Appendix A. Updated project description

Note: Additions or revisions to the project description for the Proposed Modification are identified in red text. Details that are redundant or no longer applicable to the Project are identified in ~~strikethrough~~ text.

A.1 Key features of the Project

~~The permanently available~~A desalination plant that is permanently available for operation and would have a capacity of up to 30 ML/d of potable water. The key components of the Project are described in Section A.1.1 to A.1.5 and shown in **Figure 1-3** with detailed drawings included in **Appendix C**.

A.1.1 Direct ocean intake

The direct ocean intake system would comprise:

- On-shore pump station, including a central well, screening and pump housing, consisting of a concrete structure (referred to as a wet well) of approximately ~~nine to~~ 11 m to 16 m in diameter, installed to a depth up to about 25~~0~~ m below existing surface levels to allow for future proofing of the system. The pump station building has an indicative footprint of approximately ~~800~~ 900 m^2. A 700 tonne crane with a maximum height of 110 metres would be used to lift materials i.e. concrete panels
- Intake pipeline, indicative alignment is approximately ~~1000~~ 850 m in length, extending perpendicular to the beach in a Easterly (E) direction from the pump station and would be ~~about 9~~ up to 14 m in diameter in 18 m of water offshore and would rise to a height of about 4.5 m above the existing seabed (i.e. to a level of - 13.5 m AHD) ~~outwards from the central housing to the off-shore intake structure.~~
- Construction of the intake pipeline would use the CM2 method identified in the Amendment Report (Pipejacking/micro-tunnelling) using a micro-TBM
- Off-shore intake structure, the intake structure would be in the form of a horizontal intake with a velocity cap structure and low through-screen velocity to minimise impacts on marine species and habitat. The intake structure would be located in slightly deeper waters around 18 m in depth. During design refinement the dimensions may be increased to allow for possible future increases in capacity. The intake structure would be installed by a 60 metre high, up to 700 tonne crane. The crane would be located on a jack-up ~~n offshore~~ barge located about 8~~0~~50 m offshore for a period of ~~up to~~ 8 months during construction. The barge would include a helicopter pad and a helicopter would be used to transfer construction personnel and the barge. The intake structure would be:
  - A minimum of 500 m from the existing Belmont WWTW ocean outfall (Note the Modification design has this placed around 736 metres away)
  - Located outside the surf zone
  - A diameter of ~~5~~ up to 14~~9~~ m
  - At least 4.5 m above the seafloor to minimise potential capture of sediment.

A.1.2 Water treatment process plant

The water treatment process plant would comprise a range of equipment, some of which would be housed in on-site sheds 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 (ocean water)) would comprise a mix of buried and overhead methods.

It is proposed that the desalination plant would operate with a treated water output flow rate of 380 L/s based on a 40 per cent recovery from the reverse osmosis (RO) process. This equates to a total of 32.8 ML/d~~ay~~, although due to slight variations in operations and flows over a 24 hour period, an output of 30 ML/d~~ay~~ 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 between two to four modules, with the option of operating only one (or multiple if four modules are ~~is~~ selected) module 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 32.8 ML/day plant (comprised of four modules) is provided in Table A-1 along with the quantities anticipated under the maximum flow rate scenario of 32.8 ML/day.

Table A-1 Conceptual primary flows – 30ML/day (all values in ML/day)

Flow Stream	Maximum Daily Flows	Flow Stream
Potable water		
Potable water produced	32.81	7.5
Utilities (potable water for use on site)	1.3	0.3
Desalination Plant		
Number of trains operational (min.)	8 Nos	2 Nos
Permeate production	34.1	7.8
Permeate production per train	17.05	3.9
(Hydraulic) recovery	40%	40%
Pre-Treatment Plant		
Filtered ocean water to Desalination Plant	85.22	19.5
Filtered ocean water to backwash 500 micron strainers & UF filters5	6	1.5
Ocean water to backwash band screens6	0	0
Intake Flow	91.23	21
Outfall		
Brine to outfall	51.1	11.7
Strainers & UF filter backwash to clarifier and PS5	5.6	1.5
Clarifier u/flow to WWTW	0.4	
Less Utilities and losses	1.3	0.3

1 This flow rate is used for the concept design of the delivery system, and is equivalent to a delivery pump rate of 380 L/s, albeit over 22 hours.

