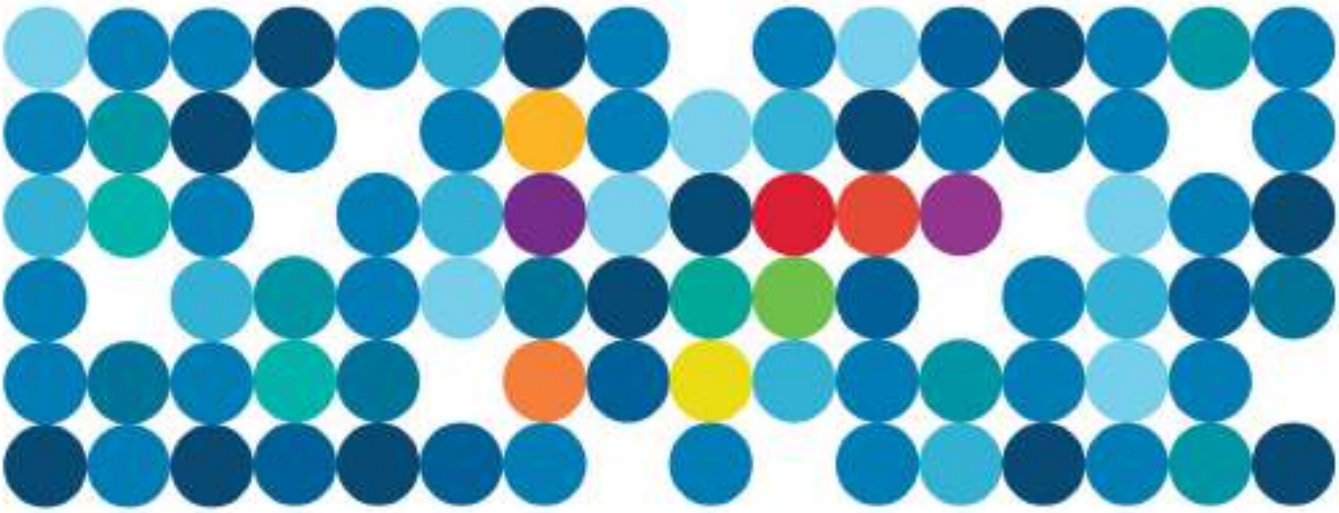
Alkimos Seawater Desalination Plant

Part V Works Approval Application

Supporting Information

March 2024



WATER CORPORATION

Document Information

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A	20/02/2024	C Chaudhry	A Thorburn	Internal Draft
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Executive summary

Premises Details

Alkimos Seawater Desalination Plant
Lot 3000 on Plan 415979 on Brindabella Parkway, Alkimos

Prescribed premises category description

Category	Description	Category Production or Design Capacity	ASDP Production or Design Capacity
54A	Water desalination plant: premises on which salt is extracted from water if – (a) wastewater is discharged into marine waters; and (b) the discharged water has a density greater than the average ambient density of the marine water at the discharge site.	Over 10 gigalitres (GL) or more per year	Stage 1 50GL (This Application)

Infrastructure and Equipment

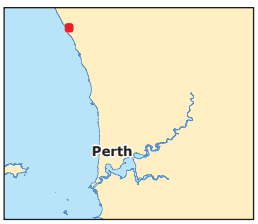
	Infrastructure	Design, construction, installation, and operational requirements	Infrastructure location
1	Seawater intake pumping station and brine discharge chamber	• Seawater pumping station • Brine turbine facility • Seawater inlet chambers (Stage 1 and 2) • Brine discharge chamber(s) • Multimedia filters (Stage 1 screens) • Screening waste bins	As depicted in Figure 2
2	ActiDAFF® Treatment	• 18 ActiDAFF® units* • Filtered water tank	
3	Reverse Osmosis (RO) pre-treatment facility	• Reverse Osmosis (RO) feed pumps • RO cartridge filters • First pass RO cartridge racks • Second pass RO cartridge racks • Antiscalant dosing system	
4	Chemical receival, storage & dosing systems	• Fully bunded closed drain systems for storage and receival	
5	Potabilization treatment	• UV disinfection unit • Lime water clarifiers	
6	Sludge treatment	• Lamella settler • Decanter centrifuge • Sludge disposal bins	

7	Clean-in-Place (CIP) Waste Handling Systems	• CIP waste tank	
8	Drainage and Containment Systems	• Fully bunded power transformer compound drainage system • Fully bunded generator / diesel storage area • Fully contained brine outfall drainage system	

LEGEND

- Proposed Alkimos SDP Prescribed Premises Boundary
- Alkimos WWTP Prescribed Premise Boundary (L8434/2010/2)

NOTE: SDP layout is indicative only and subject to survey



1:5,000 at A4

0 40 80 120 160

Metres

Coordinate System: GCS GDA 1994
Vertical Datum: AHD

AUTHOR: POWERA0	DATE: 14/03/2024

BRANCH: APDG – ENVIRONMENTAL BUSINESS UNIT

WATER CORPORATION

Alkimos Seawater Desalination Plant Works Approval Application

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Figure 2 – Prescribed Premises Boundary

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Appendices

Appendix A – Water Corporation Environmental Policy

Appendix B – Certificate of Title

Table of Attachments

The following table shows how the mandatory attachments referenced in the DWER application form have been addressed within this document.

DWER Application Form Attachment Reference	Description	Location within this Document	Comment
1A	Proof of Occupier Status	Appendix 2	Refer also to Section 2
1B	ASIC company extract	N/A	Water Corporation does not have an ASIC extract
1C	Authorisation to act as a representative of the occupier	N/A	
2	Premises map/s	Appendix C - Figure 2	Figure 2
3A	Environmental commissioning plan	Section 5.2.3.2	
3B	Proposed activities	Section 5	
3C	Map of area proposed to be cleared (only applicable if clearing is proposed)	N/A	Clearing approved under Part IV of EP Act 1986 under Ministerial Statement 1207
3D	Additional information for clearing assessment	N/A	
4	Marine surveys (only applicable if marine surveys included in application)	N/A	
5	Other approvals and consultation documentation	Section 3.8 Section 6	
6A	Emissions and discharges	Section 7	
6B	Waste acceptance	Section 7	
7	Siting and location	Section 2.1.3	
8	Additional information submitted	Appendices A, B, C & D	
9	Category-specific checklist(s)	N/A	
10	Proposed fee calculation	Section 9	
11	Request for exemption from publication	N/A	

1 Introduction

1.2 Background

Water Corporation is proposing to construct a new seawater desalination plant to provide an additional source of drinking water for Perth's Integrated Water Supply Scheme.

The Alkimos Seawater Desalination Plant (ASDP) will be located within the Alkimos Water Precinct (Lot 3000), approximately 40 km north of the Perth, within the northwest urban corridor (Figure 1).

The ASDP Proposal has been assessed under Part IV of the *Environmental Protection Act 1986* by the WA Environmental Protection Authority (EPA). This assessment process concluded in August 2023, when Ministerial Statement 1207 (MS 1207) was issued.

The ASDP Proposal approved in MS 1207 was for a capacity of 100GL. This application is to construct the first 50GL of the total capacity (Stage 1).

The remaining 50GL will be developed in either one (50 GL Stage) or two stages (two 25GL stages), estimated to be after 2030 and subject to future requirements. The timing of each stage is based on actual growth in water demand, potential groundwater allocation reduction, actual streamflow conditions and timing of other source option development (e.g. construction of additional desalination activities in Kwinana).

This proposal includes the design, construction, operation, and maintenance of ASDP Stage 1, equipped for 158ML/d (50GL/p.a.) as shown in Figure 1. For efficiency, some components of the project will be constructed to full (100GL) capacity, such as the marine intake and outfall structures, and the throughput capacity remains at 50GL for the Stage duration. The greater project includes the future construction of a co-located groundwater treatment facility to provide an additional 4.9GL/p.a. This groundwater treatment facility is not a prescribed activity and is not included in this application.

The Proposal requires the installation of a seawater intake pipeline (with two intake structures) and an outfall pipeline to return discharge seawater (through two outfall structures) approximately 2.9 and 4.4 km offshore, respectively.

Water Corporation is proposing to build and operate Stage 1 (50GL) of the ASDP. This throughput is considered a Category 54A prescribed activity under Part V of the *Environmental Protection Act 1986* (EP Act), therefore Water Corporation is seeking a Works Approval prior to construction.

1.3 Purpose

This document has been prepared to support a Works Approval application for the construction of the Stage 1 of the ASDP (50GL) under Part V of the *Environmental Protection Act 1986.* This document has been prepared in accordance with '*Procedure: Prescribed premises works approvals and licences'* (DWER, 2019).

2 Premise and Applicant Details

2.0 Occupier Details

Water Corporation is a statutory entity and was established by Section 4(1) of the *Water Corporations Act 1995* (WC Act). The Corporation is a body corporate (Section 4 of the WC Act) and as such does not have an ASIC company extract.

Water Corporation provides water, wastewater and drainage services to Perth and hundreds of towns and communities spread over 2.5 million square kilometres of Western Australia. Water Corporation holds many licences for Wastewater Treatment Plants (WWTPs) and seawater desalination plants with the Department of Water and Environment Regulation (DWER).

Water Corporation operates to an environmental management system certified to ISO 14001, which enables the systematic identification of environmental risks, setting of targets and development of environment improvement plans to reduce risks and ensure its activities are sustainable. The environmental management system is guided by the Corporation's Environment Policy refer to Appendix A.

2.1 Premise Details

2.1.1 Prescribed Activity

The construction and operation of ASDP will be a prescribed activity under C*ategory 54A: Water Desalination Plant* under Part V of the EP Act. The proposed ASDP prescribed activity and capacity is provided in Table 1.

Table 1 - Prescribed Premises Category and Capacity

Category	Description	Category Production or Design Capacity	ASDP Production or Design Capacity
54A	Water desalination plant: premises on which salt is extracted from water if – (c) wastewater is discharged into marine waters; and (d) the discharged water has a density greater than the average ambient density of the marine water at the discharge site.	Over 10 gigalitres (GL) or more per year	Stage 1 50GL (This Application)

2.1.2 Prescribed Premise Boundary

The proposed ASDP is located within the Alkimos Water Precinct (Lot 3000) as shown in Figure 2.

The ASDP proposed prescribed premises boundary is presented in Figure 3 and is located within the existing prescribed premises boundary for the Alkimos Wastewater Treatment Plant (WWTP) under L8434/2010/2.

The GPS coordinates (GDA2020) of the proposed prescribed premises boundary are provided in Appendix D.

2.1.3 Premises Location

The ASDP is located on the western boundary of Lot 3000 on Plan 415979 on Brindabella Pathway, Alkimos, within the City of Wanneroo local government area.

Lot 3000 is also now referred to as the Alkimos Water Precinct (Water Corporation, 2022a). This Lot was set aside as an area for Public Purposes, with a small portion of Urban Deferred, in an amendment of the Metropolitan Region Scheme (MRS) (MRS Amendment 1029/33). The MRS specifically provided for a 600 m odour buffer surrounding the Alkimos WWTP, hence the circular nature of the lot.

EP Act Ministerial Statement 722 (2006) approving the Alkimos-Eglinton Metropolitan Region Scheme Amendment, sets portions of the wastewater treatment plant Public Purposes reservation aside to be managed for conservation purposes. Ministerial Statement 722 conditions Areas 9a, 10a, and 10b to be managed for conservation purpose; to protect the integrity, function, and environmental value of bushland. MS1207 and EPBC Approval 2019/8453 condition the management requirements of Areas 9a, 10a and 10b.

A copy of the certificate of titles can be found in Appendix B.

2.1.4 Alkimos Wastewater Treatment Plant

The ASDP site is located within the same cadastral lot as the existing Alkimos Wastewater Treatment Plant (WWTP). The Alkimos WWTP prescribed premises boundary under Licence (L8434/2010/2) covers the entire cadastral boundary of Lot 3000 on DP 415979.

Figure 3 details the proposed prescribed premises boundary for the ASDP within the existing prescribed premises boundary for the Alkimos WWTP.

The Alkimos WWTP is a category 54 (sewage facility) and category 61 (liquid waste facility) prescribed premises. The Alkimos WWTP and the proposed ASDP infrastructure, treatment and activities are not linked and will be managed separately.

3 Regulatory Context, Approvals and Policies

3.2 *Environmental Protection Act 1986* - Part IV

The ASDP proposal was referred to the Environmental Protection Authority (EPA) under section 38 of the EP Act on 12 April 2019. The EPA determined the ASDP proposal level of assessment at

Public Environmental Review on 19 June 2019, with a four-week review period (EPA Assessment No. 2210). EPA published Report 1739 on 24 May 2023 and the Minister for Environment determined that the proposal may be implemented subject to conditions established under MS 1207 on published on 10 August 2023.

3.3 *Environmental Protection Act 1986* - Part V

Premises that have the potential to cause pollution or environmental harm are regulated under Part V of the EP Act and the *Environmental Protection Regulations 1987.* Water desalination plants that have wastewater discharged to marine waters and have a production or design capacity of 10GL or more per year are listed as a prescribed premises under category 54A of the *Environmental Protection Regulations 1987.* To enable construction and operation of the ASDP, Water Corporation is seeking to obtain a Works Approval (this application) and will subsequently apply for a licence to operate the plant under Part V of the EP Act.

Please note that the Alkimos Seawater Alliance (formerly the Northern Water Partnership) will be seeking separate Works Approvals to support the construction activities, such as the use of a temporary concrete batching plant if required.

The ASDP project has been assessed by the EPA and approved under MS 1207 and therefore the clearing of native vegetation for the proposal is exempt from requiring a clearing permit as under Schedule 6, Clause 2 of the EP Act. Clearing of native vegetation and bulk earthworks for the project commenced in November 2023.

3.4 Environment Protection and Biodiversity Act 1999

Water Corporation referred the proposed action to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 23 July 2019.

The Proposal was determined to be a ‘Controlled Action’ on 29 October 2019.. On 4 March 2020, the Proposal was determined as an ‘accredited assessment’ in accordance with the Bilateral Agreement between the State and Commonwealth Governments.

The ASDP proposal was approved subject to conditions under Section 133(1) of the EPBC Act on 8 November 2023 (EPBC Ref: 2019/8453).

3.5 Aboriginal Heritage Act 1972

No Aboriginal Heritage sites are located within the ASDP proposed Prescribed Premise boundary and therefore no approvals are required for the project under the *Aboriginal Heritage Act 1972*.

3.6 Planning and Development Act 2005

Water Corporation applied for a Development Approval for the ASDP in April 2023 (DAP/23/02473) under the *Planning and Development Act 2005*.

The Metropolitan Outer Joint Development Assessment Panel (JDAP) approved the development application on 20 September 2023 subject to conditions (LGA Ref: DA2023/401; WAPC 30-50279-8).

3.7 Rights in Water and Irrigation Act 1914

A licence to take groundwater under 5C of the *Rights in Water and Irrigation Act 1914* (RIWI Act) will be sought and obtained prior to any dewatering works being undertaken.

3.8 Other Approvals

Based on the designs, no additional approvals will be required at this stage, however, should any additional approvals or permits be required these will be obtained before relevant works being conducted.

4 Existing Environment

4.2 Specified Ecosystems

DWER's '*Guidance Statement: Environmental Siting'* (2016) lists specified ecosystems that must be considered when assessing the environmental risks of prescribed premises. Analysis of the environmental values in the Water Corporation Public Environmental Review (Water Corporation 2022a) against the datasets listed in Appendix 1 of the Guidance Statement has identified the following specified ecosystems surrounding the ASDP prescribed premises:

- Bush Forever Site 397;
- Black Cockatoo habitat;
- Acacia Shrublands on Taller Dunes of Swan Coastal Plain priority 3 ecological community (Acacia Shrublands PEC);
- Banksia Woodlands of the Swan Coastal Plain threatened ecological community (Banksia Woodlands TEC).
- Tuart Woodlands and Forests of Swan Coastal Plain threatened ecological community (Tuart Woodlands TEC) (Water Corporation, 2022a).

The above specified ecosystems are discussed in the sections below.

4.3 Terrestrial Environment

4.3.1 Topography

The ASDP prescribed premises is located on topographically irregular ridges and undulating dune landscape underlain by aeolianite which is frequently exposed with varied elevations of up to approximately 100 m above sea-level. The ASDP prescribed premises site is bound by steep-sided high-relief sand dunes to both the north and south of the site.

4.3.2 Climate

The ASDP area experiences a Mediterranean style climate characterises by mild, wet winters and warm to hot, dry summers. The nearest weather station is Gingin Aero (Station 009178) located approximately 17 km from the ASDP site. Atmospheric temperatures are highest in January/February and lowest in July/August. The annual mean maximum temperature is 25.7 °C and the annual mean minimum temperature is 11.1 °C. The Gingin Aero station reports an annual mean rainfall of 632.0 mm with the majority falling in winter in association with cold fronts from the southwest.

4.3.3 Land Uses and Sensitive Receptors

The ASDP site is located on the western boundary of Lot 3000 on Plan 415979 on Brindabella Pathway, Alkimos, within the City of Wanneroo local government area.

Lot 3000 is also now referred to as the Alkimos Water Precinct. This Lot was set aside as an area for Public Purposes, with a small portion of Urban Deferred, in an amendment of the Metropolitan

Region Scheme (MRS) (MRS Amendment 1029/33). The MRS specifically provided for a 600 m odour buffer surrounding the Alkimos WWTP, hence the circular nature of the lot.

Portions of the Public Purposes reservation have been set aside to be managed for conservation purposes to protect the integrity, function, and environmental value of the bushland. The areas were identified in Ministerial Statement 722 (Areas 9a, 10a, and 10b) and impact was assessed and managed under MS1207.

The site is primarily reserved for 'Public Purposes' under the Metropolitan Region Scheme (MRS), with a portion zoned as 'Urban Deferred' along the southern boundary of the site. To lift the 'urban deferred' zoning requires further details to confirm odour will not impact sensitive receptors.

Outside the Alkimos Water Precinct, is crown reserve and Bush Forever Site 397, which is zoned 'parks and recreation' under the MRS, as shown in Figure 4.

Water Corporation worked with Development WA on the approved Local Structure Plan over Lot 9001 for its ultimate development as a residential and mixed-use coastal node. The structure plan indicates the retention by Water Corporation of an approximately 9.7 ha parcel within Lot 9001 to be zoned 'public purpose', for the future use as an infrastructure launching site for potential marine outfall infrastructure associated with the WWTP.

The EPA's 'Guidance Statement 3 - Separation Distances between Industrial and Sensitive Land Uses' defines sensitive land uses as those sensitive to emissions from industry or infrastructure (2005).

As shown in Figure 4, Sensitive receptors surrounding the Alkimos Water Precinct are current and proposed future primarily residential dwellings, seperation distances to current and future receptors was assessed and managed under MS1207.

4.3.4 Biogeographic Region

The ASDP prescribed premise site is located within the Perth subregion of the Swan Coastal Plain bioregion of Western Australia (Mitchell *et al*., 2002). The SCP bioregion comprises low lying coastal plain coved with woodlands. The vegetation is dominated by Banksia (*Banksia* spp.) or Tuart (*Eucalyptus gomphocephala*) on sandy soils, Casuarina obesa on outwash plains, and paperbark (*Melaleuca* spp.) in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah (*Eucalyptus marginata*) woodland (Mitchell *et al.*, 2002).

The Perth subregion is composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone. Heath and/or Tuart (*Eucalyptus gomphocephala*) woodlands occur on limestone, while Banksia (*Banksia* spp.) and Jarrah (*Eucalyptus marginata*)-Banksia (*Banksia* spp.) woodlands occur on Quaternary marine dunes of various ages. Marri (*Corymbia calophylla*) occur on colluvial and alluvial. The Perth subregion also includes a complex series of seasonal wetlands (Mitchell *et al*., 2002).

4.3.5 Flora and Vegetation

The proposed prescribed premises boundary is cleared and does not contain any native vegetation. The prescribed premises clearing was authorised under MS1207 and EPBC 2019/8453.

4.3.6 Fauna

Common fauna present in the Alkimos Water Precinct includes:

- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)
- Carnaby's Black Cockatoo (*Zanda latirostris*)
- Quenda (*Isoodon fusciventer*, P4),
- Western Brush Wallaby (*Notamacropus Irma*, P4),
- Black-striped Burrowing Snake (*Neelaps calonotos*, P3) and
- SCP Shield-Backed Trapdoor Spider (*Idiosoma sigillatum*) (P3) (Water Corporation, 2022a).

The proposed prescribed premises boundary does not contain any native vegetation and therefore fauna habitat. Site clearing was authorised under MS1207 and EPBC 2019/8453. Management of fauna interactions is also covered in the Terrestrial Construction Environmental Management Plan (TCEMP) (Water Corporation, 2023b).

4.3.7 Geology and Geomorphology

The Swan Coastal Plain (SCP) constitutes an area within the Perth Basin, bordered to the east by the Darling Scarp and to the west by the Indian Ocean, which has been built by marine, alluvial and aeolian sediments. The SCP is divided into five primary geomorphic units; the Ridge Hill Shelf, the Pinjarra Plain, and three dune systems comprising of the Bassendean Dunes to the east, bordering the Pinjarra Plain, the Spearwood Dunes in the middle and the Quindalup Dunes in the west adjacent to the coast (Churchward & McArthur 1980; Gibson et al 1994). The geology of the area is dominated by surficial sands over limestone rock.

The Proposal's engineering geological model recognises eight separate engineering geological units (Jacobs & WorleyParsons 2018b):

- Fill.
- Safety Bay Sand
- Cemented Safety Bay Sand
- Swamp deposits
- Tamala Sand
- Tamala Limestone
- Ascot Formation
- Osborne Formation (Kardinya Shale Member).

