Glebe Island Concrete Batching Plant

Noise Impact Assessment

Report Number 610.17533-R01

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Hanson Construction Materials Pty Ltd

Level 5

75 George Street

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Glebe Island Concrete Batching Plant

Noise Impact Assessment

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1 INTRODUCTION

1.1 Background

Hanson Construction Materials Pty Ltd (Hanson) is seeking development consent to develop a new intermodal aggregate storage facility and concrete batching plant at Glebe Island (the Facility).

The Facility site has been selected so as to enable the co-location of the concrete plant with aggregate shipping facilities, which in proximity to the Sydney Commercial Business District (CBD) and Bays Precinct, offers several logistical and environmental benefits. Hanson, and its subsidiary Hymix Australia Pty Ltd (Hymix), already provide approximately 35% of Sydney's concrete demand from the two nearby sites (Blackwattle Bay and Pyrmont).

The Facility will allow Hanson to continue its supply of concrete to a range of concrete intensive projects around Central Sydney, in a way that is efficient, reduces overall environmental impact and that minimises regional road traffic impacts by utilising the existing aggregate shipping terminal capability, via the use of the Glebe Island Berth 1 (GIB1) for the delivery of aggregate by ship.

Ethos Urban Pty Ltd (Ethos Urban) was engaged by Hanson to prepare the Environment Impact Statement (EIS) for the Facility. SLR Consulting Australia Pty Ltd (SLR) was engaged to prepare a Noise and Vibration Impact Assessment inclusive of road and ship transport corridors for the Facility.

1.2 Assessment Requirements

The assessment of noise and vibration impacts for the Facility (SSD8544) has been guided by the NSW Department of Planning and Environment (DP&E) Secretary's Environmental Assessment Requirements (SEARs) dated 7 July 2017, as presented in **Table 1**.

Table 1 DP&E Secretary's Environmental Assessment Requirements (SSD8544)

The EIS must address the following specific issues:
• The application must include a Noise and Vibration Impact Assessment prepared in accordance with the relevant Environment Protection Authority guidelines. The assessment must consider the potential noise and vibration impacts from all marine and land-based activities during construction, operation (particularly operational noise from traffic (including marine traffic), plant and equipment) and cumulative noise impacts.
• The assessment must consider both existing and potential future users of the Bays Precinct.
• The assessment must consider potential impacts on nearby sensitive receivers and outline proposed mitigation and monitoring measures.

• Assessment of the potential cumulative impacts (noise, traffic, air etc) of the proposed development with other developments in the vicinity of the site during construction and on-going operation. In particular, this assessment shall have regard to:
  • major infrastructure projects such as West Connex, the Western Harbour Tunnel, the Iron Cove Link and the West Metro
  • potential future development in the Bays Precinct
  • Hymix Concrete Batching Plant, Pyrmont

Key policies and guidelines[1] • NSW Industrial Noise Policy (INP) (EPA, 2000) • NSW Industrial Noise Policy – application notes (EPA, 2013) • Interim Construction Noise Guideline (ICNG) (EPA, 2009) • Assessing Vibration: A technical Guideline (Assessing Vibration) (DEC, 2006) • NSW Road Noise Policy (RNP) (DECCW, 2011) • NSW Road Noise Policy - application notes (EPA, 2013)

Note 1: Ethos Urban were subsequently advised by the DP&E, that application of the recently released Noise Policy for Industry (NPfI) (EPA, 2017) in lieu of the INP, will satisfy the Secretary's requirement that the Noise and Vibration Assessment be prepared in accordance with *the relevant* EPA guidelines.

As a result, the noise and vibration impacts for the Facility have been guided by the assessment guidelines as presented in **Table 2**.

Table 2 Noise and Vibration Impact Assessment Procedure Guidelines

Assessment Guideline	Criteria	Assessment
Facility Construction Intrusive Noise and Vibration Guided by the requirements of the ICNG in relation to setting the construction noise management levels (CNMLs) and assessing any impacts.	**Section 4.1**	**Section 7.1**
Guided by the requirements of German Standard DIN 4150.3-1999 "*Structural Vibration Part 3: Effects of Vibration on Structures*" and "*Assessing Vibration: A Technical Guideline*" (DEC 2006).	**Section 5.2**	**Section 7.3**
Precinct Amenity Noise Guided by the requirements of the NPfI in relation to the potential application of a noise management precinct in accordance with Section 2.8 Noise Management Precinct.	**Section 4.2**	**Section 8.1**
Facility Operation Maximum, Intrusive and Amenity Noise Guided by the requirements of the NPfI in relation to setting the project trigger noise levels (PTNLs) and sleep disturbance noise levels (SDNLs) and assessing any impacts.	**Section 4.2**	**Section 8.2, Section 8.3**
Berth Activity The current configuration of port facilities have existed since at least 1968, and the noise assessment recognises the berth (GIB1) activity as a continued use of the existing port facility.	**Section 4.3**	**Section 8.4**
Road Traffic Noise Guided by the requirements of the EPA's Road Noise Policy (RNP) and associated Application Notes dated 15 February 2013 in relation to setting acceptable LAeq(period) noise levels for arterial and sub-arterial roads and assessing any impacts.	**Section 4.4**	**Section 9**
Waterway Traffic Noise Guided by the requirements of the Roads and Maritime Services (RMS) who are responsible for managing navigation and safety on NSW waterways, including Sydney Harbour.	**Section 4.5**	**-**

Note 1: The Environment Protection Authority (EPA) existed as a legal entity operating within the NSW Office of Environment and Heritage (OEH) which came into existence in 2011. The EPA became a separate statutory authority on 29 February 2012.

1.3 Bays Precinct Urban Transformation Program

Hanson currently operates a concrete batching facility at Blackwattle Bay, which is located on Bridge Road (**Figure 1**). The Blackwattle Bay facility also includes an aggregate shipping terminal, so it can take delivery of aggregates shipped from Hanson's Bass Point Quarry at Shellharbour. Hymix operates a concrete batching plant that is located north of the Sydney Fish Market at Bank Street, Pyrmont. The Hymix facility does not have shipping capability, so aggregates are delivered via road.

Figure 1 Existing Hanson and Hymix Concrete Batching Facilities at Blackwattle Bay

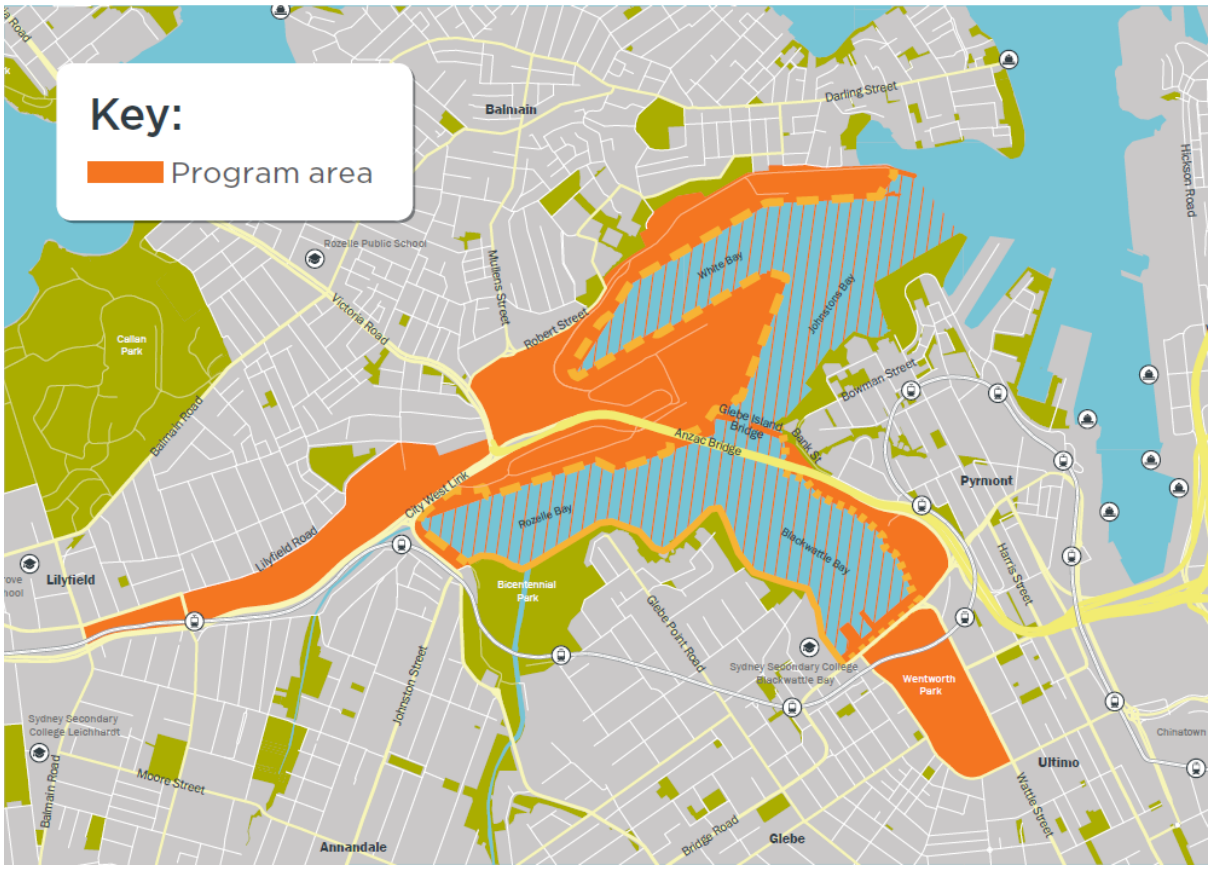
Source: Ethos Urban June 2017

Both of these existing concrete batching plants are located within the "Bays Market District" area of the Bays Precinct, which includes the Sydney Fish Market. This Bays Market District Area is nominated as the first stage of the Bays Precinct Transformation Program (**Figure 2**) and is identified as an 'immediate priority' for redevelopment. The anticipated project timeline for stage one is 'now-2019'.

With consideration of the likely redevelopment of the Bays Market District in the immediate future as part of the Bays Precinct Transformation Program, Hanson is planning for the closure of the existing Blackwattle Bay concrete batching plant. In addition to the general concrete supply impacts arising from the closure of the Blackwattle Bay facility, it will also result in the loss of aggregate shipping capacity in Central Sydney.

The proposed Facility will therefore be collocated with existing aggregate shipping facilities. Co-location of a concrete batching plant within the existing port facility, in proximity to Sydney CBD and the Bays Precinct itself, is of strategic merit, and offers several logistical benefits.

Figure 2 Bays Precinct Urban Transformation Program Area



Source: UrbanGrowth September 2017

1.4 Glebe Island and White Bay Master Plan

The Glebe Island and White Bay Master Plan (the Master Plan) (Sydney Ports, 2000) presents the historical text and planned future development for Glebe Island and White Bay. The Facility is generally consistent with the continued use of Glebe Island and White Bay as a commercial port. The current configuration of port facilities at Glebe Island and White Bay have existed since at least 1968 when reclamation works at White Bay were completed. While the Facility will be located within the broader Bays Precinct, the existing port facilities are under the jurisdiction and management of the Port Authority of NSW (Port Authority).

In addition to the port related uses, Glebe Island accommodates warehouses, manufacturing plants, and low to mid rise commercial office buildings. The port's two eastern berths (GIB1 and GIB2) are located along the length of the Glebe Islands south-eastern perimeter and are currently utilised for bulk shipping. The Multi-user Facility (adjacent GIB1 and GIB2) has existing approval, and the Port Authority is separately seeking activity approval to accommodate changes to the Multi-user Facility.

