Appendix Q – Noise and Vibration Impact Assessment

Hunter Water Corporation

Belmont Drought Response Desalination Plant
Noise and Vibration Amendment Report

June 2020

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1. Introduction

1.1 Background

Hunter Water Corporation (Hunter Water) is seeking approval to construct and operate a drought response desalination plant (the 'Project'), adjacent to the Belmont Wastewater Treatment Works (WWTW) in Belmont South, a suburb of Lake Macquarie Local Government Area (LGA) of New South Wales (NSW) (the 'Project area'); (see Figure 1-1).

Like much of NSW, the Lower Hunter region continues to experience ongoing drought conditions. In response to the drought, Hunter Water is rolling out a program of drought response measures as outlined in the 2014 Lower Hunter Water Plan (LHWP). Measures include the staged introduction of water restrictions, implementation of a broad range of water conservation and water loss initiatives as well as various operational measures. The 2014 LHWP identified the implementation of emergency desalination as a measure of last resort in response to a severe drought, and would only be implemented if water storage levels reached a critical point and all other measures have been implemented.

GHD Pty Ltd (GHD) were engaged by Hunter Water to prepare an Environmental Impact Statement (EIS) (GHD, 2019a) to support a development application for the Project as State Significant Infrastructure (SSI) under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The EIS was prepared in accordance with the provisions of the EP&A Act and the EP&A Regulation and addresses the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Industry and Environment (DPIE) for the Project on 12 December 2017 and revised on 24 January 2018. The EIS was publicly exhibited by DPIE for 28 days from 21 November 2019 to 19 December 2019.

The Project described in the EIS included the construction and operation of a desalination plant, designed to produce up to 15 megalitres per day (ML/day) of potable water, with two sub-surface intake structures.

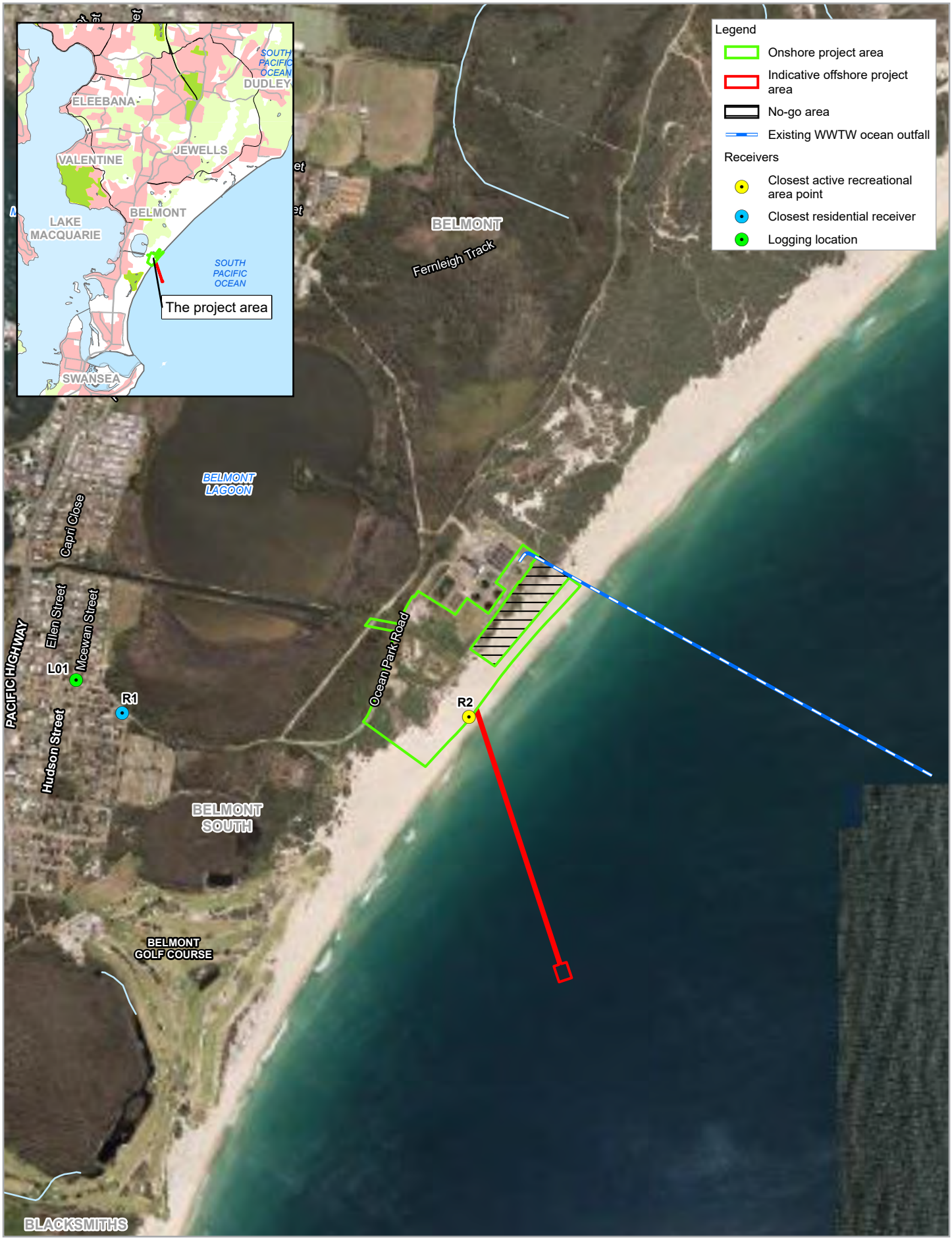
Since commencing this Project, Hunter Water has begun a major review of the 2014 LHWP, now referred to as the Lower Hunter Water Security Plan (LHWSP). The LHWSP seeks to determine the preferred portfolio of supply and demand side options to ensure a sustainable and resilient supply for the region, over the long term as well as during drought. This work indicates that a drought response portfolio including a desalination plant at Belmont with a nominal production capacity of up to 30 ML/day would provide the best balance of meeting the community's needs should a severe drought occur, while still providing value for money.