The regional physiography and geology of the SDP DE is provided on the Geological Survey of Western Australia (GSWA) 1:50,000 Environmental Geology Series map 'Yanchep', which indicates that the natural geomorphology throughout the SDP DE is associated with 'Deflation plains and basins', surrounded by a 'Parabolic and nested parabolic dune complex' of the Quindalup Dunes. Elevations are expected to vary mostly from around 10 m to 20 m above sea-level (Jacobs & WorleyParsons, 2018b).

The parabolic dunes within and surrounding the Proposal area are scrub-covered, semi-discrete, high, U-shaped sand ridges, with steep slopes on the advancing faces with natural slopes up to 20° (Water Corporation, 2022a). The dunes were initiated as blowouts and would have advanced downwind away from the initial source of erosion, with the axes of the dunes parallel to the direction of the main sand moving winds (south westerlies). The dunes have been deposited in several cycles, with periods of dune formation separated by periods of stability. Four phases of dune activity have been identified on the basis of profile maturity, soil development and vegetation cover, and younger dunes are superimposed on the older dunes (Churchward & McArthur 1980; Gibson et al 1994). The older dunes typically extend further inland (Gozzard, 2007).

The Quindalup Parabolic Dune System on the Swan Coastal Plain consists of four phases of dune formation (Q1, Q2, Q3 and Q4). Within the Quindalup Parabolic Dune System, the Alkimos Dune Complex represents a largely intact example of all four dune phases. Of particular note is the fact that the Alkimos site preserves all four main phases of Quindalup dune development – from oldest to youngest, Q1, Q2, Q3 and Q4 (Churchward & McArthur 1980); DMIRS 2022).

4.3.8 Soils

The ASDP prescribed premise site largely occurs across beach sand, sand dunes, coastal dunes, and calcareous and siliceous locally shelly and/or cemented beach rock which is generally referred to as Tamala Limestone. This comprises unconsolidated to strongly lithified calcarenite with calcrete / kankar soils (AECOM, 2017).

The prescribed premises is largely located on the topographically irregular ridges and undulating dune landscape underlain by aeolianite which is frequently exposed with varied elevations of up to approximately 100 m above sea-level.

The proposed ASDP prescribed premises site is bound by steep-sided high-relief sand dunes to both the north and south of the site. The eastern boundary of the site is characterised by moderate relief sand dunes with steep to undulating topography; whilst the western boundary is characterised by a low-relief and gently undulating ridge of shallow limestone rock. The central part of the site has gently undulating to flat topography and comprises an area of low elevation, defining a ‘central depression’ bound on all sides by relatively higher ground. The ‘central depression’ is characterised by sands, variably weakly cemented in places, underlain by a layer of peat and clay in the middle and eastern parts of the depression.

4.3.9 Acid Sulfate Soils

The proposed ASDP prescribed premises site is not mapped as having any risk of Acid Sulfate Soils (ASS) occurring within 5 m of natural ground level (DWER, 2023). No actual ASS or potential ASS (PASS) has been identified from geotechnical investigations within the prescribed premise site (Water Corporation, 2022a).

4.3.10 Contaminated Sites

There are no mapped, registered contaminated sites within 1 km of the ASDP prescribed premises boundary. The nearest registered contaminated site is located approximately 7.2 km east of the ASDP site (Water Corporation, 2022a).

4.3.11 Hydrogeology and Hydrology

Surface Water

The ASDP prescribed premise is located within the coastal surface water catchment area. The ASDP site does not contain or is located within proximity to any surface water features including watercourses, geomorphic wetlands, Ramsar wetlands, South Coast Significant Wetlands or Wetlands of International Importance. The nearest wetland is Carabooda Lake classified as a Resource Enhancement Wetland (REW) located approximately 3.5 km to the east of the ASDP site (DBCA, 2023).

Groundwater

The ASDP site is situated in the Perth Basin, which comprises a regional sedimentary basin up to 12 km thick with several significant groundwater aquifers (Water Corporation, 2022a). The SCP drainage basin covers an area of 2,126 km^2 and forms part of the larger geological formation of the Perth Basin.

The key aquifer is the superficial aquifer, which is a shallow unconfined regional aquifer. The superficial aquifer is made up of multiple geological formations and comprises Quaternary– Tertiary sediments of the coastal plain. The Proposal area comprises the Safety Bay Sand and Tamala Limestone Formations.

Groundwater flow in the region is westward from the Gnangara Mound towards the coast, where groundwater discharges over a saline wedge. Recharge is primarily from surface infiltration of rainfall and some runoff from the Gingin Scarp. During geotechnical site investigations, groundwater was encountered at depths ranging from approximately 5.8 to 17.5 metres below ground level (mbgl) or between 0.2 and 3.2 mAHD (Jacobs & Worley Parsons 2018b).

The ASDP site is located within a groundwater area proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The ASDP site is not located within a proclaimed surface water area.

Public Drinking Water Source Areas

The ASDP prescribed premise is not located within a Public Drinking Water Source Area (PDWSA). The nearest PDWSA is the Perth Coastal and Gwelup PDWSA (Priority 3) located approximately 97 m to the east of the site.

4.3.12 Conservation Areas

Portions of the Public Purposes reservation have been set aside to be managed for conservation purposes to protect the integrity, function, and environmental value of the bushland. The areas were identified in Ministerial Statement 722 (Areas 9a, 10a, and 10b) and are assessed and managed under MS1207.

The ASDP site is located within an Environmentally Sensitive Area (ESA).

4.3.13 Heritage

Aboriginal Heritage

Several Aboriginal ethnographic and archaeological surveys have been conducted over the ASDP site. The most recent Aboriginal heritage and archaeological survey of the ASDP site was conducted by Brad Goode & Associates in January and February 2022. The heritage survey was completed in consultation with representatives of the Whadjuk Traditional Owners (TOs) and with project personnel from Water Corporation. The Whadjuk are considered to be the most recent TO group within the project area and the most appropriate to consult with on Aboriginal heritage and cultural matters. The surveys consisted of desktop reviews of existing information and on-site surveys of the ASDP.

The survey noted that past and present land use practices have resulted in the disturbance of large portions of the survey area. If present, artefacts might have been destroyed, buried or concealed. The surveyors attributed the lack of artefacts at the ASDP site to the absence of nearby potable water sources.

No Aboriginal archaeological sites or material were identified during the survey (Brad Goode & Associates, 2022).

European Heritage

A search of the State Heritage Register and the Australasian Underwater Cultural Heritage Database (AUCHD) identified that there are two heritage sites, shipwrecks, located off the coast of Alkimos, the SS Alkimos, and the Barque Eglinton. The SS Alkimos (WA State Register Place No. 14294 and Shipwreck Id 3649) lies approximately 700 m to the north of the proposed outfall pipeline, while the Eglinton (WA State Register Place No. 9523 Shipwreck Id 3999) lies approximately two kilometres south of the proposed intake pipeline (AUCHD 2020). The SS Alkimos was a motor vessel built in 1943 in Baltimore, USA, wrecking above water on 20 March 1963, with 30 crew on board and no cargo (Water Corporation, 2022a).

The Eglinton, a Barque sailing rig was built in 1848 in Quebec, Canada, and wrecked on 3 September 1852. This was an important site when it was discovered, it had not been looted and gave the opportunity to learn about shipwrecks on a high-energy, shallow water reef environment. The SS Alkimos and the Barque Eglinton are not protected under State or Commonwealth legislation.

No European heritage sites are located within the prescribed premises boundary of the ASDP.

4.4 Marine Environment

This section provides a summary of the marine environment relevant to the ASDP.

The potential effects to the marine environmental where assessed under the under Part IV of the EP Act and are managed under the conditions of MS 1207 and EPBC Act approval 2019/8453.

4.4.1 Marine Conservation Areas

The site is not currently located within a classified marine park. The nearest marine park (Marmion Marine Park) is located approximately 13 km to the south of Alkimos.

In 2022 the Department of Biodiversity, Conservation and Attractions (DBCA) issued intentions to extend the Marmion Marine Park north to include the Alkimos area. Water Corporation has been in discussions with DBCA to accommodate the future management requirements.

4.4.2 Bathymetry (water depth)

The bathymetry of the ASDP increases offshore from the coastline and varies from the positioning of complex reef formations. The benthic environment consists of an inner and outer reef offshore platform separated by a sand dominated lagoon of depths between 20 – 23 m. The sand dominated lagoon runs parallel between the inner and outer reef platforms (Water Corporation, 2022a)

Depths of the seabed increase towards the west of the coastline to approximately 12 m at the edge of the inner reef platform before sharply increasing to approximately 23 m in the outer sand lagoon. The depths decrease to 20 m at the outer reef west of the sand lagoon before gradually descending to over 50 m (Water Corporation, 2022a)

4.4.3 Wind

Wind strength and direction within the proposal area varies significantly between Summer and Winter seasons. In Summer, winds are predominately south-westerly and consistently moderate to fresh (67%) (Water Corporation, 2022a).

Wind direction in winter months is variable. Wind strengths lower (calm to moderate [72%]) but characterises by short periods (4%) of strong winds of greater than 40 km/hr coinciding with winter storm events (Water Corporation, 2022a).

4.4.4 Currents

Nearshore currents within the Proposal area can be complex due to interactions between regional currents, local wind-forced currents, waves, and irregularly shaped reef systems. High to moderate relief reef structures diffract and refract swell waves, producing a complex pattern of nearshore water movement and wave energy, resulting in a high energy system, which is well mixed and generally devoid of significant stratification (Water Corporation, 2022a).

Current speeds tend to increase with distance from the shoreline; median depth-averaged current speeds range from 9.9 cm/s west of the outer reef, 7.8 cm/s in the outer sandy lagoon to 4.3 cm/s close to the shoreline (Water Corporation, 2022a).

The broader-scale circulation in the region is dominated by the Leeuwin Current, a warm boundary current flowing southward along the edge of the continental shelf. Inshore of the Leeuwin Current, the Capes Current flows northward as a result of upwelling and northward wind stresses and is thus strongest in spring and summer months. Offshore, dominant mechanisms are a combination of meteorological and oceanographic (nontidal) flows. Over the inner reef, wave-driven currents become important when waves are large (Water Corporation, 2022a).

Due to the complexity of the reef structure, wave effects on mean flows tend to be manifested primarily as shoreward-directed flow over shallow areas and offshore-directed return flows in locally deeper areas (Water Corporation, 2022a).

4.4.5 Waves

The Proposal area is exposed to persistently high swell conditions. Annual mean wave conditions approaching the outer reef have been measured at a significant wave height (Hs) of Hs=1.8 m with an associated peak period (Tp) of Tp=12.2 s (Water Corporation, 2022a).

There are two broad categories of waves: swell waves and sea waves. Swell waves are generated over large distances in the Southern and Indian oceans and regularly reach heights of 2 m on approach to the Perth coastline. As they cross the continental shelf, swell waves are refracted from the south-south-west to a more westerly direction (Water Corporation, 2022a).

Sea waves, or local wind-driven waves, have a shorter period and generally travel away from the dominant wind direction and so change their angle of propagation with seasonal changes in wind direction. Sea waves tend to achieve greater wave heights than swell waves (exceeding 4 m under windy conditions) (Water Corporation, 2022a).

4.4.6 Benthic Environment

The morphology of the benthic environment varies in rugosity from low relief to complex high relief structures, with networks of crevasses and caves. Complex reef structures provide habitats for a wide array of fish and invertebrate species, including Western rock lobster (*Panulirus cygnus*) (Water Corporation, 2022a). The area also supports an array of recreational activities from surfing and fishing to SCUBA diving (Water Corporation, 2022a).

Seagrass and macroalgal communities dominate the shallow coastal waters from the beach to a depth of approximately 23 m (Water Corporation, 2022a). Macroalgal communities consisting primarily of kelp (*Ecklonia radiata*) which dominate the reef structures, whereas seagrasses tend to predominate in the shallow lagoons near the shoreline.

4.4.7 Marine Fauna

The Proposal area provides essential habitats for a range of mostly temperate marine fauna; however, tropical species are observed occasionally due to the influence of the Leeuwin Current. These systems also provide important nursery and refuge habitats for a diverse range of marine fauna, including for commercially important species such as the Western rock lobster (*Panulirus cygnus*), Roe's abalone (*Haliotis roei*) and octopus (*Octopus spp*.) (Water Corporation, 2022a).

In support of this, a search of the EPBC Act Protected Matters Report (PMR) found the region supports a number of birds, finfish, marine mammals, and reptiles of relevance. For further information see Section 7 of the Environmental Review Document (Water Corporation, 2022a).

4.4.8 Existing Marine Users

The Alkimos area is within a growth centre of metropolitan Perth, that had a recorded total population ~6500 people in 2016 and is forecasted to increase to ~33 000 people by 2031 (CoW 2017).

Ongoing population growth in Alkimos will be accompanied by increased recreational usage of the marine and coastal zone (including beach use and marine activities). Water based beach activities along the Alkimos coast include swimming, surf skiing, surfing, kayaking, sailing, boating, windsurfing, jet skiing, kite surfing, diving, and snorkelling. The SS Alkimos wreck is a popular diving site and a significant historical artefact. The coastal area surrounding Alkimos has a high level of boat usage and activity that continues to increase with population growth. A boat launching facility and harbour for boat pens is located south of Alkimos at Mindarie Keys Marina and there is potential for a future marina north of Alkimos, near the Eglinton border (Water Corporation, 2022a).

5 Proposed Activities

This application seeks a Works Approval to facilitate the construction, commissioning and time limited operations of the ASDP. The activities covered by this application include:

- Creation of hardstand areas, track and vehicular access
- Construction of the desalination plant and equipment, and
- Commissioning and operation of the desalination plant.

The construction and operation of the ASDP will be a prescribed activity under C*ategory 54A: Water Desalination Plant* under Part V of the EP Act.

The detailed design of the ASDP is in its final stages. The following sections provide details on the current design and construction methodology and may be subject to change. The treatment specifications and final products, including the treatment quality and emissions are not subject to change and will meet the requirements set under the EP Act approval.

The scope of the proposed activities are detailed in Section 5.2.

5.2 Description of Works

Stage 1 of the ASDP project will have a production and treatment capacity of 50 GL per annum of drinking water from desalination. Drinking water produced will be pumped to the Wanneroo Reservoir and Carabooda Tank for onward distribution to the greater Perth region as part of the Perth Integrated Water Supply Scheme (IWSS).

The construction of a groundwater treatment plant is proposed to be co-located within the plant site to provide an additional 4.862 GL per annum into the scheme supply, as approved by MS 1207. Groundwater treatment is not a Prescribed Activity under *Environmental Protection Regulations 1987*, and on this basis no further details are provided in this application.

At a high-level the ASDP plant and treatment process comprise of the following works. Note that not all these activities are prescribed activities (some are located outside of the prescribed premise geographical boundary and have been included for general information purposes only):

- Stage 1 ASDP construction including:
  - Two offshore intake structures (not part of prescribed premises)
  - Intake tunnel (not part of prescribed premises),
  - Seawater intake pumping station (Stage 1 complete, Stage 2 structure only)
  - Reverse Osmosis (RO) pre-treatment facility,
  - Seawater RO,
  - Brine discharge chamber,
  - Brine outfall tunnel, and (not part of prescribed premises)
  - Two brine diffuser structures (not part of prescribed premises)
- Equipping of three (3) Eglinton groundwater production bores (not part of prescribed premises)

- A network of DN300 and DN400 buried bore water collector mains (not part of prescribed premises)
- Eglinton groundwater multi-media filtration system (excluded from the proposed Works Approval as groundwater treatment is not a prespribed category under the *Environmental Protection Regulations 1987* and is independent from the desalination process)
- Potabilisation treatment comprising UV disinfection, lime dosing, carbon dioxide dosing, chlorine disinfection and fluoridation
- Pipelines to convey water around the plant
- Drinking water tanks, pumping station and surge vessels
- Sludge treatment
- Power substation (not part of prescribed premises)
- Electrical equipment, cables and controls systems
- Administration buildings, workshops and stores
- Stage 2 ASDP future plan includes the following scope of works and separate works approval will be sought.
  - Seawater intake pumping station (Stage 2 mechanical and electrical work to be completed)
  - Duplication of the stage 1 Reverse Osmosis (RO) pre-treatment facility,
  - Duplication of the stage 1 Seawater RO,
  - Expansion of the stage 1 potabilisation treatment comprising UV disinfection, lime dosing, carbon dioxide dosing, chlorine disinfection and fluoridation,
  - Duplication or expansion / upgrade of the Drinking water pumping station
  - Expansion of the sludge treatment area
  - Pipelines to convey water around the plant,
  - Electrical equipment, cables and controls systems,

Plate 1 details the main treatment stages/units that comprise the Alkimos Seawater Desalination Plant in a block flow format. These are further explained in the following subsections.

Plate 2 (and Figure 2) shows the plan view of the proposed site layout including both stage 1 and stage 2.

Plate 3 shows a 3D model view of the ASDP site including stage 2 works.

Plate 4 shows a wider plan view of the proposed layout including the seawater intake and discharge tunnels and structures.

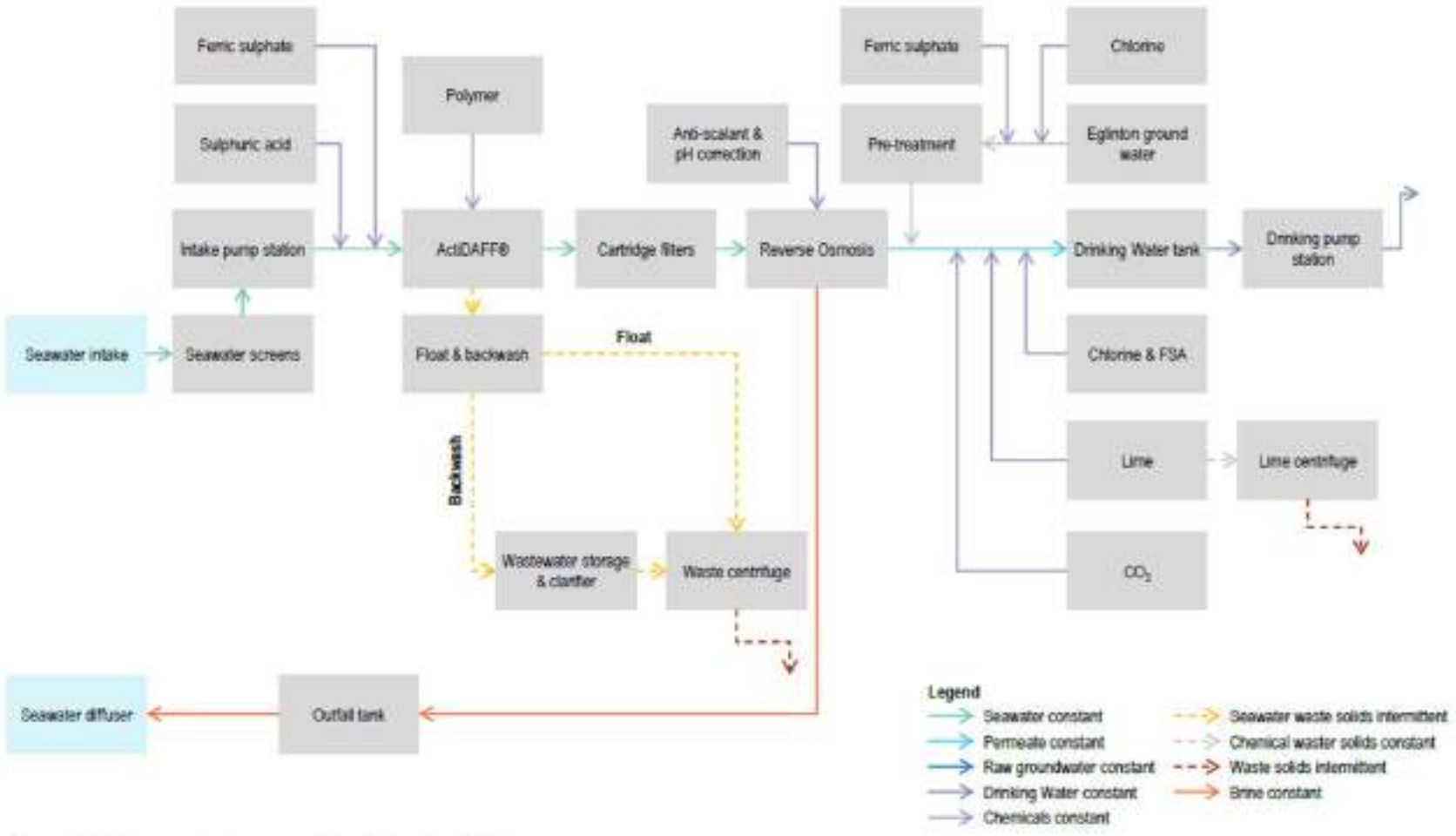
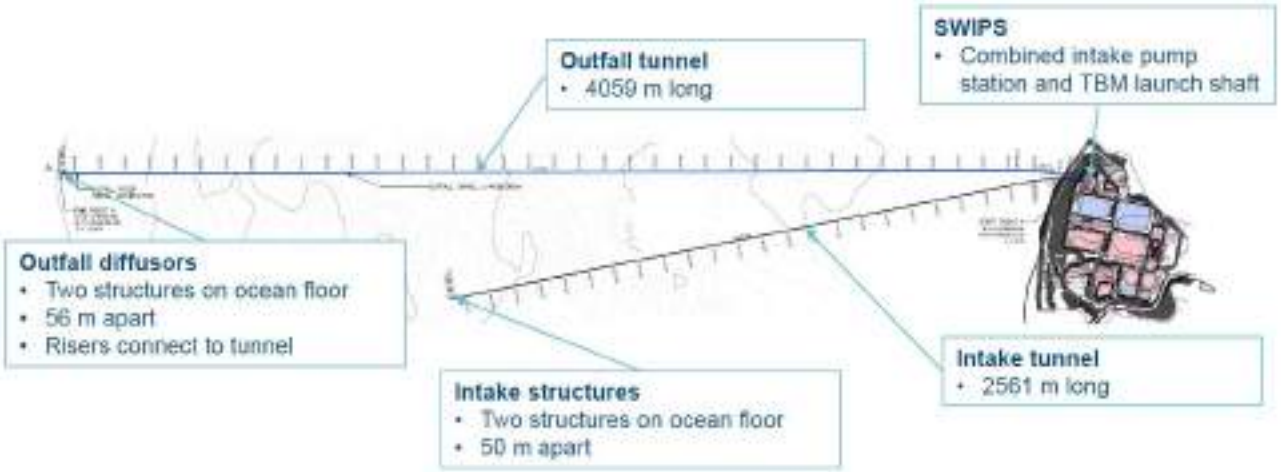


Figure 3-1: Diagrammatic representation of the desalination process

Plate 1 - Process Schematic (Northern Water Partnership, 2023)

Plate 2 – Indicative ASDP Proposed Site Layout Stages 1 and 2 (Northern Water Partnership, 2023)

Plate 3 - 3D Model of ASDP Proposed Site Layout (Stages 1 and 2) (Northern Water Partnership, 2023)



- **Plate 4: ASDP Site Layout including Intake and Outfall structures (Northern Water Partnership, 2023)**

5.2.1 Scope of Proposed Activities

The proposed activities include:

- Temporary works for construction including site offices, crib rooms etc.
- Construction of the Alkimos Seawater Desalination Plant incuding:
  - Tunnel boring machine launching structure
  - Tunnel boring of seawater inlet and brine discharge pipes (not part of the geographical prescribed premise boundary)
  - Intake and discharge riser installation (not part of the geographical prescribed premise boundary)
  - Intake and discharge structures installation (not part of the geographical prescribed premise boundary)
  - Seawater intake pumping station and brine discharge chamber
  - ActiDAFF® pre-treatment
  - Reverse osmosis feed pumping station
  - Cartridge filtration
  - Reverse osmosis
  - Energy recovery systems
  - Chemical receival, storage & dosing systems
- Eglinton multi-media gravity filtration (not part of the prescribed premise)
- Ultraviolet (UV) disinfection
- Potabilization / stabilization including:
  - Lime water preparation & dosing
  - Carbon dioxide storage & dosing
  - Chlorine disinfection
  - Fluoridation
- Drinking water storage tanks
- Drinking water pumping station
- Administration building, workshops & stores
- Commissioning and operation of the works.