2 This flow rate is used for the concept design of the pre-treatment processes.

3 This flow rate is used for the ocean water pumping system and pipework.

4 This flow rate is used for the concept design of the ocean outfall.

5 Backwash water pumped to the ocean outfall after clarification. Clarifier underflow pumped to WWTW

6 Screenings flushed from band screens to a basket and the flush water is returned upstream of the band.

~~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.~~ Once operational the permanent desalination plant would provide a flexible water supply source that is responsive to water supply needs and the plant would provide a small, continuous supply of water when total storage levels are high increasing to full supply capacity as storage levels fall in drought.

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 ocean water 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. Wastewater from this process would be directed to a sedimentation tank (clarifier) with clarified wastewater delivered to the brine waste stream and sludge processed and disposed in accordance with existing Belmont WWTW operations and EPL 1771 (as modified). If the Belmont WWTW treatment process units are unable to take the sludge stream (to be determined in detail design), then a sludge unloading facility would be provided
- 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 ocean water 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.

A number of permanent buildings would be required to house the water treatment process plant equipment. The building housing the pre-treatment equipment has the maximum height of all the Project buildings at 14 m with the exception of the lime tower which has been raised to 15 metres above the infilled ground level. The total indicative footprint of the buildings required for the water treatment process plant is approximately ~~2,88~~ 5,550 m^2. The desalination plant would be connected to Hunter Water's potable water network via a potable water pipeline proposed to be constructed to augment the existing water network.

A.1.3 Brine disposal system

The desalination process would produce up to 56 ML/d~~ay~~ 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. During construction, groundwater that is intercepted from the onshore works that cannot be reinjected may also be potentially discharged via the existing ocean outfall pipe.

Construction ~~activities~~ of the brine disposal system may include using an open cut trenching method or tunnel boring. Both methods would intersect with the groundwater brine line resulting in a greater amount of saline water requiring dewatering. The wastewater would either be reinjected or may be transferred via a pipeline to the existing nearby Belmont WWTW for disposal via the existing ocean outfall pipe into the ocean.

The indicative footprint of buildings for the brine disposal system is approximately 480 m^2.

A.1.4 Power supply

Provision of the required power supply for the operation of the Project would require connection to Ausgrid's existing 11 ~~33~~-kV overhead power network located to the south of the Project area. A new aboveground or underground powerline to the desalination plant site would be provided along Ocean Park Road at the south west end of the approved Project footprint. This new line would be outside the approved Project footprint, requiring the footprint to be revised (refer to **Figure 3-2**) ~~with new private power line connecting to a substation within the plant site (see Figure 1-1)~~. The indicative footprint of buildings for the power supply is approximately 830 m^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.

A.1.5 Ancillary facilities

There would be a range of ancillary infrastructure associated with the desalination plant site, including a number of buildings and tanks with an indicative total footprint of approximately ~~2~~3,500 m^2. Ancillary infrastructure includes but is not limited to the following:

- Stormwater drainage: Stormwater within the water treatment process plant area would be directed into a swale on the southern and ~~eastern~~ western perimeters draining to a stormwater basin in the ~~north-east~~ north-west of the Project area. The design of the stormwater basin would provide adequate sizing to ensure filtration to the surrounding environment, ensuring no ponding or requirement for discharge of stormwater. Furthermore, the swale and stormwater basin have been designed for 1 in 100 year Average Recurrence Interval (ARI) storm events, with a ~~130 m^2~~ 330 m^2 surface area which meets the stormwater pollution reduction targets set by Lake Macquarie City Council Water Cycle Management Guideline (2013b)

- Potable water network: the Project would connect to the potable water network as described in Section 3.3.1 of the EIS. Potable water storage and pumping station would be provided within the water treatment process plant
- Tank Farm: comprising ocean water (from the intakes), pre-treated ocean water (ocean water 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 water treatment process 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 of the EIS and are consistent for the amended design. Deliveries of major chemicals would be required approximately once per month, per chemical
- Hardstand: The water treatment process 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 hardstand areas would be directed to the stormwater basin as described above
- 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
- Additional buildings: A fire water system, process tankage, administration building, workshop building and switch rooms has been included in the building footprint of the latest design.

A.2 Construction methodology

As discussed in Section 2.1 of the EIS, 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.