In addition to the proposed increase in plant capacity, further design development and assessment following completion of the EIS has identified that a direct ocean intake would perform considerably better than a sub-surface option across key criteria including, reliability, efficiency and scalability.

1.2 Purpose and structure of this report

This report has been prepared to support the Amendment Report and addresses the requirements for the SEARs in considering the revised impacts of the amended Project.

This report provides a brief overview of the amended Project, a more detailed description of the Project is provided in Appendix C of the Amendment Report. This assessment considers the construction impacts and the land based operational impacts associated with the proposed amendments to the Project. This assessment has not assessed potential underwater impacts associated with the proposed amendments to the Project. Therefore, this report should be read in conjunction with GHD reports titled: *Belmont Drought Response Desalination Plant – Environmental Impact Statement (GHD, November 2019)*, *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019) and Belmont Drought Response Desalination Plant – Marine Environment Assessment Amendment Report (GHD, April 2020)*.



Paper Size ISO A4

0 110 220 330 440

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Hunter Water Corporation
Belmont Drought Response Desalination Plant
Noise and Vibration Impact Assessment

Project No. **22-19573**
Revision No. **0**
Date **29/06/2020**

Project Location

Figure 1-1

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Data source: LPI: DTDB / DCDB, 2017; public_NSW_Imagery: © Department of Customer Service 2020. Created by: fmackay

1.2.1 Consideration of design changes

The SEARs relevant to noise and vibration issues for the Project are summarised in Table 1-1 below, including identification of where in this report this requirement has been addressed with consideration to the Project, as amended (see Section 2).

Table 1-1 SEARs (SSI 17_8896) – Noise and Vibration impacts

Requirement	Relevant section
An assessment of the likely construction noise impacts of the proposed development in accordance with Interim Construction Noise Guideline (DECC, 2009)	4.1 5.1
An assessment of the likely vibration amenity and structure impacts of the project under the Assessment Vibration: A Technical Guideline (DECC, 2006) and German Standard DIN 4150-3 Structural Vibration – Effects of vibration on structures	4.1.4 4.2.4 5.1.4
An assessment of the likely operational noise impacts of the proposed development in accordance with the Noise Policy for Industry (EPA, 2017)	4.2 5.2
Measures to be implemented to minimise noise impacts during both construction and operational phases	6

2. Project changes

2.1 Overview

In addition to the proposed increase in plant capacity, the amended Project includes the following design changes:

- Seawater intake: Further design development and liaison with Hunter Water's construction partners following completion of the EIS identified reliability and construction risks with the proposed horizontal sub-surface intake system as described in the EIS. An assessment of the horizontal sub-surface intake system was undertaken against alternative intake options. This assessment found that a direct ocean intake would perform considerably better than a sub-surface option across key criteria including reliability, efficiency and scalability (see Section 2.2).
- Power supply: The EIS proposed to meet power requirements for the Project via a minor upgrade to the existing 11 kV power supply network in the vicinity of Hudson and Marriot Street. The amendment to the capacity of the water treatment process plant means this is now unfeasible, due to inability to meet energy requirements. Instead, the Project will connect to Ausgrid's 33 kV network in the vicinity of the Project (see Figure 2-1).

2.2 Key features of the amended Project

The amended Project for the construction and operation of a drought response desalination plant, designed to produce up to 30 ML/day of potable water, includes the following key components (as shown in Figure 2-1):

- **Direct ocean intake** – To ensure provision of sufficient quantities of raw feed water for the water treatment process plant, a direct ocean intake is proposed as part of the amended Project, as follows:
  - *Sea Water Pump Station (On-shore), including a central well, screening and pump housing*, proposed to be a concrete structure (referred to as a wet well) of approximately nine to 11 m diameter, installed to a depth up to 20 m below existing surface levels.
  - *Intake pipeline,* the indicative pipeline alignment is approximately 1000 m in length, extending outwards from the central housing to the off-shore intake structure. Construction of the intake pipeline would be determined during detailed design; however, the following construction methodologies/considered and assessed included Construction method 1 (CM1) Horizontal directional drilling (HDD) and (CM2) Pipejacking/micro-tunnelling.
  - *Intake structure (Off-shore)*, the intake structure would be in the form of a horizontal intake with a velocity cap structure and low through-screen velocity to minimise impacts on marine species and habitat. The intake structure would be 5 m in diameter, have a minimum of 5 m clearance from the seabed and a depth of approximately 18 m of water.

