Hunter Water Corporation

Belmont Drought Response Desalination Plant
Environmental Impact Statement

November 2019

Submission of Environmental Impact Statement

Prepared under the *Environmental Planning and Assessment Regulation 2000,* Schedule 2(6)		
Environmental Impact Statement (EIS) prepared by	Name	Michelle Kiejda
	Qualifications	Bachelor of Environmental Science
	Address	GHD Pty Ltd Level 3, 24 Honeysuckle Drive Newcastle, NSW, 2300
	In respect of:	Belmont Drought Response Desalination Plant Project (the Project)
	Applicant name:	Hunter Water Corporation
	Applicant address:	36 Honeysuckle Drive Newcastle, NSW, 2300
Development Application	Land in respect of which developed application is made: Lot no, DP/MPS, vol/fol etc.:	Refer to Table 4-6.
EIS	An Environmental Impact Statement is attached.	
Certificate	I certify that I have prepared the contents of this Environmental Impact Statement and to the best of my knowledge: • It is in accordance with the requirements of Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (NSW) and the *Environmental Planning and Assessment Regulation 2000* (NSW) (including Schedule 2) • It contains all available information that is relevant to the environmental assessment of the Project • That the information contained in the Environmental Impact Statement is neither false nor misleading Signature  Name Michelle Kiejda Date 8 November 2019	

Executive summary

Introduction

Hunter Water Corporation (Hunter Water) is planning to construct a drought response desalination plant (the 'Project'), also known as the 'temporary desalination plant', 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').

Like much of NSW, the Lower Hunter region continues to experience ongoing drought conditions. During this current drought, Hunter Water's storages have reached their lowest levels in 25 years and, at the time of EIS submission, are around 63 per cent total water storage level. In response, Hunter Water is rolling out a program of drought response measures outlined in the Lower Hunter Water Plan (LHWP), including the staged introduction of water restrictions, implementation of a broad range of water conservation and water loss initiatives and continued planning for a drought response desalination plant in Belmont South. Level 1 water restrictions were introduced across the Lower Hunter in mid-September 2019.

The LHWP, initially adopted in 2014 by the NSW Government, is a whole of government approach to the Lower Hunter's long term water security. The LHWP identified that whilst Hunter Water's supply was reliable under average climatic conditions, the region is vulnerable to drought due to relatively small storages with high natural losses, and water storage levels can fall quickly in prolonged periods of hot dry weather. Modelling indicates total water storage levels can fall from 65 per cent to empty in around 2 to 2.5 years.

Triggers for the design and construction of a drought response desalination plant were identified in the LHWP to ensure a plant would be operational prior to total water storage levels reaching no less than 15 per cent. The LHWP identified detailed design for the desalination plant to commence at around 65 per cent total water storage level to allow adequate time to design, construct and commission the plant. Triggers to commence construction of the plant were identified to be around 35 per cent in the LHWP. These triggers will continue to be reviewed in order to defer construction to as late as possible and increase the chance of storages recovering from rain, whilst ensuring adequate lead times are provided for construction.

Hunter Water is seeking a 10 year approval term for the EIS, during which time further Project stages will be instigated based on the key trigger levels. The trigger for detailed design at 65 per cent total water storage level was triggered in August 2019.

The Project would be implemented as a last resort, once all other measures have been implemented, should water storage levels reach critical levels, to produce up to 15 megalitres per day (ML/day) of potable water for supply to the Hunter Water network. This capacity would provide around 10 to 15 per cent of the regions' restricted demand for water during an extreme drought. Restricted demand in this scenario is defined as the total supply of potable water to Hunter Water's customers during level 3 water restrictions and is estimated to average 138 ML/d, but will vary based on season and climate conditions.

This Environmental Impact Statement (EIS) has been prepared in accordance with the provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and addresses the Department of Planning, Industry & Environment's (DPIE's) Secretary's Environmental Assessment Requirements (SEARs) (SSD 8896) issued for the Project on 12 December 2017 and revised on 24 January 2018.

The Project

The Project is for the construction and operation of a drought response desalination plant, designed to produce up to 15 ML/day of potable water, with key components including:

- **Seawater intakes** – The central intake structures would each be a concrete structure (referred to as a caisson) of approximately nine to 11 metres diameter, installed to a depth up to 20 m below existing surface levels. The intake structures would be finished above the existing surface (0.5 m to 1 m) to prevent being covered by dune sands over time. The raw feed water (seawater) input is proposed to be extracted from a sub-surface saline aquifer. This would be extracted by intake pipes located approximately eight to 15 m below ground level radiating out from the central structure. Pipelines and pumps are required to transfer the seawater to the desalination plant.
- **Water treatment process plant** – The water treatment process plant would comprise a range of equipment potentially in containerised form. 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 seawater.
  - *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 28 ML/day 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 the existing nearby Belmont WWTW for disposal via the existing ocean outfall pipe.
- **Power supply** – Power requirements of the plant would be met by a minor upgrade to the existing power supply network in the vicinity of Hudson and Marriot Streets. A power line extension from the existing line along Ocean Park Road into a new substation within the proposed drought response desalination plant would also be required.
- **Ancillary facilities** – Including a tank farm, chemical storage and dosing, hardstand areas, stormwater and cross drainage, access roads, and fencing, signage and lighting.

Key features of the Project are shown on Figure 1-2, while a description of each of the key components of the Project is provided in Section 4.1. Furthermore, Figure 1-3 provides a visual of the indicative processes related to the operation of the drought response desalination plant.

Statutory and planning framework

The Project satisfies Clause 4(1) of the *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SRD), being development for the purpose of desalination plants by or on behalf of a public authority that has a capital investment value of more than $10 million. The Project is therefore State Significant Infrastructure (SSI). As SSI, the Project is subject to assessment and approval under Division 5.2 of Part 5 of the EP&A Act.

The Minister for Planning (or delegate) is therefore the responsible authority for the Project.

In addition to development consent under Division 5.2 of Part 5 of the EP&A Act, various other approvals, licences and permits under other relevant NSW legislation would also be required in order to carry out the Project:

- Hunter Water currently holds an Environment Protection Licence (EPL 1771) for the Lake Macquarie sewerage system, which includes Belmont WWTW outfall. This EPL would need to be modified prior to construction to authorise the discharge of dewatered groundwater during construction and additional proposed discharges from the drought response desalination plant to the Belmont WWTW outfall during operation.
- Groundwater dewatering would be required during construction of the Project. An aquifer interference approval from Department of Planning, Industry and Environment (DPIE) Natural Resources Access Regulator for groundwater dewatering during construction would therefore be required.
- Groundwater intake during operation would require a Water Access Licence for the Project from WaterNSW. It is considered that there is sufficient groundwater available within this water source to enable Hunter Water to obtain the Water Access Licence for the Project.

Community and stakeholder consultation

The Metropolitan Water Directorate, now part of DPIE, led the development of the 2014 LHWP in consultation with Hunter Water, government agencies, the community and a range of stakeholders.

Extensive community engagement was undertaken throughout the LHWP planning process, across key areas such as community values, feedback on supply and demand side options, input to the preferred portfolios and consultation on the final LHWP.

Subsequent to the 2014 LHWP, further targeted consultation was undertaken as part of the Project. A consultation strategy was formulated as part of the EIS process to assist in the identification of key stakeholders and issues for consideration. Consultation with a range of government agencies and community stakeholders was incorporated into the strategy to inform stakeholders and to allow any issues of concern to be raised at an early stage of the planning process for incorporation into the EIS.

Consultation to date by Hunter Water has identified the following:

- The community values protecting the natural environment
- The community highly values lifestyle, recreation, liveability and wellbeing
- There are concerns regarding access to Nine Mile Beach, including for 4WDs
- There are concerns around the visual amenity of the Project

These issues were considered and investigated as part of the development of the concept design and preparation of the EIS, including the Social Impact Assessment prepared for the Project (refer to Appendix N).

Overview of environmental impacts

The EIS has been prepared in accordance with the Project SEARs and agency requirements and has been completed on a scientific basis providing certainty of potential impacts and predictions.

A number of potential environmental impacts from the Project have been avoided or reduced as a result of refinement of the concept design and identification of mitigation and management measures.

However, the Project would still result in some residual impacts during construction and operation. Key impacts include:

- Soils and coastal erosion – the coastal location and soil landscape results in a high wind erosion risk. This has the potential to result in minor impacts to coastal erosion.
- Aboriginal heritage – the Project area is of low archaeological significance and is culturally significant as part of the wider Aboriginal cultural landscape. One Aboriginal cultural site was identified within the Project area and would need to be salvaged prior to works proceeding.
- Minor, temporary impacts to air quality, traffic, visual amenity, noise during construction and seawater around the Project outfall area.

How potential impacts will be managed

This EIS identifies mitigation and management measures that would be implemented to avoid, manage, mitigate, offset and/or monitor impacts during construction and operation of the Project. These include the following best practice environmental planning and management measures:

- Erosion and sediment control measures in accordance with the Blue Book - Managing Urban Stormwater: Soils and Construction (4th ed, Landcom, March 2004)
- An Aboriginal Cultural Heritage Management Plan (ACHMP) to provide management and protection for known and unknown Aboriginal objects and places
- A Construction Environmental Management Plan (CEMP) to manage potential impacts during construction
- Continuation of the Ocean Outfall Monitoring Program (EPL 1771) throughout operation to assist in identification of any potential signs of stress

The identification of these management measures have been based on the technical assessments carried out as part of the EIS.

During detailed design and construction planning, some impacts identified in this EIS would be potentially further mitigated.

The design, construction and operation of the Project would be carried out in accordance with the management measures identified in this EIS, as well as any additional measures identified in the conditions of approval for the Project.

Conclusion

The LHWP is the whole of government strategy which sets out a cost-effective portfolio of supply and demand measures to ensure adequate water for the Lower Hunter region during drought. These drought response measures include demand management initiatives (including staged water restrictions, increased water efficiency and water loss programs and community engagement), as well as operational measures (including water transfers from the Central Coast and the operation of the Tomago groundwater scheme). Drought response desalination is included as a last resort contingency measure in the event of an extreme drought.

Development of a desalination scheme is based on deferring expenditure for as long as possible, increasing the chance of drought recovery due to rain, whilst ensuring adequate lead time is provided to design, construct and commission a drought response desalination plant should overall storages reach critical levels.

Whilst the likelihood of Hunter Water storages running out is extremely rare, the consequences would be severe for the Lower Hunter region.

The Project responds to a recognised need and the recommendations of the LHWP, which identified that the region's existing water supply sources are very susceptible to rapid depletion during a prolonged or extreme drought.

The EIS has documented the potential environmental impacts of the Project, considering both negative and positive impacts. The EIS has demonstrated that the Project would not have a significant environmental impact, through the implementation of the proposed management and mitigation measures, and the beneficial effects of the Project are considered to outweigh negative impacts, which would generally be temporary in nature.

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1 Introduction

1.1 Overview

Like much of NSW, the Lower Hunter region continues to experience ongoing drought conditions. During this current drought, Hunter Water's storages have reached their lowest levels in 25 years at around 63 per cent. In response, Hunter Water is rolling out a program of drought response measures as outlined in the Lower Hunter Water Plan (LHWP) (NSW Department of Finance and Services, 2014), including the staged introduction of water restrictions, implementation of a broad range of water conservation and water loss initiatives and continued planning for a drought response desalination plant (the 'Project') The Project is also referred to as the 'temporary desalination plant'. The Project would be implemented as a last resort if water storage levels reach a critical point to ensure water security.

The Project is located within the southern portion of the existing Belmont Wastewater Treatment Works (WWTW) off Ocean Park Road in Belmont South within the Lake Macquarie Local Government Area (LGA) of New South Wales (NSW) (the Project area) (see Figure 1-1). The desalination plant would have the capacity to produce up to 15 megalitres per day (ML/d) of potable water for supply to the local Hunter Water potable water supply network.

The LHWP, initially adopted in 2014 by the NSW Government, is a whole of government approach to the region's long term water security. The LHWP identified that whilst Hunter Water's supply was reliable under average climatic conditions, the region is vulnerable to drought due to relatively small storages with high natural losses, and water storage levels can fall quickly in prolonged periods of hot dry weather. Modelling indicates total water storage levels can fall from 65 per cent overall storage to empty in around 2 to 2.5 years.

Triggers for the design and construction of a drought response desalination plant were identified in the LHWP to ensure a plant would be operational prior to total water storage levels reaching no less than 15 per cent. The LHWP identified detailed design for the drought response desalination plant to commence at around 65 per cent total water storage level to allow adequate time to construct and commission the plant. Triggers to commence construction of the plant were identified to be around 35 per cent in the LHWP. These triggers will continue to be reviewed in order to defer construction to as late as possible and increase the chance of storages recovering from rain, whilst ensuring adequate lead times are provided for construction.

Hunter Water is seeking a 10 year approval term for the EIS, during which time further Project stages (including detailed design) will be instigated based on the key trigger levels. The trigger for detailed design at 65 per cent total water storage level was triggered in August 2019.

The Project would be implemented as a last resort, once all other measures have been implemented, should water storage levels reach critical levels, to produce up to 15 megalitres per day (ML/day) of potable water for supply to the Hunter Water network. This capacity will provide around 10 to 15 per cent of the regions' restricted demand for water during an extreme drought. Restricted demand in this scenario is defined as the total supply of potable water to Hunter Water's customers during level 3 water restrictions and is estimated to average 138 ML/d, but will vary based on season and climate conditions.

GHD Pty Ltd (GHD) has been engaged by Hunter Water to prepare an Environmental Impact Statement (EIS) 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).

This EIS has been prepared in accordance with the provisions of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and addresses the Department of Planning, Industry & Environment's (DPIE's) Secretary's Environmental Assessment Requirements (SEARs) (SSD 8896) issued for the Project on 12 December 2017 and revised on 24 January 2018.

Figure 1-1 Project location

1.2 About the proponent

Hunter Water Corporation (Hunter Water) is a NSW State Owned Corporation (SOC) responsible for providing drinking water, wastewater, recycled water and some stormwater services to a population approaching 600,000 people in homes and businesses across the Lower Hunter.

Hunter Water works closely with contractors, stakeholders and the community to manage an asset base of more than $2.5 billion worth of water, wastewater and recycled water infrastructure, ensuring a sustainable water future for the Lower Hunter.

Hunter Water's services, projects and activities cover 6,671 square kilometres in the areas of Cessnock, Lake Macquarie, Maitland, Newcastle, Port Stephens, Dungog and small parts of Singleton. Hunter Water delivers an average of 188 ML of water per day to its customers Hunter Water's four existing water sources include: Grahamstown Dam (182,000 ML), Chichester Dam (18,000 ML), Tomago Sandbeds (54,000 ML) and Anna Bay Sandbeds (16,000 ML).

Hunter Water also maintains an extensive system to transport wastewater (sewage), which includes approximately 5,000 km of sewer mains, 434 wastewater pumping stations and 19 wastewater treatment works, treating almost 70,000 ML of wastewater annually.

The relevant contact details for Hunter Water in respect of the Project are:

- Phone: 1300 657 657
- Email: desal@hunterwater.com.au

1.3 Project background

The LHWP was developed by the Metropolitan Water Directorate (now part of DPIE) in consultation with the community and a range of stakeholders. The Plan aims to ensure that the Lower Hunter is able to withstand an extreme drought, as well as meeting the community's water demand in the short to medium term. The LHWP provides continuing actions as well as drought response measures, with temporary desalination identified in the portfolio as a contingency measure for an extreme drought.

In 2016, Hunter Water commenced the *Temporary Desalination Readiness Activities Stage 1 Project*, which included field investigations, preliminary design and technical, environmental, social, commercial and financial risk assessments for four (4) shortlisted desalination plant sites. A Preliminary Environmental Assessment (PEA) for the Project was subsequently prepared to support a SSI application, and submitted to the DPIE in November 2017. SEARs for the Project were received 17 December 2017, with subsequent revisions received 24 January 2018 following comment and discussed between Hunter Water and the DPIE (Appendix A).

1.4 Overview of the Project

1.4.1 Objectives

The key objectives of the Project are to:

- Provide a rainfall independent water source in the event of an extreme drought
- Slow the depletion of existing water storages in the event of an extreme drought

The Project would address these objectives while considering the environmental, social and economic impacts, with the options assessment process considering these factors.

1.4.2 Key features

The Project is for the construction and operation of a drought response desalination plant, designed to produce up to 15 ML/day of potable water, with key components including:

- **Seawater intakes** – The central intake structures would each be a concrete structure (referred to as a caisson) of approximately nine to 11 metres diameter, installed to a depth up to 20 m below existing surface levels. The intake structures would be finished above the existing surface (0.5 m to 1 m) to prevent being covered by dune sands over time. The raw feed water (seawater) input is proposed to be extracted from a sub-surface saline aquifer. This would be extracted by intake pipes located approximately eight to 15 m below ground level radiating out from the central structure. Pipelines and pumps are required to transfer the seawater to the desalination plant.
- **Water treatment process plant** – The water treatment process plant would comprise a range of equipment in potentially containerised form. 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 seawater.
  - *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 28 ML/day 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 the existing nearby Belmont WWTW for disposal via the existing ocean outfall pipe.
- **Power supply** – Power requirements of the plant would be met by a minor upgrade to the existing power supply network in the vicinity of Hudson and Marriot Streets. A power line extension from the existing line along Ocean Park Road into a new substation within the proposed drought response desalination plant would also be required.
- **Ancillary facilities** – including a tank farm, chemical storage and dosing, hardstand areas, stormwater and cross drainage, access roads, and fencing, signage and lighting.

Key features of the Project are shown on Figure 1-2, while a description of each of the key components of the Project is provided in Section 4.1 and concept design drawings are provided in Appendix B. Furthermore, Figure 1-3 provides a visual schematic of the indicative processes related to the operation of the drought response desalination plant.

The potable water pipelines connecting the Project to the potable water network do not form part of the Project and would be constructed separately. The construction and operation of the potable water pipeline would be part of a separate design and approvals process.

Figure 1-2 The Project

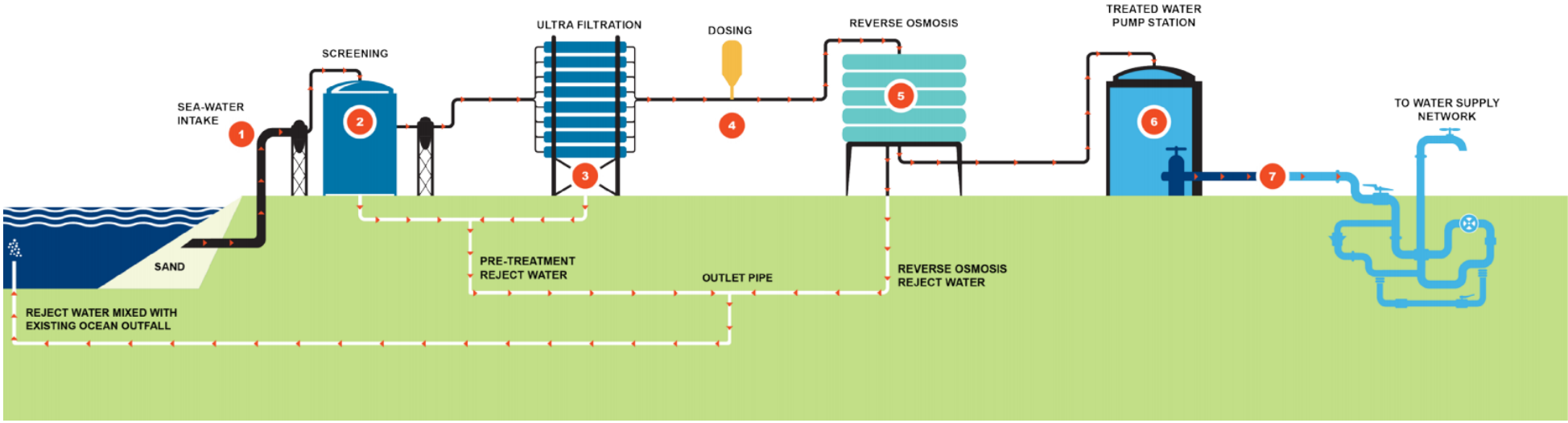

Figure 1-3 Indicative desalination processes

1.5 Overview of the planning and approvals process

The Project satisfies Clause 4(1) of the *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SRD), being development for the purpose of desalination plants by or on behalf of a public authority that has a capital investment value of more than $10 million. The Project is therefore State Significant Infrastructure (SSI). As SSI, the Project is subject to assessment and approval under Division 5.2 of Part 5 of the EP& Act.

The approval of the Minister for Planning (or delegate) is required for the Project.

The Minister for Planning (or delegate) is therefore the responsible authority for the Project.

In addition to approval under Part 5, Division 5.2 of the EP&A Act, various other approvals, licences and permits under other relevant NSW legislation would also be required in order to carry out the Project. Further details on the planning and approval processes are provided in Section 5.

1.5.1 Preparation of the EIS

This EIS has been prepared by GHD on behalf of Hunter Water in accordance with the EP&A Act and the SEARs issued for the Project by the delegate of the Secretary of the then DP&E on 12 December 2017 and revised on 24 January 2018.

Hunter Water has subsequently revised the project description, to remove the potable water connection pipelines and an option for a power supply upgrade in the vicinity of Hudson and Marriot Streets in a Revised SSI Application submitted to DPIE on 25 September 2019, which did not result in a change to the SEARs issued on 24 January 2018.

The SEARs outline the specific requirements to be addressed by this EIS. A copy of the SEARs is provided in Appendix A. A checklist of the SEARs and where they have been addressed in the EIS is provided in Table 5-2.

The EIS provides:

- Details of the Project, including the need for the Project and alternatives considered
- An assessment of the potential key environmental and social impacts of the Project as identified by the SEARs
- Hunter Water's commitments in terms of measures to minimise and manage potential environmental and social impacts

1.6 Report structure

The EIS has been prepared in accordance with the EP&A Act and the EP&A Regulation. An overview of the structure of the EIS is provided below:

- **Executive Summary**: Provides a brief overview of the Project and the key outcomes of the EIS.
- **Section 1 – Introduction**: Introduces the Project, outlines the key objectives of the Project, and provides a summary of the Project details and the structure of this document.
- **Section 2 – Needs and options considered**: Provides a description of previous and recent environmental investigations of the Project area, the Project need, and the Project objectives and options considered.
- **Section 3 – Site context**: Provides a site overview and history, and description of the existing environment and land uses.
- **Section 4 – Project description**: Contains a detailed description of the Project.

- **Section 5 – Regulatory framework**: Consideration of the legislative and policy requirements relating to the Project and the Project area.
- **Section 6 – Stakeholder consultation:** Overview of the consultation completed to date and ongoing consultation to be completed for the Project.
- **Section 7 – Key issues**: Contains a description of the existing environment and a comprehensive analysis and assessment of the issues relevant to the Project.
- **Section 8 – Environmental management and monitoring**: Summary of beneficial and potential adverse effects, and the environmental management and monitoring for the Project.
- **Section 9 – Conclusion and justification**: Conclusion including justification for the Project and how it addresses the objects of the EP&A Act and the principles of ecologically sustainable development (ESD).
- **Section 10 – References**: Lists references cited in the EIS.
- **Section 11 – Glossary:** Lists terms and acronyms used in this report.
- **Appendices** – Relevant additional information and specialist reports.

1.7 Definitions

For the purpose of this EIS, the following definitions apply:

- The 'Project' is the development that is the subject of this EIS, being the proposed construction and operation of a drought response desalination plant (see Section 4).
- The 'Project area' is the land in respect of which the development application is made and within which the Project is proposed to be carried out, with relevant Lot/DP details applicable to the Project area described in Table 4-6 (being Lot 1 of DP 433549).
- The 'locality' encompasses the suburbs in the immediate area surrounding the Project area.
- The 'Project outfall area' is the existing Belmont WWTW outfall and the area of influence considered for the Marine Assessment summarised in Section 7.4.

2 Need and options considered

2.1 Strategic need and justification for the Project

Water supplies in the Lower Hunter are generally sufficient to provide water to the community for the medium term, however, water supplies are vulnerable to droughts because the storages are relatively small or shallow and water levels can fall quickly. Modelling of an extreme drought indicated the total water storage level could drop very quickly, as follows:

- From 65 per cent to 35 per cent in approximately 14 months
- From 35 per cent to 15 per cent in approximately 10 months

Therefore, storages could drop from 65 per cent to 15 per cent in only 24 months, in which time Hunter Water would need to have completed detail design and construction of the desalination plant and associated infrastructure.

Planning for rare drought events is required because running out of water would have a significant impact on the lives of people, on businesses in the region and on the State as a whole. Even though the chance of such an extreme drought is extremely low, historical records show that the Lower Hunter's climate is highly variable. Planning for extreme drought ensures that there is time to respond to a drought that may develop into an extreme event.

The LHWP sets out a cost-effective portfolio of supply and demand measures to ensure adequate water for the Lower Hunter region during drought. These drought response measures include demand management initiatives (including staged water restrictions, increased water efficiency and water loss programs and community engagement), as well as operational measures (including water transfers from the Central Coast and the operation of the Tomago groundwater scheme). Small scale temporary desalination was included in the portfolio as a contingency measure for an extreme drought.

Seawater desalination produces high quality water without relying on rainfall, so it is resilient to drought and climate change. Use of modular desalination units, installed as late as possible if and when needed, is a key requirement in diversifying the Lower Hunter's water supply sources, and reducing the risk of running out of water in an extreme drought.

Project stages would be instigated based on the key trigger levels for implementing the Project. The trigger level for the commencement of detail design at around 65 per cent total water storage level was triggered in August 2019. Whilst the LHWP included a trigger level for commencing construction at around 35 per cent total water storage, this trigger will be reviewed throughout the detailed design phase, and it is likely that some activities would be instigated prior to 35 per cent total water storage, to ensure the desalination plant can be operational no later than 15 per cent total water storage level.

Based on total water storage levels at time of publication (November 2019), under an extreme drought scenario 35 per cent total water storage could be reached in late 2020; 15 per cent total water storage could be reached in late 2021.

2.2 Consideration of options and alternatives

2.2.1 Do nothing

The 'do nothing' option would involve Hunter Water not planning, constructing or operating a drought response desalination plant. The Hunter region is vulnerable to drought because water storage levels can fall quickly in prolonged periods of dry weather. Desalination was identified

as a last resort emergency response for a very extreme drought, once all other measures have been implemented, as it offers a solution that is not dependent on rainfall.

The 'do nothing' option would compromise water security because Hunter Water would not be able to supplement supply with a climate independent source of water in the event of a severe drought. The Project would involve the supply of up to an additional 15 mega litres per day (ML/day) of water to the water supply network, providing around 10 to 15 per cent of the demand for water in the region during an extreme drought.

The 'do nothing' option would increase the risk of the region running out of water in an extreme drought and is not in line with level of water security specified in the LHWP, a NSW government led strategy to provide water security for the region.

Therefore, the 'do nothing' option was not pursued further.

2.2.2 Options and alternatives considered

A range of alternatives were considered for different aspects of the Project, including:

- Alternative portfolios of water supply and demand options as determined through the LHWP, with detail and justification for the preferred option (Section 2.3)
- Desalination plant options, with detail and justification for the preferred option (Section 2.4)
- Intake options, with detail and justification for the preferred option (Section 2.5)
- Outfall options, with detail and justification for the preferred option (Section 2.6)
- Power supply options, with detail and justification for the preferred option (Section 2.7)

2.3 Water supply and demand options

2.3.1 Water supply and demand options considered

At the start of planning for the LHWP, over 70 water supply and demand options were identified that could potentially contribute to securing the region's water supply. This list was screened using information from technical investigations and expert knowledge.

The options that advanced from this process were broad ranging and spanned seven categories of supply and demand measures:

- Water efficiency, including residential and non-residential water efficiency and water loss minimisation programs
- Demand management, including 'water wise rules' and drought restrictions
- Stormwater capture, including stormwater harvesting and rainwater tanks
- Recycled water, including dual reticulation, greywater use, decentralised recycling and sewer mining schemes and industrial reuse of recycled water
- Surface water/inter-regional transfers including transfers from Lostock Dam and the Central Coast
- Groundwater, including Deep Tomago groundwater, other new groundwater sources and mine water
- Desalination, including small scale temporary facilities and large scale permanent facilities

To identify a mix of measures that had the best prospects for delivering a cost-effective solution for the LHWP, a number of potential portfolios were developed, or a set or sequence of water management measures, timings and rules.

Using portfolios, rather than individual options, recognises that a combination of options may be better than a single solution. It also recognises that demand and supply measures have differing characteristics, which when combined in a portfolio can provide a more flexible and resilient system.

The portfolios considered for the LHWP built on the base case, the existing supply system. They were developed so that water supply and demand measures can be put in place when they are needed (as storage levels drop) to make sure there is enough water to supply the community's needs during droughts.

Six different water planning portfolios were included in the LHWP. Each portfolio contained a mix of measures that could provide a more secure supply of water to the Lower Hunter community during drought compared with the base case.

2.3.2 Preferred water supply and demand options

The portfolio development process included the use of a multi-criteria decision analysis (MCDA). The MCDA brought together divergent views in a thorough and transparent process. Inputs from the community engagement process were incorporated into the deliberations of key stakeholders, including the intergovernmental LHWP Senior Officers Group (SOG).

The quantitative assessment of the cost and level of drought security of each portfolio was undertaken using hydro-economic models developed by Hunter Water.

The criteria used to assess the portfolios included:

- Risk - adjusted cost per kilolitre of water supplied or saved
- Consistency with community values
- Controllability – the degree of certainty with which the implementation can be guaranteed
- Impact on the natural environment
- flexibility to change – the ability to be implemented in a modular manner

The portfolios were also assessed against their sensitivity to identified risks and uncertainties. Based on this information, and on feedback from the community engagement, the SOG ranked the portfolios from most preferred to least preferred.

The outcome revealed the portfolio with demand side management, Central Coast transfers and temporary desalination as the most preferred portfolio based on weighted average scores. This was consistent with the outcome of the community engagement.

The LHWP SOG participants supported the notion that the portfolio including temporary desalination provided an acceptable level of drought security when considered against the assessment criteria.

2.4 Desalination plant options

2.4.1 Desalination plant options considered

2.4.1.1 Drought response vs permanent desalination plant

The Project considered options to construct a desalination plant, either as a drought response or permanently operated plant. A drought response desalination plant would only operate during a drought when water storage levels are lower that the predetermined trigger level, and may be

comprised of modular treatment units that could be easily mobilised and decommissioned. A permanent desalination plant would operate continuously regardless of whether a drought had commenced and would comprise all permanent infrastructure.

The preferred option for the desalination plant is a temporary option due to the simpler mobility and decommissioning and is discussed further below.

Preferred option – Drought response desalination plant

While a permanent desalination plant would operate all the time, the objective of a drought response desalination plant is a temporary measure to support an emergency drought response. As outlined in the LHWP (NSW Department of Finance and Services, 2014), modelling has demonstrated temporary, portable desalination units are able to provide enough water as a short-term solution to supplement the lower Hunter's drinking water supplies in periods of extreme drought, improving its drought security at a relatively low cost compared with other potential supply measures.

A drought response desalination plant is the preferred option over a permanent plant for the following reasons:

- Shorter lead time for design, construction and operation, with a permanent plant likely to require much longer lead times
- Provides an emergency supply measure, rather than a permanent supply measure with associated long term running and maintenance costs and environmental impacts
- Smaller footprint relative to a permanent plant
- Lower energy use compared with permanent, full-scale desalination plants due to shorter running and maintenance time
- Flexibility to scale up or down the number or configuration of desalination units
- Ability to utilise the latest technology available at the time of need
- Ability to either rent or sell the plant following decommissioning
- Ability to utilise a range of equipment based on availability, to meet delivery time

2.4.1.2 Location of the drought response desalination plant

A number of potential locations were initially proposed as the location of the drought response desalination plant, as shown in Figure 2-1. Following a detailed review of each site, the potential options were shortlisted to the following:

- Hunter Water land adjacent to the Belmont WWTW
- Hunter Water land at Stockton formerly a WWTW
- Eraring Power Station
- Newstan Colliery (Fassifern)

Investigations at each of the above sites were undertaken in 2016/17 to provide Hunter Water with the ability to confidently compare each site against consistent criteria to determine the lowest risk and therefore most appropriate site with consideration of technical, environmental, social, commercial and financial risks (AECOM, 2017a). Following these investigations, a site selection workshop was then held which was attended by representatives of Hunter Water and then Department of Primary Industries (DPI) Office of Water – Metropolitan Water Directorate (now part of DPIE).

The risk review and assessment process completed at the site selection workshop found that the Belmont WWTW site presented the lowest risk option based on the information available at the time (AECOM, 2017a). The costs associated with each site were compared and varying weightings applied to the evaluation criteria to test the robustness of the workshop outcomes in accordance with the decision making framework. Dual site options were also assessed but did not provide any obvious cost or risk benefits.

The Eraring Power Station and Newstan Colliery site options were found to have unacceptable risks related to site and infrastructure, and raw water quality and availability. These sites were therefore considered to be of high risk and not considered suitable for the desalination plant required by the LHWP.

Coastal erosion and program risks at Stockton were identified as high because the construction of the plant and ocean outfall could be significantly impacted by coastal weather conditions. The dual water supply connections required for the Belmont site are not outside of the experience and capacity of Hunter Water, so it was therefore identified as having a medium risk level.

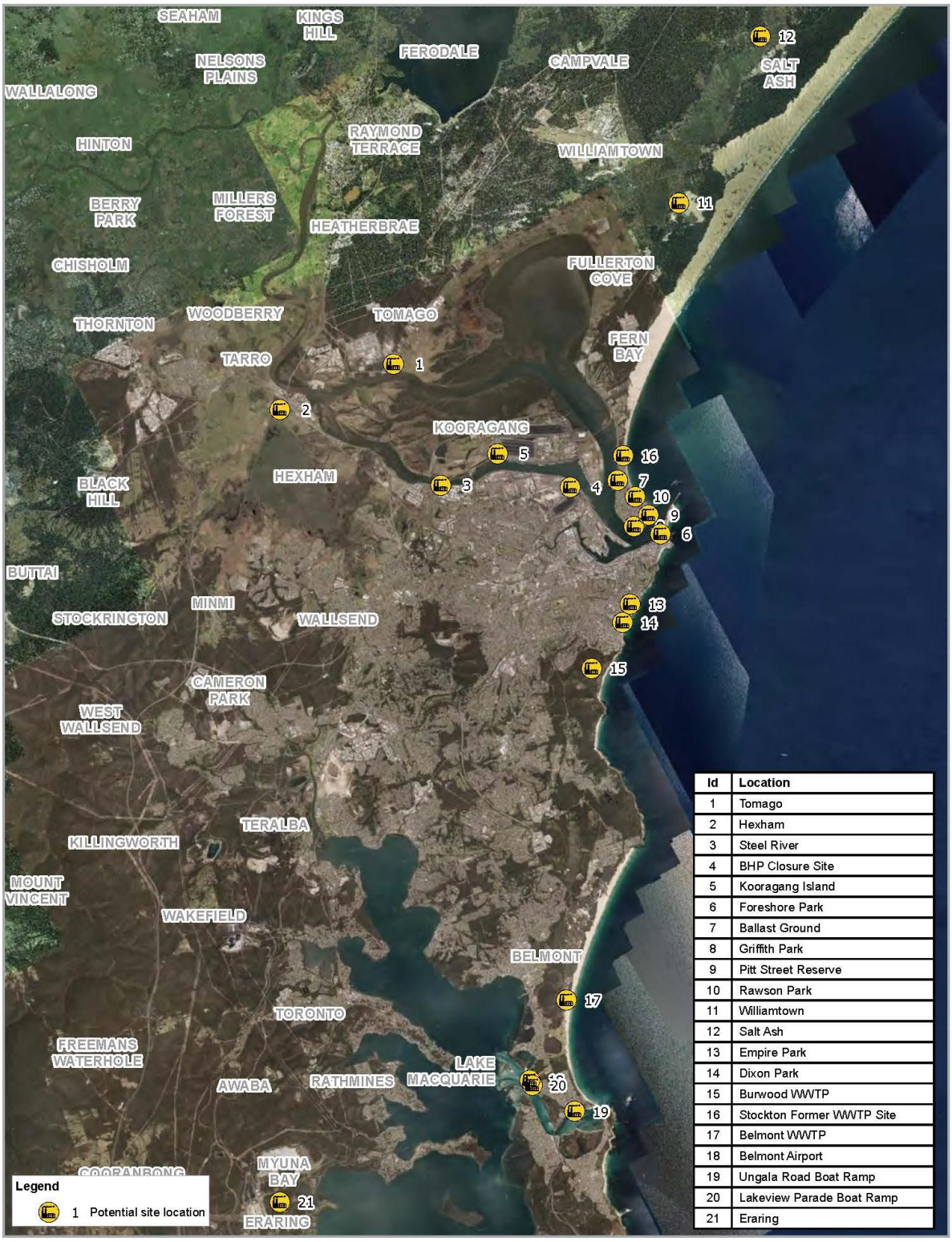

Figure 2-1 Desalination sites considered

Preferred location – Belmont WWTW

Based on the outcomes of the site selection workshop and Site Selection Report (AECOM, 2017a) it was considered that the Belmont WWTW site presented the lowest level of technical, environmental, social, commercial and financial risk. In particular, the site is preferred given that:

- There is sufficient cleared land to accommodate the desalination plant
- There is existing enabling infrastructure including an access road and the WWTW ocean outfall, which would reduce project costs and risks
- There is an environmental benefit due to reduced overall construction and operational impacts that would otherwise result from the installation of new infrastructure

2.4.1.3 Desalination technology

The two main forms of desalination technology currently available are:

- Thermal Desalination: Utilisation of heat to evaporate water from seawater. The water vapour is captured and condensed to provide freshwater.
- Reverse Osmosis (RO): RO uses pressure and a membrane to retain salts and low molecular weight solutes whilst allowing water to pass through.

The preferred option for desalination technology is RO and is discussed further below.

Preferred option – Reverse osmosis

RO desalination has been adopted as the preferred technology, for the following reasons:

- Reported salt water RO efficiencies are in the range of 36 to 50 per cent (SKM, 2012), (Hoang, et al., 2009) and (Tularam & Ilaheeb, 2007) compared with a much lower reported efficiency of 10 to 30 per cent for thermal desalination plants (Tularam & Ilaheeb, 2007).
- RO is advantageous over thermal desalination technologies as it has lower energy consumption, lower volumes of feed water due to improved efficiencies, and no thermal impacts in comparison with thermal desalination processes.

2.4.1.4 Capacity of the desalination plant

The modelling undertaken during the development of the LHWP was based on the supply of 9 ML/day of desalinated water from small, temporary desalination units installed at up to three sites (3 x 3 ML/d), but recognised that this could be scaled up or down depending on needs.

During a site selection workshop in early phases of the Project, a single desalination plant of around 9 ML/d capacity was preferred over multiple sites with smaller capacities, such as 3 ML/day. This is because all locations being considered had enough available space for a 9 ML/day desalination plant and one larger plant was much more proficient from an environmental and cost perspective than multiple smaller plants.

Following that, a conceptual hydrogeological model was run as part of a concept development report (AECOM, 2017a) to assess and optimise supply and demand based on a range of plant capacities, namely 9, 15 and 30 ML/day. The modelling and assessment considered potable water demand, raw intake quantity, brine disposal quantity, and supply and availability of process units, power and other constituents (chemicals, membranes, etc.).

The preferred option for the capacity of the desalination plant is a modular design with variable capacity up to 15 ML/day and is discussed further below.

Preferred option – Up to 15 ML/day

Although the LHWP modelled desalination supply of 9 ML/d, a higher capacity of up to 15 ML/day was identified as the preferred option as the local water network at each of the sites considered can accept the higher flow, and there was a marginal cost impact to achieve this increase and this capacity could provide around 10 to 15 per cent of total restricted demand in the region during an extreme drought. It also provides a buffer for future changes in the strategy, allowing an additional level of water security with minimal additional cost compared to a single large or multiple small plants producing only 9 ML/day.

To maintain Hunter Water's ability to choose a range of flow rates up to 15 ML/day, a modular design is nominated, such that Hunter Water can choose an initial capacity that retains the ability to expand the plant sensibly to 15 ML/day. The production of up to 15 ML/day can be provided as a combination of smaller desalination modules, meaning that supply can easily be scaled up or down depending on demand and operational circumstances. Suppliers have indicated that modular designs are available for 5 ML/day and 7.5 ML/day, meaning that 15 ML/day could be supplied in either three or two modules, respectively.

It is proposed that the plant be designed to be built in either two or three modules, which would allow the following sizes:

- 5 ML/day
- 7.5 ML/day
- 10 ML/day (2 x 5 ML/day)
- 15 ML/day (2 x 7.5 ML/day or 3 x 5 ML/day)

2.5 Intake options

2.5.1 Alternative intake options considered

The raw feed water required as input into the desalination plant must be extracted from a saltwater environment. This could be either directly from a surface water body such as the ocean or an estuary, or from a subsurface source such as groundwater or an on-shore coastal aquifer. As the salinity of the groundwater is relatively high in the vicinity of the proposed desalination plant location, both groundwater and seawater were considered for the raw feed water source. Options considered throughout feasibility and concept development include:

- **Vertical groundwater wells:** This would comprise wells installed to approximately 20 to 30 m below ground level to target the groundwater aquifer. Vertical wells (per unit) are generally considered to be cheaper than both open inlets and horizontal wells. AECOM (2017b) determined some wells may be required to be located outside Hunter Water landholding; therefore, relying on access and environmental approvals on third party properties. Furthermore, results suggested the distribution of wells required, may result in hydraulic connectivity with lower salinity groundwater aquifers creating raw water quality variability over time. For these reasons this option was not pursued.

- **Horizontal/ Slant groundwater wells:** Installed into the target aquifer by installing the wells on a slant (for example at a 45 degree angle from the surface). AECOM (2017b) determined this option is not a feasible means of extracting groundwater. This is primarily due to the target aquifer being an unconsolidated sand unit, with near horizontal layers of varying permeability. There is a risk with a horizontal well is that it would primarily extract from a single layer/horizon and not those overlying or underlying units that are separated by lower permeability layers. This would reduce the efficiency of the well, and result it not being able to meet the demand requirements. For these reasons this option was not pursued.
- **Open seawater intake:** Open seawater intakes collect water directly from the ocean through an inlet structure, which are generally required at suitable depths to limit potential environmental impacts. In addition, open seawater intakes are required to be screened to reduce entrapment and entrainment of marine organisms.
- **Horizontal subsurface seawater intake wells:** Horizontal subsurface bores are typically directionally drilled 5 to 10 m beneath the sea bed, reaching laterally from a central concrete watertight chamber. Therefore the depth of the horizontal wells is dependent upon the depth of the seabed and length of the well, although horizontal well lengths can extend up to 160 m.

The preferred option for the capacity of the desalination plant is two horizontal sub-surface seawater intake wells and is discussed further in Section 2.5.2.

2.5.2 Preferred intake option – Horizontal sub-surface seawater intake wells

The raw feed water for the desalination plant would be seawater rather than groundwater. The intakes would draw from the saltwater aquifer below the dune and beach zones, rather than directly below the sea bed. Subsurface beach wells are acknowledged as producing a better raw feed water quality than open seawater intakes which reduces pre-treatment requirements for the desalination plant.

In terms of the method of extraction, a horizontal subsurface intake is preferred over the open seawater intake for the following reasons:

- Avoids significant pre-treatment associated with the open intake as a result of marine and benthic organisms, as well as organics and other potential water quality issues. Subsurface intake water quality is generally of a higher quality than an open intake as the beach would act as a sand filter and reduce suspended solids, micro-organisms and organic material contaminants.
- The intake water quality would be more variable based on climatic conditions for the open intake compared with the subsurface option, increasing variability in pre-treatment required.
- The open seawater intake would require additional mitigation measures to minimise potential impacts to the marine environment due to potential entrapment and entrainment of marine organisms.
- Reduced pre-treatment costs with a subsurface intake, although this may be offset by increased capital and energy costs associated with the bore network and pumping (AECOM, 2017b).

2.5.3 Preferred intake option – Number of horizontal sub-surface seawater intake arms

A numerical groundwater model (see Section 7.2) was used to determine the preferred number of horizontal arms for each intake structure. The numerical groundwater model was used to predict:

- Inflows into the proposed intake structure during Project operation and the source of the water (either seawater or groundwater)
- Drawdown in groundwater sources during operation
- Approximate recovery times in groundwater levels

Two scenarios were modelled:

- One five arm diagonal and perpendicular intake operating for two years under drought conditions (Scenario 1)
- One three arm diagonal intake operating for two years under drought conditions (Scenario 2)

The three arm diagonal intake (Scenario 2) was preferred for the following reasons:

- No groundwater drawdown is expected at any registered groundwater bore (the closest being approximately 1 km from the seawater intakes).
- No groundwater drawdown is expected at a high priority Groundwater Dependent Ecosystem (Belmont Lagoon).
- Minimal groundwater drawdown (0.5 m) is expected at the high potential terrestrial Groundwater Dependent Ecosystem which is unlikely to result in a significant impact.
- The zone of predicted groundwater drawdown is primarily within the beach area.

2.6 Outfall options

2.6.1 Alternative outfall options

Both the ocean and Lake Macquarie were considered for brine discharge (AECOM, 2017b). However, discharging of hypersaline plumes into Lake Macquarie represents a potential issue due to inadequate mixing and has a higher regulatory approval risk.

Due to the high rates of mixing and large volumes, discharging to the ocean is preferred. The beach is highly dynamic and any outfall infrastructure crossing the beach needs to be either buried (as per existing outfall) or mounted on a trestle/jetty.

2.6.2 Preferred option – Existing Belmont WWTW outfall

Utilisation of the existing Belmont WWTW outfall is the preferred option as it provides a significant reduction in environmental impacts and costs associated with the construction of a new outfall. The presence of an existing outfall that could be utilised for brine disposal was a significant factor in the selection of the location for the proposed desalination plant. Brine discharge through the current WWTW outfall would also pose minimal risk on the marine environment (see Section 7.4).

2.7 Power supply options

2.7.1 Alternative power supply options considered

The power supply requirements for the drought response desalination plant are likely to be between 3 and 5 megawatts (MW). A range of power supply options for the desalination plant were considered, as summarised below.

2.7.1.1 Solar power

Installation of a ground mounted photovoltaic (PV) solar power plant within the Belmont WWTW site was considered. However, the close proximity of the site to the ocean would cause greater soiling of the PV modules compared with non-coastal locations. To avoid further loss in performance, a strict maintenance regime would be required at additional cost.

It is considered that a PV system is relatively marginal at the Belmont WWTW site from an economic perspective, however a battery system would be required for night operation, further increasing costs. Further a PV system would reduce the space available for WWTW upgrades which have already been earmarked for the future and includes significant risks that are likely to adversely impact both cost and performance. This includes the close proximity of the site to the ocean shore which would cause additional degradation to the PV modules beyond degradation associated with typical installations, requiring a strict maintenance regime.

2.7.1.2 Generators

The annual cost of operating a diesel fuelled generator over that of suppling power from the electricity grid is estimated to be approximately $7 million. In addition to this cost would be the cost to hire, install, maintain and decommission the generators. It is considered therefore that it is not feasible to supply the required power to the desalination plant via a diesel generator as it is an uneconomic solution. Further, long term generator use can result in environmental impacts including adverse noise and public perception impacts.

2.7.2 Connection to existing Ausgrid supply

2.7.2.1 Connection to the existing 11 kilovolt (kV) Ausgrid supply

As the existing WWTW is supplied by an 11 kV overhead line, it is likely to be most cost effective to reinforce the existing 11 kV network as appropriate to allow supply to be provided to the desalination plant at 11 kV.

Ausgrid currently has capacity to supply either of the required 3 megawatt (MW) or 5 MW demand from their existing 11 kV network (noting that 5 MW demand is for the scenario of a plant with no energy recovery units installed). Provision of a 3 MW supply would require relatively minor upgrade works to the existing network in Marriot Street to provide a backed up supply. However, to provide a 5 MW backed up source, in addition to the upgrade works in Marriot Street it would be required to upgrade approximately 1.5 km of overhead 11 kV power lines to Ausgrid's Pelican Zone Substation (note that this scope cannot be confirmed with Ausgrid until closer to the time of construction).

This is the preferred option for the Project, as discussed in Section 2.7.3.

2.7.2.2 Connection to the existing 33 kV Ausgrid supply

There is an existing Ausgrid 33 kV overhead line located along the western side of the existing Belmont WWTW site. This feeder is a subtransmission line between Ausgrid's Jewells and Pelican Zone substations. Ausgrid do not encourage connections to the subtransmission network and would prefer an 11 kV connection to the desalination plant site to match the existing Belmont WWTW.

Purchasing energy from the 33 kV network is likely to be more economical than buying at 11 kV, however, this saving would be negated by the higher capital and maintenance costs of establishing a 33 kV connection and substation (and associated environmental impacts including vegetation clearing, visual impacts, etc.). Therefore, pursuing a 33 kV supply for the Project is not recommended.

2.7.3 Preferred option – Connection to existing 11 kV Ausgrid network

The preferred power supply option is connection to the existing 11 kV Ausgrid network (see Section 2.7.1). A small cross connection would be made at Marriott Street to facilitate a backed up 3 MW supply. This is the most cost effective option and is considered to provide sufficient reliability.

Regarding the redundant power supply, a review of the historical supply reliability and consideration of Ausgrid repair timeframes found that it is unlikely that a power supply outage would last for a significant enough period to substantially impact the production of water. Further, there is a high likelihood that the provided plant would incorporate energy recovery and therefore the smaller 3 MW plant is considered more realistic.

In view of this it was considered that upgrades to provide a backed up 5 MW supply are not warranted. A separate 11 kV power supply to provide a backed up 5 MW service was therefore not considered required. A small generator is the preferred option to enable a controlled shut down in the event of loss of power.

3 Site context

3.1 Existing environment

3.1.1 Existing and surrounding land uses

The Project would be located in Belmont South, situated on low lying terrain between Belmont Lagoon and the Pacific Ocean and located in close proximity to mapped Coastal Wetlands and a number endangered ecological communities (EECs) (refer to Section 7.3).

The Project area is located approximately 800 m from the nearest residential properties in Belmont South and is close to recreational use areas of Belmont Wetland State Park and Nine Mile Beach.

3.1.2 Soils and geology

Reference to the Gosford – Lake Macquarie soil landscape map (Department of Conservation and Land Management, 1993), identified that the Project is underlain by the Tuggerah soil landscape, with Belmont Swamp soil landscape to the west of the Project area associated with Belmont Lagoon. These soils are associated with strongly acid soils, erosion hazard, localised flooding and high groundwater table.

Geotechnical investigations found that the subsurface profile within the Project area generally consisted of fill or topsoil comprising silty sand, sandy gravel and clay to depths of up to 1.3 m, overlying alluvial sand and silty sands. However, no fill was encountered overlying sand in boreholes BH103 and BH105 within the Project area and clay was encountered underlying sand at a depth of 31 m at borehole BH103.

3.1.3 Acid sulphate soils

Reference to the Acid Sulphate Soil (ASS) Risk Map for Swansea (Department of Land and Water Conservation, 1997) indicates that the south western portion of the Project area is located in an area with a high probability of occurrence of ASS (see Figure 7-2). The north eastern portion of the Project area is mapped as having a low probability of occurrence of ASS.

Field indicator testing results during site investigations indicate the alluvial sand encountered at depths ranging from 1.4 m to 20 m below surface level is potential ASS (PASS). No samples were recorded as actual ASS, with a field pH of 4 or less.

3.2 Land use and ownership

3.2.1 Land zoning

The Project would be located on Hunter Water owned land, zoned primarily SP2 – Infrastructure in the *Lake Macquarie Local Environmental Plan 2014* (Lake Macquarie LEP) (see Figure 3-1), within the existing Belmont WWTW site (Lot 1 DP433549). Ocean Park Road is zoned E2 – Environmental Conservation and associated with recreational land uses as well as providing access to the Belmont WWTW (see Figure 3-1).

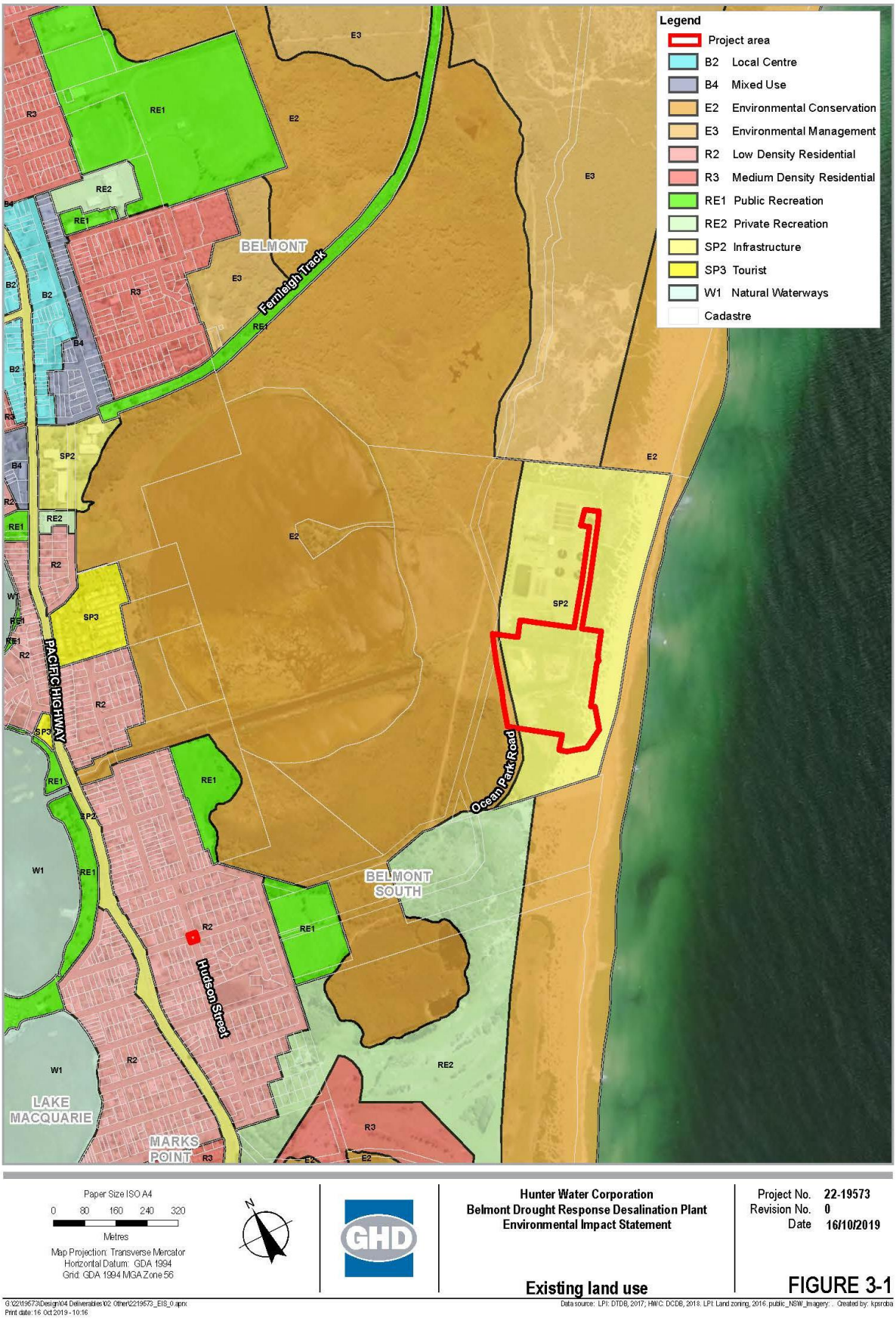

Figure 3-1 Existing land use

3.2.2 Land use

The desalination plant would be located entirely within the boundary of the Belmont WWTW (Lot 1 of DP 433549), to the south of the existing WWTW in an area that was previously used for evaporation ponds, the embankments of which are still visible despite being decommissioned as part of previous WWTW upgrades (see Plate 3-1).

Plate 3-1 Former evaporation pond at desalination plant site

3.3 Relationship to other projects

The operation of the desalination plant is directly related to the existing Belmont WWTW, due to the plan for the Project to utilise the WWTW outfall for disposal of the waste brine (see Section 4.1.3). A potable water pipeline project is planned which is directly related to this Project. There are also a number of other potential projects planned within the area which require consideration during the planning and assessment of the Project. These projects (as known at the time of writing this report) are summarised in Sections 3.3.1 to 3.3.3.

3.3.1 Potable water pipelines

A separate Review of Environmental Factors under Division 5.1 of the EP&A Act would be prepared for the potable water pipeline. The decision to assess the pipes separately was made during design development of the proposed desalination plant. Detailed hydraulic modelling of the potable water pipelines identified that the pipelines can provide an additional level of redundancy for the existing trunk water main network and can be utilised independent of the desalination plant.

While the pipelines are required to deliver potable water from the desalination plant to the potable network, it was identified that they provide benefit to Hunter Water if the desalination plant is not constructed or not operating.

Having the pipeline constructed and operating as part of the existing network would provide an additional level of readiness in the event the desalination plant is constructed in drought conditions when timeframes would be critical.

3.3.2 Belmont WWTW

3.3.2.1 Belmont WWTW

The Belmont WWTW serves the areas of the eastern side of Lake Macquarie from Charlestown and Redhead in the North, to Swansea in the South. It currently treats about 30 ML/day of wastewater and can handle wastewater from a population equivalent to 115,000 people.

The Belmont WWTW provides primary and secondary treatment of wastewater.

3.3.2.2 Ocean outfall

This sub-section provides an overview of existing operation of the Belmont WWTW outfall, with utilisation of the existing Belmont WWTW outfall the preferred option for the Project ('Project outfall area'). As discussed in Section 2.6.2, this is because it provides a significant reduction in environmental impacts and costs compared with the construction of a new outfall.

The Belmont WWTW ocean outfall currently discharges three main streams, namely:

1. Treated effluent from Belmont WWTW
2. Wet weather bypass from Belmont WWTW
3. Treated effluent from the West Lake WWTW's (Dora Creek, Edgeworth and Toronto) via a single pipeline ("Translake Pipeline")

The transfer of effluent to the ocean outfall occurs regularly, usually on a daily basis, with the three streams feeding directly to the Belmont hydraulic control structure (HCS), located on the eastern side of the Belmont WWTW. The ocean outfall operates under gravity (design capacity of 2,300 L/s) from the HCS. To manage flows in excess of this capacity requires the operation of the ocean outfall pumps. The pumps generate flows ranging from 4,400 L/s to 5,400 L/s depending on the number of pumps operating. Coordination is required with the operators at both Edgeworth and Toronto WWTW's to ensure that the capacity of the outfall is not exceeded. The wet weather bypass from Belmont WWTW becomes active when the influent flow rate to the works exceeds nominally 1,150 L/s. The flow rate of all three streams increases during wet weather.

The EPL held by Hunter Water for the Lake Macquarie sewerage system (licence number 1771) includes the ocean outfall, with limits defined for pollutant concentrations within the effluent discharged through the outfall, which must be adhered to. As the Project would involve discharge of a number of wastewater streams via the existing Belmont WWTW outfall at various stages of the Project, EPL 1771 would need to be modified to authorise the additional proposed discharges.

Further information on the capacity of the outfall, with consideration to the inclusion of the effluent from the desalination plant is provided in Section 4.1.

3.3.2.3 Power upgrades

Hunter Water has an existing connection contract with Ausgrid for an 11 kV supply to Belmont WWTW. The connection point to Ausgrid is off Capri Close via a pole mounted high voltage connection. A private overhead 11 kV line owned by Hunter Water extends from the high voltage connection and crosses the Belmont Lagoon and turns north along Ocean Park Road to the WWTW.

The existing supply line across the lagoon is to be demolished due to ongoing maintenance issues (trimming trees) and also to address cultural heritage issues. Construction work is presently underway by Hunter Water to establish a new high voltage connection in Ocean Park Road adjacent to a mobile phone base station, and construct a private overhead 11 kV line north along Ocean Park Road to the point where it meets the existing 11 kV line. This new line would pass directly in front of the desalination plant. It is anticipated this work would be completed by the end of 2019.

3.3.3 Belmont WWTW dune restoration project

The existing coastal dune system at Belmont WWTW currently acts as a buffer for the WWTW infrastructure from the dynamics of the ocean and beach environment. The dune is presently in poor condition, containing hummocks caused by vehicle tracks. There has been a progressive loss of native vegetation on the dunes and the invasive species bitou bush is present. The loss of vegetation and vehicle tracks leaves the dunes vulnerable to destabilisation and erosion. In the longer term if there is ongoing dune erosion and destabilisation this would result in the WWTW being more vulnerable to large and extreme storm events.

Hunter Water is proposing a dune protection and restoration project within the Belmont WWTW site, which is a separate to the Project. However, restoration of the dunes would assist with the future protection of the WWTW and proposed desalination plant site as well as providing a valuable coastal ecosystem. The works proposed would involve:

- Providing a designated accessway to the beach for off road vehicles on LMCC land
- Possible dune reshaping
- Installation of dune forming fences within the fenced area to provide for sand build up
- Perimeter fencing to restrict access to a 12 ha area of dune to enable native vegetation regrowth
- Spinifex seeding
- Bitou bush removal

4 Project description

4.1 Key features of the Project

The desalination plant would be designed to produce up to 15 ML/day of potable water. The key components of the Project are described in Section 4.1.1 to 4.1.5 and shown in Figure 4-1.

4.1.1 Seawater intakes

The intake structures would comprise a central well and pump housing, with horizontal sub-surface pipelines extending outwards from the central housing (refer to Appendix B for conceptual diagram). The concept design, attached in Appendix B, provides an indicative layout with two intake structures.

The central intake structure would be a concrete structure (referred to as a caisson) of approximately nine to 11 metres diameter, installed to a depth up to 20 m below existing surface levels. The intake structure would be finished above the existing surface (0.5 m to 1 m) to prevent being covered by dune sands over time. Three horizontal pipes approximately 50 m long would be connected to the central casing at varying depths between eight and 15 m below existing surface levels.

Pumps would either be installed on top of the intake structure or within the structure on rails.

The raw feed water for the desalination process is proposed to be extracted from the subsurface saltwater aquifer below the dune and beach zones adjacent to the desalination plant. The groundwater modelling predicts a combined raw feed water yield of approximately 16 ML/day, as discussed in Section 7.2, from the two intake structures.

4.1.2 Water treatment process plant

The water treatment process plant would comprise a range of equipment potentially in containerised form, which 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 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.

Each of these elements are described further in Section 4.5.

The desalination plant would be connected to Hunter Water's potable water network and based on the predicted raw feed water yield the volume of potable water produced would be designed up to a maximum of 15 ML/day.

Figure 4-1 Indicative layout of desalination plant

4.1.3 Brine disposal system

The desalination process would produce up to 28 ML/day of wastewater (at full capacity), comprising predominantly brine, as well as a small amount of pre-treatment and RO membrane cleaning waste. Brine discharge would be transferred via a pipeline to the existing Belmont WWTW, where it would connect to the existing Belmont WWTW HCS, which is an open tank where treated wastewater from Belmont and the Translake pipeline combine prior to release via the ocean outfall.

4.1.4 Power supply

Hunter Water is currently installing a new high voltage private power line to supply the Belmont WWTW from the Ausgrid network (refer to Section 3.3.1). It is proposed that an overhead line would be run from Hunter Water's new private power line to a substation within the desalination plant site. Provision of the required power supply for the desalination plant would require upgrade works to install a new cross connection between Ausgrid's existing underground and overhead supply lines in Belmont South (as shown in Figure 1-2). During operation a small generator would be provided in the desalination plant site to enable controlled shut down of the facility in the event of unexpected power failure. A small amount of fuel would be stored in a covered bund to supply the generator.