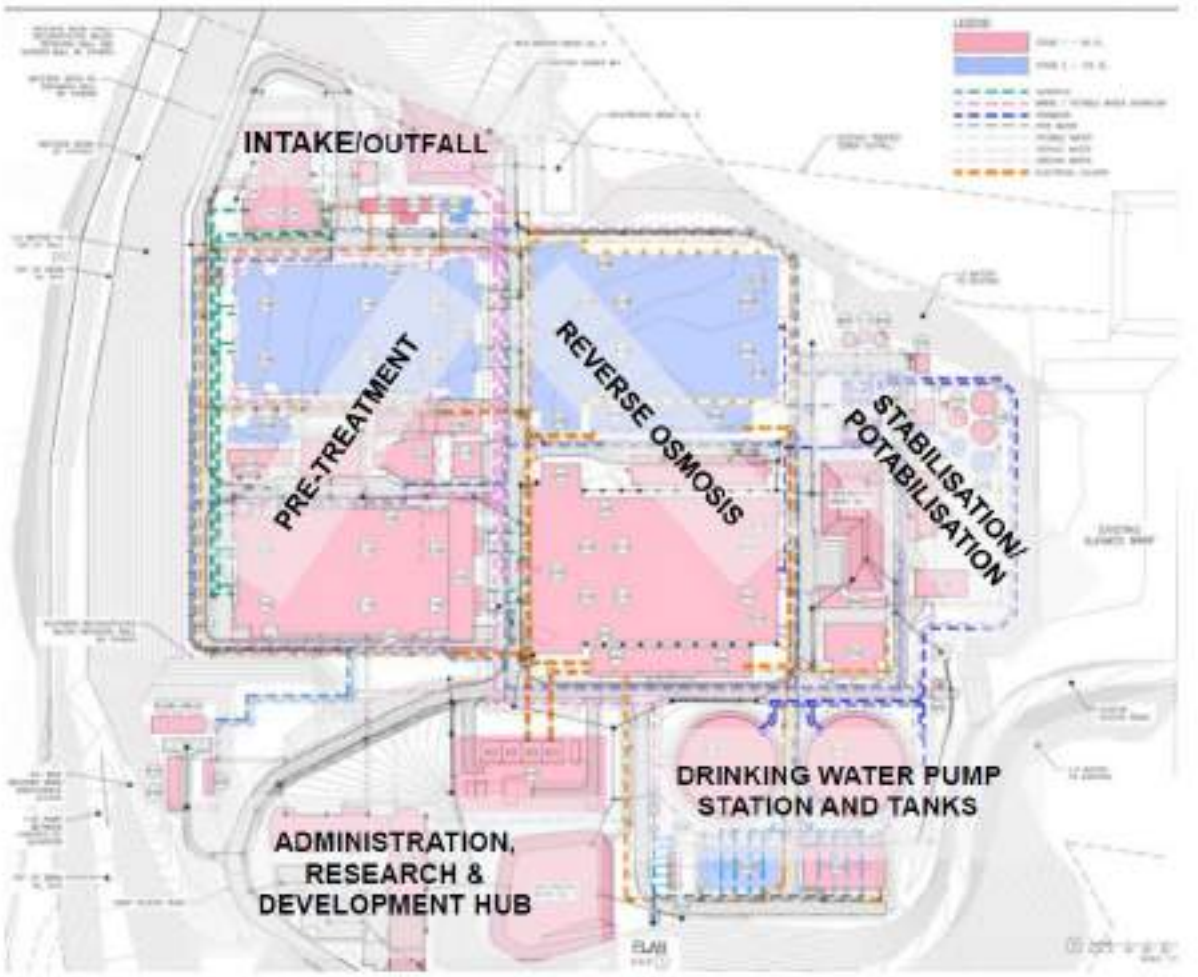


Plate 5 - Simplified Key Components (Northern Water Partnership, 2023)

The following infrastructure are outside the prescribed premises boundary and/ or is independant from the prescribed category and not part of the prescribed activities in this works approval. Details in the later sections are for information purposes only:

- Offshore seawater intake structures
- Intake tunnel
- Brine discharge outfall tunnel
- Brine diffuser structures
- Eglinton groundwater bores and groundwater collector mains
- Eglinton groundwater Treatment Plant

5.2.2 Construction & Commissioning Methodology

5.2.2.1 Temporary Construction Works

The following temporary construction works are required to be undertaken within the ASDP Prescribed Premise Boundary as part of the Works Approval prior to the construction of the permanent infrastructure of the ASDP:

- A temporary 132/11kV substation to power tunnel boring and construction site.
- A temporary 11kV electrical system for distribution of construction site power.
- Temporary site offices, crib rooms, stores, workshops and ablutions to support construction.
- A temporary wastewater pumping station and pressure main to transfer domestic wastewater from the temporary facilities to the inlet of the Alkimos wastewater treatment plant.
- A slurry treatment plant to treat drilling mud, cuttings and groundwater from the tunnel boring operations. Drilling mud (Bentonite) will be recycled back to the Tunnel Boring Machine (TBM). Cuttings will be stabilised, sorted by size and used as structural fill where possible (note the slurry treatment plant will be subject to a separate works approval submitted by the Alliance).
- A temporary access gate with security checkpoint.
- Temporary site construction roads and access ways.
- Temporary laydown areas for materials and plant required for construction of the works.

The following temporary works will be undertaken subject to additional approvals not included within this Works Approval application:

- A temporary helipad for helicopter crew transfers to/from the jack-up barge during the marine construction works (subject to other external approvals).
- A temporary concrete batching plant if required (works approval to be obtained by the Alliance)

5.2.2.2 Tunnel Boring and Launching Structure (for information only - not part of the prescribed premise)

Two slurry shield type tunnel boring machines (TBM) will be procured and delivered to site for tunnel boring of the ~2,561 m long seawater intake tunnel and the ~4,059 m long brine outfall tunnel. A circular TBM launching shaft will be constructed using secant pile wall construction and a second intersecting secant piled shaft will be constructed forming a peanut-shaped temporary structure as shown in Plate 6 (Northern Water Partnership, 2023).

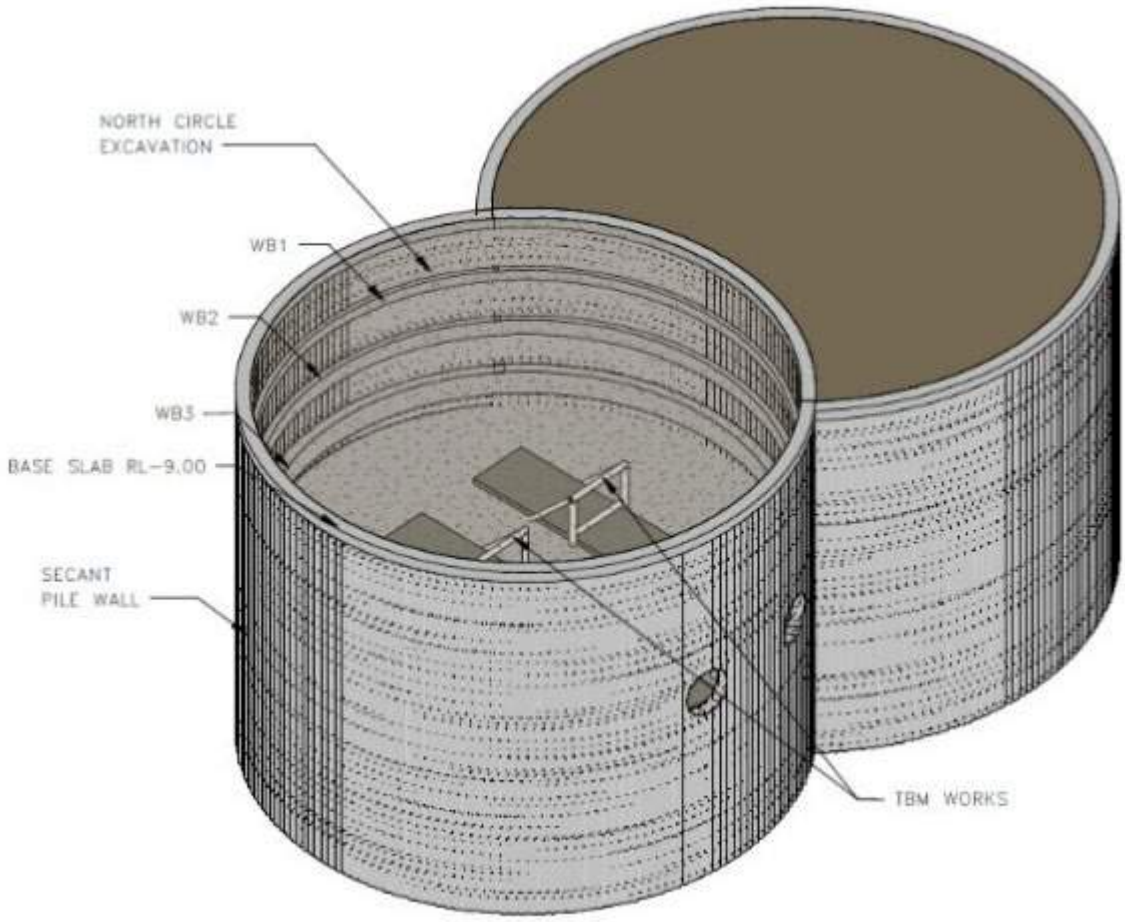


Plate 6 - 3D Model of the Temporary Works TBM Launch Shaft and Secant Piled Wall (Northern Water Partnership, 2023)

The TBMs will be launched into the first shaft and the construction of the seawater intake pumping station and brine chamber structure will be undertaken within the peanut shaped temporary structure. Plate 7 shows a typical arrangement of a TBM launching pad and sealing ring. Two of these will be constructed within the first secant piled shaft, one for the inlet TBM and the other for the outfall TBM.

Plate 7 - Typical TBM Launching Pad and Sealing Ring (Northern Water Partnership, 2023)

Construction of this large temporary structure will require dewatering to be undertaken during internal excavation and placement of a sealed floor at the bottom of the shafts. Groundwater from the dewatering will be temporarily discharged to the adjacent Alkimos WWTP outfall if the water is of suitable quality to not affect the WWTP Outfall license conditions. If not suitable it will be treated and re-infiltrated via a temporary pond. This assessment will be based on the turbidity, salinity, dissolved metals, and other components present in the groundwater and will be managed under MS1207 and an approved Groundwater Management Plan (Northern Water Partnership, 2023).

5.2.2.3 Tunnel Boring of Seawater Inlet and Brine Discharge Pipes (for information only - not part of the prescribed premise)

Tunnel boring operations involves drilling of the tunnels at the cutting face of each TBM while recirculating drilling fluid balances against the surrounding groundwater pressure and carries the cuttings away from the cutting face. The drilling fluid carries the cuttings and infiltrated water back through service piping in the tunnel to the TBM wastewater treatment plant located onshore at the ASDP site (refer section 1.2.2). The TBM slurry treatment plant recovers and restores the drilling fluid for return to the TBM cutting face while infiltrated water and cuttings are separated and treated to a suitable quality for recycling/reuse or disposal, (note the slurry treatment plant will be subject to a seperate works approval submitted by the Alliance) (Northern Water Partnership, 2023).

Reuse applications for cuttings are under investigation for the adjacent residential development, however such reuse is subject to *Contaminated Sites Act 200*3 requirements and the material meeting user specifications (e.g. composition, particle size distribution, colour, strength etc) (Northern Water Partnership, 2023).

TBM operation is a non-continuous operation where the TBM is advanced by the width of a tunnel segment (nominally 1200mm) and then a single ring of precast tunnel lining “segments” that interlock with each other is placed to extend the tunnel length by this amount. The ring of segments is placed through an opening in a rotating part of the TBM shield. After the TBM later advances past that ring segments workers inject grout into the annulus between the segments and the tunnel bore to seal the tunnel and secure the segments into place, ensuring the integrity of the tunnel. Plate 8 shows some typical precast concrete tunnel segments with single elastomer seals that are similar type to those that will be used for the ASDP tunnels (those pictured are for a larger diameter tunnel) (Northern Water Partnership, 2023).

Plate 8 - Example of Typical Pre-cast concrete tunnel segments with single seal (Northern Water Partnership, 2023)

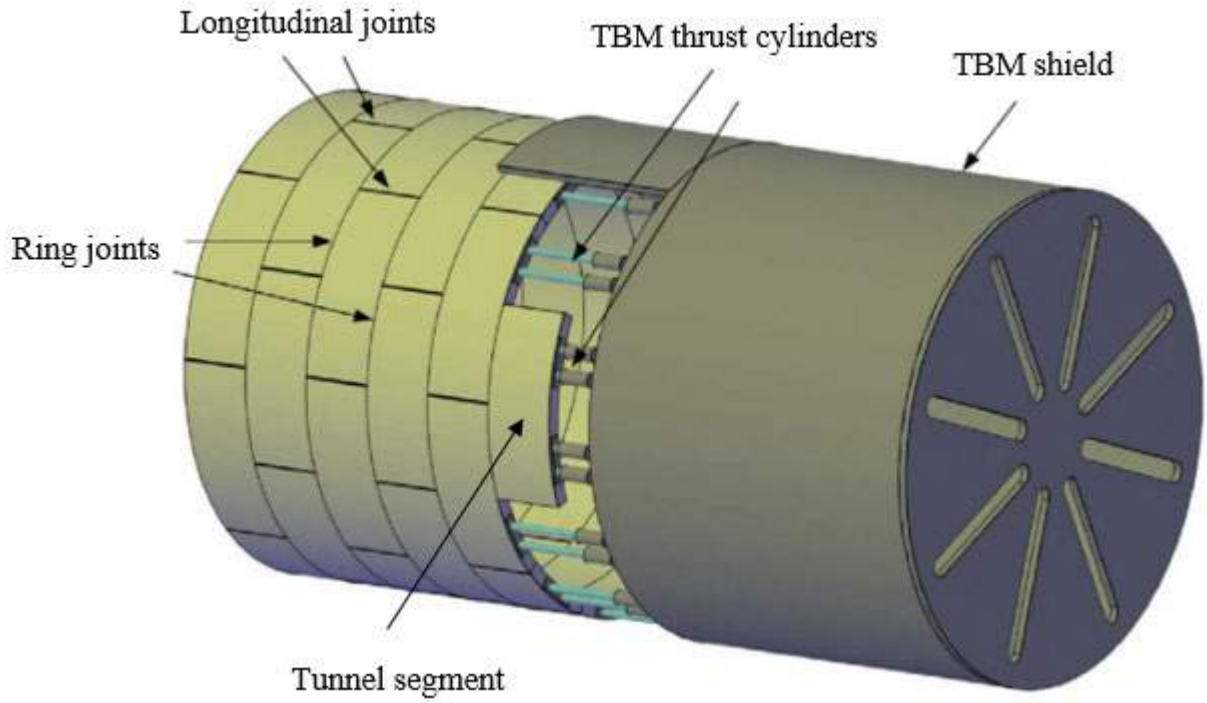


Plate 9 - Diagrammatic representation of a slurry shield TBM installing a segmentally lined tunnel (Northern Water Partnership, 2023)

Behind the TBM is a multiple bogey train, rail and utilities to service all the required TBM operations including:

- Power
- Compressed air
- Ventilation air
- Cuttings pumps
- Tunnel segment transfer to the TBM
- Grouting operations
- Testing
- Cutting heads and other consumables
- Tools & spares for TBM maintenance (Northern Water Partnership, 2023)

Utility and process connections to and from the TBM are constructed down the length of the tunnel as it is constructed with flexible hoses connecting to the TBM with sufficient coiled length for each TBM “push”. Once the length of a push is reached, all these services must be lengthened along the new section of tunnel that has just been built and reconnected to the TBM before the next push can start. Plate 2 shows the plan view of the ASDP, tunnels, intake structures and outfall diffusers (Northern Water Partnership, 2023)

5.2.2.4 Intake and Discharge Riser Installation (for information only - not geographically part of the prescribed premise)

While the intake and outfall tunnels are being constructed by the two TBM's and prior to their arrival at the locations of the risers, the four (4) risers will be installed in the seabed at their approved locations. There are two risers that are 50m apart for the intake structures and two risers that are 56.8m apart for the diffuser structures. Riser locations have been selected to:

- avoid reef damage by locating them away from reef areas
- minimise impact to recreational waters
- minimise shipping risks from the intake and outfall structures
- ensure excellent quality seawater is fed to the desalination plant (intake locations)
- ensure excellent mixing of brine discharged to the marine environment (discharge locations)
- minimise recirculation between the ASDP outfall and ASDP intake
- minimise the risk of potential pathogens from the Alkimos WWTP outfall entering the ASDP intake (Northern Water Partnership, 2023).

Plate 10 shows a 3D model section view through a seawater intake structure and its associated riser including connection to the tunnel below. Plate 11 shows similar detail for the brine discharge diffuser (Northern Water Partnership, 2023). The sea floor is not shown for clarity in these images.

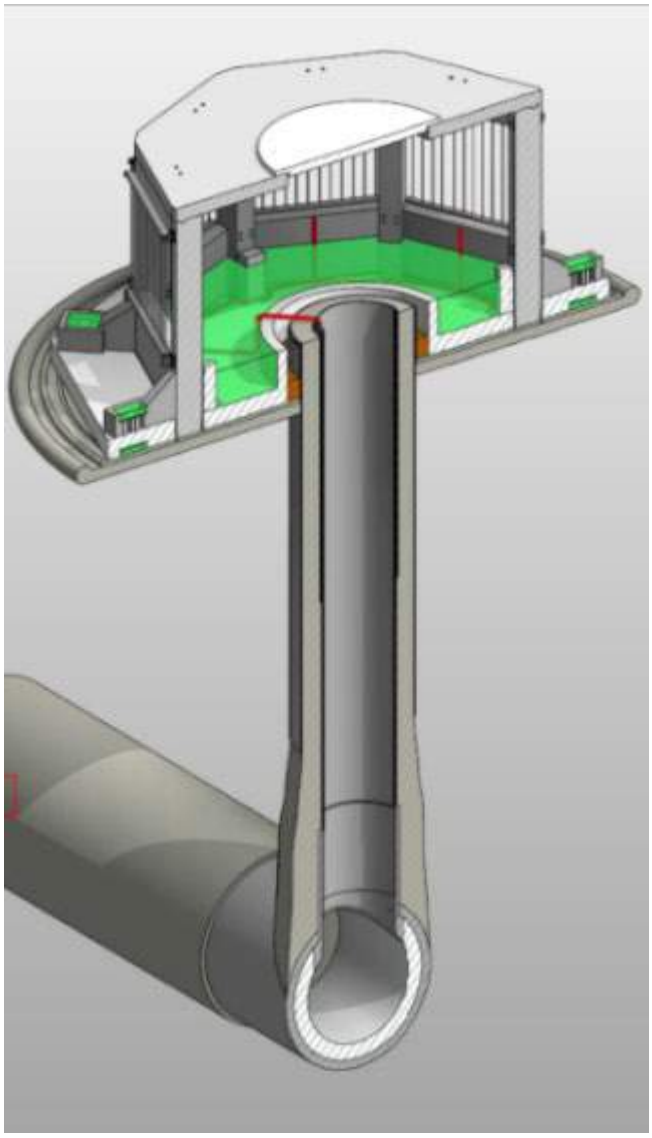


Plate 10 - 3D Model Section View through Seawater Intake Structure and Riser (Northern Water Partnership, 2023)

Plate 11 - 3D Model Section View through a Brine Diffuser Structure and Riser (Northern Water Partnership, 2023)

The risers will be installed into the seabed from a jack-up barge and will protrude above the sea floor for subsequent installation of the intake and outfall structures. The risers will be capped to prevent entry of seawater until construction is complete and the tunnels are required to be flooded. Note that the intake and outfall structures that sit on top of the risers and rest on the sea floor will also be subsequently installed from the jack-up barge (Northern Water Partnership, 2023).