- **Water treatment process plant** – The water treatment process plant would not significantly change from that described in the EIS. The inclusion of buildings to house equipment rather than the installation of containerised equipment is the primary change. The buildings would be placed above ground level and located to allow incremental installation, if required. Services to and from the process equipment (e.g. power, communications, and raw feed water (seawater)) would comprise a mix of buried and overhead methods. The general components of the water treatment process would comprise:
  - *Pre-treatment:* a pre-treatment system is required to remove micro-organisms, sediment, and organic material from the raw feed water.
  - *Desalination:* a reverse osmosis (RO) desalination system made up of pressurising pumps and membranes. These would be comprised of modular components. In addition, a number of tanks and internal pipework would be required.
  - *Post treatment:* desalinated water would be treated to drinking water standards and stored prior to pumping to the potable water supply network.
- **Brine disposal system** – The desalination process would produce up to 56 ML/d of wastewater, comprising predominantly brine, as well as a small amount of pre-treatment and RO membrane cleaning waste. The waste brine from the desalination process would be transferred via a pipeline to a brine pump station at the Belmont WWTW for disposal via the existing ocean outfall pipe.
- **Power supply** – Power requirements of the amended water treatment process plant would require connection to Ausgrid's 33 kV line to the north-west of the water treatment process plant site, with new private power line connecting to a substation within the plant site.
- **Ancillary facilities** – including a tank farm, equipment housing buildings, chemical storage and dosing, hardstand areas, stormwater and cross drainage, access roads, parking areas, and fencing, signage and lighting.

Each of these elements are described further in Appendix C of the Amendment Report.

The desalination plant would be connected to Hunter Water's potable water network via a potable water pipeline proposed to be constructed to augment the existing water network. The pipeline does not form part of the Project and would be part of a separate design and approvals process.

Paper Size ISO A4

0 60 120 180 240

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Hunter Water Corporation
Belmont Drought Response Desalination Plant
Noise and Vibration Impact Assessment

The Amended Project

Project No. **22-19573**
Revision No. **0**
Date **29/06/2020**

Figure 2-1

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Data source: HWC: Aerial Imagery, Existing outfall: 2019; LPI: DTDB / DCDB, 2017; public_NSW_Imagery: © Department of Customer Service 2020. Created by: fmackay

3. Methodology

Acoustic modelling was undertaken using SoundPLAN (Version 8.0) software to predict noise levels at the nearest sensitive receivers. Modelling was conducted in the same methodology as outlined in the original assessment (detailed in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)*). The model was updated to reflect the proposed changes as detailed in Section 2. The new predicted noise impacts were compared to the predicted noise impacts in the EIS.

4. Impact assessment – Water treatment process plant

4.1 Construction

4.1.1 Construction works noise

4.1.1.1 Power connection works

To service the amended water treatment process plant design, a change in the power connection is proposed. It is anticipated that power connection will be to Ausgrid's 33 kV line to the north-west of the water treatment process plant site. The new connection means that there will no longer be a requirement for works at the Marriott Street and Hudson Street intersection.

Table 4-4 shows the indicative equipment that will be used for the connection of the site to the power grid. The construction activity will be located north west of the water treatment process plant site (refer to Figure 2-1).

Table 4-1 Power connection construction equipment

Activity	Equipment	Qty	Sound Power Level (dB(A))[1]	Equivalent Sound Power Level (dB(A))
Power connection	Pole Installer (Crane with Auger)	1	107	110
	Excavator	1	99	
	Hand Tools	1	102[2]	
	Cherry Picker	1	105	

[1] *Sound Power Level and spectrum sourced from BS5228-1 (2009) - Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.*
[2] *Overall Sound Power Level sourced from AS2436 (2010) – Guide to noise and vibration control on construction, demolition and maintenance sites.*

The predicted noise impact level due to the works associated to the Power connection is shown in Table 4-2.

Table 4-2 Power connection noise impacts

Receiver address	Construction Noise Management Level (CNML) dB(A)	EIS predicted contribution noise level, dB(A)[1]	Amended design predicted contribution noise level, dB(A)
Nine Mile Beach	65	37	45
33 Williams Street, Belmont	48	59	32

[1] Comparison level based on Power Upgrade works assessed in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)* report.

The amended power connection works is predicted to have an increased noise impact on the nearby Active Recreational receiver (Nine Mile Beach) as predicted in the EIS. The works is predicted to have a decreased noise impact on the nearest residential receiver (33 Williams Street). This is due to the location of the works being closer to the Active Recreational receiver than the residential receiver. The activity is expected to remain under the established CNMLs.

4.1.1.2 Other construction works

The other methodology and equipment for the construction of the water treatment process plant amended design will be the same as that was identified for the EIS design. The noise impacts are not expected to change.

The Project Area will be expanded for the construction of a brine pump station and associated pipeline. The brine pump station is located on the north eastern corner of Hunter Water Corporation's Belmont Wastewater Treatment Works (WWTW) site and the associated pipeline runs along the site south eastern boundary of the WTWW site. The construction works will be approximately the same distance to the active recreational receiver (Nine Mile Beach), but slightly further away from residential receivers.

The construction timeframe for the amended water treatment plant will increase. However, it is not expected to increase the previously predicted noise impacts as impacts are assessed based on a 15 minute assessment period (in accordance with the ICNG[1]).

4.1.2 Site compound noise

There are no changes to the location of the compound or the operations at the compound. No changes in noise impact from the compound is expected.