The NPfI Section 2.8 introduces the concept of Noise Management Precincts. A noise management precinct would enable, for example, a port facility with many proponents to operate as a single site that is required to meet the relevant precinct noise amenity level where it is feasible and reasonable to do so. Given the close proximity of the proposed Facility (adjacent GIB1) and the approved Multi-user Facility (adjacent GIB1 and GIB2) it's reasonable to consider the potential cumulative noise amenity impact from both facilities, which in effect, is a precursor to a formalised noise management precinct, and further described in **Section 4.2**.

Subject to delivery schedules, the construction phases of the Facility and Multi-user Facility may also coincide, and the potential construction noise impacts are considered cumulatively in **Section 7.2.1**.

1.5 Glebe Island Present Strategic Context

While the Master Plan outlines the planned future development for Glebe Island and White Bay, the present context of proposed development in the vicinity of the area is evolving and may include several potentially significant infrastructure projects. These projects include:

- Bays Precinct Urban Renewal;
- Sydney Metro City & Southwest;
- Sydney Metro West;
- Western Harbour Tunnel; and
- Westconnex M4-M5 Link.

Although many of these projects are still conceptual and have not yet received a financial commitment from the NSW Government, it is anticipated that these projects will be transformational to the inner west of Sydney.

The location of the Facility within this changing precinct is itself transitional. A concrete batching facility is required to support development, once that development concludes the ongoing requirement for the supply of concrete will need to be re-evaluated and the form and function of the Facility may need to change to suit the future character of the area. The Facility has been designed to respond not only to the existing environment and to that of the near term infrastructure projects in the vicinity, but also to the longer term and the future built-form character of the Glebe Island that is envisaged.

The environmental impact of these projects will be assessed in turn as each project progresses and it will then be possible to consider these assessments in a cumulative manner. Based on publicly available information, the potential infrastructure projects are presented in **Appendix B**, together with the indicative schedule of development for the assessment of cumulative impacts with the proposed Facility. Currently, the only project in the vicinity of the proposed Facility for which an Environmental Impact Assessment (EIS) is publicly available is the Westconnex M4-M5 Link EIS (RMS, August 2017), where the Rozelle construction works are scheduled to commence in the fourth quarter of 2018 [refer EIS Appendix J (Noise and Vibration) Section 5.3 Table 5-64].

The construction phase of the Facility is expected to commence in Quarter 3 2018 and be completed by Quarter 1 2019 (ie approximately 9 months duration), and before the major traffic diversions and intersection works are undertaken as part of Westconnex M4-M5 Link. The Facility is expected to be operational by early 2019 when concrete demand for Westconnex M4-M5 Link via the Rozelle Interchange is expected to commence. The Westconnex M4-M5 Link EIS Appendix J (Noise and Vibration) Section 5.3, *Rozelle*, presents a comprehensive assessment of construction noise and vibration impacts which are also considered cumulatively with the construction phase of the Facility in **Section 7.2**.

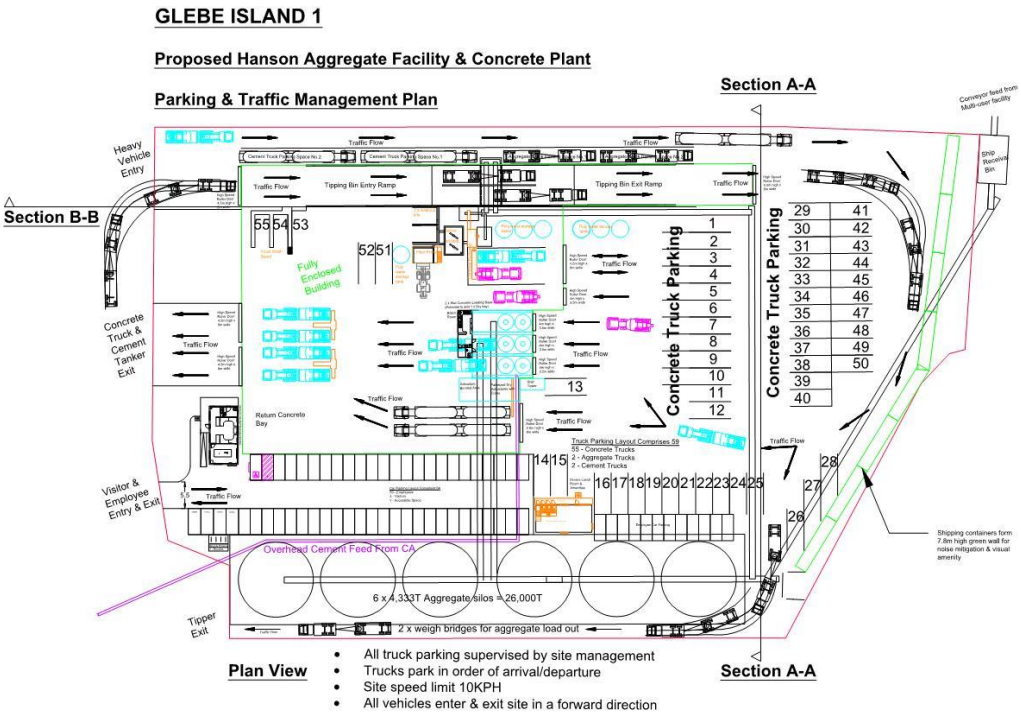
2 DESCRIPTION OF PROPOSED FACILITY

2.1 Overview

Hanson propose to develop a new intermodal aggregate storage facility and concrete batching plant (the Facility) to be located adjacent to Glebe Island Berth one (GIB1), as shown in **Figure 3**. The Facility will be designed with a capacity to produce up to 1 million cubic metres (Mcum) of concrete per annum (pa), with two main purposes:

- To act as a shipping facility that will support a number of Hanson (and Hymix) concrete batching plants by improving the delivery of aggregates into the city centre; and
- To operate as a concrete batching plant that can supply concrete for infrastructure and buildings in the Sydney CBD and inner suburbs.

Figure 3 Proposed Facility Lot 10 (DP1170710) Adjacent to Glebe Island Berth one (GIB1)



Source: Hanson January 2017 (V13B-Model)

The Facility will utilise the existing berth (GIB1) with the capacity to manage up to 1 Mcum of concrete aggregates pa delivered by ship from the Hanson Bass Point Quarry and other facilities if deemed viable. By facilitating delivery by ship, the proposed Facility will reduce the number of trucks required to haul aggregates into Sydney on the regional road network by up to 65,000 trips pa.

2.2 Construction

The Facility would be constructed during ICNG standard construction hours (**Table 3**) and involve the following major works:

- Enabling Works
- Silo Construction
- Building Construction

Construction noise modelling scenarios for the three (3) major works have been developed with the proposed equipment and associated sound power levels (SWL) presented in **Appendix C**.

As shown in **Appendix C**, rock breaking is expected to occur as part of the construction works with the potential to generate vibration from the Facility construction site.

2.3 Operation

The proposed hours for the operation are 24 hours a day, 7 days a week. The Facility will employ approximately 67 full-time equivalent employees. Three main types of commercial vehicles will operate at the plant:

- A total of 55 concrete agitator trucks – delivering concrete mixed at the plant on-site to building sites throughout the city. Some of these are standard rigid chassis agitator vehicles and some are articulated agitator vehicles.
- Cement tankers – delivering cement to the Facility, this cement will most likely come from the Cement Australia Glebe Island facilities and therefore will not have to access the public road network.
- Aggregate trucks – two tipper trucks will be based at the Facility, trucks based at other Hanson facilities may also access the plant. Aggregate trucks dispatch aggregates and sand to other concrete batching plant facilities – including the Hymix plant at Pyrmont. These are typically truck and dog trailer combinations.

Other on-site vehicles will include a forklift, a bobcat and two loaders. Cement deliveries are expected to be made by B-Double tankers. Concrete agitator trucks are usually parked at the Facility overnight, day shift drivers will arrive at the Facility in the morning between 5am and 8am to start the shift, leaving the Facility between 3pm and 6pm in the evening. It is anticipated that the majority of staff will travel to the Site by car. All batching activates will take place within an enclosed building. A plan of the proposed Facility is provided as **Figure 3**, which shows shipping containers located on the eastern perimeter of the site forming a 7.8 m green wall for noise mitigation and visual amenity.

The proposed Facility will adopt a low profile design sympathetic to its surrounding environs. The majority of the batching activities will be undertaken in an enclosed area in order to limit the noise (and air quality) impacts. The highest structures will be aggregate storage silos which will be up to 34m tall, substantially lower than the adjoining heritage listed Glebe Island Silos. Physical elements of the Facility will include:

- Cement silos;
- Aggregate silos;
- Sand silos;
- Water tanks;
- Weigh hoppers;
- Slump stand;
- Conveyors,
- Truck parking;
- Car parking;
- Weigh bridges;
- Building enclosure; and
- Ancillary offices and staff areas

2.3.1 Delivery

Delivery vehicles will access the Facility from James Craig Road beneath the old Glebe Island Bridge abutment. Cement tankers will enter the building from the east and exit from the west. Aggregate trucks will deliver sand entering the building from the west and exit from the east. Cement and fly ash delivered to the Facility will be stored in silos. All deliveries will take place within the enclosed building. Aggregate and sand will be conveyed to the storage silos by overhead conveyors.

2.3.2 Batching

Concrete agitator trucks will move from their holding area to within the enclosed building to receive the concrete for delivery. Concrete agitator trucks will enter the building from the east. Aggregate, sand, cement and fly ash will be transported from their storage silos via an enclosed conveyor system to a weigh hopper. From here, the ingredients will be transferred to an agitator truck within the enclosed building.

2.3.3 Dispatch

Once the concrete is loaded into the concrete agitator trucks, they can depart from the west of the enclosed building. Concrete agitator trucks will exit the Facility via James Craig Road and from there, travel to where their delivery is required. When the plant is operating at peak capacity, up to 120 concrete deliveries will be made from the plant in an hour. Aggregates not used in the batching of concrete will be dispatched from the storage silos by conveyor directly for loading to an aggregate truck for dispatch to another concrete batching plant facility.

2.4 Berth (GIB1) Activity

Ships will deliver aggregate to the Facility via GIB1, utilising a vessel such as the CSL Rhine (or similar). The Traffic Impact Assessment anticipates that aggregate deliveries by ship will be 2 to 3 times per week (or approximately 10 per month) with each delivery taking approximately 12 hours to complete.

The noise assessment recognises the berth (GIB1) activity as a continued use of the existing port facility.

2.5 Road Traffic

The Facility will be accessed during construction and operation via James Craig Drive connecting to The Crescent, Victoria Road, and the City-West Link Road. An assessment of road traffic impact is presented in the Facility Traffic Impact Assessment Concrete Batching Plant Glebe Island (Traffic Impact Assessment) (AECOM, 2017) and includes consideration of road traffic generated by the Facility during construction and operation.

As construction related traffic flows are relatively modest by comparison with the Facility operation traffic flows, the road traffic noise assessment focuses on the Facility operation and associated light and heavy vehicle movements.

2.6 Waterway Traffic

As described above, ships will deliver aggregate to the Facility 2 to 3 times per week.

2.7 Hours of Operation

The construction and operating hours are presented in **Table 3**.

Table 3 Construction and Operating Hours

Activity	Description	Hours
Facility Construction	Works	Generally daytime normal construction hours Monday to Friday 0700 hours to 1800 hours; Saturday 0800 hours to 1300 hours
Facility Operation	Delivery	24 hours, 7 days per week
	Batching	
	Dispatch	
Facility Road Traffic	Construction and operation	24 hours, 7 days per week
Water Traffic	Shipping	24 hours, 7 days per week
GIB1 Operation	Delivery	

Source: Hanson January 2017

2.8 Residential Receiver Localities

The Receiver Locality Plan (**Figure 4**) identifies the nearest potentially affected residential receiver localities beyond Bays Ports District (Glebe Island) Noise Management Precinct. The representative residential receiver localities are generally consistent with those identified in the White Bay Cruise Terminal (WBCT) Project Approval (MP 10_0069), namely:

- Balmain (Donnelly Street, Roberts Road, and Batty Street);
- Pyrmont (Refinery Drive and Bowman Street); and
- Glebe (Oxley Street).