A.2.1 Project area

The Project area for the desalination plant and associated infrastructure would comprise approximately ~~17.39~~ 17.54 hectares, including:

- 2.21 hectares associated with the ocean water intake and associated pipeline direct ocean intake (see Section A.1.1).
- 15.33 ~~15.18~~ hectares associated with the water treatment process plant, brine disposal system, power supply works and ancillary facilities (see Section A.1.2, A.1.3, A.1.4 and A.1.5).
- The area underneath the building and infrastructure footprint would be raised to 1.5 – 2 metres to provide a finished surface level raised to 3.8 - 4.3 m AHD to adapt to future climate change driven sea level rise and to cater for the 1 in 100 year flood event. Triggers the need for 1,600 truck and dog movements of fill (refer further to the traffic and transport discussion below). The road into the facility won't be raised.

The Project area is shown in **Figure 1-3** of the Modification Report.

A.2.2 Work methodology

Construction is proposed to be undertaken over an approximate ~~eight~~ 36 month timeframe, with Table A-2 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 A.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, Amendment Report and development consent and relevant legislation and guidelines.

The construction program detailed in **Table A-2** is indicative only and would be subject to further refinement by the construction contractor.

Table A-2 Indicative 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
Power upgrades	
Connection to Ausgrid's existing 11 ~~33~~ kV line located to the south west of the Project area ~~to the north west of the water treatment process plant site~~, with a new ~~private~~ power line installed either above ground or underground along Ocean Park Road, ~~connecting to a substation within the desalination plant site.~~ Connection would be via a new substation located within the desalination plant site.	~~4 weeks~~ 3 months
Direct ocean intake	
The construction methodology for the intakes work is described in detail below, and would generally comprise the following key aspects: ▪ Sea Water pump station: installed via a wet well technique as the sandy soils, depth and high groundwater conditions would prevent open excavation ▪ Intake pipeline: indicative alignment approximately ~~1000~~ 850 m in length, extending perpendicular to the beach in a Easterly (E) direction ~~outwards from the central housing to the~~ to the off-shore intake structure, completed via the micro-tunnelling / pipe jacking method (micro-TBM) described below ▪ Intake structure (off shore): in the form of a horizontal intake with a velocity cap structure and low through-screen velocity to minimise impacts on marine species and habitat.	~~8~~ 12-18 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 and associated buildings for operational equipment housing ▪ Process pipeline connections ▪ Installation of storage tanks, construction of various concrete structures and installation of process equipment ▪ Stabilisation and revegetation	~~4~~12-24 months

Aspect	Indicative duration
Commissioning	
Testing and commissioning of individual process units and then entire plant. Out-of-specification water to be discharged to WWTW ocean outfall.	1-2 months
Demobilisation	
Removal of redundant environmental and safety controls. General site tidy up activities.	Within the time frame 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.

A.2.2.1 Power upgrades

This would involve the following methodology:

- Isolation of the 11 kV ~~33kV~~network south of the Project area 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
- Construction of either an overhead or underground power line ~~that would likely include approximately 4 new poles and stringing of overhead or underground cables~~
- Construction of kiosk transformers at ground level in the plant site
- Testing and commissioning of the new works prior to energising in coordination with Ausgrid.

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

A.2.2.2 Direct ocean intake

Sea water pump station installation

Due to the elevated groundwater levels and medium sized sand conditions expected (refer to Sections 7.1.2 and 7.2.2 of the EIS), a 'wet caisson' method would be adopted; involving a shaft 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.

~~CM1 (HDD) would precede installation of the wet well, while~~ CM2 (Pipejacking/Micro-tunnelling using a micro-TBM) would be completed after caisson installation. However, the methodology for caisson installation is generally as follows:

- 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 to facilitate construction
- Set up and turn on dewatering spears
- Installation of the caisson (a ~~9-~~11 -14 m shaft diameter, which would be confirmed by the construction contractor during detailed design), to depth of up to 25 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 intake pipeline.