4.1.3 Construction traffic noise

The vehicle access paths of the construction works of the amended water treatment process plant is not expected to change from that assessed in the EIS. The heavy vehicle movements assessed in the EIS are considered conservative and still applicable for the construction of the amended design. The light vehicles volumes are expected to increase due to the increase in the workers required. The peak hour light vehicle movements are expected to increase from 10 to 30 for the amended design. This increase in light vehicle volumes is predicted to have minimal effect on the noise levels predicted in the EIS due to the heavy vehicle volumes on the road as part of the EIS construction methodology.

Therefore the noise impacts due to construction traffic is not expected to change from that assessed in the EIS.

4.1.4 Construction vibration

4.1.4.1 Power connection works

The amended power connection works are proposed at a different location and use a different methodology than that assessed in the EIS. Based on the increased distance of the amended works to the nearest building and the indicative construction methodology/equipment, it is expected that the vibration impact will be less than previously assessed in the EIS construction methodology. The nearest existing buildings to the works are the buildings associated with the WWTW. Consideration would be given to vibration impacts on the WWTW and water treatment process plant buildings (if these are constructed prior to the power connection works).

Table 4-3 contains an extract of the safe working buffer distances required to comply with human comfort and cosmetic damage for standard dwellings were sourced from the Construction Noise and Vibration Strategy (Transport for NSW, 2018). The amended works will require use of other plant and equipment, but excavators and vibratory rollers are some of the typical equipment that generate the most vibration.

[1] Interim Construction Noise Guideline (ICNG), DECC 2009.

Table 4-3 Vibration safe working distances

Activity	Approx. size/weight/model	Human comfort (OE&H Vibration Guideline)	Cosmetic damage in Standard dwelling (BS 7385)
Vibratory Roller	1-2 tonne	15 m to 20 m	5 m
	2-4 tonne	20 m	6 m
	4-6 tonne	40 m	12 m
	7-13 tonne	100 m	15 m
	13-18 tonne	100 m	20 m
	> 18 tonne	100 m	25 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	7 m	2 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	23 m	7 m
Large Hydraulic Hammer	1600 kg (18 to 34 t excavator)	73 m	22 m
Pile Driver - Vibratory	Sheet piles	20 m	2 m to 20 m
Jackhammer	Handheld	Avoid contact with structure	1 m

If the construction contractor needs to use any of the above equipment within the corresponding distances, then a vibration assessment (including vibration monitoring) would be conducted.

4.1.4.2 Other construction works

Similar construction equipment will be used for the water treatment process plant amended design as those indicated for the construction of the EIS design. Vibration impacts are not expected based on the indicative equipment and distances to receivers.

No changes to the vibration impacts assessed in the EIS are expected.

4.2 Operation

4.2.1 Operational noise

The EIS design change from a 15 ML/day water treatment process plant to the amended Project design (30 ML/day) water treatment process plant involves increased sizing and additional plant/equipment. Noise modelling was conducted with the amended Project design to determine the potential noise impact.

Table 4-4 shows the indicative equipment that will be used for the operation of the amended design. The water treatment process plant layout and equipment locations are shown in Appendix A.

Table 4-4 Operational equipment list

Equipment	Quantity	Sizing	Operation Cycle	Unit Sound Power Level[1]
Intake pumps	2	80 kW	Continuous	103 dBA
Raw seawater pumps	2	30 kW	Continuous	98 dBA
High pressure (HP) pumps	4	500 kW	Continuous	103 dBA
Energy recovery devices (ERD)	4	-	Continuous	103 dBA
Permeate transfer pumps	2	10 kW	Continuous	94 dBA

Equipment	Quantity	Sizing	Operation Cycle	Unit Sound Power Level[1]
Potable water delivery pumps	2 2	120 kW 60 kW	Continuous	104 dBA 101 dBA
Brine discharge pumps	2	100 kW	Continuous	104 dBA
Various pumps	4	< 5 kW	Intermittent	< 84 dBA[2]
Screen and filters	-	-	Intermittent	< 84 dBA[2]

[1] *Sound Power Level estimated from Engineering Noise Control (ENC) 4.3.*

[2] Equipment noise contribution is assumed to be 10 dB below other equipment on site.

The predicted desalination plant contribution noise levels for the amended design (30 ML/day) scenario along with EIS design (15 ML/day) scenario are shown below in Table 4-5.

Table 4-5 Operational noise impacts

Receiver address	Project noise trigger level, $L_{Aeq(15min)}$ dB(A)	EIS design (15 ML/day plant) predicted contribution noise level, $L_{Aeq(15min)}$ dB(A)[1]	Amended design (30 ML/day plant) predicted contribution noise level, $L_{Aeq(15min)}$ dB(A)
Nine Mile Beach	53	53	54
33 Williams Street, Belmont	38	33	35

[1] Comparison level based on predicted results detailed in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)* report.

The operation of the amended design is predicted to have an increased noise impact on nearby sensitive receivers when compared to the EIS design. The predicted noise levels remain under the established project noise trigger levels at the nearest residential receiver. It exceeds established project noise trigger levels at the nearest active recreational receiver (Nine Mile beach) by 1 dB.

The assessment is conservative in nature, where shielding of noise sources have not been considered. In reality, it is expected that pumps and other noisy equipment will be housed in buildings, which would reduce the noise levels.