The WBCT Project Approval (MP 10_0069) also identifies Balmain (Grafton Street) as a potentially affected residential receiver locality with respect to the WBCT. However, with respect to the proposed Facility, the Grafton Street residential receivers are located beyond the Donnelly Street, Roberts Road, and Batty Street residential receivers. Hence noise compliance from the construction and operation of the Facility at the Donnelly Street, Roberts Road, and Batty Street residential receivers would also provide noise compliance at the Grafton Street residential receivers (refer **Figure 4**).

Figure 4 Nearest Potentially Affected Residential Receiver Localities

Source: Nearmap

3 EXISTING METEOROLOGICAL AND NOISE ENVIRONMENT

3.1 Meteorological Environment

An assessment of prevailing wind conditions was derived from the Bureau of Meteorology's Automatic Weather Station (AWS) located at the nearby Observatory Hill. The dominant seasonal wind speeds and directions recorded for the 36 month period from September 2014 to August 2017 are presented in **Appendix D** for daytime (0700 hours to 1800 hours), evening (1800 hours to 2200 hours) and night-time (2200 hours to 0700 hours) in accordance with a methodology consistent with the requirements of the NPfI.

As presented in **Appendix D**, the seasonal frequency of occurrence of the prevailing winds during the daytime, evening and night-time periods is well less than 30% and therefore not further considered in this assessment in accordance with the NPfI. Similarly, the frequency of occurrence of the stable atmospheric conditions (i.e. with the potential to give rise to temperature inversions) during winter the evening/night-time period is well less than 30% and therefore not further considered in this assessment in accordance with the NPfI. The resulting standard meteorological conditions are presented in **Table 4** consistent with the requirements of NPfI Fact Sheet D Table D1.

Table 4 Standard Meteorological Conditions for Noise Modelling Purposes

Period	Assessable Condition	Air Temperature	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	20°C	59%	0 m/s	0°C/100 m
Evening	Calm	19°C	66%	0 m/s	0°C/100 m
Night-time[1]	Calm	17°C	74%	0 m/s	0°C/100 m

Note 1: Night-time standard (neutral) meteorological parameters have been adopted for all noise modelling purposes.

3.2 Noise Environment

Noise levels have been measured around the port facilities at Glebe Island and White Bay since the mid 1990's. The ambient noise environment has been established based on a review of the historical data as well as the more recent public information presented in the Report 610.11854 *Interim Exhibition Facility Glebe Island White Bay & Wharves 4 & 5 Noise Impact Assessment* (SLR, November 2012) and Report 610-04309-R51 *Glebe Island Wharves 1 & 2 Proposed Multi User Facility* (SLR, May 2013). The reports document ambient noise level measurements in the surrounding residential areas, and the relevant results are presented in **Table 5**.

Table 5 Summary of RBLs and L_{Aeq} Ambient Noise Levels Year 2009 and 2012 (dBA re 20µPa)

Locality	Location	Rating Background Level (RBL)[1] All Noise Sources			LAeq(period)[1] All Noise Sources		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Balmain	17 Donnelly Street[2]	47	45	40	57	54	51
	1 Batty Street[3]	51	49	42	57	53	47
Pyrmont	22 Refinery Drive[2]	50	49	47	56	55	53
Glebe	53 Leichhardt Street[2]	46	46	40	58	55	53

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

Note 2: The Donnelly Street, Refinery Drive and Leichhardt Street ambient noise level survey results from 2012.

Note 3: The Batty Street ambient noise level survey generally in the absence of port activities in 2009. Ambient noise survey in 2012 undertaken during some activity increased the night-time noise level by 3 dBA up to 45 dBA.

The ambient noise environment includes noise contributions from traffic and existing port facilities (when operating) and other local activities. The 2012 survey was conducted over a nine (9) day period when berths GIB7 and GIB8 were both occupied and unoccupied for similar periods. Hence when operating, the noise levels may include contributions from ships, the handling of bulk goods and containers. However, it can be reasonably inferred that the relatively elevated and longer term $L_{Aeq(period)}$ ambient noise levels result largely from non-industrial activities, in particular the Anzac Bridge and Western Distributor/City West Link traffic. Overall, the ambient noise levels are reasonably representative of the typical noise environment at the three nearest residential localities (ie Balmain, Pyrmont and Glebe) and considered suitable for further application of the NPfI.

It should be noted however, that due to the proximity and topography between residential areas, ship berths and the working harbour, port facility noise levels have at times exceeded noise planning goals, that have been generally established in accordance with more conventional approaches to the assessment of land based industrial noise sources (refer Port Authority information memorandum *Precinct and Industrial Urban Interface Amenity* dated 22 November 2017). On this basis the Port Authority considers the noise environment at the two nearest residential receiver localities to the port facilities (ie Pyrmont and Balmain) are and remain the urban industrial interface noise amenity area in accordance with the NPfI Section 2.7 and Table 2.2 *Amenity Noise Levels*. The relatively more remote Glebe area is considered as an urban noise amenity area in accordance with the NPfI (Section 2.4) Table 2.2 *Amenity Noise Levels*.

Further support for the application of the urban industrial interface noise amenity areas to the Pyrmont and Balmain residential areas is recognised by existing residential building requirements. Some western residential areas of Pyrmont have development conditions relating to noise attenuation, as potential port operating noise impacts were considered for the redevelopment of the old CSR refinery site, and as a result the Development Application Reports for Jacksons Landing at Pyrmont nominate façade 'ship noise' external level criteria of 63 dBA.

Similarly, some recent residential developments in Balmain adjacent to the White Bay 2 berth (WB2B) also have development conditions relating noise attenuation, and where relevant a 'treated' external noise level criteria of 60 dBA has been adopted (based on an internal noise level of 35 dBA and a conservative external noise reduction of 25 dBA). Note, in both cases where the residential developments have been treated, it does not mean residents will not complain about noise, as the apartments will have openable windows and balcony doors, however the design intention is that they can be closed and the building shell design will adequately attenuate external noise.

4 NOISE ASSESSMENT CRITERIA

4.1 Construction Noise Assessment Criteria

The ICNG recommends a construction noise management level (CNML) equivalent to the daytime RBL plus 10 dBA within standard hours (ie daytime) and RBL plus 5 dBA outside standard hours (ie evening and night-time). The ICNG also contains "highly noise affected" daytime CNMLs which are set at 75 dBA $L_{Aeq(15minute)}$. As the Facility construction works would be limited to daytime only, the ICNG construction noise management levels are as presented in **Table 6**.

Table 6 Intrusive $L_{Aeq(15minute)}$ Construction Noise Management Levels (dBA re 20 µPa)

Locality	Location	Daytime CNML (noise affected) RBL plus 10 dBA	Daytime CNML (highly noise affected)
Balmain	17 Donnelly Street	57	75
	1 Batty Street	61	
Pyrmont	22 Refinery Drive	60	
Glebe	53 Leichhardt Street	56	

Note 1: Daytime 0700 hrs to 1800 hrs, Evening 1800 hrs to 2200 hrs and Night-time 2200 hrs to 0700 hrs.

4.2 Operational Noise Assessment Criteria

4.2.1 Precinct Amenity, Project Amenity and Project Intrusiveness Noise Levels

The EPA has regulatory responsibility for the control of noise from "scheduled premises" under the *Protection of the Environment Operations Act, 1997*. In implementing the NPfI, the EPA has two broad objectives:

- Controlling intrusive noise levels in the short term; and

- Maintaining noise amenity levels for particular land uses over the medium to long-term.

The Facility comprises on-site operations as described in **Section 2.3**, whereas road and waterway transportation corridors are specifically excluded from the NPfI, and assessed in accordance with more appropriate guidelines.

In general terms, the NPfI sets out procedures for establishing the project intrusiveness $L_{Aeq(15minute)}$ and project amenity $L_{Aeq(period)}$ noise levels, with a view determining the lower (that is, the more stringent) being the Project Trigger Noise Level (PTNL), NPfI Section 2.1 states:

> *The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.*

Furthermore, the NPfI Section 2.8 introduces the concept of Noise Management Precincts. As described in Section **1.4**, given the close proximity of the proposed Facility (adjacent GIB1) and the repurposed Multi-user Facility (adjacent GIB1 and GIB2) it's reasonable to consider the potential cumulative noise amenity impact from both facilities. The precinct amenity noise levels are based on the recommended $L_{Aeq(period)}$ amenity noise level for the receiver area land use determined in accordance with the NPfI Table 2.2 *Amenity Noise Levels*. In addition, project amenity noise level should not result in an exceedance of the relevant precinct amenity noise level.

The applicable $L_{Aeq(period)}$ precinct amenity and project amenity noise levels are presented in **Table 7**, for assessing the operational noise from the Facility to the nearest residential localities in Balmain, Pyrmont and Glebe. The Port Authority has indicated that the $L_{Aeq(period)}$ precinct amenity at the nearest residential receiver locality at Pyrmont (Refinery Drive) should be distributed equally between the proposed Facility and the repurposed Multi-user facility. The resulting project amenity noise levels are night-time 47 $L_{Aeq(9hour)}$ evening 52 $L_{Aeq(4hour)}$ and daytime 62 $L_{Aeq(11hour)}$ for the Facility.

Table 7 Precinct Amenity and Project Amenity Noise Levels (dBA re 20 µPa)

Locality	Location	NPfI Noise Amenity Area	Precinct Amenity $L_{Aeq(period)}$[1,2]			Project Amenity $L_{Aeq(period)}$[1]		
			Daytime	Evening	Night	Daytime	Evening	Night
Balmain[3]	Donnelly Street	Urban industrial interface	65	55	50	60[3]	50[3]	45[3]
	Batty Street		65	55	50	60[3]	50[3]	45[3]
Pyrmont[4]	Refinery Drive	Urban industrial interface	65	55	50	62[4]	52[4]	47[4]
Glebe	Leichhardt Street	Urban	60	50	45	55[3]	45[3]	40[3]

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 2: Precinct Amenity noise level in accordance with NPfI (Section 2.4) Table 2.2 *Amenity Noise Levels.*
Note 3: Project amenity noise level equivalent to the Precinct amenity noise level less 5 dBA.
Note 4: Project amenity noise level equivalent to the Precinct amenity noise level less 3 dBA.

In addition, the $L_{Aeq(15minute)}$ project intrusive noise level should not exceed the background level by more than 5 dBA. The PTNLs are then determined in accordance with NPfI Section 2.1 *Project Noise Trigger Level* by identifying the lower of the project amenity or project intrusive noise levels (following conversion of the $L_{Aeq(period)}$ project amenity noise level to an equivalent $L_{Aeq(15minute)}$ value for comparison with the $L_{Aeq(15minute)}$ project intrusive noise level). NPfI Section 2.2 *Noise Descriptors* assumes a default conversion factor of plus 3 dB, however it can be shown that the project specific conversion factors for the Facility is: plus 5 dB during the evening the night-time; and 3 dB during the daytime.

It is anticipated that during evening the night-time the peak hourly Facility operation will correspond with the peak demand of a concrete pour at a building site. The Facility has been designed to accommodate peak demand, which will be followed by periods of relatively less activity on the site (ie concrete trucks attending a building site). Based Hanson's advice, the Facility is anticipated to supply concrete for typically 1 hour in every 3 hours during evening the night-time, resulting in a conversion factor of 5 dB. Similarly, based Hanson's advice, the Facility is anticipated to supply concrete for typically 1 hour in every 2 hours during the daytime, resulting in a conversion factor of 3 dB.

The $L_{Aeq(15minute)}$ project amenity and project $L_{Aeq(15minute)}$ intrusiveness noise levels and resulting PTNLs are presented in **Table 8** for assessing the operational noise from the Facility to the nearest residential localities in Balmain, Pyrmont and Glebe.