A.2.2.3 Intake pipeline

~~CM1 (HDD)~~

~~This method requires the intake pipeline to be constructed as the first phase of construction. A drilling rig and plant area would be established approximately 200 m west of the sea water pump station to account for the curvature of the HDD pipeline route. This area would be approximately 40 x 40 m in size.~~

~~A laydown area would also be established to assist in feeding equipment to the drilling rig (i.e. for pushing into the borehole and managing drilling fluid). In addition, the construction access road would be used to allow the stringing of pipe.~~

~~From on-shore, a pilot hole would be drilled (approximately 200-300 mm diameter) to an offshore barge (situated at the intake head location), which would store the HDD equipment required to ream a pilot bore to the outer extent of the pipeline. Additional allowance would be made in the diameter of the hole for any grouting required to stabilise the reamed void (need and suitability of grouting dependent on soil layers encountered).~~

~~The final step in the process would then be to pull the pipeline through the bore hole.~~

CM2 (Microtunnelling/pipe jacking)

This entails completion of the intake pipeline after completion of construction of the on-shore pump station and associated infrastructure, via a remotely-controlled micro-TBM). The micro-TBM would be jacked up from approximately 20 x 10 m launch shaft constructed to a depth of a maximum of 20 m. The launch shaft would be constructed via sheet piling, secant piles, underpinning, and caisson construction; as the preferred construction method in the relevant soils (likely to be caisson in the sandy soils within the Project area).

The micro-TBM would bore a hole from the launch shaft along the intake pipeline to a 20 x 10 m reception pit approximately 1000 m away excavated into the seabed, from which divers would clear the drill head. Due to the high forces required to drill through saturated soils and to overcome the excessive friction, intermediate jacking stations would be constructed every 100 to 300 m along intake pipeline alignment. A barge would be required to house the receival equipment and for removal of the drilling head.

Upon completion of boring works, the TBM would be sealed and flooded with ocean water from shore (i.e. to ensure drilling head can be disconnected).

A.2.2.4 Off-shore intake structure

The intake structure has the following characteristics:

- Is located at a depth of between 15 – 18 m below lowest astronomical tide (LAT) level and located at least 500 m from the low tide mark. This distance and depth was selected for the following reasons:
  - Is typically sufficient to access high quality ocean water
  - Convenient access for maintenance activities, as depths below 20 m are subject to productivity constraints for divers and beyond the depth limit for a recreational Professional Association of Diving Instructors (PADI) Open Water certification
  - Going beyond coastal surf zones that can impose large forces on the intake head structure
  - Is sufficient depth (i.e. top of structure is >4m below LAT) to minimise the risks of seagoing vessels striking the structure (noting that the selected location is much closer to shore than formal shipping corridors)
- The intake structure would be designed to minimise impingement and entrainment of marine life and sediment into the intake system. The design would consider a maximum approach velocity through the screens of 0.15 m/s to meet impingement mortality performance standards
- The intake zone of the structure would be located at least 3 m from the seabed to minimise entrainment of sediment to reduce pre-treatment capital and operating costs
- An additional option to dispose of excavated/ dredged material at a remote licenced ocean disposal site has been added to the existing option of disposal in the immediate vicinity of the DOI intake structure.

A.2.2.5 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 30,200 m^3 ~~9,800 m^3~~ of cut and ~~670 m^3~~ 8,200 m^3 fill material would be required (refer to ~~Appendix E of the AR~~ Figure 3-3 of the Modification Report for site cross section). Earthworks may include importing subgrade improvement materials if required, and localised dewatering. Suitable spoil from within the site would be reused to fill the existing evaporation ponds to provide an average building area level of RL 2.67 m AHD. The revised cut and fill areas required to raise the area underneath the building and infrastructure footprint an additional 1.5 to 2.5 metres under the desalination plant to a height of around 3.8 - 4.3 metres AHD to cater for the 1 in 100 year flood event under predicted climate change conditions which would be adopted as part of the Proposed Modification.

Plant pipeline connections

An approximately 300 m long pipeline would be installed from the desalination plant site to the brine Pump Station located within the Belmont WWTW for brine discharge via the WWTW ocean outfall. It is anticipated that the pipeline would be installed within the boundary of the Belmont WWTW site via open trenching.

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 Project area to the west (noting that this pipeline may not be required if detail design calculations indicate that the WWTW treatment process units do not have sufficient capacity and a sludge unloading facility is required).

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.

