noise sources to an area. The assessment procedure for industrial noise sources has two components:

- Controlling intrusive noise impacts in the short term for residences.
- Maintaining overall noise level amenity for particular land uses such as residences

Both of these components result in noise criteria that should not be exceeded in order to avoid any adverse noise impacts on the affected areas. Both criteria should be taken into account when assessing the noise impact of industrial source(s) associated with the proposed development, and where the intrusiveness and the amenity criterion differ, the lower of the noise criteria is generally adopted as the project-specific noise criterion, although in some circumstances it is necessary to specify both criteria as the project-specific criteria.

4.2.1 Intrusiveness Criterion

A 15-minute sampling period is typically used when measuring the level of intrusive noise. This is taken to be a reasonable estimate of the period over which annoyance may occur. Therefore the intrusiveness criterion is summarised as follows:

$$L_{Aeq\ (15\ min)} \leq L_{A90\ (15\ min)} \text{ background Level + 5 dB}$$

[7] Clauses A1 and A3 of Section 2.1.15 of Lake Macquarie DCP No.1

Because of the variable nature of background noise levels, the INP specifies single number background noise levels for use in setting the intrusiveness noise criterion. The Assessment Background Level (ABL) for each time period of a day is the level exceeded by 90 % of the $L_{A90,15min}$ measurements during that time period, and can be considered the "minimum repeatable" . The Rating Background Level (RBL) for a particular time period is the median of the ABL values for that time period for each day of the measurement period.

Industrial noise from the subject development should be controlled to not exceed the Rating Background Level (RBL) + 5 dB at the boundary of any noise sensitive receiver.

The unattended noise measurements from Logger 1 at the north end of the Trinity Point site were used to derive the Rating Background Levels (RBL) for use in setting the intrusiveness criteria. A summary of the intrusive noise criteria for the noise sensitive receivers for the Trinity Point development is given in Table 8.

Time Period	RBL dB(A)	Intrusiveness Criterion RBL + 5 dB(A)
Day	34	39
Evening	34	39
Night	30	35

Table 8: Intrusive Noise Criteria, Noise Sensitive Receivers.

4.2.2 Amenity Criterion

Criteria for the protection of amenity are given for various types of receiver and different times of the day. The amenity criterion is set so that the L_{Aeq} noise level from the industrial noise source does not increase the total industrial noise levels at the receiver above the acceptable noise level (ANL) for that receiver.

The amenity criterion is set based on how close the existing average L_{Aeq} industrial noise levels are to the ANL, using the adjustment factors given in Table 2.2 of the INP.

In cases where the existing $L_{Aeq,average}$ noise levels exceed the ANL by more than 2 dB(A), and the existing noise levels are unlikely to decrease in future, then the amenity criterion is set to be 10 dB(A) lower than the existing noise levels at the receiver.

During the attended noise measurements at Trinity Point, no noise from industrial noise sources was audible. Therefore, the existing industrial noise levels are at least 10 dB(A) below the ambient noise levels, and no correction to the ANL values will apply.

Amenity criteria at all project noise-sensitive receivers are presented in Table 9.

Time period	Average L_{eq}, dB(A)	Acceptable Noise Level, ANL L_{eq}, dB(A)	Modification to ANL*	Amenity Criterion Existing L_{Aeq} + modification of ANL (L_{eq},dB(A))
Day	<40	50	0 dB	**50**
Evening	<35	45	0 dB	**45**
Night	<30	40	0 dB	**40**

* According to Table 2.2 (NSW Industrial Noise Policy, 2000)

Table 9: Noise Amenity Criteria, Noise Sensitive Receivers

4.2.3 Applicable Criteria

The most stringent of the intrusiveness and the amenity criteria shall be the limiting criterion and sets the project specific noise level to be met by the proposed development.

Table 10 compares the intrusiveness and the amenity criteria at the closest residential and commercial Noise Sensitive Receivers, and identifies the limiting criterion for each time period.

Noise Sensitive Receiver	Time Period	Intrusiveness Criterion	Amenity Criterion	Limiting Criterion
57C Lakeview Road, Morisset Park	Day	39	50	**39**
	Evening	39	45	**39**
	Night	35	40	**35**

Table 10 Project Specific Noise Criteria, dB L_{Aeq}

The intrusiveness criterion is the lowest for the day, evening and night-time periods, and therefore forms the limiting noise criterion for industrial noise from the Trinity Point development. This is as expected, considering the low existing industrial noise levels at the Trinity Point site.

These criteria form the project-specific noise criteria for industrial noise from the Trinity Point development. A summary of the project-specific criteria for each industrial noise source contained within the Trinity Point development is presented in Table 11.

Source	Time Periods of Operation	Criterion, dB $L_{Aeq,15min}$
Boat Repair – Boat Lift, Hardstand, Workshop	Day	39
Marina vessels in marina	Day	39
	Evening	39
	Night	35
Helicopters on landing pontoon	Day	39
Mechanical Plant	Day	39
	Evening	39
	Night	35

Table 11: Overview of Industrial Noise Criteria, Trinity Point Development.