Table 8 Project Amenity and Intrusiveness Noise Levels and Resulting PTNLs (dBA re 20 µPa)

Locality	Location	NPfI Noise Amenity Area	Project Amenity $L_{Aeq(15minute)}$[1]			Project Intrusive $L_{Aeq(15minute)}$[1,4]			Resulting PTNL $L_{Aeq(15minute)}$[1,5]		
			Daytime[3]	Evening[2]	Night[2]	Daytime	Evening	Night	Daytime	Evening	Night
Balmain[7]	Donnelly Street	Urban industrial interface	63	55	50	52	50	45	52	50	45
	Batty Street		63	55	50	56	53	50	56	53	50
Pyrmont[7]	Refinery Drive	Urban industrial interface	65	57	52	55	54	52	55	54	52
Glebe	Leichhardt Street	Urban	58	50	45	51	51	45	51	50	45

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.
Note 2: $L_{Aeq(15minute)}$ project amenity noise level equivalent $L_{Aeq(period)}$ project amenity noise level (**Table 7)** plus 5 dBA
Note 3: $L_{Aeq(15minute)}$ project amenity noise level equivalent $L_{Aeq(period)}$ project amenity noise level (**Table 7)** plus 3 dBA
Note 4: $L_{Aeq(15minute)}$ project intrusive noise level equivalent to the RBL (**Table 5**) plus 5 dBA
Note 5: Resulting PTNL is the lower of the $L_{Aeq(15minute)}$ project amenity or $L_{Aeq(15minute)}$ project intrusive noise levels
Note 6: Where development conditions relate to noise attenuation, then the adopted *treated* noise level criteria is 60 dBA
Note 7: Jacksons Landing Development Application Reports nominate façade *ship* noise level criteria of 63 dBA.

The NPfI Section 2.4 states:

> *The recommended amenity noise levels have been selected on the basis of studies that relate industrial noise to annoyance in communities (Miedema and Voss, 2004). They have been subjectively scaled to reflect the perceived differential expectations and ambient noise environments of rural, suburban and urban communities for residential receivers. They are based on protecting the majority of the community (90%) from being highly annoyed by industrial noise.*

In those cases where the NPfI noise assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise "unacceptable". In subjective terms, NPfI Table 4.1 *Significance Residual Noise Impacts* characterises noise impacts resulting from residual noise exceedances generally as follows:

- If the residual noise exceedance is 0-2 dBA above the PTNL, then noise impacts are considered to be negligible (i.e. not noticeable by all people);
- If the residual noise exceedance is 3-5 dBA above the PTNL, and the project would contribute less than 1 dB to the total industrial noise level, then noise impacts are considered to be marginal (i.e. not noticeable by most people);
- If the residual noise exceedance is 3-5 dBA above the PTNL, and the project would contribute more than 1 dB to the total industrial noise level, then noise impacts are considered to be moderate (i.e. not noticeable by some people but may be noticeable by others);

- If the residual noise exceedance is >5 dBA above the PTNL, and the total industrial noise level less than or equal to the relevant amenity level, then noise impacts are considered to be moderate (i.e. not noticeable by some people but may be noticeable by others); or
- If the residual noise exceedance is >5 dBA above the PTNL, and the total industrial noise level is greater than the relevant amenity level, then noise impacts are considered to be significant (i.e. noticeable by most people).

4.2.2 Sleep Disturbance Noise Levels

A sleep disturbance assessment procedure is described in the NPfI Section *2.5 Maximum noise level event assessment*, which states:

> *Where the subject development/premises night-time noise levels at a residential location exceed:*
>
> *• $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
>
> *• L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *a detailed maximum noise level event assessment should be undertaken*

Based on the foregoing, the applicable night-time $L_{AF(maximum)}$ sleep disturbance noise levels (SDNLs) are presented in **Table 9**, for assessing the operational noise from the Facility to the nearest residential localities in Balmain, Pyrmont and Glebe.

Table 9 Night-time $L_{AF(maximum)}$ Sleep Disturbance Noise Levels (dBA re 20 µPa)

Locality	Location	RBL (refer Table 5)	SDNL LAF(max) (RBL plus 15 dBA)
Balmain	17 Donnelly Street	40	55
	1 Batty Street	42	57
Pyrmont	22 Refinery Drive	47	62
Glebe	53 Leichhardt Street	40	55

Note 1: Night-time 2200 hours to 0700 hours.

4.3 Berth (GIB1) Activity Noise Levels

As described in **Section 1.4**, the current configuration of port facilities at Glebe Island and White Bay have existed since at least 1968 when reclamation works at White Bay were completed. Hence the noise assessment recognises the berth (GIB1) activity as a continued use of the existing port facility.

While the berth will continue to operate on a 24/7 basis, berth operating noise levels can vary significantly subject to the status of the vessel which will mainly be the CSL Rhine (or similar). Noise from the ship's engine, raw material unloading conveyor mechanism and associated ventilation systems (ie both engine and accommodation areas) are likely to form the majority of the berth operating noise levels.

While the NPfI enables the implementation of a noise management precinct with respect to ports, it does not specifically address the relatively transient nature of ship noise, which once berthed generally has limited opportunity to adjust noise emissions during daytime, evening and night-time periods.

4.4 Road Traffic Noise Assessment Criteria

The RNP and associated Application Notes (**Section 1.2**) present road traffic noise impact assessment procedures for setting acceptable $L_{Aeq(period)}$ noise levels and assessing any impacts from both new and the redevelopment of existing road networks, and sets out noise mitigation strategies for residences affected by:

- Noise from the development of new road corridors;
- Noise from the redevelopment of existing roads; and
- Noise from additional traffic on roads generated by land use developments.

The RNP adopts a road classification scheme for assessing road traffic noise from arterial, sub-arterial and local roads, and then identifies noise "assessment" and "relative increase" criteria which aim to maintain an acceptable level of road traffic noise associated with traffic-generating developments.

As described in **Section 2.5**, the Facility will be accessed during construction and operation via James Craig Drive connecting to The Crescent, Victoria Road, and the City-West Link Road and in accordance the RNP all roads are classified as arterial/sub-arterial roads and the applicable noise criteria are presented in **Table 10**.

Table 10 Road Traffic Noise Assessment Criteria for Residential Land Uses (dBA re 20 µPa)

Receiver Area	Road	Land Use	Total Traffic NoiseCriteria[1]	Relative Increase Criteria[2]
Balmain	James Craig Drive; The Crescent; Victoria Road; and City-West Link Road	Existing residences affected by additional traffic on existing arterial/sub-arterial roads generated by land use developments	Daytime 60 $L_{Aeq(15hour)}$	Existing $L_{Aeq(15hour)}$ plus 12 dBA
			Night-time 55 $L_{Aeq(9hour)}$	Existing $L_{Aeq(9hour)}$ plus 12 dBA

Note 1: Daytime 0700 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

Note 2: Application Notes state that the relative increase criteria are primarily intended to protect existing quiet areas.

It is noted that that in all cases, where the nominated criteria are already exceeded, traffic associated with a development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA and this generally arises from a more than 60% traffic increase due to a project.

4.5 Waterway Noise Assessment Criteria

Roads and Maritime Services (RMS) are responsible for managing navigation and safety on NSW waterways, including Sydney Harbour. Whilst ships using Sydney Harbour need to be registered and ship captains licenced, no approvals are required for ship passage through Sydney Harbour that complies with navigational safety rules. Hence waterway noise is not further considered in this report.

5 VIBRATION ASSESSMENT CRITERIA

5.1 Categories of Vibration in Structures

The effects of vibration in buildings can be divided into three main categories; those in which the occupants or users of the building are inconvenienced or possibly disturbed, those where the building contents may be affected and those in which the integrity of the building or the structure itself may be compromised.

For the Facility construction works, the nearest structures are the heritage listed Glebe Island Silos approximately 100 m to the west and the Glebe Island 'swing bridge' approximately 100 m to the south. The nearest residential dwellings are located in Pyrmont (ie Refinery Drive) and approximately 300 m across Johnstons Bay.

5.2 Assessment Criteria

Most commonly specified 'safe' structural vibration limits are designed to minimise the risk of cosmetic damage such as surface cracks, and are set well below the levels that have potential to cause structural damage. The British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2,* provides frequency-dependent vibration limits related to the cosmetic damage risk.

The German Standard DIN 4150-3:1999 "*Structural Vibration Part 3: Effects of vibration in structures*" provides guideline values for evaluating the effect of vibration on buried pipework. In addition, SLR has identified appropriate vibration criteria for computer room floors and the operating of mechanical plant where applicable.

The EPA's "*Assessing Vibration: A Technical Guideline"* (DEC 2006) provides guideline building vibration levels associated with a low probability of annoyance from occupants. The applicable damage risk and annoyance risk vibration velocity criteria are further discussed in **Appendix E** and summarised in **Table 11**.

Table 11 Vibration Velocity Damage Risk and Annoyance Risk Criteria (mm/s)

Receiver Area	Damage Risk (mm/s)		Annoyance Risk (mm/s)	
	Horizontal	Vertical	Horizontal	Vertical
Residential/Dwellings	7.5	7.5	1.2	0.45
Commercial/Offices	25	25	1.6	0.6
Industrial/Workshops			3.2	1.2
Reinforced structures (ie silos, swing bridge abutment)			-	-
Electronic/Computers	5	5	-	-
Mechanical (On/Off)[1]	20/5	20/5	-	-
Subsurface structures	50-100	50-100	-	-

Note 1: 'On' refers to when machinery is turned on, and 'Off' is when machinery is off. Criteria are stricter for 'Off' as machinery is more likely to be damaged by vibration when it is not operating due to potential for brinelling.

6 NOISE MODELLING METHODOLOGY

6.1 Noise Modelling Procedure and Scenarios

In order to facilitate the computation of environmental noise emissions from the operation of the Facility at Glebe Island, a three dimensional computer noise model has been developed, based on available ground topography and aerial photography of the study area.

Noise emission modelling was undertaken using SoundPLAN version 7 noise prediction software, based on the utilising the CONCAWE algorithm, a commercial software system developed by Braunstein & Berndt International. The acoustical algorithms utilised by this software are endorsed national or international standards and are therefore accepted by the NSW EPA as suitable for use. The noise modelling algorithms account for the octave band sound power levels of the sources, their heights, the distances to the receivers, the natural topography, buildings, air absorption and ground effects.

The Facility operational noise modelling scenarios include the proposed mobile equipment and fix plant items operating concurrently to simulate the overall maximum energy equivalent ($L_{Aeq(15minute)}$) project intrusive noise level. A large proportion of the mobile equipment is operated in repeatable routines and a relatively smaller proportion of the emissions emanate from fixed plant items. The three (3) Facility operational noise modelling scenarios are presented in **Table 12**.

Table 12 Facility Daytime, Evening and Night-time Noise Modelling Operating Scenarios

Mobile Equipment and Fixed Plant	Peak hourly Movements (ie Arrival plus Departure)[1]		
	Daytime	Evening	Night-time
Concrete truck movements	240	100	40
Cement tanker movements	28	18	10
Aggregate or sand truck movements	160	80	76
Wet concrete mixing inside the building	✓	✓	✓
Transfer Conveyors	✓	✓	✓

Note 1 Peak hourly movements comprises arrivals plus departures (e.g. 240 movements = 120 arrivals + 120 departures).

The Facility will operate during the daytime, evening and night-time with different capacity when comparing the peak hourly operation, compared to the average capacity over each period. To calculate the project amenity noise levels, the daytime average capacity is assumed to be 50 percent of the peak operation, and the evening/night-time average capacity 33 percent of the evening/night-time peak capacity.