4.1.5 Ancillary facilities

There would be a range of ancillary infrastructure associated with the desalination plant site, including:

- *Potable water network:* the Project would connect to the potable water network as described in Section 3.3.1. A potable water storage and pumping station would be provided on site.
- *Tank Farm:* comprising seawater (from the intakes), pre-treated seawater (seawater that has undergone filtration and pre-treatment), permeate (desalinated water), and potable water.
- *Chemical storage and dosing:* A number of chemicals would be required to be stored for use in the treatment processes. The storage area would likely be placed on the western side of the desalination plant site and would have a concrete bunded unloading area draining to a sump emptied by a licensed contractor, as required. Indicative major chemicals are identified and considered in Section 7.8. Deliveries of major chemicals would be required approximately once per month, per chemical.
- *Hardstand:* The desalination plant site would generally comprise an unsealed surface (gravel, crushed concrete or similar) with some areas of concrete bunding, and concrete pads for placement of treatment components.
- *Stormwater and cross drainage:* It is anticipated that generally stormwater runoff would be discharged to the surrounding area as sheet flow and allowed to infiltrate into the ground. Given the permeability of the desalination plant site's upper soil layers, this is not expected to be an issue and is currently utilised at Belmont WWTW.
- *Fencing, signage and lighting:* It is proposed to provide chain wire fencing to the perimeter of the desalination plant site. The fencing would be about 2.4 m high and topped with barbed wire. Minimal signage would be provided to the site except as required for operational requirements. Lighting would be provided at the desalination plant, given that it would be operational on a continuous basis, in accordance with *AS 4282 – Control of the obtrusive effects of outdoor lighting*.

- *Access roads:* Access to the desalination plant would be along the existing Ocean Park Road access road to the Belmont WWTW. A new turn off would be added to enable safe access to the facility. Some areas may also be sealed in high trafficked areas, around the perimeter access road and to the southern intake structure. The final layout would be determined by the supplier during detailed design.

4.2 Construction methodology

As discussed in Section 2.1, completing a concept design and obtaining planning approval would ensure the Project can be deployed quickly in the event of extreme drought. Therefore, Hunter Water is seeking a 10 year approval term for this EIS, during which time further Project stages would be instigated based on the key trigger levels for implementing the Project.

4.2.1 Project area

The Project area for the desalination plant and associated infrastructure would comprise approximately 7.64 hectares, including:

- An area of approximately 7.60 hectares associated with the seawater intake (Section 4.1.1), water treatment process plant (Section 4.1.2), brine disposal system (Section 4.1.3) and ancillary facilities (Section 4.1.5)
- A small area of approximately 0.04 hectares associated with the power supply works (Section 4.1.4)

The Project area is shown in Figure 1-2.

4.2.2 Work methodology

Construction is proposed to be undertaken over an approximate eight month timeframe, with Table 4-1 providing an indicative breakdown of the duration of each aspect of the construction program; however, construction may be undertaken concurrently on some aspects, potentially reducing this timeframe. Further information on the indicative Project staging is provided in Section 4.2.3.

All aspects of the Project would be undertaken in accordance with a Construction Environmental Management Plan (CEMP) prepared in accordance with the EIS and development consent and relevant legislation and guidelines.

The construction program detailed in Table 4-1 is indicative only and would be subject to further refinement by the construction contractor.

Table 4-1 Construction program

Aspect	Indicative Duration
Site establishment:	
Site establishment would generally include the following activities: • Setup environmental mitigation measures, including sediment and erosion controls. • Mobilisation: Establish construction compounds including laydown and storage areas and spoil areas. Install temporary fencing around construction area and demarcate environmentally sensitive areas, establish all vehicle entry points, access roads and turning bays. It is likely that vegetation clearing for the Project area would occur at commencement of works and may be undertaken by a specialist contractor.	Within the timeframe of each aspect

Aspect	Indicative Duration
Intakes	
The construction methodology for the intakes work would generally comprise the following key aspects: • Caisson installation: The intake structure would be installed via a wet caisson technique (refer to 4.2.1) as the sandy soils, depth and high groundwater conditions would prevent open excavation. • Following installation of the caisson, the horizontal seawater intake pipes would be installed from within the structure. • Commissioning to confirm the intake capacity.	6 months
Water treatment process plant[1]	
The construction methodology for the water treatment process plant would generally comprise the following key aspects: • Earthworks and construction of hardstand • Process pipeline connections • Installation of storage tanks, construction of various concrete structures and installation of process equipment • Stabilisation and revegetation	2 months
Power upgrades	
Installation of the new cross connection between the existing underground and overhead supply lines at the intersection of Hudson Street and Marriott Street would use trenchless methods or open trench to cross the footpath and road. Connection from the 11kV power supply on Ocean Park Road to a new 11kV substation located within the desalination plant site.	2 weeks
Demobilisation	
Removal of redundant environmental and safety controls. General site tidy up activities.	Within the timeframe of each aspect

Note 1: Earthworks and some key connections for the water treatment process plant would be made during the power upgrades aspect of construction. Completion time is the portion after completion of intake structures, noting that some water treatment process plant construction would commence while the intakes are being built.

4.2.2.1 Intakes

A conceptual diagram of the intake structures is shown in Figure 4-2.

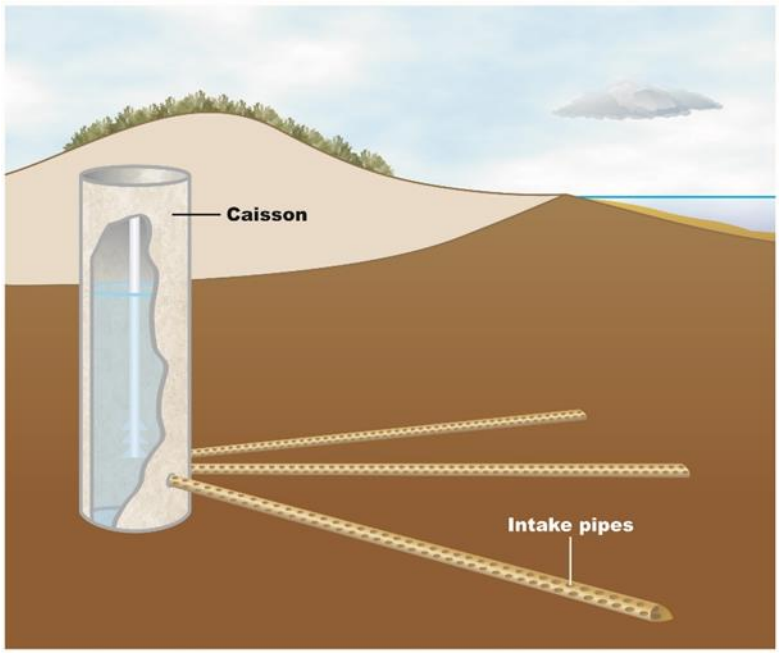

Figure 4-2 Conceptual diagram of intake structures

Caisson installation

Due to the elevated groundwater levels and medium sized sand conditions expected (refer to Sections 7.1.2 and 7.2.2), it is assumed that a 'wet caisson' method would be adopted, however there are several potential construction methods. In the wet caisson method, a shaft is pushed into the ground and the material inside the shaft is excavated (typically using a clam-shell grab) whilst maintaining the original water level in the shaft.

The caisson shaft installation uses hydraulic jacks sitting on a ring beam to provide horizontal support and help ensure the caisson shaft is straight. The shaft lining is constructed of pre-cast concrete segments, however steel linings and cast-in-situ linings can also be used.

Caisson installation would generally involve the following methodology:

- The shaft construction site would typically require 1,000 to 1,500 m^2 in area.
- Installation of a 570 m^2 gravel hardstand work area at each intake to facilitate construction.
- Set up and turn on dewatering spears.
- Installation of the caisson (a nine to 11 m shaft diameter, which would be confirmed by the construction contractor during detailed design), to depth of 15 to 20 m. This may be achieved by a number of methods including excavation and jacking the rings down, or excavation and installing ring segments from the base. Shoring or contiguous pile methods may also be considered at the design and construct stage.
- Establishment of a concrete base of the caisson, to create a seal to the shaft to enable de-watering.
- Set up of sump pumping and connection to the groundwater treatment system. It is possible that the dewatering spears would be able to be turned off at this stage.
- Demobilisation of caisson construction equipment prior to installation of the intakes.

Intake installation

Following the installation of the caisson, it is anticipated that the horizontal seawater intake pipes would be installed from within the structure via the following methodology:

- The equipment required to install the intakes would be mobilised. It is expected that this would include a microtunnel machine or similar. These machines would be lifted into place via cranes. Personnel would also be lifted into place via personnel cages attached to cranes. Pipe/bin elevators may also be installed to allow pipework and other building materials to be lifted into place while personnel is located inside the well.
- The horizontal intake pipe installation would likely involve providing a pre-cast hole in the caisson that seals and allows horizontal casing and drilling to be undertaken at required length. Casing of the pipework would be removed leaving the sieve intake pipes installed.

Excavated soils and slurry would be managed as described in Section 7.1.4.

4.2.2.2 Water treatment process plant

Earthworks

Earthworks would be required at the water treatment process plant site for a number of components, including access roads and hardstand pads.

Earthworks within the water treatment process plant site would involve minor cutting and filling to prepare foundation areas for installation of hardstand pads and internal access roads. It is estimated that approximately 18,000 m^3 of fill material would be required. Earthworks may include importing subgrade improvement materials if required, and localised dewatering. Suitable spoil from within the site would be re used to fill the existing evaporation ponds. Any spoil unsuitable for reuse would be managed as described in Sections 7.1.4.

Plant pipeline connections

An approximately 300 m pipeline would be installed from the desalination plant site to the Belmont WWTW HCS for brine discharge via the WWTW ocean outfall. It is anticipated that pipeline would be installed above ground within the boundary of the Belmont WWTW site. Minimal excavation would be required in this section.

Installation of underground piping would be required to connect various components of the desalination plant. Excavation to depths of up to 2 m may be required for the piping, which would be undertaken via open trenching. This would include an approximately 30 m pipeline within the south western portion of the desalination plant site to connect to the existing sewer rising main passing the site to the west.

The potable water pumping station would be installed as part of the desalination plant which would provide the connection point to the potable water network.

Water treatment process plant construction

Construction of the water treatment process plant would generally comprise installation of storage tanks, construction of various concrete structures and installation of process equipment. The construction methodology of each of these stages is detailed below.

- Tank installation: The concept design includes liner type tanks (this would be confirmed in detail design) and would be generally installed as follows:
  - Preparation of foundation and installation of any substructure piping.
  - Installation of perimeter ring beams.
  - Installation of framing and tank liner, followed by wall lining and roofing if required.
  - Installation of fittings, including access, pipe penetrations and valving.
  - Commissioning of the tank, which may include delivery of flows from the intake structure and potable water from the water main supply to the Belmont WWTW.
- Concrete components: A number of concrete components required for the desalination plant would be constructed in-situ, including bunded areas for major chemicals, slabs for minor chemicals, sludge/backwash pit or clarifier, foundations for desalination/tank components, slabs for pump stations, slabs for electrical supply, intake roof slab, footpaths, fence posts and other miscellaneous components.
- Desalination equipment: Transportation and installation of desalination equipment would comprise the following steps:
  - Transportation of individual units to site from the supplier. Transportation of the units would likely be by road.
  - Unloading of equipment by crane.

– Securing of equipment housing to foundations.
– Undertaking of set up works, commissioning and/or testing by the supplier where necessary.

Stabilisation and revegetation

The contractor would stabilise and revegetate disturbed areas progressively where disturbed areas would be left for longer than 21 days, or following completion of construction activities through:

- Ensuring there is appropriate topsoil for vegetation to establish
- Revegetation as described in Table 7-2

Replacement of temporary construction fencing and other physical barriers or features and removal of all temporary construction structures.

4.2.2.3 Power upgrades

This would involve the following methodology:

- Isolation of the network by Ausgrid to enable works to be undertaken safely. This may involve some power supply interruptions to nearby residents and also to the Belmont WWTW.
- Location and marking of existing services, including the existing underground supply lines.
- Typically a boring/drilling rig would be utilised to install via trenchless methods, however installation via open trenching may also be used.
- Installation of a new connection to the underground supply line and a conduit and cable installed to the pole on the corner of Marriot Street and Hudson Street.
- Installation of a switch and connection at the top of the existing pole to the existing overhead supply line. This would likely require the use of an elevated work platform.
- Installation of a new 11 kV connection via an existing pole to the existing overhead supply line to Belmont WWTW, and a conduit and short length of underground cable to a transformer and switchboards within the desalination plant site.
- Transport vehicles would be used to bring any required materials to the site, including cables and road reinstatement materials.

Following completion of works the existing footpaths and road surfaces would be reinstated to original condition prior to the works.

4.2.3 Staging and workforce

As discussed in Section 2.1, Project stages would be instigated based on the key trigger levels for implementing the Project. The trigger level for detail design commencement at around 65 per cent total storage level was triggered in August 2019. Whilst the LHWP included a trigger level for commencing construction at around 35 per cent total water storage, this trigger will be reviewed throughout the detailed design phase, and it is likely that procurement and pre-construction activities would be instigated prior to 35 per cent total water storage to ensure the plant can be operational no later than 15 per cent total water storage level.

Based on total water storage levels at time of publication (November 2019), under an extreme drought scenario 35 per cent total water storage could be reached in late 2020; 15 per cent total water storage could be reached in late 2021.

Therefore, Hunter Water is seeking a 10 year approval term for this EIS, during which time further Project stages would be instigated based on the key trigger levels for implementing the Project.

The overall construction program is approximately eight months, with an indicative breakdown of the duration of each aspect of the construction program provided in Table 4-1.

The workforce for the Project would vary depending on the needs for specific activities for each aspect of construction. However, a workforce of up to 25 full time equivalent (FTE) personnel may be required if works are able to be undertaken concurrently, as shown in Table 4-2.

Table 4-2 Indicative construction workforce required for the Project

Aspect	FTE
Intakes	10
Water treatment process plant	10
Power upgrades	5

During operation, the Project would require a workforce of up to five FTE personnel to manage onsite operations.

4.2.4 Project hours and duration

Construction works would generally occur during standard construction hours, being the following times:

- Monday to Friday: 7.00 am to 6.00 pm
- Saturday: 8.00 am to 1.00 pm
- No work on Sundays or Public Holidays

Staff may arrive and leave site before and after these times to ‘start-up’ and ‘shut-down’, but works would generally not occur outside the times specified above aside from the activities outlined in Table 4-3.

Table 4-3 Indicative out of hours work required for the Project

Aspect	Out of hours works
Intakes	Dewatering during construction of the intakes would be required
Water treatment process plant	N/A
Power upgrades	N/A

Notwithstanding this, the *Interim Construction Noise Guideline* (DECCW, 2009) acknowledges that the following activities may need to be undertaken outside the recommended construction hours:

- Emergency work
- The delivery of oversized plant or structures
- Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours

4.2.5 Plant and equipment

The indicative plant and equipment items for the Project are detailed in Table 4-4. The plant and equipment would be subject to further refinement and be chosen on a fit-for-purpose basis and would consist of various makes, tonnages and capacities, dependent on-site conditions.

Table 4-4 Indicative plant and equipment required for construction

Aspect	Plant/equipment	
Intakes	• Concrete saw • Welding equipment • Compressor • Concrete truck • 30 t crane • 15 t excavator	• Microtunnel/drilling rig • Generator • Dewatering equipment • Pumps • Heavy vehicles • Portable pipelines/couplings
Water treatment process plant	• Heavy vehicles • Welding equipment • 30 t crane • Concrete truck	• Compressor • Generator • Pneumatic tools • Vibratory roller
Power upgrades	• Heavy vehicles • Concrete/asphalt truck • Drill rig • Vibratory roller • 15 t excavator	• Compactor • Hand tools • Elevated Work Platform
Demobilisation	• Light vehicles • Heavy vehicles	• Generators

4.2.6 Public utility adjustment

Due to the extended timeframe of the Project, there is potential for new utility services or alteration to existing services to occur prior to construction commencing. Therefore a review of utility services would be required at the detailed design and construct phase, with modifications incorporated as required.

4.2.7 Traffic management and access

Access to the Project area would vary for each aspect of construction. Traffic movements would vary throughout the Project, with Table 4-5 providing a breakdown of anticipated light and heavy vehicle movements for each phase of construction, and associated construction traffic access.

Table 4-5 Indicative vehicle traffic movements

Aspect	Heavy vehicles movements	Light vehicles (2 way) per wk	Access
Intakes (movement of fill)	668[1]	120	Ocean Park Road
Water treatment process plant	25	120	
Power upgrades	5	60	Pacific Highway, Beach Street, and Hudson Street

Note 1: This volume is a conservative assessment based on the assumption that necessary fill and concrete for the Project would be sourced off-site and delivered via Ocean Park Road, and that excavated material from construction of the intakes would be unsuitable for re-use. Hunter Water would investigate ways to reduce the number of heavy vehicle movements during construction, including the identification of suitable fill materials for re-use on-site, in lieu of off-site disposal (refer to Section 7.11.3).

Ocean Park Road is in poor condition and a lightly trafficked road. It is anticipated that one lane of traffic may be closed during construction and traffic control would be required.

4.2.8 Property impact and use

The desalination plant and the main compound location would be within Hunter Water-owned land. Further information on property and land use mitigation measures is provided in Section 8.2.

The properties, land zoning and land uses intersected by the Project area are listed in Table 4-6.

Table 4-6 Land use, tenure and zoning

Lot details	Land zoning	Land Ownership	Land use
Lot 1 of DP 433549	SP2 and E2	Hunter Water	Belmont WWTW

4.3 Ancillary facilities

4.3.1 Compounds

The main compound is proposed within the desalination plant site. It is anticipated that the following facilities may be included in these areas:

- Site sheds
- Parking
- Equipment laydown areas
- Waste receptacles
- Spoil (sub and topsoil) stockpile areas
- Soil treatment area for ASS treatment if required (main compound only)
- Water treatment for dewatering during caisson construction
- Storage areas for construction materials (could include some hazardous materials such as fuels and chemicals)

4.3.2 Access tracks

No new access tracks would be created for the Project, as the construction area would generally occur within the existing Belmont WWTW land parcel, which has existing access tracks available.

New access tracks within the desalination plant site would be required for construction, with the final layout determined by the construction contractor. Some access tracks may be sealed such as in high trafficked areas, around the perimeter access road and to the southern intake structure.

4.4 Commissioning

The overall desalination plant would be fully commissioned following completion of the last component of construction work. Some commissioning of the intake elements would likely be completed as part of the construction activities, as described in Sections 4.4.1 to 4.4.2, respectively.

4.4.1 Intakes

Commissioning would be undertaken following installation to confirm the intake capacity. This would involve pumping seawater through the newly installed intake with temporary surface mounted pumps to assess whether the required flow rates can be achieved.

The exact commissioning process would be developed by the contractor at the time of construction, however, an indicative commissioning process would include the following:

- After installation of the intakes, a pre-commissioning test would be carried out to confirm performance. Prior to demobilisation of the microtunnel/drill rig machine, the first intake would be tested at full capacity. It is anticipated this would occur over a minimum of one week, unless there was an ongoing decline in the groundwater yields and/or quality. Seawater would likely be pumped directly to the brine disposal system.

- Monitoring of adjacent groundwater wells would be undertaken to confirm the reliability of groundwater modelling. Where the intakes performance is not consistent with the predicted design or environmental assessment, the contractor would liaise with Hunter Water on an alternative plan.

Following successful commissioning of the intakes (where they would be temporarily connected to the brine disposal pump station), hatches, pumps and switchboards would be installed and the intakes would be connected to the seawater delivery main.

4.4.2 Water treatment process plant

At commencement of commissioning of the water treatment process plant, there would be a period during which the raw feed water from the intake would bypass the water treatment process plant and be discharged directly to the outfall. Commissioning flows are expected to be in the order of 28 to 45 ML/day of essentially saline groundwater during this activity, which could occur for up to two to three months.

As the water treatment process plant would be constructed in more than one module, the suppliers may commence work on one module and commission that module before moving to the next module. As soon as the first module of the water treatment process plant has been tested and commissioned, the module would be put into service and run continuously, 24 hours per day.

It is anticipated that the commissioning plan would comprise:

1. Individual equipment checks
2. Package commissioning
3. Full operation of the facility

4.4.2.1 Pre-treatment process

Pre-commissioning of the pre-treatment processes would take approximately 2 weeks. A small percentage of sludge by-product would go to the existing Belmont WWTW inlet works, with the vast majority of water going to the outfall via the brine discharge pipe.

4.4.2.2 Reverse osmosis unit

During commissioning of the reverse osmosis unit, all water would be held in the treated water storage tank until it passes all specifications before discharging to the potable water pipeline and the water network.

The commissioning process would be required to demonstrate that the water produced by the desalination plant meets the quality requirements of the Australian Drinking Water Guidelines (NHMRC, 2011).

4.5 Operation

It is proposed that the desalination plant would operate with a treated water output flow rate of 190 L/s based on a 40 per cent recovery from the reverse osmosis process. This equates to a total of 16.4 ML/day, although due to slight variations in operations and flows over a 24 hour period, an output of 15 ML/day is considered to be a representative average.

Reduced flows may occur during short-term shut downs (e.g. when the plant, or a module of the plant, is undergoing maintenance such as backwashing; during short term heavy rainfall if flows in the ocean outfall are approaching capacity, or during a power failure).

It is proposed that the plant would be comprised of two smaller modules, accounting for 8.2 ML/day for each module, with the option of operating only one of the smaller modules at a time during short term shut downs or maintenance. Final flows and number of modules would be determined by the supplier at the time of implementation of the Project; however, a summary of the indicative conceptual flows for a 8.2 ML/day plant (single module) and a 16.4 ML/day plant (comprised of two modules) is provided in Table 4-7 along with the quantities anticipated under the maximum flow rate scenario of 16.4 ML/day.

Table 4-7 Conceptual Primary Flows – 15 ML/d Plant (all values in ML/d)

Flow Stream	Maximum Daily Flows (22 hours)	Nominal Daily Flows (24 hours)	Minimum Daily Flows
	Total (ML/d)	Total (ML/d)	Total (ML/d)
Potable Water			
Potable water produced	**16.4***	15	7.5
Utilities (potable water for use on site)	0.65	0.6	0.3
Desalination Plant			
Number of trains operational (min.)	4 Nos	4 Nos	2 Nos
Permeate production	17.05	15.6	7.8
Permeate production per train	8.525	7.8	3.9
(Hydraulic) recovery	40%	40%	40%
Pre-treatment Plant			
Filtered seawater to Desalination Plant	**42.6****	39	19.5
Filtered seawater to backwash UF filters	2	2	1
Filtered seawater to backwash screens	1	1	0.5
Intake Flow			
Intake Flow	**45.6*****	42	21
Outfall			
Brine to outfall	25.5	23.4	11.7
Screens Backwash	1	1	0.3
UF Backwash	2	2	1
Less Utilities and losses	-0.3	-0.3	
Total outfall flow	**28.2******	26	13

* This flow rate is used for the concept design of the delivery system, and is equivalent to a delivery pump rate of 190 L/s, albeit over 22 hours.
** This flow rate is used for the concept design of the pre-treatment processes.
*** This flow rate is used for the seawater pumping system and pipework.
**** This flow rate is used for the concept design of the outfall.

It should be noted that the groundwater yield defined in Section 7.2.3 for the designed intakes arrangement is below that defined in the table above. The numbers in the table above are indicative values based on limited water quality sampling for a concept design. It is proposed during the detail design phase to obtain further sampling and investigate more efficient desalination processes to increase the hydraulic recovery.

Once operational, the facility would run essentially continuously until storage levels recover to a trigger level (currently set at around 35 per cent) indicating that the facility can be turned off (but not necessarily decommissioned). This operational period is wholly dependent on climatic conditions at the time. Operation of the water treatment process plant would include:

- Pre-treatment: required prior to desalination to remove organic material and sediments in order to protect the RO membranes. Pre-treatment would involve passing seawater through microfiltration or ultrafiltration membranes installed upstream of the RO system. Coagulants would be added upstream of the pre-treatment membranes, which clump small particles together so they can be more easily removed.

  The pre-treatment membranes would need to be cleaned by backwashing water through the membranes. Waste water from this process would be directed to a sedimentation tank (clarifier) with clarified waste water delivered to the brine waste stream (refer to Section 4.1) and sludge processed and disposed in accordance with existing Belmont WWTW operations and EPL 1771 (as modified).

- Desalination: The RO system would comprise pressurising pumps and energy recovery devices, semipermeable RO membranes, and a membrane cleaning system. The pressurising pumps would deliver pre-treated seawater to the RO membranes at sufficient pressures to enable the RO process. The RO system would produce both a permeate (desalinated water) stream for post-treatment prior to delivery to the potable water supply network, and a brine waste stream for disposal in accordance with existing Belmont WWTW operations and EPL 1771 (as modified).

  Membrane cleaning would involve flushing the RO membranes with a number of cleaning chemicals, which would be stored in a dedicated bunded area. Cleaning would occur intermittently and produce a small quantity of waste cleaning fluid that would be delivered to the brine waste stream.

- Post-treatment: Permeate produced by the RO system would be treated to meet drinking water requirements prior to being delivered to the water supply network. This would involve stabilisation with lime and carbon dioxide as well as disinfection and fluoridation. A potable water storage and pumping station would be provided on site, which would connect to the potable water connection (refer to Section 4.2.2).

During operation, there would be routine chemical and supply deliveries and relatively small amounts of waste removed from the facility. Access to the desalination plant would be via the same access as the WWTW, namely Ocean Park Road. Given the location and low traffic volumes (current and predicted future volumes), upgrades to the road are not required nor proposed for the desalination plant.

Generally there is expected to be very little operational or maintenance input for the power supply, it would be an Ausgrid asset and managed under their existing protocols.

4.6 Decommissioning

The desalination plant would be run until an appropriate trigger point is reached in total water storage level (currently set at around 35 per cent). At the trigger level operation would cease with the units remaining on-site until the risk of continued drought is passed.

At that time, the desalination plant would be stood down and mothballed. It could then be turned back on at short notice if the operational trigger is reached once again. Alternatively, if storage levels continue to recover, the decision to partly decommission the plant would then be based on the storage levels at the time and long term weather outlooks to inform the chances of the desalination plant needing to be turned on again in the short to medium term.

Decommissioning would occur when water storage levels reach around 50 per cent or greater. A plan for decommissioning and deconstruction for the desalination plant would be further developed in the detailed design phase.

4.7 Capital investment value

The estimated Capital Investment Value (CIV) for the Project is approximately $90 million. A signed report from a qualified quantity surveyor has been prepared for the Project and is commercial in confidence. This report has been provided separately to DPIE.

The Independent Pricing and Regulatory Tribunal (IPART) determines Hunter Water's revenues and prices during periodic price reviews, including setting allowances for efficient capital and operating expenditure.

Hunter Water’s capital and operating expenditure is self-funded (financed through borrowings and retained earnings) with expenditures recovered via customer prices (the quantum of any impact would be determined by IPART if the project is required to proceed).

5 Regulatory framework

5.1 NSW legislation

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) provide the framework for development assessment in NSW. The EP&A Act and EP&A Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision making process prior to proceeding to construction.

5.1.1 State Significant Infrastructure

Some types of infrastructure are deemed to have State significance due to their size, economic value or potential impacts. The Project satisfies Clause 4(1) of the *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SRD), being development for the purpose of desalination plants by or on behalf of a public authority that has a capital investment value of more than $10 million. The Project is therefore State significant infrastructure (SSI) (see Section 5.1.3).

As SSI, the Project is subject to assessment and approval under Division 5.2 of Part 5 of the EP& Act. Relevant provisions of the EP&A Act are addressed in the following sections.

5.1.1.1 Responsible authority

The Minister for Planning is the prescribed responsible authority in respect of the development application under Division 5.2 of Part 5 of the EP&A Act. However, under section 2.4(1) of the EP&A Act, the Minister has the ability to delegate this authority to the any of the entities specified in that section, including the Independent Planning Commission (IPC), the Secretary of DPI&E or to any other public authority (as defined within the EP&A Act).

5.1.1.2 Environmental Impact Statement

An EIS is required to be prepared by or on behalf of the proponent for the purposes of environmental assessment of SSI under Section 5.16 (2). The EIS must be prepared in the form prescribed by the regulations (refer to Section 5.1.2).

5.1.2 Assessment requirements

As SSI, the Project is subject to the assessment requirements under Part 5, Division 5.2 of the EP&A Act. These requirements are discussed below.

5.1.2.1 EP&A Regulation requirements

Schedule 2 of the EP&A Regulation describes the requirements for an EIS. Clause 6, Part 3 of Schedule 2 outlines the required form for an EIS, while Clause 7, Part 3 of Schedule 2 outlines the required content. These requirements and where they are addressed in the EIS are outlined in Table 5-1 below.

Table 5-1 EP&A Regulation Schedule 2 EIS requirements

Clause	Schedule 2 requirements	Where addressed in the EIS
6 (a)	The name, address and professional qualifications of the person by whom the statement is prepared.	Submission of Environmental Impact Statement
6 (b)	The name and address of the responsible person.	
6 (c)	The address of the land	Section 4.2.8
6 (d)	A description of the development, activity or infrastructure to which the statement relates.	Section 4

Clause	Schedule 2 requirements	Where addressed in the EIS
6 (e)	An assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule.	Section 7
6 (f)	A declaration that the EIS has been prepared in accordance with the Schedule, contains all available information relevant to the environmental assessment of the Project and that the information contained in the EIS is neither false nor misleading.	Submission of Environmental Impact Statement
7 (1) (a)	A summary of the environmental impact statement.	Executive summary
7 (1) (b)	A statement of the objectives of the development, activity or infrastructure.	Section 1.4.1
7 (1) (c)	An analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure.	Section 2
7 (1) (d) (i)	An analysis of the development, activity or infrastructure, including: A full description of the development, activity or infrastructure, and	Section 4
7 (1) (d) (ii)	A general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	Sections 3 and 7
7 (1) (d) (iii)	The likely impact on the environment of the development, activity or infrastructure, and	Section 7
7 (1) (d) (iv)	A full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Section 7 and 8.2
7 (1) (d) (v)	A list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out.	Section 5.3
7 (1) (e)	A compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv).	Section 8.2
7 (1) (f)	The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	Sections 2.1 and 9

5.1.2.2 Secretary's Environmental Assessment Requirements

The EIS has also addressed the SEARs provided for the Project. The delegate of the Secretary of the DPI&E issued SEARs for the Project on 17 December 2017, with subsequent revisions issued 24 January 2018 following comment and discussed between Hunter Water and the DPIE (Appendix A).

Hunter Water has subsequently revised the project description as detailed in a Revised SSI Application submitted to DPIE on 25 September 2019, which did not result in a change to the SEARs issued on 24 January 2018.

A breakdown of the SEARs and the main sections where they have been addressed within the EIS is presented in Table 5-2. The specific government agency requirements ('Government Agencies Key Issues') included as an attachment to the SEARs have been addressed where relevant, throughout the EIS and the relevant specialist studies.

Table 5-2 Checklist of Secretary's Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements	Relevant EIS section
The Environmental Impact Statement (EIS) must comply with the minimum form and content requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.	
In particular, the EIS must include:	
• a stand-alone executive summary	Prior to table of contents
• a full description of the proposed development, including:	Section 4
– the preferred site of the desalination units	Section 2.4.1(Location of the desalination plant)
– all infrastructure and facilities required during both construction and operation, including construction laydown areas, stockpiles, above ground structures, access roads, and road upgrades (including any infrastructures that would be required for the proposed development, but the subject of a separate approvals process)	Section 4
– details of construction and operation, including any staging of the proposed development and any associated modifications/upgrades required to the existing Belmont WWTW	Section 4
– site plans and maps at an adequate scale with dimensions showing:	
▪ the locations and dimensions of all proposed components including details of construction laydown areas and above ground structures	Figure 1-2 and Appendix B
▪ existing infrastructure, sensitive land uses and environmental features in the vicinity of the proposed development (including any other existing, approval or proposed infrastructure in the region)	Sections 3.1 and 3.2
▪ required infrastructure and identification of any land use and/or environmental constraints that have been considered in the design of the proposed development	Sections 4.1 and 7 including Figure 3-1, Figure 7-1 Figure 7-2, Figure 7-3, Figure 7-5 Figure 7-7, Figure 7-9, Figure 7-10
– details of any rehabilitation along the servicing routes during and following construction	Not applicable to this Project

Secretary's Environmental Assessment Requirements	Relevant EIS section
– the likely interactions with the proposed development and any other existing, approved or proposed projects	Section 3.3
• detail of the triggers for construction and operation of the proposed development, with reference to the current Lower Hunter Water Plan or subsequent versions	Section 4.2.3
• a description of the need for the proposed development and why it is preferred over other alternatives	Section 2
• a list of any approvals that must be obtained prior to the commencement of the proposed development	Section 5.3
• an assessment of the likely impacts of the proposed development on the environment, focusing on the specific issues identified below, including:	
– a description of the existing environment likely to be affected by the proposed development	Sections 3.1 and 7
– an assessment of the likely impacts of all stages of the proposed development, including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice	Sections 7 and 7.18
– a description of the measures that would be implemented to avoid, mitigate and/or offset residual impacts of the proposed development, if it is approved (with a focus on performance-based measures to reduce the reliance on environmental management plans).	Sections 7, 7.18 and 8.2
• a consolidated summary of all of the proposed environmental management and monitoring measures, identifying all commitments in the EIS	Sections 8.1 and 8.2
• consideration of the proposed development against all relevant environmental planning instruments	Section 5.1.3
• the reasons why the proposed development should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.	Section 9.2
The EIS must be accompanied by a signed report from a qualified quantity surveyor that includes:	
• a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Environmental Planning and Assessment Regulation 2000) of the proposal, including details of all assumptions and components from which the CIV calculation is derived;	Section 4.7 Section 4.2.3
• an estimate of the jobs that will be created by the future development during the construction and operational phases of the development; and	
• certification that the information provided is accurate at the date of preparation.	This report is commercial in confidence and has been provided separately to DPIE

Secretary's Environmental Assessment Requirements	Relevant EIS section
The EIS must address the following specific issues with the level of assessment of likely impacts proportionate to the significance of, or degree, of impact on the issue, within the context of the project location and the surrounding environment:	
Strategic Justification – including:	
• a detailed justification for the proposed development and suitability of the site for the development	Sections 2.1, 2.4 and 9.1
• a demonstration that the development is consistent with all relevant planning strategies, environmental planning instruments, development control plans (DCPs), or justification for any inconsistencies	Sections 5.1.3, 5.1.4, and 5.4
• a list of any approvals that must be obtained under any other Act or law before the development may lawfully be carried out	Section 5.3
• a description of how the new facility integrates with existing on-site operations (both permanent and temporary)	Sections 4.5 and 4.6
• a description of any additional licence(s) or approval(s) required to carry out the proposed development	Section 5.3
• addressing statutory provisions within all relevant planning strategies, environmental planning instruments, development control plans (DCPs), or justification for any inconsistencies, including:	
– Biodiversity Conservation Act 2016	Section 5.3.1
– State Environmental Planning Policy (State & Regional Development) 2011	Section 5.1.3
– State Environmental Planning Policy (Infrastructure) 2007	
– State Environmental Planning Policy no. 55 – Remediation of Land	
– Hunter Regional Plan 2016	Section 5.4.3
– Lake Macquarie Local Environmental Plan 2014	Section 5.1.4
– NSW Premiers Priorities	Section 5.4.4
– NSW State Priorities	
Water – including:	
• a site water balance including a description of water demand, a breakdown of water supplies and the measures to minimise water use	Table 4-7
• an assessment of the impacts of the proposed development on the quantity and/or quality of surface and groundwater resources	Sections 7.1 and 7.2
• an assessment of the proposed development on the water quality at the outfall, including detail of dispersion in various flow scenarios and during varied tides	
• a description of the measures to minimise surface and groundwater impacts, including how works on steep gradient land or erodible soil types would be managed and any contingency requirements to address residual impacts.	

Secretary's Environmental Assessment Requirements	Relevant EIS section
Contamination including:	Section 7.1
• assessment of the abandoned mine works beneath the development site and identification of likelihood and impact of mine subsidence affecting the site	
• identification of contamination and the risk of acid sulfate soils (Class 1, 2, 3, or 4 on the Acid Sulfate Soil Risk Map) associated with the proposed development and an assessment of the impacts of the proposed development for contamination and acid sulfate soils (including impacts of acidic runoff offsite) in accordance with current guidelines including Managing Land Contamination: Planning Guidelines – SEPP 55 Remediation of Land	
• identification, handling, transport and disposal of any asbestos containing material and other contamination encountered during the construction of the proposed development, having regard to ecological and human health risks posed by contamination in the context of the past, existing and likely (or potential) future land uses surrounding the proposed development. Where assessment and/or remediation is required, document how the assessment and/or remediation would be undertaken in accordance with current guidelines	
• identification of any unexploded ordnance and management measures to avoid the impacts of these materials	
• an assessment of the impacts on soil and land resources (including erosion risk or hazard) with attention to soil erosion and sediment transport consistent with the practices and principles in current guidelines including Managing Urban Stormwater – Soils and Construction Volume 1 (Landcom, 2004).	
Coastal Processes including:	Section 7.5
• detailed assessment and consideration of coastal hazards including the preparation of a site specific coastal hazards assessment (which includes assessment of recession, wave overtopping and coastal inundation) prepared in accordance with the draft NSW Coastal Management Manual	
• detailed design of all coastal protection works required to protect the proposed development from coastal hazards. These design works must be undertaken in a manner consistent with the principles of the Coastal Management Act 2016, NSW Coastal Management Manual and the Lake Macquarie Coastal Zone Management Plan.	
Biodiversity including:	Section 7.3
• an assessment of the biodiversity values and the likely biodiversity impacts of the proposed development, in accordance with the Biodiversity Conservation Act 2016	
• a detailed description of the proposed regime for minimising, management and reporting on the biodiversity impacts of the proposed development over time	
• a strategy to offset any residual impacts of the proposed development in accordance with the Biodiversity Conservation Act 2016.	
Aquatic Ecology including:	Sections 7.3 and 7.4
• a description of the aquatic and riparian habitats adjacent to the development site;	

Secretary's Environmental Assessment Requirements	Relevant EIS section
• an analysis of any interactions of the proposed development with aquatic and riparian environments and predictions of any impacts upon these environments;	
• details of proposed buffer distances between the development and adjacent aquatic and riparian habitats; and	
• details of the mitigation measures for potential impacts to key fish habitats, including water quality impacts, to be implemented during the construction and operation of the proposed development.	
Social Impacts including:	Section 7.6
• a detailed social impact assessment, considering the Department of Planning and Environment's Social impact assessment guideline (September 2017), undertaken by a suitably qualified person that includes:	
– identification and prediction of impacts of the proposed development and the relative significance of these impacts (duration, extent, sensitivity and level of concern)	
– a profile of the surrounding community including identification of key stakeholders and community members and groups (this is to include detail of the community's perception of the development, both tangible and intangible; positive and negative)	
– details of genuine engagement undertaken with identified key stakeholders and community members and groups and how this input will inform design and operation of the proposed development	
– methods for ongoing genuine engagement (procedures and mechanisms) with identified key stakeholders and community members and groups and how this input will inform operation of the proposed development.	
Infrastructure including:	
• a detailed written and/or geographical description of the infrastructure required for the proposed development	Section 4.1
• identification of any infrastructure upgrades required off-site to facilitate the proposed development and description of any arrangements to ensure the upgrades are implemented in a timely manner to facilitate the proposed development	
• a description of how infrastructure will be co-ordinated and funded to ensure it is in place to facilitate the proposed development.	Section 4.7
Flooding and Drainage including:	Section 7.2
• an assessment of any flood risk to the proposed development (detailing the most recent flood studies for the project area) and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity	
• detail drainage associated with the proposed development including stormwater and drainage infrastructure including consideration of Guidelines for development adjoining land and water management by DECCW (OEH, 2013).	
Sustainability including:	
• a detailed assessment of the proposed development against current targets and strategies to improved Government efficiency in use of water, energy and transport	Section 7.7

Secretary's Environmental Assessment Requirements	Relevant EIS section
• detail of how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the construction and operation of the proposed development.	Section 7.7 and 9.2
Hazards and Risks including:	Section 7.8
• a preliminary risk screening completed in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), with a clear indication of class, quantity and location of all dangerous goods and hazardous materials associated with the development.	
• should preliminary screening indicate that the project is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011).	
Heritage including:	
• an assessment of the impact of the proposed development on Aboriginal cultural heritage (archaeological and cultural) in accordance with the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011) and the Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010)	Section 7.9
• adequate consultation with Aboriginal stakeholders having regard to the Aboriginal Cultural Heritage Consultation requirements for Proponents (DECCW, 2010)	Section 6.5.2
• an assessment of the impact of the proposed development on environmental heritage, including heritage conservation areas and State and local heritage items as defined under the Heritage Act 1977, having regard to the NSW Heritage Manual.	Section 7.10
Traffic and Transport including	Section 7.11
• an assessment of construction and operational traffic and transport impacts in accordance with current guidelines including RMS' Guide to Traffic Generating Developments 2002 and Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development, including:	
– current and anticipated traffic counts for traffic routes and intersections o identification of anticipated vehicular traffic generated during construction and operation and the relevant peak periods for traffic generated in these stages	
– capacity of utilised roads and intersections as well as the anticipated future impacts of other proposed developments in the area of traffic analysis using SIDRA or similar traffic model	
– detail of any other impacts upon the regional or state road network, including consideration of pedestrian, cyclist and public transport facilities and service vehicles	
– identification of necessary road network infrastructure upgrades.	
Noise and Vibration including:	Section 7.12
• an assessment of the likely construction noise impacts of the proposed development in accordance with Interim Construction Noise Guideline (DECC, 2009)	

Secretary's Environmental Assessment Requirements	Relevant EIS section
• an assessment of the likely vibration amenity and structure impacts of the project under the Assessment Vibration: A Technical Guideline i(DECC, 2006) and German Standard DIN 4150-3 Structural Vibration – Effects of vibration on structures	
• an assessment of the likely operational noise impacts of the proposed development in accordance with the Noise Policy for Industry (EPA, 2017)	
• measures to be implemented to minimise noise impacts during both construction and operational phases.	
Waste including	Section 7.13
• identification, quantification and classification of the waste streams likely to be generated during construction and operation	
• description of measures to be implemented to manage, reuse, recycle and safely dispose of waste	
• details of waste handling including, transport, identification, receipt, stockpiling and quality control	
• the measures that would be implemented to ensure that the proposed development is consistent with the aims, objectives and guidelines in NSW Waste Avoidance and Resource Recovery Strategy 2014-21.	
Visual including:	Section 7.14
• an impact assessment at representative private receptors and public vantage points.	
Air Quality including:	Section 7.15
• a description of all potential sources of air and odour emissions;	
• an air quality impact assessment in accordance with relevant Environment Protection Authority Guidelines; and	
• a description and appraisal of air quality impact mitigation and monitoring measures.	
Human Health – including:	Section 7.17
• identification of any change to the risk to human health, including mitigation measures and management to ensure appropriate standards are met.	
The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation. Those documents should be included as part of the EIS rather than as separate documents.	Appendix B

Secretary's Environmental Assessment Requirements	Relevant EIS section
Consultation The EIS must include a Community Consultation Framework which identifies relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during construction and operation. Key issues that must be addressed in the Framework include, but are not limited to, traffic management (including property access, pedestrian and bicycle access), construction activities (including out of hours work), and noise and vibration mitigation and management. You must consult the relevant local, State and Commonwealth government authorities, infrastructure and service providers, special interest groups (including Local Aboriginal Land Councils, Aboriginal stakeholders and recreational users of the area), affected landowners, businesses and the local community. In particular, you should consult with: • Lake Macquarie City Council • Environment Protection Authority • Office of Environment and Heritage • Department of Primary Industries – Water, Fisheries and Crown Lands • Subsidence Advisory NSW • Roads and Maritime Services • SafeWork NSW • NSW Police • NSW Health • The surrounding landowners and occupiers that are likely to be impacted by the proposed development including Belmont Golf Course and Belmont Wetlands State Park Trust The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	Section 6

5.1.3 Environmental planning instruments

Environmental Planning Instruments (EPIs) are the statutory plans made under Part 3 of the EP&A Act. The EPIs that apply to the Project are the:

- SEPP SRD
- *State Environmental Planning Policy (Infrastructure) 2007* ('SEPP Infrastructure')

The application of these applicable SEPPs are discussed below.

5.1.3.1 State Environmental Planning Policy (State and Regional Development) 2011

The aim of the SEPP SRD is to identify development that is State significant development and State significant infrastructure and to confer functions on joint regional planning panels to determine development applications for regional development.

Under Clause 14(1) of SEPP SRD, development is declared to be State Significant Infrastructure if the development on the land concerned is, by the operation of a SEPP, permissible without development consent under Part 4 of the EP&A Act, and the development is specified in Schedule 3 of SEPP SRD.

The Project is development that is permissible without consent under the Infrastructure SEPP and is listed under Schedule 3 of the SEPP SRD, as follows:

- Schedule 3, Clause 4(1) - Development for the purpose of desalination plants by or on behalf of a public authority that has a capital investment value of more than $10 million

The Project would exceed this capital investment threshold and is therefore declared to be SSI under Division 5.2 of the EP&A Act.

5.1.3.2 State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP aims to facilitate the effective delivery of infrastructure across the state through increased regulatory certainty and improved efficiency and flexibility in the location of infrastructure and service facilities while providing adequate stakeholder consultation.

The Project is permissible without consent under Clauses 41(1) and 125(3A) of the Infrastructure SEPP as identified in Table 5-3 below.

Table 5-3 Infrastructure SEPP provisions

Clause	Wording	Definitions	Permissibility
Clause 41(1)	Development for the purpose of an electricity transmission or distribution network may be carried out by or on behalf of an electricity supply authority or public authority without consent on any land.	Clause 41(2) states that construction works, including laying and installation of cables, overhead wires and associated component parts and support structures are considered development for the purpose of an electricity transmission or distribution network.	This clause allows the development of the power connection without consent.

Clause	Wording	Definitions	Permissibility
Clause 125 (3A)	Development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in the prescribed zone.	The prescribed zone, as defined in Clause 124, includes zone SP2 – Infrastructure. Water treatment facilities are defined in Clause 124 as 'a building or place used for the treatment of water (such as a desalination plant or a recycled or reclaimed water plant) whether the water produced is potable or not, and includes residuals treatment, storage and disposal facilities, but does not include a water recycling facility'.	This clause allows for the development of the desalination plant without consent.

5.1.3.3 Other environmental planning instruments

The Project is SSI as identified in the sections above. Section 5.22(2) of the EP&A Act provides that environmental planning instruments do not apply to or in respect of SSI, except where they apply to the declaration of infrastructure as SSI. Instead the need to consider environmental planning instruments is generally relevant to projects assessed under Part 4 of the EP&A Act; however, it is noted that the requirement to consider a number of these environmental planning instruments was identified in the SEARs, including Agency input, for the Project.

While environmental planning instruments other than SEPP SRD and SEPP Infrastructure therefore do not apply, the following instruments have been taken into consideration when assessing the potential impacts of the Project. These other EPIs are considered below.

State Environmental Planning Policy – Coastal Management 2018

State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) aims to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objectives of the *Coastal Management Act 2016*. The objectives of the Coastal Management SEPP are to manage development in the coastal zone and establish a framework for land use planning and decision making in the coastal zone.

The Project is not located within land mapped as coastal wetlands or littoral rainforest, although it is adjacent to mapped coastal wetlands and within the proximity area for coastal wetlands. Potential impacts to the biophysical, hydrological and ecological integrity of the adjacent coastal wetland are discussed in Sections 7.2 and 7.3.

The Project is located within the 'coastal use' and 'coastal environment' coastal management areas mapped under the policy (refer to Figure 4-1 Appendix M). The Coastal Management SEPP requires that development in a coastal environment area or a coastal use area address the requirements of Clause 13 and Clause 14, respectively. These are addressed in Table 5-4. A detailed assessment of the potential impacts of the project is provided in Section 7.4.

Table 5-4 Impacts to be considered under the Coastal Management SEPP

Clause 13 and 14 requirement	Comment
Clause 13(1)	
(a) The integrity and resilience of the biophysical hydrological and ecological environment	The Project would not significantly degrade biological diversity or ecosystem integrity, or disrupt ecological, biophysical, geological or geomorphological coastal processes.

Clause 13 and 14 requirement	Comment
(b) Coastal environmental values and natural coastal processes	Degradation of or disruption to the beach and foreshore amenity is avoided due to siting of the plant close to existing infrastructure and within previously disturbed areas behind the beach and dunes. With mitigation measures employed, increased erosion of the beach or adjacent land is not anticipated.
(c) The water quality of the marine estate, in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1	The Project area is not listed in Schedule 1 of the Coastal Management SEPP.
(d) Marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms	The Project has considered potential impacts on biodiversity (terrestrial and marine), with the technical reports (Appendix E and Appendix K) concluding no State or Commonwealth listed threatened biota, or their habitats, would be significantly impacted as a result of the Project.
(e) Existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,	As discussed in Section 3.3.3 a designated accessway to the beach would be constructed to the south of the Project area to maintain access by 4WD users to the beach. The Project area is behind the sand dunes and outside the area accessible by the public once on the beach. Potential access impacts during construction would be minimised through implementation of the safeguards and management measures outlined in Section 7.6.4.
(f) Aboriginal cultural heritage, practices and places	Impacts to Aboriginal cultural heritage would be minor and managed in accordance with an Aboriginal Cultural Heritage Management Plan (ACHMP) for the Project.
(f) The use of the surf zone	Degradation of or disruption to the beach and foreshore amenity is avoided due to siting of the plant close to existing infrastructure and within previously disturbed areas behind the beach and dunes. With mitigation measures employed impacts to use of the surf zone are not anticipated, including appropriate exclusion barriers, signage and site supervision to be employed so that the Project area is controlled and that unauthorised vehicles and pedestrians are excluded from the works area.
Clause 14(1)	
(a)(i) Existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability	With mitigation measures employed the Project would not affect the amenity of use of the beach or foreshore. This would be managed through the use of appropriate exclusion barriers, signage and site supervision to be employed so that the Project area is controlled and that unauthorised vehicles and pedestrians are excluded from the works area.
(a)(ii) Overshadowing, wind funnelling and the loss of views from public places to foreshores (a)(iii) The visual amenity and scenic qualities of the coast, including coastal headlands	During construction, positioning of plant and equipment within view of nearby sensitive receivers and existing road users would result in minor, temporary visual impacts. During operation the potential loss of views from public places including the Golf Course and the beach are considered negligible. The existing WWTW is also clearly visible at relevant view points. The Project would require removal of some vegetation within the boundaries of the Project area (see Section 7.14.4). Some of this vegetation contributes to the amenity and character of the local area, and/or screens views from properties adjoining the road. The removal of this vegetation would have the potential to reduce some screening between sensitive receivers and the

Clause 13 and 14 requirement	Comment
	road. This would lead to temporary visual impacts during construction until the works are complete and disturbed areas rehabilitated. Potential visual impacts during construction and operation would be minimised through implementation of the safeguards and management measures outlined in Section 7.14.4. Operational visual impacts are minor and have been considered in Section 7.14.
(a)(iv) Aboriginal cultural heritage, practices and places	Impacts to Aboriginal cultural heritage would be minor and managed in accordance with an ACHMP for the Project.
(a)(v) Cultural and built environment heritage	Construction of the proposal would not impact on non-Aboriginal heritage items. There is potential for the works to impact unidentified heritage items; however, given the highly disturbed nature of the proposal site, it is considered unlikely.

Development consent must not be granted in a coastal use or coastal environment management area unless the responsible authority is satisfied that:

- The development is designed, sited and will be managed to avoid an adverse impact, or
- If that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
- If that impact cannot be minimised—the development will be managed to mitigate that impact.

For development within the coastal use area, the responsible authority has the additional requirement of taking into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development.

Despite the SEPP not applying due to the development being SSI (see Section 5.1.1), for diligence full environmental assessment, the application of the Coastal Management SEPP was considered when assessing the potential project impacts. The results of the detailed coastal process assessment are outlined in Section 7.4.

State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33: Hazardous and Offensive Development (SEPP 33) presents a systematic approach to the assessment of development projects for potentially hazardous and offensive industry or storage. Clause 12 states that a person who proposes to make a development application to carry out development for the purposes of a potentially hazardous industry must prepare a preliminary hazard analysis in accordance with the current circulars or guidelines published by the DPIE and submit the analysis with the development application.

As outlined above (See Section 5.1.3), EPIs only apply to SSI where the SEPP applies to the declaration of infrastructure as SSI. SEPP 33 does not apply as it is not for this purpose. However, as the Project fits the definition of a potentially hazardous industry, a preliminary hazard analysis has been carried out in order to fully assess all potential impacts of the Project. The results of this preliminary hazard analysis are presented in Section 7.8.

State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline by:

(a) Requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) Encouraging the identification of areas of core koala habitat, and

(c) Encouraging the inclusion of areas of core koala habitat in environment protection zones.

LMCC is listed as a local government area (LGA) under Schedule 1 to which SEPP 44 would ordinarily apply. However, it is acknowledged that in this instance, due to the development being SSI and the function of SEPP 44 relating only to the conservation of koala habitat, SEPP 44 does not apply (See Section 5.1.3). Nevertheless, the impacts to Koala Habitat have been considered in the biodiversity assessment for the Project, which is addressed in Section 7.3.

State Environmental Planning Policy No 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) provides for a state-wide planning approach to the remediation of contaminated land. In particular, SEPP 55 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.

Although SEPP 55 does not apply, the management of contaminated land and the suitability of the site for the Project is addressed in Section 7.1.4.

Lake Macquarie Local Environmental Plan 2014

The Project is within the Lake Macquarie LGA. The *Lake Macquarie Local Environmental Plan 2014* (Lake Macquarie LEP) is the relevant LEP for this LGA. The Project is within two different land use zones under the LEP. The land use zones within which the Project (refer to Figure 3-1) would be located are identified in Table 5-5 along with the consistency of the Project with each zone's objective and permissibility.

Table 5-5- Objectives of LEP Zone (Lake Macquarie LEP 2014)

Zone	Objectives	Consistency against Objectives and permissibility
SP2	• To provide for infrastructure and related uses. • To prevent development that is not compatible with or that may detract from the provision of infrastructure. To provide land required for the development or expansion of major health, education and community facilities.	Water supply infrastructure is consistent with the objectives of the SP2 zone While water supply infrastructure is not generally consistent with the objectives of the E2zone, the Project would be primarily located below ground within this zone and in an area with other pre-existing infrastructure. With the implementation of mitigation measures provided in this EIS, the
E2 – Environmental Conservation	• To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. • To prevent development that could destroy, damage or otherwise have an adverse effect on those values.	

Zone	Objectives	Consistency against Objectives and permissibility
	• To conserve, enhance and manage corridors to facilitate species movement, dispersal and interchange of genetic material. • To encourage activities that meet conservation objectives. • To enhance and manage areas affected by coastal processes.	Project is not expected to be incompatible with the objectives of the zone.

As the Project is permitted without consent under the Infrastructure SEPP and SEPP SRD, the consent requirements of the LEP do not apply.

5.1.4 Other environmental plans

5.1.4.1 Lake Macquarie Development Control Plan 2014

The *Lake Macquarie Development Control Plan 2014* (Lake Macquarie DCP) supports the prescriptions in the Lake Macquarie LEP. The Lake Macquarie DCP provides clear objectives and controls for undertaking development within the Lake Macquarie LGA, including consideration of impacts in the following zones:

- Industrial, Business Park and Infrastructure Zones (Part 5)
- Environment Protection Zones (Part 7)

The requirements in relation to these aspects have been considered in Appendix C; however, in accordance with Section 5.22 of the EP&A Act environmental planning instruments do not apply to or in respect of SSI except where they apply to the declaration of infrastructure as SSI.

5.2 Commonwealth legislation

5.2.1 Environment Protection and Biodiversity Conservation Act 1999

The primary objectives of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to provide for the protection of the environment, especially those aspects of the environment that are matters of environmental significance. Under the EPBC Act, actions that have, or are likely to have a significant impact on a matter of national environmental significance or the environment of Commonwealth land require approval from the Minister of the Department of the Environment and Energy (DotEE). The Minister determines if assessment and approval is required under the EPBC Act.

The Project is unlikely to have a significant impact on matters of national environmental significance (MNES) or the environment of Commonwealth land, as summarised in Table 5-6. Accordingly, the Project has not been referred to DotEE. Potential impacts from the Project on matters of national environmental significance are discussed further in Sections 7.3, 7.4, 7.9 and 7.10.

Table 5-6 Assessed EPBC Act protected matters

Protected matter	Matters assessed (terrestrial and aquatic)	Matters assessed (marine)	Potential impact
World Heritage Properties	No World Heritage properties within the search radius (the Project with a 10 km buffer).	No World Heritage properties within the search radius (the Project with a 10 km buffer).	None
National Heritage Places	No National Heritage places within the search radius.	No National Heritage places within the search radius.	None

Protected matter	Matters assessed (terrestrial and aquatic)	Matters assessed (marine)	Potential impact
Wetlands of international significance (Ramsar sites)	The Hunter Estuary Wetlands: More than 15 km from the Project area. With the mitigation measures provided in Section 7.3, an impact on the Ramsar site is not anticipated.	The Hunter Estuary Wetlands: More than 15 km from the Project area. With the mitigation measures provided in in Section 7.4, an impact on the Ramsar site is not anticipated.	None
Threatened ecological communities	Two threatened terrestrial ecological communities identified within 10 km of the Project area. No threatened ecological communities were identified within the Project area. The nature and significance of indirect impacts of the Project on threatened ecological communities is outlined in Section 7.3.	One marine threatened ecological community identified within 10 km of the Project area (i.e. seagrass meadows). No threatened ecological communities were identified within the Project area.	None
Threatened species	Assessment of potential impacts on 46 terrestrial threatened species is outlined in Section 7.3.	Assessment of potential impacts on 15 marine species and 33 bird species is outlined in Section 7.4.	Unlikely
Listed migratory species	Assessment of potential impacts on 24 listed wetland and terrestrial migratory species is outlined in Section 7.3.	Assessment of potential impacts on 40 migratory marine species is outlined in Section 7.4.	Unlikely
Commonwealth Marine Areas	Not applicable	The Exclusive Economic Zone (EEZ) and Territorial Sea Commonwealth Marine Areas are located within the search radius, approximately 6 km from the Project area. The Project would involve discharge of brine via the Belmont WWTW outfall, approximately 4.5 km from the Commonwealth Marine Area. With the mitigation measures provided in this EIS, an impact on the Commonwealth Marine Area is not anticipated.	None
Great Barrier Reef Marine Park	Not applicable	None - The Great Barrier Reef Marine Park is outside the search radius.	None
Commonwealth land	7 Commonwealth properties within 10 kilometres- The Project would not directly or indirectly impact any Commonwealth land, with a second EPBC search indicating none of the Commonwealth properties are located within 1 km of the Project.	7 Commonwealth properties - The Project would not directly or indirectly impact any Commonwealth land.	None

5.2.2 Native Title Act 1993

The *Native Title Act 1993* (Native Title Act) recognises and protects native title and provides that native title cannot be extinguished contrary to the Act. The main objects of the Native Title Act are:

a) to provide for the recognition and protection of native title; and
b) to establish ways in which future dealings affecting native title may proceed and to set standards for those dealings; and
c) to establish a mechanism for determining claims to native title; and
d) to provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.

The Native Title Act covers actions affecting native title and the process for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims, the Register of Indigenous Land Use Agreements, and the National Native Title Register.

A search of the National Native Title Tribunal Spatial Data (National Native Title Tribunal, 2019) mapping indicated that the Project area is not subject to Native Title claim or indigenous land use agreement under the Native Title Act.

5.3 Approvals

5.3.1 Approvals that cannot be refused for approved SSI

Section 5.24 of the EP&A Act outlines a number of specific approvals which, so long as they are necessary for and consistent with the SSI approval, cannot be refused by the relevant authority. Of these approvals which are outlined in Section 5.24 of the EP&A Act, the Project requires the approvals outlined in Table 5-7 below.

Table 5-7 Approvals that cannot be refused for approved SSI under Section 5.24 of the EP&A Act

Legislation	Approval required	Administering authority	When approval required
Protection of the Environment Operations Act 1997	Environment protection licence	EPA	Prior to any works commencing
Roads Act 1993	Section 138 permit	Roads and Maritime	Prior to any works commencing in a roadway

5.3.1.1 Protection of the Environment Operations Act 1997

The owner or occupier of premises engaged in scheduled activities as defined in Schedule 1 of the *Protection of the Environmental Operations Act 1997* (POEO Act) is required to hold an environment protection licence (EPL) and comply with the conditions of that licence.

The Project does not meet the definition of any scheduled activities under Schedule 1 of the POEO Act and therefore does not require a scheduled activity EPL. However, the Project would involve discharge of a number of wastewater streams via the existing Belmont WWTW outfall at various stages of the Project, including desalination brine during operation and saline water direct from the intake during commissioning. Hunter Water currently holds an EPL (licence number 1771) for the Lake Macquarie sewerage system, which includes Belmont WWTW outfall. Discharge of Project wastewater streams via the existing Belmont WWTW would potentially constitute a breach of Section 120 of the POEO Act.

Therefore, prior to construction either a new EPL could be obtained or EPL 1771 be modified to authorise the discharge of dewatered groundwater during construction and additional proposed discharges from the desalination plant to the Belmont WWTW outfall during operation.

Under Section 5.24(2)(c) of the EP&A Act, after the first review of an EPL Section 5.24(1)(e) of the EP&A Act no longer applies. While it is Hunter Water's intention to seek a modification to EPL 1771, should consultation with the EPA determine a modification would not be approved, a new EPL would be sought in accordance with Section 5.24(1)(e) of the EPA Act.

5.3.1.2 Roads Act 1993

The *Roads Act* 1993 (Roads Act) sets out the requirements for the management and use of public roads. Section 138 of the Roads Act requires that a person obtain the consent of the appropriate roads authority for the erection of a structure, or the carrying out of a work in, on or over a public road, or the digging up or disturbance of the surface of a public road.

The Project would require work to be undertaken within the road reserves of the Hudson Street and Marriot Street (for which LMCC is the roads authority). Therefore a Section 138 would be required from the traffic section of LMCC prior to works commencing.

5.3.2 Other required approvals

Legislative requirements specify additional approvals which are required for the Project. These required approvals are outlined below in Table 5-8.

Table 5-8 Summary of additional approvals required

Legislation	Approval required	Administering authority	When approval required
Water Act 1912	Aquifer interference approval	DPIE – Natural Resources Access Regulator	Prior to any works commencing
Water Management Act 2000	Water Access Licence	WaterNSW	Prior to any works commencing

5.3.2.1 Water Act 1912

The *Water Act 1912* (Water Act) facilitates development and use of water by controlling the extraction of water, the use of water, and the carrying out of activities in or near water sources in NSW. Part 5 of the Water Act applies to water supply work or aquifer interference approvals within the meaning of the Act.

Groundwater dewatering would be required during construction of the Project (see Appendix D). A licence from DPIE – Natural Resources Access Regulator for groundwater dewatering during construction would therefore be required.