4.3 Entertainment Venue Noise Criteria

Events held at entertainment venues (such as the Function Room) of the Trinity Point development have the potential to cause a noise impact at nearby residential receivers, in particular the residential receivers at Lakeview Road, Morisset Park and the internal noise-sensitive receivers located within the Trinity Point development.

Noise criteria for entertainment noise have been developed from the guidance of the NSW Casino, Liquor and Gaming Control Authority, which is the responsible authority under the NSW Office of Gaming, Liquor and Racing (OGLR) for licensing matters. The CLGCA absorbed the functions of the former NSW Liquor Administration Board (LAB) as of 1 July 2008.

The Casino, Liquor and Gaming Control Authority (CLGCA) specifies noise criteria for noise emission from licensed premises. It is anticipated that entertainment venues at the Trinity Point development would be licensed premises, and therefore any event noise generated at these venues must be controlled to meet the CLBCA criteria.

The CLGCA criteria for noise from licensed premises require that:

- The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any octave band centre frequency (31.5 Hz – 8kHz inclusive) by more than 5 dB between 0700hrs (7:00am) and Midnight (12.00am) at the boundary of any affected residence.
- The L_{A10} noise level emitted from the licensed premises shall not exceed the background noise level in any octave band centre frequency (31.5 Hz – 8kHz inclusive) between Midnight (12.00am) and 0700hrs (7:00am) at the boundary of any affected residence.
- Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of Midnight (12.00am) and 0700hrs (7:00am).

No time period for the measurement is given in the above criteria; however it is considered reasonable to adopt at 15-minute time period, which is used by the DECC (in the INP) as a “reasonable estimate of the period over which annoyance may occur”.

4.4 Traffic Noise Criteria

Clause A5 of Lake Macquarie Council's DCP No. 1 requires that:

> *"Vehicle noise generated on the road complies with the NSW EPA publication* Environmental Criteria for Road Traffic Noise*, and/or*
>
> *"Vehicle noise generated within a development site complies with the amenity and intrusive criteria in the NSW EPA* Industrial Noise Policy*"*

Accordingly, noise criteria for traffic movements resulting from the Trinity Point Development have been developed from the INP[1] and the Environmental Criteria for Road Traffic Noise (ECRTN[4]).

Road traffic noise from vehicles on the Trinity Point site is characterised as industrial noise, and therefore vehicle movements on site are subject to the noise criteria discussed in Section 4.2 above.

Road traffic noise from vehicles from the Trinity Point site operating on public roads is subject to the ECRTN noise criteria. The ECRTN provides several categories for type of development and appropriate noise planning targets are given for each type of development.

The ECRTN "embodies a non-mandatory performance-based approach". ECRTN noise criteria are planning goals for new development and as such are not legislative requirements which must be met by new developments. Rather, these criteria should be used as design goals for the development; however the ECRTN recognises that "the criteria are applied as targets, but recognise that there will be situations where planning strategies are not feasible [in reducing the road traffic noise impact]".

Due to the location of Trinity Point on the Morisset peninsula, access to and from the site is restricted to a small number of roads. This has the consequence that traffic movements from the site are likely to be concentrated on these roads. It is expected that Morisset Park Road, which forms part of the access route to Trinity Point[8], will experience the greatest traffic flows from the development.

However, Trinity Point Drive and Henry Road act as collector roads to provide access from the local roads of the Trinity Point development to Morisset Park Road[8]. As these roads currently have little traffic (as they are currently no-through roads), the traffic noise impact from the Trinity Point development is expected to be greatest on these roads.

Therefore, the Trinity Point development is best characterised as a development of Type 8 – *Land use developments with potential to create additional traffic on collector roads*. Table 12 presents an extract from Table 1 of the ECRTN outlining the appropriate noise criteria.

Type of Development	Noise Criterion Day (7 am – 10 pm)	Noise Criterion Night (10 pm – 7 am)
8. Land use developments with potential to create additional traffic on collector roads	60 dB $L_{Aeq(1hr)}$	55 dB $L_{Aeq(1hr)}$

Table 12: ECRTN Criteria for Trinity Point.

In cases where existing traffic noise levels exceed these criteria, the traffic noise from the development should not increase traffic noise levels by more than 2 dB(A).

[8] Better Transport Futures (2007) Proposed Marina Development, Trinity Point NSW – Traffic Impact Assessment Report

Two of the noise loggers used for the supplementary noise survey (situated at 37 Trinity Point Drive and 13 Henry Road) were used to measure existing traffic noise impacts at receivers on these roads. As the Trinity Point development is likely to generate traffic flows on weekends as well as weekdays[8], noise levels from both weekday and weekend measurements were considered in the traffic noise survey.