The jack-up barge “marine campaign” will last several months and will involve several other support vessels. Crew transfers to/from the jack-up barge during the marine campaign are proposed to be by helicopter transfer from a temporary helipad at the ASDP (Northern Water Partnership, 2023).

After the TBM’s have passed under the location of each pre-installed riser and the respective tunnel is completed, a purpose designed reinforcing collar will be constructed inside the tunnel at the tie-in location of each riser. The construction team will then grout and/or freeze the ground between the riser and the tunnel to allow excavation through the crown (top) of the tunnel to the bottom of the riser. A sealed connection between the tunnel and the riser is then constructed(Northern Water Partnership, 2023).

5.2.2.5 *Intake and Discharge Structures Installation (for information only - not part of the prescribed premise)*

The intake and discharge structures will be installed and connected to each riser by divers operating from the jack-up barge and using cranes on the barge. The area around each riser is first prepared by removing soft sediments and leveling the sea floor.

Each structure comprises several components, each of manageable weight. The components are placed over the respective riser and assembled by divers. The annulus between the assembled structure and the riser is grouted to create a seal. Optional anchors may be drilled into the sea floor to ensure the stability of the structure in heavy seas. Rock protection is then placed around the base of the structure to prevent erosion and undermining by currents and swell (Northern Water Partnership, 2023).

Plate 12 shows a 3D model of the brine diffuser structure (1 of 2). This type of diffuser is referred to as a “rosette” style diffuser. That proposed for ASDP includes seven (7) nozzles on each rosette diffuser. The diffuser nozzles are at 45-degree angles (which would suggest 8 ports on each diffuser, however in the ADSP case the inner facing locations on each diffuser do not have a nozzle. Plate 13 illustrates this. This design improves mixing outcomes because the two inner facing nozzles would otherwise concentrate the brine discharge at the location directly between the two diffusers. The two (2) rosette diffuser are located at 56.8m separation from each other at the locations specified in the EPA approval for the project (Northern Water Partnership, 2023).

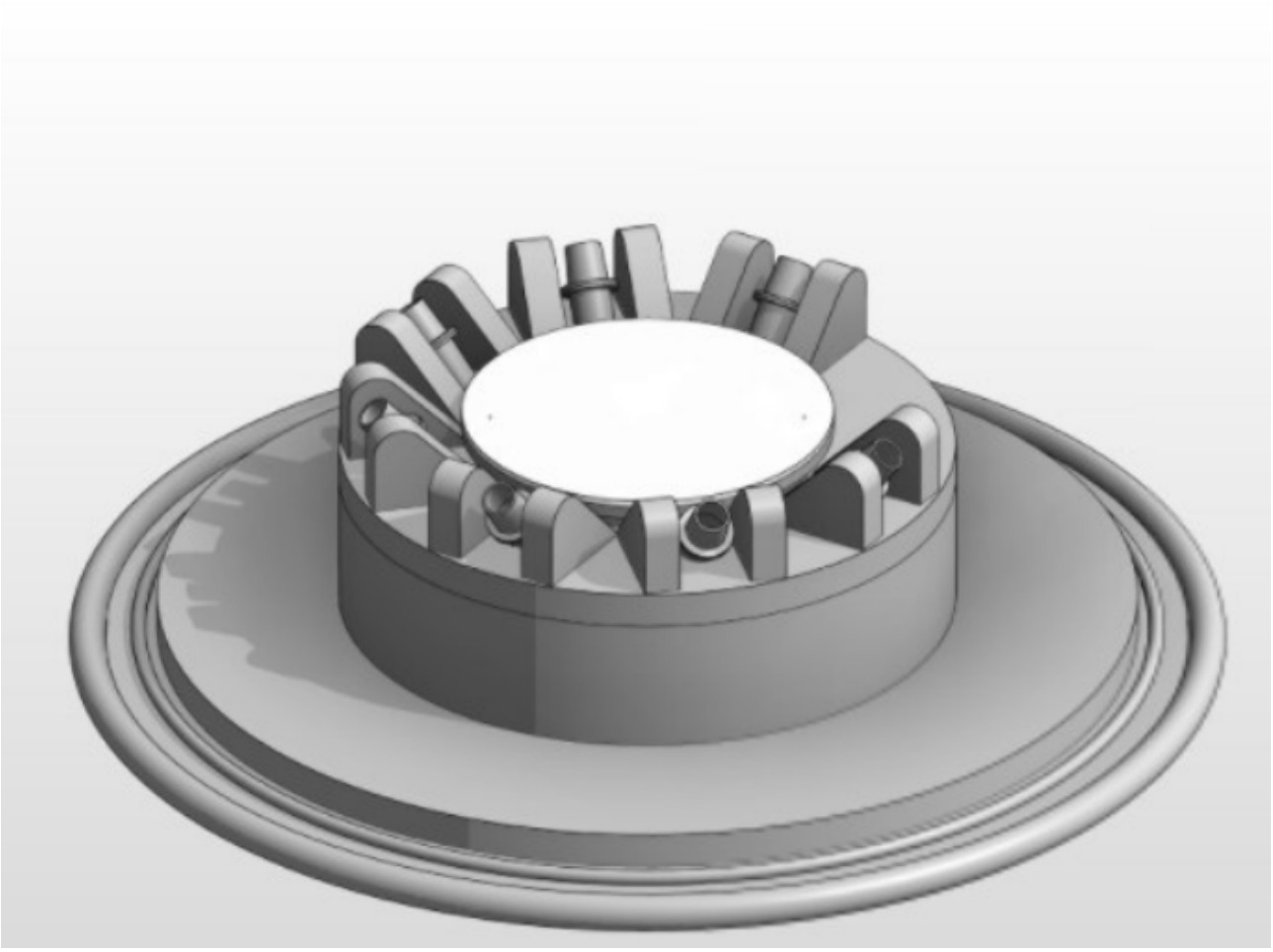


Plate 12 - 3D Model of a Brine Diffuser Structure (Northern Water Partnership, 2023)

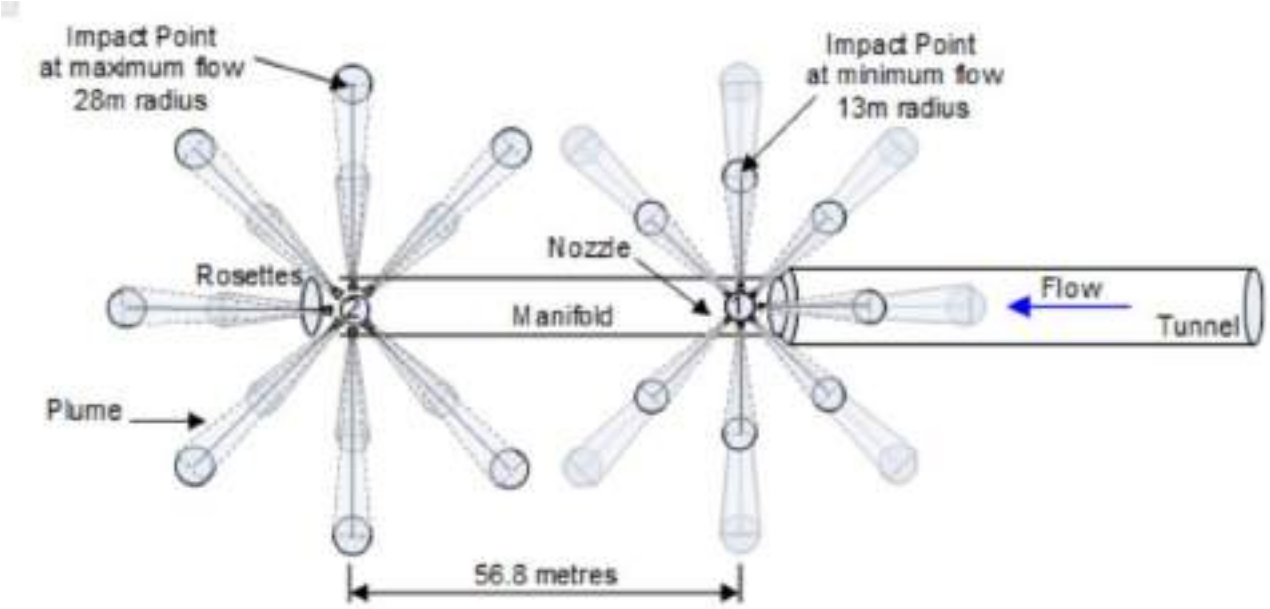


Plate 13 Diagram of Brine Discharge Diffuser Pattern (Northern Water Partnership, 2023)

5.2.2.6 Seawater Intake Pumping Station and Brine Discharge Chamber

Section 6.2.2.2 described the peanut shaped temporary secant piled chambers that will be constructed for launching of the TBM's. Following TBM launching, the seawater intake pumping station (SWIPS) will be constructed within this temporary structure. Plate 14 shows a 3D model of the SWIPS aerial view from the north-west (Northern Water Partnership, 2023).

Plate 14 - 3D Model of Seawater Intake Pumping Station (SWIPS) and Brine Discharge Chamber (Northern Water Partnership, 2023)

The seawater intake pumping station is a concrete structure with multiple channels, equipment and compartments/chambers that fulfill the following functions:

- Receive seawater inflow from the two (2) offshore subsea intake structures via the intake tunnel that connects to the SWIPS.
- Separate and direct the flow to the Stage 1 and Stage 2 SWIPS areas, both of which are constructed during the ASDP Stage 1 works (the stage 2 SWIPS area will not be fitted out mechanically and electrically until ASDP stage 2 is constructed).
- Condition the flow hydraulics (velocity, turbulence etc.) for optimum performance of the continuous band screens and seawater pumps that are located within the SWIPS channels and compartments.
- Channel the seawater through continuous band screens that remove coarse suspended matter from the seawater – e.g. seaweed, shellfish and any other entrained macro marine organisms noting that these are minimised by adopting best design practices for the seawater intake structures.

- Feed the screens seawater to the seawater booster pumps that are submerged within the last chambers of the SWIPS and deliver flow to the RO pre-treatment area.
- Collect and drain screenings that are removed by the continuous band screens. These are collected into skip bins. Odours are minimised to acceptable levels by managing the "age" of the screenings such that they do not putrefy while onsite or during transport. This has been demonstrated as effective at other operating Seawater Desalination Plants (Perth & Binningup).
- Receive RO brine and other clean plant waste streams into the brine discharge chamber for discharge to the ASDP brine diffusers via the outfall tunnel.
- Maximise energy recovery from the brine turbine that is located at the SWIPS.
- Various isolations required for plant operation and maintenance (Northern Water Partnership, 2023).

5.2.2.7 ActiDAFF® Pre-Treatment

ActiDAFF® is a combination of dissolved air flotation within a multi-media gravity filter as depicted in Plate 15. The ActiDAFF® units remove suspended material and any pathogens that are present in the incoming seawater so that the filtered seawater can be fed to the reverse osmosis membranes. The seawater pumps at the SWIPS transfer the screened seawater to 18 ActiDAFF® units (Plate 16) (Northern Water Partnership, 2023).

The dissolved air flotation part of the ASDP ActiDAFF®s will only be run when required – this is when the incoming seawater quality is poor. The majority of the time the multi-media filters will be sufficient to remove the incoming suspended material in the seawater. This aims to reduce power consumption within the ASDP(Northern Water Partnership, 2023).

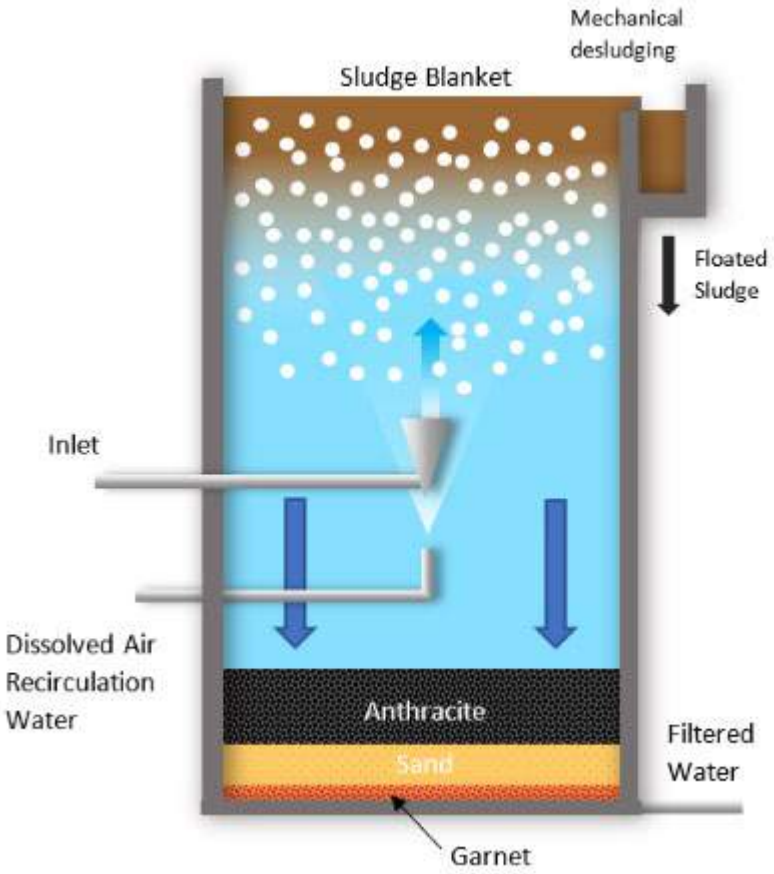


Plate 15 - Diagram of ActiDAFF® Operations (Northern Water Partnership, 2023)

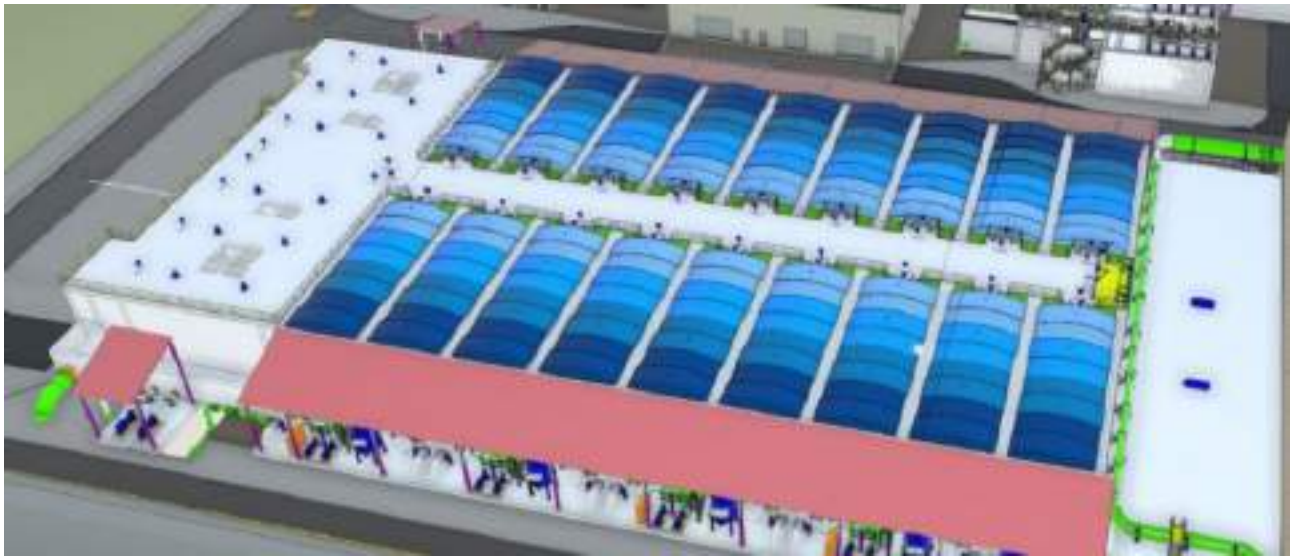


Plate 16 - 3D Model of ActiDAFFs® Structure (Northern Water Partnership, 2023)

The adjustment of pH, coagulant dosing, flocculant dosing and controlled mixing occurs upstream of the ActiDAFF® units to promote coagulation and flocculation of the suspended materials and any pathogens so that they are removed efficiently in the ActiDAFF®s. Coagulation also converts some of the dissolved organics present in seawater into a solid particulate for that is also removed

in the ActiDAFF® units. Removal of these organics helps to reduce fouling in the downstream reverse osmosis membranes which increases membrane life and reduces overall chemical and power consumption (Northern Water Partnership, 2023).

There are two waste streams from the ActiDAFF® units. When the dissolved air flotation part of the ActiDAFF® is in operation, a floating sludge blanket accumulates on the surface of each unit. This sludge blanket is periodically removed by a mechanical rake system and the sludge is sent to the sludge treatment area. The other waste stream comes from the need to periodically backwash the filter part of each ActiDAFF®. The solids containing backwash waste is also directed to the sludge treatment area (Northern Water Partnership, 2023).

Plate 17 details an example of the ActiDAFF® units during construction.

Plate 17 - Example of an ActiDAFF® Cell during Construction (Northern Water Partnership, 2023)

5.2.2.8 Filtered Water Tank & Reverse Osmosis Feed Pumping Station

After passing through the ActiDAFF® units the “filtered water” is collected in the Filtered Water Tank that is located that the eastern end of the ActiDAFF® structure. From this tank, Reverse Osmosis Feed Pumps direct the filtered water to the Reverse Osmosis building. Under the power of the Reverse Osmosis Feed Pumps, the filtered water is passed through the RO Cartridge Filters and into the suction of the High-Pressure RO Pumps (Northern Water Partnership, 2023).

Plate 18 shows a 3D model view of the Filtered Water Tank and the Reverse Osmosis Feed Pumping Station (Northern Water Partnership, 2023). The view is looking at these items from the north.

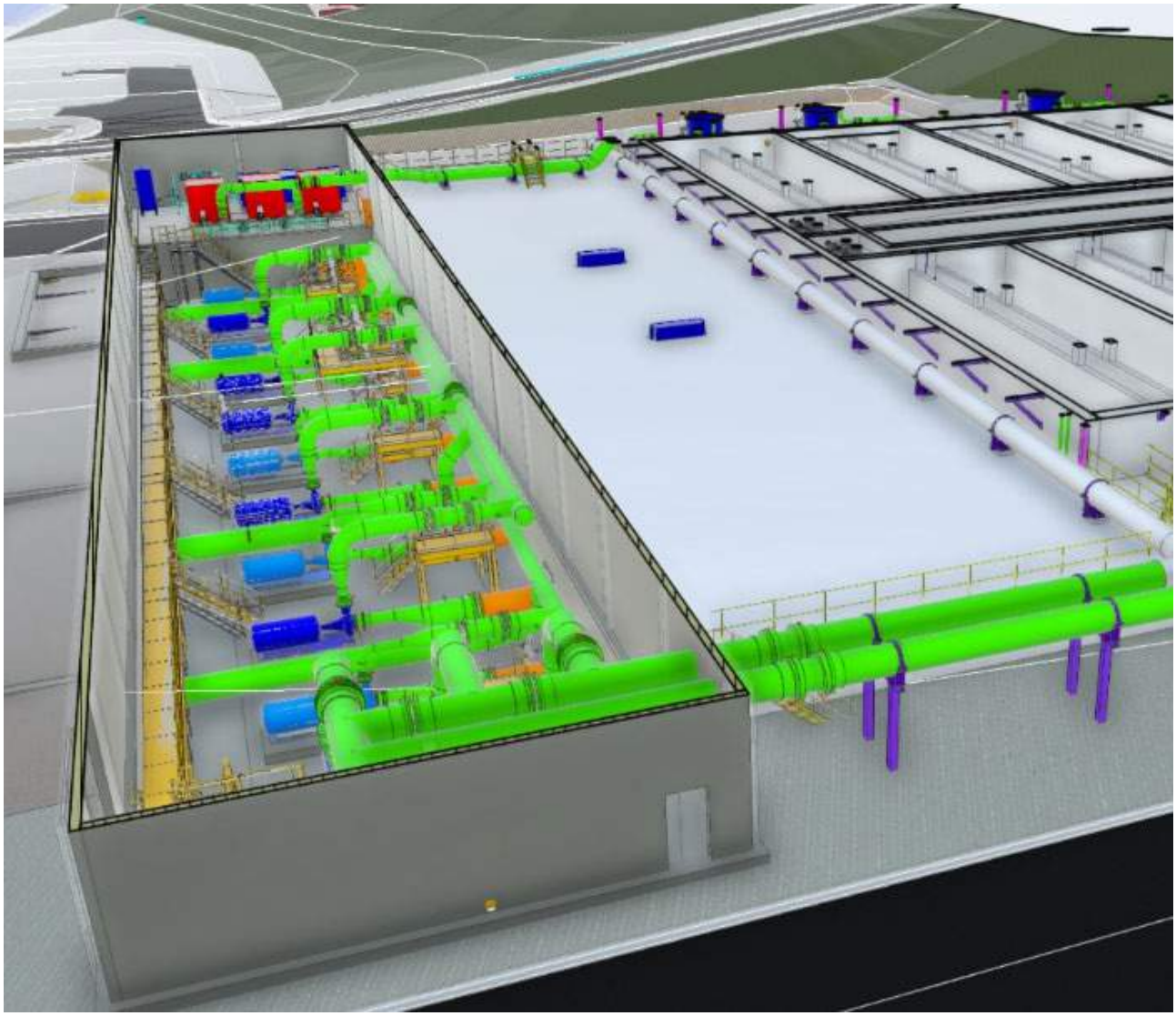


Plate 18 - 3D Model of the Filtered Seawater Storage and RO Feed Pumping Station (roof of building omitted) (Northern Water Partnership, 2023)

5.2.2.9 Cartridge Filtration

Located within the reverse osmosis building, a bank of cartridge filters provides a final stage of protection from suspended solids and foreign objects for the reverse osmosis membranes. Plate 19 shows a 3D model view of the cartridge filters and their associated maintenance platform (Northern Water Partnership, 2023).