The following design strategies are recommended to be incorporated into the detailed design of the amended water treatment process plant:

- Selection of equipment and plant items to limit noise emissions. Where practical and feasible, motor drives, gear boxes, pumps, etc. would be specified and selected to achieve a noise level of less than 85 dB(A) at a distance of 1 m, consistent with occupational health and safety requirements.
- Purpose built acoustic enclosures to be provided where required for large plant items in order to achieve noise levels of less than 85 dB(A) at 1 m.

4.2.2 Sleep disturbance

No sleep disturbance noise impacts are expected as the predicted noise levels at all residential receivers are below the screening criteria of $L_{Aeq(15\ min)}$ 40 dBA.

4.2.3 Operational traffic noise

The operational daily traffic generated is still expected to be within the daily fluctuations of the existing daily traffic movements. Therefore, no traffic noise impacts are expected from traffic generated by the operation of the amended Project.

4.2.4 Operational vibration

Given the large distances between the proposed operational equipment and the nearest sensitive receivers, vibration impacts are not expected during operation of the Project.

5. Impact assessment – Direct Ocean Intake structure

5.1 Construction

There are three main components that need to be constructed for the Direct Ocean Intake structure as described in Section 2.2. All other construction noise impacts (other activities, compounds, traffic) are expected to remain the same as assessed for the EIS Project.

5.1.1 Wet well/sea water pump station construction

Table 5-1 shows the indicative equipment that will be used concurrently for the construction of the Wet well/Sea water pump station. The construction activity will be located at the Eastern side of the desalination plant.

Table 5-1 Wet well/sea water pump station construction equipment

Activity	Equipment	Qty	Sound Power Level (dB(A))[1]	Equivalent Sound Power Level (dB(A))
Wet well/sea water pump station construction	Pump	1	97	118
	Generator	1	90	
	Welding equipment	1	101	
	15t Excavator	1	99	
	30t Crane	1	98	
	Concrete saw	1	117[2]	
	Heavy vehicles	2	108	

[1] *Sound Power Level and spectrum sourced from BS5228-1 (2009) - Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.*
[2] *Overall Sound Power Level sourced from AS2436 (2010) – Guide to noise and vibration control on construction, demolition and maintenance sites.*

The proposed infrastructure, construction method and operation of the wet well/sea water pump station is considered comparable to the caisson assessed in the EIS design. The construction noise impacts of the wet well/sea water pump station has therefore been compared to the construction noise impacts of the *'caisson installation'* construction scenario. The '*caisson installation'* construction scenario noise impact is detailed in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)*.

The predicted noise impact level due to the construction of the Wet well/seawater pump station is shown in Table 5-2.

Table 5-2 Wet well/seawater pump station noise impacts

Receiver address	Construction Noise Management Level (CNML) dB(A)	EIS predicted contribution noise level, dB(A)[1]	Amended design predicted contribution noise level, dB(A)
Nine Mile Beach	65	54	58
33 Williams Street, Belmont	48	36	36

[1] Comparison level based on Caisson Installation levels in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)* report.

The amended Wet well/Sea water pump station construction is predicted to have the same noise impact on the nearby Active Recreational receiver (Nine Mile Beach) as predicted in the EIS. It is predicted to have a lower noise impact on the nearest residential receiver (33 Williams Street). The activity is expected to remain under the established CNMLs.

5.1.2 Intake pipeline installation

The construction of the Intake pipeline can be undertaken with different methods. Two constructions methods have been identified and assessed for potential noise impacts. The final construction methodology will be determined by the construction contractor during detailed design.

The proposed infrastructure, construction method and operation of the intake pipeline is considered comparable to the 'intakes' assessed in the EIS design. The construction noise impacts of the intake pipeline has been compared to the construction noise impacts of the *'intake installation'* construction scenario. The '*intake installation'* construction scenario noise impact is detailed in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)*.

5.1.2.1 Horizontal Directional Drilling (HDD)

Table 5-3 shows the indicative equipment that would be used concurrently if Horizontal Directional Drilling methodology is used to install the intake pipeline. The noise generating activities would primarily be located on the Northern side of the desalination plant.

Table 5-3 HDD equipment list

Activity	Equipment	Qty	Sound Power Level (dB(A)) [1]	Equivalent Sound Power Level (dB(A))
Horizontal Directional Drilling	Heavy vehicles	2	108	117
	15t Excavator	1	99	
	Generator	1	90	
	Sump pumps	1	97	
	Drill Rig Truck	1	115[2]	
	Horizontal Boring Hydraulic Jack	1	111[2]	

[1] *Sound Power Level and spectrum sourced from BS5228-1 (2009) - Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.*

[2] *Sourced from WSP Memo 25/11/2019 (PS116285-WAT-MEM-001 RevA)*

Table 5-4 shows the predicted noise impact level for the installation of the intake pipeline, if Horizontal Directional Drilling methodology is employed.

Table 5-4 HDD noise impacts

Receiver address	Construction Noise Management Level (CNML) dB(A)	EIS predicted contribution noise level, dB(A)[1]	Amended design methodology predicted contribution noise level, dB(A)
Nine Mile Beach	65	61	51
33 Williams Street, Belmont	48	39	37

[1] Comparison level based on Intake Installation levels in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)* report, which covers the construction of the lateral arms of the subsurface intake structure.