Measured $L_{Aeq(1hr)}$ ambient noise levels (i.e. the L_{Aeq} of the total noise environment) at 37 Trinity Point Drive over the noise survey were 59 dB(A). Measured $L_{Aeq(1hr)}$ ambient noise levels at 13 Henry Road were 55 dB(A). Therefore, as the traffic noise component of the overall ambient noise environment cannot be greater than the total measured ambient noise levels, it follows that existing traffic noise levels are below the criteria for both roads, and that the noise criteria in Table 12 will apply.

4.5 Construction Noise Criteria

Lake Macquarie Council's DCP No.1 requires noise from construction of the development to comply with the NSW EPA Environmental Noise Control Manual (ENCM[3]) or equivalent.

Chapter 171 of the ENCM provides noise criteria for construction noise from developments. However, the DECC has recently released a *Draft Construction Noise Guideline*[9], which is intended to replace the guideline given in the ENCM[10].

Therefore, as the DCP No.1 allows for noise to be assessed against documents "equivalent" to the ENCM, and the DECC's stated intention is to replace the ENCM criteria with the Draft Guideline, it is considered reasonable to also apply the methodology of the Draft Guideline in setting construction noise targets for Trinity Point.

However, the ENCM criteria have also been considered in setting criteria, and the construction noise predictions from the development will be assessed against both criteria.

4.5.1 ENCM

The defining parameter for construction noise criteria under the ENCM is the duration of construction activities. Construction noise criteria are set based on the background noise levels of the site, which in this case have been taken to be represented by the Rating Background Levels determined in Section 4.1.1 for Receiver 2 (57C Lakeview Road, Morisset Park), which is the nearest-affected noise sensitive receiver for most components of the construction works.

The criteria for demolition/construction noise are as follows:

- Construction period up to 4 weeks and under: the L_{A10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background noise level by more than 20 dB: $L_{A10,15min} \leq$ RBL+20 dB
- Construction period in excess of 4 weeks but no more than 26 weeks: the L_{A10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background noise level by more than 10 dB: $L_{A10,15min} \leq$ RBL+10 dB
- Construction period in excess of 26 weeks: the L_{A10} level measured over a period of not less than 15 minutes when the construction site is in operation. $L_{A10,15min} \leq$ RBL+5 dB

Arup Acoustics understands that construction of Trinity Point is intended to occur through a staged approach, with each stage forming a separate programme of works.

Therefore, each stage of construction can have different construction noise criteria, based on the duration of each stage.

9 NSW DECC (2008) *Draft Construction Noise Guideline*, Draft for Consultation, August 2008.

10 NSW DECC *Draft Construction Noise Guideline* website, http://www.environment.nsw.gov.au/noise/draftconstructgline.htm, accessed 23/10/08

Construction of the marina is proposed to occur in four stages, with Stage 1 of the marina scheduled to take approximately 46 weeks to complete, and Stages 2/3/4 of the marina are scheduled to take approximately 25 weeks each.

Construction of the Village Square, Marina Buildings, Tourist Accommodation and Residential Accommodation is proposed to be conducted in stages, with expected construction duration of each stage of these works ranging from approximately 6-12 months. Therefore, the criteria for a construction period greater than 26 weeks would apply for these works.

Therefore, based on the measured daytime RBL of 34 dB(A), the following ENCM construction noise criteria for the development would apply:

- Marina Stage 1: $L_{A10,15min}$ **≤ 39 dB**
- Marina Stage 2/3/4: $L_{A10,15min}$ **≤ 44 dB**
- Village Square/Marina Buildings/Tourist/Residential: $L_{A10,15min}$ **≤ 39 dB**

4.5.2 DECC Draft Construction Noise Guideline

The Draft Guideline allows two methods of assessment of construction noise: quantitative and qualitative assessments. “Major construction projects” are required to be assessed quantitatively, while smaller projects may be assessed qualitatively. The Draft Guideline states that major construction projects are typically subject to the Environmental Assessment (EA) process.

Therefore, Trinity Point would be categorised as a “major construction project” under the Draft Guideline and a quantitative assessment is required.

Standard construction hours are given in the Draft Guideline as follows for ‘normal construction’:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- No work on Sundays or public holidays

These hours of work are consistent with the ECNM guidance.

Two noise criteria components are set out in Table 4.1 of the Draft Guideline for residential receivers:

- A “Noise affected” level ($L_{Aeq,15min}$) of the Rating Background Level (RBL) + 10 dB(A) during standard construction hours, which “represents the point above which there may be some community reaction to noise”.
- A “Highly noise affected level” of 75 dB $L_{Aeq,15min}$, which “represents the point above which there may be strong community reaction to noise”.

For works outside standard hours, a criterion of RBL + 5 dB(A) applies, but works outside the standard hours would not normally be acceptable without “strong justification”.

The Draft Guideline also presents criteria for groundborne noise and sleep disturbance’ however these criteria only apply for the “Evening” and/or “Night” time periods of the INP (i.e. outside standard construction hours).