Plate 19 - 3D Model of Cartridge Filters (Northern Water Partnership, 2023)

The filter elements within each cartridge filter vessel gradually block up and are required to be periodically changed. The frequency of this is expected to be 1-2 times per year per cartridge filter however this frequency can vary depending on seawater quality and how the pre-treatment performs. The waste cartridge filter elements are typically taken to landfill but significant investigations are being done by the Water Corporation and wider desalination industry to identify reuse or recycling of these (Northern Water Partnership, 2023).

5.2.2.10 Reverse Osmosis

A two pass, split hybrid reverse osmosis system will remove dissolved salts from the filtered seawater. The reverse osmosis system also acts as a further barrier to any pathogens in the seawater.

Stage 1 will contain six (6) first pass RO racks and six (6) second pass RO racks. Each second pass RO rack is configured as two stages to meet the target drinking water quality objectives while balancing the overall recovery of the RO system (Northern Water Partnership, 2023).

Plate 20 shows a 3D model view looking down the maintenance access corridor of the 1st pass RO racks (Northern Water Partnership, 2023).

Plate 20 - 3D Model of RO Rack Area within the RO Building (Northern Water Partnership, 2023)

A high-pressure feed pump feeds filtered seawater to each 1st pass rack. These pumps are the largest pumps on the ASDP and generate considerable noise. To ensure compliance with the environmental noise requirements all noisy RO equipment including the high-pressure feed pumps, RO energy recovery devices and RO reject valves will be located with a central room within the RO building. This room is purpose designed to limit the noise levels outside the room for operator amenity and to ensure compliance with the required noise criteria at the site boundary (Northern Water Partnership, 2023).

An antiscalant is dosed into the seawater upstream of the RO racks and energy recovery devices to suppress the formation of inorganic scales in this equipment. A second antiscalant dose occurs at the feed to the second pass RO racks for the same purpose (Northern Water Partnership, 2023).

Also located within the RO Building and adjacent RO CIP Building are the chemical system and piping for periodically cleaning the RO membranes. These clean-in-place (CIP) systems allow for the batching of various dilute chemical solutions and their subsequent circulation through the RO membranes to remove contaminants from the membranes and maintain their optimal performance. The CIP chemicals proposed are caustic soda, ethylenediaminetetraacetic acid (EDTA), sodium bisulphite, citric acid, sodium lauryl sulphate and 2,2-dibromo-3-nitrilopropionamide (DBNPA). After each membrane rack clean, the waste CIP solutions are neutralised before being discharged to the brine outfall (Northern Water Partnership, 2023).

5.2.2.11 Energy Recovery Systems

In line with MS1207 a Greenhouse Gas Management Plan has been prepared to ensure there are zero net scope 1 and 2 GHG emissions from the commencement of operations throughout the life

of the proposal. One aspect in meeting this requirements is energy recovery, which is described further below.

Energy recovery is an important part of any modern seawater reverse osmosis plant and ASDP is no exception. The high-pressure feed to the RO membranes exceeds 6000 kPa and the RO brine coming out of the RO membranes retains almost all this pressure. When you consider that this high-pressure RO brine stream is around 55 - 60% of the feed flow entering the RO membranes (the RO permeate is the other 40 - 45%), you can appreciate why energy recovery is important. With modern energy recovery devices like the 97%+ efficient pressure exchangers that will be used in ASDP, the electrical power that is required to feed the RO are halved (or less)! This is compared to an equivalent seawater RO plant that does not have energy recovery (Northern Water Partnership, 2023).

ASDP will include two different major systems of energy recovery. The first is the RO pressure exchangers that recover the pressure in the RO brine and transfer it at 97%+ efficiency into a portion of the RO feed. This is done using multiple pressure exchanger units arranged in racks. Plate 21 below shows a typical RO pressure exchanger rack. As already noted, the pressure exchanger racks will be located within the central equipment room inside the RO building due to the moderate levels of noise that is generated by the pressure exchangers (Northern Water Partnership, 2023).

Plate 21 - Example of Typical RO Energy Recovery Rack within RO Building (Northern Water Partnership, 2023)

The pressure exchangers that will be used at Alkimos require approximately 110kPa of backpressure at their brine outlet to prevent cavitation within them. It is normal for this backpressure to be provided using a control valve or a weir chamber between the pressure exchangers and the brine discharge chamber. In most seawater desalination plants this ~110kPa pressure is “lost” at the control valve or downstream of the weir chamber. ASDP will recover as much of this pressure energy as practical using an energy recovery turbine located between the weir chamber and the brine discharge chamber. It is estimated that the brine turbine will reduce site power consumption by 2100 MWh annually representing 906 tonnes of CO2 equivalent (Northern Water Partnership, 2023).

Plate 22 below shows a 3D model view of the energy recovery turbine located on a platform above the Brine Outfall Chamber (Northern Water Partnership, 2023).

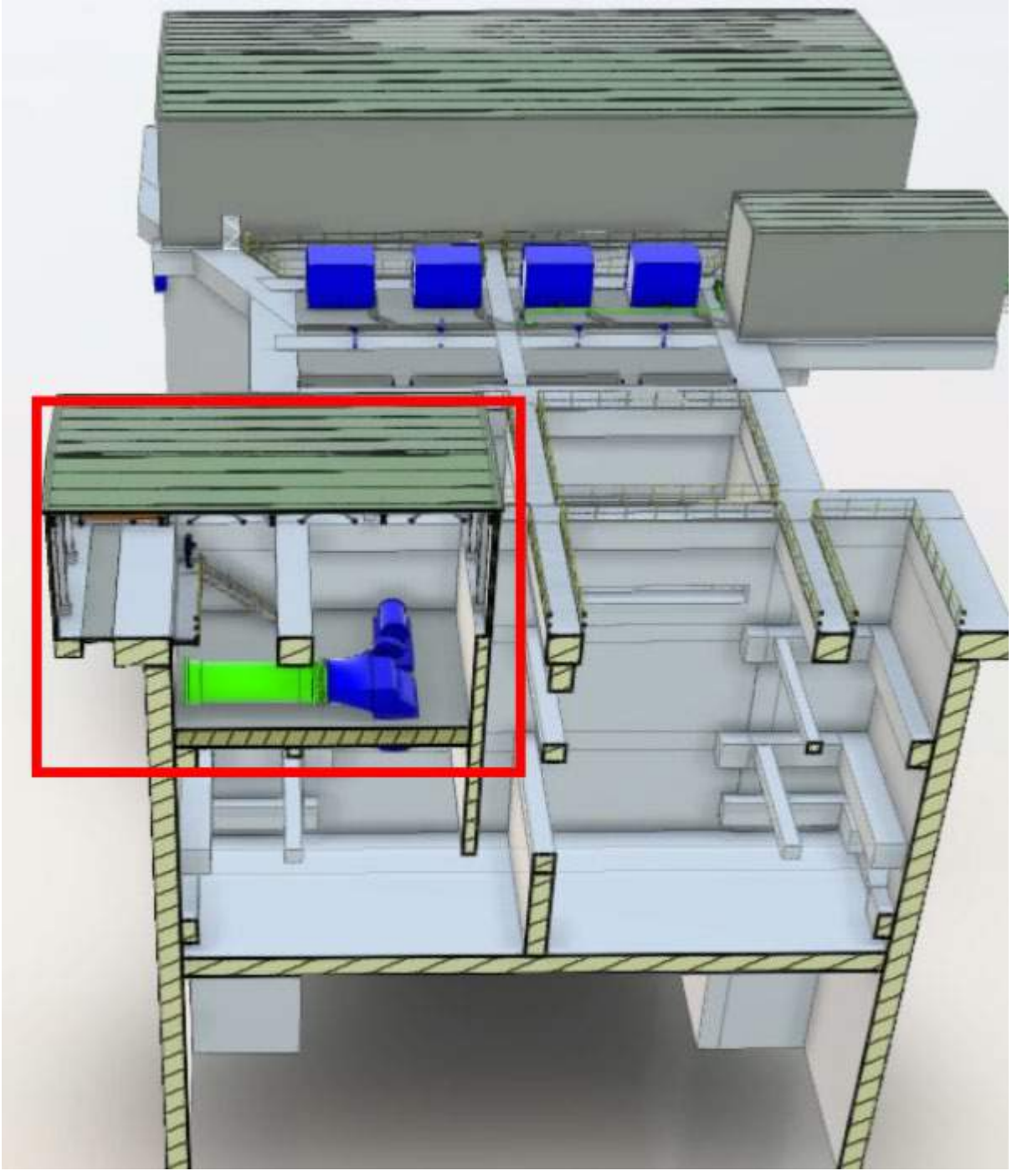


Plate 22 - 3D Model of Brine Outfall Energy Recovery Turbine (Northern Water Partnership, 2023)

The combination of RO Pressure Exchangers and Brine Energy Recovery Turbine will maximise the amount of energy recovered from the high-pressure RO brine coming out of the RO membranes.

5.2.2.12 Clean-in-Place (CIP) Waste Handling Systems

A range of CIP chemicals are used to maintain the reverse osmosis membranes. These are caustic soda, ethylenediaminetetraacetic acid (EDTA), sodium bisulphite, citric acid, Sodium Lauryl Sulphate and 2,2-dibromo-3-nitrilopropionamide (DBNPA). These chemicals are batched into dilute solutions in the RO CIP area and recirculated through an RO rack within the RO building. Sometimes the membranes are left to soak in these solutions. After CIP of an RO rack, the rack must be drained of the CIP solution and then flushed with permeate or seawater to remove any residual traces of the chemicals before being used again for drinking water production (Northern Water Partnership, 2023). The management of the clean-in-Place (CIP) Waste Handling System will be in accordance with MS1207, EPBC approval 2019/8453 and the Commissioning and Operational Marine Environmental Management Plan (COMEMP).

The “spent” CIP solutions and the contaminated flushing water are collected in a CIP waste tank. The spent CIP solutions are pH neutralised within the CIP waste tank. Most of these neutralised solutions then have sufficiently low eco-toxicity for discharge into the ASDP brine outfall where further dilution with RO brine and seawater within the low environmental protection area (LEPA) ensure the safe discharge with environmental impacts remaining as low as reasonably practical. This will be confirmed by Whole Effluent Toxicity Testing (WET testing) in accordance with MS 1207 (Northern Water Partnership, 2023).

Caustic soda, Sodium Lauryl Sulphate & Ethylenediaminetetraacetic acid (EDTA)

A CIP solution comprising these three chemicals is typically applied to RO membranes to remove metal contaminants from the membrane, particularly iron sulphate. The batched solution comprised Na4-EDTA at concentrations normally between 0.5 – 1.0% and sodium lauryl sulphate at typically 3%. The CIP batch is adjusted to 11 – 12.5pH with caustic soda (Northern Water Partnership, 2023).

It is uncertain at this time whether there will be sufficient dilution in the brine stream to reduce the ecotoxicity to acceptably low levels, of certain CIP wastes that contain EDTA as a component (including a normal safety factor of 10 to EC10). If doubts remain at completion of engineering design, then this neutralised CIP waste will not be directed to the brine outfall without further treatment to address ecotoxicity. Alternatively another disposal method will be identified, or an alternative membrane cleaning chemical solution will be investigated during operation. All methods will be undertaken in accordance with the Whole Effluent Toxicity (WET) testing requirements as per MS1207 and the Construction and Operation Environmental Management Plan (COMEMP) (Water Corporation, 2022a; 2023d).

Citric acid

A CIP solution of up to 3% citric acid is commonly used to address RO membrane fouling with metal hydroxides. The CIP solution is acidic with pH in the range 2.0 – 4.0. After cleaning the membranes, the spent citric acid solution will be neutralised with caustic soda. This converts the residual acid to sodium and citrate salts. Dilution of this neutralised solution into the RO brine stream will reduce concentration to levels that ensure compliance with the MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Sodium bisulphite

A solution of up to 3% sodium bisulfite (SBS) is commonly used to preserve RO membranes in racks that are to be shut down for longer than 24 hours. When the RO rack is to be re-started this preservation solution is neutralised within the CIP waste tank before discharge with RO brine. Sodium bisulfite solution breaks down to sodium and sulphate salts when exposed to air or mixed with oxidising chemicals. The waste SBS will partially decompose in the CIP waste tank and dilution with RO brine will further reduce its concentration to levels that ensure compliance with MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

2,2-dibromo-3-nitrilopropionamide (DBNPA)

DBNPA is a highly effective broad-spectrum biocide used to control algae, bacteria and fungi fouling on reverse osmosis membranes. It is normally applied as a shock treatment using CIP. The frequency of use depends on the level of microbiological activity in the RO feed water (which is expected to be extremely low for ASDP) and the age/condition of the RO membranes.

When used for RO membrane CIP, the spent DBNPA solution is neutralised with SBS prior to discharge with the RO brine. This neutralisation and dilution ensure that the CIP waste complies with MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

5.2.2.13 Chemical Receival, Storage and Dosing Systems

There are several chemical receival, storage and dosing systems required for efficient operation of ASDP and to ensure the quality and safety of the drinking water produced by the plant. Some of these have already been mentioned in earlier subsections (e.g. RO pre-treatment coagulant & RO CIP chemicals). This section will provide a brief description of each chemical and its use in the treatment process. All chemical receival, storage and dosing systems will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007..*

Sodium hypochlorite

Sodium hypochlorite will be intermittently dosed into the seawater intake to control marine fouling in the intake structure and intake tunnel. Chemical solution lines installed inside the intake tunnel will convey the chemical solution to the dosing locations within each of the two intake structures.

12.5% sodium hypochlorite will be delivered to site and stored in 1000L isotainers within a bunded area within the SWIPS chemical building (Northern Water Partnership, 2023) in accordance with the *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007 .*

All sodium hypochlorite dosed into the seawater intake will be fully neutralised with sodium bisulphite upstream of the reverse osmosis membranes. No free chlorine will be discharged to the outfall. The neutralisation reaction, once pH adjusted, produces only sodium ions, chloride ions and sulphate ions in solution (Northern Water Partnership, 2023).

Sulphuric acid

Sulphuric acid is used at multiple locations throughout the treatment process for pH reduction of seawater and to neutralise high pH waste streams prior to discharge. The 98% sulphuric acid will be delivered to site in bulk and stored in a single bunded chemical storage tank within the pre-treatment chemical building in accordance with the *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007 .*

All sulphuric acid used is pH neutralised prior to discharge to the outfall. Once neutralised sulphuric acid produces sulphate ions in solution. This neutralisation and dilution ensure that the waste complies with MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Sodium meta-bisulfite / sodium bisulfite

Sodium meta-bisulphite solution is used in multiple locations throughout the seawater desalination plant:

- For neutralisation of chlorine dosed to the seawater intake so that free chlorine is not present at the RO membranes (free chlorine rapidly damages RO membranes).
- For intermittent dosing upstream of the RO membranes and energy recovery devices to control aerobic bacteria growth within.
- For preservation of RO membranes in RO racks not in use for >24 hours (Northern Water Partnership, 2023)

Sodium met-bisulphate solution (40%) will be delivered to site in IBC's and stored accordance with the *Dangerous Goods Safety Act 2004, Dangerous Goods Safety (General) Regulations 2007* for use as required. When diluted with water, sodium meta-bisulphite forms sodium bisulfite (Northern Water Partnership, 2023).

When sodium bisulphite is used to neutralise chlorine, it is normal to apply excess bisulphite as a safety measure. Therefore, some un-reacted sodium bisulphite can be present in the outfall discharge occasionally. Due to dilution with the large volume of brine however, the discharge concentration becomes negligible at the diffuser. The oxidation potential of the combined discharge to the diffuser is continuously monitored to ensure this (Northern Water Partnership, 2023). This waste is managed to comply with MS 1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Ferric Sulphate

Ferric sulphate is used as a general-purpose coagulant that is dosed at the following plant / process locations:

- Upstream of the ActiDAFF® units to coagulate fine colloidal material and dissolved organics so they can be effectively removed in the ActiDAFF®'s

- Upstream of the Eglinton groundwater filters to coagulate fine colloidal material and dissolved organics so they can be effectively removed in the multi-media filters.
- In the sludge treatment area to improve the performance of sludge thickening (Northern Water Partnership, 2023).

Ferric sulphate solution (42%) will be delivered to the ASDP site in bulk and stored in two bunded tanks located at the pre-treatment chemical storage building in accordance with *Dangerous Goods Safety Act 2004, Dangerous Goods Safety (General) Regulations 2007*. Chemical dosing pumps will deliver the required dose of ferric sulphate to the above dosing locations (Northern Water Partnership, 2023).

The iron content of the dosed ferric sulphate all turns to solids and ends up in the sludge. Negligible iron remains present in the brine discharge where the very low iron concentrations are comparable to background seawater managed by MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Polymer / Flocculant for ActiDAFF® feed

A polyelectrolyte (flocculant) will be dosed at the inlet of the ActiDAFFs to aid filter performance. Typically, a cationic polyelectrolyte is used. The polyelectrolyte will be delivered to site either in powder form (25kg bags) and batched into solution prior to dosing, or alternatively delivered to site as concentrated solution or emulsion for dilution on-site. The polyelectrolyte storage, batching and dosing equipment will be in a dedicated room within the pre-treatment chemical building (Northern Water Partnership, 2023).

The polyelectrolyte (flocculant) receival, storage and dosing systems will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007.*

Polymer / Flocculant for ActiDAFF® sludge thickening

The solids containing backwash water from the ActiDAFFs is processed through a sludge thickener to concentrate the solids and recover the backwash water. To assist settlement, a polyelectrolyte will be dosed into the thickener feed. The polyelectrolyte will be delivered to site either in powder form (25kg bags) and batched into solution prior to dosing, or alternatively delivered to site as concentrated solution or emulsion for dilution on-site and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007.* The polyelectrolyte storage, batching and dosing equipment will be in a dedicated room within the pre-treatment chemical building (Northern Water Partnership, 2023).

Polymer / Flocculant for lime clarifier

Lime water for potabilization is prepared in two clarifiers (stage 1). To assist lime water clarifier performance a polyelectrolyte is dosed. The polyelectrolyte will be delivered to site either in powder form (25kg bags) and batched into solution prior to dosing, or alternatively delivered to site as concentrated solution or emulsion for dilution on-site and will be managed in accordance with

Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007.. The polyelectrolyte storage, batching and dosing equipment will be in the lime sludge dewatering building (Northern Water Partnership, 2023).

Polymer / Flocculant for lime sludge

Sludge from the lime water clarifiers will be dewatered prior to removal from site for either reuse or landfill. A polymer / flocculant is dosed into the sludge to assist dewatering in a centrifuge.

The polyelectrolyte will be delivered to site either in powder form (25kg bags) and batched into solution prior to dosing, or alternatively delivered to site as concentrated solution or emulsion for dilution on-site and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007.*. The polyelectrolyte storage, batching and dosing equipment will be in the lime sludge dewatering building (Northern Water Partnership, 2023).

Reverse Osmosis Antiscalant

An antiscalant is required to be dosed into the RO feed stream to prevent precipitation of low solubility salts in the RO membranes. The antiscalant used will be of low ecotoxicity as it is discharged with the brine sent to the diffuser (Northern Water Partnership, 2023) managed by MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

RO antiscalant will be delivered to site by either bulk tanker truck or IBC's and transferred into a bunded bulk storage tank located in the RO Chemical Building and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* . A bank of chemical dosing pumps will deliver the required antiscalant dose to each dose point within the RO process (Northern Water Partnership, 2023).

Citric acid

Citric acid is used for periodic Cleaning-in-Place of the RO membranes in each RO rack. This is done to remove any accumulated acid soluble contaminants that foul the RO membrane surface. Citric acid CIP is also partially effective for reducing biofilm from the membrane surface.

The spent CIP solution will be pH neutralised prior to discharge with the brine. managed by MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Neutralisation of citric acid with caustic results in sodium ions and citrate ions in solution. Citrate has moderate biological oxygen demand but the significant dilution with brine prior to discharge reduces this to negligible levels at the diffusers.

The 50% citric acid solution will be delivered to site by bulk tanker truck and transferred into a bunded storage tank and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* . Chemical dosing pumps will transfer the required volume of citric acid solution into a CIP batch as necessary (Northern Water Partnership, 2023).

Sodium bisulphite

A solution of up to 3% sodium bisulfite (SBS) is commonly used to preserve RO membranes in racks that are to be shut down for longer than 24 hours. When the RO rack is to be re-started this preservation solution is neutralised within the CIP waste tank before discharge with RO brine. Sodium bisulfite solution breaks down to sodium and sulphate salts when exposed to air or mixed with oxidising chemicals. The waste SBS will partially decompose in the CIP waste tank and dilution with RO brine will further reduce its concentration to levels that ensure compliance with MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) conditions that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA (Northern Water Partnership, 2023).

The 3% sodium bisulfite (SBS) will be received and stored in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* ..

2,2-dibromo-3-nitrilopropionamide (DBNPA)

DBNPA is a biocide that will be intermittently used to address any biological fouling of the RO membranes. DBNPA can be either shock dosed into the feed of an RO rack or applied as a CIP where it is recirculated through an offline RO rack and then left to soak (Northern Water Partnership, 2023).

When applied as a shock dose into the feed of an RO rack, DBNPA associates with the brine leaving the RO rack being treated. Dilution with RO brine from all other RO racks and sodium bisulphite dosing into the brine effectively reduces the ecotoxicity of DBNPA before reaching the outfall diffusers (Northern Water Partnership, 2023).

When used as a CIP solution for an RO rack, the spent DBNPA CIP solution is neutralised with SBS prior to discharge with the brine. The risk associated with the DBNPA has been modelled in the ERD and is subject to the management requirements stipulated in MS 1207 and the COMEMP (Water Corporation, 2022a; 2023d).

DBNPA will be delivered to site in 25kg drums and stored in a bunded area within the RO CIP Building and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* .