5.3.2.2 Water Management Act 2000

The *Water Act 1912* has historically been the main legislation for managing water resources in NSW, however is currently being progressively phased out and replaced by water sharing plans (WSPs) under the *Water Management Act 2000* (WM Act). Once a WSP commences, existing licences under the *Water Act 1912* are converted to Water Access Licences (WALs) and to water supply works and use approvals under the WM Act.

A WAL entitles its holder to specified shares in the available water within a specified water management area or from a specified water source. It allows the licence holder to take water at specified times, at specified rates or in specified circumstances, and in specified areas or from specified locations. WSPs define the rules for sharing the water resources of each regulated river valley, between consumptive users and the environment.

The WSP relevant to the Project is the North Coast Coastal Sands Water Sharing Plan (NCCS WSP), which commenced in July 2016. The Project is located within the Hawkesbury to Hunter Coastal Sands Groundwater Source, which is managed under this plan.

At the time of plan commencement, total entitlement within the Hawkesbury to Hunter Coastal Sands Groundwater Source was 7,680 ML/year, comprised of 1,325 ML/year town water supply, 25 ML/year basic landholder rights and 6,355 ML/year for other aquifer access. Unassigned water was 12,740 ML/year, based on the Long-Term Average Annual Extraction Limit (LTAAEL). Since this exceeds the predicted groundwater take for the Project (both three and five arm scenarios), it is considered that there is sufficient groundwater available within the water source to enable Hunter Water to obtain a Water Access Licence for the Project.

Relevant rules for water supply works approvals for this groundwater source are as follows:

- No water supply work (bores) to be granted or amended within 200 m of an existing bore that is not used for basic rights, 50 m of an existing bore that is used for basic rights, 50 m of the boundary of the property and 300 m of a local or major water utility bore.
- No water supply work (bores) to be granted or amended within 250 m of a plume associated with a contamination source as identified in the plan.
- No water supply work (bores) to be granted or amended within 800 m of a high priority GDE for bores licensed to extract more than 100 ML/year.

The proposed locations of the intakes comply with all rules with the exception of the requirement to be at least 800 m of the high priority GDE for bores licensed to extract more than 100 ML/year. However, since there is no drawdown predicted at the high priority GDE, it is considered that the Water Sharing Plan requirement that the water supply works be located at least 800 m away does not apply.

5.3.3 Approvals that are not required

A summary of State environmental and planning legislation potentially relevant to the Project are addressed in Table 5-9.

Under Section 5.23 of the EP&A Act, if a SSI application is approved under Division 5.2 of Part 5 of the EP&A Act, the following authorisations, which may otherwise have applied, would not be required to carry out the Project:

- A permit under section 201, 205 and/or 219 of the *Fisheries Management Act 1994* (FM Act)
- An approval under Part 4, or an excavation permit under section 139 of *the Heritage Act 1977* (Heritage Act)
- An Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 2000* (NPW Act)
- A bushfire safety authority under section 100B of the *Rural Fires Act 1997* (Rural Fires Act)
- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000* (WM Act)

Table 5-9 Other NSW legislation of potential relevance to the Project

Planning provisions	Comments	Further approval required?
Coal Mine Subsidence Compensation Act 2017 (CMSC Act)	The CMSC Act recently replaced the *Mine Subsidence Compensation Act 1961*. Under section 22 of the *Coal Mine Subsidence Compensation Act 2017,* approval is required to alter or erect improvements within a mine subsidence district. Review of the Subsidence Advisory. Review of the Subsidence Advisory NSW mapping indicates that the Project is outside mapped mine subsidence areas. Therefore, approval of Subsidence Advisory NSW is not required for the Project. However, as investigations have shown that the Project area was undermined as discussed in Section 7.1.2.6, further consultation with Subsidence Advisory NSW will be undertaken.	No
Biodiversity Conservation Act 2016 (BC Act)	The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future. The BC Act lists threatened species, populations and ecological communities as well as critical habitat and key threatening processes that must be considered when assessing the effects of an activity. The BC Act outlines the factors to be considered when making an assessment. Section 7.9 of the BC Act provides that a Biodiversity Development Assessment Report (BDAR) must accompany any application for approval of SSI unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values. A BDAR has been prepared for the Project (Appendix E), the results of which are further discussed in Section 7.3.	No
Biosecurity Act 2015 (Biosecurity Act)	The *Biosecurity* Act provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers. The Hunter Regional Weeds Committee has developed the *Hunter Regional Strategic Weed Management Plan 2017-22* to focus on managing weed biosecurity in the area. Six species listed as priority weeds in Appendix 1 were recorded within the Project area as follows: • Asparagus Fern (*Asparagus aethiopicus*) • Bitou Bush (*Chrysanthemoides monilifera subsp. rotundata*) • Coolatai Grass (*Hyparrhenia hirta*) • Lantana (*Lantana camara*) • Prickly Pear (*Opuntia stricta*) • Fireweed (*Senecio madagascariensis*) Mitigation measures to control the spread of priority weeds are discussed in Section 7.3.	No
FM Act	As above, approvals under Section 201, 205 and/or 219 of the FM Act are not required in accordance with Section 5.23 of the EP&A Act. A Species Impact Statement is required if there is likely to be a significant impact on a threatened species, population or ecological community or its habitat. As described in Sections 7.3 and 7.4 a significant impact on a threatened species, population or ecological community as listed under the FM act is not predicted. Therefore, the FM Act is not triggered and is not considered further.	No

Planning provisions	Comments	Further approval required?
	As the proposal does not include dredging and reclamation work on water land, as defined in Section 198A of the FM Act, a notification under Section 199 of the FM Act is not required for the Project.	
Heritage Act	The Heritage Act aims to ensure that the heritage of NSW is adequately identified and conserved. The Heritage Act provides protection to items such as places, buildings, works, relics, moveable objects, precincts or land that have been identified, assessed and listed on the State Heritage Register. A historic heritage assessment was completed for the Project, which determined that no sites or objects of heritage significance that would be impacted by the Project (see Section 7.10 and Appendix F). No further approval is required.	No
NPW Act	The NPW Act aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. Under clause 5.23 (1)(d) of the EP&A Act, an Aboriginal heritage impact permit under section 90 of the NPW Act is not required for approved SSI development. However, an Aboriginal Cultural Heritage Assessment (ACHA) was carried out of the study area by an Aboriginal heritage consultant (Appendix G), with findings provided in Section 7.9.	No
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act establishes a process for investigating and (where appropriate) remediating land that is considered to be contaminated. A contamination assessment has been completed for the Project (Appendix H), the results of which indicate that notification under the CLM Act is not required. Potential impacts associated with contamination, and mitigation measures are further addressed in Section 7.1.	No
WM Act	In accordance with Section 5.23 of the EP&A Act, section 89, 90 and 91 approvals under Part 3 of the WM Act do not apply to the Project. Under Part 2 of the WM Act, a water access licence (WAL) is required to take shares in the available water from the relevant water sharing plan (WSP). Licence requirements and WSPs relevant to the Project are addressed in Section 5.3.2.	No
Hunter Water Act 1991 (HW Act)	The HW Act aims to establish a State owned corporation in relation to the supply of water, the provision of sewerage and drainage services and the disposal of wastewater in the Hunter region and certain other matters and to provide for the transfer of assets, rights and liabilities of the Hunter Water Board. Hunter Water's operations are regulated by the NSW Government on behalf of the community and the primary functions are established in the HW Act and the current Operating Licence. This Project would be operated in accordance with the requirements of the HW Act.	No
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	The WARR Act promotes waste avoidance and resource recovery to achieve a continual reduction in waste generation. The Act provides for the development of a state-wide Waste Strategy and introduces a scheme to promote extended producer responsibility for the life-cycle of a product. Potential impacts associated with waste, and mitigation measures are further addressed in Section 7.13.3.	No
Pipelines Act 1967	Section 11 of the *Pipelines Act* outlines licensing requirements for pipelines. Under section 11, a licence is required to:	No

Planning provisions	Comments	Further approval required?
(Pipelines Act)	• Commence, or continue, the construction of a pipeline; • Alter or reconstruct a pipeline; or • Operate a pipeline. However, as noted in Section 5 of the *Pipelines Act 1967*, a licence is not required for the following purposes: *(b) a pipeline constructed or to be constructed by a public authority,* *(d) a pipeline constructed or to be constructed for the purpose of the supply of water (including for irrigation), the drainage of land or the conveyance of waste water, mine water, aqueous slurries of minerals, mineral concentrates or mineral tailings,* The pipelines within the desalination plant for the proposal would be constructed by Hunter Water, a public authority, and would be integrated with the existing Belmont WWTW. Furthermore, Clause 5(1)(c) of the *Pipelines Act 1967* states a licence is not required for: *a pipeline constructed or to be constructed on land used for residential, business, commercial or industrial purposes, designed for use solely for the residential, business, commercial or industrial purposes carried out on that land and situated wholly within the boundaries of that land,* Therefore, a licence under the *Pipelines Act 1967* is not required.	

5.4 Relevant strategic policies

There are a number of state and regional plans that apply to the Project. While these plans do not constitute a legal requirement, they are important to consider to ensure that the Project is aligned with the local, regional and state planning strategies. A summary of some of the key planning strategies that apply to the Project are provided in the following sub-sections.

5.4.1 NSW aquifer interference policy

The *NSW Aquifer Interference Policy* (Department of Trade and Investment (DTI) 2012) outlines the water licencing and approval requirements for aquifer interference activities in NSW. Many aspects of this policy were given legal effect through the *Water Management (General) Amendment (Aquifer Interference) Regulation 2011* (Aquifer Interference Regulation). The Aquifer Interference Regulation commenced on 30 June 2011.

The *NSW Aquifer Interference Policy* also outlines the water licensing requirements under the WM Act. A water access licence is required whether water is taken for consumptive use or whether it is taken incidentally by an aquifer interference activity (such as groundwater inflows into cuttings). The water access licence must hold sufficient share component and water allocation to account for the take of water from the relevant water source at all times.

The policy requires that potential impacts on groundwater sources, including their users and groundwater dependant ecosystems (GDEs), be assessed against the minimal impact considerations outlined in the policy The Project was subject to a groundwater assessment which addressed the requirements of the *NSW Aquifer Interference Policy* including the minimal impact criteria (see Appendix D).

In addition, potential impacts on GDEs, landholder rights and existing registered bores are assessed in Appendix D.

As discussed in Table 5-8, the Project would require an aquifer interference approval under section 91 of the WM Act.

5.4.2 Lower Hunter Water Plan

The LHWP (Metropolitan Water Directorate, 2014) outlines how the Lower Hunter region would respond to drought using an integrated approach to water management. The LHWP sets out the mix of supply and demand measures that will:

- Provide water security during drought
- Ensure reliable water supplies to meet growing water demand due to a growing population and increased business and industry activity
- Help protect aquatic ecosystems
- Maximise net benefits to the community

The LHWP identified that the region's existing water supply sources are secure and reliable during normal weather conditions, but are very susceptible to rapid depletion during a prolonged or extreme drought. To guard against potential future droughts, the LHWP outlines a series of water supply, management and efficiency measures to be implemented in stages, if required to slow the depletion of storages.

As part of investigations for the LHWP, baseload desalination (capable of supplying baseload water demand i.e. a supply that can satisfy a large percentage of Hunter Water's daily potable water network demands) was investigated as an option for emergency drought response. The investigation concluded that lead in times (time required to plan, design seek approvals and construct) for baseload desalination were too long to be considered since water storage levels for the lower Hunter can deplete rapidly in the event of an extreme drought. Small scale temporary desalination was preferred and subsequently included in the LHWP due to its lower lead in time and the ability to either rent or sell/re-use the desalination plants when they are no longer required.

Desalination can reduce the Lower Hunter region's reliance on rain-fed dams in the event of severe drought. Use of modular desalination units, installed as late as possible if and when needed, is a key requirement in diversifying the Lower Hunter's water supply sources, and reducing the risk of running out of water in an extreme drought. Desalination is intended to be used in conjunction with other staged drought response measures that would already be in place for an extreme drought including water transfers from the Central Coast, developing new groundwater resources, demand management programs (including Water Wise rules) and water/stormwater re-use schemes.

The Project is strategically aligned with the LHWP and, during a drought, would contribute to the supply measures outlined the LHWP by allowing for a quick response to provide water security during a drought. The Project would directly respond through the supply measure of temporary desalination. By planning for the project in advance of a drought, the Project can be built quickly if and when needed and can be removed when no longer needed.

5.4.3 Hunter Regional Plan 2036

The *Hunter Regional Plan 2036* (HRP) (DPE, 2012) was prepared by the NSW Department of Planning and Environment in 2012 to guide land use planning priorities and decisions toward 2036. The vision of the HRP is for the Hunter Region to be the leading regional economy in Australia with a vibrant new metropolitan city at its heart. The HRP includes 27 strategic directions and associated actions to guide land use. Lake Macquarie LGA, which the Project is located in, is subject to the HRP.

The Project would contribute to the following relevant strategic directions:

- Direction 15: Sustain water quality and security. Direction 15 includes the action to plan for the security of the region's town water supply.
- Direction 16: Increase resilience to hazards and climate change. Direction 16 identifies that climate change is likely to result in varying rainfall, higher temperatures and prolonged dry periods and drought and includes the action to manage the risk associated with climate change.

The Project would directly respond to these two actions from the HRP by increasing resilience to drought and planning for the future security of the region's water supply by providing a drought contingency measure that is not dependant on rainfall. The provision of a secure water supply is also closely linked to the ability of the HRP to meet the needs of projected population and jobs growth within the Hunter region.

5.4.4 NSW Premier's and State Priorities

In September 2015, the NSW Premier unveiled 12 personal priorities and 18 state priorities intended to set the agenda for the NSW Government Sector over the coming years with the stated aims of growing the economy, delivering infrastructure, protecting the vulnerable, and improving health, education and public services across NSW. The Premier's Priorities were updated in 2019.

The Project is relevant to a number of the Premier's Priorities and State Priorities, including:

- Premiers priorities:
  - Improving the health system – The Premier is targeting improving service levels in hospitals as well as in outpatient and community care. The project would help meet the water security needs of current and future patients to ensure facilities can continue to provide vital basic human necessities.
  - Better Environment – The Premier is targeting greener public spaces as well as greener cities, with quality open and green spaces as well as increasing tree canopy and green cover across Greater Sydney. The Project would contribute to ensuring water security is available to support the growth and maintenance of these green spaces.
- State priorities:
  - Stronger budget and economy: Boosting apprenticeships – This priority identifies the value of apprenticeships in building a skilled workforce. Infrastructure projects are identified as an important avenue for providing opportunities for on-the job training and the completion of apprenticeships. The desalination plant is an infrastructure project that would provide a range of trade jobs during construction that would contribute to the opportunities for the completion of apprenticeships.
  - Infrastructure: Increasing housing supply – This priority identifies the need for housing supply to increase to meet the needs of population growth across the state. The improved water security that would result from the Project would help to ensure that the water supply needs associated with increased housing and population in the Hunter are met.

5.4.5 NSW Coastal Planning Guideline: Adapting to Sea Level Rise (2010)

The *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (DoP, 2010) has been prepared to provide guidance on how sea level rise is to be considered in land use planning and development assessment in coastal NSW. The Guideline applies to all coastal areas of NSW and includes six coastal planning principles, which are addressed in Table 5-10.

Table 5-10 NSW Coastal Planning Principles

Coastal planning principles	Comment
1. Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks.	Coastal risks, including sea level rise have been assessed in Section 7.5.
2. Advise the public of coastal risks to ensure that informed land use planning and development decision-making can occur.	This principle emphasises the importance of providing the public with timely advice on coastal risks so that informed land use planning and development decision making occurs. This includes allowing for Council's coastal hazard and flood studies being made publicly available for the purpose of allowing the public to make planning and development decisions. The Lake Macquarie Coastal Zone Management Plan (CZMP) has informed the assessment of coastal process in this EIS (Section 7.5).
3. Avoid intensifying land use in coastal risk areas through appropriate strategic and land use planning.	The Project would not involve changes to strategic planning that would intensify land use. The Project was situated away from the coastal hazard lines, as described in Section 7.5.
4. Consider options to reduce land use intensity in coastal risk areas where feasible.	
5. Minimise the exposure to coastal risks from proposed development in coastal areas.	Mitigation measures to minimise exposure to coastal risks and implement appropriate management responses and adaptation strategies are provided in Section 7.5.
6. Implement appropriate management responses and adaptation strategies, with consideration for the environmental, social and economic impacts of each option.	

5.4.6 City of Lake Macquarie Environmental Sustainability Action Plan 2014-2023

The *City of Lake Macquarie Environmental Sustainability Action Plan 2014-2023* (LMCC, 2014) a framework for sustainability planning, decision-making and action, to achieve improved environmental sustainability for the City of Lake Macquarie. Water is listed as one of the priority areas of environmental sustainability for action under the Action Plan. This Action Plan also identifies the need to adapt to climate change and ensure preparedness against natural hazards and disasters. The Project would address these needs in providing a contingency measure for securing water supply during drought, with the frequency and duration of drought potentially increasing under climate change conditions.

6 Consultation

6.1 Introduction

GHD was engaged to undertake community and stakeholder engagement as part of the planning for the proposed drought response desalination plant at Belmont.

A Community and Stakeholder Engagement Plan (CSEP) was formulated to assist in the identification of key stakeholders and address key issues. Consultation with a range of government agencies and community stakeholders was incorporated into the strategy to inform the stakeholders of the Project and to allow any issues of concern to be raised at an early stage of the planning process for incorporation into the EIS. This aligns with Hunter Water's strategic aspirational goal of having full support from customers and community for decisions.

This chapter provides a description of the government and community consultation activities undertaken and outlines the key issues identified and where they are addressed in this document. This section also includes a description of the consultation activities that would continue throughout all stages of the Project.

6.2 Consultation strategy

Consultation and engagement activities for the Project built upon the engagement process used for preparation of the LHWP and aligned with Hunter Water's 2018 Customer and Community Engagement Plan.

Hunter Water made a commitment to conduct open and inclusive engagement and consultation with key stakeholders and the wider community.

The approved CSEP was used to manage communication and engagement activities for the project. Underpinning the key objectives was the aim to provide best practice consultation, including to:

- Demonstrate that all concerns and issues raised by stakeholders are considered in the development of the EIS and any associated planning documents.
- Implement an approach to stakeholder communications that is transparent and timely, and that is coordinated between Hunter Water and GHD.
- Keep accurate records of consultation with stakeholders.

Hunter Water plans to continue to consult with the community and key stakeholders as planning progresses.

6.3 Purpose and objectives

The overarching aim of the engagement process was to conduct meaningful engagement with all stakeholders. To do this, Hunter Water was required to do more than just inform the community and relevant key stakeholders that the project was underway.

Hunter Water actively engaged with government, businesses, community groups, residents and interested parties by seeking out opportunities to promote the project, opening effective lines of communication, publishing and updating project information online and in print and creating opportunities for stakeholders to learn, share and engage with the project.

By doing this, the objectives of the CSEP were met by:

- Initiating and maintaining open communication with relevant stakeholders and the community.

- Communicating the regulatory approval process to stakeholders and the community.
- Ensuring relevant stakeholders and the community are informed about the project and are given the opportunity to provide feedback.
- Providing stakeholders with relevant information to show their feedback has been considered as part of the planning process.
- Providing stakeholders with an opportunity to ask questions and to identify areas of concern with respect to the project.
- Effectively and proactively identify and manage stakeholder engagement issues.

6.4 Key stakeholders

Table 6-1 provides a summary of the key stakeholder groups and organisations consulted in relation to the Project and during the EIS preparation period.

Table 6-1 Key stakeholders

Stakeholder Group	Organisation/Stakeholder
NSW Government departments and agencies	DPIE
	Department of Industry (DoI) – Crown Lands and Water
	Department of Primary Industries (DPI) Fisheries
	Office of Environment, Energy and Science
	Environment Protection Authority (EPA)
	Roads and Maritime Service
	Local Land Services
	Lake Macquarie City Council
	Safework NSW
	NSW Health
	NSW Police
	Subsidence Advisory NSW
Local organisations	Ocean and Coastal Care – Lake Macquarie
	Newcastle Community Environment Network
Community interest groups	Belmont Wetlands State Park Trust
	Belmont and District Resident's Action Group
	Belmont Neighbourhood Watch Association
	Friends of Belmont Trust Landcare
	Lake Macquarie Sustainable Neighbourhood Alliance
	Belmont Golf Club
	Newcastle District 4WD Club
	Hunter 4x4 Club
NSW Police	Belmont Police Community Liaison Officer
Aboriginal	Bahtabah Local Aboriginal Land Council
	LMCC Liaison Officer
	Registered Aboriginal Parties (RAPs)
Service providers	Ausgrid
	Jemena Gas North
	NBN Co
	Optus and Uecomm
	Telstra.

6.5 Community consultation

Hunter Water announced the project and initiated consultation activities with a media release in November 2017. A project page was published on Hunter Water's website in February 2018, followed by a project page site on Hunter Water's *Your Voice* community engagement platform.

Since February 2018, Hunter Water has implemented a robust consultation plan including making direct contact with key stakeholders, face-to-face meetings, community presentations, events, door-knocking and direct letters.

A 24 hr community information line was open for all enquiries on 1800 066 243 and emails could be sent directly to tempdesal@hunterwater.com.au.

The project page on Hunter Water's *Your Voice* community engagement platform received around 1,500 visits between February 2018 and September 2019. Of this total, around 1,000 visitors were considered 'aware' participants (viewed at least one page) and around 400 visitors were considered 'informed' participants (viewed multiple pages, a video, photo or downloaded a document).

6.5.1 Residents and community

Hunter Water undertook a door-knock and letterbox drop to residents and businesses in Belmont South on 8 August 2018, in proximity to the Project area to inform them of the Project, invite them to view the project details on Your Voice or provide any feedback.

Flyers were delivered to homes in Beach Street, Williams Street, Marriot St and McEwan St and to the Aquarius Motel, Lakeview Motor Inn, Squids Ink Motel, Gunyah Hotel and Lake Mac Game Fishing. Notices intended to inform them of the project, invite them to view the project details on Your Voice or provide any feedback.

Flyers were also delivered to all locations that sold 4WD permits for Nine Mile Beach along with a larger, laminated version of the flyer for display.

Flyers and posters were delivered to:

- Tackle Power (Charlestown)
- Metro Petroleum (Redhead)
- BRS off-Road (Redhead)
- Gateway Lifestyle Caravan village (Belmont)
- Belmont Wetlands State Park Trust
- Belmont Golf Club
- Aquarius Hotel (Belmont)
- Caltex (Swansea)
- Home Timber and Hardware (Swansea)

A copy of the flyer provided to residents and businesses is provided in Appendix I.

Hunter Water held information stalls at various events across the Lake Macquarie LGA, providing community members with project information and an opportunity to discuss the project directly with the project team. Information stalls were held at:

- SEEN @ Swansea Open Day, Swansea Library – 12 May 2018
- Eastlakes NAIDOC Family Fun Day – 20 July 2018
- Lake Macquarie Living Smart Festival – 22 September 2018

- Redhead Surf Club twilight markets – 7 December 2018
- Redhead Beach Australia Day clean-up – 1 February 2019
- Belmont Citi Shopping Centre – 21 February 2019

6.5.2 Aboriginal community

In accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a), the Aboriginal community has been engaged as part of the Aboriginal cultural heritage assessment (ACHA), which is discussed further in Section 7.9.

In addition to the OEH requirements, Hunter Water made a concerted effort to engage with Bahtabah Local Aboriginal Land Council (Bahtabah LALC) and LMCC during the initial stages of consultation, before the EIS commenced.

Hunter Water met with the LMCC Aboriginal Liaison Officer, who in turn provided an introduction to the new Bahtabah LALC CEO.

The Project Team met with Bahtabah CEO and the Conservation and Land Management Supervisor on 9 May 2018 and provided an overview and the formal engagement for Registered Aboriginal Parties (RAPs) as part of the EIS.

Hunter Water also sponsored a stall at the 2018 Pelican NAIDOC Week Family Day on 20 July 2018 and spoke directly to community members about the Project and provided an opportunity for feedback direct to the project team.

6.5.3 Interest groups

Initial contact was made with interest groups via phone and email with an offer to provide a face-to-face briefing on the Project. A letter was sent to interest groups in August 2018. A copy of this letter is provided in Appendix I.

Individual briefings and presentations to provide Project detail and gather feedback were held with a number of community interest groups including:

- Belmont Wetlands State Park Trust and Friends of Belmont Wetlands – 3 April 2018 and 1 February 2019
- Belmont and District Residents Action Group – 13 April 2018 and 13 June 2018
- Belmont Neighbourhood Watch – 16 April 2018
- Lake Macquarie Sustainable Neighbourhood Alliance – 16 October 2018
- Belmont CWA – 16 July 2019

Follow-up emails and letters were sent to Belmont Surf Life Saving Club with no response but Hunter Water did attend the Redhead Surf Club Twilight Markets in December 2018, sponsoring a community stall. The Project team spoke to attendees about the project, invited feedback and sign-up to Your Voice.

6.5.4 Additional stakeholders

Contact was made with additional identified stakeholders listed in Table 6-1 via phone and email and a letter distributed in August 2018 notifying all of the EIS process and investigation works taking place on site. The purpose of this additional engagement was to capture a wide range of stakeholders across the Belmont community who may have some interest in the project now or at a later stage. Letters were sent to Ocean and Coastal Care – Lake Macquarie, and the Newcastle Community Environment Network to provide them with information on the project and allow opportunity for feedback.

A meeting was held with the Belmont Police Community Liaison Officer on 20 September 2018 to discuss the Project with a specific focus on safety and security in and around the project site. Hunter Water provided detail about the security measures (signage and bollards) that would be used during the investigations and offered to provide information on security measures for any future work.

A copy of the letters are provided at Appendix I.

In addition, Notice of Entry correspondence has occurred since commencement of the EIS to request access to a number of properties for survey purposes, including noise assessments. The letter issued to property owners is provided in Appendix I.

6.6 Key Issues

Two key themes were identified throughout the consultation process including:

- The cost of building the desalination plant and costs to consumers
- Environmental impacts.

Other issues that were raised include noise and traffic generated by construction activity, and cultural and historical concerns.

A summary of the issues and questions raised by stakeholders during consultation is provided below in Table 6-2.

Table 6-2 Key stakeholder issues

Stakeholder	Summary of Issues	Response
Belmont Wetlands State Park Trust and Friends of Belmont Wetlands	Ongoing discussions with Belmont Police regarding safety and security in the Park, adjacent to the WWTW.	Hunter Water engaged with Belmont Police and is having ongoing discussions with the WWTW operator regarding safety and security.
	How will it be powered? How much electricity will be used?	The desalination plant would use 34,500 MWh per year. Section 4.1.4 describes how it would be powered.
	Why temporary? Does it have to be sold off?	The LHWP allowed for a temporary desalination plant with infrastructure to be sold off when no longer needed. Further discussion is provided in Section 2.4.
	Will it produce enough water?	Section Table 4-7
	Why not recycle water or rain water tanks?	The plant would only be built following a raft of water saving and drought response measures by Hunter Water. Desalination is the only rainfall independent source of water. Further discussion is provided in Sections 2.3 and 2.4.
Belmont & District Residents Action Group	What is the quality of water like?	The water will be produced in line with Australian Drinking Water Guidelines.
	Biggest issue is traffic and a solution to traffic (along the main roads) is a priority.	Section 7.11.3

Stakeholder	Summary of Issues	Response
Friends of Belmont Cemetery	Safety and security including trail bike riders, 4WD access, vandalism and dumping.	Hunter Water engaged with Belmont Police and is having ongoing discussions with the WWTW operator regarding safety and security. Hunter Water is having ongoing discussions with the LMCC Land Management Working Group for Nine Mile Beach regarding beach access.
	How would the plant affect sea life?	Section 7.4
	Noted there isn't much smell "these days" from the WWTW. Is there a smell generated from desalination?	Section 7.15
	Upgrade Beach St access	Section 7.11.3 Hunter Water is having ongoing discussions with the LMCC Land Management Working Group for Nine Mile Beach regarding beach access.
	Increase in noise?	Section 7.12
	Will it be operational 24 hours?	Section 4.5
	Will there be extra lights?	Section 7.14
	What will it cost to build? What will it cost us?	Section 4.7
	Is it energy efficient?	Section 2.7 and 7.16
Bahtabah LALC	Local sacred sites, some not mapped but very important locally.	Noted and agreed to engage with Bahtabah early when preparing EIS. ACHA prepared in accordance with SEARs and relevant guidelines (Appendix G).
	How will it affect sea life/marine ecology?	Section 7.4
	Dune erosion is an ongoing issue on Nine Mile Beach	Facilitate internal connection between Bahtabah and Hunter Water for the dune rejuvenation work. Potential erosion issues have been considered in Sections 7.1 and 7.2, with management measures summarised in Section 8.2.
	Ongoing engagement very important.	Noted and agreed. Bahtabah engaged early and often throughout the process, see Appendix G.
Belmont Golf Club	Safety and security an ongoing concern – damage to club greens	Hunter Water engaged with Belmont Police and is having ongoing discussions with the WWTW operator regarding safety and security.
	Beach access	Hunter Water is having ongoing discussions with the LMCC Land Management Working Group for Nine Mile Beach (which the Golf

Stakeholder	Summary of Issues	Response
		Club is part of) regarding beach access.
	Water usage/water share arrangements – how will the water be used?	It is intended that the water produced by the desalination plant will be used to supplement the water supply during severe drought.

6.6.1 Pulse Survey

At three separate events, community members were invited to answer a one-question survey. This Pulse Survey was designed to capture immediate reactions to the concept of desalination. Results were used to gauge support for a desalination plant in Belmont and track how communication and consultation activities were progressing.

Question: Do you support temporary desalination as the Hunter's insurance policy in case of severe drought?

Answers:

A – I support temporary desalination

B – I need more information

C – There are better options

There were 33 answers collected in total with the majority (24) selecting A – I support temporary desalination. Only 4 people said they need more information and, on all occasions, members of the project team were able to engage directly with respondents and answer any questions.

Table 6-3 Pulse survey results

Event	Answer A	Answer B	Answer C	Total Responses
Redhead Twilight Markets	13	2	4	19
Belmont City Centre Info Stall	5			5
Redhead Beach Clean Up	6	2	1	9
			Total responses collected	33

6.7 Government agency and stakeholder involvement

6.7.1 Agency consultation

Due to the type and scale of the Project, a number of NSW Government departments and agencies were consulted via letters advising them of the project objectives and preparation of the EIS and associated specialist reports (see Table 6-1).

NSW Government departments and agencies were invited to make comments on the Project within 21 days of receipt of the letters and a mailing address and email address were supplied. An example of the letter submitted to agencies is provided in Appendix I, this letter was issued to all relevant NSW Government departments and agencies (see Table 6-1). A summary of responses received is provided in Table 6-4.

Table 6-4 Agency consultation

Agency	Summary of Response	Where addressed in this report
Office of Environment and Heritage	OEH is satisfied that the SEARs adequately identify the key issues that are to be addressed in the EIS.	Appendix A
	The EIS is to be prepared under SEPP Coastal Management if the date of application for approval is greater than 12 months from the commencement of SEPP Coastal Management.	Section 5.1.3
NSW Police – Belmont LALC	There is a brand new Critical Infrastructure Resilience Strategy released 6 days ago, you may be interested in https://www.emergency.nsw.gov.au/criticalinfrastructure The other advice was to consult the Secure NSW website https://www.secure.nsw.gov.au/	Section 2 and 7.5
Hunter New England Health – NSW Health	Community consultation is key with this project given the siting of the Temporary Desalination Plant adjacent to the Belmont WWTW. There is potential for the community to not appreciate the area of source water harvesting and the multi barriers that will be in place to protect water quality and public health.	Sections 6.6 and 7.6
	Air quality impacts	Section 7.15
	Noise impacts	Section 7.12
	Impacts on water quality associated with inputting finished water into the reticulation from this plant.	Section 7.2
	Potential mosquito vector breeding and management associated with the development.	The Project would not result in any additional pools or ponding of water; therefore, potential impacts to mosquito vector breeding are not predicted.
	Health will also have a significant interest with respect to fluoridation of the supply and disinfection.	The commissioning process would be required to demonstrate that the water produced by the desalination plant meets the quality requirements of the Australian Drinking Water Guidelines (NHMRC, 2011). Furthermore, consultation with Hunter New England Health – NSW Health are ongoing and would continue, as relevant throughout detailed design, construction and operation.

Agency	Summary of Response	Where addressed in this report
Office of Environment & Heritage – Conservation and Regional Delivery, Hunter Central Coast Branch	The savings and transitional provisions of the new State Environmental Planning Policy (Coastal Management) 2018 (specifically clause 21 (3)) state that the former planning provisions (i.e. SEPP 14 – Coastal Wetlands and SEPP 71 – Coastal Protection) continue to apply to the proposal and the Coastal Management SEPP does not apply if the application for development consent is made within 12 months after the commencement of the Coastal Management SEPP (commenced 3 April 2018). As such, whether assessment of the development application is to be made against the now repealed SEPP 14 – Coastal Wetlands and SEPP 71 – Coastal Protection or the new Coastal Management SEPP (2018) will depend on the date of application for development consent.	Section 5.1.3
LMCC	Refer to Appendix J.	

LMCC provided a number of comments relating to the design and environmental assessment of the project via email on 15 October 2018. Hunter Water responded to Council's comments via letter on 24 January 2019. This correspondence is provided in full in Appendix J.

6.7.2 Service provider consultation

The following relevant service providers were consulted via letter and invited to make comments on the Project within 21 days of receipt of the letters:

- Ausgrid
- Jemena Gas North
- NBN Co
- Optus and Uecomm
- Telstra

Comments were received in response to the consultation letter in respect to the EIS from Ausgrid and are summarised in Table 6-5. All service providers have been further consulted with regarding the location of services within the project area. Potential interactions with services have been considered during development of the concept design. Additionally, as the Project includes connection to the Ausgrid network, meetings have been held with Ausgrid to inform the design of power supply aspects of the Project.

Table 6-5 Service provider response summary

Service Provider	Summary of Response	Where addressed in this report
Ausgrid	Application for Connection must be submitted to Ausgrid. Ausgrid requires that due consideration be given to the compatibility of proposed development with existing Ausgrid's infrastructure, particularly in relation to risks of electrocution, fire risks, Electric & Magnetic Fields (EMFs), noise, visual amenity and other matters that may impact on Ausgrid or the development.	Section 2.2.7
	An SER will be required for the works in accordance with NS174. The proposed alignment may intersect with land mapped as "proximity area for coastal wetlands". In that case	Section 2.2.7

Service Provider	Summary of Response	Where addressed in this report
	the works will need to clearly address clause 11 of SEPP Coastal Wetlands.	
	Power supply constraints in the area; In August 2018 Power Solutions Pty Ltd requested Ausgrid's Distribution Planning provide preliminary advice on the electrical supply requirements associated with the proposed desalination plant at Belmont. Ausgrid Contestability responded on 3/09/2018. Advising Pelican Zone Substation has sufficient spare capacity for the development load however the 11kV Feeder capacity is insufficient and would require augmentation. Power Solutions is considering options.	Section 2.2.7

6.8 Public exhibition of the EIS

The requirements for public exhibition of the EIS are for a minimum of 28 days, as outlined in Schedule 1, Part 1, Division 2 the EP&A Act. Hunter Water would publish a media release, e-newsletter update and website information to announce the exhibition of the EIS.

This EIS would be placed on public display at Hunter Water's head office on Honeysuckle Drive, Newcastle, and Government agencies, stakeholders and the community would be provided an opportunity to view the project detail and make submissions.

The Project Team would host two community drop-in sessions at a local community facility during the EIS exhibition period. The exact location, date and timing of the drop-in sessions would be confirmed closer to the date of exhibition, with the details to be made available on Hunter Water's website. The Project Team would be available to answer questions on the EIS and initial investigations, show concept designs and artist's impressions.

During the exhibition period, Hunter Water may be contacted via the following methods:

Phone: 1300 657 657 (Mon – Fri 8:00 am – 5:00 pm)

Phone: 1300 657 000 (Emergency 24/7)

Email: desal@hunterwater.com.au

Online: www.yourvoice.hunterwater.com.au/desal

Submissions received by the Secretary of the DPIE would be provided to Hunter Water. Hunter Water would prepare and submit a submissions report, which would:

- Summarise issues raised in submissions and respond to the issues raised.
- Provide any new information about the project in addition to that included in the EIS.
- Identify any changes to the project and the potential impact of those changes.

The Secretary of the DPIE would then provide an Assessment Report on the SSI Application to the Minister for Planning (or delegate), who would determine if approval would be granted and, if granted, any conditions to which the Project is subject.

6.9 Future consultation

Consultation and engagement would continue with public notification of the submission of the Environmental Impact Assessment and feedback channels would remain open.

Hunter Water would continue to provide project updates via http://www.yourvoice.hunterwater.com.au/desal, through media releases and via standard communication channels.

If the Project is approved, Hunter Water would continue to engage with the customers, the local community and all relevant stakeholders. During the construction and operation period, a complaints management protocol, inclusive of emergency contact phone number and email address would be developed and implemented.

7 Key issues

7.1 Soil, geology and contamination

This section describes the existing environment in relation to soils, geology and contamination and addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is summarised from the *Contamination Assessment* (GHD, 2019e) (Appendix H).

7.1.1 Methodology

7.1.1.1 Desktop review

A desktop review was carried out to inform the geotechnical (GHD, 2019b) and contamination (GHD, 2019e) investigations and characterise the existing soil, geology and environmental conditions, including a range of sources including:

- EPA record of notices and sites notified to the EPA under the *Contaminated Land Management Act* 1997 (CLM Act)
- *Protection of the Environment Operations Act 1997* (POEO) Environment Protection Licence (EPL) Register
- ASS Risk Map for Swansea (Department of Land and Water Conservation, 1997)
- Mine subsidence mapping
- Existing background documentation for the Project area, including Spoil investigation report for the Belmont WWTW (SKM, 2012), Phase 1 contamination review for the desalination plant site (AECOM, 2017c), Geotechnical investigation report for upgrade of Belmont WWTW (Robert Carr and Associates, 2002), and Preliminary Environmental Assessment for the desalination plant (AECOM, 2017d)

7.1.1.2 Site survey and investigation

Site surveys and investigations were completed to inform the concept design and EIS for the Project, including:

- A general inspection of the Project area to identify areas of potential contamination concern as well as geotechnical investigations.
- Geotechnical investigations inform the design between August and September 2018 (GHD, 2019b), comprising eight (BH101 – BH108) and six test pits (TP101 – TP106) (refer to Figure 7-1). Boreholes were drilled to a maximum depth of 22 m, with the exception of BH103, which was drilled to 41 m. The remaining boreholes were drilled to a maximum depth of 5 m, while test pits were excavated to a maximum depth of 3 m.
- Contamination sampling was conducted from various depths at BH101-BH104 and BH108 and six test pits target areas of potential soil disturbance and contamination. Analysis included pH; cation exchange capacity (CEC); asbestos; heavy metals; benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH). The analytical program is summarised in Table 4-2 of (Appendix H).

7.1.2 Existing environment

7.1.2.1 Geology

Reference is made to the Newcastle 1:100,000 scale Coalfields Regional Geology sheets (Department of Mineral Resources, 1995), the regional geological and coastal Quaternary geology maps ((Geological Survey of NSW, 2015) and (Geological Survey of NSW, 2016)). These maps indicate the Project area is underlain by medium to fine grained dune and marine sand that has been disturbed by fill and excavation works related to the construction of the Belmont WWTW and previous Defence activities.

7.1.2.2 Topography

Topographically the Project area is in a relatively low lying flat area, with elevation ranging from 2 m to 5 m Australian Height Datum (AHD). The surface has been modified to form evaporation ponds which are now decommissioned, including excavation below surrounding ground level within the ponds and build-up of the pond embankments, which vary in height between approximately 1.5 m – 3.0 m above surrounding ground level (Plate 7-1). To the north, the Belmont WWTW lies on top of a low rise, ranging from 4 m to 8 m AHD, and to the east are undulating sand dunes. Topographic contours are shown on Figure 7-1.

Plate 7-1 Embankments for disused evaporation ponds within desalination plant site

7.1.2.3 Soil landscapes and profile

Reference to the Gosford – Lake Macquarie soil landscape map (Department of Conservation and Land Management, 1993), identified that the project is underlain by the soil landscapes described in Table 7-1 and shown on Figure 7-1. The potential erosion hazard of each soil landscape was assessed in accordance with Figure 4.6 of the *Blue Book - Managing Urban Stormwater: Soils and Construction* (the Blue Book) (Landcom, 2004).

Table 7-1 Soil landscapes of the Project area

Landscape type	Location	Description	Limitations
Tuggerah	Western extent of the desalination plant site.	Gently undulating to rolling coastal dune fields. Local relief is up to 20 m and slope gradients are in the range of 1% to 10%. Soils include loose sands and are covered with heathland vegetation. Potential erosion hazard is low.	Wind erosion hazard, high permeability soils, localized flooding, high water table, strongly acid soil in places and the landscape coincides with a mine subsidence district.

Landscape type	Location	Description	Limitations
Narrabeen	Eastern extent of the desalination plant site.	Beaches and foredunes along the coast on mainland and barrier beaches exposed to ocean swell and salt-laden winds. Local relief is <10 m (beach plains) and <20 m (foredunes) and slope gradients are <3% for beach dunes and up to 45% for foredunes. Soils are Sands. Potential erosion hazard is high.	Severe wave erosion hazard, severe wind erosion hazard, extreme foundation hazard, non-cohesive highly permeable strongly alkaline saline soils of very low fertility.

Geotechnical investigations found that the subsurface profile within the Project area generally consisted of fill or topsoil comprising silty sand, sandy gravel and clay to depths of up to 1.3 m, overlying alluvial sand and silty sands. However, no fill was encountered overlying sand in boreholes BH103 and BH105 (refer to Figure 7-1) within the desalination plant site and clay was encountered underlying sand at a depth of 31 m at borehole BH103.

7.1.2.4 Acid sulphate soils

Reference to the Acid Sulphate Soil (ASS) Risk Map for Swansea (Department of Land and Water Conservation, 1997) indicates that the south western portion of the Project area is located in an area with a high probability of occurrence of ASS. The north eastern portion of the Project area is mapped as having a low probability of occurrence of ASS (Figure 7-2).

7.1.2.5 Contamination

No odours or staining was observed during the collection of soil samples. There were no other visual signs of contamination noted within the boreholes and test pits excavated during the assessment. However, coal fragments were noted within the overburden/side bank east of the track between Ocean Park Road and Kalaroo Road, outside the Project area. One potential asbestos containing material (ACM) fragment was noted on the surface between TP106 and GW103 (within the desalination plant site), with additional smaller fragments noted near GW108 (70 m west of the desalination plant site, outside of the construction footprint). Results of contamination testing by location are provided below.

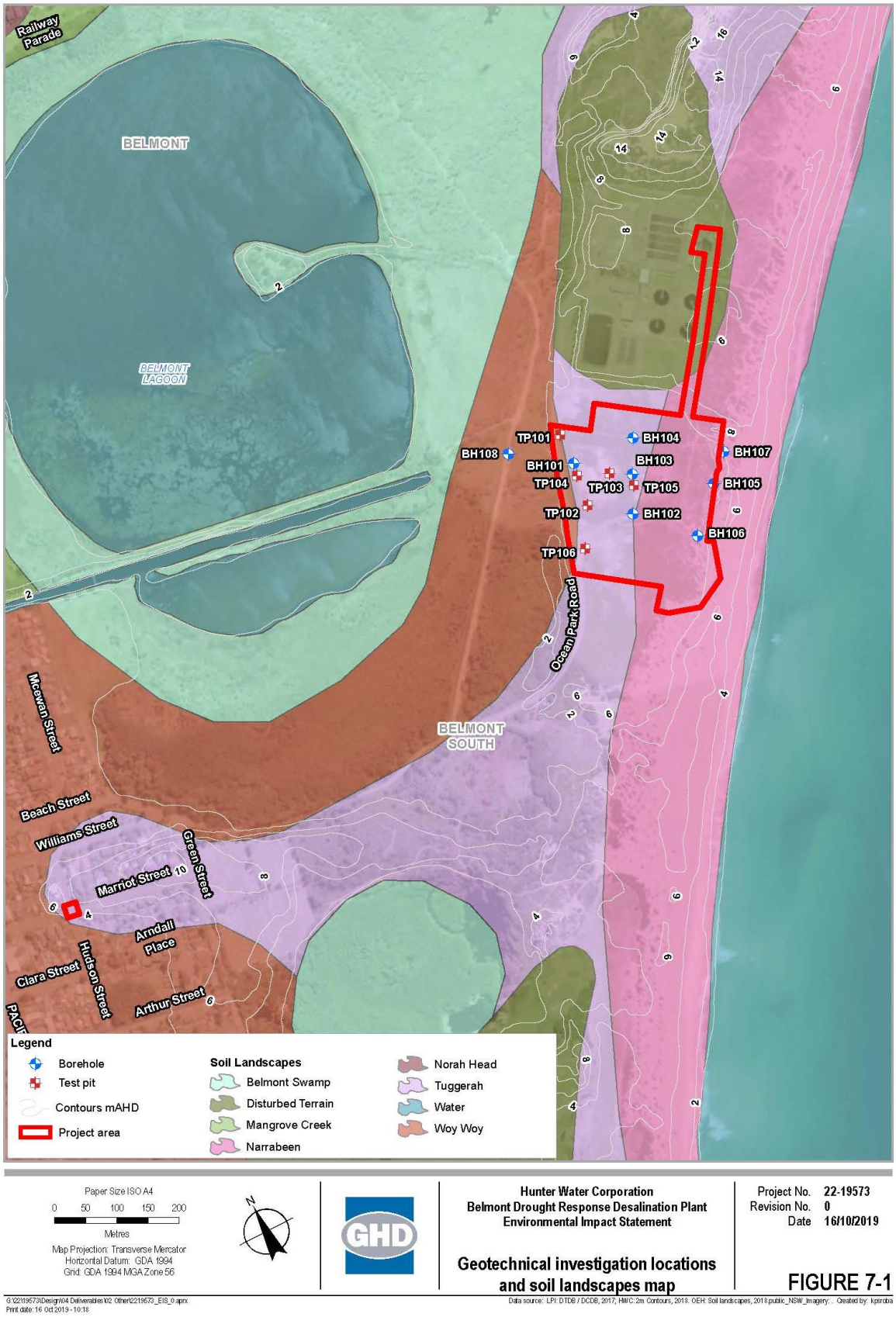

Figure 7-1 Geotechnical investigation locations and soil landscapes map

Desalination plant site

Concentrations of contaminants were below the adopted health assessment criteria for both recreational/open space and commercial/industrial land use for all samples analysed within the desalination plant site. Health assessment criteria was determined in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended by the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013*.

No asbestos was detected in soil samples analysed. However, one fragment of non-friable potential ACM was observed between TP106 and GW103 within the Project area and other small fragments of non-friable potential ACM were found on the surface near GW108 (70 m west of the Project area, outside the construction footprint). These fragments were bonded and given that there was no fibres identified in soils, the risk to workers is considered to be low and can be managed through an unexpected finds protocol in a contaminated soil management plan (CSMP).

With regards to ecological assessment criteria, concentrations of copper (194 mg/kg) and zinc (3,130 mg/kg) were above both recreational (copper: 95 mg/kg, zinc: 230 mg/kg) and commercial/industrial (copper: 140 mg/kg, zinc: 360 mg/kg) land use criteria at test pit TP106. The results are considered to be due to the presence of fill consisting of silty sand with gravel including asphalt, concrete, bricks and rock.

Concentrations of copper (120 mg/kg) and total recoverable hydrocarbons (600 mg/kg) in fill samples from borehole BH104 were above the ecological assessment criteria for urban residential land use (copper: 95 mg/kg, total recoverable hydrocarbons: 300 mg/kg). This was located on the northern boundary of the former evaporation ponds. Fill at this location was described as dark grey to brown silty sands and sands.

Concentrations of total recoverable hydrocarbons (420 mg/kg) were above the ecological assessment criteria for urban residential land use (300 mg/kg) at borehole BH102 south of the former evaporation ponds. Fill at this location was described as brown to grey sand with rootlets and trace plastic and wire.

Soils at the study area would generally be classified as General Solid Waste, with the exception of soils at TP106 and BHA304 which are currently classified as Restricted Solid Waste. These classifications may be reduced with further sampling and TCLP analysis. In addition, soils where either asbestos fragments or acid sulfate soils are identified would also be classified as either asbestos waste or acid sulfate soil waste. It is noted that these classifications are preliminary only and further sampling and analysis would be required prior to disposal off site.

Power connection

An assessment of contamination within the indicative power connection area has not been undertaken; however, the potential significant contamination is considered to be low given its location within the residential area and based on the results to date completed within other portions of the residential area. Potential contamination may be associated fill or road base used in the construction of the road.

7.1.2.6 Mining

The Lake Macquarie Mine Subsidence District is located north of Belmont Swamp and west of the Fernleigh Track, including the residential areas of Jewells, more than 900 m north-west of the Project area. However, an initial review of publicly available data as part of the geotechnical assessment identified mine workings underlying the site (GHD, 2019b).

The review found that while the Project area is not within a mine subsidence district, underground mine workings of John Darling Colliery do underlay the Project area, (Kapp, William Arthur, 1984). Underground workings are within the Victoria Tunnel Seam (understood to be approximately 200 m below the existing surface of the Project area) and the deeper Borehole Seam. Mining of these seams was completed in the late 1980s and there are no current exploration or mining leases within the Project area.

7.1.2.7 Unexploded Ordinance

During World War Two the coastal area immediately east of Belmont was used as a field firing range and training area by Newcastle garrison units. The desktop review identified that the land directly to the north of the Belmont WWTW was a former Defence military area which is classified as having a slight potential for residual unexploded ordinance (UXO) (see Figure 1. Appendix A of Appendix H). This area however, is outside the Project area and would not be impacted by the Project.

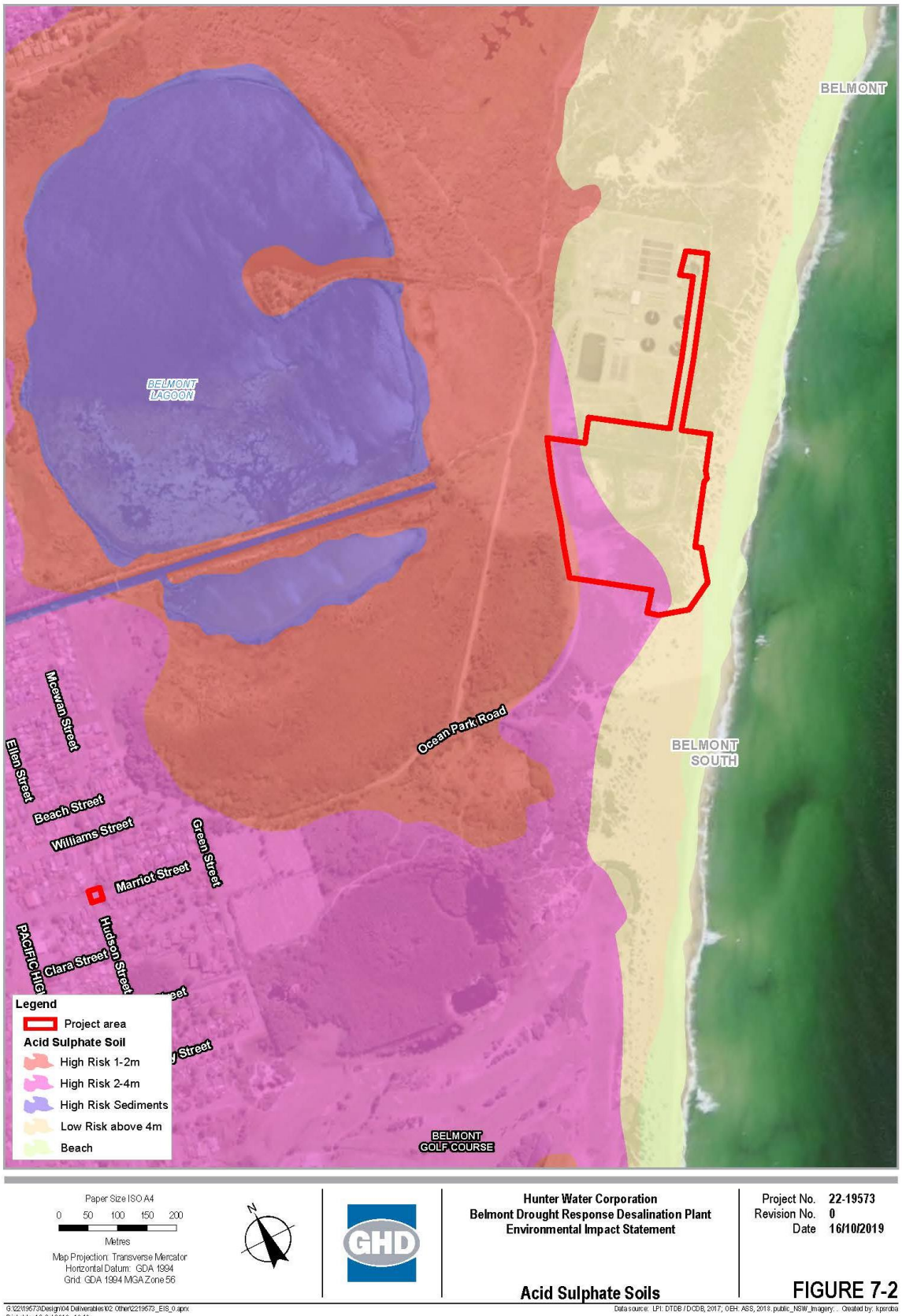

Figure 7-2 Acid Sulphate Soils

7.1.3 Potential impacts

7.1.3.1 Construction

Acid sulphate soils

As discussed in Section 7.1.2, areas of the Project area are mapped as having low and high probability of occurrence of ASS (see Figure 7-2). Disturbance of potential ASS during construction could lead to the production of acid sulphate leachate due to the iron sulphides contained within ASS reacting with oxygen to create sulphuric acid. In addition, the acid can cause metals such as iron and aluminium in the soil to be more soluble and therefore be released in toxic amounts (NSW OEH, 2017). Due to the relatively close proximity of some areas of construction to drainage lines and coastal wetlands, acid leachate and toxic metals could be released into waterways with associated impacts. The acid and heavy metals can have damaging effects on the receiving environment, including reducing survival and growth rates for aquatic flora and fauna, corrosion of materials and health impacts to humans and animals from toxic water and dust. However, the effects this would have on the environment are governed by the volume of disturbance and the connection of acidic leachate with natural water bodies.

The Acid Sulphate Soil Management Advisory Committee (ASSMAC) Assessment Guidelines defines “action criteria” triggering the need for an Acid Sulphate Soil Management Plan (ASSMP) for projects based on the quantity and texture of materials to be disturbed. For projects that would disturb more than 1000 tonnes of coarse material (such as sand), action criteria are 0.03 per cent oxidisable sulphur or a Total Potential Acidity of 18 H^+/tonne.

As the probability of occurrence mapping for ASS within the Project area is variable (see Figure 7-2) , the requirement for an Acid Sulphate Soil Management Plan (ASSMP) has not been established and would be confirmed during detailed design.

Contamination

The results of the baseline survey investigations indicate that soils within the Project area are unlikely to present a significant health risk to workers during construction, or future site users post construction. However, concentrations of copper, zinc, total recoverable hydrocarbons and benzo(a)pyrene were reported above the ecological assessment criteria in five locations across the project area. The concentrations of contaminants are most likely attributable to the presence of fill materials and proximity of the samples to either the former WWTW sludge ponds or being adjacent to roadways. The elevated levels of these contaminants could present a potential environmental risk to nearby sensitive receptors such as bushland and waterways if not managed appropriately during construction. One potential asbestos containing material (ACM) fragment was noted on the surface within the Project area (between TP106 and GW103), with additional smaller fragments noted 70 m west of the Project area. These fragments were bonded and no fibres were identified in soils. As a result these are considered to present a low risk to workers.

During construction, there would be a requirement for a number of fuel-powered vehicles and equipment as well as some chemicals and lubricants. There is potential for accidental spillage or leaks of hydrocarbons or chemicals during works or from any stored hazardous materials in the compound areas. While this would present a negative impact, the volumes of potential spillages would be relatively minor so would not be anticipated to result in a significant impact. However, mitigation measures including the preparation of an incident emergency spill plan would be developed and implemented before any construction commences.

Potential exists for undetected contaminated soils, wastes or hazardous building materials to be identified during construction. In particular, there is a potential for unidentified contaminated materials to be present under areas of the site not investigated or in any fill materials that may

be present on site. In the event of discovering any unexpected contamination, unexpected finds protocols would be included in the Contaminated Soil Management Plan (CSMP) to include demolition waste, contaminated fill, and potential asbestos containing material and also sampling and analysis requirements for assessment of soils for waste classification prior to disposal. The risk of exposure from any isolated contaminated areas or unexpected finds can be managed during construction with an unexpected contaminated material find procedure in the CSMP.

Indications of potential contamination may include:

- Stained or discoloured fill, soils or seepage water
- Odorous materials
- Construction/demolition wastes such as concrete, bricks, timber, tiles, fibre cement sheeting, fragments and pipes
- General rubbish such as plastic, glass, packaging
- Imported materials such as ash, slag or coal chitter

Exposure of soil to erosion

The Project would require earthworks and stockpiling of soil material and movement of trucks and machinery across the ground surface. This would expose and disturb soil that is currently covered with either vegetation or compacted access tracks. The Project area is approximately 7.64 hectares including construction compounds, therefore a Soil and Water Management Plan (SWMP) would be required in accordance with the Blue Book. Soil erosion has the potential to cause impacts, including siltation of watercourses and increased mobilisation of windblown sediment.

The Project is located in an area considered to have a low erosion potential, due to water, however due to its coastal location and the soil landscape has a high wind erosion risk. The characteristics of the soils in this area are loose sands, coarse grained and coarse grained sands. Therefore, erosion impacts in this area would be managed with standard erosion and sediment control measures in accordance with the Blue Book.

Measures to mitigate and avoid soil erosion impacts would be implemented and are provided in Section 7.1.4.

Mine subsidence

Based on the anticipated depth of workings, which are currently understood to be greater than 200 m below the surface, mine subsidence or pothole features are not expected to impede the Project.

During the next stage of the project, a desktop review will further assess the mine subsidence hazard and associated risk to the structures including review of record tracings and other information held by Subsidence Advisory NSW and DPIE, the results of which will inform any further work required. Project information has been provided to Subsidence Advisory NSW for comment (refer Section 6.7.1), however, to date no response has been received.

7.1.3.2 Operation

Impacts to soil, geology and contamination are not anticipated as a result of operation of the Project. A number of chemicals would be stored onsite as identified in Section 7.8. All chemical storage and delivery areas would be within bunded areas with a capacity of 110 percent of chemical storage volume. Additionally, chemicals would be stored in accordance with the Australian Dangerous Goods (ADG) Code and relevant Australian Standards, hence potential contamination impacts due to inappropriate storage or chemical spills is considered unlikely.

7.1.4 Mitigation measures

Mitigation measures provided Table 7-2 will be implemented to minimise potential impacts on soils, geology and contamination.

Table 7-2 Proposed mitigation measures – soils, geology and contamination

Impact	Mitigation measure	Timing
Consultation with Subsidence Advisory NSW	. Further assess the mine subsidence hazard and associated risk to the proposed structures, including review of the record tracings for John Darling Colliery and other information held by SA NSW and DPIE. The results of this will inform any further assessment or mitigation measures required.	Detailed design
Mobilisation and spread of contamination in soils	Include contamination mitigation measures in an overall Contaminated Soil Management Plan (CSMP) for the construction to describe excavation, validation and disposal requirements for potentially contaminated soils. The CSMP must be prepared by appropriately qualified specialists and form a sub plan to the CEMP and will include the following as a minimum: • Method of identification, separation, management and tracking of contaminated soils • Stockpile any contaminated soil as far away from waterways/drainage lines as possible • Keep contaminated and non-contaminated soils separate at all times • Testing of soils to assess suitability if they are to be placed near sensitive receptors	Pre-construction
Exposure to Asbestos Containing Materials	Include an asbestos finds procedure in the overall CSMP. The asbestos finds procedure will be prepared by suitably qualified person or a competent person as determined under the Work Health and Safety Regulation (2017), and include: • Guidance on the identification of asbestos containing materials (ACM) • Steps to be undertaken if ACM is identified during works • Management and remediation/removal procedures • Required health and safety controls • Waste disposal requirements • Ongoing site management	Pre-construction
UXO procedures	Management and safe guarding procedures for UXO waste to be included in construction safety documentation.	Pre-construction
Acid sulphate soils	Conduct ASS testing within the Project area to confirm presence of ASS. If the ASSMAC Assessment Guidelines action criteria are triggered an Acid Sulphate Soil Management Plan (ASSMP) will be prepared as part of the CEMP in accordance with the Acid Sulphate Soil Laboratory Methods and Manual (ASSMAC, 1998). Include the following as a minimum: • Method for spoil material testing to confirm presence of ASS during construction and prior to excavation in an area • Conduct laboratory testing to calculate and verify treatment of ASS spoil material if it is to be treated on-site • Locate ASS treatment area within the Project area, which is already disturbed and is outside of flood liable land • Measures to manage any stockpiles of ASS materials, including bunding and cover to minimise leachate • Supervision and certification of treatment prior to removal from treatment areas for re-use	Detailed design, Pre-construction

Impact	Mitigation measure	Timing
Exposure of soil to erosion	Prepare an Erosion and Sediment Control Plan (ESCP) as part of a SWMP in accordance with *Blue Book - Managing Urban Stormwater: Soils and Construction* (4th ed, Landcom, March 2004), which must include the following: • Establish all erosion and sediment control measures before ground disturbance work commences and these are to remain in place until all surfaces have been fully restored and/or stabilised • Outline the process for stabilisation and progressive revegetation of all disturbed area which will include species consistent with the dune restoration project to be undertaken within the greater Belmont WWTW site • Maintenance and inspection program and checklist including: – Conditions that would trigger watering of exposed and revegetated areas – Requirements for maintenance of revegetated areas – Maintenance of erosion and sediment controls including clean out before 30% capacity remaining • Limiting traffic movements on disturbed areas • Exposed areas that is susceptible to wind generated dust particles, shall be progressively vegetated or watered. Where vegetation is not yet possible, dust suppression by watering shall be provided • Install a 40% porous, open weave barrier fence as a wind-break on the eastern side of the Project area in accordance with Standard Drawing SD6-15 (Blue Book) • Provide a clean water diversion around disturbed areas • Procedures for how any sediment laden water will be treated prior to leaving the Project area The ESCP must be prepared by appropriately qualified specialists (e.g. *completed an International Erosion Control Association (IECA) endorsed course, or passed the examination for Certified Professional in Erosion and Sediment Control* (CPESC)) as a coordinated sub plan to the SWMP.	Pre-construction
Spoil Management	Include the management of material movements in the Soil and Water Management Plan, as follows: • Identification of materials during excavations including contaminated, ASS, ENM/VENM • Stockpiling and tracking of all materials throughout construction • Validation and certification of material stockpiles prior to re-use • Tracking of materials incoming and outgoing from site (e.g. as waste, quality of imported material) • Method of soil testing including number of samples and how samples will be taken to confirm any soil amelioration requirements. Testing to include as a minimum fertility, sodicity and aluminium toxicity • Waste classification of soils that require offsite disposal using the six-step process and criteria detailed in Waste Classification Guidelines – Part 1: Classification of Waste (NSW EPA 2014)	Pre-construction
Accidental contamination from leaks or spills of fuels / chemicals etc.	Prepare an incident emergency spill plan as part of the CEMP to be implemented during construction. Include procedures for the storage and handling of hazardous materials including fuel and chemicals within the CEMP, including: • No refuelling to occur on-site unless an appropriate bunded area is available • Storage of hazardous materials on-site to be kept to a minimum and will be in accordance with national guidelines and the Safety Data Sheets relating to bunding, coverage, storage of incompatible materials, etc. • Construct the bunded hazardous materials storage area within the desalination plant as early as possible within the construction schedule so that this area could be used for storage of any hazardous materials required during construction	Pre-construction

Impact	Mitigation measure	Timing
	• Locate chemical storage and delivery areas within bunded areas with a capacity of 110 percent of chemical storage volume • Store chemicals in accordance with Australian Standards and maintain in accordance to equipment supplier recommendations • Implement safe work procedures for the handling of all chemicals including transfer, storage, spill prevention and clean up requirements • Develop an emergency response plan that includes dangerous goods spill scenarios	Operation
Unexpected discovery of contaminated soils	Should unexpected contaminated soils be identified during any ground works, seek advice from a suitably qualified environmental consultant and notify the Hunter Water Project Manager. Complete any additional investigations/abatement in general accordance with guidelines developed or endorsed by NSW EPA. Include contingency plans for unexpected finds protocols for contaminated soils in the CSMP.	Construction

7.2 Water resources

This section describes the existing environment in relation to water resources (surface water and groundwater). It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The groundwater information presented in this section is summarised from the *Groundwater Assessment* (GHD, 2019f) (Appendix D).