It is anticipated at this stage that construction works for Trinity Point will be restricted to the standard hours. Therefore, assessment of construction noise impact will be restricted to standard construction hours only, and only consider airborne construction noise, in accordance with the requirements of the Draft Guideline.

The Rating Background Levels determined in Section 4.1.1 for Receiver 2, which is the closest and most sensitive noise sensitive receiver for most construction works, have been used to determine construction noise criteria based on the Draft Guideline.

Therefore, the following construction noise criteria for the development apply, for construction during standard hours:

- Noise Affected Level $L_{Aeq,15min}$ **44 dB**
- Highly Noise Affected Level $L_{Aeq,15min}$ **75 dB**

4.6 Helicopter Noise Criteria

Noise criteria for helicopter operations from the Trinity Point development have been developed from several sources, including appropriate State Legislation, and the Australian Civil Aviation Safety Authority (CASA)'s *Guidelines for the establishment and use of Helicopter landing sites (HLS)*[11].

The CASA *Guidelines* do not specifically impose noise restrictions on helicopter operation, but mention that noise impacts from helicopter landing sites may be affected by environmental protection legislation. The NSW Protection of the Environment (Operations) Act (1997) ("POEO Act") and the Protection of the Environment Operations (Noise Control) Regulations (2000) ("POEO Regulations") do not impose numerical noise limits on helicopter noise emission, but do specify that helipad operations with more than 30 movements per week require an "environment protection licence".

The proposed helipad at Trinity Point is not intended to have more than 30 helicopter movements per week, and therefore will not require an environmental protection licence.

Lake Macquarie City Council, in its DCP No.1[2] states that the noise criteria of the ENCM should be adopted for noise from premises, where appropriate, and therefore adopting these criteria for helicopter noise from the Trinity Point development would be in keeping with the requirements of Council.

However, in a recent case in the NSW Land and Environment Court (*Lilley vs. Lithgow City Council*[12]), the ENCM criteria were not considered appropriate, and it was concluded by the Senior Commissioner presiding that the "least unsuitable" criteria for aircraft noise were given in the AirServices Australia *Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise* document[13], supplemented by the *Fly Neighbourly Guide* also issued by AirServices Australia.

The noise criteria given in the *Principles and Procedures* document and the *Fly Neighbourly Guide* are as follows:

- Aircraft noise is not considered significant if noise exposure is less than 40 dB $L_{Aeq,24hr}$ and there are less than 50 overflights per day.
- The recommended range of noise exposure for a residence from aircraft noise is 40 - 50 dB $L_{Aeq,24hr}$
- No residential area should receive more than 60 dB $L_{Aeq,24hr}$
- No residential area should experience aircraft noise levels greater than 95 dB L_{Amax}

In the *Lilley* case, the Senior Commissioner presiding over the case noted that "it was common ground amongst the experts that there was no single recognised criterion for aircraft noise". Therefore, in establishing criteria for a development, multiple criteria must be taken into consideration, and the most suitable criterion for the development must be determined.

For the Lilley case, a criterion of 40 dB $L_{Aeq,24hr}$ was adopted. However, there are several factors that must be considered in determining an appropriate criterion for the Trinity Point

11 Civil Aviation Safety Authority Australia (1996): CAAP 92-2(1) – Guidelines for the establishment and use of helicopter landing sites (HLS)

12 *Lilley v Lithgow City Council*, NSW Land and Environment Court NSWLEC 608, 25 September 2007.

13 AirServices Australia (2002) Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise, Environment Branch

development, and the criterion adopted for the *Lilley* case is not necessarily the appropriate criterion to adopt for Trinity Point.

The *Lilley* case concerned an application for a commercial helipad in a rural-residential area to provide up to 20 flights a day, with associated hangar and refuelling facilities.

In contrast, the proposed helipad at Trinity Point is for a landing pontoon only, with no hangar facilities, and for only 4 flights per day, which is 20% of the flights proposed for the *Lilley* case.

In judgement in the NSW Land and Environment Court, the Senior Commissioner concluded that:

> *"the conditions imposed on the consent are the most stringent yet imposed on the flying of helicopters in Australia. In the circumstances there is no reason to withhold consent…"*

It was demonstrated that even using the most stringent criterion available – the 40 dB $L_{Aeq,24hr}$ criterion – the application did not have a significant noise impact, and that the council had no grounds to withhold consent on noise issues.

However, this does not necessarily mean that 40 dB $L_{Aeq,24hr}$ represents an appropriate maximum criterion for aircraft noise – indeed, the record indicates that this criterion was considered "too stringent" by one acoustic expert involved in the *Lilley* case.

If 40 dB $L_{Aeq,24hr}$ were intended to be applied as a maximum level for aircraft noise, there would be no need for the *Principles and Procedures* guideline to specify a maximum level of aircraft noise exposure – which it does in Principle 6: "No residential area should receive more than 60 dB $L_{Aeq,24hr}$".