Caustic soda

Caustic soda (sodium hydroxide) is used to:

- Increase the pH of filtered water entering the RO unit to optimise performance of the RO membranes.
- Increase the pH of the drinking water to reduce corrosion in the water distribution network.
- raise the pH of some of the CIP solutions during their preparation.

- neutralise acidic spent CIP solutions (e.g. spent citric acid CIP solution) prior to their discharge. Such neutralisation is done in the CIP neutralisation tank (Northern Water Partnership, 2023).

At the pH neutral conditions of the brine discharge, the caustic soda breaks down to only sodium ions in solution managed by MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Caustic soda will be delivered to site in bulk and stored in two (2) tanks within a dedicated bund inside the RO Chemical Building and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023).

Ethylenediaminetetraacetic acid (EDTA)

EDTA is used in the preparation of clean-in-place solutions for removal of metal scaling on RO membranes, particularly sulphate-based scaling. The solutions are expected to be used infrequently (if at all). EDTA has high ecotoxicity. An investigation is currently being completed to determine whether spent CIP solutions that contain EDTA can be directed to the brine discharge with an acceptable dilution safety factor that will ensure compliance with the EPA conditions (MS 1207) (Northern Water Partnership, 2023).

The disposal route for spent CIP solutions that contain EDTA will depend on the outcome of this work. It is likely that this waste will not be directed to the brine discharge or will require additional treatment to destroy the EDTA before discharge with the brine. Alternative this waste may be managed as a trade waste for discharge to sewer or third party operator. The risk associated with the discharge to brine has been modelled in the ERD and is subject to the management requirements stipulated in MS1207 and the COMEMP (Water Corporation, 2022a; 2023d).

EDTA receival, storage and dosing systems will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023).

Sodium lauryl sulphate

Sodium lauryl sulphate is used in clean-in-place (CIP) solutions for the intermittent cleaning of RO membranes. The CIP solution is often alternated between high pH through the addition of caustic soda, followed by low pH by the addition of acid. The resulting detergent solution is effective in removing organic fouling from the surface of the membranes.

Spent CIP solutions containing SLS are adjusted to neutral pH in the CIP neutralisation tank prior to discharge with the RO brine to the outfall diffusers. The discharge is managed by MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA. The resulting neutralised solution has negligible ecotoxicity (Northern Water Partnership, 2023).

Sodium lauryl sulphate is used in clean-in-place (CIP) solutions will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023).

Carbon dioxide

To manage corrosion in the distribution system and in customer plumbing, the pH of RO permeate needs to be adjusted to a target range (7.5pH – 8.5pH) and the hardness and bicarbonate alkalinity need to be increased (target alkalinity >50mg/L). This is achieved by dosing carbon dioxide and calcium hydroxide (hydrated lime). These two chemicals react with each other to form calcium ions (calcium hardness in solution), bicarbonate ions (alkalinity) and increase the pH (Northern Water Partnership, 2023).

Liquid carbon dioxide is delivered to site in bulk tanker trucks and stored in several cryogenic liquid carbon dioxide vessels and will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023). Liquid CO2 is drawn from the vessels and passed through an atmospheric vaporizer where heat from the atmosphere boils the liquid CO2. The gas pressure is regulated by a pressure regulator valve at the outlet of the vaporizer. A control valve then adjusts the flow of CO2 gas to inline carbonators that dissolve the required flow of CO2 gas into the flowing permeate. Figure 24 below illustrates a typical cryogenic storage vessel for liquid CO2 shown with a typical atmospheric vaporiser and pressure regulator (Northern Water Partnership, 2023).

Plate 24 - Cryogenic liquid carbon doixide tank, atmospheric vaporizer and pressure regulator illustration (Northern Water Partnership, 2023)

The cryogenic liquid carbon dioxide storage vessels are heavily insulated to minimise heat entering into the tanks from the surrounding atmosphere. This heat causes some minimal boil-off of CO2 from the vessels. This bio-off gas is vented to atmosphere. The boiloff rate is depends on ambient temperature and solar radiation. For the large vessels that will be required for ASDP, the boiloff rate is expected to be less than 0.5% of the vessel volume per day (Northern Water Partnership, 2023).

Plate 25 below is a photograph of the CO2 storage vessels installed at the Water Corporations' Southern Seawater Desalination Plant in Binningup. Stage 1 of ASDP is expected to have 4 or 5 similar vessels with additional vessels added for stage 2 (Northern Water Partnership, 2023).

Plate 25 - Liquid Carbon Dioxide Storage Vessels (Southern Seawater Desalination Plant) (Northern Water Partnership, 2023)

Hydrated lime

Hydrated lime is used to produce a clear lime water solution that is then used to increase the pH and alkalinity of the drinking water.

Hydrated lime will be delivered to site in bulk powder form and pneumatically transferred into two (2) lime silos located in the potabilization area. A high-quality hydrated lime product will be used that has low insoluble components. The majority of insoluble components are calcite and silica (sand) which end up in the lime clarifier sludge. All chemical receival, storage and dosing systems will be managed in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023). **Fluosilicic acid**

Fluosilicic acid is dosed into drinking water in the potabilization area to provide a fluoride ion concentration in drinking water as per WA Health Department directive. A nominal fluoride ion concentration of 0.85 mg/L is required (Northern Water Partnership, 2023).

A 22% FSA solution is delivered to site in bulk tanker trucks and stored in two (2) bunded tanks in the potabilization area chemical building. Chemical metering pumps dose the required flow of FSA

into the drinking water before it enters the drinking water tanks. The dosing lines between the chemical bund and the dosing location are double contained. This arrangement of bunded storage and double contained dose pipes is industry best practice and minimises the risk of leaks and spills causing environmental harm in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023).

Chlorine gas

Chlorine gas is used for final disinfection of the drinking water by providing a free chlorine residual that provides lasting (several days) protection against pathogens as the water traverses through the distribution system to customers (Northern Water Partnership, 2023).

Liquified chlorine gas will be delivered to site in 920kg (or possibly 1000kg) containers and stored in a dedicated chlorine building in accordance with *Dangerous Goods Safety Act 2004 and Dangerous Goods Safety (General) Regulations 2007* (Northern Water Partnership, 2023).. Chlorine gas is drawn from the online containers and reduced to vacuum conditions by vacuum regulators that are mounted directly on the chlorine container outlet valves. A vacuum ejector generates the vacuum that opens the vacuum regulator allowing chlorine gas to flow out of the container. This arrangement minimises the risk of chlorine leaks because any small leak tends to draw air in rather than allow chlorine gas to leak out. Larger piping or equipment leaks result in a loss of vacuum and automatic closure of the spring-loaded vacuum regulators (Northern Water Partnership, 2023).

The rate of chlorine gas flow that is drawn from the containers is controlled by a specialised chlorinator and dissolved into water at the vacuum ejector. This solution is then piped to the chlorine dose points in the potabilization area.

The management of chlorine release risk mandates the designation of a 100m diameter chlorine risk buffer with restricted land use within this buffer. The chlorine buffer is shown in Plate 26 below (Northern Water Partnership, 2023).

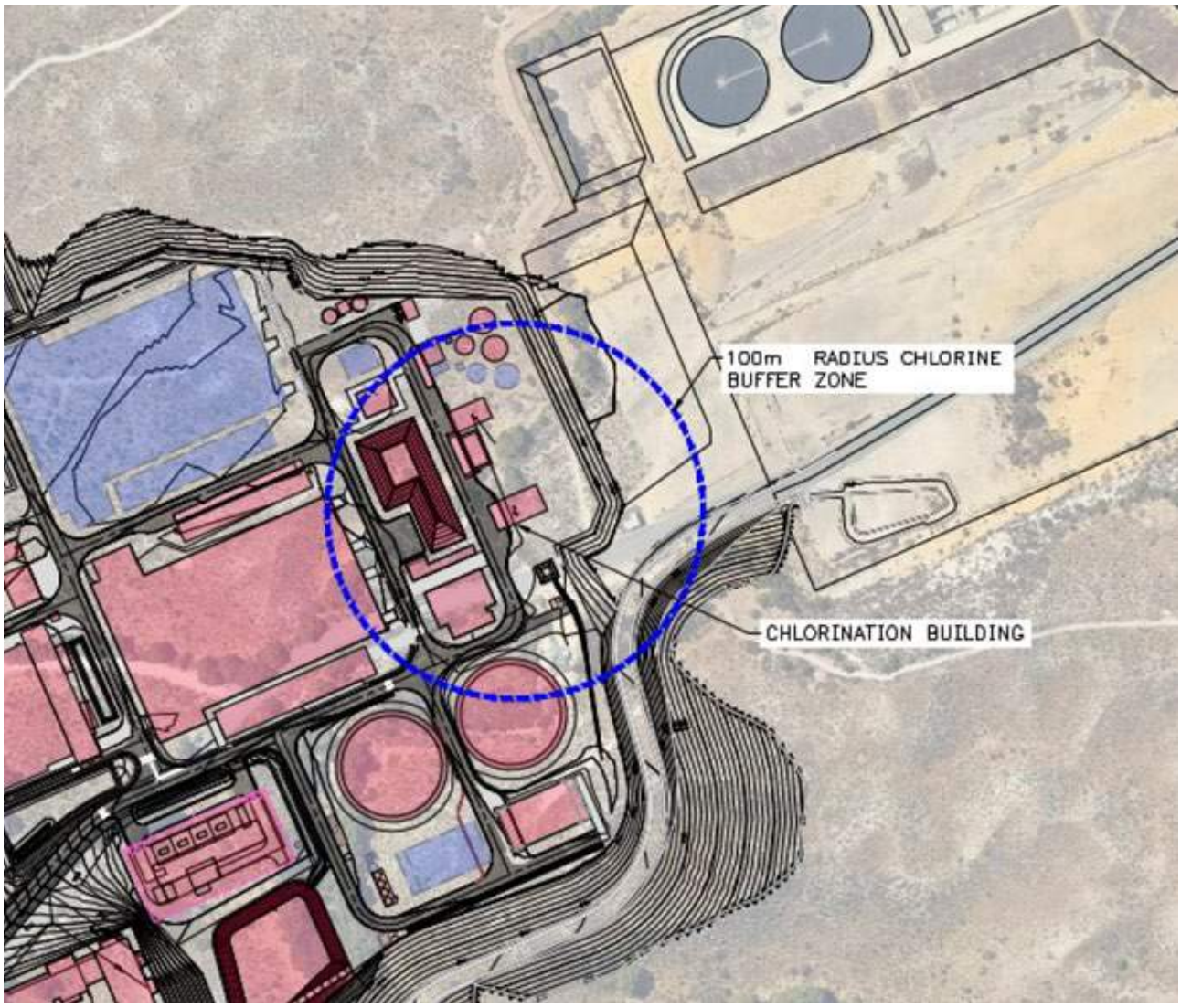


Plate 26 - Location of chlorine building showing 100 m radius risk buffer zone (Northern Water Partnership, 2023)

5.2.2.14 Potabilization

RO permeate is too “pure” for drinking water use. The very low levels of dissolved salt ions and negligible alkalinity mean that RO permeate would be corrosive to most pipe and plumbing materials and therefore would contain many corrosion by-products such as once it reached customer taps. It is therefore necessary to potabilize the RO permeate prior to distribution (Northern Water Partnership, 2023).

Permeate from the RO process and filtered water from the Eglinton Groundwater Treatment area are blended together and directed to the potabilization area (note this is indepedant of desalination and not part of the prescribed premises). Blending of these two streams is highly beneficial as it significantly reduces the treatment requirements for Eglinton groundwater and also reduces the chemical requirements for potabilization of the RO permeate (Northern Water Partnership, 2023).

Potabilisation consists of the following treatment steps:

- UV disinfection during periods of very poor seawater quality when the ActiDAFF® performance may be challenged by high algae or turbidity in the incoming seawater.
- Carbon dioxide and lime water dosing to increase the pH and alkalinity of the drinking water such that corrosion within the water distribution system and customer plumbing is minimised.
- Optional caustic soda dosing to further adjust pH for corrosion minimisation.
- Fluosilicic acid dosing to provide a fluoride concentration for public health.
- Chlorine dosing to provide a free chlorine residual to manage the risk of pathogen contamination (Northern Water Partnership, 2023).

Plate 27 below shows the flow diagram of the potabilization area. Optional caustic dosing is not shown in this diagram but may be included in the final design.

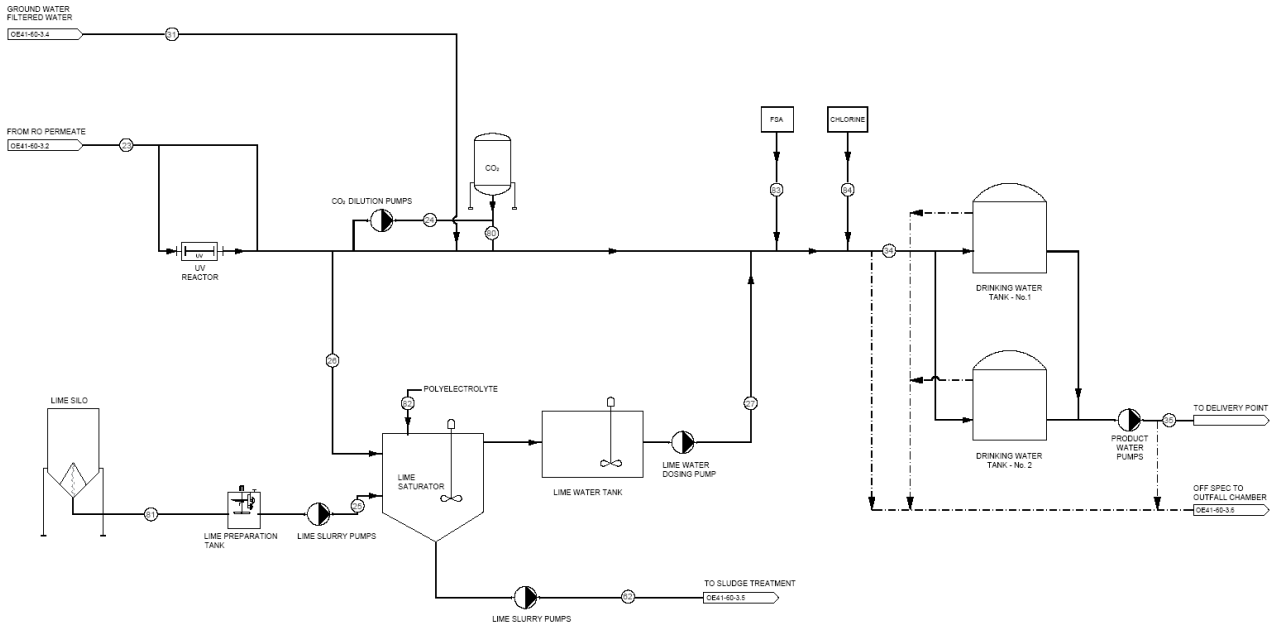


Plate 27 - Flow Diagram of the Potabilization Area (Northern Water Partnership, 2023)

UV Disinfection

The ASDP design considers that the incoming seawater has a source pathogen risk level of 3 according to the Australian Drinking Water Guidelines 2011. As such, the treatment process must maintain high levels of pathogen removal or inactivation, and also must include multiple treatment barriers to pathogens. During periods of normal seawater quality this is ensured by pathogen removal in the ActiDAFF units, RO membranes and by the disinfecting action of free chlorine.

During periods where the seawater contains elevated levels of suspended solids (e.g. storms), the ActiDAFF® pre-treatment system will be increasingly challenged and filtrate quality may marginally decline. This can increase the risk of pathogens passing through the ActiDAFFs. To address this risk an ultraviolet disinfection system will be operated during periods of poor seawater quality. The

UV system will be bypassed during periods of good seawater quality (Northern Water Partnership, 2023).

The UV disinfection system is located after the RO unit. When operational, all RO permeate is passed through the UV vessels where exposure to high intensity UV light kills any pathogens present. The previous section shows the UV disinfection unit on the potabilization flow diagram and Plate 28 below shows a 3D model view of the UV units.

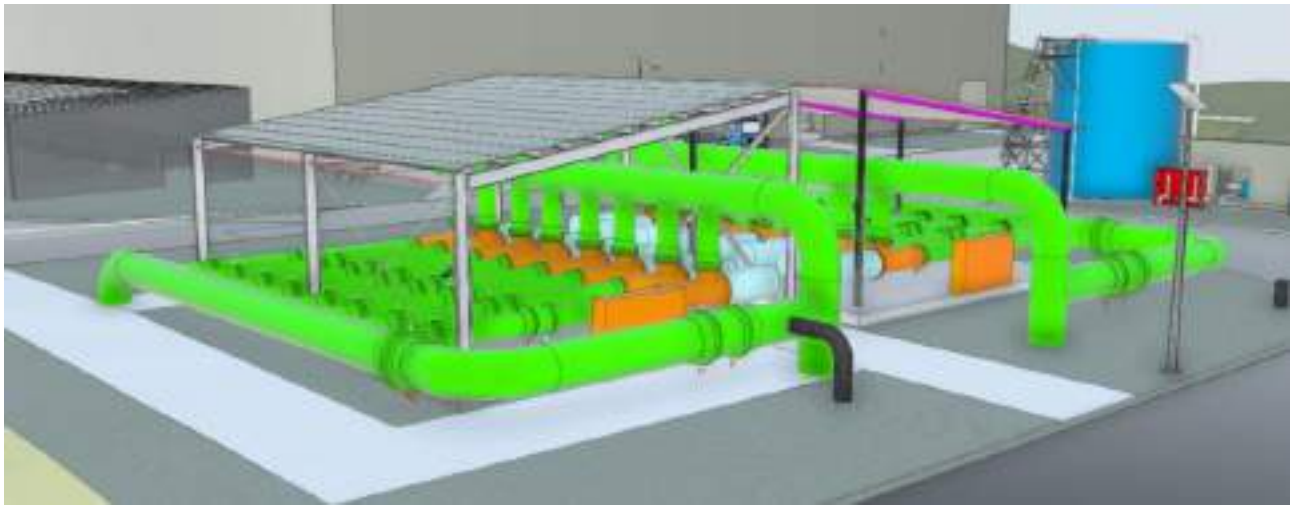


Plate 28 - 3D Model of Ultraviolet Disinfection System (Northern Water Partnership, 2023)

Lime Water Preparation & Dosing

Lime water is an almost clear solution of calcium hydroxide (hydrated lime) in water. Lime water is produced by mixing high quality hydrated lime with water and then settling any insoluble material in a gravity clarifier-thickener. A polyelectrolyte is added to assist settling in the clarifier-thickener. Insoluble material that comprises mostly silica sand and calcium carbonate, settles and is thickened in the bottom of the clarifier-thickener and the lime water solution is collected in launders at the top (Northern Water Partnership, 2023).

Plate 29 below shows an aerial 3D model view of the two ASDP stage 1 clarifier-thickeners. Mixing chambers at the inlet of each unit (the small and medium tanks on the left hand side of the image) provide optimum conditions for mixing the hydrated lime, water and polyelectrolyte and for formation of flocs that will easily settle and thicken in the larger chamber (the clarifier-thickening tanks on the right had side of the image). The lime water solution is then stored in two lime water tanks for dosing into the RO permeate at the required flow rate using variable speed dosing pumps and flow control valves (Northern Water Partnership, 2023).

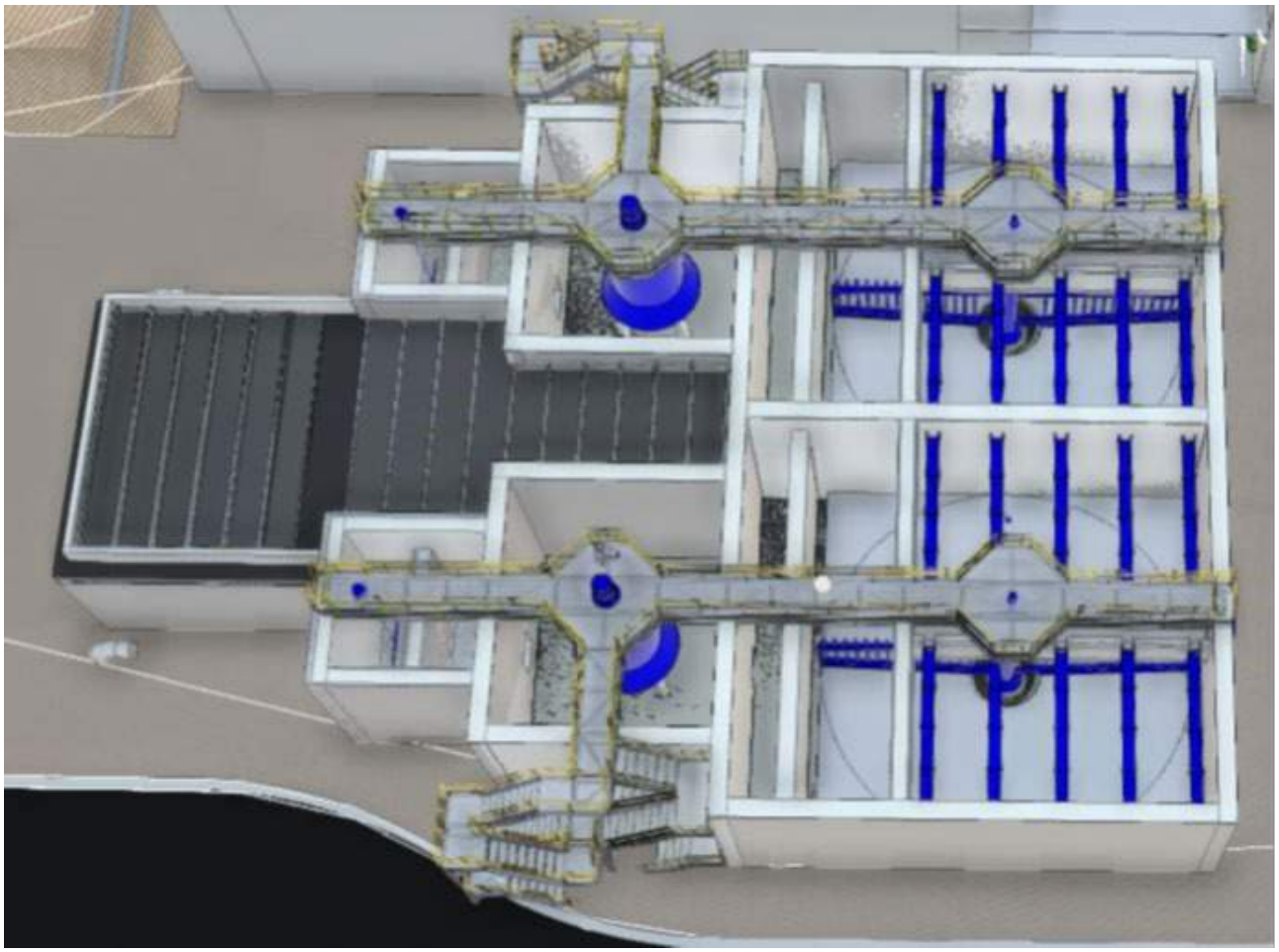


Plate 29 - 3D Model of the two (2) lime water clarifiers (Northern Water Partnership, 2023)

5.2.2.15 Sludge treatment – thickening, dewatering & out-loading

The process generates four waste streams that contain solids that are required to be captured, thickened, de-watered and transported for final disposal and/or reuse. These waste streams include:

- ActiDAFF® floated sludge.
- ActiDAFF® backwash.
- Lime sludge (Northern Water Partnership, 2023).