Plant construction

Construction of the desalination 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 DOI 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. The RO and UF building walls would be prefabricated concrete construction
- 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, in accordance with the Native Vegetation Management Plan, including:

- Ensuring there is appropriate topsoil for vegetation to establish
- Revegetation of disturbed areas would be using appropriate groundcover species consistent with the dune restoration project undertaken by Hunter Water independently of this Project, and as specified in the Native Vegetation Management Plan
- Replacement of temporary construction fencing and other physical barriers or features and removal of all temporary construction structures.

~~A.2.2.6 Power upgrades~~

~~This would involve the following methodology:~~

- ~~Isolation of the 33 kV network south of the Project area 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~~
- ~~Construction of approximately 4 new poles and stringing of overhead or underground lines as required between each~~
- ~~Construction of kiosk transformers at ground level in the plant site~~
- ~~Testing and commissioning of the new works prior to energising in coordination with Ausgrid.~~

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

A.2.3 Staging and workforce

~~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. Following completion of this stage, there will be a hold point until construction commences. Whilst the LHWP (2014) included a trigger level for commencing construction at around 35 per cent total water storage, it is likely that procurement and pre- construction activities would be instigated prior to reaching the trigger level, (based on construction lead times determined during the detailed design stage) to ensure the plant can be operational no later than 15 per cent total water storage level.~~

~~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 36 ~~24 12~~ months, with an indicative breakdown of the duration of each aspect of the construction program provided in Table A-3.

The workforce for the Project would vary depending on the needs for specific activities for each aspect of construction. However, a workforce of ~~60 150~~ around 215 full time equivalent (FTE) personnel may be required if works are able to be undertaken concurrently, as shown in **Table A-3**.

Table A-3 Indicative construction workforce required for the Project

Aspect	Indicative duration
Power upgrades	15
Direct ocean intake	~~10~~ 40
Water treatment process plant	~~30~~ 160

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

A.2.4 Project hours and duration

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

- Monday to Friday: 7.00AMto 6.00PM
- Saturday: 8.00AM to 1.00PM
- 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 A-4**.

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

Aspect	Out of hours work
Direct ocean intake	▪ Dewatering during construction of the intakes would be required ▪ The micro-TBM activities would require construction activities for 24 hours per day 7 days per week for the marine intake pipeline. ~~Accelerate the construction period particularly for the offshore marine based construction activities~~ ▪ A twin engine helicopter would potentially operate during out of hours. Helicopters operating during night works are required to have a dual engine.
Water treatment process plant	N/A
Power upgrades	N/A
Overall project	▪ Additional dewatering for the brine pipeline (underground option) and other deeper excavations ▪ Large crane lifts may, on occasion, be carried out in the early morning to avoid high winds ▪ Small amount of OOHW light and heavy vehicle construction traffic ▪ Some cut-over and commission activities

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.

A.2.5 Plant and equipment

The indicative plant and equipment items for the Project are detailed in **Table A-5**. The plant and equipment would be subject to further refinement, be chosen on a fit-for-purpose basis and would consist of various makes, tonnages and capacities, dependent on-site conditions.

Table A-5 Indicative plant and equipment required for construction

Aspect	Plant/equipment	
Direct ocean intakes	▪ General plant and equipment: - Generators - ~~15~~ 45 t excavators - Heavy vehicles - Heavy fork lift - Tipper truck - Loader - Compressor - Generator - Sucker truck	▪ On-shore sea water pump station: - Pumps - Welding equipment - ~~30~~ 160 t crane - Concrete saws ▪ ~~CM1~~ ~~- Sump pumps~~ ~~- Drill rig truck~~ ~~- HDD equipment~~ ▪ Intake pipeline using the CM2 method