In Principle 5 ("Noise is not considered significant when selecting noise preferred options if exposure amounts to less than 40 dB $L_{Aeq,24hr}$ and there are less than 50 overflights per day"), the wording "when selecting noise-preferred options" implies that this principle is to be used when selecting possible flightpaths. This principle can be viewed as a test of whether noise is a significant issue when selecting flighpaths.

Collectively, the AirServices Australia guidance strikes a balance between protecting the acoustic amenity of residences and allowing an 'acceptable' degree of aircraft operations.

The *Principles and Procedures* document provides criteria for "minimum" (i.e. non-significant) noise impact – 40 dB $L_{Aeq,24hr}$ - and for "maximum" (i.e. unacceptable) noise impact: 60 dB $L_{Aeq,24hr}$.
The *Fly Neighbourly* guide provides a recommended range of 40 dB $L_{Aeq,24hr}$ to 50 dB $L_{Aeq,24hr.}$

This results in several "zones" of noise exposure levels:

- Below 40 dB $L_{Aeq,24hr}$ aircraft noise is "not significant"
- Between 40 dB $L_{Aeq,24hr}$ and 50 dB $L_{Aeq,24hr}$ is the recommended range of noise exposure for residences
- Above 50 dB $L_{Aeq,24hr}$, noise exposure is higher than recommended, but is not "unacceptable".
- Above 60 dB $L_{Aeq,24hr}$ represents an unacceptable level of aircraft noise impact.

The number of 'noisy' events per day is likely to be a major component of annoyance in surrounding residents as well as the actual level of each event, and it may be preferable for residents to experience fewer 'noisy' events at higher sound levels than a larger number of events at lower sound levels.

In other words, sound exposure is a function both of absolute noise level and number of "noisy" events – and an inverse relationship applies: the higher the noise level, the fewer the number of "noisy" events that would be acceptable, and vice-versa.

An example of where this approach has been applied for other noise sources is in Chapter 152 of the ENCM, which provides guidelines for noise from some motor sport facilities. The greater the number of events per year proposed for a facility, the more stringent the noise criterion becomes.

Although several ENCM guidelines have been superseded by more recent guidance, the INP specifically does not apply to motor sport venues, and therefore it is considered reasonable to continue to use Chapter 152 for guidance.

Similarly, DECC licence conditions for outdoor entertainment events (such as for the Royal Botanic Gardens) typically allow a greater number of “small” events with more stringent criteria, and a few “large” events with higher noise criteria.

Therefore, given that 4 movements per day are proposed for Trinity Point, and that the criteria adopted for the *Lilley* case can be considered “too stringent”, there is merit in adopting an increased noise criterion for the helipad component of Trinity Point compared to the *Lilley* case, which has 20 proposed movements per day.

Accordingly, the following helicopter noise criteria have been adopted for the Trinity Point development, applicable at any residential receiver:

- $L_{Aeq,24hr}$ should not exceed 50 dB(A).
- L_{max} should not exceed 95 dB(A).

Operation outside of the hours of 7 am to 10 pm should not be permitted except for emergency flights. The proposed hours of operation of the helipad (8 am to 6 pm weekdays and 10 am to 4 pm weekends and public holidays) comply with this requirement.

4.7 Overview of Criteria

A summary of the noise criteria developed for the Trinity Point development is presented below in Table 13. Noise criteria apply at the boundary of any noise-sensitive receiver.

Noise Source	Criteria	Reference
Industrial Noise	Day: $L_{Aeq,15min}$ ≤ 39 dB Evening: $L_{Aeq,15min}$ ≤ 39 dB Night: $L_{Aeq,15min}$ ≤ 35 dB	Industrial Noise Policy
Entertainment Venue Noise	Before 12.00 am: L_{A10} ≤ BG+5 dB in any octave band (31.5 Hz–8 kHz) After 12.00 am: L_{A10} ≤ BG+0 dB in any octave band (31.5 Hz–8 kHz) After 12:00 am: Inaudible in any habitable room.	Casino, Liquor and Gaming Control Authority
Road Traffic Noise	<u>On Site:</u> Day: $L_{Aeq,15min}$ ≤ 39 dB Evening: $L_{Aeq,15min}$ ≤ 39 dB Night: $L_{Aeq,15min}$ ≤ 35 dB	Industrial Noise Policy
	<u>On Road:</u> Day: $L_{Aeq,(1h)}$ ≤ 60 dB Night: $L_{Aeq,(1h)}$≤ 55 dB	Environmental Criteria for Road Traffic Noise
Marine Vessel Noise	<u>In Marina:</u> Day: $L_{Aeq,15min}$ ≤ 39 dB Evening: $L_{Aeq,15min}$ ≤ 39 dB Night: $L_{Aeq,15min}$ ≤ 35 dB	Industrial Noise Policy
Construction Noise	<u>During Standard Hours</u> $L_{Aeq,15min}$ ≤ 44 dB $L_{Aeq,15min}$ ≤ 75 dB	Draft Construction Noise Guideline
Helicopter Noise	<u>Helicopter On Pontoon:</u> Day: $L_{Aeq,15min}$ ≤ 39 dB Evening: $L_{Aeq,15min}$ ≤ 39 dB	Industrial Noise Policy
	<u>Helicopter In Air:</u> $L_{Aeq,i24hr}$ ≤ 50 dB $L_{max,\ in\ operation}$ ≤ 95 dB	AirServices Australia *Principles and Procedures* and *Fly Neighbourly* Guidelines