The sludge thickening system collects the first three of these waste streams. Lime sludge is handled separately due to its different properties and to maximise the potential for beneficial reuse of this material.

The sludge thickening system is sized to process both stage 1 and 2 waste streams. The waste streams are directed to a lamella settler (similar to the technology employed for lime water preparation shown in Plate 30). Mixing chambers at the inlet of each unit provide optimum hydraulic conditions for dosing additional coagulant and flocculant that aid the performance of the settler. The main chamber of the lamella settler slows the movement of the waste streams to enable suspended

solids to settle towards the floor. The feed to the lamella settler is separated into two streams. The overflow stream, referred to as clarified water, has limited solids remaining and is directed to the brine outfall. The solids containing “sludge” stream from the floor of the lamella is discharged to two sludge holding tanks. Both of these tanks include a vertical mixer to avoid sludge sedimentation accumulating inside them (Northern Water Partnership, 2023).

From the two sludge holding tanks, the sludge is pumped to a decanter centrifuge system located in the Sludge Dewatering Building as shown in Plate 31. The building will assist in managing noise emissions from decanter centrifuges. The centrifuges further thicken the sludge to a cake consistency (targeting a sludge dryness of 20%). The removed water (centrate) is directed to the ocean through combining with the brine stream. The sludge obtained from the decanter centrifuges will be stored in sludge bins and removed by truck to a licensed landfill. Investigations are ongoing to locate a beneficial reuse option, however limited success has occurred to date due to the high salt content of the sludge cake (Northern Water Partnership, 2023).

Plate 30 - 3D Model view of the ActiDAFF® Sludge Dewatering Building (Northern Water Partnership, 2023)

The lime sludge generated from the lime water process, is treated separately due to the high potential for beneficial reuse options e.g. soil conditioner. A dedicated lime sludge building, and sludge dewatering centrifuges, that are sized to cater for stage 2 flows, are provided for dewatering the lime sludge, as shown in Plate 31. The building will assist in mitigating noise emissions from the dewatering centrifuges. Two separate streams, water and dewatered lime sludge, are discharged from the centrifuges. The dewatered lime sludge will be stored in sludge bins and removed by means of truck to either a reuse facility or a licensed landfill (Northern Water Partnership, 2023).

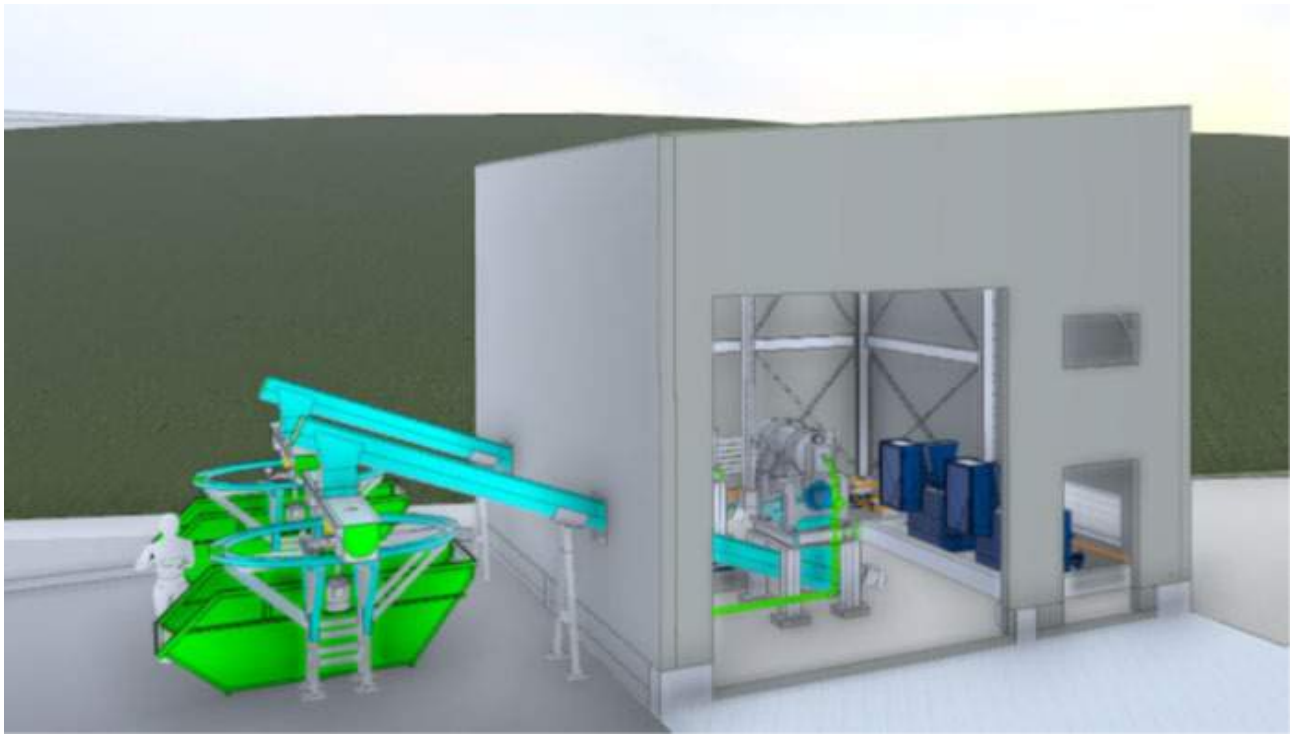


Plate 31 - 3D Model view of the Lime Sludge Dewatering System within the ActiDAFF® Buildings (Northern Water Partnership, 2023)

5.2.2.16 Drinking Water Storage Tanks and Pumping Station

Following potabilization the drinking water is sampled and monitored by a group of online water quality analysers that continuously monitor pH, temperature, turbidity, conductivity, free chlorine and fluoride ion concentration. Any deviation from allowable limits for these parameters will initiate an alarm on the control system. Unsafe deviations will automatically stop the transfer of drinking water from the site into the distribution system (Northern Water Partnership, 2023).

After the water quality sample offtake, the drinking water is directed to the two drinking water tanks. These are large concrete tanks each of 25 million litres volume. The drinking water will be transferred from the drinking water tanks to Carabooda Tank and Wanneroo Reservoir by the large drinking water pumps located with the Drinking Water Pump Station (stage 1). Several large surge vessels reduce pressure surges that can damage piping and cause excessive noise when a drinking water pump starts or stops (Northern Water Partnership, 2023).

Plate 32 below shows a 3D model view of the two drinking water tanks, drinking water pumping stations and surge vessels looking from the west. Both drinking water tanks will be constructed with

the stage 1 works but only one pumping station will initially be constructed (the top one in the image). The second pumping station will be constructed with the future stage 2 upgrade (Northern Water Partnership, 2023).

Plate 32 - 3D Model of Drinking Water Tanks, Drinking Water Pump Station and Surge Vessels (Northern Water Partnership, 2023)

5.2.2.17 Drainage and Containment Systems

There are several drainage systems incorporated into the ASDP design. These can be broadly broken down as follows:

- Stormwater drainage system
- Uncontaminated process drainage system
- Potentially contaminated drainage system
- Brine discharge system
- Domestic wastewater drainage system (Northern Water Partnership, 2023).

Stormwater Drainage

The site stormwater drainage system comprises four drainage infiltration basins, with a pit and pipe network for rooftop runoff, roads, open drains on the southwest and southeast of the site and drainage swales (rain gardens) throughout the site.

The site is divided into catchment areas. The largest catchment area is designed to go to infiltration basin no. 1 and sized to accommodate the entire site's runoff. As shown in Plate 33, Infiltration basin

no. 4 is located in the north of the site and will accommodate runoff from the seawater intake chamber area, as well as Stage 2 Pre-treatment and RO buildings. Infiltration basin no. 5, located in the eastern part of the site will accommodate runoff for a portion of Stage 1 and 2 RO buildings, as well as the ancillary buildings located on the eastern part of the site (Northern Water Partnership, 2023).

The City of Wanneroo Stormwater Design Standard (WDS5, 2015) specifies design criteria for the minor and major storm events. For the minor storms (10% Annual Exceedance Probability - AEP), the drainage infrastructure will safely convey all flows in open swales, side entry pits (SEPs) and pipes, as well as partly on road corridors, while allowing at least one lane on all roads to remain serviceable. For major storm events (1% AEP), the drainage infrastructure will safely convey all flows in the open swales, SEPs and pipes, and on road corridors up to the top of kerb level, by maintaining a freeboard of at least 300mm between the 1% AEP flood level and the building floor levels to prevent building floor flooding, as per WDS5.13 (Northern Water Partnership, 2023).

Storm events greater than 1% AEP will result in the collected stormwater overflowing weirs (located in selected infiltration basins) and flowing to the brine discharge drainage system in accordance with MS 1207 and the COMEMP (Water Corporation 2022a; 2023d).

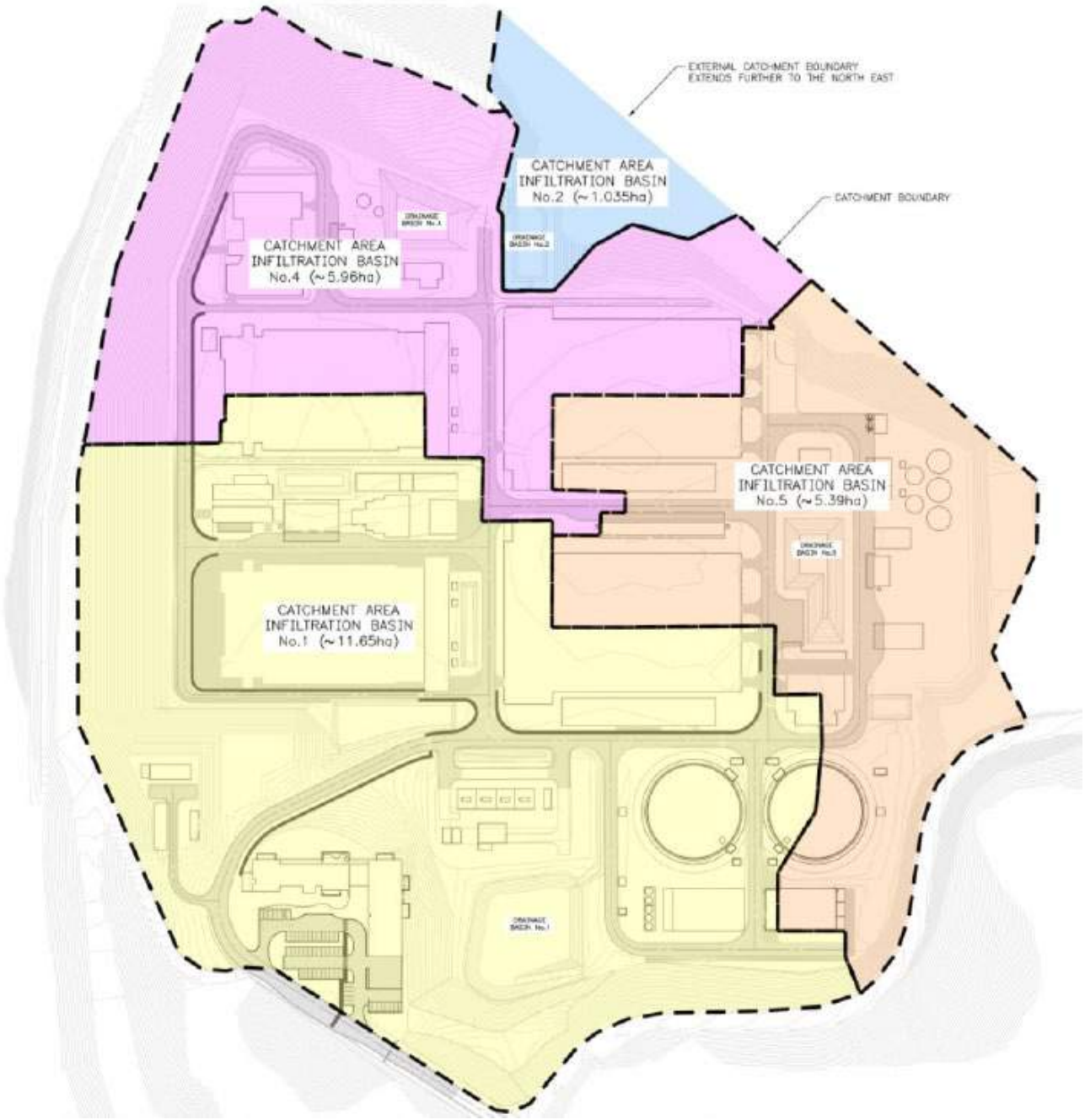


Plate 33 – ASDP Main Site Stormwater Drainage Catchment Areas(Northern Water Partnership, 2023)

Chemical Storage Area Drainage

Chemical storage area drainage includes normally closed drains from chemical bunds and chemical drains. These drains are segregated where necessary to prevent risk of mixing of incompatible chemicals. For bunded chemicals, any inventory found within the bund is initially considered to be a potential chemical spill. The spill is investigated to determine whether it is chemical or water. Such

testing depends on the chemical stored in the bund. Acids and bases would typically be tested using a pH meter for example. The chemical delivery truck aprons, which are outdoors and will therefore also collect stormwater, are directed to a contained drainage sump. All liquid entering the sump is also initially considered to be a potential chemical spill until proven otherwise (Northern Water Partnership, 2023).

Where liquid in the chemical bunds and chemical delivery apron drainage sumps is proven to be water, the contents will be drained to the stormwater drainage network. Where found to contain chemical, then an operational decision will be made regarding how to manage the spill and whether any further investigation is required. Testing to differentiate chemicals from water will generally consist of:

- In-situ pH testing for acid and base storage and transfer areas (e.g. citric acid, FSA, caustic)
- In-situ conductivity testing for areas where ionic chemicals that are niether strong acids or bases are stored (e.g. sodium meta-bisulfite)
- Conductivity combined with either ORP or free chlorine testing for sodium hypochlorite storage areas.
- Sampling and laboratory analysis for chemicals where simple in-situ testing cannot reliably differentiate between a dilute chemical spill and water (e.g. DBNPA).

Chemical spills may be:

- Neutralised in-situ (e.g., simple inorganic acids and bases) before release to the stormwater drainage system.
- Neutralised in-situ (e.g., small quantities of CIP chemicals) and then transferred to the brine outfall drainage system.
- Transferred directly to the CIP neutralisation tank(s) where the chemical may either contribute to neutralisation of spent CIP solutions, or can be effectively neutralised in that tank prior to discharge to the brine outfall drainage system.
- Transferred off-site to a licensed chemical waste treatment and disposal facility (Northern Water Partnership, 2023).

Reverse Osmosis Clean-in-Place Drainage

CIP solutions may comprise either a single chemical or a mix of several chemicals that aim to remove different types of contaminants that may become fouled on the membrane surface. A CIP is carried out on one RO rack at a time. Cleans are more frequent on first pass RO racks compared to second pass racks. On completion of a CIP, the spent CIP solution is drained through a dedicated drainage network to the CIP neutralisation tank(s). After the CIP, the RO rack also needs to be thoroughly flushed with permeate before being put back into normal operation and this flushing water is also directed to the CIP neutralisation tank (Northern Water Partnership, 2023).

Following neutralisation, confirmed by online pH measurement, the contents of the CIP neutralisation tank are pumped to the brine outfall drainage system for discharge into the brine outfall (Northern Water Partnership, 2023).

Only spent CIP solutions that can be neutralised to very low levels of ecotoxicity are managed in this manner. This is to ensure the necessary levels of protection of marine species within the Low

Ecological Protection Area and the High Ecological Protection Area around the brine diffusers are achieved in accordance with MS 1207 and the COMEMP (Water Corporation 2022a; 2023d).

Power Transformer Compound Drainage

All high voltage and medium voltage transformers within the ASDP site will utilise natural ester oil for cooling. This oil is biodegradable in soil, and all transformers will be located within dedicated bunds. Stormwater that accumulates within the transformer bunds will initially be held in the bund until confirmed to be oil free. Oil free stormwater will be discharged to the stormwater drainage system via an oily water separator. Any leaked transformer oil or oil contaminated stormwater that is found in a transformer bund will be removed offsite to a licensed waste disposal facility (Northern Water Partnership, 2023).

Generator Set/Diesel Storage Bund Area Drainage

Generator sets and their associate diesel storage(s) will be located within dedicated bunds. Stormwater that accumulates within the bund will initially be held in the bund until confirmed to be hydrocarbon free. Oil free stormwater will be discharged to the stormwater drainage system via an oily water separator. Any leaked hydrocarbons or contaminated stormwater that is found in a bund will be removed offsite to a licensed waste disposal facility (Northern Water Partnership, 2023).

Brine Outfall Drainage System

The brine outfall drainage system comprises a network of pipes that collect the following process stream and route them to the brine outfall chamber (Northern Water Partnership, 2023).

- 1st pass RO reject (brine)
- Any recirculated seawater from the seawater intake pumps (used to improve offshore diffuser mixing during periods of low plant throughput)
- Raw seawater drainage from the SWIPS and seawater pipelines up to the ActiDAFFs.
- Filtered seawater drainage.
- Filtered ActiDAFF® maturation / rinse water (the initial flow of filtrate following backwash of an ActiDAFF® filter).
- Clear supernatant from the ActiDAFF® backwash thickener.
- Centrate (separated process water) from the sludge centrifuges in the thickening area.
- Centrate (separated process water) from the lime dewatering centrifuge area.
- Any filtered seawater or RO permeate that is not within specification but otherwise presents ALARP environmental risk if discharged to the brine outfall.
- Overflows from the filtered water tank, permeate tank and drinking water tanks (any drinking water tank overflow will have free chlorine neutralised with sodium bisulfite).
- Neutralised spent RO CIP solutions from the CIP Neutralisation Tank.
- Other plant drains where specifically risk assessed as safe to be directed to the brine outfall.

All of the above streams have been determined as suitable to be directed to the brine outfall in compliance with MS1207 and the COMEMP (Water Corporation, 2022a; 2023d) requirements that have been set for the project i.e. 99% marine species protection at the boundary of the LEPA.

Whole Effluent Toxicity (WET) Testing will be carried out during commissioning to confirm that the combined effluent stream meets the required marine species protection guideline "trigger" levels for toxicants before entering the designated Low Ecological Protection Area around each outfall diffuser and the High Ecological Protection Area beyond. WET testing will include test carried out on effluent samples that contain neutralised CIP solutions since brine discharge that contains this intermittent stream represent the highest concentration and broadest range of contaminants. All testing will comply with the EPA-WA Technical Guidance on Protecting the Quality of Western Australia's Marine Environment (Northern Water Partnership, 2023).

The contents of the outfall chamber are continuously monitored by online water quality analysers and regularly sampled for other contaminants of potential concern. Continuous online monitoring measures and alarms the following parameters (Northern Water Partnership, 2023).

- Dissolved oxygen
- Oxidation reduction potential (ORP)
- pH
- Conductivity / salinity
- Turbidity
- Chlorine (confirmation that none is present)
- Temperature.

Domestic Wastewater Drainage System

Domestic wastewater from construction temporary facilities (offices, kitchens, crib rooms, bathrooms, showers and similar will be collected in a temporary gravity sewage collection system that drains to a temporary package sewage pumping station. The temporary sewage pumping station will transfer the domestic wastewater to the inlet of the adjacent Alkimos Wastewater Treatment Plant by a buried sewer pressure main (Northern Water Partnership, 2023).

Domestic wastewater from the permanent facilities (Administration Building, R&D Complex, Workshop) will be collected in a permanent gravity sewage collection network that drains to the permanent sewage pumping station. Sewage will then be pumped to the inlet of the adjacent Alkimos Wastewater Treatment Plan by a buried sewer pressure main (Northern Water Partnership, 2023).

5.2.2.18 Power

Power Substation

A 132/11kV substation is located within a separately fenced area within the ASDP site. The substation receives incoming power at 132kV from Western Powers' distribution network (via a

dedicated buried feeder from the Western Power Yanchep substation). The ASDP substation will convert the incoming 132kV feed to 11kV for distribution throughout the ASDP site. The substation comprises of the following (Plate 34) (Northern Water Partnership, 2023).