6.2 Noise Mitigation and Management Measures

6.2.1 Mobile Equipment and Fixed Plant Sound Power Levels

The potential for machinery to emit noise is quantified as the sound power level (SWL) measured on the A-weighted scale in decibels re 1 picowatt (dBA re 1ρW). At the receptor, the received noise is quantified as the sound pressure level (SPL) measured on the A-weighted scale in decibels re 20 micropascals (dBA re 20 μPa).

In general terms, any variation in the on-site mobile equipment and fixed plant and SWLs would produce a similar variation in the off-site SPL at the receiver (e.g. an increase of 5 dBA in the SWL of equipment operating at a site may result in a corresponding 5 dBA increase in SPL of intrusive noise at the receiver, when averaged over the same 15 minute period).

In accordance with NPfI Section 3.1, Hanson is obligated to consider to feasible and reasonable noise mitigation measures for the Facility. Noise mitigation requirements were identified during preliminary noise modelling, the resulting source and transmission noise control and management measures are presented in **Table 13**, together with the resulting mitigated SWL and or SPL adopted for noise modelling and associated prediction of the off-site environmental intrusive and amenity noise levels.

Table 13 Facility and Berth Noise Mitigation Measures and Sound Power Levels (SWLs) (dBA re 1ρW)

Plant and Equipment	Nominal Noise Control	Overall $L_{Aeq(15min)}$
Front End Loader[1] (Komatsu 480)	low-noise specification	SWL 107 dBA per unit
Truck operation[1]	speed limited to 20 km/hr	SWL 108 dBA per unit SWL L_{Amax} 113 dBA per unit
Truck handbrake[1] (air release)	assume normal air release	SWL L_{Amax} 122 dBA per unit
Reversing alarms[1]	squawker reversing alarms fitted to all mobile plant, concrete and aggregate trucks	SWL L_{Amax} 105 dBA per unit
Building Enclosure[1]	selection of quiet mechanical plant and equipment	Internal reverberant SPL 87 dBA
	construction colour bond minimum thickness 0.6 mm	
	roof ventilation maximum area 15 square metres	
	roller doors automatic open and closure; maximum opening time 60 seconds	
Conveyors[2]	low-noise specification with full enclosure	SWL 95 dBA/100 m
Conveyor drive[2]	low-noise specification with full enclosure	SWL 90 dBA/100 m
CSL Rhine[3,4]	In service operating condition	SWL 106 dBA

Note 1 SWL for mobile equipment and fixed plant from SLR database of equivalent operating machinery
Note 2 Conveyors and drives located external to buildings, silos and silo to ship hopper
Note 3 SWL inclusive of significant noise sources based on 12,000 tonnes vessel capacity
Note 4 Ship bow orientated south, with the discharge conveyor feeding the hopper

In addition, shipping containers located on the eastern perimeter of the site will form a 7.8 m green wall for noise mitigation and visual amenity (**Figure 3**).

6.2.2 NPfI Corrections for Annoying Noise Characteristics

The proposed noise mitigation measures (**Table 13**) and associated noise controlled SWLs aim to minimise potential annoying characteristics from the Facility operating noise levels at the noise source. Subject to implementation (ie acoustical design, specification, procurement and construction) the noise mitigation measures aim to negate additional modifying factor corrections to the predicted noise levels in accordance with NPfI Section 3.3.1 *Identifying noise parameters* and NPfI Fact Sheet C.

6.2.3 Noise and Vibration Management Plans

Subject to approval, Hanson will prepare an Environmental Management Plan (EMP) for the Facility and associated management sub-plans for Construction Noise and Vibration Management Plan (CNVMP) and Operating Noise Management Plan (ONMP).

7 CONSTRUCTION NOISE AND VIBRATION IMPACT ASSESSMENT

7.1 Construction Noise Impact Assessment

The predicted daytime intrusive $L_{Aeq(15minute)}$ noise levels from the Facility's three (3) major construction works (**Section 2.2**) to the nearest residential localities are presented **Table 14** together with recommended CNMLs (**Table 6**) during ICNG standard construction hours (**Table 3**).

Table 14 Predicted Daytime Construction Intrusive $L_{Aeq(15minute)}$ Noise Levels (dBA re 20 µPa)

Locality	Location	Enabling	Silo	Building	CNML (noise affected)	CNML (highly noise affected)
Balmain	Donnelly Street	47	47	46	57	75
	Batty Street / Roberts Road[1]	52	52	51	61	
Pyrmont	Bowman Street[2]	62	62	61	60	
	Refinery Drive	57	57	56		
Glebe	Glebe Point Road	50	50	49	56	

Note 1 The higher noise level from receivers at Batty Street and Roberts Road is shown
Note 2 The higher noise level at multilevel apartment buildings is shown
Note 3: Predicted noise level complies with the CNML (noise affected)
Note 4: Negligible residual noise exceedance 1 to 2 dBA above CNML (noise affected)

The predicted daytime construction noise levels comply with the relevant CNML (noise affected) except at Pyrmont (Bowman Street) where there is a negligible residual noise exceedance of up to 2 dBA, but remain well below the CNML (highly noise affected) of 75 dBA.

7.2 Cumulative Construction Noise Impact Assessment

7.2.1 Multi-user Facility Construction Works

As described in **Section 1.4**, subject to delivery schedules the construction phases of the Facility and Multi-user Facility may coincide for a period of up to approximately 9 months. Given the proximity of the sites to each other, there is a potential for cumulative construction noise impacts.

The Multi-User Facility REF Appendix D (Noise Impact Assessment) Table 19 presents the predicted construction noise levels from similar phases of construction to that of the Facility. In the event that construction works do occur concurrently, the cumulative predicted daytime intrusive $L_{Aeq(15minute)}$ noise levels from the Facility and the Multi-User Facility to the nearest common residential localities are presented **Table 15,** together with recommended CNMLs (**Table 6**) during ICNG standard construction hours (**Table 3**).

Table 15 Predicted Daytime Construction Intrusive $L_{Aeq(15minute)}$ Noise Levels (dBA re 20 µPa)

Locality	Location	Enabling plus Establishment	Silo plus Formwork	Building Works	CNML (noise affected)	CNML (highly noise affected)
Balmain	Batty Street	60	55	54	61	75
Pyrmont	Refinery Drive	67	62	62	60	
Glebe	Glebe Point Road	59	54	53	56	

Note 1: Predicted noise level complies with the CNML (noise affected)
Note 2: Negligible residual noise exceedance 1 to 2 dBA above CNML (noise affected)
Note 3: Moderate residual noise exceedance 3 to 5 dBA above CNML (noise affected)
Note 3: Appreciable residual noise exceedance >5 dBA above CNML (noise affected) but less than CNML 75 dBA

The predicted daytime construction noise levels comply with the relevant CNML (noise affected) except at Pyrmont (Refinery Drive) where there is a negligible residual noise exceedance of up to 2 dBA during concurrent silo plus formwork constructions works as well as building works. Furthermore, cumulative construction noise levels may exceed CNML (noise affected) of 60 dBA at Pyrmont (Refinery Drive) during the initial site enabling plus establishment phases by up to 7 dBA, but remain well below the CNML (highly noise affected) of 75 dBA.

As described in **Section 6.2.3**, a CNVMP would be prepared in accordance with the ICNG requirements and consider potential cumulative noise impacts and include a programme of operator-attended noise monitoring.

7.2.2 Westconnex M4-M5 Link Rozelle Construction Works

As described in **Section 1.5**, the Westconnex M4-M5 Link Rozelle construction works are scheduled to commence in the fourth quarter of 2018 [refer EIS Appendix J (Noise and Vibration) Section 5.3 *Rozelle* Table 5-64]. The construction phase of the Facility is expected to commence in Quarter 3 2018 and competed by Quarter 1 2019 (ie approximately 9 months duration), and before the major traffic diversions and intersection works are undertaken as part of Westconnex M4-M5 Link.

However, the Westconnex M4-M5 Link EIS Appendix J (Noise and Vibration) Section 5.3 *Rozelle* Figure 5-18 also identifies that the construction footprint approaches (but does not adjoin) the proposed Facility. Furthermore, the residential noise catchment areas (NCAs) NCA25, NCA27 and NCA29 (refer Figure 5-18) are well separated and not common with the nearest potentially affected residential receiver localities identified for the Facility in **Section 2.8** and shown on **Figure 4**.

While it is anticipated that construction phase of the Facility will coincide with Westconnex M4-M5 Link (Rozelle*)* construction works for a period of approximately 6 months, it is concluded that any cumulative construction noise impacts will be minimal due to the separation of the respective construction sites and the absence of common residential receivers.

7.3 Construction Vibration Impact Assessment

As described in **Section 5.1**, for the Facility construction works, the nearest structures are the heritage listed Glebe Island Silos approximately 100m to the west and the Glebe Island 'swing bridge' approximately 100m to the south. The nearest residential dwellings are located in Pyrmont (ie Refinery Drive) and approximately 300m across Johnstons Bay.

The predicted safe working distances to comply with both the vibration damage Risk and annoyance risk criteria (**Table 11**) are presented in **Table 16** due to the use of a large rock breaker (ie 1600 kg and 25 tonne excavator) on the construction site.

Table 16 Predicted Safe Working Distances to Comply with Damage Risk and Annoyance Risk Criteria

Receiver Area	Damage Risk Safe Distance (m)	Annoyance Risk Safe Distance (m)
Residential/Dwellings	22 m	73 m
Commercial/Offices	3 m	61 m
Industrial/Workshops		49 m
Reinforced structures (ie silos, swing bridge abutment)		-

Based on the predicted safe working distances presented in **Table 16**, it is concluded that residential dwelling vibration damage and occupant annoyance risks are minimal, as the nearest residential dwellings are beyond 300m from the Facility construction site.

Similarly, commercial and industrial property vibration damage and occupant annoyance risks are minimal, as the nearest commercial and industrial structures are beyond 100m from Facility construction site. Moreover, the heritage listed Glebe Island silos and swing bridge vibration damage risk is also minimal due to the intervening distance between the structures and Facility construction site.

8 FACILITY OPERATING NOISE IMPACT ASSESSMENT

8.1 Predicted LAeq(period) Project Amenity Noise Levels

The predicted LAeq(period) operating amenity noise levels from the Facility's three (3) operating scenarios (**Section 6.1**) to the nearest residential localities are presented in **Table 17** together with recommended LAeq(period) project amenity noise levels (**Table 6**).

Table 17 Predicted LAeq(period) Operating Amenity Noise Levels (dBA re 20 µPa)

Locality	Location	LAeq(period) Operating Amenity Noise Levels			LAeq(period) Project Amenity Noise Levels		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Balmain	Donnelly Street	40	36	34	60	50	45
	Batty Street / Roberts Road[1]	43	40	37			
Pyrmont	Bowman Street[2]	47-51	43-47	42-45	62	52	47
	Refinery Drive[2]	44-46	41-42	40-41			
Glebe	Glebe Point Road[2]	37-38	33-34	32-33	55	45	40

Note 1 The higher noise level from receivers at Batty Street and Roberts Road is shown
Note 2 The range of noise levels to the different floors at multilevel apartment buildings is shown
Note 3: Predicted noise level complies with the project amenity LAeq(period) noise level

The predicted amenity LAeq(period) noise levels from the Facility's three (3) operating scenarios comply with the project amenity noise levels, and therefore meet the precinct amenity noise goals (**Table 7**).

8.2 Predicted LAeq(15minute) Project Intrusive Noise Levels

The predicted LAeq(15minute) operating intrusive noise levels from the Facility's three (3) operating scenarios (**Section 6.1**) to the nearest residential localities are presented **Table 18** together with resulting PTNLs (**Table 8**).