7.2.1 Methodology

7.2.1.1 Assessment approach

The groundwater assessment for the Project was undertaken using the following approach:

- Desktop review to collate relevant climatic, geological and hydrogeological data as well as the identification of groundwater receptors (GDEs and registered groundwater supply works)
- Site investigations, including:
  - Drilling and construction of eight monitoring wells
  - Sample collection during drilling for particle size distribution (PSD) analysis
  - Conductivity profiling during drilling and post well installation
  - Geophysical surveying of the subsurface via electrical resistivity imaging (ERI) and seismic refraction
  - Long term groundwater level monitoring (September 2018 through May 2019)
  - Seven groundwater monitoring events (September 2018 through April 2019)
  - Aquifer pumping test
- Development of an updated conceptual hydrogeological model based on the desktop review and field investigation
- Construction of a numerical groundwater model to predict groundwater extraction volumes and groundwater drawdown
- Groundwater impact assessment in accordance with the NSW AIP

7.2.2 Existing environment

7.2.2.1 Surface water

Hydrology and flooding

The Project is located within a coastal dune environment which due to elevation and soil (sand) transmissivity lacks significant surface water features. Surface waterbodies and watercourses in close proximity to the Project area are shown in Figure 7-3 and consist of:

- Belmont Lagoon located 30 m to the north-west. This is a shallow coastal saltwater lagoon which connects to Lake Macquarie in Belmont Bay via Cold Tea Creek. The lagoon is adjacent to protected (Coastal SEPP) wetlands.

- The South Pacific Ocean located 80 m to the east. This area of coastline between Redhead Headland to the north and Swansea Channel to the south contains three beaches. From north to south these beaches are known as Redhead Beach, Nine Mile Beach (adjacent to the site) and Blacksmiths Beach. With the exception of the Belmont WWTW and the Belmont Golf Course to the south, Nine Mile Beach and its dune system are relatively undeveloped and therefore have minimal surface impact from human activities. Due to the transmissivity of the sandy soils there is no significant standing water in the beach or dune environments close to the Project area.
- Belmont Bay located 1.2 km to the west. Belmont Bay forms part of Lake Macquarie which is a large (approx. 110 km^2), relatively shallow (average depth approx. 8 m) coastal saltwater lake which drains to the Pacific Ocean through the Swansea Channel approximately 5 km to the south of the Project area.
- Sludge/effluent lagoons within the Belmont WWTW. A lined lagoon within the boundaries of the Belmont WWTW for the storage of sludge materials following wastewater processing. The WWTW also includes a number of aboveground concrete storage tanks such as clarifier tanks and aerobic digester tanks.

Runoff from the west of the Belmont WWTW access road generally drains to Belmont Lagoon, while runoff from the east of the Belmont WWTW access road is directed to the lowest point at the Belmont WWTW at the base of the existing sand dunes along Nine Mile Beach where it infiltrates into the sandy soils.

The Lake Macquarie Waterway Flood Study (WMAwater, 2012) indicates probable flood levels for Lake Macquarie of 1.23 m AHD for a 1 in 20 year flood, and 1.5 m AHD for a 1 in 100 year flood. The Project is located outside of Council's mapped 1 in 100 year flood extent; however, portions of the site are within the Lake Macquarie LEP flood planning area (defined as 1 in 100 year flood level plus 0.5 m).

Belmont WWTW wet weather management

Effluent discharged via the Belmont WWTW ocean outfall includes transfers from three inland WWTWs (Edgeworth, Dora Creek and Toronto). At each of these WWTWs effluent overflows can occur in extreme wet weather events when pump capacity is exceeded. Additionally, flows to Belmont WWTW cease when high water level triggers are reached at the Belmont WWTW hydraulic control structure, which can also contribute to overflows at the inland WWTWs.

7.2.2.2 Groundwater

The Project is underlain by Quaternary aged sands to depth up to approximately 30 m below ground level, which are underlain by clay and residual soils. Both the sand and clay units dip to the west and thin to the east. The sand unit forms an unconfined aquifer with recharge from rainfall and connection with the Pacific Ocean to the east and Belmont Lagoon to the west.

A schematic of the conceptualisation of the hydrogeological system is shown In Figure 7-4.

Figure 7-3 Hydrology and Flooding

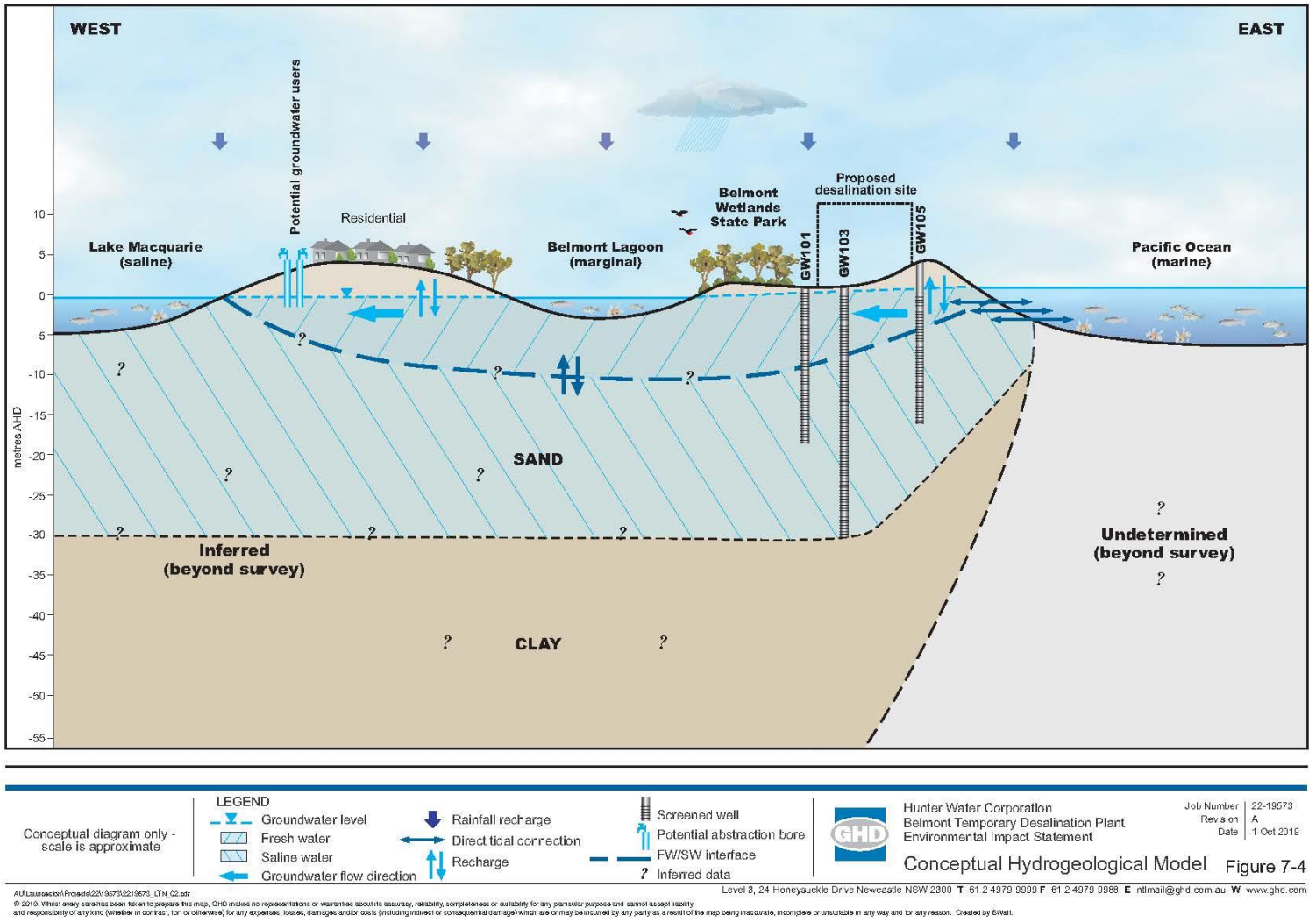

Figure 7-4 Conceptual hydrogeological model

Groundwater levels

Based on continuous groundwater level monitoring of wells GW101 – GW108 between September 2018 and May 2019, the water table is shallow with elevation ranging from approximately 0.3 to 1.2 m AHD across these sites. Groundwater flow in the vicinity of the Project area is generally from east to west. Temporal variation in levels is relatively small (approximately 0.5 m) due to the close proximity to the ocean, and occur as a result of tidal variation and rainfall recharge. Tidal effects decrease with distance from the coast and have been most notable at GW107 with fluctuations ranging approximately 10 cm.

Groundwater quality

Groundwater is near neutral (pH 7 – 8), saline at depth (approximately 50,000 - 60,000 µS/cm) and of Na-Cl type. Dissolved oxygen levels are less than 6.5 mg/L and the redox state is generally oxidative. Metal, organic and pathogen concentrations are low at depth but vary in concentration in the upper part of the aquifer.

Based on geophysical investigations, the fresher groundwater zone ranges from approximately 2 to 15 m thick above a lower saline region ranging in thickness from 3 to 30 m. The location of the freshwater/saltwater interface is variable, occurring between -2 to -10 m AHD, and becomes shallower closer to the ocean.

Based on electrical conductivity profiling, the fresher groundwater (up to 10,000 µS/cm) extends up to 10 m below the water table on average and thins towards the east. The transition to saline conditions occurs via a mixing zone (10,000 – 50,000 µS/cm) of approximately 5 m thickness. Saline water (> 50,000 µS/cm) extends to the base of the aquifer.

The beneficial use of the deeper groundwater would be limited due to its high salinity. There is also limited use of the fresher shallow groundwater in the vicinity of the Project area as demonstrated by the absence of registered bores. However there is interaction between the shallow groundwater and aquatic ecosystems and therefore it is considered that the beneficial use category of the groundwater in the vicinity of the Project area would be ecosystem support.

Groundwater receivers

An examination of the online WaterNSW register (conducted September 2019) identified 73 registered groundwater bores within 5 km of the Project area. Bore locations are shown in Figure 7-5.

The majority of registered bores are located to the southwest of the Project area throughout Belmont South and Swansea. The closest bore to the Project area (GW054897) is located approximately 1 km to the west on the western side of Belmont Lagoon.

Most bores are shallow (less than 7 m depth). Usage data are limited, although it is assumed most are used for domestic and irrigation purposes. Only one bore is listed as ‘abandoned’, although the status of many is ‘unknown’. The existing monitoring wells were not identified in the search.

Figure 7-5 Registered groundwater bores

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) identified in the vicinity of the Project area are detailed in Section 7.3.2.

An aquatic GDE (known as Belmont Lagoon Swamps) is mapped to the west of the Project area. An aquatic GDE relies on the surface expression of groundwater. It is listed as a High Priority GDE for the Hawkesbury to Hunter Coastal Sands Groundwater Source. The boundary of this High Priority GDE is located less than 400 m from the intake structures at its closest point. It is noted that the High Priority GDE excludes the mangroves, saltmarsh, seagrass and saline waterway components of the Belmont Lagoon Swamps.

In addition, the Groundwater Dependant Ecosystems Atlas (http://www.bom.gov.au/water/groundwater/gde/) shows a terrestrial GDE is mapped as a high potential to occur on the seaward side of the foredunes. A terrestrial GDE interacts with the subsurface presence of groundwater. The mapped GDE is PCT 1644 Coast Tea Tree – Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast. An inspection of the site confirmed that PCT 1644 or related PCTs do not occur on the site and has been replaced by bitou bush and exotic scrub.

7.2.3 Potential impacts

7.2.3.1 Construction

Surface water

Construction of the Project has the potential to temporarily increase sediment and erosion runoff due to the works resulting in exposed disturbed soils. However, as discussed in Section 7.1, the Project area is more susceptible to wind erosion than erosion as a result of surface water runoff.

In addition, construction has the potential to impact surface water captured within the Project area due to leakage or spillage of hydrocarbon products from vehicles, wash down areas and refuelling bays and fuel, oil and grease storages. While this has the potential to impact on the water quality of receiving waters; the volumes of potential spillages would be relatively minor and are not anticipated to result in a significant impact.

The Project would not result in any significant impacts on surrounding water quality if appropriate erosion and sediment controls are implemented (refer to Section 7.2.4).

Safety procedures would be in place to avoid impacts on workers and measures would be implemented to ensure that no equipment or materials are stored or left within areas mapped as being within the flood planning area. This includes ensuring stockpiles are located in order to minimise the potential alteration of flood levels, flow paths and velocities during construction.

Groundwater

Installation of the intake structures would involve groundwater interception and dewatering. The extent and duration of dewatering during construction is expected to be less than the dewatering and drawdown during operation. Therefore groundwater level (and quantity) impacts during construction are expected to be less than during operation (assessed below).

Construction activities have the potential to introduce contaminants into the groundwater source, particularly hydrocarbons. This may occur as a result of the operation of the drilling equipment as well as leakage or spillage of hydrocarbon products from vehicles, wash down areas, workshops and refuelling bays and fuel, oil and grease storages. While this has the potential to impact on local groundwater quality, the volumes of potential spillages would be relatively minor and are not anticipated to result in a significant impact.

7.2.3.2 Operation

Surface water

The addition of hardstand areas within the Project area has the potential to increase stormwater runoff to surrounding areas. As stated in Section 4.1.5 the desalination plant site would generally comprise an unsealed surface (gravel, crushed concrete or similar) with some areas of concrete bunding, and concrete pads for placement of treatment components. Stormwater from rooves and hardstand areas would be directed as sheet flow to permeable areas within the Project area and allowed to infiltrate into the ground. Given the permeability of the desalination plant site's upper soil layers, minimal runoff and ponding is likely to occur and is consistent with stormwater management currently utilised at Belmont WWTW. This is considered to meet the aims for stormwater management as detailed in Section 2.2 of the *Guidelines for developments adjoining land managed by the Office of Environment and Heritage* (OEH, 2013).

Chemical storage and loading/unloading of deliveries would be managed as part of a separate water management system from the additional hardstand area and in accordance with the Australian Dangerous Goods (ADG) Code and relevant Australian Standards. This would include the provision of bunded areas with 110 per cent capacity of the stored chemical volume for chemical storage and delivery (loading/unloading) areas, as described in Section 7.8.2.

Therefore, impacts to the surrounding hydrology and potential contamination impacts due to inappropriate storage or chemical spills is considered unlikely.

Ground surface levels within the Project area would be altered to provide suitable hardstand areas for the installation of desalination plant components. As the Project area would be located outside of the 1 in 100 year flood levels, this minor alteration to surface levels is unlikely to impact flood levels or flow velocities.

As the Project area is partially within the Lake Macquarie LEP flood planning area, Council's flood planning level (2.36 mAHD) has been adopted as the minimum floor level. As such, impacts to the Project area as a result of flooding are not anticipated.

During operation, a number of wastewater streams would be discharged via the Belmont WWTW outfall (refer to Section 7.13). Increased flows to the Project outfall area has the potential to cause the hydraulic control structure capacity to be exceeded, increasing the potential for overflows at the inland WWTWs, which can impact the water quality of receiving waterways. However, as the desalination plant would only be operational in a period of extreme drought, effluent storage would likely be at minimum levels due to the prolonged dry weather and increased effluent reuse associated with water savings initiatives implemented in this time. Additionally, the desalination plant can be turned off during extreme wet weather events if there is a risk of exceeding the outfall capacity. It is therefore considered that impacts to surface water quality as a result of increased effluent overflows is unlikely.

Groundwater

The groundwater impact assessment during operation of the Project has been undertaken in accordance with the NSW Aquifer Interference Policy (AIP), with consideration to groundwater drawdown impacts (see Figure 7-6). Groundwater impacts have been assessed against the Level 1 minimal impact considerations for highly productive coastal sands groundwater sources which are as follows:

- Water table: less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post-water sharing plan' variations, 40 m from any high priority GDE or high priority culturally significant site listed in the schedule of the relevant WSP. A maximum of a 2 m decline cumulatively at any water supply work (groundwater bore).
- Water pressure: a cumulative pressure head decline of not more than a 2 m decline at any water supply work (groundwater bore).
- Water quality: any change in the groundwater quality would not lower the beneficial use category of the groundwater source beyond 40 m from the activity.

Figure 7-6 Predicted groundwater drawdown

The numerical groundwater model developed for the Project indicates that yields from one three arm seawater intake are predicted to range from approximately 5.0 to 10.5 ML/day. The uncertainty in model predictions is based on the existing uncertainty range in the horizontal and vertical hydraulic conductivity of the sand aquifer. The expected yield from two three arm seawater intakes located at the Project area is up to 16 ML/day.

Modelling indicates that approximately 80% of the yield is from seawater while the remainder is from Belmont Lagoon and groundwater (including rainfall). Therefore considerably less than 3.2 ML/day (1,168 ML/year) of groundwater is expected to be extracted from two three arm seawater intakes (based on the yield estimate of 16 ML/day). The unassigned water within the Hawkesbury to Hunter Coastal Sands Groundwater Source of the North Coast Coastal Sands Water Sharing Plan is 12,740 ML/year (at commencement of the plan in 2016). Since this exceeds the predicted groundwater take for the Project, it is considered that there is sufficient groundwater available within the water source to enable Hunter Water to obtain a Water Access Licence for the Project.

Predicted groundwater drawdown from one three arm intake extends beyond the Project area as shown in Figure 7-6. Drawdown is calculated as the difference between the modelled groundwater elevation with no groundwater extraction (existing condition) and the modelled groundwater elevation after two years of continuous groundwater extraction. The zone of groundwater drawdown from two identical intake structures operating simultaneously is not expected to extend any closer inland towards Belmont Lagoon than a single intake operating alone. This is because adding a second intake with the same constraint on intake arm elevations at approximately the same distance away from Belmont Lagoon will not change the hydraulic gradient between the Lagoon and the intake wells. The second intake is actually proposed to be slightly further from the Lagoon than the first. It is noted that the water level in Belmont Lagoon will not drop due to its connection to Lake Macquarie via Cold Tea Creek. No groundwater drawdown is expected at any registered groundwater bore (the closest being approximately 1 km from the seawater intakes) or at a high priority GDE (Belmont Lagoon), noting that the aquatic GDE between the site and Belmont Lagoon is not considered high priority since it is predominantly saltmarsh. Therefore, the predicted groundwater impacts are less than the Level 1 water table and water pressure criteria from the AIP and are therefore considered to be acceptable. In addition, since there is no drawdown predicted at the high priority GDE, it is considered that the Water Sharing Plan requirement that the water supply works be located at least 800 m away does not apply.

The zone of predicted groundwater drawdown is centred within the beach and low risk zones on the Acid Sulphate Soil Risk Map (Figure 7-2) but extends westward to the high risk 1-2 m and 2-4 m depth zones. For the three arm scheme, groundwater level drawdown is predicted to be from approximately zero to 2 m in the ASS high risk 1-2 m zone and from 2 m to 3 m in the ASS high risk 3-4 m zone. Since these drawdown predictions are based on continuous extraction for two years, the exposure and oxidation of pyritic material depends on how long the scheme is actually operating for and the existence of PASS in the drawdown zone. It is considered unlikely that the operation of the Project will result in the oxidation of PASS and deterioration of groundwater quality, however it will be necessary to implement the mitigation measures outlined in Table 7-3 including additional ASS investigation in the area during the detailed design phase. Overall, the beneficial use category of the groundwater source is not expected to be lowered and therefore the predicted groundwater quality impact is less than the Level 1 criterion from the AIP and therefore considered to be acceptable.

7.2.4 Mitigation measures

Mitigation measures to minimise potential impacts to flooding, hydrology, water quality, groundwater levels and groundwater quality are provided in Table 7-3.

Table 7-3 Proposed mitigation measures – water resources

Impact	Mitigation measure	Timing
Sedimentation of waterways during construction	Vehicle wash down and/or cement truck washout will occur in a designated bunded area or offsite.	Construction
	Include provision in the ESCP for visual inspections of nearby waterways and drainage lines following rainfall events and corrective actions in the event of impacts.	Construction
	Revegetation will be undertaken in all areas subject to ground disturbance, in accordance with the requirements listed in Table 7-2. Sediment and erosion controls (including dust) will be maintained until vegetation cover is established.	Construction
Flooding	The soil and water management plan will include procedures to ensure that machinery, stockpiles, equipment, fuels and chemicals, and other facilities are not stored or left within areas subject to flooding.	Pre-construction
	An emergency response plan will be prepared to include a procedure for managing flooding due to natural events. This will include an emergency procedure for ensuring the health and safety of construction workers.	
Increased WWTW overflows	Manage operation of the desalination plant, including shutting down in extreme wet weather if necessary.	Operation
Groundwater monitoring program	A comprehensive groundwater monitoring program will be developed. Existing monitoring wells GW101 – GW108 will be considered for inclusion in the program and additional monitoring sites will be identified (if necessary). The groundwater monitoring program will include continuous monitoring of groundwater levels and routine groundwater quality monitoring.	Construction, Operation
Groundwater drawdown	Develop an ongoing groundwater monitoring program, including groundwater level triggers and an appropriate trigger, action, response plan. Update the groundwater model to revise drawdown predictions if necessary. Groundwater drawdown may be reduced if necessary by modifying the intake pumping schedule (i.e. allow periodic recovery by shutting off pumps) or by shutting off one or more horizontal arms.	Operation
Groundwater quality	Develop an ongoing groundwater monitoring program, including groundwater quality triggers and an appropriate trigger, action, response plan. Undertake additional Acid Sulphate Soil (ASS) sampling within the zone of groundwater drawdown during the detailed design phase to confirm the risk of exposure of ASS due to drawdown. Reduce groundwater drawdown (if necessary) as outlined above.	Operation

7.3 Terrestrial and freshwater biodiversity

This section provides the biodiversity impact assessment undertaken for the Project in accordance with the SEARs (see Table 5-2). This section describes the existing environment in relation to terrestrial and freshwater biodiversity. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is drawn from the Biodiversity Development Assessment Report (BDAR) (GHD, 2019c) (Appendix E). A BDAR is a specific type of biodiversity impact assessment report prepared in accordance with the Biodiversity Assessment Methodology (BAM) to assess terrestrial biodiversity impacts listed under the BC Act. The BAM is established by the *Biodiversity Assessment Method Order 2017* under the provisions of Part 6, Division 2 of the BC Act.

Threatened freshwater biota and terrestrial MNES assessed under the FM Act and EPBC Act have also been included in the BDAR.

7.3.1 Methodology

The Project was assessed in accordance with the BAM (OEH, 2017a). Key components of the assessment method undertaken include the following:

- Desktop assessment, comprising:
  - Literature review
  - Review of NSW and Commonwealth threatened species databases.
  - Review of various relevant spatial databases, including soil landscapes, wetland and estuarine habitat mapping, LMCC LGA vegetation mapping, key fish habitat mapping, and DPI modelled freshwater fish distributions.
  - Review of relevant Plant Community Type (PCT) profiles held in the BCD BioNet Vegetation Classification database (OEH, 2018b).
  - Review of aerial photography.
- Site surveys, comprising:
  - Vegetation ground-truthing survey to verify and update LGA vegetation mapping.
  - Vegetation integrity survey plots to assess site condition in accordance with Section 5.3.3 and Section 5.3.4 of the BAM.
  - Threatened species habitat assessment, which included identifying habitat constraints in accordance with Section 6.4.1.9 – Section 6.4.1.16 of the BAM and identifying freshwater aquatic habitats.
- Geographic Information System (GIS) analysis to complete a landscape assessment in accordance with Section 4.3 and 5.1 of the BAM.
- BAM credit calculations undertaken by an accredited BAM assessor.

A detailed description of the assessment methodology is provided in the BDAR (GHD, 2019c) (Appendix E), including a full list of all information sources reviewed.

7.3.2 Existing environment

7.3.2.1 Landscape context

The Project area is located within the Sydney Basin bioregion and Wyong sub-bioregion. It is located on the Sydney – Newcastle Barriers and Beaches NSW soil landscape, which commonly underlies coastal beaches to inland sand dunes and coastal lagoons.

The Project area generally occurs on low-lying coastal lands between Nine Mile Beach and the eastern edge of Lake Macquarie on the Belmont peninsula. This landscape features a series of wetlands and riparian swamp forest vegetation that are mapped under the Coastal Management SEPP and includes wetlands within the Belmont Wetlands State Park to the north of the Project area, as well as:

- Belmont Lagoons wetland complex
- Belmont Cemetery wetland
- Belmont Golf Course wetland
- Pelican Flat

The wetlands and associated riparian vegetation in the wider locality are collectively described as the Lake Macquarie Coastal Wetlands (NSW189) in the National Directory of Important Wetlands (DIWA). Some of these vegetation types conform to threatened ecological communities associated with coastal floodplains, namely:

- *Swamp Sclerophyll Forest on Coastal Floodplains*, which is listed as Endangered under the BC Act
- *Swamp Oak Floodplain Forest*, which is listed as Endangered under both the BC Act and EPBC Act
- *Freshwater Wetlands on Coastal Floodplains*, which is listed as Endangered under the BC Act
- *Coastal Saltmarsh*, which is listed as Endangered under the BC Act and Vulnerable under the EPBC Act

Other landscape features have been considered and described in accordance with Section 4 of the BAM and is provided in Section 5 of the BDAR (GHD, 2019c) (Appendix E).

7.3.2.2 Vegetation within the Project area

The desalination plant would be located on the foredunes behind Nine Mile Beach. This site is currently dominated by exotic vegetation. The site of the desalination plant has previously been used for the WWTW evaporation ponds (now decommissioned but still visible) and continues to be accessed by four-wheel drives and pedestrians, including dog-walkers. The dune is presently in poor condition, containing hummocks caused by vehicle tracks. There has been a progressive loss of native vegetation on the dunes, and the native vegetation along the foredunes is now largely replaced by the exotic species, *Chrysanthemoides monilifera* subsp. *rotundata* (Bitou Bush) scrub, and exotic grassland dominated by *Cenchrus clandestinus* (Kikuyu). Bitou Bush is the dominant vegetation type across large sections of the foredunes in the locality, and is a prominent vegetation feature of the desalination plant site. Despite the likely presence of threatened ecological communities in the wider locality, No threatened ecological communities listed under the BC Act and EPBC Act have been identified within the Project area.

The foredunes would have originally been vegetated by coastal scrub featuring salt pruned shrubs and stunted trees typical of other sections of the coastal foredune zone in the Lake Macquarie area, such as *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Leptospermum laevigatum* (Coast Teatree) and *Acacia longifolia* subsp. *sophorae* (Coastal Wattle). On the landward side of the dunes to the west of the Project area, native vegetation represented by swamp forest, wet heath, rushland and estuarine vegetation associated with Belmont Lagoon and the greater Lake Macquarie Coastal Wetlands (NSW189) still occurs.

The power upgrade component of the Project area is located on the corner of Marriot Street and Hudson Street and has been completely urbanised. The vegetation at this intersection is comprised of a grassed roadside verge dominated by a mix of exotic grass and forb species including *Chloris gayana* (Rhodes Grass), *Briza maxima* (Quaking Grass), *Melinis repens* (Red Natal Grass), *Hyparrhenia hirta* (Coolatai Grass), *Vicia sativa* (Vetch), *Hydrocoyle bonariensis* (Largeleaf Pennywort), *Medicago polymorpha* (Burr Medic) and *Trifolium repens* (White Clover). Trees and shrubs are restricted to plantings within garden beds in adjacent residential properties, street plantings or occur as weed patches in the roadside verge and include *Grevillea robusta* (Silky Oak), Coast Banksia, *Nerium oleander* (Oleander), *Monstera deliciosa* (Fruit Salad Plant), *Syagrus romanzoffiana* (Cocos Palm), Bitou Bush and *Callistemon viminalis* (Weeping Bottlebrush).

The vegetation mapping of the Project area is shown in Figure 7-7 and summarised in Table 7-4. It demonstrates that the Project area is dominated by exotic vegetation, namely Bitou Bush Scrub (*sensu*. Unit 50c, (Bell, 2016)) and exotic grassland.

Table 7-4 Vegetation types within the Project area

Vegetation type	Extent within Project area (ha)		Total area (ha)
	Desalination plant	Power connection	
Bitou Bush Scrub	3.24	0.00	3.2
Exotic grassland	3.02	0.01	3.0
Cleared	1.36	0.03	1.4
Total area (ha)	**7.62**	**0.04**	**7.7**

7.3.2.3 Defining vegetation zones for the BAM calculator assessment

The desalination plant is located within proximity of swamp and wetland vegetation associated with the Belmont Wetlands State Park and the Belmont Lagoon. The nearby swamp and wetland vegetation provides habitat for native flora and fauna. Although the Project area contains exotic vegetation, due to the proximity of native swamp and wetland habitats, threatened species have been conservatively assessed in the BDAR in accordance with Section 6 of the BAM.

For the purposes of undertaking the threatened species assessment component of the BAM, the Bitou Bush Scrub and exotic grassland units (within the desalination plant component of the Project area only) have been assigned to the original PCT that would have likely once occurred on the foredunes in the Lake Macquarie area to allow vegetation zones to be defined and entered into the BAM calculator. No PCT was assigned to the exotic grassland areas mapped at the power connection site and this area was not subject to threatened species assessment due to its urbanised nature.

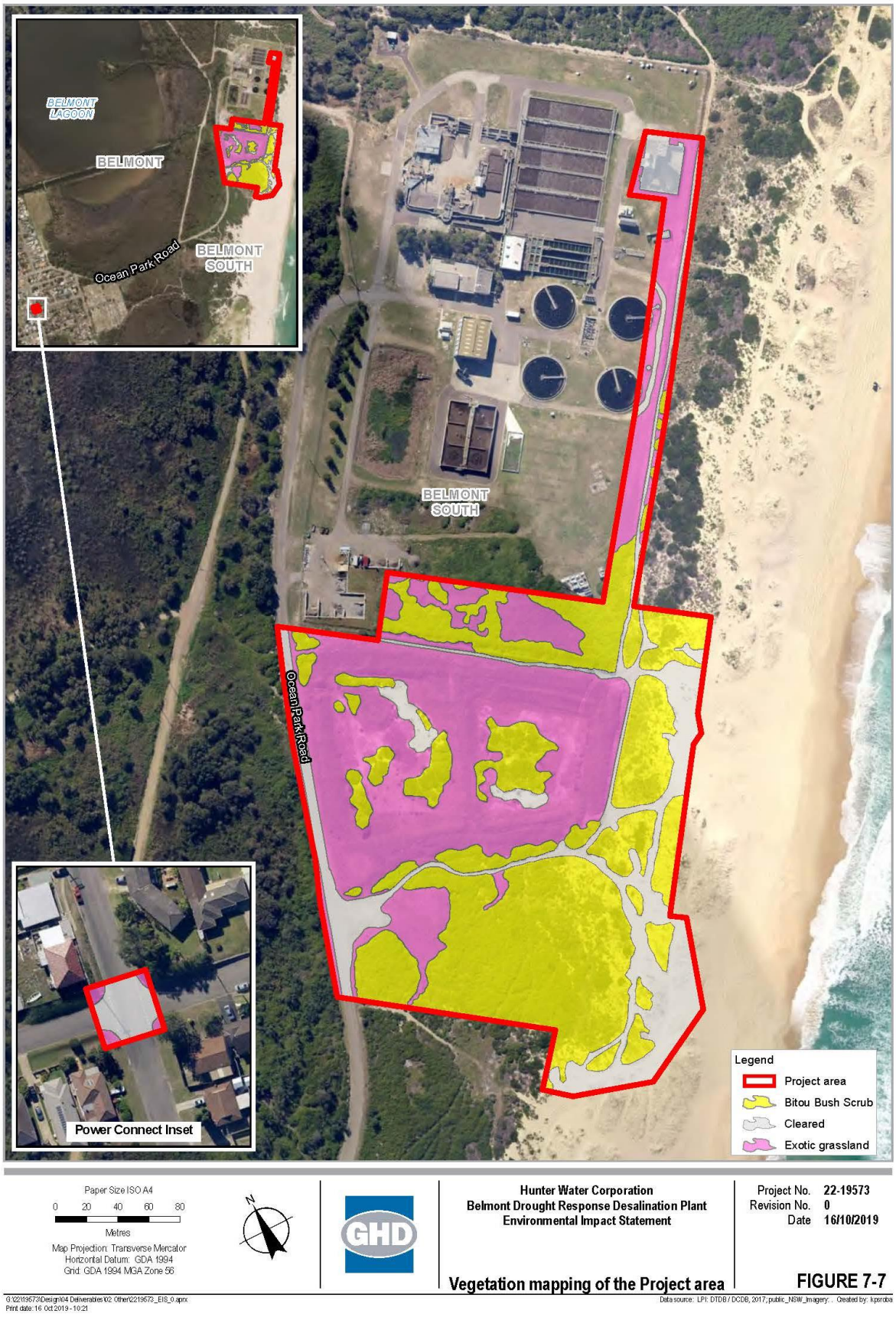

Figure 7-7 Vegetation mapping of the Project area

PCT 772 Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion (corresponding to Unit 50a described by Bell, 2016) was assigned to the vegetation within the Project area and stratified into two distinct low condition vegetation zones. For a detailed description of the vegetation zones in the Project area, refer to Section 6.1 of the BDAR (GHD, 2019c) (Appendix E).

7.3.2.4 Groundwater Dependent Ecosystems

The Groundwater Dependent Ecosystems Atlas indicates that both the seaward side of the foredunes, Belmont Lagoon as well as terrestrial vegetation to the west of Ocean Park Road is likely to contain vegetation that represents high potential terrestrial Groundwater Dependent Ecosystems (GDEs) (as updated by regional studies). The associated vegetation that the atlas identifies as being a high potential terrestrial GDE is PCT 1644 Coast Tea Tree – Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast, which is related to PCT 772 (OEH, 2018a). Native communities related to PCT 1644 Coast Tea Tree – Old Man Banksia coastal shrubland on foredunes of the Central and lower North Coast do not occur within the Project area, as PCT 772 has been replaced by Bitou Bush Scrub and exotic grasslands. As such, no GDEs are present in the Project area.

Potential terrestrial and aquatic GDEs are also mapped to the west of the desalination plant by the Groundwater Dependent Ecosystems Atlas. Belmont Lagoon is identified as a moderate potential GDE from the national assessment. The potential terrestrial GDEs located between Belmont Lagoon and the Project area corresponds to a mix of coastal swamp forests, coastal heath forests and sand heath scrub described by the LMCC LGA vegetation mapping (Bell, 2016), which includes PCT 1724 Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast as identified by the Groundwater Dependent Ecosystems Atlas.

7.3.2.5 Flora species recorded in the Project area

The floral assemblage within the Project area is dominated by exotic species, with 70% (or 42 species) of the recorded species richness comprising exotic species. In addition to this, the vegetation cover is also dominated by high threat weeds as classified by the Biodiversity and Conservation Division (BCD, formerly the NSW Office of Environment and Heritage, OEH) for BAM assessments. High threat weeds are (for the purposes of the BAM assessment) defined as vascular plants not native to Australia that, if not controlled, would invade and outcompete native plant species. Bitou Bush and Kikuyu are both high threat weeds and are the dominant species within the Project area.

The full list of high threat weeds recorded within the Project area are listed in Table 7-5 below. Six of these high threat weed species are also priority weed species declared for the Hunter region, to which Lake Macquarie LGA belongs. The species, their relevant weed objectives (HLLS, 2017) and related regulatory measures are also summarised in Table 7-5.

Bitou Bush, *Senecio madagascariensis* (Fireweed), *Lantana camara* (Lantana), *Asparagus aethiopicus* (Asparagus Fern) and *Opuntia stricta* (Prickly Pear) are also Weeds of National Significance declared under the National Weed Strategy (DAWR, 2017), which recommends that their spread should be minimised to protect priority assets. Specific assets have not been identified in the national strategy but Priority 3.3 of the strategy identifies that asset assessments should be undertaken to assess which assets need to be protected and from which weed species (DAWR, 2017).

No threatened species listed under the BC or EPBC Acts were recorded or are considered likely to occur within the Project area.

7.3.2.6 Terrestrial fauna and fauna habitats

Five fauna species were recorded within the Project area at the site of the desalination plant during survey. No fauna species were recorded at the power connection site but common urbanised species including honeyeaters and lorikeets are likely to fly over or to feed in the planted trees and shrubs in residential gardens from time to time.

None of the fauna species recorded in the Project area are threatened species listed under the BC Act or EPBC Act, and none are considered likely to utilise the habitats within the Project area.

At the desalination site, a small number of Welcome Swallows (*Hirundo neoxena*) were observed hawking for insects over the Bitou Bush Scrub. A couple of Australian Magpies (*Cracticus tibicen*) were recorded foraging on the ground for insects on the foredunes among *Carpobrotus glaucescens* (Pigface) and at the edges of the Bitou Bush Scrub. One Black-shouldered Kite (*Elanus axillaris*) was observed hovering over Bitou Bush Scrub in the existing WWTW grounds hunting for prey. A few Silver Gulls (*Chroicocephalus novaehollandiae*) were observed flying in the distance on the seaward side of the foredunes within proximity of the Project area. All of these species are common species associated with cleared areas on forested or woodland fringes, or with vacant lands of urban and coastal areas. The Project area is also frequently accessed by pedestrians walking their dogs.

The Project area provides very limited habitat for native fauna. It is dominated by highly invasive high threat weed species Bitou Bush and Kikuyu. These have respectively formed a scrub thicket and a dense matting grassland on the foredunes. The Project area also lacks aquatic, wetland and forested habitats. The foraging and sheltering resources provided by such habitat types are therefore limited or absent from the Project area, including hollow-bearing trees, blossom and nectar resources from myrtaceous trees and mistletoes, fallen timber and logs, mudflats, fringing vegetation around wetland ponds etc.

The Project area is situated directly adjacent to larger patches of habitat comprising a mixture of swamp sclerophyll forests, coastal woodland, coastal shrubland and wetlands. These surrounding habitats are associated with the Belmont Wetlands State Park and Belmont Lagoon and represent a larger network of fragmented vegetation patches along the coast. Fauna species that are likely to be observed within or flying over the Project area would be limited to those species capable of persisting in fragmented and modified landscapes, or wide-ranging highly mobile species capable of travelling throughout fragmented landscapes.

The surrounding habitats associated with Belmont Lagoon and the Belmont Wetlands State Park has potential to provide suitable habitat for a number of potential candidate fauna species that were assessed for the Project area (refer to Section 7.1.2 of the BDAR (GHD, 2019c) (Appendix E)). However, the Project area itself lacks key breeding habitat features for candidate fauna species including Regent Honeyeater (*Anthochaera phrygia*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*), large forest owls, and hollow-dependent microchiropteran bats that rely on trees and / or tree hollows. The Project area also lacks aquatic habitats and damp microsites (i.e. wet grassland meadows, wet heath, reedlands or sedgelands, and inundated tussock grasslands) that are utilised by threatened frog species for breeding, like Green and Golden Bell Frog (*Litoria aurea*), Wallum Froglet (*Crinia tinnula*) and Mahony's Toadlet (*Uperoleia mahonyi*). Habitat features for candidate mammal species associated with swamp forest, dry eucalypt forests, heathy woodlands or forests, grassy woodlands etc. are generally absent from the Project area. Such species, including Eastern Pygmy Possum (*Cercartetus nanus*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Common Planigale (*Planigale maculata*) and Squirrel Glider (*Petaurus norfolcensis*) require a diversity of flowering trees and shrubs, tree hollows, and/or insect- or fungi-rich loamy soils for foraging and sheltering.

Koala habitat (SEPP 44)

The native vegetation to the west, north and south of the Project area includes swamp vegetation dominated by *Eucalyptus robusta* (Swamp Mahogany), which is a Koala feed tree listed under Schedule 2 of SEPP 44 and a primary feed tree listed in the Koala Recovery Plan (DECC, 2008a) for the Central Coast Koala Management Area (which includes the Hunter-Central Rivers catchment management area). One Koala sighting was recorded in 2006 to the south of the Project area within the Belmont Golf Course wetland in Coastal Sand Swamp Forest (a Swamp Mahogany – Paperbark coastal swamp forest) (OEH, 2018a).

The vegetation within the Project area is generally treeless and dominated by non-native species. There are no Koala feed tree species or supplementary tree species present in the Project area (i.e. SEPP 44 Schedule 2 list, or tree species listed in the Koala Recovery Plan) and the vegetation does not constitute potential or core Koala habitat.

Table 7-5 High threat weeds recorded in the Project area

Family	Species	Name	Priority weed objective	Regulatory measure	Weed of National Significance
Aizoaceae	*Galenia pubescens* var. *pubescens*	Galenia			
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	Asset protection (State)	**Prohibition on dealings** must not be imported into the State or sold	x
Asteraceae	*Chrysanthemoides monilifera subsp. rotundata*	Bitou Bush	Containment (State)	**Prohibition on dealings** must not be imported into the State or sold	x
Asteraceae	*Gazania rigens*	Treasure Flower			
Asteraceae	*Senecio madagascariensis*	Fireweed	Asset protection (State)	**Prohibition on dealings** must not be imported into the State or sold	x
Cactaceae	*Opuntia stricta*	Prickly Pear	Additional species of concern (Regional)	**Prohibition on dealings** must not be imported into the State or sold	x
Convolvulaceae	*Ipomoea cairica*	Coastal Morning Glory			
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass			
Poaceae	*Chloris gayana*	Rhodes Grass			
Poaceae	*Ehrharta erecta*	Panic Veldtgrass			
Poaceae	*Hyparrhenia hirta*	Coolatai Grass	Asset protection (Regional)	**Regional recommended measure:** The plant should not be bought, sold, grown, carried or released into the environment. Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread from their land. Land managers to reduce impacts from the plant on priority assets.	
Poaceae	*Paspalum dilatatum*	Paspalum			
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass			
Verbenaceae	*Lantana camara*	Lantana	Asset protection (State)	**Prohibition on dealings** must not be imported into the State or sold	x

7.3.2.7 Aquatic biodiversity

Overview

No freshwater or estuarine habitats occur within the Project area. In the wider area, the Project area (at the desalination plant site) is surrounded by swamp and wetland vegetation associated with Belmont Lagoon and the greater Lake Macquarie Coastal Wetlands (NSW189) and mapped as Coastal Management SEPP Coastal Wetlands. Estuarine habitats comprising mangroves, saltmarsh and seagrass meadows are located around the margins of Belmont Lagoon and Lake Macquarie to the west of the Project area.

The aquatic habitats associated Belmont Lagoon is separated from the Project area by Ocean Park Road and a vegetated corridor of approximately 200 m width.

Threatened freshwater fish distributions

Indicative threatened freshwater fish distributions have been modelled across NSW using records collected over two decades (DPI, 2018). There are no threatened fish species that are modelled to occur within or near the Project area, with the closest modelled distributions for the threatened Purple Spotted Gudgeon (*Mogurnda adspersa*) located over 18 kilometres away at Brunkerville Creek and also at South Channel Hunter River (DPI, 2018).

Key fish habitat

Key fish habitat areas are identified areas of aquatic and riparian habitat in NSW that are important to the maintenance of “fish” (including aquatic invertebrate) populations and communities, and the commercial and recreational fishing industries. Key fish habitat generally includes all marine and estuarine habitats, and most permanent and semi-permanent freshwater habitats. Key fish habitat is defined in the *Policy and guidelines for fish habitat conservation and management* (reference) according to (1) waterway class and/or (2) habitat sensitivity type. All SEPP Coastal Wetlands are classified as Type 1 – highly sensitive key fish habitat, and marine waterways are classified as Major key fish habitat.

The DPI Key Fish Habitat mapping (reference) maps key fish habitat on the seaward and landward side of the Project area, corresponding to the wetland and aquatic habitats associated with the wetlands around Belmont Lagoon and Lake Macquarie to the west, and the ocean to the east.

No mangrove or saltmarsh habitat is located within the Project area. No areas of SEPP Coastal Wetlands or marine waterways are located within the Project area. There is no mapped Key Fish Habitat within the Project area.

7.3.3 Potential impacts

The BDAR assesses the Project impacts in accordance with the prescribed steps in Stage 2 of the BAM by first reviewing the avoidance and mitigation strategies proposed for the Project and then assessing the residual impacts of the Project.

7.3.3.1 Impact avoidance

The Project is located in non-native vegetation comprising Bitou Bush Scrub and exotic grasslands. Construction of the Project would avoid direct clearing of native vegetation and threatened species habitat. Access to the Project area would be along Ocean Park Road and would not require clearing of native vegetation.

The Project also avoids Coastal Wetland mapped under the Coastal Management SEPP, although it does fall within the proximity area for mapped Coastal Wetland. No aquatic or wetland habitat would be directly impacted by the Project and aquatic habitats associated with

Belmont Lagoon are unlikely to be impacted by the Project as they are at least 200 m from the Project area and are buffered by a corridor of swamp forest, wet heath and rushland vegetation.

7.3.3.2 Impact mitigation

Considering the proximity of native swamp and wetland habitats to the Project area, the potential biodiversity impacts of the Project would likely arise during construction and would affect native swamp forests and wetland vegetation adjacent to the desalination plant site (including potential threatened ecological communities and potential threatened species habitat). This includes:

- Mobilisation of sands from the dunes due to onshore winds during the construction period, when vegetation would be removed and earthworks would take place. Deposition of sand to west of the Project area could smother some areas of native vegetation in adjacent/nearby wetland and swamp habitats associated with Belmont Lagoon.
- Further spread of highly invasive weed species along the foredunes and into adjacent native vegetation during construction, namely high threat weed species recorded within the Project area. This includes Bitou Bush, Lantana, Coolatai Grass, Kikuyu and Coastal Morning Glory (*Ipomoea cairica*).

Other potential biodiversity impacts of the Project include:

- Increased surface run-off from construction of hardstand areas into adjacent wetland and swamp vegetation, with potential to transport pollutants or contaminants from the Project area.
- Potential introduction, or further spread of pathogens into adjacent wetland and swamp vegetation, particularly Chytrid fungus (*Batrachochytrium dendrobatidis*) as it is found in soil and water.

Measures to manage potential indirect impacts are detailed in Section 7.3.4 below.

7.3.3.3 Residual impacts

Direct impacts

The Project would remove or disturb approximately 6 ha of vegetation comprising Bitou Bush Scrub and exotic grassland (see Table 7-6) for the proposed desalination plant at the Belmont WWTW site, and for the construction of the power connection at the Marriott Street and Hudson Street intersection.

This vegetation is non-native and does not conform to any native vegetation communities listed as threatened under the BC Act or EPBC Act.

Table 7-6 Direct clearing impacts within the Project area

Vegetation type	Extent within Project area (ha)		Total area (ha)
	Desalination plant	Power connection	
Bitou Bush Scrub	3.24	0	3.2
Exotic grassland	3.02	0.01	3.0
Cleared	1.36	0.03	1.4
Total area (ha)	**7.62**	**0.04**	**7.7**

Indirect impacts

The Project has potential to have indirect impacts on adjacent native swamp and wetland vegetation during the construction of the desalination plant at the Belmont WWTW site. The adjacent vegetation includes community types that are threatened under the BC Act or EPBC Act.

The potential indirect impacts are largely associated with wind erosion hazards and disturbance of high threat and priority weed species during vegetation clearing and earthworks but also includes potential for impacts on aquatic habitats and injury to any native fauna that may be present during construction are also possible. In summary, the potential indirect impacts include:

- Smothering of adjacent native vegetation due to mobilisation of sand from wind erosion
- Introduction and spread of high threat or priority weeds and pathogens
- Impacts on water quality and adjacent sensitive receivers (i.e. surrounding wetlands and riparian vegetation)
- Potential disturbance of acid sulphate soils, which may affect adjacent sensitive receivers
- Potential for fauna injury and mortality during construction

Discussion of the potential indirect impacts of the Project is provided in Section 8.3 of the BDAR (GHD, 2019c) (Appendix E). The measures to address the potential indirect impacts of the Project are detailed in Section 7.3.4 below.

Serious and Irreversible Impacts (SAII)

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles set up in Section 6.7 of the BC Regulation.

The principles are aimed at capturing impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These include impacts that will:

- Cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- Further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable

A set of criteria have been developed and are included in the *OEH Guidelines to assist a decision-maker to determine a SAII* (OEH, 2017b). Threatened biota that meet the criteria under one or more of the above principles have been identified as SAII entities and are listed in the fore mentioned document. Each potential SAII entity has an impact threshold identified which can be used to help determine if a development would result in SAII.

The Project area does not contain or support habitat for any potential SAII entities and no further assessment is required under Section 10.2 of the BAM.

Potential impacts on groundwater dependent ecosystems

Drawdown would occur below vegetation mapped as a high potential GDE, corresponding to PCT 1724 Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast and is predicted to reduce water table levels by up to 0.5 m (see Section 7.2). The drawdown would act on the water table up to a distance of approximately 30 m to the west of Ocean Park Road. The drawdown has potential to affect the cover of the understorey vegetation for the period of the drawdown, as sedges and various ground ferns characterising coastal swamp and heath forests are generally influenced by the degree of waterlogging in the soils. However, the predicted drop in water table levels by up to 0.5 m is considered unlikely to significantly impact on the composition or the persistence of such vegetation communities, particularly in relation to swamp forests, which have a widespread distribution in the locality and is likely to occur over a range of water table levels.

Assessment of MNES

There are no MNES entities (threatened ecological communities, threatened species, migratory species) considered likely to occur within the Project area. Direct impacts on MNES caused by the construction and operation of the Project are therefore considered to be unlikely.

The Project has the potential to indirectly impact MNES including adjacent native swamp forests and coastal saltmarsh within proximity of the desalination plant site. The Project would not affect any important habitat for migratory waders. Potential indirect impacts on beach and wetland habitat would have a negligible impact on potential habitat for these highly mobile species and other threatened fauna species that may occur in the locality from time to time. Potential indirect impacts include those discussed above and are proposed to be mitigated through implementation of a number of measures during construction (see Section 7.3.4).

Given the degraded habitat present in the Project area, lack of habitat for MNES, and limited potential for indirect impacts on MNES, no assessments of significance were considered necessary. The Project is unlikely to have a significant impact on any MNES, and referral of the project to the Commonwealth Minister for the Environment is not considered necessary.

7.3.4 Mitigation measures

To mitigate the potential impacts of increased surface runoff due to the construction and operation of the desalination plant, the Project would include the following indicative design measures:

- Installation of impermeable concrete bunding around chemical storage areas to minimise the risk of contamination.
- Use of crushed gravel for hardstand areas to minimise the generation of runoff.
- Roof water catchment areas generally limited to containers and tanks (i.e. no large buildings and roof surfaces that would generate runoff).

A CEMP would be implemented for the construction phase of the Project. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures, including the procedures outlined below. The proposed mitigation measures would include environmental safeguards for protection of neighbouring areas and waterways in accordance with relevant policy documentation and Government guidelines.

In order to address the potential impacts of the Project on biodiversity as discussed above, the mitigation and management measures outlined in Table 7-7 will be implemented as part of the CEMP for the site.

Table 7-7 Proposed mitigation measures (terrestrial and freshwater ecology)

Impact	Mitigation	Timing
General	Site induction: All workers will be provided with an environmental induction prior to starting working on-site. This will include information on the ecological values of the area surrounding the Project area, key weed threats and measures to be implemented to protect biodiversity, particularly focussing on erosion management, and potential weed and pathogen spread.	Pre-construction, Construction
Proximity of adjacent native vegetation	Limit disturbance of vegetation to the minimum necessary to undertake the works.	Pre-construction
	Prior to the commencement of any work adjoining areas of native vegetation, clearly delineate the construction area marking the limits of clearing to avoid unintended clearing of adjacent native vegetation. Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Pre-construction, Construction (daily inspections of exclusion zones during works in area)
	Install appropriate temporary fencing during the construction phase to exclude native ground fauna from adjacent native habitat entering construction areas (whether they are recorded during pre-construction survey or not). Fencing should remain in place until the completion of all construction activities including revegetation.	After completion of clearing activities/ construction works
	Stockpiles of fill or vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Pre-construction, Construction
Soil erosion, sedimentation and runoff	Erosion and sediment controls will be installed and maintained in accordance with the measures outlined in Section 7.1.4.	Pre-construction, Construction, Operation
	A protocol for accidental spills will be developed and implemented in accordance with the measures outlined in Section 7.1.4.	Pre-construction, Construction, Operation
Acid sulphate soils	Prepare and implement an ASSMP in accordance with the measures outlined in Section 7.1.4.	Pre-construction Construction
Introduction and/or spread of weeds and pathogens	Develop a weed species management sub-plan as part of project CEMP to manage weeds and pathogens during the construction phase of the Project.	Pre-construction, Construction
	The location and extent of any priority and/or high threat environmental weeds within the Project area will be identified by a suitably qualified ecologist during pre-clearance surveys. The introduction and spread of weed species will be minimised by restricting access to areas of native vegetation and communicating the responsibilities of all Project personnel at site inductions and during regular toolbox meetings. All priority weeds identified on the Project area will be controlled and removed in accordance with the requirements of the *Biosecurity Act 2015* and Council's relevant Weed Control Manuals: Appropriate pesticides will be applied if required and a record of such application made in the pesticide application register. All noxious and environmental weeds will be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed	Pre-construction, Construction

Impact	Mitigation	Timing
	waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material. Disposal must be documented, and evidence of appropriate disposal must be kept.	
	All machinery entering the Project area must be appropriately inspected, and washed down and disinfected as required prior to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*) in accordance with the national best practice guidelines for Phytophthora (O'Gara et al, 2005) and the Myrtle Rust factsheet (DPI, 2015b) for hygiene control.	Pre-construction, Construction
	Incorporate control measures in the design of the Project to limit the spread of weed propagules off site. Sediment control devices, such as sediment fences, will assist in reducing the potential for spreading weeds.	Pre-construction, Construction
	All machinery entering the Project area must be appropriately inspected, and washed down and disinfected to prevent introduction or spread of Chytrid fungus as per the Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECC, 2008b).	Pre-construction, Construction
Wind erosion	Erosion and sediment controls will be implemented in accordance with Section 7.1.4 before commencement of ground disturbance work and will be retained until all surfaces have been fully restored and stabilised.	Pre-construction, Construction
Fauna encounters during vegetation clearing	The construction contractor is to contact the Project ecologist for advice if any unexpected fauna are found during the construction period (i.e. before, during or following clearing of native vegetation where the Project ecologist is not on site).	Construction
	A procedure to manage unexpected threatened species finds will be included in the CEMP and is to be implemented in the event of any unexpected threatened species finds during clearing.	Pre-construction,
	A post-clearing report will be prepared documenting all animals that are handled, or otherwise managed, within the site. Data to be recorded includes: • Date and time of the sighting and details of the observer • Species • Number of individuals recorded • Adult/juvenile • Condition of the animal (living/dead/injured/sick). • Management action undertaken (e.g. captured, handled, taken to vet). • Results of any management actions (e.g. released, euthanised, placed with carer).	Post-construction

7.3.5 Credit summary and biodiversity offsetting

7.3.5.1 Offsetting under the BC Act – ecosystem and species credit generation

The BDAR (GHD, 2019c) (Appendix E) assumed on a conservative basis that the exotic vegetation within the Project area is associated with threatened species habitat and assessed the Project area for ecosystem and species credits.

The BDAR identified a number of predicted and candidate threatened species that were assessed for ecosystem and species credits in accordance with Section 6.4.1.1 to Section 6.4.1.19 of the BAM. The assessment of predicted and candidate species is detailed in Section 7.1 of the BDAR (GHD, 2019c) (Appendix E).

No ecosystem credits were generated for clearing of approximately 6 ha of exotic vegetation conservatively assessed as threatened species habitat (see Section 9.1 of the BDAR for further details). No species credits were generated for the Project as assessment of the habitat constraints of the Project area found that the habitat is substantially degraded and therefore, no candidate threatened species required further assessment for species credits.

7.3.5.2 Offsetting under the EPBC Act

Department of the Environment and Energy (DEE) administers an environmental offset policy under the EPBC Act (DSEWPaC, 2012). Environmental offsets are only required for controlled actions where residual impacts are considered to be significant.

As discussed in Section 7.3.3, given the degraded habitat present in the Project area, lack of habitat for MNES, and limited potential for indirect impacts on MNES, the Project is unlikely to have a significant impact on any MNES, and no environmental offsets are required under the EPBC Act.

7.3.5.3 Offsetting under the FM Act

DPI generally enforces a ‘no net loss’ habitat policy as a permit condition or condition of consent. Achieving no net loss of key fish habitat may involve habitat rehabilitation or provision of habitat compensation on a minimum 2:1 basis.

The Project area does not contain freshwater or estuarine habitats, and does not contain key fish habitat as defined under the in the *Policy and guidelines for fish habitat conservation and management* (DPI, 2013). There are limited indirect impacts on key fish habitat to the east and west of the desalination plant; these potential indirect impacts would be managed through the implementation of mitigation measures under a CEMP. Considering this, the Project is unlikely to result in a net loss of key fish habitat and no offsetting under the FM Act is required.

7.4 Marine biodiversity

This section describes the existing environment in relation to marine biodiversity. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is drawn from the *Marine Assessment* (GHD, 2019h) (Appendix K) which was prepared to assess the potential for impacts on marine biodiversity values.

7.4.1 Methodology

Assessment of the existing marine ecology and potential impacts from the construction and operation of the Project has been completed using a combination of methods, including:

- Review of relevant environmental legislation.
- Desktop assessment to describe the existing environment around the Belmont WWTW and to determine the likelihood of any threatened species and their habitats occurring in the Project area. This assessment included database searches, review of existing studies and review of other EIS technical assessments.
- Use of both historical and field data to describe the extant conditions.
- Understand of potential construction and operational impacts on the marine ecology (directly and indirectly) from the proposed Project activities and assessment of these impacts.
- Determining a number of management and mitigation measures to avoid and minimise the impacts to the marine ecological values.

7.4.2 Existing environment

7.4.2.1 Ambient seawater

Ambient seawater quality was characterised across quarterly measurements during July 2011-April 2013 (Worley Parsons, 2014) and August 2017-July 2018 at four reference sites approximately 2 km from the Burwood WWTW outlet (Burwood Beach Marine Environmental Assessment Program 2017-2019).

Seawater temperature measurements collected from the vicinity of the Burwood WWTW outfall between February and June 2018 showed that water temperatures ranged from a minimum of 15-16°C to a maximum of 22-23°C. Salinity ranged from 32.7 to 36.4 practical salinity units (PSU) for the 20th to 80th percentiles, respectively.

The average turbidity was above the 80th percentile due to isolated occurrences of very high turbidity values with approximately half of the values exceeding the recommended water quality guideline of 0.5 NTU.

The median of ammonia (NH_X) was below 0.005 mg/L and below the recommended guideline value. Concentrations of nitrogen oxides (NO_X) however varied quite considerably, with the median being approximately 10-fold lower than the 80th percentile value, showing a relatively small number of samples with a high concentration of NOx. The median NOx value was below the recommended water quality guideline of 0.025 mg/L. Similarly total nitrogen concentrations were relatively high, with the median, average and 80th percentile values all exceeding the recommended water quality guideline of 0.120 mg/L.

Conversely, median concentrations of total phosphorus were within guideline water quality values.

Generally the medians of faecal coliforms and enterococci were lower than respective limits of reporting (<1 colony forming units/100 ml), although the average values for both are above the 80th percentile due to isolated occurrences of spikes in concentrations.

7.4.2.2 Groundwater

Water quality sampling of the raw water feed (saline groundwater) completed late 2018-2019 across a number of events identified that salinity was consistent with ambient seawater quality conditions. Further, levels of potential contaminants within the raw feed water (e.g. nutrients,

metals, faecal coliforms, suspended solids, etc.) were well below those entrained within the effluent stream being discharged from the WWTW outlet.

7.4.2.3 Substrate and sediment quality

The existing ocean outfall, which has been in place since 1982 with an upgrade in 1993, provides a hard substrate within an otherwise open area of soft sandy substrate. The soft sediment habitat around the Belmont WWTW outfall is predominantly (>90%) comprised of sand fractions, rather than larger gravel/cobbles or smaller silt and clay fractions.

Historical sediment quality testing determined that there is no evidence to suggest that the Belmont outfall is a point source for contaminants. Differences in total organic carbon and metals observed between sampling sites were largely attributable to the difference in particle size distribution and were deemed unrelated to the presence or operation of the outfall.

7.4.2.4 Epibenthic and benthic ecology

The Belmont WWTW outfall pipe provides a hard substrate in an area that is otherwise comprised of soft sediment habitat. Since its installation, a variety of filter feeding organisms have recruited to the pipe, such that there is now a locally dense and diverse community established. The pipe is dominated by a variety of sponges from the class Demospongiae. Other sessile organisms present within the sponge garden include encrusting and solitary ascidians, and a variety of encrusting and erect algal species. Together, these sessile organisms form a diverse biogenic habitat that supports an array of invertebrate and fish species. Crinoids, which are slow moving filter feeders closely related to sea stars are present in high numbers. It is expected that small crustaceans, molluscs and other echinoderms would also be present. The soft sediment adjacent to the pipeline supports occasional seapens (Pennatulacea), a type of filter feeding soft coral. The filter feeding organisms are likely taking advantage of the additional nutrient input entrained in the WWTW effluent. The assemblage would also be providing an ecosystem service of filtering bioavailable nutrients from the water column, forming an important part of the local nutrient cycle.

Annual infauna monitoring at the Belmont WWTW outfall has been undertake across 12 sites (five samples collected per site) since 2016. Assemblages are typically dominated by marine worms (e.g. Polygordiidae and Spionidae annelids), and small crustaceans (e.g. Amphipod spp. - Arthropoda) (Advisian, 2019). The surveys identified that a few prevalent taxa (Polygordiidae, Phoronidae and Spionidae) varied with increasing distance from the outfall.

Assessment of infauna undertaken to date indicates that effluent discharge has a localised effect on infaunal assemblages in proximity to the point of discharge (Advisian, 2019). This influence has been detected across a number of indices in multiple surveys, and indicates that infaunal assemblages within 100 m of the point of discharge have adapted to the ongoing input of effluent from the WWTP.