Table 13: Overview of Noise Criteria

5 Predicted Noise Levels

5.1 Construction Noise

Construction of Trinity Point is proposed to occur through a staged approach, with each stage forming a separate programme of works.

Stage 1 of the development is scheduled to take approximately 46 weeks to complete, while Stages 2/3/4 are scheduled to take approximately 25 weeks each.

Construction noise levels from the Trinity Point site were predicted for construction of Stage 1 of the marina (including the breakwater, travel lift/hardstand and marina operation buildings), and for construction of the Village Square component of the development. These works involve the most equipment and the longest construction period of the overall construction process of the development, and the construction activity would be located closer to noise-sensitive receivers for these works.

A timeline of the proposed construction process was provided to Arup Acoustics by Worley Parsons, and was used to predict construction noise levels for each construction activity based on the equipment used for each activity.

Construction noise levels were estimated using the equipment sound power levels and guidance given in Australian Standard AS2436[14] and British Standard BS5228[15], and the overall construction sound power level for each component of the works was estimated.

Alternate construction methods to reduce the construction noise impact were investigated in consultation with Worley Parsons. Noise from the piling operations for the breakwater and marina construction was identified to be one of the noisiest activities likely to result from construction of Trinity Point. A quieter construction methodology for piling was therefore adopted for use in the noise predictions, by replacing impact piling with vibratory piling, and by screening all noise sources where possible.

Predicted construction noise levels were made at the nearest noise sensitive receiver from three components of works, which were identified as being the most sensitive components of works due to either their proximity to residential receivers or their sound levels.

An overview of the components of works, the equipment used for each construction stage and the overall sound power levels for each component is presented in Table 14 below:

Construction Element	Construction Equipment Likely to be Used	Overall Sound Power Level, dB(A) re 10^{-12} W
Marina Breakwater	Trucks, crane, floating barge with vibratory piling equipment, small work boats, hand-held power tools; equipment screened where feasible	106
Travel Lift	Trucks, floating barge with vibratory piling equipment, small work boats, hand-held power tools, vibratory piling equipment (land-based); equipment screened where feasible	109
Marina/Resort Buildings	Trucks, mobile crane, vibratory piling equipment, hand-held power tools; equipment screened where feasible	103

Table 14: Construction Equipment and Noise Levels used for Predictions

[14] Australian Standard AS2436 (1981) Guide to noise control on Construction, Maintenance and Demolition Sites
[15] British Standard BS5228 (1997) Part 1 Noise and Vibration Control on Construction and Open Sites

Noise predictions were made using the CONCAWE[16] noise propagation model within the SoundPLAN environmental noise prediction software. The CONCAWE model was developed for conducting environmental noise predictions for noise from large industrial sites, and is commonly used for modelling environmental propagation of sound, including meteorological effects due to wind and/or temperature inversions, ground attenuation and atmospheric attenuation.

Terrain data for the surrounding area was used to generate a digital terrain model to calculate shielding, atmospheric absorption and ground absorption effects on the noise propagation from source to receiver. The reflective properties of the water surface were included into the model to account for sound propagation over water, such as Bardens Bay.

The construction equipment for each stage of works was modelled as a point noise source. The noise sources for each stage of works were located as shown in Figure 3 below:

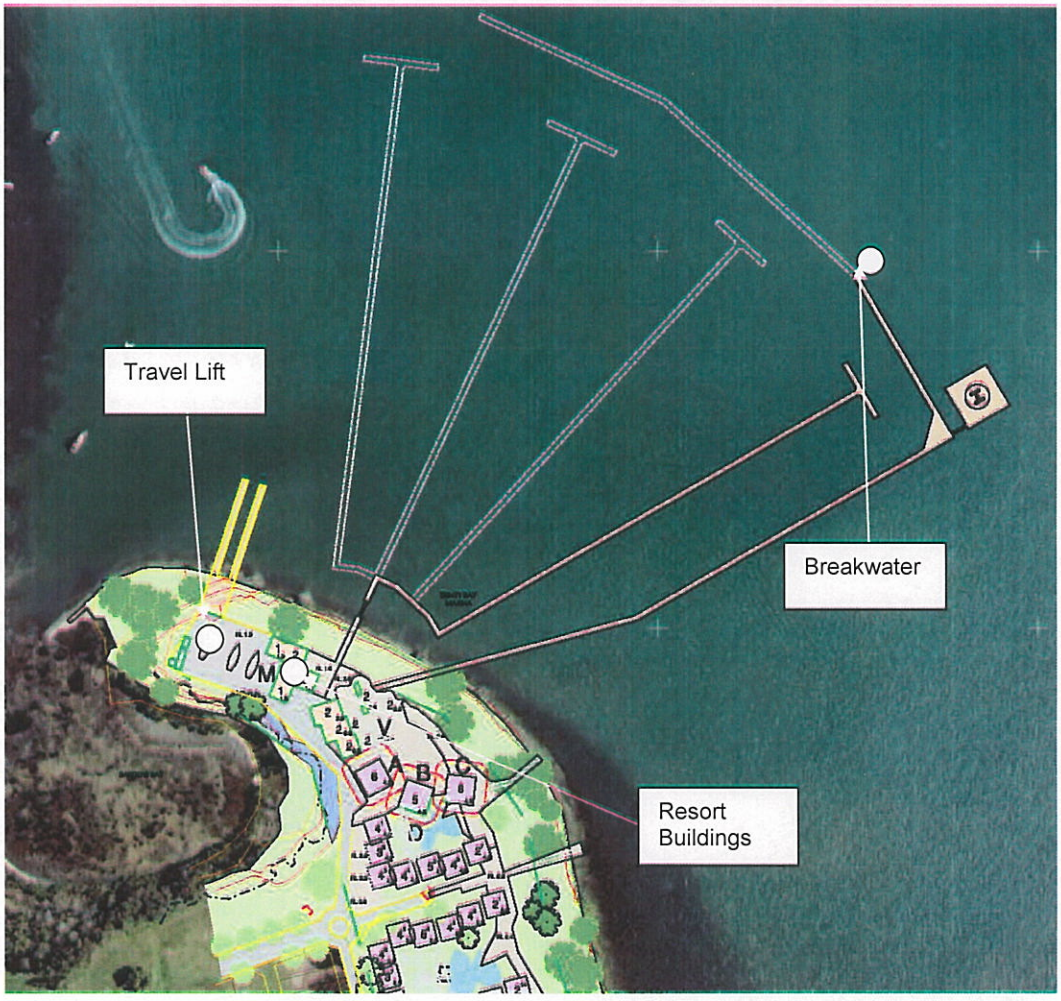

Figure 3: Approximate Locations of Construction Noise Sources

Predicted construction noise levels, and approximate durations for each activity from Stage 1 of construction are outlined in Table 15:

16 Manning, CJ (1981) – The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, Conservation of Clean Air, Water and the Environment (CONCAWE).

Noise Source	Most-Affected Receiver	Predicted Noise Level	Noise Criterion Draft Guideline	Meets Criterion ? Draft Guideline	Noise Criterion ENCM	Meets Criterion? ENCM
Breakwater (Approximately 20 weeks)	52 Buttaba Road, Brightwaters	44	44	✓	39	✗
Travel Lift / Hardstand (Approximately 4 weeks)	57C Lakeview Road, Morisset Park	50	44	✗	39	✗
Marina/ Resort Buildings (Approximately 32 weeks)	57C Lakeview Road, Morisset Park	41	44	✓	39	✗

Table 15: Predicted Construction Noise Levels at Noise Sensitive Receivers, Stage 1 of Construction Works

The construction noise impact of Stages 2, 3 and 4 is expected to be primarily due to construction of the breakwater and marina. Noise levels from these stages are expected to be comparable to the noise impact from the breakwater construction as part of Stage 1.

5.2 Boat Repair Noise

Operational noise levels for boat repair activities have the potential to impact on surrounding residential receivers, due to the location of the boat repair activities at the north of the Trinity Point site and the proximity of noise sensitive receivers in Lakeview Road to the development. The following hours of operation are recommended, based by DECC for the boat repair operations:

- Monday to Friday: 7 am to 6 pm
- Saturday: 9 am to 1 pm

Limited works only will be undertaken on Sundays or Public Holidays (i.e. no abrasive blasting, sanding, use of the 45 kW compressor or use of the travel lift). “Light” works such as general maintenance or minor boat repairs may be acceptable during these time periods.

These hours lie within the ‘Day’ period of the INP, and therefore the INP criteria for the day time period would apply.

Three main noise sources were identified as likely to be the major noise sources resulting from boat repair activities at Trinity Point:

- Noise from operation of the travel lift
- Noise from maintenance operations on the hardstand (including abrasive blasting, sanding and washdown)
- Noise from the workshop area.

At this stage, detailed information of the types and numbers of equipment to be used on site is not yet available, and therefore indicative noise levels from each noise source have been predicted. Guidance from AS2436[14], Laymon Miller’s *Noise Control for Buildings and*

Manufacturing Plants[17], and Arup Acoustics' internal database of noise measurements was used in predicting noise levels for boat repair equipment.