Table 18 Predicted Operating Intrusive LAeq(15minute) Noise Levels (dBA re 20 µPa)

Locality	Location	Predicted Intrusive LAeq(15minute) Noise Levels			Resulting PTNLs LAeq(15minute)		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Balmain	Donnelly Street	43	41	39	52	50	45
	Batty Street / Roberts Road[1]	46	45	42	56	53	50
Pyrmont	Bowman Street[2]	50-54	48-52	47-50	55	54	52
	Refinery Drive[2]	47-49	46-47	45-46			
Glebe	Glebe Point Road[2]	40-41	38-39	37-38	51	50	45

Note 1 The higher noise level from receivers at Batty Street and Roberts Road is shown
Note 2 The range of noise levels to the different floors at multilevel apartment buildings is shown
Note 3: Predicted noise level complies with the project trigger LAeq(15minute) noise level

The predicted intrusive LAeq(15minute) noise levels from the Facility's three (3) operating scenarios comply with the project trigger noise levels.

8.3 Predicted Project Maximum Sleep Disturbance Noise Levels

The predicted night-time project maximum sleep disturbance noise levels from the Facility's three (3) operating scenarios (**Section 6.1**) to the nearest residential localities are presented **Table 19** together with night-time SDNL (LAF(max)) (**Table 9**). Maximum noise levels predicted for short term effects such as truck start-up, parking brake with compressed air release.

Table 19 Predicted Facility Operating Maximum Sleep Disturbance Noise Levels (dBA re 20 µPa)

Locality	Location	Predicted Maximum Noise Level	SDNL LAF(max)
Balmain	Donnelly Street	47	55
	Batty Street / Roberts Road[1]	46	57
Pyrmont	Bowman Street	64	62
	Refinery Drive	60	
Glebe	Glebe Point Road	50	55

Note 1 The higher noise level from receivers at Batty Street and Roberts Road is shown
Note 2: Predicted noise level complies with the SDNL $L_{AF(max)}$
Note 3: Negligible residual noise exceedance 1 to 2 dBA above SDNL $L_{AF(max)}$

The predicted night-time maximum sleep disturbance noise levels comply with the relevant SDNL except at Pyrmont (Bowman Street) where there is a negligible residual noise exceedance of up to 2 dBA. In addition, as described in Section **3.2**, development application reports for Jacksons Landing (off Bowman Street Pyrmont) nominate a façade external level criterion of 63 dBA, effectively reducing the residual noise exceedance to only 1 dBA.

8.4 Predicted Berth (GIB1) Activity and Combined Operating Amenity Noise Levels

The predicted $L_{Aeq(period)}$ berth (GIB1) activity amenity noise levels (ie CSL Rhine or similar) to the nearest residential localities are presented **Table 20**. The $L_{Aeq(period)}$ operating amenity noise levels from the Facility's three (3) operating scenarios (**Table 17**) have also been summed with the berth (GIB1) activity amenity noise levels in order to estimate amenity noise level from the combine operations (ie Berth (GIB1) activity plus the Facility operation), as shown in **Table 20**.

Table 20 Predicted Berth (GIB1) Activity and Combine Operating Amenity Noise Levels (dBA re 20 µPa)

Locality	Location	Existing Use Berth GIB1 Activity Amenity $L_{Aeq(period)}$ Noise Levels			Combine Operation GIB1 plus the Facility Amenity $L_{Aeq(period)}$ Noise Levels		
		Daytime	Evening	Night-time	Daytime	Evening	Night-time
Balmain	Donnelly Street	44	44	44	45	45	44
	Batty Street / Roberts Road[1]	44	44	44	47	45	45
Pyrmont	Bowman Street[2]	51-51	51-51	51-51	54-55	52-53	52-52
	Refinery Drive[2]	50-51	50-51	50-51	52-53	51-52	51-52
Glebe	Glebe Point Road[2]	40-40	40-40	40-40	42-42	41-41	41-41

Note 1 The higher noise level from receivers at Batty Street and Roberts Road is shown
Note 2 The range of noise levels to the different floors at multilevel apartment buildings

The predicted $L_{Aeq(period)}$ berth (GIB1) activity amenity noise levels and the estimated amenity noise levels from the combine operations (ie Berth (GIB1) activity plus the Facility operation) to the nearest residential localities are generally consistent with existing use and associated noise environment, as described in **Section 3.2**. In particular, due to the proximity between GIB1 and Pyrmont residential receivers, port facility noise levels may exceed noise planning goals established in accordance with more conventional approaches to the assessment of industrial noise sources.

As described in **Section 4.3**, while the NPfI enables the implementation of a noise management precinct with respect to ports, it does not specifically address the relatively transient nature of ship noise, which once berthed generally has limited opportunity to adjust noise emissions.

Hanson advise that they will coordinate with the ship operator(s), to ensure that the ship's engine, raw material unloading conveyor mechanism and associated ventilation systems (ie both engine and accommodation areas) which are likely to form the majority of the berth activity noise levels are minimised where feasible and reasonable to do so.

9 ROAD TRAFFIC NOISE IMPACT ASSESSMENT

9.1 Road Traffic Noise Criteria

The Facility will be accessed during operation via James Craig Drive connecting to, Anzac Bridge, Victoria Road, the City-West Link Road and The Crescent. The relevant road traffic noise criteria are presented in **Section 4.4**, and in accordance the RNP all roads are classified as arterial/sub-arterial roads and the applicable noise criteria are presented in **Table 21**.

Table 21 Road Traffic Noise Assessment Criteria for Residential Land Uses (dBA re 20 µPa)

Receiver Area	Road	Land Use	Total Traffic NoiseCriteria[1]	Relative Increase Criteria[2]
Balmain	James Craig Drive; The Crescent; Victoria Road; and City-West Link Road	Existing residences affected by additional traffic on existing arterial/sub-arterial roads generated by land use developments	Daytime 60 $L_{Aeq(15hour)}$	Existing $L_{Aeq(15hour)}$ plus 12 dBA
			Night-time 55 $L_{Aeq(9hour)}$	Existing $L_{Aeq(9hour)}$ plus 12 dBA

Note 1: Daytime 0700 hours to 2200 hours, night-time 2200 hours to 0700 hours.
Note 2: Application Notes state that the relative increase criteria are primarily intended to protect existing quiet areas.

It is noted that that in all cases, where the nominated criteria are already exceeded, traffic associated with a development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA and this generally arises from a more than 60% traffic increase due to a project.

9.2 Road Traffic Movements

As described in **Section 2.5**, as the construction related traffic flows are relatively modest by comparison with the Facility operation traffic flows, the road traffic noise assessment focuses on the Facility operation and associated light and heavy vehicle movements. The existing base traffic flows (2016) and the estimated Facility operating traffic flows on the arterial road network are presented in **Table 22** for the daytime and night-time traffic noise assessment periods. The percentage increase arising from the Facility operating traffic is also shown in brackets.

Table 22 Base Vehicles 2016 and Facility Operating Road Traffic

Roadway	Time Period	Existing Base Traffic Flows 2016[1]			Facility Operating Traffic Flows[2,3]		
		Light	Heavy	Total	Light	Heavy	Total
Anzac Bridge	Daytime 0700 hrs to 2200 hrs	114,651	6,103	120,754	9 (0.0%)	337 (5.5%)	346 (0.3%)
Victoria Road		50,117	2,598	52,715	72 (0.1%)	337 (13.0%)	409 (0.8%)
City-West Link Road		48,268	3,339	51,607	35 (0.1%)	741 (22.2%)	776 (1.5%)
The Crescent		11,338	815	12,153	9 (0.1%)	172 (21.1%)	181 (1.5%)
Anzac Bridge	Night-time 2200 hrs to 0700 hrs	26,222	1,395	27,617	1 (0.0%)	68 (4.9%)	69 (0.2%)
Victoria Road		9,363	418	9,781	6 (0.1%)	68 (16.3%)	74 (0.8%)
City-West Link Road		11,525	801	12,326	3 (0.0%)	170 (21.2%)	173 (1.4%)
The Crescent		1,334	149	1,483	1 (0.1%)	38 (25.5%)	39 (2.6%)

Note 1: Source: Westconnex M4-M5 Link EIS and RMS Traffic Surveys 2016.
Note 2: Source: Concrete Batching Plant, Glebe Island Traffic Impact Assessment AECOM 2017, together with an assumed split of Facility generated traffic to the west of 80% along City West Link Road and 20% to The Crescent

9.3 Traffic Noise Levels

The calculation of traffic noise on public roads for comparison with the road traffic noise criteria (**Section 9.1**) has been performed using the Calculation of Road Traffic Noise (CORTN) model, which has the advantage of having been specifically validated under Australian conditions, and the L_{Aeq} calculation based on the US Environmental Protection Agency - Report 550/9-74-004 (1974). The modelling predicts traffic noise levels at the receiver based on existing and projected traffic volumes, percentage of light and heavy vehicles, vehicle speed and distance to the receiver.

Traffic noise levels have been predicted for the nearest receivers adjacent to the Facility access route (ie via James Craig Drive connecting to, Anzac Bridge, Victoria Road, the City-West Link Road and The Crescent). The road traffic noise criteria (**Section 9.1**), the predicted total traffic noise level, and the predicted Facility related increase (decibels and percentage) are presented in **Table 23**, for the daytime and night-time traffic noise assessment periods.

Table 23 Predicted Total Traffic Noise Levels and Facility Related Increase (dBA re 20 µPa)

Access Road	Daytime $L_{Aeq(15hour)}$ Noise Levels[1]				Night-time $L_{Aeq(9hour)}$ Noise Levels[1]			
	Noise Criteria	Total Traffic	Facility Increase		Noise Criteria	Total Traffic	Facility Increase	
Anzac Bridge	60 dBA	74 dBA	0.0 dB	0.3%	55 dBA	70	0.0 dB	0.2%
Victoria Road		75 dBA	0.1 dB	0.8%		69	0.1 dB	0.8%
City-West Link Road		75 dBA	0.2 dB	1.5%		71	0.2 dB	1.4%
The Crescent		70 dBA	0.2 dB	1.5%		63	0.4 dB	2.6%

Note 1: Total traffic noise level inclusive of 2.5 dBA facade correction.

9.4 Noise Impact Assessment

Total traffic noise levels at the nearest receivers to the Anzac Bridge are predicted to already exceed the daytime and night-time traffic noise criteria due to existing base traffic flows. The daytime Facility related traffic flow increase of 0.3%, corresponds to a negligible (<0.0 dB) increase in the existing daytime $L_{Aeq(15hour)}$ traffic noise levels. Similarly, night-time Facility related traffic flow increase of 0.2%, corresponds to a negligible (<0.0 dB) increase in the existing night-time $L_{Aeq(9hour)}$ traffic noise levels. Any traffic noise impacts via the Anzac Bridge are therefore considered acceptable.

Total traffic noise levels at the nearest receivers to Victoria Road are predicted to already exceed the daytime and night-time traffic noise criteria due to existing base traffic flows. The daytime Facility related traffic flow increase of 0.8%, corresponds to a negligible 0.1 dB increase in the existing daytime $L_{Aeq(15hour)}$ traffic noise levels. Similarly, night-time Facility related traffic flow increase of 0.8%, corresponds to a negligible 0.1 dB increase in the existing night-time $L_{Aeq(9hour)}$ traffic noise levels. Any traffic noise impacts via Victoria Road are therefore considered acceptable.

Total traffic noise levels at the nearest receivers to the City-West Link Road are predicted to already exceed the daytime and night-time traffic noise criteria due to existing base traffic flows. The daytime Facility related traffic flow increase of 1.5%, corresponds to a negligible 0.2 dB increase in the existing daytime $L_{Aeq(15hour)}$ traffic noise levels. Similarly, night-time Facility related traffic flow increase of 1.4%, corresponds to a negligible 0.2 dB increase in the existing night-time $L_{Aeq(9hour)}$ traffic noise levels. Any traffic noise impacts via the City-West Link Road are therefore considered acceptable.