7.4.2.5 Fish assemblages

Fish assemblages associated with the pipeline include those that are using the structure of sponge gardens as refugia, those that are actively feeding on the sessile organisms, and higher order predators which are attracted to this prey. Species observed include the highly abundant Mado which were ubiquitous across the pipe. The next most commonly observed fish was the Australian Salmon, which were schooling in the water column above the pipe. Less commonly observed fish include the stripey, striped catfish, eastern fortescue, wrasse, gobies, leatherjackets, moray eel, sergeant baker, and Port Jackson shark.

7.4.2.6 Conservation values

The Belmont ocean outfall and area of potential direct impact of the Project are not located within any of the key ecological features or protected places of the Temperate East Marine Region. However, marine biologically important areas for some of the region's protected species (DoEE, 2015) do cover the Project locality, comprising:

- Humpback whale migration
- Short-tailed shearwater bird, sooty shearwater and wedge-tailed shearwater foraging
- Indo-Pacific/Spotted Bottlenose dolphin breeding and calving
- Grey nurse shark breeding

Further, the Project is located within a broad area that is designated by the Department of Primary Industries as key fish habitat, which comprises aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

One hundred and forty-two (142) listed threatened species were identified by the BC and FM BioNet as having the potential to occur within the project area. Of these species the following were identified as potentially occurring in the project area and was thus assessed under the BC Act 2016 assessment criteria:

- New Zealand fur seal (*Arctocephalus forsteri)* (**vulnerable**) suitable rocky/complex habitat is not present within the project area. However it may transit past the project area along the coast as a transient visitor as it has been recorded within 10 km of the area.
- Southern right whale (*Eubalaena australis*) (**endangered 1)** Belmont is at the very northern tip of this species distribution. This species is likely to forage and transit the area during migrations and has been recorded within 10 km of the area.
- Dugong (*Dugong Dugon*) (**endangered 1**) is known to undertake long-distance migration/dispersal events. This species may transit the project area to forage and has been recorded within 10 km of the project area.
- Humpback whale (*Megaptera novaeangliae*) (**vulnerable**) the coast of southern NSW to northern QLD is listed as a Biologically Important Area (BIA) for humpback whales. This species is likely to transit the area during migrations and has been recorded within 10 km of the project area.
- Loggerhead *(Caretta caretta)* (**endangered 1**) and green turtles (*Chelonia mydas*) (**vulnerable**) are widely distributed throughout the Australian coast. The species are likely to forage and transit the area and has been recorded within 10 km of the site.

Schedule 4, 4A and 5 of the FM Act 1994 provides lists of critically endangered, endangered and vulnerable species, populations and ecological communities occurring in NSW. The great white shark was identified as potentially occurring in the project area and was thus assessed under the FM Act 1994 assessment criteria:

- The great white shark listed (*Carcharodon carcharias*) as **vulnerable**. The nearshore environment in the vicinity of Hawks Nest and Stockton Beach are a known primary residency region for juveniles of the species. The species is likely to transit through the project area.

The EPBC Act 1999 Protected Matters Search Tool was used to identify MNES and other matters protected under the EPBC Act 1999 that are predicted to occur in, or relate to the project area. This search identified a number of MNES of relevance to the project. Of these, the following species/groups were identified as likely to occur within the project area; these have been assessed in accordance with the related Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013):

- Great white shark
- Loggerhead, green and hawksbill turtles
- Southern right whale and humpback whale
- Dugong
- Syngnathids

7.4.3 Impact assessment

7.4.3.1 Construction

The Project would require land based construction works to support installation of a pipeline connecting the desalination plant to the existing WWTW outfall, a subsurface intake, hardstand areas for installation of the pre-fabricated plant and installation of ancillary infrastructure including power.

Construction activities would generally comprise vegetation clearing, earthworks, trenching, pipeline installation, dewatering, soil treatment (if required) and rehabilitation/revegetation. None of these works are marine based. The facility design intends to use an existing ocean outfall pipeline currently in operation for the Belmont WWTW. As no in-water construction is planned to occur direct impacts to the marine environment during construction are not expected.

Coastal vegetation provides benefit to fisheries assemblages and mitigates risk of coastal erosion affecting water quality. Removal of coastal vegetation during construction may therefore pose risk of indirect impact to marine values via changes to water quality.

The subsurface intake would be installed using drilling from behind the dune system such that coastal vegetation stabilising the local beach environment is not expected to be affected.

Due to the close proximity of the proposed desalination plant to the marine environment, there is potential that any accidental spillage of hazardous materials or inappropriately managed waste released during construction could impact upon the marine environment. However, the Project area would be a minimum of 100 m from the ocean and therefore the risk of any accidental spills reaching the ocean is reduced. Further, spill prevention and management measures and the implementation of standard guidelines for the storage and management of waste and hazardous materials would further minimise the risk of impact.

Given the avoidance of impacting upon dune systems combined with the application of standard industry controls for management of release of hazardous and waste materials during construction would be applied, the risk of indirectly impacting the marine environment as a result of the proposed construction work is considered to be as low as reasonably practical.

7.4.3.2 Commissioning

Commissioning of the desalination plant would occur over an estimated two month duration. During commissioning operational performance of installed intake well and pumping systems would be tested. During this period a small percentage of sludge by-product would go to the existing Belmont WWTW inlet works. As that material would be treated via standard operations of the WWTW this is not expected to have any influence on the marine environment.

During testing the majority of the intake water would bypass treatment and be released direct to marine environment via the Belmont WWTW outfall. Transference of this raw feed water from the intake to the outfall would increase discharge to between 45-50 ML/day compared to an average of 30 ML/day during normal outfall operations. Change in volume of water released at the outfall is not expected to have any influence on the marine environment as long as quality of the raw water released is equivalent to existing conditions at the outfall. Modelling indicated that diffusers at the outfall have been designed to primarily rely on buoyancy driven plume mixing upon release of effluent from the outfall into receiving waters, and not jet-induced mixing. As such, added volume should integrate into surrounding waters with rate of mixing driven by current conditions.

Data indicates that the quality of raw feed water is within the ranges currently delivered to the receiving environment by the WWTW outlet. Accordingly, as long as raw feed water conditions are not significantly different during commissioning, the release of additional flow of intake groundwater during the two month testing phase should not have detectable impact upon the marine environment. However, groundwater testing indicates that there are nutrients present in the intake water. Therefore, if nutrient concentrations in raw feed water are elevated at time of release consideration may need to be given to risk of triggering algal bloom risk at the outfall; depending on extant conditions of the environment and quality of effluent with which raw feed water would be mixed.

Further to the above, commissioning of the RO plant would require release of pre-treated permeate (desalinated water output from the RO) into the WWTW outfall over a period of two weeks. This activity is likened to release of freshwater into the marine environment similar to that of a stormwater event. As such the release of permeate during this period is not expected to impact on the surrounding waters with a rate of mixing driven by current conditions and reflective of natural variance of ambient conditions.

7.4.3.3 Operation

Estimates of the discharge and salinity for the WWTW treated wastewater discharge and the normal full operation capacity of the desalination plant were modelled to understand how operation of the plant may influence the environment from current operations. The full report on modelling is provided as the Brine Discharge Modelling Report (Appendix L – GHD, 2019b).

In that assessment water quality objectives (WQOs) were estimated from water quality measurements of the existing WWTW effluent and the proximal ambient marine waters, the anticipated design water quality of the plant brine, and trigger values on the basis of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000). The assessment gave consideration to potential changes in water quality conditions that would impact upon marine toxicity, ecosystem productivity and salinity. A conservative numerical tracer of the discharge through the diffuser was utilised to predict the spatial extent of the area of impact for each of the WQOs and simulate the dilution factor of the WWTW treated effluent and comingled effluent.

A salinity difference of 1 PSU between the outlet plume and ambient seawater ($\triangle$S) was adopted for the project (GHD, 2019i), in line with $\triangle$S used for the Sydney (GHD, 2005) and Perth desalination plants. This is referred to as the ambient salinity WQO and was set as a conservative objective for marine ecology health.

Two discharge scenarios were evaluated via near-field and 3D far-field modelling:

- Existing (baseline) discharge baseline conditions of the WWTW effluent, and
- Normal full operation of the proposed plant with a design brine discharge of 25.2 ML/day that is comingled with the WWTW effluent prior to discharge into the marine environment.

To compare the near-field mixing performance of the baseline effluent and proposed comingled effluent-brine discharges, near-field modelling used the high discharge (90th percentile) and low discharge (10th percentile) as inputs into the model. The low discharge (10th percentile) conditions are by definition infrequent and of short duration.

The far-field region beyond the near-field is where mixing and dilution of the diffuser waters is driven by ambient mixing and transport processes associated with tides, winds, surface heat fluxes and waves. 3D far-field modelling considered both dry weather vs wet weather conditions. The area of impact (or effect) of WWTW discharge on the marine environment during dry weather conditions was predicted for a combination of median dry weather effluent discharge and poor effluent water quality (90th percentile). For wet weather conditions, the area of impact (or effect) was predicted on the basis of the median wet weather effluent discharge and the 20th percentile effluent water quality. During wet weather conditions with elevated stormwater flows, effluent quality is reasonably characterised by the 10th to 20th percentile water quality.

The dilution factors to meet the marine toxicity, marine ecosystem and ambient salinity WQOs for both the baseline and proposed scenarios during wet and dry weather periods are summarised in Table 7-8. The dilution factors for each WQO use the same analyte across the baseline and proposed scenarios. Generally, the addition of brine to the WWTW effluent reduces the WQO dilution factors due to lower brine concentrations (pre-dilution) and increased salinity (outflow salinities thereby closer to ambient marine waters) relative to the baseline case.

Table 7-8 Dilution factors to define area of impact (or effect) for marine toxicity, marine ecosystem and ambient salinity WQOs

WQO	Analyte	Dry Weather Baseline Dilution Factor	Dry Weather Proposed Dilution Factor	Wet Weather Baseline Dilution Factor	Wet Weather Proposed Dilution Factor
Marine Toxicity	NH_X	0.8	0.7	0.0	0.1
Marine Ecosystem	NO_X	234	203	142	144
Ambient Salinity (Above Seabed $S_{Diffuser}$<35 psu)	ΔS	31	8	31	18
Ambient Salinity (On Seabed $S_{Diffuser}$>35 psu)	ΔS	NA	14	NA	NA

The key conclusions in regards to the water quality impacts of the release of the proposed brine-effluent discharge into the marine environment via the existing diffuser include (Appendix L – GHD, 2019b):

- The marine toxicity WQO for NHx is met within approximately 1 m of the diffuser. Near-field modelling indicates that the required dilution factor (<1) is met immediately upon release into the marine environment.
- The spatial area of effect of the marine ecosystem WQO for NOx is predicted to be similar across dry and wet season periods and baseline and proposed scenarios. The WQO is met within approximately 1 km of the diffuser for 95% of the time.
- The comingled effluent-brine during high WWTW effluent discharge (90th percentile) yields a characteristic salinity of 19.7 PSU. This salinity is lower than ambient marine waters (35 PSU) so the same mechanism of buoyancy driven mixing (i.e. plume rising through the ambient waters) occurs as during the baseline discharge conditions (i.e. characteristic salinity of 4.8 PSU).
- The comingled effluent-brine during low WWTW effluent discharge (10th percentile) yields a characteristic salinity of 38.0 PSU, which is greater than the ambient marine waters

(35 PSU). Under these conditions, a negatively buoyant plume occurs that falls to the seabed with low near-field dilution the spatial area to meet the ambient marine salinity WQO (ΔS of 1 PSU) is predicted to be substantially smaller during the dry weather (<100 m for 95% of the time) than the wet weather (<500 m from the diffuser for 95% of the time) periods. Generally, the largest spatial extent of the WQO is due to buoyant plumes reaching the near-surface and then undergoing dilution under natural mixing processes. Generally, the spatial area of impact of salinity was less (dry season) or similar (wet season) during the baseline relative to the proposed scenarios. For the comingled effluent-brine outflows with high salinity during the dry season (maximum of ~48 PSU), a dilution factor for the ambient salinity WQO of 14 is readily met in the immediate vicinity of the diffusers.

Overall, the key finding from the modelling assessment is that the proposed brine-effluent discharge through the existing diffuser is predicted to have the same or smaller areas of impact (or effect) in terms of marine toxicity, marine ecosystem and ambient salinity WQOs (Appendix L – GHD, 2019b). During the dry season, changes in salinity as a result of effluent input would be improved via the addition of brine, such that discharges would be closer to ambient water quality, and spatial footprints of salinity plumes reduced. During the wet season no changes to current salinity impacts are predicted from input of brine. As is currently the case with discharged effluent, buoyant plumes of lower salinity water are predicted to rise to the near surface, rather than sink to the benthos, where they will then be diluted via natural mixing processes. Therefore significant impacts to WQOs and associated marine ecology are not likely from the proposed brine-effluent discharge. Minor salinity differentials are expected within 1 km of the diffuser. Pelagic species with sensitivities to changes in salinity will be able to disperse, avoid the area around the diffuser. Epi-benthic and benthic species may need to adjust to the higher salinities in the dry weather; however resilience of these species is evident by their encrusting abilities and habitat creation in areas which were otherwise de-pauperate.

Review of the groundwater quality which is planned for extraction/desalination and discharged as brine indicates that levels of metals, nutrients, suspended solids, and faecal coliforms are well below those currently discharged by the WWTW. Therefore, concentrations of potential contaminants in groundwater are not expected to impact on sediment quality by the addition of brine discharge to the effluent.

The local ecology of the region has been influenced by the ongoing presence of the Belmont WWTW outfall and its operation since 1994. As noted above the outfall provides support for a diverse assemblage of biota that is not representative of surrounding biota which is more depauperate. Benthic infauna communities, and epi-benthic pipeline communities are not expected to be impacted by operation of the desalination plant. Flow on effects to higher order taxa such as fish associated with/attracted to the pipeline community are therefore also expected to be negligible.

7.4.3.4 Decommissioning

Decommissioning of the desalination plant would reinstate flow levels and water quality at the Belmont WWTW outfall location to pre-desalination conditions. Established marine communities in the vicinity and on the outfall are not expected to be impacted by these changes in conditions.

Onshore decommissioning activities of the plant and any associated infrastructure are not expected to impact on the nearby marine environment as long as appropriate buffer distances and waste management practices are implemented.

7.4.3.5 Significant impact assessment of threatened species

State assessment

The potential to significantly impact on listed species identified within the project area has been assessed on the basis that the identified management and mitigation controls. The assessment was conducted against the BC Act 2016 and FM Act 1994 and considered Threatened Species Assessment Guidelines (Department of Environment and Climate Change (DECC), 2013) with relevance to:

- Species distribution and habitat requirements
- Likelihood of interaction with the timing of the proposed works
- Potential impact pathway
- Relevance of Project impact management and mitigation measures at controlling risk of interference

The great white shark listed under the FM Act 1994 and EPBC Act 1999 as threatened, was categorised as being likely to occur within the project outfall area. The Project has been assessed as unlikely to have significant impact on this species under the FM Act 1994 through all phases of work. The Project is considered to have a low impact risk on the marine environment.

The six marine species listed under the BC Act 2016 and EPBC Act 1999 as threatened were categorised as being likely to occur within the project outfall area. On the basis of the assessment on operational activities of the plant have been assessed as unlikely to have significant impact on any threatened species under the BC Act 2016 through all phases of work.

Commonwealth assessment

The potential to significantly impact on MNES identified within the Project area has been assessed on the basis that the proposed works are considered to be of low impact to the marine environment. The assessment was conducted against the EPBC Act Significant Impact Assessment Guidelines 1.1 (DoEE, 2013) and considered:

- Species distribution and habitat requirements
- Likelihood of interaction with the timing of the proposed works
- Potential impact pathway
- Relevance of Project impact management and mitigation measures at controlling risk of interference

One Commonwealth protected species Hawksbill turtle (*Eretmochelys imbricata*) that is not protected by State legislation was identified as likely to occur from the assessment. This species was fully assessed following the EPBC Significant Impact Guidelines The results of this assessment indicate that this Project is unlikely to have significant impact on MNES across all phases of the Project.

7.4.4 Mitigation measures

Mitigation measures provided in Table 7-9 will be implemented to minimise potential impacts on the marine environment.

Table 7-9 Proposed mitigation measures – marine environment

Impact	Management measure	Timing
Seawater	Standard industry obligations such as spill prevention and management measures and the implementation of standard guidelines for the onshore storage and management of waste and hazardous materials.	Construction, Operation and Decommissioning
Benthic and sediment	Continuation of the Ocean Outfall Monitoring Program (EPL 1771) throughout operation of the project including benthic infauna and sediment quality testing.	Operation

7.5 Coastal processes

This section describes the existing environment in relation to coastal processes. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is drawn from the *Belmont Temporary Desalination Plant Coastal Processes Assessment* (GHD, 2019d) (Appendix M) which was prepared to assess the potential for impacts on coastal processes.

7.5.1 Methodology

Assessment of the existing coastal processes and hazards and potential impacts from the construction and operation of the Project has been completed using a combination of methods, including:

- A review of available literature and legislation, with some of the key resources reviewed to inform the baseline conditions include:
  - Survey data from the Project area
  - *Lake Macquarie Coastal Zone Management Plan 2015-2023* (CZMP) (Umwelt, 2015) and associated studies, including a *Coastal Zone Hazard and Risk Assessment* and *Coastal Hazard Study report* (BMT WBM, 2015a, 2015b), both commissioned by LMCC as part of the Lake Macquarie CZMP.
  - NSW Sea Level Rise Policy Statement
- An assessment of potential impacts of the Project was undertaken via a qualitative assessment against previously endorsed plans.
- Mitigation measures developed based on the outcome of the baseline conditions and impact assessment process. Mitigation measures were designed to address any potential impacts to coastal processes or to manage potential impacts of coastal hazards on the Project.

7.5.2 Existing environment

7.5.2.1 Setting

The Project area is located in the coastal dunes behind Nine Mile Beach, located within 170 metres of the shoreline.

The Project area is located in the Newcastle Coast sediment compartment as defined under the CM Act.

7.5.2.2 Coastal processes

Coastal processes that influence the Project location include:

- Bathymetry and coastal morphology – Nine Mile Beach is characterised by a low sandy beach ridge in the south near Swansea Channel, extending to wide dunes of heights up to 15 m to the north at Redhead. At the Project area, the beach is oriented to the south-east. The narrow and steep nature of the nearshore zone and continental shelf offshore of Lake Macquarie means there is less energy dissipation of deep water waves as they travel into the nearshore zone and onto the shoreline, accentuating the potential for wave-induced coastal erosion relative to surrounding coastal compartments.
- Wave climate – The NSW coast is subject to a moderate wave climate predominantly from the south to southeast with an average offshore significant wave height (Hs) in the order of 1.6 m. Large waves can be generated year round by tropical cyclones, mid latitude cyclones and east coast lows. Given the orientation of the beach at the Project area, waves from the south-east would have the most potential for cross-shore erosion.
- Water levels – fluctuate as they are influenced by tidal variation (semi diurnal), storm surge (from significant reduction in barometric pressure), wind setup (from onshore winds), wave setup (raised water levels as a result of broken waves, approximately 15 per cent of offshore wave height), wave runup (uprush of water from a breaking wave).
- Longshore sediment transport – prevailing northerly drift due to the dominant south-south-east wave direction on the NSW east coast. The gross transport rates for Nine Mile Beach have been estimated up to 600,000 m^3 although net littoral drift outside of the embayment is thought to be significantly lower.
- Cross-shore sediment transport – typical patterns are erosion during significant wave events (increased wave heights and elevated water levels cause sand to be eroded from the upper beach/dune system and transported in an offshore direction) and accretion when wave conditions are mild (in calmer weather, sand slowly moves onshore from the nearshore bars to the beach). Typically, the cross-shore exchange of sand from the upper beach/dune area to the nearshore profile represent a net balance in the overall active beach system.
- Aeolian sediment transport – transport of sediment from the dry upper beach face and berm into unvegetated incipient dunes and foredunes by wind.
- Climate change and sea level rise – elevated water levels associated with climate change (increase in mean sea level above 1990 levels of 0.4 m by 2050 and 0.9 m by 2100 (DECCW, 2009b)) and potential for variation to storm intensity and frequency.

7.5.2.3 Coastal hazards

During an unlikely storm event (defined as a 100 year ARI storm surge and 100 year ARI design wave, in combination), wave run-up is expected to breach the low dune barrier along the northern boundary of Belmont Golf Course to a point near the southern property boundary of the Belmont WWTW. The consequences of the wave run up would likely be enhanced by storm erosion.

At the Project area, the volumes of water that do overtop the dune may be dispersed by draining toward Belmont Lagoon via Cold Tea Creek or infiltrating directly through the dune sands, depending upon the rate of overtopping.

Maps defining the present day (2010) and future (2050 and 2100) hazard lines and risk areas associated with coastal inundation, erosion and recession in the vicinity of the Project area are presented in the CZMP (Umwelt, 2015). This mapping indicates the proposed plant area is subject to high erosion risk in 2100 and a portion of the intake structures subject to extreme erosion risk in 2100. For all other scenarios regarding erosion and coastal inundation, the Project area is located landward of the designated risk areas. This does not include subsurface infrastructure, such as horizontal wells, which would extend into the coastal zone but are assumed deep enough such that the risk of exposure is negated.

7.5.3 Potential impacts

7.5.3.1 Potential impact of the Project on coastal processes and hazards

Coastal erosion

The potential impacts on coastal erosion from the Project are provided in Table 7-10 below. Mitigation measures provided in Section 7.5.4 would minimise these impacts. The Coastal Processes Assessment (Appendix M) has considered both the intake structures and pipelines, and the desalination plant itself.

Table 7-10 Potential impacts of the Project on coastal erosion

Existing conditions	Impact	Process
The geotechnical investigation revealed near surface sediments are of loose to medium density and are thus susceptible to erosion.	Exposing sands to aeolian processes, which may increase the mobility of dunal sands leading to increased rates of erosion	Disruption to dune vegetation systems, aeolian processes and associated dune stability during: • Construction as a result of heavy vehicle movement and earthworks • Operation: due to hardstand runoff and other plant activities
Coastal processes are typically in equilibrium and rely on the availability of dunal sands during periods of erosion.	Consolidating or 'locking up' of coastal dunes, removing the buffer for coastal erosion and increasing the risk of inland erosion	Establishment of built infrastructure is likely to lock up these sands such that they are no longer available to the natural system of coastal processes. • The Project would be constructed behind the front layer of dunes, which are proposed to be restored as part of a separate project by Hunter Water, which reduces the likelihood of this impact. • The horizontal intake pipes extend into the extreme hazard area for erosion and recession risk. However, with the exception of the isolated above ground portion of the caissons, the remainder of the wells would be at varying depths between eight and 20 metres below existing surface levels, which is considered to be deep enough such that the risk of sand lock-up is considered negligible.

Coastal inundation

There are no perceivable impacts on coastal inundation that could be caused by the Project. This is because the footprint and methodology for construction and operation would have zero influence on the processes that effect coastal inundation.

7.5.3.2 Potential impact of coastal processes and hazards on the Project

Coastal erosion

Present day (2010) and future (2050) scenarios

Should a storm occur during construction of the Project, coastal erosion could be exacerbated due to the exposure of the sub-surface, with the intake structures and pipelines being the aspects of the Project most at risk due to their proximity to the coastline. The detailed design would ensure the extent and duration of earthworks in these areas are limited as far as practicable.

As discussed in Section 7.5.2, part of the sub-surface infrastructure would extend into the mapped hazard areas of the coastal zone under these scenarios, including the horizontal intake wells and the pipeline connection between the desalination plant and the WWTW.

Under the current concept design, the horizontal intake pipes extend into the extreme hazard area for erosion and recession risk. However, these wells would be at varying depths between eight and 15 m below existing surface levels, which is considered to be deep enough such that the risk of exposure and reduced sand filtration capacity is negated. With regards to the brine pipeline connection between the desalination plant and the WWTW, it is outside of the hazard area for 2010, but is within the mapped high hazard area for 2050.

During the 2050 scenario, potential beach erosion could expose and directly damage this infrastructure, which is critical to the operation of the Project. Furthermore, beach erosion could expose sands to aeolian processes, with the potential to cause sand ingress into the plant leading to operational maintenance issues. However, given the Project is for the temporary operation of a desalination plant, the 2050 scenario is not likely to be of relevance to the Project.

Long term future scenario (2100)

The Project is predicted to be subject to low erosion risk in 2100 given it is landward of the rare hazard line. However, the intake caissons and pipeline structures, including the brine pipeline connection to the WWTW is predicted to be subject to extreme erosion risk.

Should a rare 2100-equivalent event occur while the Project is operational, beach erosion could occur; resulting in shoreline recession, beach level fluctuation and storm bite leading to slope instability and disruption of dunes exposing sands to aeolian processes. These processes could have a range of impacts on Project infrastructure including equipment, materials and personnel. However, given the Project is for temporary operation of a desalination plant, the 2100 scenario is not likely to be of relevance to the Project.

Coastal inundation

Mapping for the CZMP (Umwelt, 2015) indicates all infrastructure within the Project would be landward of the designated risk areas and not deemed to be at risk of coastal inundation. However, indicative locations of wave overtopping during a storm event for the future 2050 and 2100 scenarios indicates that this could increase near the proposed location of the intake structures and pipelines.

While this would likely be dispersed by draining, there could be a temporary impact to the above-surface portion of the intake structures as a result of the ocean water passing over the site.

7.5.4 Mitigation measures

Mitigation measures provided in Table 7-11 will be implemented to minimise potential impacts on the marine environment.

Table 7-11 Proposed mitigation measures – coastal processes

Impact	Mitigation measure	Timing
Erosion management	Implement a coordinated erosion monitoring and mitigation program in conjunction with the strategies implemented for the WWTW, including: • Site profiling and revegetation following completion of civil works in accordance with the final design which is to comply with the Lake Macquarie CZMP (Umwelt, 2015) and Department of Land and Water Conservation (2001). • Monitoring of recession and implementation of mitigation measures below as needed: - Beach management works such as beach scraping to reshape dunes and increase dune volume/recovery after storms if necessary. - Stabilisation of the frontal dune system by removing invasive species and replacing with locally indigenous dune vegetation. - Installation of sediment fences to minimise the movement of sands during construction. - Control off road vehicle access and surface runoff.	Construction, Operation
Aeolian sand ingress	Implement a coordinated erosion monitoring and mitigation program and update if required.	Operation
Consolidating or 'locking up' of coastal dunes by built infrastructure, removing the buffer for coastal erosion and increasing the risk of inland erosion	The current concept design situates the desalination plant behind the foredunes. Avoid locating the plant and sub- surface intake structures more seaward than is currently proposed in the concept design and minimise hardstand areas or structures that would consolidate the coastal dunes.	Detailed Design
Exposure of the subsurface network by coastal processes including beach level fluctuation and storm bite	Ensure that infrastructure installed within the active portion of the beach profile is of sufficient depth such that it is below the limit of scour. Alternatively, modify the infrastructure design such that it can be exposed to wave action during extreme events, or ensure plant is decommissioned prior to risk levels increasing under future scenarios.	Detailed Design
	Preferentially construct subsurface structures (particularly the deep intake wells) by directional drilling (or alternative), to avoid the need for an open trench. Monitor weather forecasts when working on the horizontal intake wells and the connection pipeline and halt works when extreme coastal warnings are issued by the Bureau of Meteorology.	Construction

Impact	Mitigation measure	Timing
Risk of coastal erosion	Any proposed changes to the current concept design need to consider the existing coastal hazard and risk maps in Figure 5-1 and Figure 5-2 of Appendix M as well as any future updates that may be available that would supersede the existing guidance. Ensure that plant boundaries do not extend into areas of present day erosion and recession risk and that the future risk level applied allows for the most conservative operational and decommissioning timeframes.	Detailed Design, Construction and Operation
	Conduct consistency reviews at major design milestones against the EIS, approval conditions and latest available literature including the Lake Macquarie CMP. It is understood that the EIS will have a 10 year validity period if approved, and as such it is likely that updated sea level rise guidance and coastal risk maps will be available in the interval between concept design and project implementation. The review is required to ensure that the Project area remains acceptable from a coastal erosion risk perspective.	Operation
Wave overtopping	Design infrastructure and landscaping to minimise the likelihood and extent of wave overtopping. Minimise the impact on the plant should wave overtopping occur by maintaining appropriate drainage and designing the plant to withstand an overtopping event.	Detailed Design

7.6 Social

This section describes the existing socio-economic environment of the Project area and vicinity. It addresses the social impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is drawn from the Social Impact Assessment (SIA) (GHD, 2019j) provided in Appendix N, which was prepared to assess the potential for social impacts on community and stakeholder values.

7.6.1 Methodology

The SIA was prepared in accordance with social impact assessment principles and methods including:

- *Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects* (Vanclay, 2015)
- *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development* (DPE, 2017), which recognises a social impact as a consequence experienced by people due to changes associated with a Project, which can impact people's:
  - Way of life
  - Community
  - Access to and use of infrastructure, services and facilities
  - Culture
  - Health and wellbeing
  - Surroundings
  - Personal and property rights

- Decision-making systems
- Fears and aspirations

This SIA has considered the potential impacts relevant to this Project in accordance with the following impact categories:

- Amenity and character
- Employment and economy
- Access and connectivity

The methodology for the SIA included:

- Identification of the social area of influence, including the local government areas, suburbs, communities and infrastructure, likely to be affected by the Project
- Describing the existing social environment of the identified area, with particular reference to the Project area and community values
- Identification and prediction of the potential social benefits and impacts on the communities and community facility infrastructure in the social area of influence
- Development of mitigation measures to avoid or minimise potential adverse social impacts and maximise benefits to the community and other stakeholders

7.6.1.1 Consultation

This SIA has been informed by SIA-specific consultation with LMCC and outcomes of community consultation led by Hunter Water for the Project.

7.6.2 Existing environment

7.6.2.1 Regional and local study areas

The Project is located within the Lake Macquarie LGA in the Hunter Region of NSW (the regional study area). The local study area is where the proposed works are likely to directly and indirectly impact surrounding residents and community members (e.g. changes to amenity, access and connectivity, and community values). The local study area comprises of the suburb of Belmont South.

Belmont South is situated on a peninsula between the eastern coast line and the eastern boundary of Lake Macquarie, approximately 20 km south of Newcastle. The suburb is located just south of the Belmont Wetlands State Park, and hosts a low density residential area. Belmont South and its neighbouring suburbs are a popular holiday destination (Lake Macquarie Council, 2018) and contains natural attractions such as the wetlands, Nine Mile Beach and Lake Macquarie.

Belmont South is intersected by the Pacific Highway which travels north-south through the suburb, which links the surrounding suburbs of Charlestown and Swansea. Charlestown is a popular commercial and retail hub (Dantia, 2014).

7.6.2.2 Outcomes of consultation

A meeting with a LMCC representative was conducted on 17 January 2019 to confirm the existing social environment, identify potential social impacts during construction and operation of the Project, and identify any mitigation strategies. The key findings of this meeting included:

- The community values maintaining the lifestyle and liveability of the region, including recreation
- Recreational four-wheel driving is popular in the area and access to Nine Mile Beach is important to this user group
- Construction impacts are expected to be minimal and temporary, due to the distance of the Project area to the nearest residential area of Belmont South
- A desalination plant would benefit residents of Lake Macquarie through ensuring a backup supply of water during periods of drought

Hunter Water has also conducted ongoing consultation for the Project. Outcomes from this consultation relevant to this SIA include:

- The community values protecting the natural environment
- The community highly values lifestyle, recreation, liveability and wellbeing
- Concern regarding access to Nine Mile Beach, including for 4WDs
- Concerns around the visual amenity of the Project

7.6.2.3 Existing social environment of Belmont South

This section provides key points from a demographic summary based on ABS 2016 Census data for Belmont South. Belmont South in comparison to the LGA can be characterised as having:

- A higher level of need for assistance with self-care, communication or mobility activities, due to disability (8.0 per cent compared to 6.6 per cent in LGA).
- A smaller proportion employed in the construction industry (14.3 per cent compared to 17.7 per cent in the LGA), however construction is the second largest industry of employment in Belmont South, after health care and social assistance (16.1 per cent).
- A lower proportion of people over 60 years (25.2 per cent in Belmont South compared to 27.1 per cent in LGA). Belmont South also has a lower proportion of people aged 18 years and under (19.7 per cent compared to 22.1 per cent in the LGA).
- Belmont South has an Index of relative socio-economic advantage and disadvantage (IRSAD) score of 890 and the LGA has an IRSAD score of 985, which demonstrates that there is more socio-economic disadvantage in Belmont South.
- A significantly higher level of renting in Belmont South compared to the LGA (40.1 per cent compared to 23.8 per cent in the LGA). Of these rented dwellings, a significantly higher proportion are public housing dwellings (37.5 per cent in Belmont South compared to 19.1 per cent in the LGA).
- A lower rate of labour force participation in relation to the LGA (53.2 per cent compared to 56.8 per in the LGA). Belmont South also has a higher proportion of unemployed persons (11.9 per cent compared to 6.9 per cent in the LGA).
- An audit of community infrastructure within one kilometre of the Project area identified the following facilities: Creative Kids Preschool, Belmont Cemetery, Belmont Wetlands State Park, Fernleigh Track, Belmont Golf Club, Nine Mile Beach and Blacksmiths Beach.

7.6.2.4 Community values

The values of Lake Macquarie communities relevant to this SIA have been identified based on a review of consultation outcomes and policy documents. This includes EIS community consultation (refer to Section 6) and a review of *The Lake Macquarie City Vision and Community Values – November 2016* (the City Vision) (LMCC, 2016a).

From the community reference group developed to inform the City Vision plan, commonly occurring community values comprised:

- Unique landscapes: an emphasis on protecting and enhancing the revered natural environment, enthusiasm for 'vibrant' town centres and the natural landscape.
- Lifestyle and wellbeing: the community has expressed the importance of adaptable and inclusive health and community services as part of the shared vision for the region. The provision of safe public space is seen to compliment this vision.
- Connected communities: the community values having the capacity to be adaptable to change, including climate change as well as the need to encourage sustainable lifestyles and sustainable infrastructure.
- Shared decision-making: the community has thrived on their ability to participate and be heard during decision-making that impacts the region. The community has expressed a strong value for knowing how and why decisions are made.

7.6.2.5 Key findings

Based on the information presented in the existing environment section, below is a summary of the key findings relevant to the SIA:

- The Project is located within Hunter Water owned land, next to an existing facility which is not in plain sight of any dwellings or community facilities within the area.
- Belmont South is characterised by a higher level of disadvantage compared to the LGA. Belmont South is also characterised by lower education levels, higher rate of unemployment and a higher proportion of state housing authority tenure. Belmont South has higher rates of vulnerable communities including a higher proportion of Indigenous people, and a higher proportion of people who need assistance.
- In total there are seven community facilities located nearby to the Project area, these include Creative Kids Preschool, Belmont Cemetery, Belmont Wetlands State Park, Fernleigh Track, Belmont Golf Club, Nine Mile Beach and Blacksmiths Beach.
- The Project area is located amongst areas utilised for popular outdoor recreational activities. These activities include four-wheel driving, coastal activities, bike riding and walking.
- The Lake Macquarie community value the protection and maintenance of the natural environment. They also value the ability to be adapt to climate change and water availability.

7.6.3 Potential impacts

Residents, the local community and passing motorists may be subject to some social impacts related to traffic and transport, noise and vibration, visual amenity and air quality as a result of the Project. These potential impacts have informed the SIA and have been addressed in other sections of the EIS, as follows:

- Traffic and transport (refer to Section 7.11)
- Noise and vibration (refer to Section 7.12)
- Visual amenity (refer to Section 7.14)
- Air quality (refer to Section 7.15)

The key social impacts that may occur during construction and operation of the Project are described in the following sections.

Figure 7-8 Local study area and Lake Macquarie LGA

7.6.3.1 Construction

Amenity and character

Properties and land uses close to the Project area are likely to experience potential amenity and community values impacts resulting from construction of the Project, including:

- Temporary increase in traffic and short delays during construction, with a small number of construction vehicle movements can be expected on the following roads to the Project area:
  - Pacific Highway
  - Beach Street
  - Ocean Park Road
  - Hudson Street (see Section 7.11)
  - Temporary increase in noise and vibration from construction activities, with construction noise during the daytime potentially noticeable to the following receivers:
  - Residents near the eastern end of Williams Street, due to construction activities occurring within the Project area
  - Residents within approximately 45 m of the proposed power upgrades at the intersection of Marriot Street and Hudson Street
  - Users of Nine Mile Beach and Blacksmiths Beach, due to construction activities occurring at the Project area
  - Users of Belmont Cemetery, due to construction activities occurring at both the Project area and the power upgrades at the Marriot Street and Hudson Street intersection (see Section 7.12)
- Landscape character and visual amenity impacts, with positioning of plant and equipment within view of nearby sensitive receivers and existing road users likely to result in minor, temporary visual impacts (see Section 7.14).
- Temporary impacts on air quality as a result of dust generation during construction; however, dust emissions during construction would be localised and would be managed through the application of mitigation measures (see Section 7.15).

Impacts on amenity discussed above would be managed through the implementation of mitigation measures detailed in Sections 7.11.4, 7.12.5, 7.14.4 and 7.15.4.

Employment and economy

It is anticipated that a workforce of about 25 full time equivalent construction and site management personnel would be required on site each day during construction, which is anticipated to take place over an eight month period. Construction is a major industry of employment in Belmont South demonstrating that there would likely be an existing labour force within the region who could take advantage of the Project employment opportunities. This would result in a short-term positive impact for these skilled workers.

Construction workers may create some demand for local food and beverage, and retail services close to the Project area. Given the small number of workers and short construction program, this would result in a minor positive impact for these local businesses.

Access and connectivity

The construction of the Project would lead to changed traffic conditions and delays. This would have a minor impact on motorists, including local residents, transport providers (e.g. school buses, community transport), freight companies, and others.

During construction, access along Ocean Park Road would be maintained for all road users, including motorists, cyclists and pedestrians. As a result, 4WD motorists and other users are expected to be able to continue with their leisure and social activities at the beach. Any potential impacts to access would be negligible and temporary.

Potential impacts on local amenity, access and connectivity would be generally minimal and would be managed through mitigation measures identified in Section 8.2.

7.6.3.2 Operation

Amenity and character

Operation of the Project would alter the character of the Project area and would have minor negative impacts on the experience of the area for the community and visitors.

Employment and economy

The Project's key objective is to provide a supplementary water supply to slow the depletion of existing water storages in the event of an extreme drought. This would likely provide a long-term positive impact for a range of local and regional businesses.

The Project is anticipated to result in a small number of ongoing jobs in relation to maintenance and operation of the facility. This would create a minor increase to job opportunities available to skilled workers, resulting in a minor positive long-term impact.

Access and connectivity

Operational traffic volumes of the Project are expected to be minimal. As a result, no social impact is expected on residents, general community members or users of Blacksmiths Beach including 4WD motorists as a result of traffic or changes to access.

7.6.4 Mitigation measures

Mitigation measures provided in Table 7-12 will be implemented to minimise potential impacts on the marine environment.

Table 7-12 Proposed mitigation measures - social

Category	Mitigation or management	Timing
Amenity and character	Ongoing consultation will be undertaken with key stakeholders prior to and during construction and operation of the Project to identify potential issues as they arise. This will include: - Notifying affected residents about planned Project activities, duration of activities, and expected impacts. Consultation should target vulnerable community members, who may include older residents and people experiencing disability. Notification should be provided to users of Nine Mile Beach and Belmont Cemetery as well as residents including those living along: - Williams Street - Marriot Street - Hudson Street - Maintain a register of stakeholders who would like to receive updates about the project and email/write to these stakeholders at appropriate intervals. - Communicate Project information to relevant stakeholders previously identified, including local businesses and community groups.	Pre-construction, Construction, Operation

Category	Mitigation or management	Timing
	- - Communicating Project information through Hunter Water's communication channels, such as a Project website and community update. - Providing a feedback mechanism for residents to contact the Project.	
Access and connectivity	As part of ongoing community engagement, the heavy vehicle movements will be communicated in community information materials along local residential streets such as Beach Street, Ocean Park Road and Hudson Street.	Construction, Operation

7.7 Sustainability

This section provides the sustainability assessment undertaken for the Project in accordance with the SEARs (see Table 5-2). It describes the overall approach to sustainability, and the specific objectives and initiatives that would be incorporated into the Project's design, construction and operation.

7.7.1 Methodology

This section was prepared by comparing both the sustainable development and resource efficiency initiatives planned for the Project, and the internal policies of the proponent with the following industry and government benchmarks:

- The Infrastructure Sustainability Council of Australia's (ISCA) *Infrastructure Sustainability (IS) rating scheme*, version 1.2
- The *NSW Government Resource Efficiency Policy 2019* (NSW GREP)

The IS rating scheme is an established industry benchmark designed to promote the consideration of sustainable development principles in the planning, design, construction and operation of infrastructure. The NSW GREP is a current policy which includes a range of targets to improve Government efficiency in the use of water, energy, and transport.

The purpose of selecting the IS rating tool as criteria for this assessment is to demonstrate the extent to which the Project is consistent with the principles of ecologically sustainable development (ESD) defined in section 6(2) of the *Protection of the Environment Administration Act 1991* and clause 7(4) of Schedule 2 of the EP&A Regulation, and to identify how they can be considered during the construction and operation of the Project.

The IS rating tool was selected for the breadth of its subject matter and its applicability to infrastructure developments. The IS rating tool covers a wide range of topics, and we consider it to address the ESD principles to a sufficient level of depth for this purpose. Specifically, the tool addresses:

- The precautionary principle (e.g. through the promotion of conservative targets and minimising impacts)
- Inter-generational equity (e.g. through the inclusion of criteria for community health and wellbeing and targets for reducing greenhouse gas emissions)
- Conservation of biological diversity and ecological integrity (e.g. through the specific assessment of biodiversity impacts and targets to reduce various impacts to biodiversity)
- Improved valuation, pricing and incentive mechanisms (e.g. by promoting efficiency of resource consumption, recognition of life-cycle costs and driving sustainability assessment and targets proportional to the costs incurred – in monetary value but also in terms of broader impacts)

These matters are considered further in Section 9.2.

7.7.1.1 Assessment approach

This assessment was executed as a desktop review of the Project's concept design documentation, other studies prepared as part of this EIS, and Hunter Water sustainability policies. This was supported by consultation with technical specialists and review of relevant background information.

Sustainability initiatives incorporated into the concept design were assessed for the extent to which they align with the requirements of applicable IS credits and the NSW GREP. Where important requirements were not currently being addressed, recommendations were made for future phases of the Project to address these requirements.

In addition, a number of Hunter Water policies and procedures were reviewed against the requirements of the relevant IS credits and the NSW GREP. Specifically, the following documents were reviewed:

- *The Hunter Water Greenhouse and Energy Management Policy* (Hunter Water GEMP; (Hunter Water Corporation, 2019)), which describes Hunter Water's approach to the abatement of greenhouse gas emissions from its activities.
- *The Hunter Water Community and Environment Policy* (Hunter Water Corporation, 2018), which describes Hunter Water's approach to managing its impacts on the environment and its responsibilities to the community.
- *The Hunter Water Sustainability Guiding Principles* (Hunter Water Corporation, In Draft), which outlines mandatory and optional sustainability compliance requirements.

The IS rating tool is divided into 15 topics or "categories", and the IS materiality assessment, which forms part of the rating tool, was used to assess the applicability and importance (or materiality) of each sustainability category to the Project. There is a degree of cross-over in the sustainability categories covered by the IS rating scheme, NSW GREP and Hunter Water GEMP (Table 7-13). However, each document includes different sustainability requirements within the common categories, and all have been considered in this assessment.

It should be noted that the IS rating scheme is being applied informally for the purposes defined above, and this assessment does not form a part of a registration of the proposal for an ISCA rating.

Table 7-13 Sustainability categories addressed by the reference documents

Sustainability category	IS rating scheme	NSW GREP	Hunter Water GEMP
Management systems	X		X
Procurement and purchasing	X	X	X
Climate change adaptation	X		
Energy and carbon	X	X	X
Water	X	X	
Materials	X		
Discharges to air, land and water	X	X	
Land	X		
Waste	X	X	
Ecology	X		
Community health, wellbeing and safety	X		
Heritage	X		
Stakeholder participation	X		

Sustainability category	IS rating scheme	NSW GREP	Hunter Water GEMP
Urban and landscape design	X		
Innovation	X		

7.7.1.2 Applicability of individual sustainability categories

The features of the Project affect the degree to which different sustainability categories as listed above apply to the Project. In order to assess the relative importance (or materiality) of each sustainability category, a IS rating scheme materiality assessment was completed. This assessment involved answering specific questions regarding the environmental, social and economic context of the Project. Based on the responses to the questions, each sustainability category was assigned a materiality score, presented in Table 7-14 (0 - negligible, 1- low, 2 - moderate, 3 - high or 4 - very high).

Table 7-14 Assessment of the importance of sustainability categories

Category	Environmental, social and governance context of the proposal	Importance
Management systems	The Project is worth more than $20 million (as the threshold for a small project) and involves an issue of considerable importance for the local region.	Moderate (2)
Procurement and purchasing	A default materiality value was assigned for this credit as there are no specific questions to be answered for procurement and purchasing under the IS rating scheme materiality assessment.	Moderate (2)
Climate change adaptation	The Project is located within an area predicted to be impacted by sea level rise, however the life of the project is linked to dam trigger values and therefore likely to have a short operational life as defined by IS (under 10 years).	Negligible (0)
Energy and carbon	The Project is a water supply facility, the operation of which would involve a number of energy-intensive processes, including a reverse osmosis desalination system and pumping for potable water delivery. Construction of the facility would also involve energy-intensive activities, such as earthmoving.	Moderate (2)
Water	The Project is located in an area susceptible to drought during extended periods of dry weather. Being a desalination plant, the use of potable water during operation is expected to be low, however construction water use may be significant.	High (3)
Materials	During construction, expenditure on materials is predicted to be high. During operation, expenditure on materials is predicted to be moderate.	Very high (4)
Discharges to air, land and water	<u>Water</u> Operation of the Project would result in the discharge of additional brine into the marine environment. Moreover, there is some risk of pollution of waterways during construction. Biologically important areas for some protected species cover the proposal locality.	High (3)
	<u>Noise and vibration</u> While the site of the desalination plant is not close to sensitive receivers, the location of the proposed power upgrades is adjacent to residences. Construction would involve some noise and vibration generating activities, including boring/drilling for the power upgrades.	High (3)

Category	Environmental, social and governance context of the proposal	Importance
	Air The location of the proposed power upgrades is in an urban area. Construction would involve the use of diesel plant and equipment, potentially generating air emissions.	Moderate (2)
	Lighting Night works will not be required in areas close to residences. During operation, the desalination facility would be lit, potentially impacting upon light sensitive receivers, particularly in Belmont Lagoon, which is <100 m away from the project boundary.	Low (1)
Land	Topsoil The Project has the potential to disturb some uncontaminated topsoil during construction, however the soil erosion hazard has been assessed as low (Section 7.1.3).	Moderate (2)
	Contamination Levels of contaminants have been found to be above ecological assessment criteria in some locations within the Project area. In some cases, these could present a contamination risk to the environment if not suitably managed.	Moderate (2)
	Flooding Some parts of the Project are located adjacent to flood liable land close to sensitive land uses.	High (3)
Waste	Waste management During construction, materials intensity is predicted to be high, including a number of waste generating activities. During operation, materials intensity is predicted to be moderate.	Very high (4)
	Deconstruction/disassembly Some of the desalination plant equipment may be temporary and may be decommissioned after use.	Very high (4)
Ecology	Construction of the Project would occur on previously disturbed land adjacent to areas of native vegetation to the west.	Moderate (2)
Community health, wellbeing and safety	There is likely to be some public interaction with the Project area, particularly interaction with beach users.	Moderate (2)
Heritage	The Project is within a LMCC mapped Sensitive Aboriginal Landscape with the area identified as culturally sensitive by Registered Aboriginal Parties. However, No existing AHIMS sites are recorded within the Project area based on the location of their registered grid co-ordinates in the AHIMS site search results. However, one Aboriginal cultural site (RPS BEL IF01) was been identified within the Project area and therefore would need to be salvaged prior to works proceeding. The site has been submitted for registration on the AHIMS database. No other known Aboriginal heritage objects or places would be impacted as a result of the Project.	Very high (4)
Stakeholder participation	Stakeholder engagement has identified that there is stakeholder interest in the Project.	High (3)

Category	Environmental, social and governance context of the proposal	Importance
Urban and landscape design	The power supply connection portion of the Project is located in an urban area and the desalination plant is adjacent to Nine Mile Beach.	Moderate (2)
Innovation	The desalination plant would be constructed using purchased modules and standard techniques, restricting opportunities for innovation.	Moderate (2)

7.7.2 Existing environment

The desalination plant would be located next to the existing Belmont WWTW, with Belmont Lagoon to the west, Belmont Wetlands State Park to the north, the ocean to the east and Belmont Golf Course to the south. The power supply connection would be within an urban area, adjacent to properties at the intersection of Hudson Street and Marriot Street.

The desalination plant would be located adjacent to native vegetation and in a mapped Sensitive Aboriginal Landscape.

7.7.3 Potential impacts

The following sections identify performance against each of the categories of the IS rating scheme v 1.2 assessed in Table 7-14 above, with the exception of categories assessed as negligible, which were scoped out of the assessment. Recommended actions for future project phases are provided in the mitigation measures (Section 7.7.4).

7.7.3.1 Management systems

Hunter Water's Community and Environment Policy and GEMP consider environmental, social and economic aspects, including commitments to restorative actions. These policies are endorsed by senior management and are linked to specific objectives and targets.

Contractor sustainability reporting for major project milestones and monthly reporting against targets is a mandatory requirement under Hunter Water's Sustainability Guiding Principles. Moreover, contractors are required to provide sustainability 'lessons learned' which contribute to addressing the ISCA requirements.

Under Hunter Water's operating licence, Hunter Water would be subject to external audits, though the frequency of these audits is not specified.

An options assessment has been undertaken for the Project (summarised in Section 2), which considered environmental, social and economic aspects and included a no-project option.

While these measures address some ISCA criteria for management systems credits, however there are some requirements which have not yet been met.

7.7.3.2 Procurement and purchasing

Contractors to Hunter Water are contractually required to comply with the requirements of the Hunter Water Sustainability Guiding Principles, which include both mandatory and voluntary sustainability objectives and targets.

The mandatory requirements of the Sustainability Guiding Principles include a number of specific initiatives towards sustainable procurement. Contractors are required to complete a modern slavery risk assessment for the Project and suppliers would complete a modern slavery questionnaire. Contractors must also report on supplier workforce diversity as well as spending on supplier engagements which are Indigenous enterprises or social enterprises.

Although not a mandatory requirement of the Sustainability Guiding Principles, contractors are encouraged to consider sustainability performance when assessing and engaging suppliers. This assessment of sustainability performance would consider environmental, social and economic aspects and would be performed prior to, throughout and at the conclusion of supply contracts.

The mandatory procurement requirements from Hunter Water's Sustainability Guiding Principles address a number of the ISCA requirements. However, the assessment of contractor and supplier performance is currently a voluntary initiative, despite being an important aspect of sustainable procurement and an ISCA requirement.

7.7.3.3 Energy and carbon

Energy use and greenhouse gas emissions have been modelled for both construction and operation phases of the Project with results presented in Section 7.16.3. Energy reduction has also been considered in the design of the Project, with a high likelihood that energy recovery would be incorporated into the desalination plant (Section 4.5).

Opportunities for the use of an on-site solar photovoltaic system to provide a portion of the Project's operational energy requirements have been identified in Section 2.7. However, on-site solar has not been selected as a preferred power supply option due to economic and space considerations.

These measures address some criteria for ISCA credits relating to energy and carbon, in particular relating to emissions modelling, reducing energy use and investigating renewable energy opportunities as well as the Hunter Water GEMP requirement to implement energy reduction measures. However, no suitable project-specific energy target or GreenPower procurement target has yet been set to address the requirements of the NSW GREP and there are remaining ISCA criteria which are yet to be addressed.

7.7.3.4 Water

A high level site water balance has been prepared for the Project which considers water demand and a breakdown of water supplies (Section 4.5). During construction, dust suppression activities would be undertaken using water from excavation dewatering activities, provided this water is of suitable quality. During operation of the Project, there would be a net generation of potable water using non-potable saline sub-surface water.

These measures address some ISCA criteria for water credits, in particular the credit relating to the replacement of potable water. However, given the high materiality of water to sustainability performance, monitoring of water usage is recommended to ensure satisfactory performance. Moreover, reporting of water use is recommended as per the NSW GREP.

7.7.3.5 Materials

Some opportunities for reductions in materials lifecycle impacts have been incorporated into the concept design. For example, there is the possibility that used desalination modules would be procured for the Project, resulting in materials impact reductions when compared with the use of new modules. Opportunities for the beneficial reuse of waste have also been identified and are summarised in the 'Waste' subsection, below.

Moreover, under Hunter Water's Sustainability Guiding Principles, contractors are required to make three materials selections which result in lower environmental impacts.

These measures address some ISCA criteria for materials credits, however, no modelling of materials impacts has been completed and no monitoring has thus far been planned. The modelling and monitoring of materials impacts is not considered practicable for the scale of the Project.

7.7.3.6 Discharges to air, land and water

The potential impacts of the Project on air quality during construction and operation have been assessed in Section 7.15. There is the potential for some adverse air quality impacts at sensitive receptors due to dust, gaseous emissions and odour, however these impacts would be minimised through appropriate management actions.

The potential noise and vibration impacts of the Project have been assessed in Section 7.12. Noise modelling has predicted that during construction, there would be some exceedances of noise goals, though these would be neither major nor recurring. During operation, no exceedances of noise goals have been predicted. An assessment of noise impacts during construction of the power supply connection has determined that impacts would be minimal. Complaints regarding noise would be investigated, with additional noise management measures implemented as appropriate. Vibration modelling has predicted no recurring or major divergences from vibration goals during construction and operation and no physical damage to buildings due to vibration.

The potential impacts of the Project to receiving waters during construction and operation have been assessed in Sections 7.2 and 7.4. Modelling undertaken for these assessments has predicted that the Project would have no adverse impact on receiving water environmental values and would not significantly increase peak stormwater flows. Wastewater generated from dewatering during construction of the intakes would only be disposed of via the WWTW outfall following treatment to EPL limits. As such, the disposal of this wastewater is not predicted to have significant impacts. Monitoring of brine discharge from the desalination plant would be undertaken during operation.

The potential impacts of lighting during construction and operation of the project have been assessed as part of the Landscape Character & Visual Impact Analysis summarised in Section 7.14. Measures to prevent light spill during construction have been identified, including the direction of lighting to avoid light spill into adjoining properties. Operational lighting would be designed in accordance with AS 4282 – *Control of the obtrusive effects of outdoor lighting*.

These measures are generally consistent with the ISCA criteria for credits relating to discharges to air, land and water. However, there are additional requirements for air emissions under the NSW GREP which could be addressed as described in Section 7.7.4.

7.7.3.7 Land

The potential impacts of the Project to soil quality and contamination during construction and operation have been assessed in Section 7.1.

The desalination plant would be constructed on previously disturbed land adjacent to the existing Belmont WWTW site, on Hunter Water land and the power connection upgrade would also be installed on previously disturbed land. The desalination plant location was selected based on consideration of existing land uses, impacts on stakeholders, zoning and other factors, as outlined in Section 2.4.

Soil conservation has been considered in design, with excess spoil and fill to be reused as fill, provided it is of suitable quality. Moreover, spoil stabilisation and revegetation measures to prevent further erosion would be detailed in the Project's construction environmental management plans (Section 7.1.4) and Hunter Water is proposing a related dune restoration project within the WWTW site which would improve the quality of a previously disturbed area (see Section 3.3.3). A Soil and Water Management Plan would be prepared to describe management methodologies for contaminated soils.

A hydrology and flooding assessment has been completed for the Project, which has found that impacts to surrounding hydrology are not anticipated as a result of the Project (Section 7.2).

These measures address a number of the ISCA criteria for land credits.

7.7.3.8 Waste

A waste assessment has been completed for the Project (Section 7.13), including high-level predictions of major waste streams during construction and operation. In addition, Hunter Water contracts include requirements for waste management and tracking as part of their general specification, including monthly reporting of waste generated and percentage recycled. Furthermore, under Hunter Water's Sustainability Guiding Principles, contractors are required to achieve a landfill avoidance target of at least 80 per cent for materials which can legally be recycled.

Where possible during construction, waste generation would be minimised and excess spoil may be reused as fill. Furthermore, dewatered groundwater from construction of the intakes may be used for dust suppression activities, if it is of suitable quality.

Following decommissioning of the desalination plant, desalination modules, pre- and post-treatment elements, ancillary components including pump stations, switchboards, transformers, communications equipment, fencing and signage may be reused, sold or recycled.

These measures address some of the ISCA criteria for waste credits, particularly the credit relating to the conservation of onsite resources.

7.7.3.9 Ecology

A BDAR has been prepared for the Project which includes a detailed assessment of potential biodiversity impacts and includes management and monitoring measures as well as offset requirements (Appendix E). The Project is not anticipated to increase habitat fragmentation.

The measures outlined in the BDAR address many ISCA criteria for ecology credits.

7.7.3.10 Community health, wellbeing and safety

In terms of community benefit, the operation of the Project would benefit residents of Lake Macquarie through ensuring a backup water supply meeting the quality requirements of the Australian Drinking Water Guidelines during periods of drought.

Moreover, in terms of crime prevention, the construction of fencing as part of the dune restoration project may reduce security issues through access control and improved definition of space and ownership.

These measures address some requirements of the ISCA credits relating to community health, wellbeing and safety.

7.7.3.11 Heritage

The potential impacts of the Project to heritage during construction and operation have been assessed in Section 7.9 and 7.10.

The heritage assessments have integrated community heritage values through stakeholder engagement and the participation of Registered Aboriginal Parties in heritage studies. The interpretation of Aboriginal heritage has been facilitated through an ongoing consultation process. A detailed Aboriginal Cultural Heritage Assessment report (ACHA) (see Appendix G) and Non-Aboriginal Heritage Impact Assessment (HIA) (see Appendix F) have been prepared for the Project. These assessments outline mitigation measures to minimise the impacts of the Project on cultural heritage.

The heritage assessments meet the relevant ISCA requirements under heritage credits.

7.7.3.12 Stakeholder participation

Consultation which has been undertaken for the Project is summarised in Section 6.

A Community and Stakeholder Engagement Plan has been developed for the EIS and planning process, which included consultation on the Inform, Consult and Involve levels of the IAP2 spectrum (IAP2, 2015). The Community and Stakeholder Engagement Plan included activities to give stakeholder groups the opportunity to express concerns regarding the Project and provide stakeholders with information about how their feedback has been considered.

These measures address many of the criteria under the ISCA stakeholder engagement credits.

7.7.3.13 Urban and landscape design

Although an urban and landscape assessment has not been completed for the Project, an assessment of impacts on visual amenity has been completed (Section 7.14), with mitigation measures suggested to reduce the visual impact of the Project. Given the temporary nature of the desalination plant operation, the measures undertaken thus far address many of the relevant ISCA requirements.

7.7.3.14 Innovation

The Project is to be composed of existing technology and common construction methodologies. It is considered unlikely that any innovative strategies or technologies would be implemented. Given the temporary nature of the desalination plant operation, this is considered reasonable.

7.7.4 Mitigation measures

Mitigation measures provided in Table 7-15 are recommended to improve sustainability performance. Where mitigation measures specifically address the requirements of the NSW GREP or Hunter Water GEMP, this is specified. Mitigation measures which are not specified to be based on NSW GREP or Hunter Water GEMP requirements are based on the IS rating scheme requirements.

Table 7-15 Proposed mitigation measures - sustainability

Sustainability category	Mitigation measure	Timing
Management systems & Procurement and purchasing	Develop and implement a Sustainability Management Plan (SMP) which establishes governance, structures, processes and systems to ensure integration of all sustainability considerations, initiatives, monitoring and reporting during the detailed design and construction phases of the Project. The SMP should include the following: • Sustainability objectives and targets • Roles and responsibilities for sustainability management, including adequate resourcing of sustainability • Inspection, monitoring and auditing requirements • Provisions for sustainability reporting and review by senior management • Provisions for the assessment and management of supplier sustainability performance	Detailed design
Energy and carbon	Incorporate the following measures into future stages of design to improve sustainability performance: • Adopt a target of 10 per cent energy reduction compared to business as usual for a desalination plant, as per the NSW GREP, and integrate this target into Project contracts, in accordance with the Hunter Water GEMP • Procure a desalination module which incorporates energy recovery • Procure a minimum 6 per cent GreenPower for operation of the Project, in alignment with the requirements of the NSW GREP. • Consider offsite renewable energy procurement as part of the procurement process to contribute to meeting the requirements of the NSW GREP • Incorporate all financially viable measures to reduce greenhouse gas emissions and energy use into detailed design, in accordance with the Hunter Water GEMP • Design operational lighting in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.	Detailed design
	Incorporate the following measures into construction and operation in alignment with the requirements of the Hunter Water GEMP: • Develop an energy management plan for project operation • Monitor and report within Hunter Water energy consumption and greenhouse gas emissions • Communicate energy and greenhouse gas management objectives and performance internally and externally • Provide training and raise awareness of energy and greenhouse gas emissions procedures, initiatives and conservation opportunities to employees responsible for operation of the plant	Construction Operation
Water	Monitor water use throughout construction and operation and report as part of project sustainability reporting, in accordance with the NSW GREP.	Construction Operation

Sustainability category	Mitigation measure	Timing
Materials	Incorporate the following measures into future stages of design to improve sustainability performance: • Consider selection of concrete mixes with low carbon cementitious materials to achieve a reduction in imbedded carbon. • Source steel which has an accompanying Environmental Product Declaration (EPD) and has been produced using an energy-reducing production process, such as polymer-injection technology • Undertake value engineering exercises during detailed design to identify opportunities to reduce construction materials use • Incorporate materials reduction initiatives into the sustainability 'lessons learned' for the Project	Detailed design
Discharges to air, land and water	Incorporate the following measures into procurement to improve sustainability performance and comply with the requirements of the NSW GREP: • Consider EU or US EPA standards when purchasing or leasing non-road diesel plant and equipment • Consider air emissions from contractor-supplied non-road diesel plant and equipment	Pre-construction
	Monitor the quality of brine discharge against water quality objectives as recommended in Section 7.4.4.	Operation
Land	Implement the contamination measures recommended in Section 7.1.4.	Detailed design
Waste	Incorporate the following measures into future stages of design to improve sustainability performance: • Develop a plan for waste management, including targets for waste avoidance, waste handling and disposal requirements, monitoring requirements, and reporting of the top three waste streams as per the NSW GREP • Develop a plan for decommissioning and deconstruction which considers the principles of Designing for Deconstruction (DfD; Guy, 2006)	Detailed design
Community health, wellbeing and safety	Incorporate the Crime Prevention Through Environmental Design (CPTED) principles into detailed design.	Detailed design

7.8 Hazards and risk

State Environment Planning Policy No. 33 - Hazardous and Offensive Development (SEPP 33) applies to any project which falls under the policy's definition of 'potentially hazardous industry' or 'potentially offensive industry'. If not controlled appropriately, some activities within these industries may create an offsite risk or offence to people, property or the environment thereby making them potentially hazardous or potentially offensive.

The purpose of this Section is to determine if the Project is potentially hazardous or potentially offensive. The methodology to determine whether a Project would be deemed potentially hazardous or potentially offensive and the required follow up assessments is provided in Section 7.8.1.