The installation of the intake pipeline via HDD is predicted to have the lower noise impact on the nearest sensitive receiver compared to the EIS. The construction activity is expected to remain under the established CNMLs.

5.1.2.2 Pipe jacking/micro tunnelling

Table 5-5 shows the indicative equipment that will be used concurrently if Pipe jacking/micro tunnelling methodology is used to install the intake pipeline. The noise generating activities would primarily be located on the northern side of the desalination plant.

Table 5-5 Pipe jacking/micro tunnelling equipment list

Activity	Equipment	Qty	Sound Power Level (dB(A)) [1]	Equivalent Sound Power Level (dB(A))
Pipe Jacking/Micro-Tunnelling	Auger Drill Rig	1	116[2]	120
	Boring Jack Power Unit	1	112[2]	
	Drill Rig Truck	1	115[2]	
	15t Excavator	1	99	
	Heavy vehicles	2	108	
	30t Crane	1	98	
	Generator	1	90	
	Sump pumps	1	97	

[1] *Sound Power Level sourced from BS5228 2009 - Code of practice for noise and vibration control on construction and open sites*

[2] *Sourced from WSP Memo 25/11/2019 (PS116285-WAT-MEM-001 RevA)*

Table 5-6 shows the predicted noise impact level for the installation of the intake pipeline, if Pipe jacking/Micro tunnelling methodology is employed.

Table 5-6 Pipe jacking/micro tunnelling noise impacts

Receiver address	Construction Noise Management Level (CNML) dB(A)	EIS predicted contribution noise level, dB(A)[1]	Amended design methodology predicted contribution noise level, dB(A)
Nine Mile Beach	65	61	54
33 Williams Street, Belmont	48	39	40

[1] Comparison level based on Intake Installation levels in *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)* report, which covers the construction of the lateral arms of the subsurface intake structure.

The installation of the intake pipeline via Pipe jacking/Micro tunnelling is predicted to have a lower noise impact on the nearby Active Recreational receiver (Nine Mile Beach) compared to the EIS. It is predicted to have a slightly higher noise impact on the nearest residential receiver (33 Williams Street). The noise impact is conservative as it has been calculated with the noise source at ground level when the activity will take place within the wet well, providing shielding. The construction activity is predicted to remain under the established CNMLs.

5.1.3 Intake structure construction

Table 5-7 shows the indicative equipment that would be used concurrently for the construction of the intake structure. The noise generating activities will primarily be located out in the ocean (approximately 870 metres out from the Wet well/Seawater pump station).

Table 5-7 Intake structure construction equipment list

Activity	Equipment	Qty	Sound Power Level (dB(A))[1]	Equivalent Sound Power Level (dB(A))
Intake Structure construction	15t Excavator	1	99	109
	30t Crane	1	98	
	Ocean Barges	2	N/A[2]	
	Concrete Batching	1	105	
	Clamshell Excavator	1	105[3]	

[1] *Sound Power Level and spectrum sourced from BS5228-1 (2009) - Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.*

[2] *Barges are assumed to be anchored in place and will not generate noise.*

[3] *Overall Sound Power Level sourced from Hitachi ZX350LC datasheet.*

The intake structure for the Direct Ocean Intake design does not have a comparable component in the EIS design. The construction noise impact of the intake structure therefore has not been compared to any previous construction scenario covered in the EIS. It is noted as an additional noise source during construction, but not expected to occur concurrently with the other construction stages.

The predicted noise impact level due to the construction of the intake structure is shown Table 5-8.

Table 5-8 Intake structure construction noise impacts

Receiver address	Construction Noise Management Level (CNML) dB(A)	EIS predicted contribution noise level, dB(A)	Amended design methodology predicted contribution noise level, dB(A)
Nine Mile Beach	65	N/A[1]	31
33 Williams Street, Belmont	48	N/A[1]	23

[1] No comparison level in EIS design.

The construction of the intake structure is predicted to remain under the established CNMLs.

5.1.4 Construction vibration assessment

Construction activities would result in a short-term increase in localised vibration levels, as energy from equipment is transmitted into the ground and transformed into vibration, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on a range of factors including the method of energy transfer, the vibration frequency and type and the characteristics of the ground and surrounding topography. Due to complicated ground conditions and other variables associated with construction vibration, an exact vibration assessment result is generally not expected from available prediction methods.

Exact details of the equipment sizing and type were not known at the time of writing this report. This is generally selected by the construction contractor. For reference, an extract of the safe working buffer distances to comply with human comfort and cosmetic damage for standard dwellings were sourced from the Construction Noise and Vibration Strategy (Transport for NSW, 2018) is shown in Table 5-9. Note that construction will require use of other plant and equipment, but excavators and vibratory rollers are some of the typical equipment that generate the most vibration. The nearest existing buildings to the works are the buildings associated with the WWTW.

Table 5-9 Vibration safe working distances

Activity	Approx. size/weight/model	Human comfort (OE&H Vibration Guideline)	Cosmetic damage in Standard dwelling (BS 7385)
Vibratory Roller	1-2 tonne	15 m to 20 m	5 m
	2-4 tonne	20 m	6 m
	4-6 tonne	40 m	12 m
	7-13 tonne	100 m	15 m
	13-18 tonne	100 m	20 m
	> 18 tonne	100 m	25 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	7 m	2 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	23 m	7 m
Large Hydraulic Hammer	1600 kg (18 to 34 t excavator)	73 m	22 m
Pile Driver - Vibratory	Sheet piles	20 m	2 m to 20 m
Jackhammer	Handheld	Avoid contact with structure	1 m

These safe working distances are indicative only and may vary depending on the specific equipment used and the ground conditions. Based on the indicative type of equipment that is going to be used for construction and the distance between construction areas and receivers, it is not expected that there will be vibrational impacts on nearby sensitive receivers.