Total traffic noise levels at the nearest receivers to The Crescent are predicted to already exceed the daytime and night-time traffic noise criteria due to existing base traffic flows. The daytime Facility related traffic flow increase of 1.5%, corresponds to a negligible 0.2 dB increase in the existing daytime $L_{Aeq(15hour)}$ traffic noise levels. Similarly, night-time Facility related traffic flow increase of 2.6%, corresponds to a negligible 0.4 dB increase in the existing night-time $L_{Aeq(9hour)}$ traffic noise levels. Any traffic noise impacts via The Crescent are therefore considered acceptable.

10 SUMMARY OF FINDINGS

This assessment of noise and vibration impacts for the Facility (SSD8544) has been guided by the NSW DP&E SEARs dated 7 July 2017, as presented in **Table 1**, with the Facility construction and operating noise and vibration impacts assessed in accordance with the relevant guidelines in **Table 2**. The construction and operating noise and vibration impact assessments are summarised in **Table 24**.

Table 24 Facility Construction and Operating Noise and Vibration Impact Assessment Summary

Description	Parameter	Assessment Summary	Impact Summary
Construction	Intrusive noise	Commencement: Quarter 3, 2018. Duration: Approximately 9 months. Hours: Generally daytime normal construction hours Monday to Friday 0700 hours to 1800 hours; and Saturday 0800 hours to 1300 hours.	The predicted daytime construction noise levels comply with the relevant CNML (noise affected) except at Pyrmont (Bowman Street) where there is a negligible residual noise exceedance of up to 2 dBA, but well below the CNML (highly noise affected) of 75 dBA.
	Cumulative noise	The construction phases of the Facility and the Multi-user Facility may coincide, for a period of up to approximately 9 months.	The predicted daytime construction noise levels comply with the relevant CNML (noise affected) except at Pyrmont (Refinery Drive) where there is a negligible residual noise exceedance of up to 2 dBA during the building works. Cumulative construction noise levels may exceed CNML (noise affected) of 60 dBA at Pyrmont (Refinery Drive) during the enabling plus establishment phases by up to 7 dBA, but well below the CNML (highly noise affected) of 75 dBA.
		The construction phase of the Facility will coincide with Westconnex M4-M5 Link (Rozelle) construction works for a period of approximately 6 months.	Cumulative construction noise impacts will be minimal due to the separation of the respective construction sites and the absence common residential receivers in the Rozelle area.
	Vibration	The nearest residential dwellings are located in Pyrmont approximately 300 m across Johnstons Bay. The nearest structures are the heritage listed Glebe Island Silos to the west and the Glebe Island ‘swing bridge’ to the south.	Based on the predicted safe working distances presented in **Table 16**, the vibration damage and occupant annoyance risks are minimal due to the intervening distance between the residences and structures to the Facility construction site.
	Mitigation and Management	Construction Noise and Vibration Management Plan (CNVMP) prepared in accordance with ICNG requirements with particular reference to Section 7, and include operator-attended monitoring.	

Description	Parameter	Assessment Summary	Impact Summary
Operation	Facility (project) amenity noise	The applicable precinct amenity and project amenity noise levels are presented in Table 7, and the Port Authority has indicated that the precinct amenity at Pyrmont should be distributed equally between the proposed Facility and the repurposed Multi-user facility. The resulting night-time project amenity noise level is 47 $L_{Aeq(9hour)}$ for the Facility. The project trigger noise levels (PTNLs) are presented in Table 8, and maximum sleep disturbance noise levels in Table 9.	The predicted amenity $L_{Aeq(period)}$ noise levels from the Facility's three operating scenarios comply with the project amenity noise levels, and therefore meet the precinct goals.
	Facility (project) intrusive noise		The predicted intrusive $L_{Aeq(15minute)}$ noise levels from the Facility's three operating scenarios comply with the PTNLs.
	Facility (project) maximum noise		The predicted night-time maximum sleep disturbance noise levels comply with the relevant SDNL except at Pyrmont (Bowman Street) where there is a negligible residual noise exceedance of up to 2 dBA. DA reports for Jacksons Landing nominate a façade criterion of 63 dBA, effectively reducing the residual exceedance to 1 dBA.
	Mitigation and Management	Operating Noise Management Plan (ONMP) prepared in accordance with NPfI requirements, with particular reference the noise mitigation measures in Table 13, and include operator-attended noise monitoring.	
Berth	GIB1 activity and combine operations (ie Berth (GIB1) activity plus the Facility operation) amenity noise	The current configuration of port facilities have existed since at least 1968, and the berth (GIB1) activity is recognised as a continued use of the existing port facility 24 hours per day, 7 days per week.	The predicted GIB1 activity and the estimated amenity noise levels from the combine operations (ie Berth (GIB1) activity plus the Facility operation) to the nearest residential localities are generally consistent with existing use and associated noise environment. In particular, due to the proximity between GIB1 and Pyrmont receivers, port facility noise levels may exceed noise planning goals.
	Mitigation and Management	Hanson will coordinate with the ship operator(s), to ensure that the ship's engine, raw material unloading conveyor mechanism and associated ventilation systems which are likely to form the majority of the berth operating noise levels are minimised where feasible and reasonable to do so.	
Road Traffic	Noise	The Facility operation will be accessed via James Craig Drive connecting to, Anzac Bridge, Victoria Road, the City-West Link Road and The Crescent 24 hours per day, 7 days per week.	Total traffic noise levels at the nearest receivers are predicted to exceed the traffic noise criteria due to existing base traffic flows. Any traffic noise increases due the Facility operating are negligible.
	Mitigation and Management	Road Traffic Management Plan (RTMP) prepared in accordance with the requirements of the Traffic Impact Assessment and any associated project approval conditions.	
Waterway	Noise	Roads and Maritime Services (RMS) are responsible for managing navigation and safety on NSW waterways, including Sydney Harbour. Whilst ships using Sydney Harbour need to be registered and ship captains licenced, no approvals are required for ship passage through Sydney Harbour that complies with navigational safety rules. Hence waterway noise is not further considered in this report.	

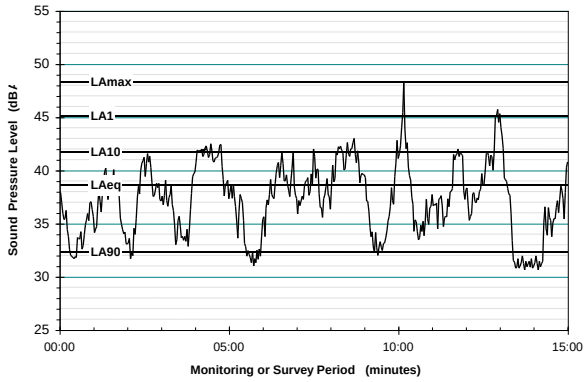
ACOUSTIC TERMINOLOGY

Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the L_{A10}, L_{A90} and L_{Aeq} and L_{Amax} noise levels.

- The L_{A10} is the A-weighted sound pressure level exceeded 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound over the same measurement period. The $L_{Aeq(15hour)}$ is the measurement parameter used to describe the road traffic noise level over the entire daytime (7.00 am to 10.00 pm) period. The $L_{Aeq(9hour)}$ is the measurement parameter used to describe the road traffic noise level over the entire night-time (10.00 pm to 7.00 am) period. Similarly, the $L_{Aeq(1hour)}$ is the measurement parameter used to describe the road traffic noise level during the loudest 1-hour period during the daytime or night-time periods.
- The L_{A90} noise level is the A-weighted sound pressure level exceeded 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the "background" level.
- The L_{Amax} noise level is the maximum A-weighted noise level associated with road traffic movements.

Graphical Display of Typical Noise Indices



Typical Noise Levels

The following table presents examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerb side of busy street	Loud
	Loud radio or television	
70		
60	Department store	Moderate to Quiet
50	General Office	
40	Inside private office	Quiet to Very quiet
30	Inside bedroom	
20	Unoccupied recording studio	Almost silent

A-Weighting or dBA Noise Levels

The overall level of a sound is usually expressed in terms of dBA, which is measured using the "A-weighting" filter incorporated in sound level meters. These filters have a frequency response corresponding approximately to that of human hearing. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the "loudness" of that sound. Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).

Sensitivity of People to Noise Level Changes

A change of up to 3 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

INFRASTRUCTURE PROJECTS WITH INDICATIVE SCHEDULES OF DEVELOPMENT FOR CUMULATIVE IMPACT ASSESSMENT

Projects	2018- 2019 (immediate)	2020 -2030 (10 years)	2030 - 2040 (20 years)	Cumulative Assessment Comment
Bays Precinct (2015-2019)[1] • Bays Market District (BMD)	✓ Draft Masterplan Urban Design Principles issued	-	-	No EIS is currently available for the fish markets relocation, although the BMD is expected to be delivered in the near future. The sites are also well separated and no specific cumulative impact is expected to occur. This can be revised once the the fish market EIS or BMD masterplan is released.
Bays Precinct (2019-2022)[1] • Rozelle Bay and Bays • Waterways (Blackwattle Johnstons Bays)	✓	✓	-	Not applicable, as no EIS is currently available. This is likely to be on hold for now.
Bays District (2022 and beyond)[1] • Rozelle Rail Yards, • Glebe Island, • White Bay (2025)	-	✓	✓	Not applicable, as no EIS is currently available.
Sydney Metro City & Southwest	✓ Detailed design and EIS complete. EIS available on Major projects website. Refer to references below for links.	✓ Operational by 2024	-	Not applicable, as the footprint of the City Metro will not directly affect the Bays Precinct
Sydney Metro West	-	✓ Operational by 2025	-	Not applicable, as no EIS is currently available. Sydney Metro West is expected to have a station at Glebe Island / White Bay, this presents the opportunity for the concrete batching plant to service the project without concrete or aggregate trucks entering the public road network. This opportunity will be explored in the planning phase for the West Metro.

INFRASTRUCTURE PROJECTS WITH INDICATIVE SCHEDULES OF DEVELOPMENT FOR CUMULATIVE IMPACT ASSESSMENT

Projects	2018- 2019 (immediate)	2020 -2030 (10 years)	2030 - 2040 (20 years)	Cumulative Assessment Comment
Western Harbour Tunnel	✓ Detailed design and EIS by 2018	✓ Completed by 2025	-	Not applicable, as no EIS is currently available.
Westconnex M4-M5 Link 2019-2023	✓ Detailed design and EIS complete. EIS available on Major projects website. Refer to references below for links.	✓ Completed by 2023	-	The impacts described in the Westconnex M4/M5 EIS to be assessed cumulatively with the proposed Facility.