7.8.1 Methodology

7.8.1.1 Preliminary hazard assessment

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) requires that:

> *a person who proposes to make a development application to carry out development for the purposes of a potentially hazardous industry must prepare (or cause to be prepared) a preliminary hazard analysis in accordance with the current circulars or guidelines published by the Department of Planning and submit the analysis with the development application.*

The Department of Planning's *Hazardous and Offensive Development Application Guidelines Applying SEPP 33* (Department of Planning, 2011a) (Applying SEPP 33) set out the process for applying SEPP 33.

A person is required to undertake a preliminary risk screening of a proposed development to determine the need for a Preliminary Hazard Analysis (PHA) to assess the potential hazards associated with a proposed development. The preliminary screening phase involves identification and assessment of the storage of specific dangerous goods classes that have the potential for significant off-site effects. If, at the proposed location and in the presence of controls, the risk level exceeds the acceptable criteria for impacts on the surrounding land use, the development is classified as 'hazardous' or 'offensive' industry and may not be permissible within most land use zones in NSW.

A 'potentially hazardous industry' is defined under SEPP 33 to mean:

> *a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*
>
> *(a) to human health, life or property, or*
>
> *(b) to the biophysical environment,*
>
> *and includes a hazardous industry and a hazardous storage establishment.*

An ‘potentially offensive industry’ is defined under SEPP 33 to mean:

> *a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*

A proposed development cannot be considered either hazardous or offensive until it is firstly identified as a potentially hazardous industry or potentially offensive industry (i.e. through the preliminary risk screening process), and is subjected to the assessment requirements of SEPP 33 (and Applying SEPP 33). A PHA is required if a proposed development is a potentially hazardous industry.

A proposed development may also be a potentially hazardous industry if the number of traffic movements for the transport of hazardous materials exceeds the annual or weekly criteria outlined in Table 2 of Applying SEPP 33. If these thresholds are exceeded a route evaluation study is likely to be required.

Hazardous Industry Planning Advisory Paper No. 6 Guidelines for Hazard Analysis (Department of Planning, 2011b) notes that a PHA should identify and assess all hazards that have a potential for off-site impact. The expectation is that hazards would be analysed to determine the consequence to people, property and the environment and the potential for hazards to occur.

7.8.1.2 Preliminary risk screening

Preliminary risk screening is undertaken to determine the requirement for a PHA. Applying SEPP 33 contains screening thresholds for hazardous material storage quantities that if exceeded have the potential to create off-site impacts.

Dangerous Goods storage

A number of chemicals would be required to be stored as part of the treatment processes. This includes anti-scalant chemicals, coagulants, membrane cleaners, disinfectants, fluoride and potentially fuels for generators.

A summary of the indicative type and quantity of dangerous goods (DG) that are expected to be handled and/or stored on-site as a result of the Project and ongoing operation of the desalination plant are shown in Table 7-16 for major chemicals and Table 7-17 for minor chemicals. These chemicals would be required, either as part of the pre-treatment processes, or as part of the post-treatment processes. The major and minor chemicals are considered generic, however reference to example manufacturer safety data sheets was used to confirm DG class.

Table 7-16 Chemical usage summary – Major chemicals

Chemical/product	UN #	Dangerous Goods (DG) class	Packing group	Maximum storage quantity
Sulphuric Acid[1]	1830	8	II	30 kL = 55.2 tonnes
Sodium Hydroxide (Caustic Soda)[2]	1824	8	II	40 kL = 61.2 tonnes

[1] IXOM, Sulphuric acid with more than 51 per cent acid, substance no. 000033972201, version 5, issued 06/02/2015.
[2] IXOM, Caustic soda – liquid (46 per cent-50 per cent), substance no. 000031006701, version 6, issued 11/05/2015.

Chemical/product	UN #	Dangerous Goods (DG) class	Packing group	Maximum storage quantity
Sodium Hypochlorite[3]	1791	8	II	8 kL = 9.6 tonnes
Sodium Metabisulphite[4]	N/A	Not classified as DG		8 kL = 10.7 tonnes
Petrol[5]	1203	3	II	1000 L = 0.8 tonnes

During the screening process, the use of a number of other chemicals on-site was considered and are included in Table 7-18. The concept design indicates that the location of chemicals to be stored is on the western side of the Project area as described in Section 4.1.5.

Fuel (petrol) has been included in this screening as there is potential that it would be used to fuel an emergency generator, with an associated storage tank. Fuel would be brought in as required by a licenced contractor. As the need, size and type of emergency generator is still to be determined, for the purposes of the screening a worst case scenario of an above ground 1,000 litres tank of petrol in a self bunded container is assumed. Provided that the onsite storage quantity of petrol falls below five tonne it would not exceed the SEPP 33 threshold (of five tonnes). If diesel is used as the fuel (and no other flammable liquids are present), there would be no restrictions on storage size, as it is a combustible liquid.

Table 7-17 Chemical usage summary – Minor chemicals

Chemical/product	UN #	DG class	Packing group	Maximum storage quantity
Fluorosilicic Acid[6]	1778	8	II	1 m^3 = 1.39 tonnes
Biocide[7]	3265	8	III	1 m^3 = 1.03 tonnes
Citric Acid[8]	N/A	Not classified as DG		N/A
Phosphoric Acid[9]	1805	8	III	1 m^3 = 1.68 tonnes
Anti-scalant[10]	3265	8	III	1 m^3 = 1.50 tonnes
Hydrochloric Acid (Detergent)[11]	1789	8	II	1 m^3 = 1.10 tonnes
Coagulant[12]	N/A	Not classified as DG		N/A
Sludge Treatment Chemicals Polymer[13]	N/A	Not classified as DG		N/A

Table 7-18 Chemical usage summary – Other goods used on-site

Chemical/product	UN #	DG class	Packing group	Maximum storage quantity
Lime[14]	N/A	Not classified as DG		8 tonnes
Carbon Dioxide[15]	1013	2.2	N/A	0.5 tonnes

[3] IXOM, Sodium hypochlorite solution (10-15 per cent available chlorine), substance no. 000034421401, version 11, issued 09/07/2018.
[4] IXOM, Sodium metabisulphite (all grades), substance no. 000031030201, version 5, issued 21/06/2017.
[5] BP Premium Unleaded Petrol, product code 0000002734, version 3, issued 26/04/12.
[6] Pelchem, Fluorosilicic acid, PTC-SHE-SDS-01015 (MSDS-015), revision 3.
[7] Baker Hughes, Biocide BPA68915, version 1.01, issued 08/02/2010.
[8] IXOM, Citric acid solution 30 per cent to 60 per cent, substance no. 000000030291, version 3, issued 15/03/2013.
[9] IXOM, Phosphoric acid, substance no. 000031028801, version 5, issued 21/04/2017.
[10] LAB 794, product code 794-10 794-25, issued October 2013. Assumed similar density to other treatment chemicals i.e. 1.5 g/cm^3.
[11] IXOM, Spectrum hydrochloric acid, substance no. 000031061124, version 6, issued 22/06/2017.
[12] Integra, CLEARFLOX 525, version 16.01, issued 18/07/16.
[13] Integra, POLYFLOX 165, version 16.01, issued 25/07/16.
[14] Boral Cement, Hydrated lime, revision 2, issued 21/01/2015. Based on 262.4 kg/day from Treatment report.
[15] Air Liquide, Carbon dioxide, reference AL062, version 7.1, issued 18/12/2016. Based on 17.1 kg/day from Treatment report.

Class 8 dangerous goods are corrosive substances. Corrosive substances may cause severe damage when in contact with living tissue, such as skin, or damage or destroy incompatible materials in case of leakage.

Class 3 dangerous goods are flammable liquids. Packing group II liquids have an initial boiling point greater than 35°C at an absolute pressure of 101.3 kPa and a flash point less than 23°C, such as gasoline (petrol).

The screening thresholds for on-site storage of dangerous goods are shown in Table 7-19.

Table 7-19 SEPP Dangerous Goods threshold figures

DG class	Combined storage threshold (tonnes)	Combined quantity (tonne)	Exceedance of SEPP 33 threshold
2.2	None	0.5	Pass (does not exceed)
3 - II	Greater than 5	0.8	Pass (does not exceed)
8 - II	25	128.5	Fail (exceeds the threshold)
8 - III	50	4.21	Pass (does not exceed)

In accordance with SEPP 33, for Schedule 8 chemicals the storage thresholds are exceeded for on-site storage of dangerous goods and a PHA is required.

7.8.1.3 Transport screening

Based on the storage duration in the Treatment Report[16], the expected dangerous goods deliveries to the site for the major chemicals are shown in Table 7-20.

Just-in-time delivery of major chemicals is expected to occur once a month on average based on storage duration. Therefore, twelve transport movements per year per chemical tank.

Table 7-20 Chemical storage summary – Major chemicals

Chemical/product	Storage duration (days)	Maximum storage quantity	Annual tank deliveries
Sulphuric Acid	29.8	30 kL = 55.2 tonnes	12 tanks
Sodium Hydroxide (Caustic Soda)	28.7	40 kL = 61.2 tonnes	12 tanks
Sodium Hypochlorite	30	8 kL = 9.6 tonnes	12 tanks
Sodium Metabisulphite	31.1	8 kL = 10.7 tonnes	Not classified as DG, therefore not applicable
Petrol	Until required for an emergency	1000 L = 0.8 tonnes	1 tank

Minor chemicals as listed in Table 7-17 have a maximum storage quantity of 1 m^3 per chemical. Minor chemicals are anticipated to be used on a monthly basis for cleaning. Therefore, the minor chemicals (8 x intermediate bulk containers – IBC) would be delivered monthly, resulting in twelve transport movements per year for each minor chemical.

The transportation screening thresholds for hazardous materials entering or leaving the site are shown in Table 7-21.

[16] HWC Temporary Desalination Project, Design Development Report, Document No 2219573-16194, section 15.4, Rev A, dated February 2019.

Table 7-21 SEPP transport screening threshold figures

DG class	Combined storage threshold (tonnes)	Transport movements threshold (weekly peak)	Transport movements threshold (annual)	Combined transport movements (annual)	Exceedance of SEPP 33 threshold
2.2	None	N/A	N/A	N/A	Pass (does not exceed)
3 - II	> 5	> 45	> 500	1	Pass (does not exceed)
8 - II	25	> 30	> 500	60	Pass (does not exceed)
8 - III	50	> 30	> 500	36	Pass (does not exceed)

It is considered that the transport of dangerous goods to and from the plant is not potentially hazardous and therefore does not require a route evaluation.

7.8.1.4 Conclusion

The Project is not considered to be a potentially hazardous industry with respect to the transportation of hazardous substances. However, the results indicate the Project exceeds the thresholds for storage of hazardous substances.

Therefore, in accordance with SEPP 33 and Applying SEPP 33, a Level 1 PHA (qualitative hazard identification) is required and further risk analysis and assessment has been completed below.

7.8.1.5 Preliminary Hazard Analysis

The results of the hazard identification are provided in Table 7-22. Mitigation measures are also outlined in Table 7-23 and are required to ensure the risk scenarios that were identified are contained or at least controlled to an acceptable level.

The study identified that the only credible scenario to have an offsite impact is a delivery truck accident leading to a chemical spill leaving site and resulting in environmental damage. However, the likelihood of a chemical spill with this consequence is estimated to be low due to the mitigation measures in place to manage the risk and the minimal quantity of chemicals being delivered to site. As such, the hazard identification study did not identify any hazards with the potential for significant offsite impact that would not be suitably controlled. Mitigation measures are required to ensure the risk scenarios that were identified are controlled to an acceptable level.

If changes occur to the inventories or types of dangerous goods to be stored on-site, it is recommended that the screening process be repeated in order to determine if those changes affect the PHA. It is anticipated that during the detail design and construction stage, this aspect of the Project would be revisited by the supplier to ensure it is current to the final site arrangement and treatment system.

Table 7-22 Hazard Identification

Hazard scenario	Causes	Consequence	Potential for offsite impact	Consequence rating	Likelihood rating	Risk rating	Identified/recommended safeguards
Delivery truck interaction with personnel on-site	Vehicle movements in vicinity of personnel	Personal injury	No	Critical	Rare	5 (Low)	Traffic management plan (TMP) including standard traffic rules, signage Site speed limits Designated pedestrian areas Driver competency Construction management plan
Delivery truck interaction off-site with another truck	Vehicle movements	Personal injury Chemical spill Environmental damage	Yes	Major	Unlikely	8 (Medium)	TMP including standard traffic rules, signage Site speed limits Designated pedestrian areas Driver competency Emergency response plan
Forklift puncturing IBC during delivery leading to large spill outside bunded area	Vehicle movements	Personal injury Chemical spill Environmental damage	No	Moderate	Unlikely	6 (Medium)	TMP including standard traffic rules, signage Site speed limits Designated pedestrian areas Driver competency Emergency response plan
Chemical reaction	Human error that transfers an incompatible chemical into a bulk storage tank	Personal injury Chemical spill Environmental damage	No	Moderate	Unlikely	6 (Medium)	Storage of chemicals to appropriate standards Inspection and maintenance regime Chemical handling procedures Chemical transfer procedures Spill containment procedures Spill kits Safe Working Method Statement (SWMS) Bunded area Purpose designed delivery system
Loss of containment of fuel during delivery	Damage to delivery truck e.g. due to external impact Human error	Environmental damage	No	Minor	Unlikely	4 (Low)	Licenced contractors to deliver fuels. Purpose designed delivery system, including bunded area Inspection and maintenance regime Delivery procedures Spill containment procedures

Hazard scenario	Causes	Consequence	Potential for offsite impact	Consequence rating	Likelihood rating	Risk rating	Identified/recommended safeguards
Ignition of spilled fuel	Nearby fire/ignition source Deliberate act Electrical fault	Asset damage Personal injury / fatality	No	Critical	Rare	5 (Low)	Purpose designed fuel store to appropriate standards Intrinsically safe hazardous area classification Fire protection systems Housekeeping standards Inspection and maintenance regime Operator competency and training
Natural hazards	Flooding, earthquake, lightning, bushfire	Personal injury Plant shut down Possible fire Asset damage	No	Moderate	Unlikely	6 (Medium)	Structures designed to appropriate codes and standards Site chemical management Housekeeping standards Site drainage Vegetation management Fire protection systems
Onsite fire	Dry conditions, Electrical fire	Asset damage Plant shut down Personal injury	No	Moderate	Rare	3 (Low)	Fire protection systems Buffer zones
Loss of containment of chemicals including dangerous goods	Damage to storage containers e.g. due to external impact Human error	Environmental damage Personal injury Spills	No	Minor	Unlikely	4 (Low)	Storage of chemicals to appropriate standards Inspection and maintenance regime Chemical handling and transfer procedures Spill kits and containment procedures Safe Work Method Statement (SWMS) Bunded area Purpose designed delivery system Onsite personnel located away from chemical storage area

Hazard scenario	Causes	Consequence	Potential for offsite impact	Consequence rating	Likelihood rating	Risk rating	Identified/recommended safeguards
Loss of containment of chemicals during delivery, including dangerous goods	Damage to storage containers e.g. due to external impact Damage to delivery truck e.g. due to external impact Human error	Environmental damage Personal injury Spills	No	Minor	Possible	6 (Medium)	Storage of chemicals to appropriate standards Inspection and maintenance regime Chemical handling and transfer procedures Spill kits and containment procedures Safe Work Method Statement (SWMS) Bunded area Purpose designed delivery system Onsite personnel located away from chemical storage area Appropriate PPE Delivery procedures
Contact with chemicals, including dangerous goods	Maintenance of chemical storage facility	Personal injury	No	Minor	Possible	6 (Medium)	Storage of chemicals to appropriate standards Inspection and maintenance regime Chemical handling and transfer procedures Spill kits and containment procedures Safe Work Method Statement (SWMS) Bunded area Onsite personnel located away from chemical storage area Appropriate PPE

7.8.2 Mitigation measures

Mitigation measures provided in Table 7-23 will be implemented to minimise potential impacts on hazards and risk.

Table 7-23 Proposed mitigation measures – hazards and risk

Impact	Mitigation measure	Timing
General hazards and risk	Review proposed transport of dangerous goods logistics. If notable differences to what was assessed are proposed, repeat the screening process to determine if a route evaluation is required.	Detailed design and construction
	Review the proposed types and quantities of dangerous goods to be stored on site. If notable differences to what was assessed are proposed, repeat the screening process to determine if the changes affect the PHA and outcome.	Detailed design and construction
	Conduct an independent review of the hazardous chemical elements associated with the proposal, including location of storages, compatibility of adjacent chemicals and bunding requirements. The review will be undertaken by an expert in hazardous chemical storage. Any recommendations will be incorporated into the detail design.	Detailed design
Dangerous goods spill	Locate chemical storage and delivery areas within bunded areas with a capacity of 110 percent of chemical storage volume. Store chemicals in accordance with Australian Standards and maintain in accordance to equipment supplier recommendations. Appropriately label, separate and dispose of each chemical in accordance with Australian Standards. Provide access to the Material Safety Data Sheet (MSDS) register of all chemicals that are located on-site for worker and emergency services reference. Implement safe work procedures for the handling of all chemicals including transfer, storage, spill prevention and clean up requirements. Spill kits to be available on-site in appropriate areas. Develop an emergency response plan that includes dangerous goods spill scenarios.	Operation
Delivery of dangerous goods	Develop and implement a traffic management plan including standard traffic rules, site speed limits, signage and designated pedestrian areas. Ensure transport of dangerous goods complies with the Australian Dangerous Goods (ADG) code, including driver competency. Develop a construction management plan.	Construction, Operation
Fuel spill	Fuel store to be designed to appropriate standards. Fuel to be stored in an intrinsically safe hazardous area as per appropriate standards. Implement appropriate fire protection systems.	Construction, Operation
Natural hazards	Appropriately design site drainage for the site. Develop a fire prevention vegetation management procedure for the site.	Detailed design, Construction, Operation

7.9 Aboriginal heritage

This section addresses the Aboriginal heritage impacts associated with the Project and details the management measures proposed to mitigate these impacts.

The information presented in this section is drawn from the Aboriginal Cultural Heritage Assessment (ACHA) (RPS, 2019a) in collaboration with the Registered Aboriginal Parties (RAPs) to assess the Aboriginal cultural heritage values of the Project area (see Appendix G).

The ACHA process has involved consultation with all 12 Registered Aboriginal Parties (RAPs) for the Project. Further details of the consultation process are provided in Section 6.

7.9.1 Methodology

7.9.1.1 Assessment approach

The ACHA has been prepared to satisfy the requirements of:

- The SEARs for the Project
- NPW Act
- NPW Regulation
- The principles of the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013* (the Burra Charter) (Australia ICOMOS, 2013).
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011).
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a).
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b).

The objectives of the ACHA are to investigate and assess the potential impacts of the Project on known and potential Aboriginal objects and places and cultural heritage values within the Project area and provide appropriate management and mitigation strategies.

7.9.1.2 Consultation process

Consultation for the Project was undertaken for the ACHA, in accordance with the NPW Act and NPW Regulation, with reference to *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a).

In accordance with these guidelines a total of 12 RAPs were consulted for the Project during the preparation of the ACHA, including Bahtabah Local Aboriginal Land Council (LALC). RAPs were involved in all facets of the assessment process including a review of the draft survey strategy and project methodology, and the site survey. In addition, Registered Aboriginal Parties were provided a draft copy of the ACHA on 23 September 2019 for 28 days review and comment. Full details of the consultation process undertaken in relation to the ACHA are contained in Appendix G.

The consultation approach also provided the RAPs with opportunities to decide in what way they wanted their information shared and to identify any restricted access provisions. It allowed the Registered Aboriginal Parties to contribute their cultural knowledge through RPS. It also provided opportunities to identify a range of Aboriginal cultural values of the Project area and levels of attachment. This included social values, historic values, scientific values, aesthetic values and intergenerational values.

7.9.1.3 Database searches

A search of the OEH Aboriginal Heritage Information Management System (AHIMS) was carried out on 11 November 2018 and 23 August 2019 (Appendix G). The search identified 51 and 53 registered Aboriginal sites within the search co-ordinates respectively.

No previously registered sites are within the Project Area. Two newly registered sites, the identified AHIMS #45-7-0397 registered for this current project (see Appendix G, Section 5.1.3), and AHIMS #45-7-0393 are included in the search results for 23 August 2019. AHIMS #45-7-0393 is located approximately 1.1 kilometres northwest of the Project area and is not under consideration for this report.

The two closest sites to the Project area are AHIMS #45-7-0042 Artefact Site (Number Unspecified) and AHIMS #45-7-0130 Artefact Site (Number Unspecified). AHIMS #45-7-0042 is located approximately 120 metres south-east of the Project area and AHIMS #45-70130 is located approximately 630 metres north-east of the Project area.

As such, the two sites would not be impacted by the Project.

7.9.1.4 Site inspection

A site inspection of the Project area was conducted on 24 May 2019, by RPS archaeologists, with the involvement of Peter Leven (Awabakal Descendants Traditional Owners Aboriginal Corporation (ADTOAC)), Kenton Proctor (Bahtabah LALC), David Allen (Lower Hunter Aboriginal Incorporated (LHAI) and Tracie Howie (Guringai Tribal Link Aboriginal Corp (GTLAC)).

7.9.2 Existing environment

7.9.2.1 Cultural context

As a result of past mining operations, much of the original soil profiles have been disturbed and may only occur in smaller areas than naturally would occur. Soil disturbance, particularly the erosion of topsoils has an impact on the presence and/or density of Aboriginal cultural objects.

The Lake Macquarie coastal corridor, comprising marine, estuarine, lake shoreline, open woodland and heath environs provided abundant resources used by local Aboriginal people.

The Lake Macquarie Aboriginal Heritage Management Plan (ACHMP 2011) recognises that the traditional boundaries of the Awabakal tribe were wider than the current LGA boundary or the boundary of the Awabakal LALC.

Based on the above information the Project area would likely have been used to gather resources for food and resource materials. The lack of fresh water in the immediate surrounds would tend to indicate that Aboriginal people likely would have used it as an important cultural connection between the coastal shorelines and the inland areas. Very little to no raw lithic resource is available in the Project area or in the immediate surrounds.

7.9.3 Potential impacts

7.9.3.1 Survey results

Fieldwork was completed in a day and was conducted as per the Project methodology and survey strategy that was approved by the RAPs. The survey included pedestrian coverage of the Project area in its entirety. One isolated find (RPS BEL IF01), a complete tuff flake, was observed and recorded in the base of one pond. No other Aboriginal cultural materials were identified on the surface of the Project area.

All the RAPs present expressed the cultural sensitivity of the area. For example, song lines are associated with the adjacent Belmont Lagoon. Highly sensitive areas are located around these dunes, including, but not limited to, Swansea Heads and Black Neds Bay.

7.9.3.2 Archaeological significance assessment

The Burra Charter provides guidance for the conservation and management of places of cultural significance (cultural heritage places), and is based on the knowledge and experience of Australia ICOMOS members.

Aboriginal cultural heritage sites are therefore assessed following these categories of significance developed under the Burra Charter:

- Social or spiritual value (assessed only by Aboriginal people)
- Spiritual value (assessed only by Aboriginal people)
- Historical value
- Scientific/archaeological value (assessed mostly by archaeologists/heritage consultants)
- Aesthetic value

From Aboriginal consultation to date, it is understood that the Project area and all Aboriginal objects identified within are of high cultural value. The isolated find, a completed tuff flake was identified in the north-western portion of the Project area and found to be of low archaeological significance. No other Aboriginal cultural materials were identified on the surface of the Project area.

The Project area is representative of the wider archaeological landscape of low-level landforms adjacent to lake and coastal shorelines and is of low archaeological significance. The isolated find is indicative of stone reduction activities however, is likely to have been manufactured elsewhere and carried to the coastal area for utilisation. It is likely that the isolated find has been deposited in the Project area as a result of recent activities.

7.9.3.3 Impacts on Aboriginal heritage objects and places

No AHIMS sites are recorded within the Project area based on the location of their registered grid co-ordinates in the AHIMS site search results. However, one Aboriginal cultural site (AHIMS #45-7-0397 (RPS BEL IF01)) has been identified within the Project area during the site survey and therefore would need to be salvaged prior to works proceeding.

AHIMS #45-7-0397 (RPS BEL IF01) has been found to be of low archaeological significance. The site area has been disturbed. The artefact is not assessed to be rare in the context of Belmont/Lake Macquarie archaeology. The type of artefact is consistent with residue of stone tool production and the artefact does not possess any educational potential.

No other Aboriginal heritage objects or places would be impacted as a result of the Project.

Variations in soil profile were identified within the Project Area; well-sorted, medium-grain, bleached A horizon sand, in the lesser disturbed areas to the south of the evaporation ponds, the well-sorted, coarse-grained, light grey-yellow sand, at the boundary of the evaporation ponds and the medium-grained yellow-grey loam sand at the central base of the evaporation ponds and in the area designated for the brine pipeline.

The soil profile in the area of AHIMS #45-7-0397 (RPS BEL IF01) was a B horizon, yellow-grey well-sorted, coarse sand. The presence of this profile correlates with the removal of A horizon soils to facilitate the construction of the evaporation ponds.

The disturbed soil profile across the Project area indicate the majority of A1 horizon has been disturbed or removed either through landscape modification associated with the WWTW or through previous vegetation clearance which has promoted topsoil erosion and movement through wave and wind processes. The disturbed soil profiles reduce the potential for Aboriginal cultural objects across the ground surface to low. In areas which comprise B horizon soil presence of subsurface Aboriginal cultural objects is expected to be low. In other areas which comprise A2 horizon, the potential for surface and subsurface Aboriginal cultural objects is moderate.

Based on the presence of the isolated artefact at the base of the evaporation pond, the disturbed A horizon soil profiles are assessed as potentially containing archaeological deposits, albeit at relatively low densities (based on the limited visible evidence) and in a disturbed context.

The proposed works at the intersection of Hudson and Marriott Street is located within a modified landscape associated with residential development, including sealed roads and subsurface utilities. It is considered to have low to nil potential for the presence of surface Aboriginal cultural objects, and low potential for the presence of subsurface Aboriginal cultural objects.

7.9.4 Mitigation measures

The measures described in Table 7-24 will be implemented to avoid or minimise Aboriginal cultural heritage impacts.

Table 7-24 Proposed mitigation measures – Aboriginal heritage

Impact	Management and mitigation measure	Timing
Salvage of existing items	One Aboriginal cultural site, AHIMS #45-7-0397 Isolated Find (RPS BEL IF01), has been identified within the Project area and therefore will need to be salvaged through Community Collection, prior to works proceeding.	Pre-construction
Management Plan	An Aboriginal Cultural Heritage Management Plan (ACHMP) should be formulated following the EIS to provide management and protection process for known and unknown Aboriginal objects and places.	Pre-construction, Construction
Additional inspections	The ACHMP should include provision for the completion of the following: • Additional inspection and surface collection of any artefacts exposed in the area mapped as containing A horizon soils in a disturbed context. The opportunity to undertake additional inspection and surface collection should be provided to an archaeologist and Aboriginal party representatives following vegetation clearance and respreading of A horizon soils currently within the bunds and adjoining area (refer to Appendix G Figure 4). • Additional inspection of the areas with the potential for intact A horizon soils, with the opportunity to undertake the additional inspection to be provided to an archaeologist and Aboriginal party representative following vegetation clearance and during earthworks (where the earthworks will occur within A horizon soils). Methodologies should be included for collection of surface artefacts and for the completion of archaeological salvage excavations if an archaeological feature (such as a possible hearth, discrete scatter of high density artefacts or midden	

Impact	Management and mitigation measure	Timing
	material with the potential to retain archaeological integrity) is identified (refer to Appendix G Figure 4).	
Unexpected finds	In the event that skeletal remains are identified, work must cease immediately in the vicinity of the remains and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of a crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, OEH must be contacted on Enviroline 131 555. An OEH officer will determine if the remains are Aboriginal or not; and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.	Construction
Site inductions	All Hunter Water personnel and subcontractors involved in the proposed works should be advised of the requirements of the NPWS Act 1974 that it is an offence for any person to knowingly destroy, deface, damage or permit destruction, or defacement to an Aboriginal object or place without the consent of the Director General of the Department of Environment and Conservation.	Pre-construction, Construction

7.10 Non-Aboriginal heritage

This section addresses the non-Aboriginal heritage impacts associated with the Project and details the management measures proposed to mitigate these impacts.

The information presented in this section is drawn from the *Belmont Temporary Desalination Plant, Non-Aboriginal Heritage Impact Assessment Report* (HIA) (RPS, 2019b) (Appendix F), which was prepared by RPS Australia to assess the potential for non-Aboriginal heritage impacts.

7.10.1 Methodology

The HIA was carried out in accordance with the SEARs (see Table 5-2). The following was carried out to identify any listed or potential non-Aboriginal heritage items in the Project area:

- A site inspection by Jo Nelson (RPS) on 24 May 2019 of the Project area
- Searches of National and State heritage databases:
  - Australian Heritage Database (National and Commonwealth heritage lists)
  - State Heritage Register
  - NSW State Heritage Inventory
- Search of the Lake Macquarie LEP
- Review of relevant literature and aerial photography
- Identification of management and mitigation measures to avoid, minimise or mitigate impacts to any identified heritage values of any non-Aboriginal heritage items

7.10.2 Existing environment

A search of the following databases was conducted:

- UNESCO World Heritage list
- The Australian Heritage Database

- The State Heritage Register and Inventory
- Lake Macquarie LEP

No items listed on any of these registers were identified within, in the immediate vicinity of the Project area.

The closest non-Aboriginal heritage item is the locally listed Belmont tank traps associated with the defence ditch of Cold Tea Creek which was used as a WWII defence installation. The eastern-most end of the ditch is 200 metres to the west of the Project Area and would not be impacted by the Project. The concrete tank traps were located in the vicinity of the Project, however were removed in 1945 and therefore would not be impacted.

7.10.3 Potential impacts

No items of non-Aboriginal heritage would be impacted by the construction or operation of the Project.

7.10.4 Mitigation measures

The measures described in Table 7-25 will be implemented to avoid or minimise non-Aboriginal heritage impacts.

Table 7-25 Proposed mitigation measures – Non-Aboriginal heritage

Impact	Management and mitigation measure	Timing
Unexpected finds	If, during the course of the works, unexpected archaeological items or relics, as defined by the Heritage Act 1977 (as amended), are uncovered, work should cease in that area immediately. The Heritage Branch, Office of Environment & Heritage (Enviroline 131 555) should be notified and works only recommence when an approved management strategy developed.	Construction

7.11 Traffic and transport

This section describes the existing environment in relation to traffic and transport. It addresses the impacts associated with the Project during construction, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is drawn from the Traffic Impact Assessment (TIA) prepared by GHD (2019k) (Appendix O). As the operational traffic volumes of the Project are expected to be minor, the Traffic Assessment has only been undertaken for the construction phases of the project.

7.11.1 Methodology

The methodology of the TIA included:

- A review of available information on the existing road network and crash data
- Undertaking peak hour traffic surveys for the intersections of interest to observe traffic counts and traffic network peak hours
- Assessing mid-block capacity for the road network
- Assessing the operation of the intersections of interest, using SIDRA intersection modelling

- Assessing the vehicle movements and associated traffic access for each construction phase of the Project
- Outlining the proposed mitigation measures to minimise the potential traffic access impacts associated with the Project

7.11.2 Existing environment

7.11.2.1 Road network

The road network surrounding the Project is shown on Figure 7-9 and described below.

7.11.2.2 Pacific Highway

The Pacific Highway is a State/arterial road that runs along the east coast of Australia. Key features of the Pacific Highway within proximity of site are subject site are outline in Table 7-26.

Table 7-26 Pacific Highway

Feature	Description
Carriageway	A divided carriageway with two lanes in each direction and additional turning lanes at signalised intersections.
Parking	Typically unavailable
Speed Limit	60 km/h.
Pedestrian Facilities	Footpaths/grassed verges provided on both sides of the road.
Bicycle Facilities	Roads and Maritime identify the Pacific Highway as moderate/high difficulty on-road route.
Public Transport	A small number of bus services operate on the Pacific Highway. Bus jump off lanes are provided on the Pacific Highway at its intersection with Ntaba Road.

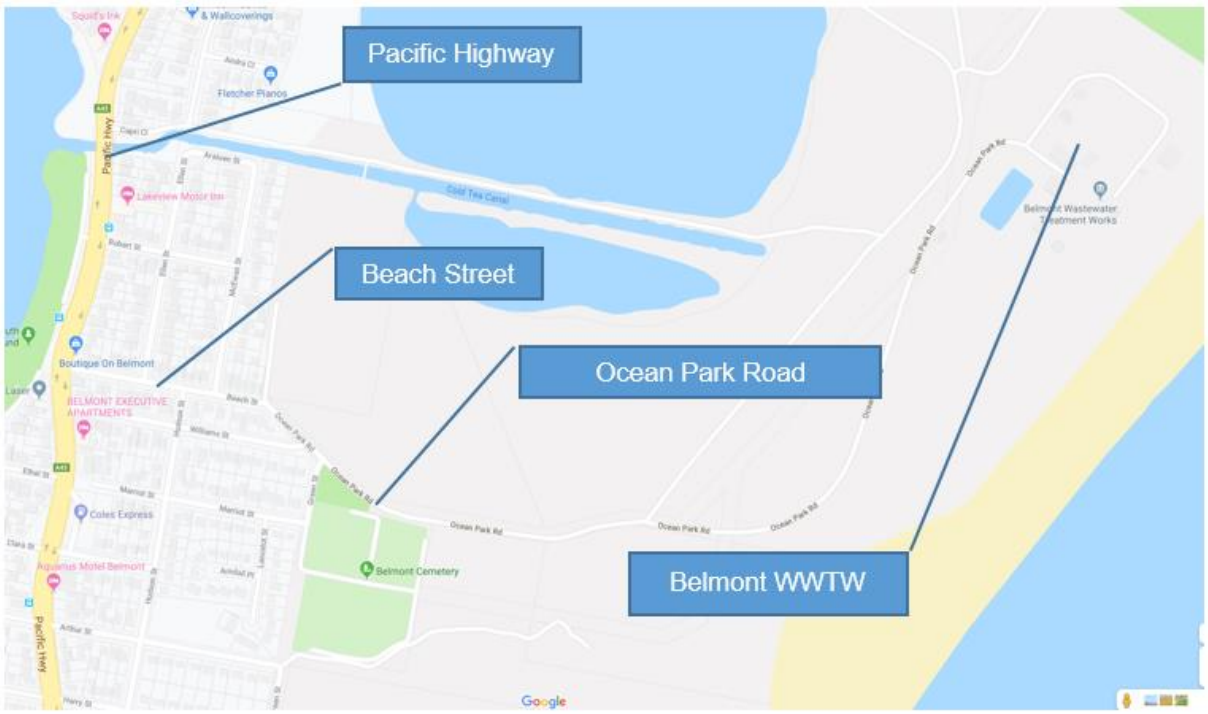

Figure 7-9 Road network around Project Area

Source: Google Maps (2019), modified by GHD

Beach Street

Beach Street is a local road with a width of approximately 10 m that intersects the Pacific Highway at a signalised junction. The key features of Beach Street are outlined in Table 7-27.

Table 7-27 Beach Street

Feature	Description
Carriageway	An undivided carriageway with a single travel lane in each direction
Parking	Unrestricted
Speed Limit	50 km/h
Pedestrian Facilities	Grassed verges provided on both sides of the road
Bicycle Facilities	No dedicated facilities
Public Transport	No dedicated facilities

To the east of McEwan Street, Beach Street becomes Ocean Park Road.

Ocean Park Road functions as a rural local road and is in relatively poor condition, with a width of approximately 5 m and accommodates bi-directional traffic flows. It provides vehicular access to the Belmont WWTW.

7.11.2.3 Road safety

Crash data was requested Roads and Maritime for the previous five years (2013-2017) at the intersection of Pacific Highway/Beach Street:

- There was a single crash at the intersection of the Pacific Highway and Beach Street (in 2013). This crash involved a rear-end collision that resulted in a “moderate injury”.

7.11.2.4 Traffic surveys

Peak hour traffic surveys were undertaken at the intersection of Pacific Highway/Beach Street on 19 June 2019.

The traffic counts were undertaken in 15-minute intervals for the following times, to coincide with peak periods of road network activity:

- 7:00 am – 9:30 am
- 4:30 pm – 7:00 pm

The observed traffic network peak hours were identified as the following:

- 7:30 am – 8:30 am and 4:30 pm – 5:30 pm for the Pacific Highway and Beach Street.
- The data from the current peak hour traffic volumes for the intersections of interest indicates that:
  - Traffic volumes on the Pacific Highway are tidal with higher northbound traffic flows in the AM peak and higher southbound traffic flows in the PM peak.
  - Traffic volumes on Beach Street are relatively minor, between 11 – 88 vehicles per hour in each direction.

7.11.2.5 Current network operation

The operation of the intersections of interest were assessed using SIDRA 8.0.

The data from SIDRA indicates that the intersection of Pacific Highway/Beach Street currently operate with an overall good Level of Service (LoS).

7.11.3 Potential impacts

7.11.3.1 Construction

Traffic generation, distribution and efficiency

Traffic generation

The traffic generated by the Project is expected to vary depending on the stage of construction; however, estimated traffic volumes are detailed in of Appendix O.

Works for the Project are planned to be carried out during standard working hours of:

- Monday to Friday: 7.00 am to 6.00 pm
- Saturday: 8.00 am to 1.00 pm
- Sundays and public holidays: no work

As the working hours are 7.00 am to 6.00 pm on weekdays, it is likely that many of the light vehicle movements generated would occur outside the peak periods.

The construction of the intakes is associated with the most intensive period of traffic generation for the Project, with 668 trucks are expected to access the construction site across the six month timeframe for construction of the intakes as a worst case scenario. This results in an average of approximately 110 trucks accessing the Project area per month, being approximately five trucks per day. This would comprise of the following:

- 522 truck movements for the import of fill (based on a truck capacity of six metres squared)
- 136 truck movements for the delivery of concrete (based on a truck capacity of seven metres squared)
- Ten trucks movements associated with the delivery of intake pipes

The intakes package would be completed in two stages:

- Construction of a watertight restraining structure (the caisson) – approximately three months
- Construction of the well floor and laying of horizontal pipes – approximately three months

In considering potential impacts on traffic generation, it is considered that this variation in traffic movement within the road network would have no adverse impact on the road system and/or intersection operation and fall within typical daily traffic fluctuations, with all intersections impacted by the Project to maintain their existing LoS (see Table 4-1 of Appendix O).

Traffic access

Access to the Project area would occur via the intersection of Pacific Highway and Beach Street, with indicative vehicle movements provided in Table 4-5.

To be conservative it has been assumed all the construction traffic would access/egress of the intersection of interest over the course of the construction periods.

For the purposes of analysis, it has been assumed that half of the trucks would access/egress the site to/from the north and half of the trucks would access/egress the site to/from the south.

It is expected that the majority of workers (80 per cent) would access/egress the construction site to/from the north with the remainder from the south.

Traffic analysis

Assumptions

The trigger for the construction of the desalination plant is Hunter Water's total dam storage falling below 35 per cent. Therefore, it is currently unknown if/when it would be constructed.

For the purposes of analysis, it was assumed that desalination plant would be constructed in five years (2024).

Additional intersection traffic modelling was undertaken for the following two scenarios in the 2024 horizon year:

- A "no-build" scenario, accounting for background traffic growth only
- A "build" scenario accounting for the background traffic growth and the expected peak construction traffic associated with the desalination plant

The difference between the "no build" and "build" scenario quantifies the traffic impacts associated with the construction of the desalination plant.

A linear annual growth rate of one per cent was applied to the surveyed traffic volumes (2019) to determine the 2024 "no build" traffic volumes.

Results

The results of the SIDRA analysis indicates that in the modelled year (2024):

- The intersection of Pacific Highway and Beach Street are expected to operate with a good LoS.
- The forecast increase in traffic associated with the construction of the Project is expected to have a negligible impact on the intersection operation.

In traffic engineering terms, it would be considered that this variation in traffic movement within the road network would have no adverse impact on the road system and/or intersection operation and fall within typical daily traffic fluctuations.

Construction vehicles would access/egress the construction site via the existing road network and the impacts to the adjoining active transport and public transport networks are expected to be negligible.

As such, no road upgrades or changes are required to the regional road network as a result of the project.

7.11.3.2 Operation

During operation, there would be routine chemical and supply deliveries and relatively small amounts of waste removed from the facility. It is not certain if full-time attendance by an operator would be necessary, but at times operators would attend site. Further, there would be periodic maintenance to various parts of the facility.

There is expected to be very little operational or maintenance input for the Project during operation, which would be operated under standard operating procedures for Hunter Water.

7.11.4 Mitigation measures

In order to guide traffic management during the construction phase, a number of mitigation measures are proposed to minimise the potential traffic and access impacts associated with the Project. These mitigation measures are outlined in Table 7-28.

Table 7-28 Proposed mitigation measures – traffic and transport

Impact	Management and mitigation measure	Timing
Additional traffic generation due to project construction	In consultation with Lake Macquarie City Council, a Construction Traffic Management Plan (CTMP) should be prepared and include detail with respect to: • Appropriate Traffic Control Plans • Traffic control measures in works areas • Controls associated with the delivery of heavy plant and materials to site during peak traffic periods • Appropriate entry/exit points for the proposed construction compound areas • Advising motorists of the change in traffic conditions associated with the work	Pre-construction
Traffic control	Appropriate exclusion barriers, signage and site supervision is to be employed so that the project site is controlled and that unauthorised vehicles and pedestrians are excluded from the works area.	Construction
	All traffic control devices are to be in accordance with AS 1742.3-2009 – Manual of uniform traffic control Devices: Traffic control for works on roads and Roads and Maritime Traffic control at worksites manual.	
Creation of additional roads or access tracks	Only existing roads and access roads or access roads approved for construction by this EIS are to be utilised.	
Misinformation or an uninformed community	The community is to be kept informed about the project through appropriate means such as advertisements in the local media, notices and/or signs.	Pre-construction, Construction

7.12 Noise and vibration

This section describes the existing environment in relation to noise and vibration. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is summarised from the Noise and Vibration Impact Assessment (NVIA) (GHD, 2019) (Appendix P).

7.12.1 Methodology

The methodology for the NVIA included:

An initial review of project information including construction methodology, design plans and identification of sensitive receivers (Figure 7-10) Background noise monitoring for a period of one week at 24 Beach Street, near the Project (Figure 7-10).

- Background noise monitoring captured existing ambient noise levels from sources such as road traffic and enabled site-specific noise goals to be set for the construction and operations of the Project.
- Assessment of noise data including filtering to remove extraneous noise or adverse weather conditions. Weather data over the monitoring period was obtained from the nearest Bureau of Meteorology (BoM) Automatic Weather Station (AWS).
- Establishing the Project Specific Noise Level (PSNL) for the noise generated during:
  - Construction (based on *Interim Construction Noise Guideline* (ICNG (DECCW, 2009))
  - Operation (based on the *Noise Policy for Industry* (NPI) (EPA, 2017)

- A noise model was developed for the Project based on site layout, plant and equipment sound power levels, and topography. The noise model provided an indication of noise impacts (construction and operational) on the identified nearby noise sensitive receivers.
- Based on the noise model results, the predicted construction noise and operational noise at nearby noise sensitive receivers were compared to the established PSNLs. Where exceedances were predicted, in-principle advice was provided on possible noise attenuation measures to mitigate operational impacts from the site.
- Desktop traffic noise assessment was conducted based on site, delivery and staff vehicle movements on public roads with respect to the established *Road Noise Policy* (RNP) criteria.
- Desktop assessment of construction and operational vibration impacts, with recommendations for noise management and control measures, if warranted.

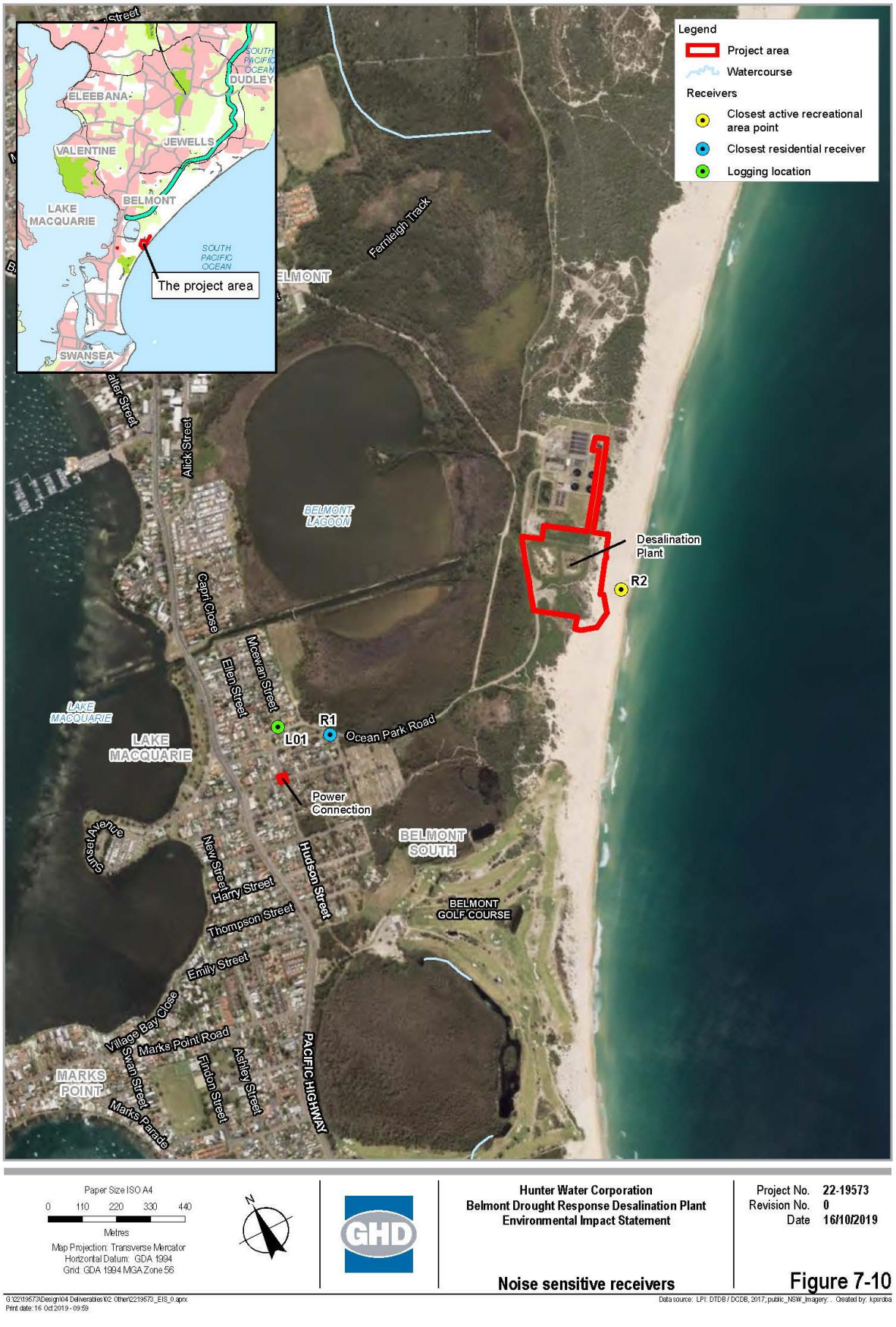

Figure 7-10 Noise sensitive receivers

7.12.2 Existing environment

The Project is located in Belmont South, NSW. The Project consists of a desalination plant and the brine disposal system, located on the southern portion of the current WWTW site, on the boundary of Belmont and Belmont South, off Ocean Park Road.

Baseline unattended noise monitoring was conducted in accordance with the procedures in the *Noise Policy for Industry* (NPI, 2017) guideline at one location. The noise logger was deployed at 24 Beach Street, South Belmont. Table 7-29 presents a summarised result of the noise logging data.

Table 7-29 Unattended Noise monitoring results

Location	L_{A90} RBL noise levels dB(A)			L_{Aeq} ambient noise levels dB(A)		
	Day	Evening	Night	Day	Evening	Night
24 Beach Street, Belmont	38	37	33	55	50	47

Note: Day time: 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and Public Holidays. Evening: 6:00 pm to 10:00 pm. Night time: remaining period (NSW Noise Policy for Industry (EPA, 2017)).

7.12.2.1 Sensitive receivers

There are sensitive receivers near the Project area, which may be impacted by noise from the construction works and operation of the proposed plant. Figure 7-10 shows the Project area and construction impact areas relative to the surrounding area. The nearby sensitive receivers identified are categorised as:

- Residential
- Commercial/Retail
- Hotel/Motel
- Active recreation
- Passive recreation
- Education

7.12.3 Criteria

7.12.3.1 Construction noise and vibration criteria

Construction noise

Construction noise criteria were developed in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009a) for each noise catchment area. Standard hours defined in the guideline are:

- 7:00 am to 6:00 pm Monday to Friday
- 8:00 am to 1:00 pm on Saturday
- No work on Sundays or public holidays

The proposed construction activities are expected to generally occur during the standard construction hours. However, dewatering activities during the intake construction would need to occur continuously to remove water from the well.

The ICNG acknowledges that the following activities can be justified to be conducted outside the recommended construction hours:

- The delivery of oversized plant or structure
- Emergency work
- Works for which it can be demonstrated that there is a need to operate outside the recommended standard hours.
- Works which maintain noise levels at receivers below the night time noise affected construction noise management levels.

For recommended standard hours, the following terms are used in relation to establishment of construction noise criteria:

- The 'noise affected level' represents the point above which there may be some community reaction to noise. For standard construction hours this level is established with reference to the measured rating background level (RBL) plus 10 dB(A). Outside standard construction hours this level is the RBL plus 5 dB(A).
- The 'highly noise affected level' represents the point above-which there may be strong community reaction to noise. This level is set at L_{Aeq}(15min) 75 dB(A).

The construction noise management levels (CNMLs) that apply to sensitive receivers within each noise catchment area during construction of the Project are presented in Table 7-30.

Table 7-30 ICNG CNMLs at identified receivers, dB(A)

Receiver Type	ICNG Management Level $L_{Aeq(15min)}$ dB(A)[1]			
	Highly affected noise level	During standard construction hours	Outside standard construction hours (day[1])	Outside standard construction hours (night[2])
Residential	75 dB(A)	48 dB(A)	43 dB(A)	38 dB(A)[3]
School	-	45 dB(A) Internal (When in use)	-	-
Retail outlets	-	70 dB(A) External	70 dB(A) External	70 dB(A) External
Active recreation area	-	65 dB(A) External	65 dB(A) External	65 dB(A) External

[1]Outside standard construction hours (day) is defined as 7:00 am to 8:00 am and 1:00 pm to 6:00 pm on Saturdays, 8:00 am to 6:00 pm on Sundays and public holidays.

[2] Outside standard construction hours (night) is defined as 6:00 pm to 7:00 am Monday to Friday and 6:00 pm to 8:00 am on Saturdays, Sundays and public holidays.

[3] Criteria based on night time RBL.

Construction traffic noise

The RNP (DECCW, 2011) provides traffic noise target levels for receivers in the vicinity of existing roads. These levels are applied to construction works to identify potential construction traffic impacts and the subsequent need for reasonable and feasible mitigation measures. Table 7-31 presents the applicable criteria relating to noise due to additional traffic generated during construction of the Project.

Table 7-31 Construction traffic noise criteria - L_{Aeq} dB(A)

Type of receiver	Day+ (7:00 am – 10:00 pm)
Existing residences affected by additional traffic on existing arterial roads generated by land use developments*	60 $L_{Aeq(15hr)}$ dB(A) (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments*	55 $L_{Aeq(1hr)}$ dB(A) (external)

* Under the RNP this is any land use that causes additional traffic. Construction is considered a land use.

+ Only day time is considered as no construction vehicle movements are expected during the night period.

Based on the *Road Noise Policy* (DECCW, 2011) it is considered that where road traffic noise levels already exceed the assessment criteria, an increase of less than 2 dB(A) represents a minor impact that is barely perceptible to the average person.

Sleep disturbance

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

Construction vibration

Human comfort

Vibration criteria for human comfort have been established with consideration to the *Assessing Vibration: A Technical Guideline* (AVTG) (DEC, 2006) for guidance on human exposure to vibration.

The AVTG separates sources of vibration into continuous, impulsive and intermittent and explains that each category should be assessed differently. Vibration from construction work, passing heavy vehicles, and piling is provided as an example of an intermittent source of vibration which is to be assessed using the vibration dose value (VDV) method.

While the AVTG recommends that for intermittent vibration VDV is used as the primary indicator for human comfort, the British Standard BS 5228-2:2009 *Code of practice for noise and vibration on construction and open sites – Part 2: Vibration* guidance (BS, 2009) can be used as an additional indicator of perceptibility. BS 5228-2 recommends the guidance values presented in Table 7-32. These values are often more suitable for construction works as available information for construction activities and equipment is typically in the form of a peak particle velocity value rather than a dose value.

Table 7-32 Guidance on effects of vibration levels

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30 mm/s	Vibration might be just perceptible in residential environments.
1.00 mm/s	It is likely that vibration of this level in residential environments would cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Cosmetic damage

Vibration criteria for cosmetic damage have been established with consideration to:

- British Standard BS 7385:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground Borne Vibration* (BS, 1993) for guidance on cosmetic damage to residential buildings
- German Standard DIN 4150-3: 2016 *Vibrations in buildings – Part 3: Effects* on structures for guidance on cosmetic damage to heritage buildings

BS 7385:1993 (BS, 1993) provides guidance on the vibration level likely to cause cosmetic damage to residential buildings or reinforced structures. The guide is reproduced below in Table 7-33.

Table 7-33 Transient vibration guide for cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
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
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	

7.12.3.2 Operation

The NPI (EPA, 2017) provides guidance on the assessment of operational noise impacts. Operational noise impacts from a development is assessed against a project noise trigger level that, if exceeded, indicates a potential noise impact on the community. The Project noise trigger level is the lower value of the intrusiveness noise level and the amenity noise level.

Project intrusiveness noise level

The intrusiveness noise level aims to protect against significant changes in noise levels. Typically, this would be the Project noise trigger level in areas with low existing background noise levels. The intrusiveness noise level is determined by a five dB(A) addition to the measured background noise level. The NPI (EPA, 2017) recommends that the intrusive noise criteria for the evening period should not exceed the day-time period and the night-time period should not exceed the evening period.

The intrusive noise criteria are only applicable to residential receivers.

Project amenity noise level

The Project amenity noise level represents the noise level objective for noise from a single development. It aims to limit the cumulative noise impacts from other industries and developments on all receiver types. The Project amenity noise level is determined by a five dB(A) subtraction from the recommended amenity noise level for receivers that are not impacted by more than four individual industrial noise sources.

To standardise the time periods for the intrusiveness and amenity noise levels, the Project amenity noise level is corrected using a three dB(A) addition such that noise is assessed over a 15 minute period and not over the standard day, evening and night-time periods.

The Project amenity noise level may be modified in the following cases:

- Developments within high traffic noise levels
- Developments located near or inside an existing or proposed industrial cluster
- Where the Project amenity noise level is at least 10 dB(A) lower than the existing industrial noise level
- Where there are no other existing or proposed industries within the development area

The NPI amenity criteria for the identified receiver types surrounding the Project area are provided in Table 7-34.

Table 7-34 NPI amenity noise levels

Receiver type	Time of day	Recommended amenity $L_{Aeq(period)}$ noise level, dB(A)
Residential – suburban	Day	55
	Evening	45
	Night	40
Hotels/motels		5 dB(A) above residential amenity noise level
Commercial	All	65
School Classroom - internal	Noisiest 1-hour	35
Active recreation	All	55

Maximum noise level events

The NPI recommends a maximum noise level assessment to assess the potential for sleep disturbance impacts which include awakenings and disturbance to sleep stages. An initial screening test for the maximum noise levels events should be assessed to the following levels.

- $L_{Aeq(15min)}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater

If the screening test indicates there is a potential for sleep disturbance then a detailed maximum noise level assessment should be undertaken. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

7.12.3.3 Project noise trigger levels

The Project noise trigger levels for the sensitive receivers identified are provided in Table 7-35.

Table 7-35 Project noise trigger levels, dB(A)

Receiver	Time period	Project amenity noise level[1,2], $L_{Aeq(15\ min)}$	Intrusiveness noise level, $L_{Aeq(15\ min)}$[3]	Project noise trigger level, dBA
Residential – suburban	Day	53	43	43 $L_{Aeq(15\ min)}$
	Evening	43	42	42 $L_{Aeq(15\ min)}$
	Night	38	38	38 $L_{Aeq(15\ min)}$
				52 L_{AFMax} 40 $L_{Aeq(15min)}$ (*Sleep disturbance*)
Hotels/motels	Day	58	-	58 $L_{Aeq(15\ min)}$
	Evening	48	-	48 $L_{Aeq(15\ min)}$
	Night	43	-	43 $L_{Aeq(15\ min)}$

Receiver	Time period	Project amenity noise level[1,2], $L_{Aeq(15\ min)}$	Intrusiveness noise level, $L_{Aeq(15\ min)}$[3]	Project noise trigger level, dBA
Commercial	All	63	-	63 $L_{Aeq(15\ min)}$
School Classroom - internal	When in use	35 ($L_{Aeq,1hr}$)	-	35 $L_{Aeq(1hr)}$
Active Recreation	When in use	53		53 $L_{Aeq(15\ min)}$

Note 1: The project amenity noise levels have been calculated by subtracting five dBA from the recommended amenity noise levels as the identified receivers are not impacted by more than four individual industrial noise sources.
Note 2: The NPI recommends applies a 3 dBA addition to the $L_{Aeq(period)}$ noise level to convert the amenity noise level to a $L_{Aeq(15\ min)}$
Note 3: Intrusiveness noise level is equal to the recommended RBL plus 5 dB(A).

Low frequency, tonal land impulsive noise

The NPI (EPA, 2017) requires that modifying factor adjustments are added to the measured or predicted noise levels if the noise sources contain tonal, low frequency or impulsive noise characteristics. These noise characteristics can cause greater annoyance to the community than other noise at the same noise level. The modifying factor adjustments are summarised in Table 7-36 and are assessed at the receiver.

Low frequency noise is assessed through a comparison between the measured or predicted C and A weighted levels at each receiver. The A-weighting curve is used to approximate the sensitivity of the human ear at low levels. The C-weighting curve is designed to be more responsive to low-frequency noise.

Table 7-36 Modifying factor adjustments

Factor	Assessment/ measurement	When to apply	Correction[1,2]
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500 – 10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160 – 400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25 – 125 Hz	5 dBA[2]
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C and A weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more and: • where any of the one-third octave noise threshold level are exceeded by up to and including 5 dB and cannot be mitigated, a 2-dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise threshold levels are exceeded by more than 5 dB and cannot be mitigated, a 5 dBA positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and	5 dBA[2]

Factor	Assessment/ measurement	When to apply	Correction[1,2]
		a 2-dBA positive adjustment applies for the daytime period.	
Impulsive noise	A-weighted fast response and impulse response	If the difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB.	Apply the difference in measured noise levels as the correction up to a maximum of 5 dBA
Intermittent noise	Subjectively assessed	The source noise heard at the receiver varies by more than 5 dBA and the intermittent nature of the noise is clearly audible. This adjustment is applied to the night-time period only.	5 dBA
Duration[3]	If the duration of the noise event in any 24 hour period is as follows: • to 2.5 hours then increase the noise criteria by 2 dBA day and 0 dBA night • 15 minutes to 1 hour then increase the noise criteria by 5 dBA day and 0 dBA night • 6 minutes to 15 minutes then increase the noise criteria by 7 dBA day and 2 dBA night • 1.5 minutes to 6 minutes then increase the noise criteria by 15 dBA day and 5 dBA night • less than 1.5 minutes then increase the noise criteria by 20 dBA day and 10 dBA night		

Note 1: Where two or more modifying factors are present the maximum correction is limited to 10 dBA.

Note 2: Where a source emits a tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low frequency range.

Note 3: Duration correction is a negative correction which increases the noise criteria.

Operational traffic noise

The RNP (DECCW, 2011) provides traffic noise target levels for receivers in the vicinity of existing roads (Table 7-31). The criteria is applied to operational and construction traffic on public roads to identify potential road traffic impacts and the requirement for feasible and reasonable mitigation measures.

7.12.4 Potential impacts

7.12.4.1 Construction

Construction overview

For the purposes of modelling, activities for the Project have been separated the following construction activities:

- Planning, mobilisation and preparation
- Pipeline and civils
  - Desalination plant earthworks and hardstand
  - Desalination plant pipeline connection
- Intakes
  - Caisson installation
  - Intake installation
  - Commissioning

- Treatment Plant
  - Tank installation
  - Concrete components
  - Containerised equipment
- Power Upgrades
- Use of site compound

The equipment assumed to be utilised including sound power levels (SWLs) for each scenario are listed in Table 7-37. The equipment anticipated to be used for the different construction scenarios are summarised in Table 7-37. The sound power levels are sourced from BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites.*

Table 7-37 Construction equipment – Standard construction hours

Scenario	Equipment name	Sound power level, dB(A)	Qty	Adopted Sound Power Level, dB(A)	Location
Planning, mobilisation and preparation.	15t Excavator	107	1	111	Desalination plant site Hudson Street and Marriott Street intersection
	Hand tools	102	1		
	Heavy vehicles	107	1		
	Light vehicles	78	2		
Desalination plant earthworks and hardstand	Dozer	107	1	117	Desalination plant site
	15t Excavator	107	1		
	Compressor	101	1		
	Generator	99	1		
	Concrete pump	108	1		
	Vibratory roller	108	1		
	Grader	110	1		
	Water cart	101	1		
	Concrete truck	109	1		
	Heavy vehicles	107	2		
	Light vehicles	78	2		
Desalination plant pipeline connections	15t Excavator	107	1	111	Desalination plant site
	Generator	99	1		
	Franna Crane	104	1		
	Hand tools	102	2		
	Welding equipment	105	1		
Caisson installation	Pump	97	1	114	Desalination plant site
	Generator	99	1		
	Compressor	101	1		
	15t Excavator	107	1		
	30t Crane	104	1		
	Concrete truck	109	1		
	Heavy vehicles	107	1		
Intake installation	Pump	97	1	120	Desalination plant site
	Generator	99	1		
	Welding equipment	105	1		
	15t Excavator	107	1		
	30t Crane	104	1		

Scenario	Equipment name	Sound power level, dB(A)	Qty	Adopted Sound Power Level, dB(A)	Location
	Microtunnel/drilling rig	114	1		
	Concrete saw	117	1		
	Heavy vehicles	107	1		
Commissioning	Pump	97	1	108	Desalination plant site
	Generator	99	1		
	Heavy vehicles	107	1		
Tank Installation	30t Crane	104	1	118	Desalination plant site
	Generator	99	1		
	Compressor	101	1		
	Pneumatic tools	116	1		
	Welding equipment	105	1		
	Heavy vehicles	107	2		
Concrete components	Concrete truck	109	1	113	Desalination plant site
	Concrete pump	108	1		
	Generator	99	1		
	Light vehicles	78	1		
	Hand tools	102	2		
Containerised equipment	30t Crane	104	1	118	Desalination plant site
	Generator	99	1		
	Compressor	101	1		
	Pneumatic tools	116	1		
	Welding equipment	105	1		
	Heavy vehicles	107	2		
Power upgrade	15t Excavator	107	1	118	Hudson Street and Marriott Street intersection
	Cherry picker	105	1		
	Concrete/asphalt	109	1		
	Compactor	113	1		
	Hand tools	102	1		
	Horizontal directional drill	117	1		
	Heavy vehicles	107	1		
Compounds	Excavator	107	1	112	South west of desalination plant site.
	Delivery trucks	107	2		
	Light vehicles	78	2		

To construct the subsurface seawater intake, a deep well needs to be excavated to install the central well (caisson). The well would require dewatering 24 hours per day, 7 days per week and needs to be assessed for construction noise impacts outside of standard hours.