Aspect	Plant/equipment	
	- Spoil truck ▪ Offshore intake structure: - Crawler crane 700 t - Mobile cranes up to 250 t - Jack-up barge - Logistical barges - Spilt hopper barge - Tugs - Vibro-hammer for piling - Bell suction dredge pump - Compressors - Generator - Helicopter - Auxiliary equipment – rotator, EWP, light towers, LARS, decompression chamber - Concrete batching - Clamshell excavator.	~~- Auger drill rig~~ ~~- Boring jack power unit~~ ~~- Drill rig truck~~ ~~- 30 t crane~~ ~~- Sump pumps~~ - Mobile cranes up to 250 t - Crawler cane 100 t - AVN 2000 micro-TBM - Separation plant 500 m^3/h - Water treatment plant - 14 L/sec. -
Water treatment process plant	▪ Heavy vehicles ▪ Welding equipment ▪ 30 t crane ▪ Concrete truck ▪ Articulated 30 t Dump Truck Excavator ▪ D6 Dozer ▪ 14 M Grader	▪ Compressor ▪ Generator ▪ Pneumatic tools ▪ Vibratory rollers (10 t smooth drum / 14 t padfoot) ▪ High energy impact rollers (tractor + impact roller) ▪ 18,000 L Water cart ▪ Plate compactors
Power upgrades	▪ Heavy vehicles ▪ 15 t excavator ▪ Pole installation rig	▪ Compactor ▪ Hand tools ▪ Elevated Work Platforms
Demobilisation	▪ Light vehicles ▪ Heavy vehicles ▪ 15 t crane	▪ Generators
General building construction activities	▪ Concrete agitators (up to 10 cube capacity – 10 wheelers) ▪ Pumps and generators ▪ Concrete line and boom pumps (up to 42 foot extent) ▪ Telehandler ▪ Manitou ▪ 40 t pick and carry crane (Franna) ▪ Mobile crane up to 450 t	▪ Crawler crane up to 280 t ▪ Scissor lifts ▪ Knuckle booms ▪ 8 t Gantry crane ▪ Concrete cutting and scabbling ▪ Welding ▪ Grinding ▪ Pipe joining equipment including rattle guns

A.2.6 Helicopter

The Proposed Modification would require the use of a helicopter to transfer construction personnel and materials to and from the offshore jack-up barge to construct intake structure of the DOI system. Generally, there would not be more than 24 movements per day and around 3,000 movements in total in accordance with the following:

- Light twin engine helicopter as aviation regulations require the night operations to be conducted in a twin engine helicopter
- The aim is to move up to 12 personnel twice a day by helicopter from Lake Macquarie Airport to the jack-up platform positioned off Blacksmith's Beach and return

- The shift changes would be 12 hours apart and there would be a requirement to conduct some operations after dark
- It is likely that up to 3-4 personnel would be transferred at a time and it would require 3-4 movements to and from the jack-up barge for each shift change
- The operation would likely commence at the start of 2025 and last for eight months allowing for weather contingencies
- Generally there would not be more than 24 movements per day and around 3,000 movements in total
- The majority of helicopter movements would be centred around the start and end of shifts at 7 AM and 6 PM to transfer construction personnel to and from Lake Macquarie Airport and the jack-up barge and flights would commence around 5:30AM and end around 8:30PM.

A.2.7 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.

A.2.8 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 A-6** providing a breakdown of anticipated light and heavy vehicle movements for each phase of construction, and associated construction traffic access.

Vehicles would follow the nationally approved haulage routes prior to following the planned route from the Pacific Highway, Beach Street and Ocean Park Road to the desalination plant.

Potential OSOM or very large but not OSOM deliveries such as the TBM would be delivered from Newcastle Port to the ~~site~~ Project area on a number of lowloaders. The cranes would be delivered from Kooragang on a mixture of lowloaders and semi-trailers. All cranes, except for the crawler crane, would be delivered to the ~~site~~ Project area during restricted hours based on transport licences.

General deliveries would include semi-trailers, rigid trucks, semi rigid trucks, tilt trays and truck and dogs – pipe, mechanical equipment, precast, spoil and quarry materials. General site works would require the delivery of a 5 t truck, construction light vehicles, manitou, telehandler, positrack, street sweeper, vac truck, water cart, minitankers.

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.

Table A-6 Indicative vehicle traffic movements

Aspect	Heavy vehicle movements (total)	Light vehicle (2 way) movements per day (maximum)	Access
Heavy vehicles			
Direct ocean intake	7,521	240	Ocean Park Road
Water treatment process plant	25	360	Ocean Park Road
Power upgrades	5	120	Pacific Highway, Beach Street and Hudson Street
Spoil import	3,000	-	Ocean Park Road
Concrete trucks	2,400	-	Ocean Park Road
Material deliveries	3,000	-	Ocean Park Road
Marine works	500	-	Ocean Park Road
Others (excluding light vehicles)	1,100	-	Ocean Park Road

Aspect	Heavy vehicle movements (total)	Light vehicle (2 way) movements per day (maximum)	Access
Heavy vehicles			
Light vehicles			
Light vehicles	-	430 ~~144~~[2]	Ocean Park Road

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.