The following equipment was used for the noise predictions for boat repair noise:

- Engine noise from the 82 kW housing-mounted motor powering the travel lift (two options for the powerplant for this travel lift are being considered – a diesel engine and an electric motor).
- Noise from an air compressor (approximately 45 kW power) to be used for maintenance operations in the hardstand area. Noise from this compressor is expected to be the dominant noise source for these operations.
- Noise from hand tools used for repair operations in the workshop.

A summary of noise levels used for predictions is given in Table 16. Locations of noise sources for boat repair noise are shown in Figure 4.

Noise Source	Equipment	Overall Sound Power Level, L_w re 10^{-12} W
Travel Lift – Engine Noise	82 kW diesel engine (housed), with high-performance exhaust muffler	94 dB(A)
	82 kW electric motor (housed)	93 dB(A)
Hardstand - Maintenance	45 kW air compressor, abrasive blast jet	100 dB(A)
Workshop – Hand Tools	Electric drill, angle grinder	87 dB(A)

Table 16: Boat Repair Equipment Noise Levels used for Predictions

[17] Laymon N. Miller (1981) – *Noise Control for Buildings and Manufacturing Plants*, Bolt, Beranek and Newman Inc.

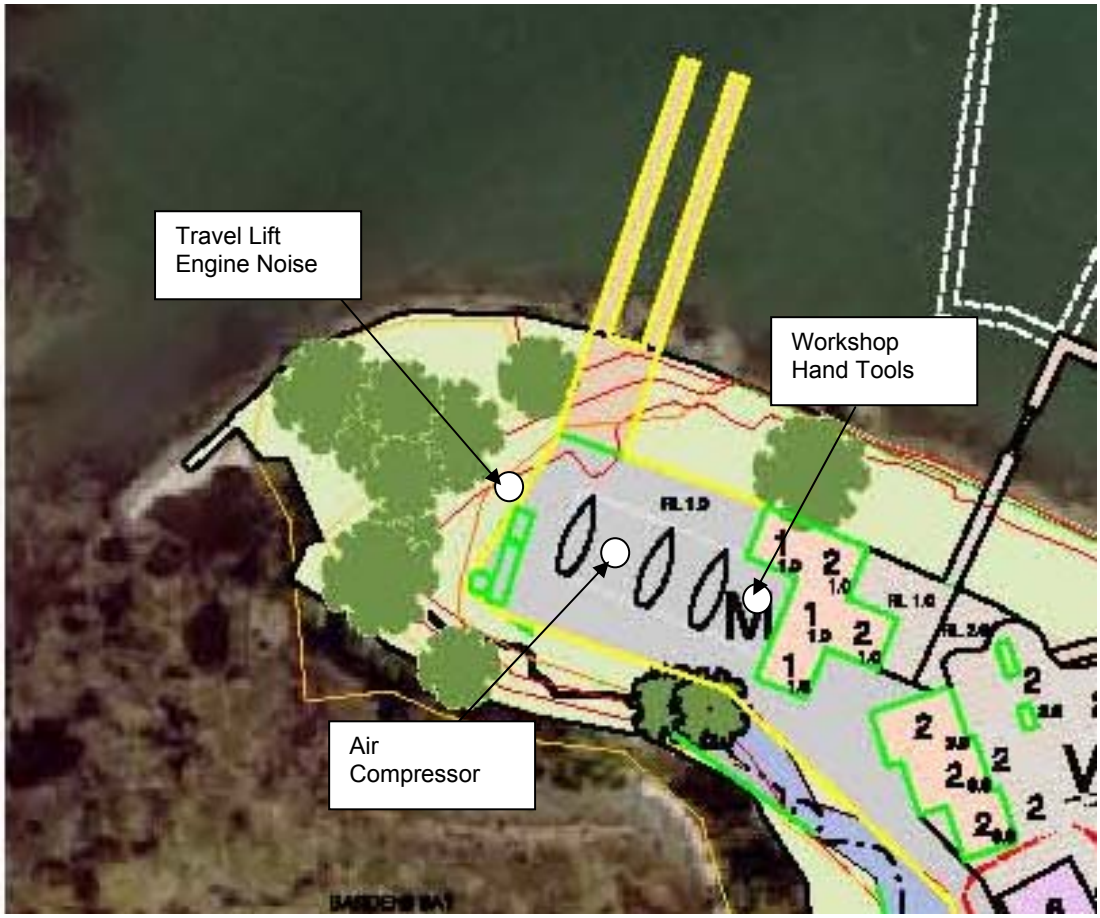

Figure 4: Approximate Locations of Boat Repair Noise Sources

Noise levels were predicted using the CONCAWE noise propagation model. The prediction methodology was the same as for the construction noise predictions. Noise predictions were made at Receiver 2 (57C Lakeview Road, Morisset Park) and at the residential receivers located in Block A of the Trinity Point development (see Figure 1).

These receivers are the nearest affected residential properties (internal and external) for noise from the boat repair operations.