Table 7-38 Construction equipment - Outside of standard construction hours

Scenario	Equipment name	SWL, dB(A)	Qty	Adopted SWL, dB(A)	Location
Intake dewatering	Generator	97	1	101	Desalination plant site
	Pumps	99	1		

Predicted construction noise levels

Construction activities take place in two areas:

- The desalination plant site
- Intersection of Hudson Street and Marriott Street

The desalination plant is located adjacent to Nine Mile Beach (Active Recreational Area), which would be the most susceptible to noise impacts from the construction activities. The nearest residential receiver to the desalination plant is 33 Williams Street, Belmont. Table 7-39 shows the predicted noise level at the nearest point of Nine Mile Beach and 33 Williams Street, Belmont against the relevant Construction Noise Management Level (CNML).

Table 7-39 Construction noise impact

Construction Scenario	Nine Mile Beach (Active Recreation Area)		33 Williams Street, Belmont (Residential)	
	CNML dB(A)	Predicted noise level, dB(A)	CNML dB(A)	Predicted noise level, dB(A)
Standard construction hours				
Planning, mobilisation and preparation	65	48	48	31
Desalination plant earthworks and hardstand		57		39
Desalination plant pipeline connections		55		37
Caisson installation		54		36
Intake installation		61		39
Commissioning		48		31
Tank Installation		56		37
Concrete components		52		33
Containerised equipment		56		37
Use of site compound	65	52	48	36
Outside of standard construction hours				
Intake dewatering	65	43	38	22

All construction activities associated with the construction of the desalination plant are predicted to comply with the CNML.

The construction works at the intersection of Hudson Street and Marriott Street is in close proximity to residential receivers, with the nearest receiver being within 20 metres of the works. The worst case construction scenario is from the power upgrade works. It is predicted that these works would have a noise impact on nearby receivers.

- The noise impact on residential receivers within 45 metres of the work would be above the 75 dB(A) highly affected noise level.
- The noise impact on residential receivers within 160 metres of the work would be above the 62 dB(A) CNML noise level.

The noise assessment has been on a worst-case scenario where all anticipated equipment are operating at maximum levels simultaneously.

The construction activities at Hudson Street and Marriott Street intersection are expected to take less than three weeks. Although the works would be conducted during standard construction work hours and have short term noise impacts on the surrounding sensitive receivers; it is recommended that mitigation methods outlined in Section 7.12.5 are implemented, where reasonable and feasible.

Construction traffic noise

The increase in traffic due to construction works on Pacific Highway represents are predicted to result in a negligible increase in noise levels. This is due to the existing volume of traffic on the road being significantly higher than that generated due to construction activities.

The traffic volume due to construction works on Hudson Street, Beach Street and Ocean Park Road is a substantial increase to the existing. The individual construction traffic movements would be noticeable with the increase in heavy vehicles. However, the overall noise (L_{eq})

increase due to the construction traffic on the local roads would be largely masked by the road traffic noise generated by the nearby arterial road (Pacific Highway) during high traffic times.

Table 7-40 Construction traffic noise impacts

Location	Predicted road traffic noise (existing) L_{eq} (dB(A))	Predicted road traffic noise (existing + construction) L_{eq} (dB(A))	Difference (dB(A))
Cnr Pacific Highway and Beach Street	76	76	0
Cnr Beach Street and Hudson Street	61	62	1
Cnr Beach Street and Ocean Park Road	60	63	3
Cnr Williams Street and Ocean Park Road	58	60	2

The model results shown in Table 7-40 indicate construction traffic noise levels are predicted to increase by up to 3 dB at assessed receiver locations. Generally, the smallest change (increase or decrease) in decibels that the human ear can detect is about 2 to 3 dB but this varies with individual sensitivity; however, a change of 5 dB is considered noticeable by most people. A 5 dB change is often used as a target objective when considering the potential for noise nuisance. Therefore, the predicted increase in traffic noise due to construction traffic generation is expected to be acceptable to the majority of people.

Despite predictions indicating construction road traffic noise is expected to be acceptable, the measures outlined in Section 7.12.5 are provided to assist in reducing potential impacts:

- Ensure traffic movements, especially heavy vehicles, are limited to standard construction hours
- Avoid the use of engine compression brakes
- Advocate appropriate driver behaviour
- Ensure the road surface is maintained to assist with minimising banging/bumping noise from vehicles as they travel to and from the Project area, particularly when they are unloaded
- Keep truck drivers informed of designated vehicle routes, parking locations and delivery hours

Construction vibration

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.

The safe working buffer distances in Table 7-41 to comply with human comfort and cosmetic damage for standard dwellings were sourced from the *Construction Noise and Vibration Strategy* (Transport for NSW, 2018).

Table 7-41 Indicative 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 would be vibrational impacts on nearby sensitive receivers.

7.12.4.2 Operation

Operational noise

Operational noise has been modelled using SoundPLAN (version 8.0). SoundPLAN is a computer program for the calculation, assessment and prognosis of noise exposure. SoundPLAN calculates environmental noise propagation according to '*ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors*' algorithm.

Table 7-42 lists the indicative equipment for the desalination plant and their associated SWLs.

Table 7-42 Operational noise sources

Equipment	Quantity	Operation Cycle	SWL
High pressure (HP) pumps	4	Continuous	103 dB(A)
Energy recovery devices (ERD)	4	Continuous	103 dB(A)
Air compressor	1	Intermittent	Negligible
Intake pumps	6	Continuous	Negligible - Submersed
Various pumps	6	Continuous	75 dB(A)
Screen and filters	-	Intermittent	Negligible

The assessment was based on the HP pumps and energy recovery units as it is expected that this equipment would have the highest noise impact. The various pumps on site are smaller in size and some are submerged in water. Air compressor, screens and filters operate intermittently and would be shielded in containers.

Table 7-43 shows the predicted noise level at the relevant sensitive receivers. The Project would be operating continuously and hence it is assessed against the most stringent period (night time).

Table 7-43 Predicted operational noise at nearest receivers dB(A)

Receiver address	Project noise trigger level, $L_{Aeq(15min)}$ dB(A)	Predicted contribution noise level, $L_{Aeq(15min)}$ dB(A)
Nine Mile Beach (Active Recreation Area)	53	53
33 Williams Street, Belmont (Residential)	38	33

Based on the noise model results, the operational noise is predicted to comply with the Project Noise Trigger Level (PNTL) during the night-time period.

Although noise levels are predicted to comply with the environmental noise levels specified, the following design strategies are recommended to be incorporated into the detailed design of the desalination 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 one metre, 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 one metre.

Sleep disturbance

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

Annoying characteristics

Any annoying characteristics (such as tonality, low frequency, impulsiveness, etc.) generated by the Project would need to have corrections factors applied, as per the NPI. This would need to be assessed as part of the detailed design stage where specific operational equipment are selected.

Operational traffic

Operational traffic generation to and from the Project area would include staff movements with an occasional heavy vehicle accessing the site. The primary access route would be off Ocean Park Road via Beach Street.

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

Operational vibration

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

7.12.5 Mitigation measures

The measures described in Table 7-44 will be implemented to avoid or minimise noise and vibration impacts.

Table 7-44 Proposed mitigation measures – noise and vibration

Impact	Management and mitigation measure	Timing
Noise and vibration – Site inductions	All employees, contractors and subcontractors will receive an environmental induction. The induction will include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Location of nearest sensitive receivers • Employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures	Pre-construction, Construction
Noise and vibration – Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.	Pre-construction, Construction
Equipment selection	Use quieter and less vibration emitting construction methods where reasonable and feasible.	Pre-construction, Construction
Noise and vibration – Community consultation	Ongoing stakeholder consultation will occur including: • Establishing contact with local residents and the construction program and progress communicated on a regular basis, particularly when noisy activities are planned. • Notifying affected receivers of the intended work, its duration and times of occurrence. This may include a local community update letters for specific construction activities and a project info line. • Specific notifications will be provided to receivers where the highly noise affected level of 75 dB(A) is predicted to be exceeded.	Pre-construction, Construction
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.	Construction
Noise and vibration – Traffic noise	Comply with the recommended standard construction hours. Plan traffic flow, parking and loading unloading areas to minimise reversing movements within the site. Loading and unloading of materials/deliveries is to occur during standard construction hours. Contractors are to avoid dropping materials from height where practicable, during loading and unloading. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. No truck movements before 7.00 am or after 6.00 pm.	Construction
Noise and vibration – Vibration monitoring	Vibration monitoring will be undertaken where equipment is being used within the safe working distances detailed in Table 7-41 or when a complaint is received. Vibration monitoring should be conducted during these activities at the most susceptible buildings close to the construction sites.	Construction

Impact	Management and mitigation measure	Timing
	Any vibration measurement will be undertaken by a qualified professional and with consideration to the ICNG guidelines.	
Noise and vibration – Complaints management	Complaints will be managed in accordance with the CEMP and the procedure outlined below. Signage will clearly and visibly provide a contact number and name to receive complaints and enquiries about construction. Potential complaints specific to these works could include: • Vibration impacts from works that significantly affect structures or dwellings • A cluster of noise and/or vibration complaints The response will be to: • Verbally respond to complainant • Provide a written response within seven calendar days if the complaint cannot be resolved verbally • Log the complaint, and any actions taken with regards to the complaint within a complaints register • Undertake monitoring at the complainant's residence(s) • Investigate the nature and reasons of the impact • Investigate and implement further mitigation measures to minimise the impact	Construction
Noise– Respite periods	High noise generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. High noise refers to construction noise impacts which exceed the highly affected noise management level of 75 dB(A) LAeq(15-min) during standard construction hours.	Construction
Sleep disturbance – Annoying characteristics	Any annoying characteristics (such as tonality, low frequency, impulsiveness, etc.) generated by the site will need to have corrections factors applied, as per the NPI. This will need to be assessed as part of the detailed design stage where specific operational equipment are selected.	Detailed design
Operational noise – Detailed design	The following design strategies will be incorporated into the detailed design of the desalination plant: • Selection of equipment and plant items to limit noise emissions. Where practical and feasible, motor drives, gear boxes, pumps, etc. will be specified and selected to achieve a noise level of less than 85 dB(A) at a distance of one metre, 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 one metre.	Detailed design

7.13 Waste management

This section describes the existing environment in relation to waste management. It addresses the potential waste streams associated with the Project during construction and operation, and details the measures proposed to manage waste associated with the Project.

7.13.1 Existing environment

There are currently three main wastewater streams that are discharged to the Pacific Ocean via the Belmont WWTW ocean outfall, namely:

1. Treated effluent from Belmont WWTW
2. Wet weather screened bypass from Belmont WWTW
3. Treated effluent from the West Lake WWTW's (Dora Creek, Edgeworth and Toronto)

The ocean outfall has a maximum discharge capacity of 5,500 L/s. During dry weather, discharges vary on a daily basis from minimums of 50 L/s to maximums of 550 L/s. However, during wet weather events the non-sewage component of the outfall discharge (associated with stormwater) has the greatest influence, with historical discharge flow up to 3,800 L/s. During extreme weather events higher peak discharges can occur.

Waste disposal and discharges from Belmont WWTW are subject to the EPL held by Hunter Water for the Lake Macquarie sewerage system (licence number 1771), which defines the conditions under which effluent may be discharged from the outfall, including pollutant concentrations (oil and grease, total suspended solids (TSS)), daily discharge volumes and authorised activities.

The remainder of the Project area is not currently subject to any waste generation activities.

7.13.2 Potential impacts

The potential impacts associated with waste generation from the Project are provided in the following sub-sections.

7.13.2.1 Construction

During construction of the project, the following major wastes would be produced:

- Excess spoil
- Wastewater from groundwater dewatering during excavation
- General construction waste

Excess Spoil

Approximately 3,130 m^3 of excess spoil would be generated from construction of the intakes. Excess spoil would be reused on-site as general fill where suitable, including for filling of the former evaporation ponds at the desalination plant site. The remainder would be disposed offsite in accordance with the *Waste Classification Guidelines* (EPA, 2014), which could be up to the entire quantity of excess spoil depending on filling requirements.

The results of soil analysis completed for the contamination assessment were compared to the waste classification criteria from the *Waste Classification Guidelines* (EPA, 2014) to provide an indication of the potential waste classification for off-site disposal should excess spoil from construction works not be suitable for on-site re-use (refer to Appendix D in Appendix H). Based on the results, soils were generally classified as General Solid Waste with the following exceptions:

- Soils at one location: TP106 within the desalination plant site (refer to Figure 7-1) would be classified as restricted solid waste based on lead concentrations.
- Soils where either ASS or asbestos fragments are identified would also be classified as either ASS or asbestos waste.

These classifications are preliminary only and further sampling and analysis would be required prior to disposal off-site at an approved materials recycling or waste disposal facility. Records of the disposal of any contaminated soils would be kept and maintained. General solid waste would require disposal to landfill, while restricted solid waste would require disposal to an appropriately licenced facility capable of receiving that waste type. All waste disposal would be in accordance with the *Waste Classification Guidelines* (EPA, 2014). Hunter Water would ensure re-use of general solid wastes, where this waste meets the relevant requirements of the *Waste Classification Guidelines* (EPA, 2014).

Dewatered groundwater

Construction of the intake structures are predicted to generate approximately 10 ML of groundwater from dewatering activities, which may be disposed of via the Belmont WWTW outfall (Project outfall area) following appropriate treatment to ensure that water quality limits including TSS are met. It is considered that the EPL would need to be modified prior to construction to authorise the discharge of dewatered groundwater during construction via the Belmont WWTW outfall (Project outfall area).

General construction waste

General construction activities would result in the generation of a range of waste streams, including:

- Material packaging and offcuts
- Packaging and general waste from staff (lunch packaging, office waste, etc.)
- Concrete waste, including concrete washout
- Cleared vegetation which could include native green waste as well as declared weed material
- Removed structures such as fencing and guide posts
- Redundant erosion and sediment controls
- Sewage produced by the workforce

Re-use of materials where possible would reduce the impact of the Project considerably, as remaining material would be sent to landfill.

7.13.2.2 Commissioning

Intake

Commissioning of the intake would involve pumping seawater through the newly installed intake structures at full capacity (up to 45 ML/day) for approximately one week. It is expected that the brine discharge pipeline between the desalination plant and the HCS would be utilised to dispose of commissioning flows without going through the desalination process.

In the event that sufficient flows are not achieved, further commissioning would be required following installation of additional intakes, with flows discharged via the HCS during each round of commissioning. Given the expected quality and volume of flow from the intake commissioning, an impact from disposal of this waste stream to the marine environment is not anticipated (refer to Section 7.4).

Desalination plant

Commissioning of the desalination plant would comprise commissioning of the pre-treatment process and then the RO units. During this process, four waste streams would be generated as described in Table 7-45.

Table 7-45 Desalination plant commissioning waste steams

Waste stream	Disposal method	Impact
Pre-treatment commissioning		
Sludge - approximately 456 kg/day generally comprising sediments and organic matter.	To the WWTW inlet works via a new connection to the existing rising main, where it would be treated along with sewage input and discharged with other WWTW outputs to the ocean outfall.	As the sludge would be treated as part of the WWTW process and it is not expected to contain contaminants of concern or comprise a significant volume, an impact from disposal of this waste stream is not anticipated.
Screened groundwater	Straight to the outfall via the hydraulic control structure.	This waste stream would be the same as the wastewater from commissioning of the intake, but of lower volume and with some screening which would improve the quality. As such, an impact from disposal of this waste stream is not anticipated.
RO commissioning		
Permeate – water generated from the RO process before being treated to become drinking water (pre-chlorine and fluoride dosing). May not meet the required permeate specifications for drinking water quality.	Straight to the outfall via the hydraulic control structure.	The permeate water may not meet specifications for drinking water quality during commissioning. However, given that the permeate would comprise intake water that has gone through some treatment as part of the RO process, it would be of equivalent or superior quality to the screened groundwater waste stream in terms of contaminant concentrations. Therefore, an impact as a result of contaminants in the waste stream is not expected. However, this waste stream would be of much lower salinity (freshwater) than the wastewater from intake or screened groundwater commissioning. In the event that this waste stream is discharged at high volumes, particularly during a wet weather event, the discharge plume dynamics from the outfall could be altered and the impact of discharging low salinity wastewater to the marine environment increased. The implementation of mitigation measures described in Section 7.13.3 would minimise this impact.

Waste stream	Disposal method	Impact
Potable water (permeate post-dosing with chlorine and fluoride)	To the WWTW inlet via the existing rising main, where it would be treated along with sewage input and discharged with other WWTW outputs to the ocean outfall.	Given the close proximity of the plant to the WWTW there is a chance that inputting chlorinated water into the WWTW could affect the biological processes of the wastewater treatment plant; however, dilution of the potable water with wastewater is likely to reduce any potential impacts. With regards to fluoride, relatively large concentrations are generally input into the WWTW within sewage, so an impact from this is not expected.

7.13.2.3 Operation

Brine waste production from desalination operations

The desalination process would produce up to 28.2 ML/day of wastewater, comprising 25.5 ML/day of brine, 2.0 ML/day of RO membrane cleaning and pre-treatment waste (refer to subsection below) and 0.75 ML/day of other losses and utilities. The brine discharge would be transferred via a pipeline connection to the Belmont WWTW, where it would be added to the HCS for disposal to the ocean through the existing outfall. Potential impacts of the discharge of brine on the marine environment and associated mitigation measures are provided in Section 7.4.

Pre-treatment and RO membrane cleaning waste

The pre-treatment process of the desalination plant would produce a waste stream comprising solids and organics removed from pre-treatment filters by backwashing. Small quantities of wastewater would also be produced by the RO membrane cleaning system, comprising spent cleaning solutions that would likely include sodium hydroxide, citric acid and sodium bisulphite. Pre-treatment and RO membrane cleaning waste would be neutralised and directed to a sedimentation tank (clarifier or equivalent).

Approximately 2.0 ML/day of clarified water would be delivered from the clarifier to the brine waste stream, while up to 456 kg/day of solids would be processed and disposed of through the Belmont WWTW as sludge via a connection to the existing sewage rising main passing the desalination plant.

7.13.2.4 Decommissioning

While some components of the Project would remain in place following decommissioning (i.e. below ground portion of the intake structure, concrete bunds and hardstand areas) and other components would be demolished/removed, it has been identified that several components would be sold or re-used, which would significantly reduce the impact on waste as a result of decommissioning. Aspects of the desalination plant that may be sold or reused comprise:

- Seawater pumps
- Pre and post treatment elements, including tanks, process equipment, piping, cabling and other ancillary components
- Desalination modules
- Ancillary components including pump stations, switchboards and transformers, chemical dosing facilities and communications equipment
- Fencing and signage

While some of the remaining material may be re-used for other purposes or recycled (e.g. concrete from demolition of hardstand elements, piping and cabling that cannot be sold or reused, brine disposal pipeline and some fencing and signage), some elements would be sent to landfill for disposal in accordance with with the *Waste Classification Guidelines* (EPA, 2014).

7.13.3 Mitigation measures

Mitigation measures provided in Table 7-46 will be implemented to minimise potential impacts on waste generation.

Table 7-46 Proposed mitigation measures – waste management

Impact	Mitigation measure	Timing
General	Obtain modification to EPL 1771 to provide for discharge of brine, commissioning flows and dewatered groundwater (if applicable) via the Belmont WWTW HCS.	Pre-construction
	Follow the resource management hierarchy principles: • Avoid unnecessary resource consumption as a priority • Re-use materials, reprocess, recycle and recover energy • Dispose as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act 2001*)	Throughout the project duration
	Manage all waste material in accordance with the POEO Act and Waste Classification Guidelines (EPA 2014) and the Waste Avoidance Resource Recovery Strategy for NSW (NSW EPA).	Throughout the project duration
	Manage and track waste in accordance with Hunter Water specifications, including recording of the total waste generated per month and the percentage recycled.	Throughout the project duration
Spread of contamination through inappropriate waste management	Include waste classification, sampling and analysis in the Contaminated Soil Management Plan. Manage materials in accordance with the Contaminated Soil Management Plan. Dispose of waste to an appropriately licensed facility with supporting waste classification documentation.	Construction
Generation of general construction waste	Provide labelled waste receptacles to promote the segregation of waste and recycle materials where appropriate.	Construction
	Conduct and record site inductions as specified in the CEMP to ensure staff are aware of waste disposal protocols.	Construction
	Preferentially procure materials with no or minimal packaging, or those where packaging is recyclable or able to be returned for re-use to the supplier.	Construction
	Maintain all working areas by keeping free of rubbish and cleaning up at the end of each working day.	Construction
	Do not accept waste from outside of the project site.	Construction
	Follow mitigation measures for weed disposal as defined in Section 7.3.	Construction
	Provide portable toilets for construction workers and manage to ensure the appropriate disposal of sewage (i.e. removed by a licensed supplier). Portable toilets should be located away from drainage lines.	Construction

Impact	Mitigation measure	Timing
Generation of wastewater from dewatering	Collection and testing of dewatered groundwater to be included in the CEMP. If of suitable quality, reinject, use for dust suppression or discharge in the vicinity of the works. If unsuitable for reuse or reinjection, or discharge dispose of via the Belmont WWTW HCS in accordance with conditions of EPL 1771.	Construction
Generation of wastewater during commissioning of intake and desalination plant	During commissioning, test any wastewater that is to be disposed of to the WWTW or to the outfall to ensure that parameters will not exceed the conditions of EPL 1771 or relevant marine water quality guidelines. Calculations will need to reflect dilution with the existing WWTW effluent.	Commissioning
	Treat chlorinated water prior to release into the HCS to prevent chlorine impacts to fauna.	Commissioning
	Release commissioning wastewater as slowly as possible to minimise the impact on the WWTW effluent quality and quantity.	Commissioning
Generation of brine	Dispose of brine via the Belmont WWTW HCS in accordance with the conditions of EPL 1771.	Operation
Generation of pre-treatment sludge waste	Dispose of pre-treatment sludge waste via the Belmont WWTW in accordance with the conditions of EPL 1771.	Operation
Decommissioning	Where possible sell or repurpose components and materials for use on other projects. Where reuse is not possible, recycle materials at an appropriately licenced facility. Dispose to a licenced landfill only after re-use and recycling options have been exhausted.	Decommissioning

7.14 Visual amenity

This section describes the existing environment in relation to both landscape character and visual amenity. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

The information presented in this section is summarised from the Landscape Character & Visual Impact Analysis (LCVIA) (GHD, 2019g) (Appendix Q).

7.14.1 Methodology

The LCVIA was prepared with reference to Environmental Impact Assessment Practice Note – Guideline for landscape character and visual impact assessment (RMS, 2018) and *Guidance Note for Landscape and Visual Assessment* (Australian Institute of Landscape Architects 2018).

The visual impacts of the Project were assessed in terms of:

- Landscape Character – an analysis of the existing landscape (built, natural and cultural aspects) that identifies landscape character zones according to their similar properties or defined spatial qualities such as topography, drainage and urban form
- Representative viewpoints - identification and analysis of impacts of the Project on representative viewpoints from both private receptors and public vantage points

The visual impact is measured based on a combination of:

- Sensitivity – Refers to how sensitive the character of the setting is to the proposed change and its capacity to absorb the change
- Magnitude: Refers to the scale, form and character of a Project

The rankings of sensitivity and magnitude of landscape character and visual impact are detailed in Table 7-47 and Table 7-48. The combination of sensitivity and magnitude providing an impact rating for the Project based on Table 7-49.

Table 7-47 Sensitivity ranking

Rank	Description
None	No defining features or contribution to local character. Land use retains no original/intrinsic character and modern trends are widespread. Very densely settled with landscapes of very low quality and in degraded condition/derelict. Widespread erosion or loss. No sense of remoteness.
Negligible	Undesignated landscape heritage or biodiversity features. Densely-settled with some noticeable erosion/loss. Few/poor/negative perceptual and aesthetic qualities and poor representation of landscape character type.
Low	Undesignated landscape heritage or biodiversity features. Land use retains little original or intrinsic value with strong modern trends. Moderately settled with medium level of built form. Limited representation of landscape character type. Low scenic beauty.
Moderate	Locally-important but undesignated landscape heritage or biodiversity features. Land use retains some of the original/intrinsic character but also reflects modern changes. Moderate condition landscape but could have some erosion or loss. Moderate level of scenic beauty.
High	Pristine landscape with regionally important landscape heritage or biodiversity features. Predominantly intact and very good condition landscape with distinctive character and strong sense of place.

Table 7-48 Magnitude ranking

Rank	Description
None	No part of the Project is discernible.
Negligible	Very minor loss or alteration to one or more key elements/features/characteristics of the landscape character and/or introduction of elements that are consistent with the existing character.
Low	Minor loss of/or alteration to one or more key elements/features/characteristics of the landscape character (with recovery expected in the short term 0-4 years) and/or introduction of elements that are consistent with the existing character.
Moderate	Partial loss of/or alteration to one or more key elements/features/characteristics of the landscape character and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic.
High	Substantial or total loss of key elements/features/characteristics of the landscape character and/or introduction of elements that are considered to be totally uncharacteristic.

Table 7-49 Landscape character impact matrix

		Sensitivity			
		High	*Moderate*	*Low*	*Negligible*
Magnitude	*High*	High	Moderate - High	Moderate	Negligible
	Moderate	Moderate - High	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

7.14.2 Existing environment

The Project is located within the Lake Macquarie LGA, approximately 1.6 km from the centre of Belmont. Belmont, particularly Belmont South, is characterised by a narrow, flat, low lying strip of land between Lake Macquarie and the ocean. The setting, amenity and lifestyle provided by close proximity to the lake, the coast, and bushland are a defining feature of the area and a key factor in attracting new residents, visitors and investment.

The vast majority of the surrounding area is associated with open space land uses. Apart from the Belmont Golf Course, adjoining open space land uses comprise a mix of informal outdoor activities. Nine Mile Beach is commonly used for four wheel driving, and other public recreation such as camping adjacent to the Belmont Wetlands State Park. Belmont Lagoon and associated coastal wetlands and the Belmont Wetlands State Park comprise utilities, access roads, environmental restoration and conservation and public recreation activities including bush walking, bird watching, horse riding and four wheel driving.

7.14.2.1 Landscape character

The Project and surrounding areas comprise of two main landscape character zones (LCZ). These LCZs include:

- LCZ1 – Coastal Dunes and Beach Scape: Sensitivity is moderate. The existing character is vast, exposed and varied. The area in close proximity to the Project has been previously modified by the built structures of the Belmont WWTW.
- LCZ2 – Belmont South residential: Sensitivity is low. The existing character is sub urban residential street scapes often forming the edge to dense forest.

7.14.2.2 Key viewpoints

Key viewpoints with the potential to be visually impacted by the Project have been determined based on desktop analysis and site investigations (refer to Figure 7-11).

Five viewpoints have been selected as a representation or a typical example of a view/views from a particular visual catchment area, these include:

- Viewpoint 1 – Nine Mile Beach – Adjacent to the Project area
- Viewpoint 2 – Belmont Golf Course
- Viewpoint 3 – Andersons Point - elevated residential
- Viewpoint 4 – Belmont North - elevated residential
- Viewpoint 5 – Belmont Wetlands State Park – Kalaroo fire trail

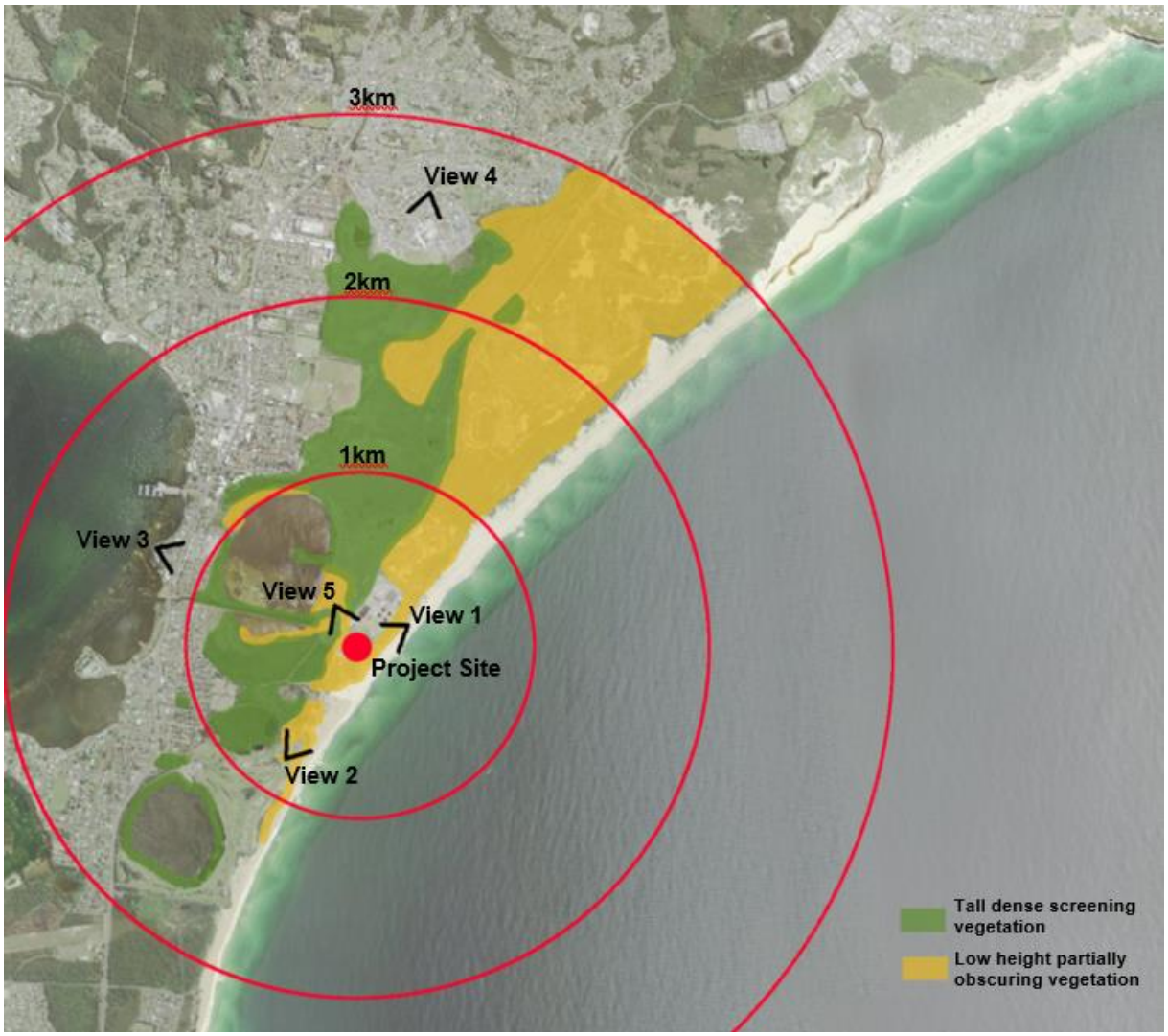

Figure 7-11 Key viewpoints

7.14.3 Potential impacts

7.14.3.1 Construction

During construction, positioning of plant and equipment within view of nearby sensitive receivers and existing road users would result in minor, temporary visual impacts. Earthworks would also expose subsoil.

The Project would require removal of some vegetation within the boundaries of the Project area (see Section 7.14.4). Some of this vegetation contributes to the amenity and character of the local area, and/or screens views from properties adjoining the road. The removal of this vegetation would have the potential to reduce some screening between sensitive receivers and the road. This would lead to temporary visual impacts during construction until the works are complete and disturbed areas rehabilitated.

Potential visual impacts during construction would be minimised through implementation of the safeguards and management measures outlined in Section 7.14.4.

7.14.3.2 Operation

An assessment has been carried out to measure the operational impact of the proposal on the landscape character zones and the viewshed (i.e. the geographical area visible from a location), and key viewpoints and is summarised below.

The landscape character and visual impact assessment of the Project indicates potential impacts primarily be on the visual setting of the area in the immediate vicinity of the Belmont WWTW. In general, it is not anticipated that the Project would detract from the vast, exposed, beachscape character and being set back from the beach towards the forested vegetation means that it would be relatively camouflaged. Unless a receiver would be directly adjacent to the Project, it is not expected to be visible above the dunes. Further, in close proximity to the Project on Nine Mile Beach where the Project is visible, the existing character has been previously modified by the built structures of the existing WWTW. As such, the Project is not anticipated to result in a notable alteration to the landscape character or visual amenity.

Landscape character

The Project is predicted to result in a moderate-low impact on LCZ1 – Coastal Dunes and Beach Scape as a result of operation, while impacts on LCZ2 are predicted to be negligible (see Table 7-50).

Table 7-50 Landscape character zone assessment

LCZ	Sensitivity	Magnitude	Overall level of impact	Comment
1 – Coastal Dunes and Beach Scape	Moderate	Low	Moderate-Low	The Project would not detract from the vast, exposed, beachscape character and being set back from the beach towards the forested vegetation means that it would be relatively camouflaged. Unless a receiver would be directly adjacent to the Project, it is not expected to be visible above the dunes. As such, the Project is not anticipated to result in a notable alteration to the landscape character of this LCZ.

LCZ	Sensitivity	Magnitude	Overall level of impact	Comment
2 – South Belmont residential	Low	Negligible	Negligible	The character of this zone would be impacted for a brief temporary period (approximately two weeks) during construction. As such, the Project is not anticipated to result in a notable alteration to the landscape character of this LCZ.

Key viewpoints

The level of potential visual impact have been assessed through consideration of the combination of magnitude of visual change in the landscape and its proximity to the viewer, and the sensitivity in relation to the quality of the view and how sensitive it is to the proposed change.

The Project is predicted to result in moderate-low impact for viewpoints 1 and 5, and negligible for viewpoints 2, 3 and 4. Table 7-51 provides discussion on the visual impact for each of the key viewpoints.

Table 7-51 Visual impact assessment

Viewpoint	Sensitivity	Magnitude	Overall level of impact	Comment
1	Low	Moderate	Moderate-Low	Although in this case the view distance is short, the Project occupies a small part of the overall Nine Mile Beach landscape environment. This location is not adjacent to the beach access point and is also directly next to the WWTW. As such, the magnitude of change to the visual impact is reduced given that the Project structures is consistent with the view of existing WWTW structures.
2	Low	Negligible	Negligible	The 11th hole is Belmont Golf Course's most north eastern location, therefore closest to the Project area. The existing WWTW is currently visible within the coastal dune environment set back from Nine Mile Beach. The Project however, is screened by vegetation from this viewpoint.
3	Moderate	Negligible	Negligible	The elevated residential enclave of Andersons Point has a few residences which face east towards the project site. While some residences may be sufficiently elevated to potentially glimpse the Project, the vegetation screening between them and the project is such that any sighting would be very limited. The Project is over 1 km away therefore the magnitude of the Project would be negligible.

Viewpoint	Sensitivity	Magnitude	Overall level of impact	Comment
4	Moderate	Negligible	Negligible	The elevated residential enclave of Belmont North has a few residences which face south east towards the Project. The Project is unlikely to be seen above the dense vegetation. The Project is over 2 km away therefore the magnitude of the project would be negligible.
5	Low	Moderate	Moderate-Low	The key visual elements of the Project are the four holding tanks, each with an approximate height of 5 m. The majority of vegetation surrounding the Project to the west contains dense Coastal Sand Swamp Forest with a height above 5 m. Within close proximity to the Project the land is low lying. The Project would only be visible where dense, high forest vegetation between receptors and the Project is at a minimum. Within the Belmont Wetlands State Park and conservation areas to the west of the Project, these viewpoints are limited.

7.14.4 Mitigation measures

The measures described in Table 7-52 will be implemented to avoid or minimise potential impacts on landscape character and visual amenity.

Table 7-52 Proposed mitigation measures – visual amenity

Impact	Management and mitigation measure	Timing
Minimise visual impact for receptors	Existing large trees and vegetation will be maintained and protected wherever possible.	Operation
Minimise light spill into any adjoining landholding or dwelling	During operation, lighting will be provided at the desalination plant, given that it will be operational on a continuous basis. Lighting will be provided in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.	Operation
Minimise visual impact on residential areas	Following completion of the minor upgrade to the power connection at the intersection of Hudson Street and Marriot Street, Belmont South, the existing footpaths and road surfaces will be reinstated to original condition prior to the works.	Construction
Minimising visual impact on the adjoining dwellings	During construction of the project, the works area will be kept tidy and any lighting during night time will be used over a short duration and directed to avoid spill into any adjoining properties.	Construction
Contrast of structures against the surrounding vegetation	A muted colour palette should be utilised for the desalination site structures.	Detailed Design

7.15 Air quality

This section describes the existing environment in relation to air quality. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

7.15.1 Methodology

The assessment involved:

- Reviewing existing regional ambient air quality and meteorology
- Undertaking a screening level construction air quality impact assessment
- Identifying sensitive receivers near the proposal site that may be exposed to levels of construction dust above the relevant criteria
- Qualitatively assessing the potential for air quality impacts during operation
- Providing mitigation measures

7.15.1.1 Legislative and policy context

Companies and property owners are legally bound to control emissions (including particulates and deposited dust) from construction sites under the POEO Act. Activities undertaken onsite must not contribute to environmental degradation, and pollution and air emissions must not exceed the standards. Further information on the POEO Act as it relates to the Project is provided in Section 5.

The *Protection of the Environment Operations (Clean Air) Regulation 2010* (the Clean Air Regulation) provides regulatory measures to control emissions from motor vehicles, fuels, and industry. The Project would be operated to ensure it complies with the Clean Air Regulation.

Air quality impact assessment criteria are prescribed by the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) (known as 'the Approved Methods'). These generally apply to stationary sources of air pollution. However, as the construction period for the Project as a whole would be around 8 months, the particulates and deposited dust criteria in the Approved Methods were used for the assessment of potential construction impacts of the Project.

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality in February 2016. These are known as the *National Environment Protection (Ambient Air Quality) Measure* ('the Air NEPM'). The Air NEPM sets non-binding standards and ten-year goals (for 2026). The goal for the Air NEPM is a PM_{10} of 50 micrograms per cubic metre (µg/m^3) as a 24-hour average (no exceedances per year) and a $PM_{2.5}$ goal of 25 µg/m^3 as a 24-hour average.

The Air NEPM standards apply to regional air quality as it affects the general population. The standards do not apply in areas impacted by localised air emissions, such as industrial sources, construction activity, and heavily trafficked streets and roads.

Background concentrations of air pollutants are ideally obtained from ambient monitoring data collected at a Project area in accordance with the Approved Methods. The Approved Methods recognises that this data is rare, and that data is typically obtained from monitoring sites as close as possible to a Project area, where sources of air pollution resemble the existing sources at the Project area.

7.15.2 Existing environment

7.15.2.1 Sensitive receivers

Key sensitive air quality receivers near the Project include:

- Residents of Belmont South located in close proximity to the power connection
- Belmont Cemetery, located approximately 200 m to the east of the power connection and 620 m south west of the desalination plant
- Flora and fauna within close proximity to the Project area
- Belmont Golf Course, located approximately 590 m to the south of the Project area
- Users of Nine Mile Beach located adjacent to the Belmont WWTW, approximately 85 metres east

7.15.2.2 Ambient air quality

Long-term data for fine particulate matter (PM_{10}) and nitrogen dioxide (NO_2) was obtained from the nearest OEH air quality monitoring station, which is located at Newcastle, about 15 km north of the site at the closest point. PM_{10} data recorded over the past 18 months indicates an average daily concentration of 25.3 $\mu g/m^3$, which is below the daily average assessment criteria adopted by the EPA (2017) (Table 7-53). Further, the average and maximum daily averages for NO_2 were within the annual average criteria, indicating that the ambient background air quality is good and not adversely impacted by exhaust fumes or industrial activities, which is consistent with the land uses of the surrounding area.

Table 7-53 Ambient air quality concentrations recorded at Newcastle

Parameter	Criteria (EPA, 2017)	Mean daily average	Maximum daily average	Minimum daily average
PM_{10} ($\mu g/m^3$)	50	25.3	146	6.5
NO_2 (pphm)	3 (annual average)	0.6	2.3	0

*OEH air quality data from Newcastle monitoring station from September 2017 to March 2019 (OEH, 2019)

The National Pollutant Inventory holds a database of facilities and emissions to air in the Newcastle region. A search of the National Pollutant Inventory for a 2 km radius around the Project area indicated that the only registered business with source emissions is Belmont WWTW which emits hydrogen sulphide and is located adjacent to the Project area.

The other primary source of air emissions within immediate proximity of the Project area is expected to be vehicles within the residential areas of Belmont South and accessing the Belmont WWTW from Ocean Park Road, generating particulate matter and products of combustion (exhaust emissions).

7.15.2.3 Local meteorology

Climate data was obtained from the Bureau of Meteorology (BoM) Newcastle Nobbys Signal Station weather station (site number 061055), located approximately 17 km north of the Project area. The annual average maximum and minimum temperatures experienced at Newcastle are 21.8 degrees and 14.3 degrees respectively. On average, January is the hottest month with an average maximum temperature of 25.6 degrees. July is the coldest month, with an average minimum temperature of 8.5 degrees. Most of the annual 1,121 mm of rainfall occurs between January and June.

Wind speeds, which are of particular importance when determining the potential for dust impacts are typically greater in winter and spring. Annual wind rose data for the period of 1957 to 2019 shows that winds are predominantly from the north west and west in the mornings (Figure 7-12) and from the east, south east and south in the afternoons (Figure 7-13). Winds greater than 20 km/hr could cause nuisance dust (DERM, 2011). Both morning and afternoon wind rose data show that the study area experiences winds greater than 20 km/hr and up to 40 km/hr. Therefore, strong winds have the potential to cause dust impacts.

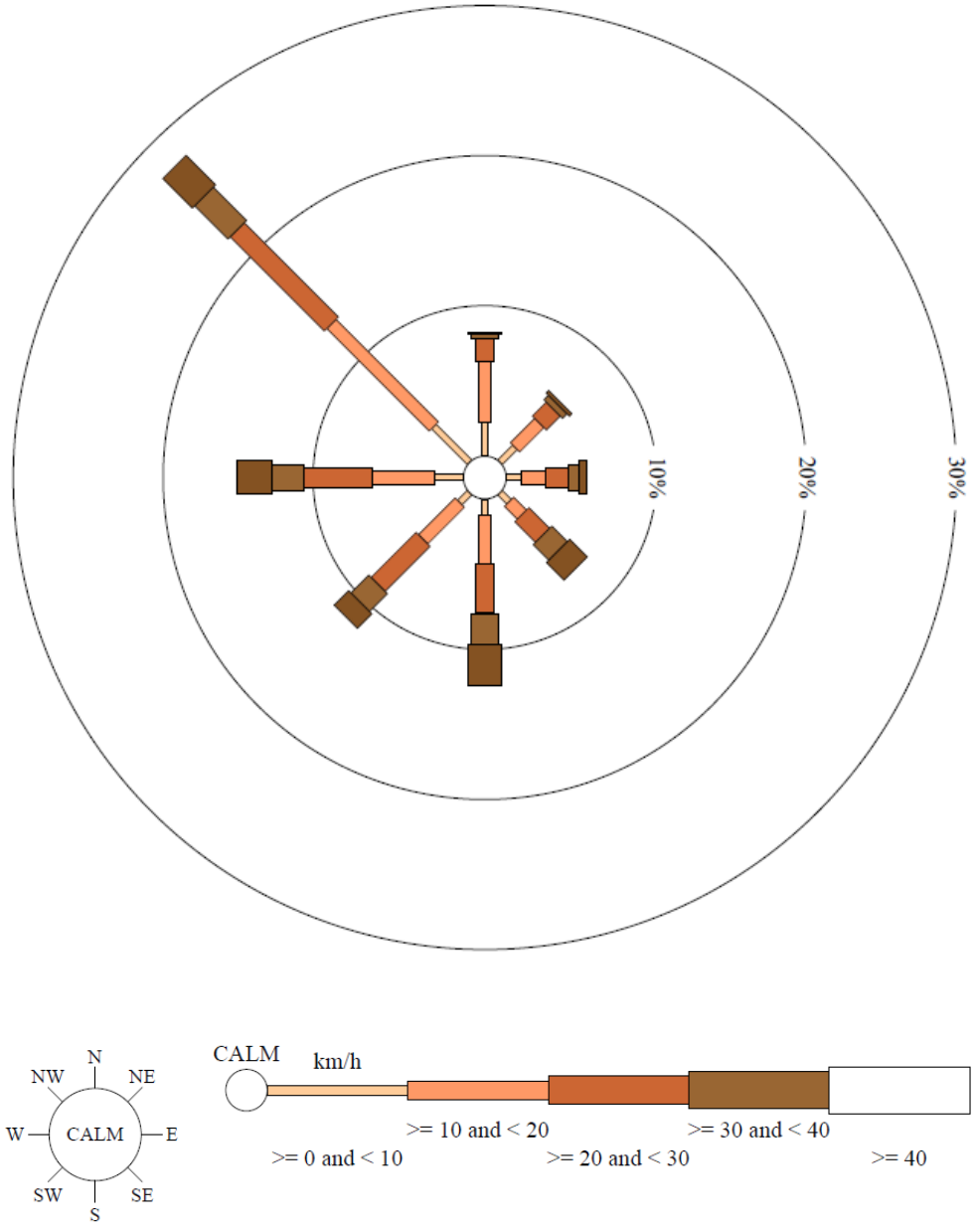

Figure 7-12 9:00 am annual wind rose data for Newcastle Nobbys Signal Station weather station (BoM, 2019)

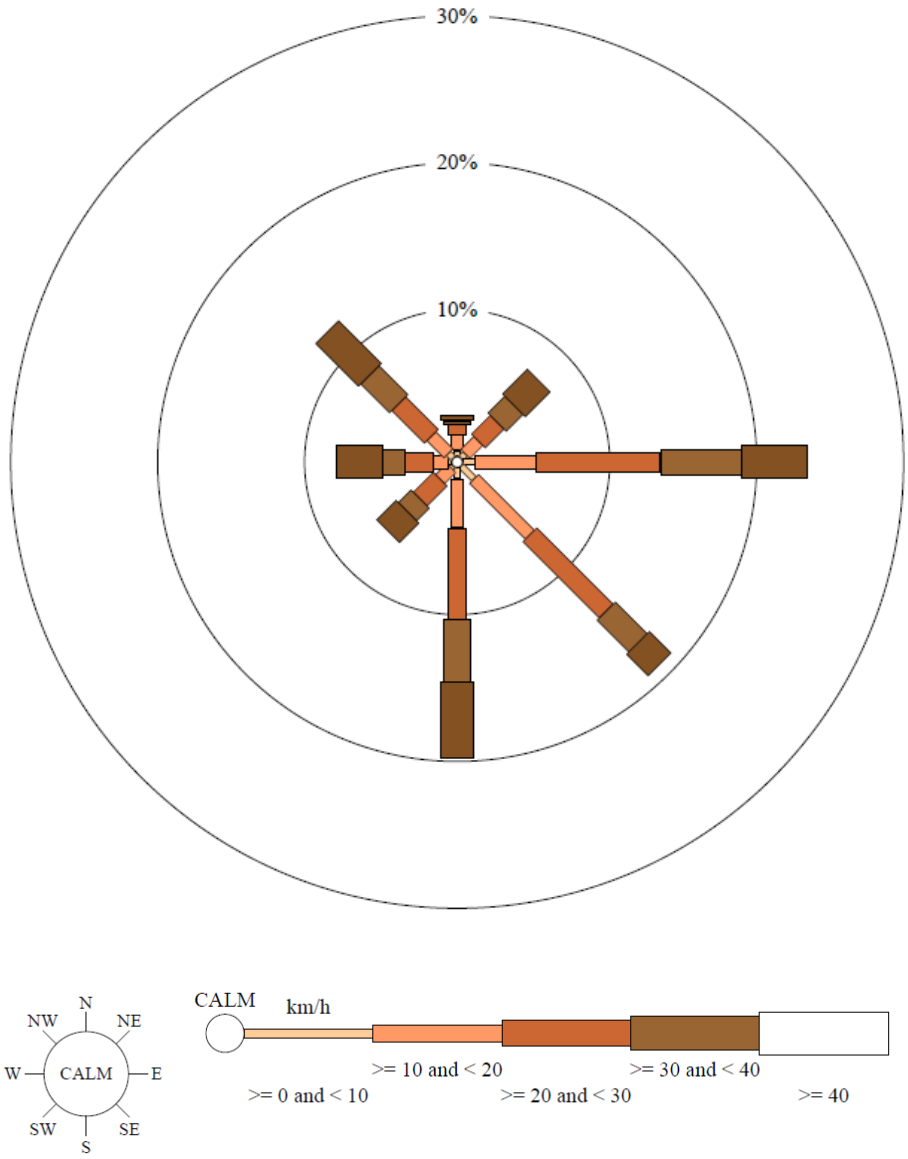

Figure 7-13 3:00 pm annual wind rose data for Newcastle Nobbys Signal Station weather station (BoM, 2019)

7.15.3 Potential impacts

7.15.3.1 Construction

Dust generation

Construction of the Project may have short-term localised impacts on air quality, primarily due to dust generation. Dust (total suspended particulates, including PM_{10}) would be the primary emission to air generated during the construction of the Project. The individual processes that generate dust are:

- Mechanical disturbance – dust emissions brought about by the operation of construction and maintenance vehicles and equipment
- Wind erosion – dust emissions from exposed, disturbed soil surfaces under high wind speeds during construction

The potential for exposure to dust emissions is dependent on the intensity of construction work (i.e. the amount of dust generated and material transfer volumes occurring), soil moisture content, soil particle size, duration and frequency of the activities in any given locality and the relative location of nearby sensitive receivers. The transport and dispersion of air emissions during the construction work would be influenced by the direction and strength of prevailing winds and the soil type. As discussed in Section 7.1.2 the soil landscapes within the Project area have the potential for wind erosion. However, the soils are sandy and due to the large particle size would only travel short distances and be localised. Sensitive receivers downwind of construction activities have the highest potential for short-term air quality impacts. Dust emission sources to consider are:

- Material handling during earthworks
- Loading and dumping of material
- Levelling, grading, compacting of and driving over disturbed soil surfaces
- Wind erosion of exposed unstable soil surfaces and localised stockpiles

The closest sensitive receivers would be residents located adjacent to the power connection works. Construction works would potentially result in dust generation from vehicle movement and ground disturbing works. However, as these works would be completed in two weeks or less, potential impacts are considered minor and managed in accordance with the measures outlined in Section 7.15.4.

Construction activities would occur for a longer period at the desalination plant site; however, this area is located further from sensitive receivers and dust emissions during construction would be localised and would be managed through the application of mitigation measures. From the desalination plant site, the key receivers would be Belmont Lagoon and users of Nine Mile Beach based on the predominant wind directions. Dust management measures have been outlined in Section 7.15.4 to assist in minimising off-site impacts during the construction phase of the Project. This would include installation of weave barrier fence as a wind break, progressive stabilisation and revegetation of the Project area, limiting potential dust emissions during the construction program.

Gaseous emissions

Vehicle exhaust emissions and generators used during the construction phase have the potential to impact air quality. However, the impact is not likely to be significant given the limited amount of equipment, distance to receivers at the Project area, and the limited timeframe of construction.

All construction and administrative vehicles are expected to be maintained in a serviceable condition such that exhaust emissions are reduced to manufacturer specified levels.

Odour

During construction, there is the potential for minor odour impacts from activities including:

- Putrescible waste not being removed in a timely manner
- Exhaust fumes from vehicles and equipment that have not been maintained and serviced appropriately
- Inappropriately managed sewage waste and unclean toilets
- Oxidising ASS may cause odour, although this is unlikely and would only impact areas within close proximity to the oxidisation

If managed appropriately, the impact from odour is anticipated to be negligible.

7.15.3.2 Operation

Gaseous and dust emissions

There would be no point source emissions during operation of the Project, with the exception of a small generator provided in the desalination plant to enable controlled shut down of the facility in the event of unexpected power failure. As the generator would only be used rarely if at all, emissions would be negligible.

During operation, there would be routine chemical and supply deliveries and periodic maintenance at the desalination plant that would have the potential to generate gaseous emissions and dust from vehicles and equipment. It is anticipated that dust generation and emissions would be minimal due to the limited number of vehicle movements and the use of existing sealed roads to access the site.

Appropriate stabilisation and revegetation of the Project area upon completion of construction would limit potential dust emissions from disturbed soils post-construction (refer to Section 7.1.4 and 7.3).

Odour

Odour is not expected to be generated during operation.

7.15.4 Mitigation measures

Mitigation measures provided in Table 7-54 will be implemented to minimise the impact on air quality.

Table 7-54 Proposed mitigation measures – air quality

Impact	Mitigation measure	Timing
Generation of dust	Include a procedure for effective dust control in the CEMP, including: • Limit earthmoving activities during periods of high winds • Implement dust suppression using water carts or binder sprays if required • Specify height and cover of stockpiles • Minimise vehicle movements and limit maximum speed on site to 40 km/h • Cover loads during transport • Assign haulage routes and minimise vehicle and equipment movements outside of sealed roads/areas	Pre-construction
	Limit the areas of clearing and ground disturbance to the minimum required.	Construction
	Investigate any dust complaints and implement correction as soon as possible. Define the complaint procedure within the CEMP.	Construction
	Stabilise and revegetate disturbed areas progressively where disturbed areas will be left for longer than 21 days. Revegetate in accordance with the mitigation measures provided in Table 7-2.	Construction
	Maintain dust suppression controls including weave barrier fence as wind breaks on up wind of disturbed areas until rehabilitation is completed with appropriate vegetation coverage.	Construction
Exhaust emissions	Turn off plant and machinery when not in use and fit with emission control devices complying with Australian Design Standards	Construction

Impact	Mitigation measure	Timing
	Maintain construction plant and equipment in good working condition in accordance with manufacturer requirements. Stand down any equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) until repaired	Construction
Combustion emissions	Prohibit burning of any materials on-site	Construction
Impact on sensitive receivers	Advise local residents of hours of operation and duration of work and provide a contact name and number for queries regarding air quality	Pre-construction
Odour	Maintain a clean and tidy site with waste removed frequently, particularly sewage and putrescible waste	Construction

7.16 Greenhouse gas

This section describes the existing environment in relation to greenhouse gases. It addresses the impacts on emissions associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

7.16.1 Relevant policy and guidelines

Human activities, including greenhouse gas emissions, are presently driving climate change through global warming. In response to anthropogenic climate change, a number of international, national, state and local policies and guidelines have been prepared. The primary purpose of these documents is to cap or reduce greenhouse gas emissions. Detail about the policies and guidelines relevant to the Project, including their proposed emission reduction targets, are outlined below.

7.16.1.1 International & National

Paris Agreement

The Paris Agreement was agreed under the United Nations Framework Convention on Climate Change (UNFCCC) at the 21st Conference of the Parties in Paris (30 November to 12 December 2015). The Paris Agreement is a non-binding agreement that sets in place a durable and dynamic framework for all countries to take climate action from 2020, building on existing international efforts in the period up to 2020.

As a Party to the Paris Agreement, Australia has set a target to reduce emissions by 26-28 per cent below 2005 levels by 2030.

National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (Cth) was introduced to provide a single national reporting framework for information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production of corporations. Under the *National Greenhouse and Energy Reporting Act* there are two types of thresholds:

- Facilities that emit over 25,000 tonnes of carbon dioxide equivalent (tCO_2-e) or, produce or consume at least 100 terajoules of energy per year
- Corporations that emit over 50,000 tCO_2-e per year or, produce or consume more than 200 terajoules of energy

7.16.1.2 State & Local

NSW Climate Change Policy Framework

The *NSW Climate Change Policy Framework* (OEH, 2016) aims to maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change. The Framework includes an aspirational objective to achieve net-zero emissions by 2050.

Lake Macquarie Greenhouse Gas Emissions Reduction Targets

The *Lake Macquarie Greenhouse Gas Emissions Reductions Targets* (LMCC, 2016b) aims to achieve rigorous emission targets for greenhouse gases at a Citywide and Council-operations level. This Policy statement is:

- That Council adopts rigorous greenhouse gas emission reduction targets of a 3 per cent per annum reduction in greenhouse gases from the City's emissions (measured on a per capita basis); and a 3 per cent per annum reduction in greenhouse gas emissions for Council operations (based on 2008 baseline data).
- That Council undertakes annual monitoring of the 3 per cent target and receives an annual report on the target and strategies employed to keep the reduction process proceeding.
- That Council support the Mayor of Lake Macquarie becoming a signatory to the NSW Mayor's Agreement on Climate Change as a gesture of its support for climate change mitigation and adaptation programs.

Hunter Water Greenhouse and Energy Management Policy

Hunter Water has developed an approach to managing energy and abatement of greenhouse gas emissions for all its activities and operations. Hunter Water aims to reduce its carbon emissions to help meet the NSW Government target of net-zero emissions by 2050.

7.16.2 Existing environment

7.16.2.1 National emissions

The Commonwealth Department of the Environment and Energy publishes Australia's *National Greenhouse Accounts*, which track national emissions from 1990 onwards.

The latest Quarterly Update of Australia's *National Greenhouse Gas Inventory: December 2018* (the Quarterly Update) provides estimates of Australia's national inventory of greenhouse gas emissions, shown in Table 7-55. Total annual emissions are 538.2 Mt CO_2-e.

National emission levels for the December quarter 2018 increased by 0.8 per cent relative to the previous quarter, on a seasonally adjusted and weather normalised basis, primarily due to increased emissions from LNG for export, diesel consumption across transport, and metal manufacturing. In trend terms, emissions have also increased by 0.2 per cent.

Australia's emissions for the year to December 2018 have declined 14.2 per cent since the peak in the year to June 2007 and were 0.4 per cent above emissions in 2000 and 11.9 per cent below emissions in 2005.

Emissions per capita, and the emissions intensity of the economy, were at their lowest levels in 29 years. Emissions per capita in the year to December 2018 have fallen 38.2 per cent since 1990, while the emissions intensity of the economy has fallen 61.4 per cent.

Table 7-55 National and state emissions

Emissions Source	2018 Australian Emissions (Mt CO_2-e) [1]	2017 NSW Emissions (Mt CO_2-e) [2]
Energy – Electricity	178.9	51.1
Energy – Stationary Energy excluding electricity	102.8	15.1
Energy – Transport	101.7	28.0
Energy – Fugitive Emissions	58.1	14.0
Industrial processes and product use	34.7	13.4
Agriculture	69.4	19.4
Waste	12.1	3.1
Land Use, Land Use Change and Forestry	-19.5	-12.7
Overall Total	538.2	131.5

Source:

1) Table 3, Department of the Environment and Energy "Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2018" June 2019
2) Table 4, Department of the Environment and Energy "State and Territory Greenhouse Gas Inventories 2017" June 2018

7.16.2.2 State emissions

The most recently published state-based emissions inventory is for 2017. NSW greenhouse gas emissions, by sector, for the 2017 year are also presented in Table 7-55 above. Total annual emissions were 131.5 Mt CO_2-e. NSW emissions represent 24 per cent of Australia's total emissions while NSW is home to around one third of Australia's population, and over 30 per cent of national gross domestic product.

7.16.2.3 Local emissions

Lake Macquarie City Council (LMCC) annually reports on Council's progress towards implementing the *Lake Macquarie City Environmental Sustainability Action Plan 2014-2023* through the *State of the Environment Report 2017-2018* (LMCC, 2018).

To enable source data collection, the annual reporting of the City carbon footprint and Council carbon footprint is one year in arrears. City-wide energy usage for 2016-2017 increased by 0.6 per cent, with a 1.6 per cent increase in total residential electricity use and a 1.1 per cent decrease in total non-residential (low voltage) electricity usage. Solar generation exported to the grid increased by 6.2 per cent.

7.16.3 Potential emissions

The following greenhouse gas emissions from the Project have been considered:

- Scope 1 emissions from direct energy use during construction and operation
- Scope 2 emissions from indirect energy use from imports and exports of electricity, heat or steam

The following emission sources were included in the assessment boundary:

7.16.3.1 Construction

During construction of the Project, fuel would be required for the machinery and equipment required to undertake:

- Site establishment including installing sediment and erosion controls, establishing construction compounds such as laydown, storage and spoil areas, and undertaking vegetation clearing
- Civil works including the earthworks and construction of hardstand at the desalination plant as well as stabilisation and revegetation
- Intake works including installation of the intake structure and the horizontal seawater intake pipes
- Transportation of materials and personnel to and from the Project area
- Operation of generators on site

7.16.3.2 Operation

Operation of the Project would require electricity to run the desalination plant. It is estimated that approximately 35, 500 kWh would be used per year.

7.16.3.3 Exclusions

The assessment only considered greenhouse gas (GHG) emissions sources within the boundary of the Project, and excluded upstream and downstream emissions. Exclusions from this assessment include:

- Emissions which are likely to be negligible compared with other emissions from the Project, including:
  - Emissions associated with combustion of fuels used in minor quantities such as LPG, acetylene, solvents, oils and greases.
  - Emissions associated with the leakage of hydrofluorocarbons. The Project may use negligible quantities of hydrofluorocarbons for air conditioning in site sheds.
  - Emissions associated with generator usage during operations. The generator would be small and would only be used rarely, if at all, to allow controlled shutdown of the facility in the event of a power failure.
- Emissions from sulphur hexafluoride or perfluorocarbons – these substances are not used or stored as part of the Project.
- Emissions from wastewater treatment and disposal during operation. The wastewater would consist of concentrated brine and would not generate greenhouse gases.
- Scope 3 emissions such as those associated with embodied energy of construction materials.
- Scope 3 emissions from construction waste transport and disposal/ recycling.

7.16.3.4 Assumptions

Assumptions used in estimating GHG emissions for the construction and operation of the Project are listed in Table 7-56. The assessment was based on emission factors available at the time of the assessment and future changes in emission factors were not considered.

Activity data used for the GHG assessment was provided by Hunter Water Corporation or other studies conducted as part of this EIS. All Emission Factors (EF) used were as per the NGER (Measurement) Determination.

Table 7-56 Greenhouse gas assessment assumptions by source

Parameter	Assumptions
Construction	
Construction timing and duration	Estimated construction duration is 8-9 months of which 6 months would be the intake installation phase and the last 3 months would be building the water treatment process plant, with two weeks of power upgrades. Construction timeframe: • Monday to Friday: 7.00 am to 6.00 pm • Saturday: 8.00 am to 1.00 pm • No work on Sundays or Public Holidays
Diesel - Construction stationary energy	Assumptions were made of the construction equipment energy consumption, based on the size of the equipment being used, where known, e.g.: crane - 30 tonnes; excavator - 15 tonnes. The rest of the machinery (drilling rig, grader, compressor, vibratory roller, and generator) was assumed to be the smallest available. Estimated diesel usage information was as per the manufacturer's data sheets (e.g.: Caterpillar performance handbook). It was estimated that 314 kL of diesel fuel would be used during construction.
Diesel - construction transport (materials)	Estimated that 66 kL of diesel fuel would be used during transportation of materials. Assumptions for the intake installation: 522 truck movements for removal of excess spoil likely to be six wheeled trucks; 136 truck movements for concrete pouring trucks; 10 truck movements for delivery of the horizontal intake pipes in large semitrailer. For the construction of the desalination plant, 25 truck movements for delivery of the treatment plant components likely to be large semi-trailer. For the last week of power connection construction, 5 truck movements for power upgrades which assumed to be six wheeled trucks. The distance of travel: was assumed to be maximum 50 km trip.
Diesel - commuting	10 kL of fuel was estimated to be used for commuting during construction. Light vehicles would be used for commuting. For the Intake Installation phase it would be a 10 person workforce over 6 months. For the Treatment plant: 10 person workforce over 3 months. For the power connection installation, 5 person workforce over 1 week. The distance of travel: was assumed to be maximum 44 km round trip from Newcastle.
Grid electricity use - construction	Estimated that no grid electricity would be used for construction of the plant and equipment. The equipment, lighting during construction, and site sheds will be powered directly by diesel or from diesel electricity generators.
Vegetation Removal	The total project area is 7.62 ha. It is estimated that there is a total of 3.24 ha of bitou bush scrub and 3.02 ha of exotic grassland being removed. The remaining 1.4 ha was existing cleared land and not included in the estimated vegetation removal.