- Note 2: Generally around 80% of the staff (peaking at 215) would arrive before the start of the day shift which is scheduled to start at 7am and around 80% (peaking at 215) would depart after the end of the day shift which is scheduled to end at around 6PM.
- Light vehicle trips required for the FTE staff would also vary over the 36 months as follows:
  - The first 11 months 18 - 82 car trips twice a day
  - The next 12 months 147 – 215 car trips twice a day
  - The next 12 months 32 - 79 car trips per day.

A.2.9 Property impact and use

The desalination plant and the main compound location would be within Hunter Water-owned land. The properties, land zoning and land uses intersected by the Project area are listed in **Table A-7**.

Table A-7 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
	E2	Crown Land	Sea bed/Coastal Waters

A.3 Ancillary facilities

A.3.1 Compounds

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

- Site buildings for equipment housing
- Parking
- Equipment laydown areas
- Waste receptacles
- Temporary spoil stockpile areas
- Soil treatment area for ASS treatment if required (main compound only)
- Water treatment for dewatering during caisson (wet well) construction
- Storage areas for construction materials (could include some hazardous materials such as fuels and chemicals).

A.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.

A.4 Commissioning

A.4.1 Direct ocean intakes

Commissioning would be undertaken following installation to confirm the intake capacity. This would involve pumping ocean water through the newly installed direct ocean 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. Ocean water would likely be pumped from the intake well directly to the brine disposal system
- Full commissioning would then be undertaken to deliver flow from the intake well to the plant.

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 raw feed water delivery main.

A.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 ocean outfall. Commissioning flows are expected to be essentially seawater 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:

- Individual equipment checks
- Package commissioning
- Full operation of the facility
- Pre-treatment process.

Commissioning of the pre-treatment processes would take approximately 2-4 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 ocean outfall via the brine discharge pipe.

A.4.3 Reverse osmosis unit

During commissioning of the reverse osmosis unit, all water would be returned to the ocean via the ocean outfall 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* (National Health and Medical Research Council (NHMRC), 2011).

A.5 Operation

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 a Hunter Water asset and managed under their existing protocols.

The desalination plant ~~would operate on a permanent basis~~ would be permanently available for operation.

A.6 Decommissioning

The desalination plant would be operated until Hunter Water's water storages recover to an appropriate level. At this point the desalination plant would be stood down and mothballed. The desalination plant could then be turned back on in the event that water storages deplete in the future.

The desalination plant is designed for a minimum of ~~20~~ 50 year operational life after it is first commissioned. Towards the end of this operational period Hunter Water would make a decision on whether to invest additional capital to prolong its operation, or to decommission the desalination plant. Decommissioning would be completed to the relevant Australian Standards applicable at the time. General tasks for decommissioning would include:

- Removing the desalination plant from the land. This would include site clean-up, and where required, any remediation of the land
- The Project area would be returned to a state that does not inhibit beneficial future re-use, and would be completed in consultation with Lake Macquarie City Council and the NSW State Government
- The intake pipelines associated with the direct ocean intake would be left in place after being made safe. It is considered that there would be significantly higher environmental impacts associated with removing them from below the sea floor
- Investigations would be completed to determine if the intake structure should be removed or if there are environmental benefits associated with leaving it in place. These benefits may include habitat creation.

A.7 Capital investment value

The initial estimated Capital Investment Value (CIV) for the design and construction of the desalination plant was ~~is~~ approximately $201 million. Consistent with the design and methodology modifications, and increases in construction costs, this is now estimated at $530 million, of which $490 million is associated with this modification application (remaining expenditure is associated with lead in water network augmentations, which will be assessed and determined by Hunter Water separately from this application). ~~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 to customer prices would be ~~determined by~~ confirmed through this IPART process~~if the Project is required to proceed~~. Hunter Water's next pricing period commences on 1 July 2025.

~~IPART recently finalised a determination taking effect from 1 July 2020. Hunter Water did not request IPART include any capital or operating cost allowance for the Project in the current regulatory period. Any capital expenditure in the period 2020 to 2024 would be added to Hunter Water's regulatory asset base from 1 July 2024.~~