5.2 Operation

No operational noise and vibration are changes expected from the Direct Ocean Intake structure.

6. Summary of results and revised mitigation measures

A summary of the change in impacts are shown in Table 6-1 below.

Noise modelling results for the construction of the amended water treatment process plant indicates compliance with the established Construction Noise Management Levels (CNMLs). The operation of the amended water treatment process plant are predicted to be slightly (i.e. 1-2 dB) higher than for the EIS design plant. The operation of the amended water treatment process plant is predicted to have an exceedance of 1 dB at the nearest active recreational receiver, but remain under the previous established criteria for the nearest residential receiver.

Noise modelling results for the construction of the direct ocean intake indicates compliance with the established CNMLs. There is no change expected to the operational noise associated with the direct ocean intake.

The mitigation measures detailed in *Belmont Drought Response Desalination Plant – Environmental Impact Statement (GHD, November 2019)* and *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019) are still appropriate*. They should be implemented where reasonable and feasible.

Table 6-1 Summary of impacts

Description	Impact Changes (Amended Design verses EIS Design)	Compliance
Water Treatment Process Plant		
Construction Noise		
Power connection	Decreased for Residential Receiver (27 dB) Increased at Active Recreational Receiver (8 dB)	Yes Yes
Other construction works	No Changes	Yes
Construction Compound Noise	No Changes	Yes
Construction Traffic Noise	No Changes	Yes
Construction Vibration		
Power connection	Decreased	Yes
Other construction works	No Changes	Yes
Operational Noise	Increased (1 to 2 dB)	1 dB exceedance at active recreational receiver.
Operational Traffic	No Changes	Yes
Operational Vibration	No Changes	Yes
Direct Ocean Intake		
Construction Noise		
Wet well/Sea water pump station	Decreased (0 to 3 dB)	Yes
Pipeline installation – HDD	Decreased (2 to 10 dB)	Yes
Pipeline installation – Pipe jacking	Decreased at Active Recreational Receiver (7 dB) Increased at nearest Residential Receiver (1 dB)	Yes Yes
Intake structure	N/A - New infrastructure	Yes
Construction Traffic Noise	No Changes	Yes
Construction Compound Noise	No Changes	Yes
Construction Vibration	No Changes – refer to Section 5.1.4	Yes
Operational Noise	No Changes	Yes
Operational Traffic	No Changes	Yes
Operational Vibration	No Changes	Yes

7. Conclusion

The noise and vibration assessment of the amended Project indicates minimal change in the overall impacts compared to the design that was assessed previously (*Belmont Drought Response Desalination Plant – Environmental Impact Statement (GHD, November 2019)*). An exceedance of 1 dB at the nearest active recreational receiver is predicted from the amended water treatment process plant. The noise impacts of the amended Project are predicted to comply with the previous established criteria/management levels for all other receivers.

The mitigation measures detailed in *Belmont Drought Response Desalination Plant – Environmental Impact Statement (GHD, November 2019)* and *Belmont Drought Response Desalination Plant – Noise and Vibration Assessment (GHD, November 2019)* are still appropriate. They should be implemented where reasonable and feasible.

Appendices

Appendix A – Site layout

GENERATOR KIOSK
SLUDGE RETURN TO WWTW INLET WORKS
SLUDGE PUMP STATION TO WWTW
FUTURE ELECTRICAL AREA
FUTURE RO BUILDING
FUTURE UF FILTERS
CONSTRUCTION LAYDOWN AREA
FUTURE SWALE
STORMWATER SWALE
OVERFLOW
INDICATIVE COMPOUND/ LAYDOWN/STOCKPILE/SOIL
STORMWATER BASIN
SWITCH ROOM 1
SWITCH ROOM 2
KIOSK
GENERATOR KIOSK
POTABLE WATER PUMP STATION
CONCRETE DELIVERY BUND
CHEMICAL STORAGE AND DELIVERY BUND ROOF
MAJOR CHEMICALS
CLARIFIER
RO BUILDING
PERMEATE
POTABLE WATER
ACCESS ROAD
UF FILTRATE
RAW SEA WATER
UF FILTERS
FUTURE POTABLE WATER
LIME DOSING
ADMIN BUILDING WITH CARPARK
FUTURE POTABLE WATER TANK
TEMPORARY CAR PARK
INTAKE CONSTRUCTION CORRIDOR
ACCESS ROAD
GROUND WATER TREATMENT AREA
SEAWATER INTAKE, SCREENING AND PUMPING STRUCTURE
BRINE PIPELINE DISCHARGE
BRINE DISTRIBUTION GROUND WATER TREATMENT AREA CORRIDOR
BRINE DISCHARGE PUMP STATION
HCS

NOTES:

1. LAYOUT AND DESIGN IS INDICATIVE FOR THE PURPOSES OF ENVIRONMENTAL APPROVAL.
2. SYSTEM DESIGN IS SUBJECT TO DETAILED DESIGN AND MAY OCCUR ANYWHERE IN THE CONSTRUCTION FOOTPRINT.
3. PIPELINES SHOWN MAY COMPRISE A MIXTURE OF MULTIPLE RUNS AND ABOVE AND BELOW GROUND.
4. SIZING IS INDICATIVE AND IS LIKELY TO BE OPTIMISED DURING DETAILED DESIGN AND BASED ON AVAILABLE TECHNOLOGY.