Parameter	Assumptions
Operations	
Project operation	Operating hours will be 24 hours a day.
Grid electricity use - operations	The electricity usage would be around 34,500 MWh per year (without energy recovery), with 43% of the operational electricity used in the Reverse Osmosis Plant[17]. Operations are assumed to be occurring at a maximum of 24 hours a day for the lifespan of the Project. The demand includes electricity required for inlet works, pre-treatment, RO plant and potable water delivery.
Diesel - operations	Assumed negligible diesel will be needed during the operations for the emergency generator.

7.16.4 Impact assessment

7.16.4.1 Construction stage

A summary of estimated scope 1 GHG emissions occurring as a result of construction activities for the Project is presented in Table 7-57. This represents emissions across the entire construction period. There are no Scope 2 emissions anticipated.

Table 7-57 Construction emissions

Activity	Scope 1 Emissions (t CO_2-e)
Diesel combustion (stationary)	851
Diesel – construction transport (materials)	181
Diesel - Commuting	28
Vegetation Removal	716
Total	1,776

The quantity of emissions to occur during construction are estimated as approximately 1,776 tCO_2-e during the entire construction period. Construction emissions are estimated as approximately 6% of annual operational emissions. Construction emissions would be of limited duration.

7.16.4.2 Operational stage

A summary of estimated annual greenhouse gas emissions from operation of the Project is given in Table 7-58 below.

Table 7-58 Annual operational emissions

Activity	Scope 2 Emissions (t CO_2-e)	Percentage of emissions
Electricity use – inlet works, pre-treatment, potable water delivery	15,910	57%
Electricity use – RO plant	11,997	43%
Total	**27,907**	

The quantity of emissions estimated to occur during operations at full capacity are estimated as approximately 27,907 tCO_2-e per annum. This is a conservative estimate as the plant is likely to incorporate energy recovery and would therefore have lower annual emissions.

Total emissions associated with the Project operations, when operating at full capacity, are above the threshold for facility level reporting under the NGER Act of 25,000 tCO_2-e so would require annual reporting under the NGER scheme.

[17] Table 2, Design Development Report

The operation of the temporary desalination plant is by far the largest source of emissions described in this inventory; however, it is still minor in the context of Australia's greenhouse gas emissions as a whole. Annual emissions from the project would account for approximately 0.005 per cent of Australia's annual emissions and approximately 0.02 per cent of NSW's annual emissions, which is insignificant.

The overall average annual emissions for the 15 ML/day desalination plant is 5.10 tCO_2-e/ML. The energy usage is 6.3 MWh/ ML.

7.16.5 Mitigation measures

Mitigation measures provided in Table 7-59 will be implemented to minimise potential impacts on energy and greenhouse gases.

Table 7-59 Proposed mitigation measures – greenhouse gas

Impact	Mitigation measure	Timing
Electricity use	Investigate energy recovery during detailed design.	Detailed design
	Turn power tools and electrical equipment off when not in use.	Construction
	The operations of the desalination plant will follow the guidelines stated in the Hunter Water Greenhouse Gas and Energy Management Policy. The following measures will be undertaken to minimise/reduce greenhouse gas emissions and energy use during operations: • Incorporate specific energy management targets and KPIs • Review and audit energy management systems and their performance	Operations
Fuel consumption	Develop options during the detailed design for optimising construction and transport activities and minimising fuel usage (e.g. reduce the number of vehicle trips required). Mitigation of greenhouse gas emissions will follow a hierarchical approach: • Avoid emissions source • Reduce consumption • Improve energy efficiency • Replace with low emissions alternative • Offset	Pre-construction
	Develop a fuel management strategy that incorporates project planning, logistics, operator education and maintenance.	
	Investigate use of biodiesel for vehicles, equipment and machinery used during the Project.	
	Adopt sustainable procurement practices where feasible.	
	Maintain construction plant and equipment in good working condition in accordance with manufacturer requirements. Stand down any equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) until repaired.	Construction

Impact	Mitigation measure	Timing
	Turn off plant and machinery when not in use and fit with emission control devices complying with Australian Design Standards.	
	Reduce fuel consumption through the use of efficient plant and vehicles. Modern vehicles, equipment and machinery only will be used. These are more fuel efficient and have better emission controls than older models.	

7.17 Human health

This section describes any change to the risk to human health as a result of the Project. It looks at the potential of adverse health effects in humans who may be exposed to chemicals, pollutants or other harmful substances in the environment as a result of the Project. It addresses the impacts associated with the Project during construction and operation, and details the management and mitigation measures proposed to mitigate these impacts.

7.17.1 Existing environment

7.17.1.1 Beach recreation

OEH monitors and reports water quality at recreational swimming sites along the NSW coast (OEH, 2018c). Samples are collected and tested for bacteria (enterococci) to provide guidance on whether conditions are safe for swimming (safe swimming conditions are indicated by enterococci levels of less than 40 cfu/100mL in accordance with the *Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008). Monitoring data is used to assign Beach Suitability Grades (very good, good, fair, poor, very poor) to each site to indicate the suitability for recreational use over time.

Blacksmiths Beach is the nearest monitoring site to the Belmont WWTW and therefore the most likely monitoring site to be influenced by discharges from the WWTW outfall. Monitoring data from September 2016 to April 2018 indicate that water quality at Blacksmiths Beach has been generally safe for swimming, with enterococci concentrations exceeding 40 cfu/100mL on only two occasions following heavy rainfall (OEH, 2018c). Blacksmiths Beach has been assigned a beach suitability grade of Very Good, indicating that water quality is considered suitable for swimming almost all of the time.

7.17.1.2 Potable water supply

Hunter Water supplies water to the Lower Hunter under regulation by NSW Health. Potable water is managed in accordance with the Australian Drinking Water Guidelines (NHMRC, 2011), which include water quality management requirements to protect public health. Water is treated and tested throughout the water supply system to ensure compliance with drinking water quality criteria.

7.17.1.3 Contamination

Human health risk assessment is a scientific process whereby chemical-specific toxicological data from animals or humans is combined with estimates of potential exposure, to enable predictions of whether the chemical in question poses an unacceptable risk to human health. Risk is the probability (or likelihood) that an adverse health effect would occur following exposure to a particular chemical at a particular dose.

The contamination assessment undertaken for the Project (Appendix H) found no concentrations of contaminants in soils that exceeded human health criteria (refer to Section 7.1).

7.17.1.4 Raw feed water quality

Based on sampling results from GW101 – GW108, raw feed water quality is near neutral (pH 7 – 8), saline at depth (approximately 50,000 - 60,000 µS/cm) and of Na-Cl type. Dissolved oxygen levels are less than 6.5 mg/L and the redox state is generally oxidative. Metal, organic and pathogen concentrations are low at depth but vary in concentration in the upper part of the aquifer.

Raw feed water contained low levels of ammonia (<1 mg/L), nitrate (<2 mg/L), phosphorus (<2 mg/L) and dissolved organic carbon (DOC), ranging below limit of reporting (LOR) to 4 mg/L.

Faecal coliform and *Escherichia coli* (*E. coli*) bacteria counts generally approximated 1 CFU/100 ml with occasional exceptions. Total coliform counts ranged below detection to 250,000 CFU/100 ml, being highest in the first groundwater monitoring event. *Enterococci* bacteria counts were generally low in all wells with the exception of GW104 with populations consistently above LOR ranging 10 to 9,000 CFU/100 ml.

7.17.2 Potential impacts

7.17.2.1 Construction

Contamination

The results of the contamination assessment indicate that soils within the Project area are unlikely to present a significant health risk to workers during construction (refer to Section 7.1). Therefore, it is considered there is negligible human health risks to off-site sensitive receivers and on-site workers from inhalation and dust deposition.

Potential exists for undetected contaminated soils, wastes or hazardous building materials to be encountered during construction.

Air Quality

The potential for exposure to dust emissions during construction of the desalination plant due to the wind erosion risk of the soils. As the soils are sandy in nature and have a large particle size they are predicted to only travel short distances and have a very localised impact. As such the risk to human health as a result of dust generation is unlikely to change as a result of construction activities.

7.17.2.2 Operation

Chemical storage

A number of chemicals would be stored onsite as identified in Section 7.8. All chemical storage and delivery areas would be within bunded areas with a capacity of 110 per cent of chemical storage volume. Additionally, chemicals would be stored in accordance with the ADG code and Australian Standards, hence the risk to human health as a result of storage or chemical spills is considered low.

Beach recreation

The impact of discharging brine through the Belmont WWTW outfall (Project outfall area) was assessed by three-dimensional (3D) hydrodynamic modelling (GHD, 2019a) (Appendix L). The model compared the existing conditions of WWTW effluent discharge with the proposed normal full operation of the desalination plant, which would comingle 28.2 ML/day of brine with the WWTW effluent. The model was used to predict and compare the mixing zones of the existing WWTW discharge and the proposed comingled effluent and brine discharge.

Water quality objectives (WQOs) for human health impacts were defined as enterococci values <35 MPN/100 ml in accordance with the recreational primary contact (i.e. swimming) guideline values (RPCGV) of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).

The spatial area to meet the human health WQO for primary contact is predicted to be similar between the existing and proposed cases. Exceedances of the human health WQO are greater than ~1 km from the nearest beach, and thereby do not pose a material risk to swimmers for either the baseline or proposed scenarios. Therefore, the risk to human health is unchanged.

Potable water supply

Following desalination, RO permeate would be treated with lime and carbon dioxide, followed by chlorine and fluoride. The treated potable water would be tested to meet the quality requirements of the *Australian Drinking Water Guidelines* (NHMRC, 2011) and in ongoing consultation with NSW Health prior to provision to the local community as potable water. As such, supplementing the existing potable water supply with water produced by the desalination plant would not change the risk to human health.

7.17.3 Mitigation measures

Mitigation measures provided in Table 7-60 will be implemented to minimise potential impacts on human health.

Table 7-60 Proposed mitigation measures – human health

Impact	Mitigation measure	Timing
Encounter contamination during construction.	Should unexpected contaminated soils be identified during any ground works, seek advice from a suitably qualified environmental consultant and notify the Hunter Water Project Manager. Complete any additional investigations/ abatement in general accordance with guidelines developed or endorsed by NSW EPA. Include contingency plans for unexpected finds protocols for contaminated soils in the CSMP.	Construction
Exposure to chemicals during operation of the desalination plant	Locate chemical storage and delivery areas within bunded areas with a capacity of 110 per cent of chemical storage volume. Store chemicals in accordance with Australian Standards and maintain in accordance to equipment supplier recommendations. Implement safe work procedures for the handling of all chemicals including transfer, storage, spill prevention and clean up requirements. Develop an emergency response plan that includes dangerous goods spill scenarios.	Operation
Human health impacts at recreational swimming sites	Monitor enterococci levels in the discharge stream and nearby recreational swimming sites once the plant is operational to confirm the predicted low human health risk.	Operation
Potable water quality.	Manage potable water quality in accordance with the requirements of the Australian Drinking Water Guidelines (NHMRC, 2011) and NSW Health.	Operation

7.18 Cumulative impacts

The SEARs require consideration of cumulative impacts in the EIS. This section discusses how potential cumulative impacts have been considered in the EIS and the management and mitigation measures to address potential cumulative impacts.

7.18.1 Potential impacts

Cumulative impacts are those that may not be considered significant on their own but that may be more significant when considered in association with other impacts. Cumulative impacts may occur as the result of the interaction of impacts within a single project or due to the combined effects of a number of projects occurring simultaneously in a given area.

The consideration of the Project's cumulative impacts has included a review of existing developments that the Project may affect. The LMCC and DPIE websites (http://apptracking.lakemac.com.au/modules/ApplicationMaster/default.aspx and https://www.planningportal.nsw.gov.au/major-projects respectively) were searched (August 2019) to identify if any applications were under consideration, or have recently been approved nearby the Project, which would potentially have a significant impact. A review of applications within the Lake Macquarie LGA on these websites indicates there are no development applications proposed in the vicinity of the Project. Hunter Water is not aware of any significant construction or development activities currently proposed in the vicinity of the Project area during the period the Project is likely to be constructed and operated. It is therefore considered unlikely that there would be significant cumulative impacts as a result of the Project.

As discussed in Section 1.1, Hunter Water is seeking a 10 year approval term for this EIS, during which time further Project stages (including detailed design) would be instigated based on the key trigger levels for implementing the Project are outlined in Section 2.1. This results in some level of uncertainty as to when construction and operation of the Project is likely to occur; therefore, making assessment of cumulative impacts with other projects occurring concurrently a difficult exercise. Therefore, cumulative impacts would be considered as part of consistency reviews for the Project against the EIS, approval conditions and latest available project information at the LMCC and DPIE websites.

The Project would only operate temporarily in the event of extreme drought until storage levels recover to a trigger level (currently set at 35 per cent). The Project would pass a brine waste stream from the desalination process to the existing Belmont WWTW HCS. There are not anticipated to be any significant cumulative impacts from the Project operating in conjunction with Belmont WWTW. Additionally, the desalination plant can be turned off during extreme wet weather events if there is a risk of exceeding the outfall capacity. It is therefore considered that cumulative impacts to surface water quality as a result of increased effluent overflows is unlikely.

7.18.2 Mitigation measures

Mitigation measures provided in Table 7-61 will be implemented to minimise potential impacts on human health.

Table 7-61 Proposed mitigation measures – cumulative

Impact	Mitigation measure	Timing
Cumulative impacts	Cumulative impacts will be considered as part of consistency reviews at major design milestones for the Project against the EIS, approval conditions and latest available project information at the LMCC and DPIE websites	Construction

8 Environmental management

8.1 Environmental management

A number of safeguards and management measures have been identified in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the Project. If the Project proceeds, these management measures would be incorporated into the detailed design and applied during the construction and operation of the Project to minimise any potential adverse impacts arising from the proposed works on the surrounding environment.

A Construction Environmental Management Plan would be prepared to describe safeguards and management measures identified. This plan will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

8.2 Summary of mitigation measures

A consolidated list of all environmental management and monitoring measures outlined in this EIS is presented in Table 8-1.

Table 8-1 Summary of mitigation measures

Impact	Measure	Timing
Soils, Geology and Contamination		
Consultation with Subsidence Advisory NSW	Further consultation with Subsidence Advisory NSW, including review of the subsidence risk and any relevant design considerations, will be undertaken during detailed design.	Detailed design
Mobilisation and spread of contamination in soils	Include contamination mitigation measures in an overall Contaminated Soil Management Plan (CSMP) for the construction to describe excavation, validation and disposal requirements for potentially contaminated soils. The CSMP must be prepared by appropriately qualified specialists and form a sub plan to the CEMP and will include the following as a minimum: • Method of identification, separation, management and tracking of contaminated soils • Stockpile any contaminated soil as far away from waterways/drainage lines as possible • Keep contaminated and non-contaminated soils separate at all times • Testing of soils to assess suitability if they are to be placed near sensitive receptors	Pre-construction
Exposure to Asbestos Containing Materials	Include an asbestos finds procedure in the overall CSMP. The asbestos finds procedure will be prepared by suitably qualified person or a competent person as determined under the Work Health and Safety Regulation (2017), and include: • Guidance on the identification of asbestos containing materials (ACM) • Steps to be undertaken if ACM is identified during works • Management and remediation/removal procedures • Required health and safety controls • Waste disposal requirements • Ongoing site management	Pre-construction
UXO procedures	Management and safe guarding procedures for UXO waste to be included in construction safety documentation.	Pre-construction
Acid sulphate soils	Conduct ASS testing within the Project area to confirm presence of ASS. If the ASSMAC Assessment Guidelines action criteria are triggered an Acid Sulphate Soil Management Plan (ASSMP) will be prepared as part of the CEMP in accordance with the Acid Sulphate Soil Laboratory Methods and Manual (ASSMAC, 1998). Include the following as a minimum: • Method for spoil material testing to confirm presence of ASS during construction and prior to excavation in an area • Conduct laboratory testing to calculate and verify treatment of ASS spoil material if it is to be treated on-site • Locate ASS treatment area within the Project area, which is already disturbed and is outside of flood liable land • Measures to manage any stockpiles of ASS materials, including bunding and cover to minimise leachate • Supervision and certification of treatment prior to removal from treatment areas for re-use	Pre-construction
Exposure of soil to erosion	Prepare an Erosion and Sediment Control Plan (ESCP) as part of a SWMP in accordance with *Blue Book - Managing Urban Stormwater: Soils and Construction* (4th ed, Landcom, March 2004), which must include the following: • Establish all erosion and sediment control measures before ground disturbance work commences and these are to remain in place until all surfaces have been fully restored and/or stabilised • Outline the process for stabilisation and progressive revegetation of all disturbed area which will include species consistent with the dune restoration project to be undertaken within the greater Belmont WWTW site • Maintenance and inspection program and checklist including: – Conditions that would trigger watering of exposed and revegetated areas	Pre-construction

Impact	Measure	Timing
	– Requirements for maintenance of revegetated areas – Maintenance of erosion and sediment controls including clean out before 30% capacity remaining • Limiting traffic movements on disturbed areas • Exposed areas that is susceptible to wind generated dust particles, shall be progressively vegetated or watered. Where vegetation is not yet possible, dust suppression by watering shall be provided • Install a 40% porous, open weave barrier fence as a wind-break on the eastern side of the Project area in accordance with Standard Drawing SD6-15 (Blue Book) • Provide a clean water diversion around disturbed areas • Procedures for how any sediment laden water will be treated prior to leaving the Project area The ESCP must be prepared by appropriately qualified specialists (e.g. *completed an International Erosion Control Association (IECA) endorsed course, or passed the examination for Certified Professional in Erosion and Sediment Control* (CPESC)) as a coordinated sub plan to the SWMP.	
Spoil Management	Include the management of material movements in the Soil and Water Management Plan, as follows: • Identification of materials during excavations including contaminated, ASS, ENM/VENM • Stockpiling and tracking of all materials throughout construction • Validation and certification of material stockpiles prior to re-use • Tracking of materials incoming and outgoing from site (e.g. as waste, quality of imported material) • Method of soil testing including number of samples and how samples will be taken to confirm any soil amelioration requirements. Testing to include as a minimum fertility, sodicity and aluminium toxicity • Waste classification of soils that require offsite disposal using the six-step process and criteria detailed in Waste Classification Guidelines – Part 1: Classification of Waste (NSW EPA 2014)	Pre-construction
Accidental contamination from leaks or spills of fuels / chemicals etc.	Prepare an incident emergency spill plan as part of the CEMP to be implemented during construction. Include procedures for the storage and handling of hazardous materials including fuel and chemicals within the CEMP, including: • No refuelling to occur on-site unless an appropriate bunded area is available • Storage of hazardous materials on-site to be kept to a minimum and will be in accordance with national guidelines and the Safety Data Sheets relating to bunding, coverage, storage of incompatible materials, etc. • Construct the bunded hazardous materials storage area within the desalination plant as early as possible within the construction schedule so that this area could be used for storage of any hazardous materials required during construction	Pre-construction
Exposure to Asbestos Containing Materials	• Locate chemical storage and delivery areas within bunded areas with a capacity of 110 percent of chemical storage volume • Store chemicals in accordance with Australian Standards and maintain in accordance to equipment supplier recommendations • Implement safe work procedures for the handling of all chemicals including transfer, storage, spill prevention and clean up requirements • Develop an emergency response plan that includes dangerous goods spill scenarios	Operation
Unexpected discovery of contaminated soils	• Should unexpected contaminated soils be identified during any ground works, seek advice from a suitably qualified environmental consultant and notify the Hunter Water Project Manager. Complete any additional investigations/abatement in general accordance with guidelines developed or endorsed by NSW EPA. Include contingency plans for unexpected finds protocols for contaminated soils in the CSMP.	Construction
Water Resources		

Impact	Measure	Timing
Sedimentation of waterways during construction	Vehicle wash down and/or cement truck washout will occur in a designated bunded area or offsite.	Construction
	Include provision in the ESCP for visual inspections of nearby waterways and drainage lines following rainfall events and corrective actions in the event of impacts.	Construction
	Revegetation will be undertaken in all areas subject to ground disturbance, in accordance with the requirements listed in Table 7-2. Sediment and erosion controls (including dust) will be maintained until vegetation cover is established.	Construction
Flooding	The soil and water management plan will include procedures to ensure that machinery, stockpiles, equipment, fuels and chemicals, and other facilities are not stored or left within areas subject to flooding.	Pre-construction
	An emergency response plan will be prepared to include a procedure for managing flooding due to natural events. This will include an emergency procedure for ensuring the health and safety of construction workers.	Pre-construction
Increased WWTW overflows	Manage operation of the desalination plant, including shutting down in extreme wet weather if necessary.	Operation
Groundwater monitoring program	A comprehensive groundwater monitoring program will be developed. Existing monitoring wells GW101 – GW108 will be considered for inclusion in the program and additional monitoring sites will be identified (if necessary). The groundwater monitoring program will include continuous monitoring of groundwater levels and routine groundwater quality monitoring.	Construction, Operation
Groundwater drawdown	Develop an ongoing groundwater monitoring program, including groundwater level triggers and an appropriate trigger, action, response plan. Update the groundwater model to revise drawdown predictions if necessary. Groundwater drawdown may be reduced if necessary by modifying the intake pumping schedule (i.e. allow periodic recovery by shutting off pumps) or by shutting off one or more horizontal arms.	Operation
Groundwater quality	Develop an ongoing groundwater monitoring program, including groundwater quality triggers and an appropriate trigger, action, response plan. Undertake additional Acid Sulphate Soil (ASS) sampling within the zone of groundwater drawdown during detailed design phase to confirm the risk of exposure of ASS due to drawdown. Reduce groundwater drawdown (if necessary) as outlined above.	Operation
Terrestrial and Freshwater Biodiversity		
General	Site induction: All workers will be provided with an environmental induction prior to starting working on-site. This will include information on the ecological values of the area surrounding the Project area, key weed threats and measures to be implemented to protect biodiversity, particularly focussing on erosion management, and potential weed and pathogen spread.	Pre-construction, Construction
Proximity of adjacent native vegetation	Limit disturbance of vegetation to the minimum necessary to undertake the works.	Pre-construction
	Prior to the commencement of any work adjoining areas of native vegetation, clearly delineate the construction area marking the limits of clearing to avoid unintended clearing of adjacent native vegetation. Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Pre-construction, Construction (daily inspections of exclusion zones during works in area)
	Install appropriate temporary fencing during the construction phase to exclude native ground fauna from adjacent native habitat entering construction areas (whether they are recorded during pre-construction survey or not). Fencing should remain in place until the completion of all construction activities including revegetation.	After completion of clearing activities/ construction works

Impact	Measure	Timing
	Stockpiles of fill or vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Pre-construction, Construction
Soil erosion, sedimentation and runoff Soil erosion, sedimentation and runoff	Erosion and sediment controls will be installed and maintained in accordance with the measures outlined in Section 7.1.4.	Pre-construction, Construction, Operation
	A protocol for accidental spills will be developed and implemented in accordance with the measures outlined in Section 7.1.4.	Pre-construction, Construction, Operation
Acid sulphate soils	Prepare and implement an ASSMP in accordance with the measures outlined in Section 7.1.4.	Pre-construction
Introduction and/or spread of weeds and pathogens	Develop a weed species management sub-plan as part of project CEMP to manage weeds and pathogens during the construction phase of the Project.	Pre-construction, Construction
	The location and extent of any priority and/or high threat environmental weeds within the site will be identified by a suitably qualified ecologist during pre-clearance surveys. The introduction and spread of weed species will be minimised by restricting access to areas of native vegetation and communicating the responsibilities of all Project personnel at site inductions and during regular toolbox meetings. All priority weeds identified on the Project area will be controlled and removed in accordance with the requirements of the *Biosecurity Act 2015* and Council's relevant Weed Control Manuals: Appropriate pesticides will be applied if required and a record of such application made in the pesticide application register. All noxious and environmental weeds will be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material. Disposal must be documented, and evidence of appropriate disposal must be kept.	Pre-construction, Construction
	All machinery entering the Project area must be appropriately inspected, and washed down and disinfected as required prior to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*) in accordance with the national best practice guidelines for Phytophthora (O'Gara et al, 2005) and the Myrtle Rust factsheet (DPI, 2015b) for hygiene control.	Pre-construction, Construction
	Incorporate control measures in the design of the Project to limit the spread of weed propagules off site. Sediment control devices, such as sediment fences, will assist in reducing the potential for spreading weeds.	Pre-construction, Construction
	All machinery entering the Project area must be appropriately inspected, and washed down and disinfected to prevent introduction or spread of Chytrid fungus as per the Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECC, 2008b).	Pre-construction, Construction
Wind erosion	Erosion and sediment controls will be implemented in accordance with Section 7.1.4 before commencement of ground disturbance work and will be retained until all surfaces have been fully restored and stabilised.	Pre-construction, Construction
Fauna encounters during vegetation clearing	The construction contractor is to contact the Project ecologist for advice if any unexpected fauna are found during the construction period (i.e. before, during or following clearing of native vegetation where the Project ecologist is not on site).	Construction
	A procedure to manage unexpected threatened species finds will be included in the CEMP and is to be implemented in the event of any unexpected threatened species finds during clearing.	Pre-construction, Construction
	A post-clearing report will be prepared documenting all animals that are handled, or otherwise managed, within the site. Data to be recorded includes:	Construction

Impact	Measure	Timing
	• Date and time of the sighting and details of the observer • Species • Number of individuals recorded • Adult/juvenile • Condition of the animal (living/dead/injured/sick) • Management action undertaken (e.g. captured, handled, taken to vet) • Results of any management actions (e.g. released, euthanised, placed with carer)	
Marine Biodiversity		
Seawater	Standard industry obligations such as spill prevention and management measures and the implementation of standard guidelines for the onshore storage and management of waste and hazardous materials.	Construction, Operation and Decommissioning
Benthic and sediment	Continuation of the Ocean Outfall Monitoring Program (EPL 1771) throughout operation of the project including benthic infauna and sediment quality testing.	Operation
Coastal Processes		
Erosion management	Implement a coordinated erosion monitoring and mitigation program in conjunction with the strategies implemented for the WWTW, including: • Site profiling and revegetation following completion of civil works in accordance with the final design which is to comply with the Lake Macquarie CZMP (Umwelt, 2015) and Department of Land and Water Conservation (2001). • Monitoring of recession and implementation of mitigation measures below as needed: - Beach management works such as beach scraping to reshape dunes and increase dune volume/recovery after storms if necessary. - Stabilisation of the frontal dune system by removing invasive species and replacing with locally indigenous dune vegetation. - Installation of sediment fences to minimise the movement of sands during construction. • Control off road vehicle access and surface runoff.	Construction, Operation
Aeolian sand ingress	Implement a coordinated erosion monitoring and mitigation program and update if required.	Operation
Consolidating or ‘locking up’ of coastal dunes by built infrastructure, removing the buffer for coastal erosion and increasing the risk of inland erosion	The current concept design situates the desalination plant behind the foredunes. Avoid locating the plant and sub-surface intake structures more seaward than is currently proposed in the concept design and minimise hardstand areas or structures that would consolidate the coastal dunes.	Detailed Design
Exposure of the subsurface network by coastal processes including beach	Ensure that infrastructure installed within the active portion of the beach profile is of sufficient depth such that it is below the limit of scour. Alternatively, modify the infrastructure design such that it can be exposed to wave action during extreme events, or ensure plant is decommissioned prior to risk levels increasing under future scenarios.	Detailed Design
	Preferentially construct subsurface structures (particularly the deep intake wells) by directional drilling (or alternative), to avoid the need for an open trench.	Construction

Impact	Measure	Timing
level fluctuation and storm bite	Monitor weather forecasts when working on the horizontal intake wells and the connection pipeline and halt works when extreme coastal warnings are issued by the Bureau of Meteorology.	
Risk of coastal erosion	Any proposed changes to the current concept design need to consider the existing coastal hazard and risk maps in Figure 5-1 and Figure 5-2 of Appendix M as well as any future updates that may be available that would supersede the existing guidance. Ensure that plant boundaries do not extend into areas of present day erosion and recession risk and that the future risk level applied allows for the most conservative operational and decommissioning timeframes.	Detailed Design, Construction and Operation
	Conduct consistency reviews at major design milestones against the EIS, approval conditions and latest available literature including the Lake Macquarie CMP. It is understood that the EIS will have a 10 year validity period if approved, and as such it is likely that updated sea level rise guidance and coastal risk maps will be available in the interval between concept design and project implementation. The review is required to ensure that the Project area remains acceptable from a coastal erosion risk perspective.	Operation
Wave overtopping	Design infrastructure and landscaping to minimise the likelihood and extent of wave overtopping. Minimise the impact on the plant should wave overtopping occur by maintaining appropriate drainage and designing the plant to withstand an overtopping event.	Detailed Design
Social		
Amenity and character	Ongoing consultation will be undertaken with key stakeholders prior to and during construction and operation of the Project to identify potential issues as they arise. This will include: • Notifying affected residents about planned Project activities, duration of activities, and expected impacts. Consultation should target vulnerable community members, who may include older residents and people experiencing disability. Notification should be provided to users of Nine Mile Beach and Belmont Cemetery as well as residents including those living along: - Williams Street - Marriot Street - Hudson Street • Maintain a register of stakeholders who would like to receive updates about the project and email/write to these stakeholders at appropriate intervals. • Communicate Project information to relevant stakeholders previously identified, including local businesses and community groups. • Communicating Project information through Hunter Water's communication channels, such as a Project website and community update. • Providing a feedback mechanism for residents to contact the Project.	Pre-construction, Construction, Operation
Access and connectivity	As part of ongoing community engagement, the heavy vehicle movements will be communicated in community information materials along local residential streets such as Beach Street, Ocean Park Road and Hudson Street.	Construction, Operation
Sustainability		
Management systems & Procurement and purchasing	Develop and implement a Sustainability Management Plan (SMP) which establishes governance, structures, processes and systems to ensure integration of all sustainability considerations, initiatives, monitoring and reporting during the detailed design and construction phases of the Project. The SMP should include the following: • Sustainability objectives and targets • Roles and responsibilities for sustainability management, including adequate resourcing of sustainability • Inspection, monitoring and auditing requirements	Detailed design

Impact	Measure	Timing
	• Provisions for sustainability reporting and review by senior management • Provisions for the assessment and management of supplier sustainability performance	
Energy and carbon	Incorporate the following measures into future stages of design to improve sustainability performance: • Adopt a target of 10 per cent energy reduction compared to business as usual for a desalination plant, as per the NSW GREP, and integrate this target into Project contracts, in accordance with the Hunter Water GEMP • Procure a desalination module which incorporates energy recovery • Procure a minimum 6 per cent GreenPower for operation of the Project, in alignment with the requirements of the NSW GREP. • Consider offsite renewable energy procurement as part of the procurement process to contribute to meeting the requirements of the NSW GREP • Incorporate all financially viable measures to reduce greenhouse gas emissions and energy use into detailed design, in accordance with the Hunter Water GEMP • Design operational lighting in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.	Detailed design
	Incorporate the following measures into construction and operation in alignment with the requirements of the Hunter Water GEMP: • Develop an energy management plan for project operation • Monitor and report within Hunter Water energy consumption and greenhouse gas emissions • Communicate energy and greenhouse gas management objectives and performance internally and externally • Provide training and raise awareness of energy and greenhouse gas emissions procedures, initiatives and conservation opportunities to employees responsible for operation of the plant	Construction Operation
Water	Monitor water use throughout construction and operation and report as part of project sustainability reporting, in accordance with the NSW GREP.	Construction Operation
Materials	Incorporate the following measures into future stages of design to improve sustainability performance: • Consider selection of concrete mixes with low carbon cementitious materials to achieve a reduction in imbedded carbon. • Source steel which has an accompanying Environmental Product Declaration (EPD) and has been produced using an energy-reducing production process, such as polymer-injection technology • Undertake value engineering exercises during detailed design to identify opportunities to reduce construction materials use • Incorporate materials reduction initiatives into the sustainability ‘lessons learned’ for the Project	Detailed design
Discharges to air, land and water	Incorporate the following measures into procurement to improve sustainability performance and comply with the requirements of the NSW GREP: • Consider EU or US EPA standards when purchasing or leasing non-road diesel plant and equipment • Consider air emissions from contractor-supplied non-road diesel plant and equipment	Pre-construction
	Monitor the quality of brine discharge against water quality objectives as recommended in Section 7.4.4.	Operation
Land	Implement the contamination measures recommended in Section 7.1.4.	Detailed design
Waste	Incorporate the following measures into future stages of design to improve sustainability performance: • Develop a plan for waste management, including targets for waste avoidance, waste handling and disposal requirements, monitoring requirements, and reporting of the top three waste streams as per the NSW GREP • Develop a plan for decommissioning and deconstruction which considers the principles of Designing for Deconstruction (DfD; Guy, 2006)	Detailed design

Impact	Measure	Timing
Community health, wellbeing and safety	Incorporate the Crime Prevention Through Environmental Design (CPTED) principles into detailed design.	Detailed design
Hazards and Risk		
General hazards and risk	Review proposed transport of dangerous goods logistics. If notable differences to what was assessed are proposed, repeat the screening process to determine if a route evaluation is required.	Detailed design and construction
	Review the proposed types and quantities of dangerous goods to be stored on site. If notable differences to what was assessed are proposed, repeat the screening process to determine if the changes affect the PHA and outcome.	Detailed design and construction
	Conduct an independent review of the hazardous chemical elements associated with the proposal, including location of storages, compatibility of adjacent chemicals and bunding requirements. The review will be undertaken by an expert in hazardous chemical storage. Any recommendations will be incorporated into the detail design.	Detailed design
Dangerous goods spill	Locate chemical storage and delivery areas within bunded areas with a capacity of 110 percent of chemical storage volume. Store chemicals in accordance with Australian Standards and maintain in accordance to equipment supplier recommendations. Appropriately label, separate and dispose of each chemical in accordance with Australian Standards. Provide access to the Material Safety Data Sheet (MSDS) register of all chemicals that are located on-site for worker and emergency services reference. Implement safe work procedures for the handling of all chemicals including transfer, storage, spill prevention and clean up requirements. Spill kits to be available on-site in appropriate areas. Develop an emergency response plan that includes dangerous goods spill scenarios.	Operation
Delivery of dangerous goods	Develop and implement a traffic management plan including standard traffic rules, site speed limits, signage and designated pedestrian areas. Ensure transport of dangerous goods complies with the Australian Dangerous Goods (ADG) code, including driver competency. Develop a construction management plan.	Construction, Operation
Fuel spill	Fuel store to be designed to appropriate standards. Fuel to be stored in an intrinsically safe hazardous area as per appropriate standards. Implement appropriate fire protection systems.	Construction, Operation
Natural hazards	Appropriately design site drainage for the site. Develop a fire prevention vegetation management procedure for the site.	Detailed design, Construction, Operation
Aboriginal Heritage		
Salvage of existing items	One Aboriginal cultural site, AHIMS #45-7-0397 Isolated Find (RPS BEL IF01), has been identified within the Project area and therefore will need to be salvaged through Community Collection, prior to works proceeding.	Pre-construction
Management Plan	An Aboriginal Cultural Heritage Management Plan (ACHMP) should be formulated following the EIS to provide management and protection process for known and unknown Aboriginal objects and places.	Pre-construction, Construction

Impact	Measure	Timing
Additional inspections	The ACHMP should include provision for the completion of the following: • Additional inspection and surface collection of any artefacts exposed in the area mapped as containing A horizon soils in a disturbed context. The opportunity to undertake additional inspection and surface collection should be provided to an archaeologist and Aboriginal party representatives following vegetation clearance and respreading of A horizon soils currently within the bunds and adjoining area (refer to Appendix G Figure 4). • Additional inspection of the areas with the potential for intact A horizon soils, with the opportunity to undertake the additional inspection to be provided to an archaeologist and Aboriginal party representative following vegetation clearance and during earthworks (where the earthworks will occur within A horizon soils). Methodologies should be included for collection of surface artefacts and for the completion of archaeological salvage excavations if an archaeological feature (such as a possible hearth, discrete scatter of high density artefacts or midden material with the potential to retain archaeological integrity) is identified (refer to Appendix G Figure 4).	
Unexpected finds	In the event that skeletal remains are identified, work must cease immediately in the vicinity of the remains and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of a crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, OEH must be contacted on Enviroline 131 555. An OEH officer will determine if the remains are Aboriginal or not; and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.	Construction
Site inductions	All Hunter Water personnel and subcontractors involved in the proposed works should be advised of the requirements of the NPWS Act 1974 that it is an offence for any person to knowingly destroy, deface, damage or permit destruction, or defacement to an Aboriginal object or place without the consent of the Director General of the Department of Environment and Conservation.	Pre-construction, Construction
Non-Aboriginal Heritage		
Unexpected finds	If, during the course of the works, unexpected archaeological items or relics, as defined by the Heritage Act 1977 (as amended), are uncovered, work should cease in that area immediately. The Heritage Branch, Office of Environment & Heritage (Enviroline 131 555) should be notified and works only recommence when an approved management strategy developed.	Construction
Traffic and Transport		
Additional traffic generation due to project construction	In consultation with Lake Macquarie City Council, a Construction Traffic Management Plan (CTMP) should be prepared and include detail with respect to: • Appropriate Traffic Control Plans • Traffic control measures in works areas • Controls associated with the delivery of heavy plant and materials to site during peak traffic periods • Appropriate entry/exclusion points for the proposed construction compound areas • Advising motorists of the change in traffic conditions associated with the work	Pre-construction
Traffic control	Appropriate exclusion barriers, signage and site supervision is to be employed so that the project site is controlled and that unauthorised vehicles and pedestrians are excluded from the works area.	Construction
	All traffic control devices are to be in accordance with AS 1742.3-2009 – Manual of uniform traffic control Devices: Traffic control for works on roads and Roads and Maritime Traffic control at worksites manual.	Construction
Creation of additional roads or access tracks	Only existing roads and access roads are to be utilised.	Construction

Impact	Measure	Timing
Misinformation or an uninformed community	The community is to be kept informed about the project through appropriate means such as advertisements in the local media, notices and/or signs.	Pre-construction, Construction
Noise and vibration		
Noise and vibration – Site inductions	All employees, contractors and subcontractors will receive an environmental induction. The induction will include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Location of nearest sensitive receivers • Employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures	Pre-construction, Construction
Noise and vibration – Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.	Pre-construction, Construction
Equipment selection	Use quieter and less vibration emitting construction methods where reasonable and feasible.	Pre-construction, Construction
Noise and vibration – Community consultation	Ongoing stakeholder consultation will occur including: • Establishing contact with local residents and the construction program and progress communicated on a regular basis, particularly when noisy activities are planned. • Notifying affected receivers of the intended work, its duration and times of occurrence. This may include a local community update letters for specific construction activities and a project info line. • Specific notifications will be provided to receivers where the highly noise affected level of 75 dB(A) is predicted to be exceeded.	Pre-construction, Construction
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.	Construction
Noise and vibration – Traffic noise	Comply with the recommended standard construction hours. Plan traffic flow, parking and loading unloading areas to minimise reversing movements within the site. Loading and unloading of materials/deliveries is to occur during standard construction hours. Contractors are to avoid dropping materials from height where practicable, during loading and unloading. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. No truck movements before 7.00 am or after 6.00 pm.	Construction
Noise and vibration – Vibration monitoring	Vibration monitoring will be undertaken where equipment is being used within the safe working distances detailed in Table 7-41 or when a complaint is received. Vibration monitoring should be conducted during these activities at the most susceptible buildings close to the construction sites. Any vibration measurement will be undertaken by a qualified professional and with consideration to the ICNG guidelines.	Construction

Impact	Measure	Timing
Noise and vibration – Complaints management	Complaints will be managed in accordance with the CEMP and the procedure outlined below. Signage will clearly and visibly provide a contact number and name to receive complaints and enquiries about construction. Potential complaints specific to these works could include: • Vibration impacts from works that significantly affect structures or dwellings • A cluster of noise and/or vibration complaints Works have the potential to cause noise complaints from nearby receivers. The response will be to: • Verbally respond to complainant • Provide a written response within seven calendar days if the complaint cannot be resolved verbally • Log the complaint, and any actions taken with regards to the complaint within a complaints register • Undertake monitoring at the complainant's residence(s) • Investigate the nature and reasons of the impact • Investigate and implement further mitigation measures to minimise the impact	Construction
Noise – Respite periods	High noise generating activities may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. High noise refers to construction noise impacts which exceed the highly affected noise management level of 75 dB(A) LAeq(15-min) during standard construction hours.	Construction
Sleep disturbance – Annoying characteristics	Any annoying characteristics (such as tonality, low frequency, impulsiveness, etc.) generated by the site will need to have corrections factors applied, as per the NPI. This will need to be assessed as part of the detailed design stage where specific operational equipment are selected.	Detailed design
Operational noise – Detailed design	The following design strategies will be incorporated into the detailed design of the desalination plant: • Selection of equipment and plant items to limit noise emissions. Where practical and feasible, motor drives, gear boxes, pumps, etc. will be specified and selected to achieve a noise level of less than 85 dB(A) at a distance of one metre, 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 one metre.	Detailed design
Waste Management		
General	Obtain modification to EPL 1771 to provide for discharge of brine, commissioning flows and dewatered groundwater (if applicable) via the Belmont WWTW HCS.	Pre-construction
	Follow the resource management hierarchy principles: • Avoid unnecessary resource consumption as a priority • Re-use materials, reprocess, recycle and recover energy • Dispose as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act 2001*)	Throughout the project duration
	Manage all waste material in accordance with the POEO Act and Waste Classification Guidelines (EPA 2014) and the Waste Avoidance Resource Recovery Strategy for NSW (NSW EPA).	Throughout the project duration
	Manage and track waste in accordance with Hunter Water specifications, including recording of the total waste generated per month and the percentage recycled.	Throughout the project duration
Spread of contamination through inappropriate waste management	Include waste classification, sampling and analysis in the Contaminated Soil Management Plan. Manage materials in accordance with the Contaminated Soil Management Plan. Dispose of waste to an appropriately licensed facility with supporting waste classification documentation.	Construction

Impact	Measure	Timing
Generation of general construction waste	Provide labelled waste receptacles to promote the segregation of waste and recycle materials where appropriate.	Construction
	Conduct and record site inductions as specified in the CEMP to ensure staff are aware of waste disposal protocols.	Construction
	Preferentially procure materials with no or minimal packaging, or those where packaging is recyclable or able to be returned for re-use to the supplier.	Construction
	Maintain all working areas by keeping free of rubbish and cleaning up at the end of each working day.	Construction
	Do not accept waste from outside of the project site.	Construction
	Follow mitigation measures for weed disposal as defined in Section 7.3.	Construction
	Provide portable toilets for construction workers and manage to ensure the appropriate disposal of sewage (i.e. removed by a licensed supplier). Portable toilets should be located away from drainage lines.	Construction
Generation of wastewater from dewatering	Collection and testing of dewatered groundwater to be included in the CEMP. If of suitable quality, reinject, use for dust suppression or discharge in the vicinity of the works. If unsuitable for reuse or reinjection, or discharge dispose of via the Belmont WWTW HCS in accordance with conditions of EPL 1771.	Construction
Generation of wastewater during commissioning of intake and desalination plant	During commissioning, test any wastewater that is to be disposed of to the WWTW or to the outfall to ensure that parameters will not exceed the conditions of EPL 1771 or relevant marine water quality guidelines. Calculations will need to reflect dilution with the existing WWTW effluent.	Commissioning
	Treat chlorinated water prior to release into the HCS to prevent chlorine impacts to fauna.	Commissioning
	Release commissioning wastewater as slowly as possible to minimise the impact on the WWTW effluent quality and quantity.	Commissioning
Generation of brine	Dispose of brine via the Belmont WWTW HCS in accordance with the conditions of EPL 1771.	Operation
Generation of pre-treatment sludge waste	Dispose of pre-treatment sludge waste via the Belmont WWTW in accordance with the conditions of EPL 1771.	Operation
Decommissioning	Where possible sell or repurpose components and materials for use on other projects. Where reuse is not possible, recycle materials at an appropriately licenced facility. Dispose to a licenced landfill only after re-use and recycling options have been exhausted.	Decommissioning
Visual Amenity		
Minimise visual impact for receptors	Existing large trees and vegetation will be maintained and protected wherever possible.	Operation
Minimise light spill into any adjoining landholding or dwelling	During operation, lighting will be provided at the desalination plant, given that it will be operational on a continuous basis. Lighting will be provided in accordance with AS 4282 – Control of the obtrusive effects of outdoor lighting.	Operation
Minimise visual impact on residential areas	Following completion of the minor upgrade to the power connection at the intersection of Hudson Street and Marriot Street, Belmont South, the existing footpaths and road surfaces will be reinstated to original condition prior to the works.	Construction
Minimising visual impact on the adjoining dwellings	During construction of the project, the works area will be kept tidy and any lighting during night time will be used over a short duration and directed to avoid spill into any adjoining properties.	Construction

Impact	Measure	Timing
Contrast of structures against the surrounding vegetation	A muted colour palette should be utilised for the desalination site structures.	Detailed Design
Air quality		
Generation of dust	Include a procedure for effective dust control in the CEMP, including: • Limit earthmoving activities during periods of high winds • Implement dust suppression using water carts or binder sprays if required • Specify height and cover of stockpiles • Minimise vehicle movements and limit maximum speed on site to 40 km/h • Cover loads during transport • Assign haulage routes and minimise vehicle and equipment movements outside of sealed roads/areas	Pre-construction
	Limit the areas of clearing and ground disturbance to the minimum required.	Construction
	Investigate any dust complaints and implement correction as soon as possible. Define the complaint procedure within the CEMP.	Construction
	Stabilise and revegetate disturbed areas progressively where disturbed areas will be left for longer than 21 days. Revegetate in accordance with the mitigation measures provided in Section 7.3.4.	Construction
	Maintain dust suppression controls including weave barrier fence as wind breaks on up wind of disturbed areas until rehabilitation is completed with appropriate vegetation coverage.	Construction
Exhaust emissions	Turn off plant and machinery when not in use and fit with emission control devices complying with Australian Design Standards.	Construction
	Maintain construction plant and equipment in good working condition in accordance with manufacturer requirements. Stand down any equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) until repaired.	Construction
Combustion emissions	Prohibit burning of any materials on-site.	Construction
Impact on sensitive receivers	Advise local residents of hours of operation and duration of work and provide a contact name and number for queries regarding air quality.	Pre-construction
Odour	Maintain a clean and tidy site with waste removed frequently, particularly sewage and putrescible waste.	Construction
Greenhouse Gas		
Electricity use	Turn power tools and electrical equipment off when not in use.	Construction
	The operations of the Belmont Desalination Facility will follow the guidelines stated in the Hunter Water Greenhouse Gas and Energy Management Policy. The following measures will be undertaken to minimise/reduce greenhouse gas emissions and energy use during operations: • Incorporate specific energy management targets and KPIs • Review and audit energy management systems and their performance	Operations

Impact	Measure	Timing
Fuel consumption	Develop options during the detailed design for optimising construction and transport activities and minimising fuel usage (e.g. reduce the number of vehicle trips required). Mitigation of greenhouse gas emissions will follow a hierarchical approach: • Avoid emissions source • Reduce consumption • Improve energy efficiency • Replace with low emissions alternative • Offset	Pre-construction
	Develop a fuel management strategy that incorporates project planning, logistics, operator education and maintenance.	Pre-construction
	Investigate use of biodiesel for vehicles, equipment and machinery used during the Project.	Pre-construction
	Adopt sustainable procurement practices where feasible.	Pre-construction
	Maintain construction plant and equipment in good working condition in accordance with manufacturer requirements. Stand down any equipment found to be emitting excessive exhaust emissions (such as excessive visible diesel smoke) until repaired.	Construction
	Turn off plant and machinery when not in use and fit with emission control devices complying with Australian Design Standards.	
	Reduce fuel consumption through the use of efficient plant and vehicles. Modern vehicles, equipment and machinery only will be used. These are more fuel efficient and have better emission controls than older models.	
Human Health		
Encounter contamination during construction.	Should unexpected contaminated soils be identified during any ground works, seek advice from a suitably qualified environmental consultant and notify the Hunter Water Project Manager. Complete any additional investigations/abatement in general accordance with guidelines developed or endorsed by NSW EPA. Include contingency plans for unexpected finds protocols for contaminated soils in the CSMP.	Construction
Exposure to chemicals during operation of the desalination plant	Locate chemical storage and delivery areas within bunded areas with a capacity of 110 per cent of chemical storage volume. Store chemicals in accordance with Australian Standards and maintain in accordance to equipment supplier recommendations. Implement safe work procedures for the handling of all chemicals including transfer, storage, spill prevention and clean up requirements. Develop an emergency response plan that includes dangerous goods spill scenarios.	Operation
Human health impacts at recreational swimming sites	Monitor enterococci levels in the discharge stream and nearby recreational swimming sites once the plant is operational to confirm the predicted low human health risk.	Operation

Impact	Measure	Timing
Potable water quality.	Manage potable water quality in accordance with the requirements of the Australian Drinking Water Guidelines (NHMRC, 2011) and NSW Health.	Operation
Cumulative impacts		
Cumulative impacts	Cumulative impacts will be considered as part of consistency reviews at major design milestones for the Project against the EIS, approval conditions and latest available project information at the LMCC and DPI&E websites	Construction

9 Conclusion

9.1 Project justification

9.1.1 Benefits of the Project

The Hunter region is vulnerable to drought because water storage levels can fall quickly in prolonged periods of dry weather. Modelling of an extreme drought indicated the Hunter region's total water storage level could drop very quickly, as follows:

- From 65 per cent to 35 per cent in approximately 14 months
- From 35 per cent to 15 per cent in approximately 10 months

Therefore, storages could drop from 65 per cent to 15 per cent in only 24 months.

Development of the drought response desalination plant is based on deferring expenditure for as long as possible, increasing the chance of drought recovery due to rain, whilst ensuring adequate lead time is provided to design, construct and commission the desalination plant should overall storages reach critical levels.

Completing a concept design and obtaining planning approval would ensure the Project can be delivered in the event of extreme drought.

Ultimately, the Project would provide a rainfall independent water source in the event of an extreme drought, and slow the depletion of existing water storages by providing up to 15 ML/day of potable water.

9.1.2 Consequences of not proceeding

While a number of drought response measures are considered in the LHWP, desalination was identified as an emergency response for a very extreme drought, as it offers a solution that is not dependent on rainfall.

If the Project does not proceed and an extreme drought occurs, the Lower Hunter region is at risk of running out of water, the consequences of which are severe.

9.1.3 Consistency with objects of the EP&A Act

The Project's consistency or otherwise with Section 1.3 of the EP&A Act is summarised in Table 9-1.

Table 9-1 Compliance with the Section 1.3 Objects of Act

Object	Comment
(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The Project's key objective is to slow the depletion of existing water storages in the event of an extreme drought. This would likely provide a long-term positive impact for a range of local and regional businesses and the broader community.
(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	Ecologically sustainable development (ESD) is considered in Section 9.2. For the reasons discussed in that Section, the Project is considered to be consistent with the principles of ESD.

Object	Comment
(c) to promote the orderly and economic use and development of land,	The Project would be within Hunter Water-owned land, making using of existing Belmont WWTW infrastructure, ensuring associated impacts are generally restricted to existing Hunter Water assets. Decommissioning would occur when water storage levels reach around 50 per cent or greater. Therefore, the Project would not limit the future economic use and development of the land.
(d) to promote the delivery and maintenance of affordable housing,	Not relevant to the Project.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The Project would remove or disturb approximately 6 ha of vegetation comprising Bitou Bush Scrub and exotic grassland. Construction of the Project would avoid direct clearing of native vegetation and threatened species habitat. Access to the Project area would be along Ocean Park Road and would not require clearing of native vegetation. This vegetation is non-native and does not conform to any native vegetation communities listed as threatened under the BC Act or EPBC Act.
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	In relation to Aboriginal heritage, a comprehensive ACHA process was completed for the Project in consultation with the RAPs for the Project. Hunter Water has incorporated a range of controls to minimise impacts on Aboriginal and non-Aboriginal heritage, including heritage inductions and preparation of an ACHMP.
(g) to promote good design and amenity of the built environment,	Potential visual amenity impacts have been considered in Section 7.14. Decommissioning would occur when water storage levels reach around 50 per cent or greater. . Therefore, the Project addresses the requirement to promote good design by ensuring re-use of aspects of the Project, where practicable.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	Not relevant to the Project.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	There has been ongoing consultation with both local and State government representatives throughout the Project planning and environmental assessment process (Section 6).
(j) to provide increased opportunity for community participation in environmental planning and assessment.	The community has been involved in the environmental planning and assessment process through consultation (Section 6).

9.2 Ecologically sustainable development

The principles of ecologically sustainable development are defined under the EP&A Regulation (Schedule 2) as:

(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

These principles are addressed in turn, as they pertain to the Project, in the following sections.

9.2.1 The precautionary principle

This principle states 'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.

Evaluation and assessment of alternative options has aimed to reduce the risk of serious and irreversible impacts on the environment. Stakeholder consultation considered issues raised by stakeholders and a range of specialist studies were undertaken for key issues to provide accurate and impartial information to assist in the design development process.

The concept design has sought to minimise impacts on the amenity of the study area while maintaining engineering feasibility and safety for the Project. A number of management measures have been proposed to minimise potential impacts. These management measures would be implemented during construction and operation of the Project. No management measures have been postponed as a result of lack of scientific certainty.

A CEMP would be prepared before construction starts. No management measures or mechanisms would be postponed as a result of a lack of information.

9.2.2 Intergenerational equity

This principle states, 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'.

The Project has been developed to ensure environmental protection for the benefit of both current and future generations. This EIS has utilised a risk-based approach to identify potential Project impacts and appropriate mitigation measures to reduce impacts to an acceptable level. As a result of this approach, the Project would not result in significant adverse impacts on the health, diversity or productivity of the environment for future generations, provided that the mitigation measures summarised in Section 8.2 are implemented.

While the construction and operation of the Project would result in greenhouse gas emissions contributing to climate change, these emissions have been estimated to be minor in the context of Australia's greenhouse gas emissions as a whole (Section 7.16). The greenhouse emissions associated with the Project have been reduced, including potential for incorporating energy recovery devices into the reverse osmosis system. In addition mitigation measures have been identified which would reduce the greenhouse gas impact of the Project, including the adoption of energy reduction targets and measures to reduce the embodied carbon in construction materials.

Moreover, an infrastructure sustainability assessment has been completed against the ISCA IS rating scheme (Section 7.7). The IS rating scheme is broad-ranging and includes criteria for a range of matters of relevance to intergenerational equity, including resource efficiency, greenhouse gas emission reductions, waste avoidance and recovery and conserving ecological and heritage values, amongst others. By assessing the Project against these criteria and identifying measures to reduce impacts, intergenerational equity impacts have been reduced on the Project.

9.2.3 Conservation of biological diversity and ecological integrity

This principle states the 'diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival'.

An assessment of the existing local environment was undertaken to identify and manage any potential impacts of the Project on local biodiversity. Specific design efforts have been taken to minimise impacts upon biological diversity and ecological integrity, this included the selection of a pre-existing brownfield site (Belmont WWTW) over a greenfield site which would ultimately result in greater impacts on biological diversity and ecological integrity.

The Project would not have a significant impact on biological diversity and ecological integrity. A biodiversity assessment and appropriate site-specific management measures are provided in Section 7.3.

9.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires 'costs to the environment should be factored into the economic costs of a proposal'.

The EIS has examined the environmental consequences of the proposal and identified measures to manage the potential for adverse impacts. While the implementation of these mitigation measures would represent an upfront cost for the Project, the mitigation measures would avoid the costs to society of potential environmental impacts. Moreover, the costs of mitigating environmental impacts would be factored into the total cost for the Project. In this way, the costs of the potential environmental impacts of the Project would be appropriately incorporated into the cost of the asset.

9.3 Summary

It is not anticipated that the Project described in this EIS would have any significant adverse environmental impacts as a result of construction or operation. Obtaining planning approval would provide significant benefit to the local and wider community, ensuring the Project can be deployed quickly in the event of extreme drought.

Whilst the LHWP included a trigger level for commencing construction at around 35 per cent total water storage, this trigger will be reviewed throughout the detailed design phase, and it is likely that some activities would be instigated prior to 35 per cent total water storage, to ensure the plant can be operational no later than 15 per cent total water storage level.

Based on total water storage levels at time of publication (November 2019), under an extreme drought scenario 35 per cent total water storage could be reached in late 2020; 15 per cent total water storage could be reached in late 2021.

The Project would be implemented as a last resort if water storage levels reach a critical point to ensure water security and would have the capacity to produce up to approximately 15 ML/day of potable water for supply to the local Hunter Water network.

The desalination plant would be run until an appropriate trigger point is reached in total water storage level, currently set at around 35 per cent. At the trigger level operation would cease with the units remaining on-site until the risk of continued drought is passed. At that time, the desalination plant would be stood down and mothballed. It could then be turned back on at short notice if the operational trigger is reached once again. Alternatively, if storage levels continue to recover, the decision to partly decommission the plant would then be based on the storage levels at the time and long term weather outlooks to inform the chances of the desalination plant needing to be turned on again in the short to medium term. Decommissioning would occur when water storage levels reach around 50 per cent or greater.

The Project does have potential to have short-term impacts during construction works; however, these impacts would be managed through the adoption of appropriate and targeted environmental management and mitigation measures identified in this EIS and summarised in Section 8.2.

As outlined in Sections 9.1 and 2.1, the Project is a robust response to a recognised need and provides a number of benefits. The EIS has demonstrated that the Project is in the public interest and is consistent with the objects of the EP&A Act and the principles of ESD.

The consequence of the Project not proceeding would compromise water security because Hunter Water would not be able to slow the depletion of water storages by supplementing supply with desalinated water.

The EIS has documented the potential environmental impacts of the Project, considering both negative and positive impacts. The concept design in conjunction with the detailed assessment of potential environmental impacts of the desalination plant has sought to minimise impacts on the environment while maintaining feasibility. The EIS has demonstrated that the Project would not have a significant environmental impact, through the implementation of the proposed management and mitigation measures, and the beneficial effects of the Project are considered to outweigh negative impacts, which would generally be temporary in nature.

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11 Glossary

Term/acronym	Definition
ACHA	Aboriginal Cultural Heritage Assessment
ADCP	Acoustic doppler current profiler
ADGC	Australian Dangerous Goods Code
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ASS	Acid sulphate soil
ASSMAC	Acid Sulphate Soil Laboratory Methods and Manual
ASSMP	Acid Sulphate Soils Management Plan
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	*Biosecurity Act 2015*
BoM	Australian Government Bureau of Meteorology
BOS	Biodiversity Offset Scheme
CEMP	Construction Environmental Management Plan
CIV	Capital investment value
CLM Act	*Contaminated Land Management Act 1997*
CPTED	Crime Prevention Through Environmental Design
CSMP	Contaminated Soil Management Plan
CZMP	Coastal Zone Management Plan
DCP	Development Control Plans
DECCW	Department of Environment, Climate Change and Water
Defence	Department of Defence
DfD	Designing for Deconstruction
DG	Dangerous goods
DICL	Ductile iron cement lined
DoI	Department of Industry
DotEE	Department of the Environment and Energy
DP	Deposited plan
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DPIE	Department of Planning, Industry & Environment
DTV	Default marine trigger values
EEC	Endangered ecological communities
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPD	Environmental Product Declaration
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically sustainable development
FM Act	*Fisheries Management Act 1994*
FTE	Full time equivalent
GEMP	Greenhouse and Energy Management Policy
GREP	NSW Government Resource Efficiency Policy

Term/acronym	Definition
GRP	Glass reinforced plastic
HCS	Hydraulic control structure
Heritage Act	*Heritage Act 1977*
HRP	*Hunter Regional Plan 2036*
Hs	Significant Wave Height
HW	Hunter Water Corporation
HW Act	*Hunter Water Act 1991*
IS	Infrastructure Sustainability
ISCA	Infrastructure Sustainability Council of Australia
kV	Kilo volt
L/s	Litres per second
LEP	Local Environmental Plan
LGA	Local Government Area
LHWP	Lower Hunter Water Plan
LTI	Injury or temporary impairment where one or more working days are lost
ML/d	Mega litres per day
MSCL	Mild steel cement lined
MSDS	Material Safety Data Sheet
MTTV	Marine toxicant trigger values
MW	Megawatt
Native Title Act	*Native Title Act 1993*
NHMRC	National Health and Medical Research Council
NHx	Hydrogenated nitride
NNTT	National Native Title Tribunal
NOx	Nitrogen oxides
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NTU	Nephelometric turbidity units
OEH	NSW Office of Environment and Heritage
PASS	Potential Acid Sulphate Soil
PE	Polyethylene
PEA	Preliminary Environmental Assessment
PHA	Preliminary Hazard Analysis
PIN	Penalty infringement notice
PMST	Protected Matters Search Tool
POEO Act	*Protection of the Environment Operations Act 1997*
PSU	Practical salinity units
PV	Photovoltaic
PVC	Polyvinyl chloride
RAPs	Registered Aboriginal Parties
RF Act	*Rural Fires Act 1997*
RO	Reverse osmosis
Roads Act	*Roads Act 1993*
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SMP	Sustainability Management Plan
SRD	State and Regional Development
SSI	State Significant Infrastructure

Term/acronym	Definition
SWMP	Soil and Water Management Plan
SWMS	Safe Work Method Statement
WM Act	*Water Management Act 2000*
WWTW	Wastewater Treatment Works

Appendices

Appendix A – Secretary's Environmental Assessment Requirements (SEARs)

Note that the re-issue date on the SEARs stated 24 January 2017. However, the actual date of issue is 24 January 2018, which has been confirmed by email from the Department of Planning and Environment on 7 March 2019.

Appendix B – Concept Design Drawings

Appendix C – DCP Requirements

Appendix D – Groundwater Assessment

Appendix E – Biodiversity Development Assessment Report (BDAR)

Appendix F – Non-Aboriginal Heritage Impact Assessment (HIA)

Appendix G – Aboriginal Cultural Heritage Assessment Report (ACHA)

Appendix H – Contamination Assessment

Appendix I – Stakeholder consultation materials

Appendix J – LMCC Comments and Responses

Appendix K – Marine Assessment

Appendix L – Brine Discharge Modelling Report

Appendix M – Coastal Processes Assessment

Appendix N – Social Impact Assessment

Appendix O – Traffic Assessment

Appendix P – Noise and Vibration Impact Assessment

Appendix Q – Landscape Character and Visual Impact Assessment

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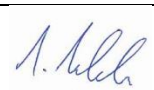
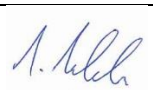
0	M. Kiejda	N. Malcolm		N. Malcolm		18/10/2019
1	M. Kiejda	N. Malcolm		N. Malcolm		7/11/2019

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