Note 1: Based on the transformation program issued by UrbanGrowth. Ground reality indicates potential for delay in project schedule.
Source: Ethos Urban December 2017

Reference documents and links

1. The Bays Precinct Urban Transformation Program, Jan 2017 - http://www.urbangrowth.nsw.gov.au/assets/Uploads/MUTP-UrbanGrowth-NSW-factsheet-The-Bays-Precinct-2017.pdf
2. Sydney Metro City & Southwest, Jan 2017 -https://www.sydneymetro.info/sites/default/files/document-library/16118%20Sydney%20Metro%20Project%20Overview_WEB.pdf
   Sydney Metro City & Southwest, EIS - http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7400
3. Sydney Metro West, June 2017 - https://www.sydneymetro.info/sites/default/files/document-library/Sydney%20Metro%20West%20Project%20Overview_0.pdf
4. Western Harbour Tunnel, Beaches Link and Fore Hill Freeway Connection, Scoping Report, Oct 2017 (page 85-88)- http://www.rms.nsw.gov.au/documents/projects/sydney-north/western-harbour-tunnel-beaches-link/bl-scoping-report-october-2017.pdf
5. M4-M5 Link, EIS (57) - https://majorprojects.accelo.com/public/c12dc60a1801fc21646f67294e802024/01.%20M4-M5%20EIS_Vol%201A%20_Chapters%201-8.pdf

CONSTRUCTION NOISE MODELLING SCENARIOS AND ASSOCIATED EQUIPMENT SWLS

Construction Component	Construction Period	Equipment Involved at each Work Site	
		Equipment Type	**Number of Items**
Enabling Works/Demolition			
Enabling Works	Daytime	15t excavator breaker	1
		15t excavator	1
		12-15t Trucks	3
		Hand tools	1
Construction			
Silo Construction	Daytime	Auger Drill Rig	1
		100t Mobile Crane	1
		12-15t Trucks	2
		Concrete Trucks / Agitator	1
		Concrete Pump	1
		Concrete Vibrators	2
		Hand Tools	4
Construction			
Building Construction	Daytime	Auger Drill Rig	1
		100t Mobile Crane	2
		12-15t Trucks	2
		Concrete Trucks / Agitator	1
		Concrete Vibrators	1
		Hand Tools	4

Facility Construction Equipment	**Overall SWL $L_{Aeq(15minute)}$ (dBA re 1ρW)**
Auger Piling Rig	111
Bobcat	104
Concrete Pump	106
Concrete saw	115[1]
Concrete Truck / Agitator	108
Concrete Vibrator	110
Excavator (15 tonne)	96
Excavator (30 tonne)	104
Excavator breaker (15 tonne)	117[1]
Excavator breaker (Large)	121[1]
Hand Tools	94
Mobile Crane (100 tonne)	101
Mobile Crane (50 tonne)	100
Mobile Crane (25 tonne)	99
Truck (12 -15 tonne)	108
Truck (25 tonne)	110

Note 1 The SWL includes a 5 dB impulsive penalty.

OBSERVATORY HILL WEATHER STATION DATA SEPTEMBER 2014 TO AUGUST 2017

Prevailing Wind

Table D1 Seasonal Frequency of occurrence 10 m Wind Velocity - Daytime

Period	Calm (<0.5 m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	0.4%	WNW	2.7%	3.6%	6.3%
Summer	0.3%	E	2.6%	2.8%	5.3%
Autumn	0.5%	WNW	2.8%	4.5%	7.3%
Winter	0.6%	WNW	4.1%	5.0%	9.1%
Spring	0.2%	WNW	2.2%	2.9%	5.1%

Table D2 Seasonal Frequency of occurrence 10 m Wind Velocity - Evening

Period	Calm (<0.5 m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	1.2%	NE	6.3%	3.6%	9.8%
Summer	0.4%	E	6.2%	6.4%	12.6%
Autumn	1.6%	NNE	8.4%	3.6%	12.1%
Winter	1.9%	NW	12.7%	6.0%	18.7%
Spring	0.6%	ENE	7.0%	4.0%	10.9%

Table D3 Seasonal Frequency of occurrence 10 m Wind Velocity - Night-Time

Period	Calm (<0.5 m/s)	Wind Direction ±45°	Wind Speed		
			0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Annual	1.2%	WNW	7.2%	7.3%	14.5%
Summer	2.1%	NE	11.6%	5.3%	16.9%
Autumn	1.1%	WNW	8.4%	8.5%	16.9%
Winter	0.4%	WNW	4.7%	7.7%	12.5%
Spring	1.3%	NW	10.2%	7.1%	17.2%

The seasonal frequency of occurrence of the prevailing winds during the daytime, evening and night-time equal to or greater than 30% are presented in **Table D4** in accordance with the NPfI. In all cases, the frequency of occurrence of the prevailing winds is well less than 30% and therefore not further considered in this assessment in accordance with the NPfI.

Table D4 Prevailing Seasonal 10 m Wind Velocities In Accordance with the NPfI

Season	Winds ±45 degrees ≤ 3 m/s with Frequency of Occurrence ≥ 30%		
	Daytime	Evening	Night-Time
Annual	Nil	Nil	Nil
Summer	Nil	Nil	Nil
Autumn	Nil	Nil	Nil
Winter	Nil	Nil	Nil
Spring	Nil	Nil	Nil

OBSERVATORY HILL WEATHER STATION DATA SEPTEMBER 2014 TO AUGUST 2017

Temperature Inversions

The seasonal combined evening/night-time temperature gradients and atmospheric stability are presented in **Table D5** in accordance with the NPfI. The combined evening/night-time frequency of occurrence of moderate to strong (i.e. >1.5°C/100 m) winter temperature inversions is well less than 30% (being approximately 12%) and therefore not further considered in this assessment in accordance with the NPfI.

Table D5 Prevailing Seasonal Temperature Gradients in Accordance with the NPfI

Stability Class	Frequency of Occurrence - Evening/Night-time					Temperature Gradient °C/100 m[1]	Qualitative Description
	Annual	Summer	Autumn	Winter	Spring		
A	0.0%	0.0%	0.0%	0.0%	0.0%	<-1.9	Lapse
A	0.0%	0.0%	0.0%	0.0%	0.0%	-1.9 to -1.7	Lapse
B	0.0%	0.0%	0.0%	0.0%	0.0%	-1.7 to -1.5	Lapse
C	65.0%	63.7%	64.2%	67.0%	65.3%	-1.5 to -0.5	Neutral
D	20.0%	17.6%	21.8%	21.7%	18.7%	-0.5 to 1.5	Weak inversion
F	13.6%	16.7%	12.8%	10.3%	14.7%	1.5 to 4	Moderate inversion
G	1.4%	2.0%	1.3%	1.0%	1.3%	>4.0	Strong inversion
F+G	15.0%	18.7%	14.0%	11.3%	16.0%	>1.5	Moderate to Strong

Note 1: °C/100 m = Degrees Celsius per 100 metres.

The resulting standard meteorological conditions are presented in **Table D6** consistent with the requirements of NPfI Fact Sheet D Table D1.

Table D6 Standard Meteorological Conditions for Noise Modelling Purposes

Period	Assessable Condition	Air Temperature	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	20°C	59%	0 m/s	0°C/100 m
Evening	Calm	19°C	66%	0 m/s	0°C/100 m
Night-time[1]	Calm	17°C	74%	0 m/s	0°C/100 m

Note 1: Night-time standard (neutral) meteorological parameters have been adopted for all noise modelling purposes.

Vibration - Building Structures Cosmetic Damage Risk

Most commonly specified 'safe' structural vibration limits are designed to minimise the risk of cosmetic damage such as surface cracks, and are set well below the levels that have potential to cause structural damage. British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2,* provides frequency-dependent vibration limits related to the cosmetic damage risk. Noting, cosmetic damage is very minor in nature, is readily repairable and does not affect the structural integrity of the building.

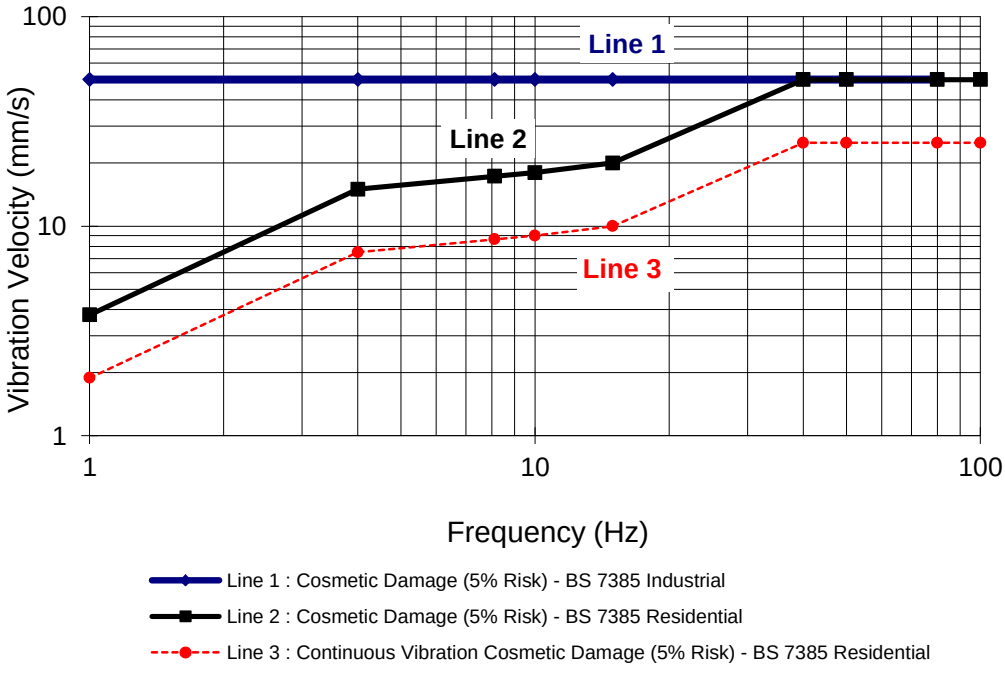
The BS 7385 Part 2-1993 sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect. Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in **Table E1** and graphically in **Figure E1**.

Table E1 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Figure E1 Graph of Transient Vibration Guide Values for Cosmetic Damage



BS 7385 Part 2-1993 goes on to state that cosmetic damage is possible at vibration magnitudes which are greater than twice those given in **Table E1**, and damage to a building structure may occur at values greater than four times the tabulated values. It is also noteworthy that extra to the guide values nominated in **Table E1**, the BS 7385 Part 2-1993 states that:

> *"Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK."*

Also that:

> *"A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

BS 7385 Part 2-1993 states that the guide values in **Table E1** relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings. Where the dynamic loading caused by continuous vibration (ie rock breaking or sheet piling) may give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in **Table E1** may need to be reduced by up to 50%.

For construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receiver type is given below:

- Unreinforced or light framed structures: **7.5 mm/s**.
- Reinforced or framed structures: **25.0 mm/s**

Vibration - Computer Rooms

Based on previous experience, SLR has found a peak particle velocity (ppv) criterion of 5 mm/s to be appropriate for computer room floors (based on vibration requirements for hard drives). If it is determined that more sensitive equipment is stored in these rooms, this criterion may need to be revised.

Vibration - Mechanical Plant

The criteria in **Table E2** are based on previous experience at port facilities.

Table E2 Guideline Values for Vibration - Effect of Short Term Vibration on Mechanical Plant

Situation	Vibration Measured on Support Structure (ppv mm/s)
Mechanical Plant (ie conveyors, drive assemblies) **In Operation**	20
Mechanical Plant (ie conveyors, drive assemblies) **Not In Operation**	5

Vibration - Buried Pipework

The German Standard DIN 4150-3:1999 "*Structural Vibration Part 3: Effects of vibration in structures*" provides guideline values for evaluating the effect of vibration on buried pipework. The values are based on the assumption that pipes have been manufactured and laid using current technology. Additional considerations may be required at junctions. The recommended limits for short term vibration to ensure minimal risk of damage are presented numerically in **Table E3**.

Table E3 Guideline Values for Vibration - Effects of Short Term Vibration on Buried Pipework

Pipe Material	Vibration Measured on the Pipe[1] (ppv mm/s)
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
Masonry, plastic	50

Note 1: Mounting equipment directly onto pipes may not be possible. If the vibration source is not immediately next to the pipework, measurements can be made on the ground surface to obtain an estimate. Generally, this vibration level will be greater than the level measured directly on the pipework.

Vibration - Human Comfort

EPA's "*Assessing Vibration: A Technical Guideline"* (DEC 2006) is based on the information set out in British Standard 6472-1992 "*Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".* This standard defines levels of building vibration associated with a "low probability of adverse comment" from occupants. The applicable levels for continuous daytime activities are shown in **Table E4**.

Table E4 Vibration Levels with "Low Probability of Adverse Comment" (1 Hz to 80 Hz)

Building Type	Peak Floor Vibration	Peak Floor Vibration (Z Vertical)
Residential	0.8 mm/s to 1.6 mm/s	0.3 mm/s to 0.6 mm/s
Commercial/Offices	1.6 mm/s	0.6 mm/s
Industrial/Workshops	3.2 mm/s	1.2 mm/s