PLAN
SCALE 1:750

HORIZONTAL SCALE 1:750

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
B	DRAFT FINAL ISSUE	JR	06/11/19
A	PRELIMINARY ISSUE	LC	-

VERSION 4

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HUNTER WATER

DESIGNED: LC	DATE: -	COMPANY: GHD PTY LTD	
DRAWN: RG	DATE: -	COMPANY: GHD PTY LTD	
CHECKED: NM	DATE: -	COMPANY: GHD PTY LTD	
APPROVED: NM	DATE: -	COMPANY: GHD PTY LTD	

TITLE:
CS0865
TEMPORARY DESALINATION PLANT
CONCEPT DESIGN
SITE LAYOUT

SIZE	SCALE	INDEX No.	DRAWING No.	SHEET	REV No.
A1	1:750	-	15830	010	0B

Plot Date: 04/02/20 - 11:17 Cad File: G:\22\19573\Design\03 Drawings\15830-010_0B.dwg

EXISTING DN100 WATERMAIN (MATERIAL UNKNOWN)
SOUTHERN PIPELINE
SWITCH ROOM 2
KIOSK
SWITCH ROOM 1
GENERATOR KIOSK
GENERATOR KIOSK
CONNECTION TO NORTHERN AND SOUTHERN WATERMAINS
LINE OF BOLLARDS - APPROX 3m APART
POTABLE WATER PUMP STATION
CHEMICAL DOSING LINE TO POTABLE WATER
PUMP STATION TO TRANSFER PERMEATE TO POTABLE WATER TANK
MAJOR CHEMICALS
HARDSTAND AREA
5000
CONCRETE DELIVERY BUND
CHEMICAL STORAGE AND DELIVERY BUND ROOF
NORTHERN PIPELINE
EXISTING DN750 DICL RISING MAIN. HOTTAP NEW CONNECTION FROM CLARIFIER TO ALLOW DISCHARGE SLUDGE TO THE WWTW. ALTERNATIVELY CAN PROVIDE DEDICATED MAIN TO WWTW INLET WORKS.
SLUDGE RETURN TO WWTW INLET WORKS
FUTURE ELECTRICAL AREA
SLUDGE PUMP STATION TO WWTW
FUTURE RO BUILDING
CLARIFIER
SLUDGE PIPELINE DISCHARGE
CLARIFIER OVERFLOW
RO BUILDING
RO BRINE DISCHARGE
POTABLE WATER LINE
PERMEATE LINE
PERMEATE
POTABLE WATER
HARDSTAND AREA
ACCESS ROAD
6000
TANK OVERFLOWS DISCHARGING TO DN1200 SQUARE PRECAST PITS
24000
24000
HARDSTAND AREA
TEMPORARY CARPARK
FUTURE POTABLE WATER
PUMP STATION TO HCS
FUTURE UF FILTERS
6000
UF FILTERS
PUMP STATION TO DELIVER FILTERED WATER TO THE HP PUMPS
UF FILTRATE
10000
RAW SEA WATER
6000
ACCESS ROAD
FUTURE SWALE
CONSTRUCTION LAYDOWN AREA
STORMWATER SWALE
SALT WATER DELIVERY LINE
PUMP STATION TO TRANSFER SEAWATER TO FILTERS
DN750 TANK OVERFLOW
SEAWATER INTAKE, SCREENING AND PUMPING STRUCTURE
GROUND WATER TREATMENT AREA
OVERFLOW
STORMWATER BASIN

NOTES:

1. PAD LEVEL TO BE MINIMUM RL 2.63m.
2. STORMWATER MAY BE SHED TO ADJACENT AREAS TO SOAK INTO SURROUNDING AREAS.
3. MOST FILTERS AND PRESSURE VESSELS SHOWN ARE CONTAINERISED WITH CONTAINERS NOT SHOWN FOR CLARITY.

PLAN
SCALE 1:500

0 5 10 15 20 25 30 35
5 0
HORIZONTAL SCALE 1:500

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

No.	REVISION DETAILS	DWN	DATE
B	DRAFT FINAL ISSUE	JR	06/11/19
A	PRELIMINARY ISSUE	LC	-

VERSION 4

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APPROVED: NM	DATE: -	COMPANY: GHD PTY LTD	

TITLE:
CS0865
TEMPORARY DESALINATION PLANT
CONCEPT DESIGN
TREATMENT SITE GENERAL ARRANGEMENT

SIZE	SCALE	INDEX No.	DRAWING No.	SHEET	REV No.
A1	1:500	-	15830	011	0B

Plot Date: 04/02/20 - 11:16 Cad File: G:\22\19573\Design\03 Drawings\15830-010_0B.dwg

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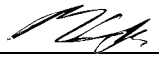
0	A. Cheung	M. Kiejda		N. Malcolm		29/06/2020

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