- SF6 Gas Insulated Switchgear (GIS) within a dedicated GIS building for all 132kV isolations, metering, monitoring and control.
- Incoming metering at 132kV.
- A relay room for housing of the Western Power control relays associated with the substation operation. This may be either within the GIS building or within a separate building within the substation area.
- A relay room for housing of Water Corporation control relays associated with the substation operation.
- Two (2) 132/11kV KNAN transformers located outdoors in bunds and with fire-rated walls between each transformer compound (refer section 1.2.10.2 for details of the transformer bund drains).
- Provision for up to two (2) additional future transformers for stage 2 of the ASDP development and other potential future loads within the greater Water Corporation Alkimos precinct land holdings.
- An 11kV switchroom.
- An auxiliary transformer for critical low voltage supplies required within the substation.
- A diesel generator set and diesel storage for emergency power supply to the ASDP site (refer section 1.2.10.2 for details of generator and diesel storage bunding & drainage).
- Lightning protection pole(s) as required for lightning protection.
- An extensive in-ground earthing grid.

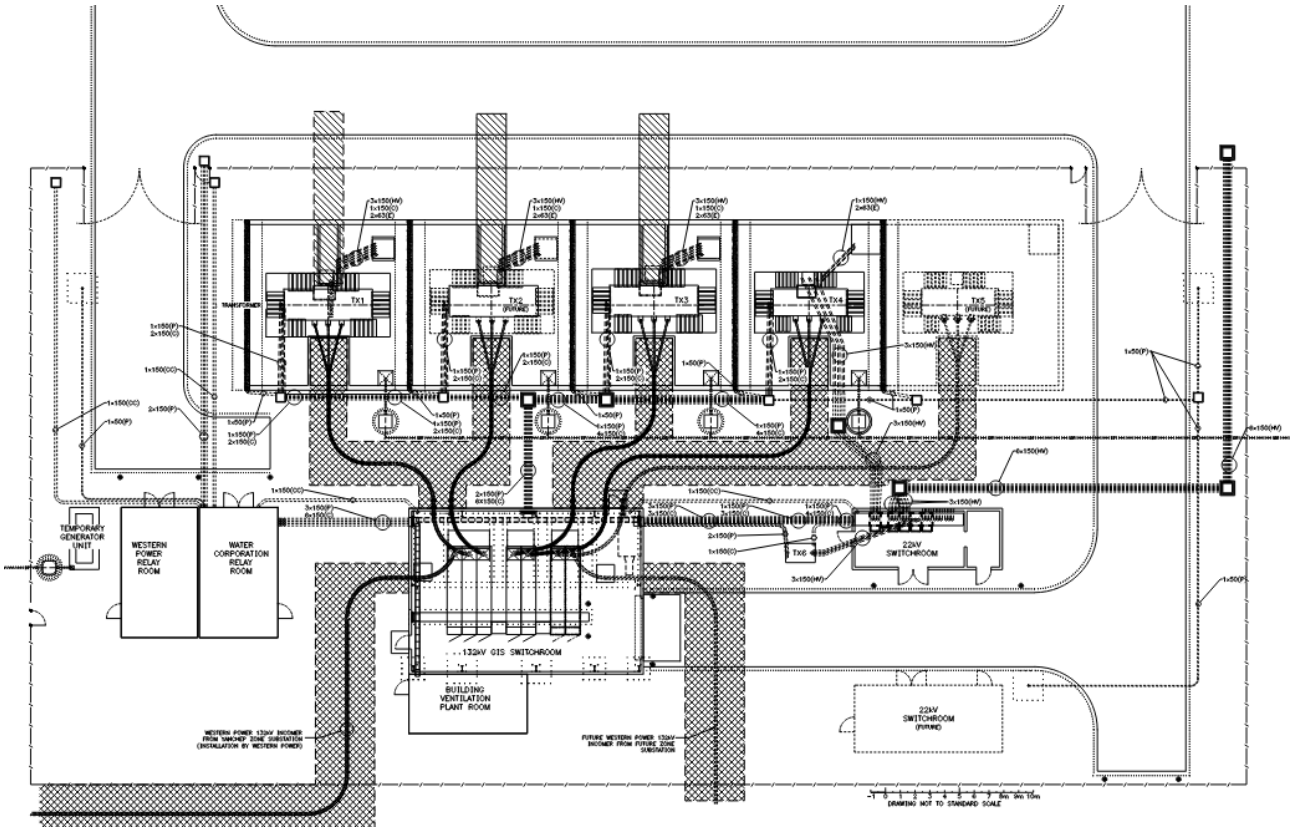


Plate 34 - Typical Plan Layout of a 132kV Power Substation (Northern Water Partnership, 2023)

Solar Power

ASDP will include rooftop solar panels to several of the major structures including stage 1 RO building, drinking water tanks and chemical building. The combined stage 1 solar PV systems are estimated to reduce the ASDP site grid demand by 3,300 MWh per annum. Plate 34 details the typical substation layout. Plate 35 below is a 3D model view of the rooftop solar panels on the stage 1 RO building and Drinking Water tanks. In addition to rooftop solar, all site streetlighting is proposed to utilise integrated stand-alone solar battery systems (Northern Water Partnership, 2023).

Plate 35 - 3D Model of Rooftop Solar on Stage 1 RO Building and Drinking Water Tanks (Northern Water Partnership, 2023)

5.2.2.19 Administration Building and R&D Complex

The ASDP will have a well-integrated, high-security Administration Building and R&D Complex. This facility controls access to the Plant, as well as being the central administration, operations (including control room), research and testing facility for the site. The combining of the Administration Building and R&D Complex optimises space as facilities such as reception and meeting rooms can be shared. The building design maintains a separate and secure area for the portion of the building relating to ASDP operation. The buildings are oriented to the north and south, using solar-passive principles to maximise passive heating, cooling and ventilation. A site carpark, incorporating EV charging stations, is located adjacent to this facility for employees and visitors.

Conveyance infrastructure will direct sanity wastewater from the Administration building, R&D Complex and Workshop and Storage building. The wastewater will gravity flow towards a new Type 10 wastewater pumpstation located to the east of the Workshop and Storage building. This pump station will transfer the wastewater to the adjacent Alkimos Wastewater Treatment Plant (WWTP) via sewer pressure main (Northern Water Partnership, 2023).

5.2.3 Project Timing

The balance of construction will not commence until after the Works Approval that is the subject of this application, is granted. Construction works is expected to commence immediately after granting of this Works Approval and will continue through to June 2028 when the ASDP is planned to be brought into full operation.

Commissioning and performance testing of the works will be done in parallel with the last 12 months of construction, planned for June 2027 to June 2028.

Initial construction works that drive the project schedule (critical path) are:

- Construction and commissioning of the 132kV substation
- Establishment of a temporary 11kV power supply from the 132kV substation to energise the temporary facilities (site offices, crib rooms, workshops, stores etc.) and to power the tunnel boring operations.
- Procurement, manufacture, and delivery to site of the two tunnel boring machines.
- Construction of the launch shaft (the “peanut” shaped temporary secant piled structure) for the TBM’s.
- Supply, installation and commissioning of support infrastructure for TBM operation – slurry treatment plant (note the slurry treatment plant will be subject to a seperate works approval submitted by the Alliance), gantry crane(s) etc.
- Launching of the two TBM’s and construction of the seawater intake and brine outfall tunnels
- Marine works – installation of the four (4) total intake and outfall risers.
- Making of connections between the completed tunnels and the four risers.
- Installation of intake and brine diffuser structures onto the marine risers (Northern Water Partnership, 2023).

In parallel with much of the above works, the permanent onshore ASDP infrastructure will be detail designed and constructed with the critical path for the onshore works comprising detailed design, construction and commissioning of the RO building and RO systems.

The onshore and offshore works will progress in parallel and mostly independently, being managed and executed by separate teams (but under the one Contract). The main interface between these two teams will be at the seawater intake pumping station that is planned to be constructed within the temporary secant piles launch shaft structure. Some of the SWIPS construction will progress while tunnel boring works are progressing while the remainder cannot be done until tunnelling is complete and the TBM launch shaft is no longer being used for TBM operations (Northern Water Partnership, 2023).

Once the tunnelling and marine works are complete and the SWIPS construction has also been completed, the tunnels will be flooded. This will bring seawater into the SWIPS allowing mechanical and process commissioning of ASDP to commence.

Table 2 summarises key Construction, Commissioning and Time Limited Operations estimated dates.

Table 2 - Proposal Timing and Staging (ASDP Stage 1 Only)

Phase	Description	Estimated Dates
Works Approval Construction Commencement	Stage 1 of ASDP and Seawater intake pump station	June 2024
Practical Construction Completion (Construction and Compliance Report will be provided with 10 weeks of PPC)	All assets are constructed	September 2027
Submission of management plans to DWER – Commissioning & Operations Marine Environmental Management Plan	Target submission to allow sufficient time for DWER acceptance prior to commencement of commissioning.	December 2025
Commissioning	Start of Plant Commissioning	June 2026
	End of Plant Commissioning	March 2028
Time limited operations (Plant Proving and System Integration)	Start of Plant and IWSS Integration Testing	April 2028
	End of Plant and IWSS Integration Testing	October 2028

***Note these are estimated dates and are subject to change and update and are affected by the construction date, construction completion schedule delays, and/ or commissioning delays (asset repairs, calibrations or rectifications).*

5.2.3.1 *Construction Quality Assurance and Quality Control*

Upon completion of the construction of the Works the Water Corporation will submit a letter of compliance confirming that all the works have been completed. A Construction Quality Assurance (CQA) Report will confirm the infrastructure has been installed as per the manufacturer's recommendations and is free of defects. The Water Corporation will submit this CQA report to DWER upon the completion of construction works (Northern Water Partnership, 2023).

5.2.3.2 *Commissioning*

The commissioning of the ASDP is expected to take in excess of one year from construction. Planning of commissioning commences by breaking the works into a number of discrete "commissioning areas". As construction of each commissioning area is completed, final inspection and testing is jointly carried out by the construction team and the area commissioning team. The inspection and testing aims to confirm that the construction works (for that commissioning area) have been correctly completed and the area is ready to be handed over to the commissioning team.

Water Corporation will provide DWER with a a revised Commissioning and Operations Marine Management Plan 6 month before commencement of commissioning. Commissioning works shall not commence until DWER CEO has confirmed in writing that these plans meet the requirements of MS 1207.

Commissioning Planning

Commissioning planning is in progress and will continue well into the construction phase of the ASDP. The aim is that a robust and detailed commissioning plan is prepared for each commissioning area before construction of that area is complete. Commissioning planning includes the following to be prepared in a plan:

- Identifying boundaries and isolations between commissioning areas
- Developing an overall detailed commissioning schedule for the work that integrates with the construction schedule
- Preparation of detailed commissioning procedures
- Identifying and sourcing the required commissioning personnel
- Identifying and sourcing commissioning equipment, tools and consumables
- Developing the Project Quality Register which includes:
- A complete equipment list for all major mechanical, electrical, civil, instrumentation and SCADA / control systems components.
- Testing & inspections to be carried out (ITR's & ITP's) at each stage of the project (Supply, Construction, Pre-Commissioning, Equipment Commissioning, Integration Commissioning, Performance Testing)
- Responsible contractor/person for verification.
- Test witnessing requirements.
- Test schedule dates
- Test report details

- A mechanism for tracking progress (Northern Water Partnership, 2023).

Factory acceptance testing / supply verifications

For significant packages of equipment, supply contracts will include the requirements for factory acceptance testing and other supply verifications. Factory acceptance tests will be carried out at locations around the globe. These tests will normally be witnessed by a commissioning team representative or an independent nominee who is approved by the commissioning manager (Northern Water Partnership, 2023).

Supply verifications involve the completion of inspection and test plans (ITP's) by the supplier. These ITP have been developed or approved by the commissioning team.

Construction verification

The commissioning team will develop and provide the Inspection & Testing Plans (ITP's) and Inspection Test Records (ITR's) that will be used to verify the completion and quality of the construction works prior to area handover for commissioning. These will be completed by the construction team and compiled into the Inspection Test Report (ITR) for that area (Northern Water Partnership, 2023).

Pre-commissioning

Immediately prior to commissioning commencing, the commissioning team will first complete pre-commissioning activities to ensure the safety of the plant and preparedness for commissioning. Pre-commissioning activities will be planned for each area and recorded on pre-commissioning ITP's and ITR's (Northern Water Partnership, 2023).

Equipment commissioning

Commissioning commences with the testing of each discrete piece of equipment or instrument. For example, an individual pump will be tested to confirm correct operation in terms of flow, pressure, suction head, power draw, vibration etc. A water quality analyser would be powered up, calibrated and tested with flowing sample. This is all recorded on commissioning ITP's and ITR's all of which are kept as commissioning records (Northern Water Partnership, 2023).

Integration commissioning focusses on commissioning of the control system. It aims to test and validate that:

- instrumented safety systems function as per design and ensures safe operation of equipment and process.
- The process control system functions as per the design intent as documented in the functional control specification (Northern Water Partnership, 2023).

On occasions, changes are necessary to ensure that the plant and process operates optimally and is unconditionally safe. Such changes to instrumented safety functions or process controls are managed according to an established management of change process.

Integration testing commences with any drinking water that is produced being directed (after neutralisation of any free chlorine with sodium bisulfite) to the brine outfall. At a later stage during integration testing, when all water quality safety systems have been proven and the plant is producing drinking water that meets the specification, drinking water will be delivered to the Integrated Water Supply System (IWSS) for distribution to customers (Northern Water Partnership, 2023).

Process stabilisation period

Once integration commissioning has been completed for all commissioning areas, a contractual process stabilisation period will be completed during which the ASDP will be required to operate "normally" and produce drinking water that meets the specifications for the plant. The aim of this contractual period is to allow processes to settle into their normal operating states before the contractual performance testing period is commenced. For example, it may take several days to weeks for a thickener to accumulate a normal operating inventory of sludge which is the feed that goes to the decanter centrifuges. Without this stabilisation period there would be no sludge to feed the centrifuge during the performance test (Northern Water Partnership, 2023).

Performance testing

A contractual performance test will be completed to “stress test” the plant over a period of several weeks. The performance test will last for a minimum of 6 weeks. Significant failures of the performance test can add to the test duration or require that the test is re-commenced after the cause of the failure is addressed (Northern Water Partnership, 2023).

The performance test aims to confirm the reliable operation of the plant under the full range of design conditions and that the specified performance guarantee requirements have been achieved.

Proving period

On successful completion of the performance test a further 6 week proving period. The proving period will further demonstrate the new assets operate on a sustained basis in compliance with the:

- Project process performance
- Design Mass Balance
- Drinking Water Quality Management Plan
- Pump Station / System Hydraulic Operating Envelope
- Alliance Performance Guarantees
- Basis of Design and Construction (Northern Water Partnership, 2023).

Commissioning reporting including project validation reporting

On successful completion of the plant commissioning (all of the above stages), all records that validate the works and its successful commissioning will be compiled into the Commissioning Report for the benefit of the plant owner (Water Corporation) and operators (initially the Alkimos Seawater Alliance, later the Water Corporation) (Northern Water Partnership, 2023).

6 Stakeholder Consultation

Water Corporation has conducted significant stakeholder engagement throughout the various stages of the development of the ASDP project. A stakeholder engagement summary was provided as part the EPA Assessment process (Assessment No. 2210) (Water Corporation, 2023a). Table 3 presents the key stakeholders identified for the ASDP project.

Table 3 - ASDP Key Stakeholders

Stakeholder Group	Stakeholders	Acronym
Commonwealth Government	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	DCCEEW
	National Native Title Tribunal	
State Government Departments	Environmental Protection Authority	EPA
	Department of Water and Environmental Regulation (DWER)	DWER
	Department of Planning, Lands and Heritage	DPLH
	Department of the Premier and Cabinet - Ministers for Water and Environment	DPC
	Department of Biodiversity, Conservation and Attractions	DBCA
	Department of Primary Industries and Regional Development	
	Department of Energy, Mining, Industry Regulation and Safety	DEMIRS
	Department of Treasury	-
	Department of Health	DoH
Local Government and Key Organisations	City of Wanneroo	CoW
	Western Australian Planning Commission	WAPC
	Main Roads Western Australia	MRWA
	Development WA (previously LandCorp)	-
	Public Transport Authority – Metronet.	PTA (Metronet)
	Local Members of Parliament	
Aboriginal Groups	Ballaruk (Whadjuk Noongar Traditional Owners)	-
	South West Aboriginal Land and Sea Council.	SWALSC
Non-Government Groups	Surrounding landholders, land users, businesses, and interest groups	-
	Lendlease	-
	WA Fishing Industry Council	-
	Recfishwest	-

	Western Rock Lobster Council	-
	Alkimos Beach Surf Lifesaving Association	-
	Alkimos Beach Progress Association	-
	Alkimos Eglinton Landowners Group	
	Urban Bushland Council	UBC
	Local residents and community members	-
	Conservation Council of Western Australia	CCWA

Stakeholder and community engagement for the Proposal commenced in 2017 and has been conducted in several formats, including face to face meetings with state and local government agencies, corporations, and public interest groups; participation in community events; and drop-in sessions in public spaces to promote general awareness and stimulate public feedback.

A summary of the consultation in the ERD and RTS documentation as part of Part IV approvals (Water Corporation, 2022a; 2023a).

7 Environmental Risks, Management and Reporting

The potential environmental impacts from construction, commissioning and operations activities of the ASDP was assessed under Part IV of the EP Act (Assessment No. 2210) and approved under MS 1207.

This section provides a summary of the environmental risks and management measures to be implemented during construction, commissioning and operations relevant to activities of the ASDP that will or may cause pollution or emissions as under Part V of the EP Act.

Environmental Management Plans

The following documents contain environmental management measures for the construction, commissioning and operations of the ASDP:

- Environmental Review Document (ERD), Water Corporation, 2022a.
- Response to Submissions Supporting Document (RTS), Water Corporation 2023a.
- Terrestrial Construction Environment Management Plan (TCEMP), Water Corporation, 2023b – as assessed (EPA Report 1739).
- Construction Marine Environmental Management Plan (CMEMP), Water Corporation, 2023c – as approved under EPBC 2019/8453.
- Commissioning and Operations Marine Environmental Management Plant (COMEMP), Water Corporation, 2023d – as required under MS 1207.

7.2 Construction Phase

Table 4 provides a summary of the environmental management, monitoring and reporting actions of the construction phase of the ASDP to support this Works Approval application, as outlined in the above environmental management plans and regulated under MS 1207.

Table 4 - Construction Phase Environmental Risks, Controls, Management and Monitoring

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
Noise and Vibration						
Management Objectives / Targets • Ensure the activities do not unreasonably affect the amenity of surrounding landowners. • 100% compliance with Section 4 of AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* • Compliance with the *Environmental Protection (Noise) Regulations 1997* • No substantiated noise related complaints						
• Civil and construction works (terrestrial and marine) • Vehicular movement, equipment and mobile plant.	Air/windborne pathway	Implementation of the TCEMP	Prior to and during construction	As per the TCEMP approved under EPBC 2019/8453 and assessed under EPA Assessment No. 2210.	As per the TCEMP	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a) • TCEMP (Water Corporation, 2023b)
		Regular communication with local residents providing specific information on construction activities which may impact the local area.	Prior to and during construction			
		Install signs that provide a contact number for complaints	Prior to and during construction			
		Nominate the equipment types and expected noise emissions for construction activities and how works will be conducted in accordance with Section 4 of AS 2436-2010	Prior to and during construction			
		Identify appropriate noise and vibration mitigation strategies to minimise impacts on residents and fauna. Document strategies within the TCEMP and implement them during the works.	Prior to and during construction			
		Any premises which is likely to receive emissions greater than the levels prescribed in the Environmental Protection (Noise) Regulations must be notified at least 24 hours before the commencement of works	Prior to and during construction			
		Works are to be limited to between 0700 and 1900h Monday to Saturday.	During construction			
		Where possible, no truck associated with the works should be left standing with its engine operating in a street adjacent to a residential area. Some vehicles such as concrete trucks are required to leave engines running, however they should not be located within residential areas.	During construction			
		All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, shall be maintain	During construction			
		After hours construction requirements (if applicable) A Noise Management Plan is to be developed detailing: • The work that is required to be completed and the reason for the work to be completed outside of construction working hours • Predicted noise levels associated with these works • The types and duration of activities that may result in noise above the prescribed levels • Control measures to be implemented to minimise noise and vibration • The monitoring requirements • The complaint response procedure	Prior to after-hours construction			

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		The Noise Management Plan is to be submitted to Water Corporation at least 30 days prior to the commencement of the works. The Noise Management Plan is to be submitted to the City of Wanneroo to allow approval to be issued at least 7 days prior to the commencement of works. Any premises which is likely to receive emissions greater than the levels prescribed in the Environmental protection (Noise) Regulations must be notified at least 24 hours before the commencement of works.				
	Marine underwater pathway	Implementation of the CMEMP	Prior to, during and post marine related construction activities	As per the CMEMP approved under EPBC 2019/8453 and assessed under EPA Assessment No. 2210.	As per the CMEMP	• CMEMP (Water Corporation, 2023c) • ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a)
	Marine underwater pathway	Construction activities will be conducted, wherever practicable, outside of key marine mammal migration periods; OR Develop an appropriate alternative management strategy based on enforcement of a suitable marine mammal exclusion zone	Prior to construction			• CMEMP, Water Corporation, 2022a • ERD (Water Corporation, 2023a) • RTS (Water Corporation, 2023b)
		Implement appropriate risk mitigation strategies to minimise potential noise-related impacts.	Daily during construction activities			
		Ensure contractors and the proponent, have a common understanding of the management procedures for marine mammal interactions, and (if necessary) the extent of the marine mammal exclusion zone	Prior to construction and during inductions			
		Document all marine fauna interactions.	During construction			
		In the event it is necessary to install the marine infrastructure during or overlapping the marine mammal migration period, prepare an appropriate Project Execution Plan with details of the approach to managing the potential impacts to marine mammals, via the enforcement of an appropriate exclusion zone	During construction			
		At the completion of the construction phase, submit a Summary Report documenting the outcomes of the mitigation strategies	Post construction			
Dust Emissions						
Management Objectives / Targets • Ensure that activities do not unreasonably affect the amenity of surrounding land users and environment. • No visible dust plumes extending greater than 10 m from the boundary of the ASDP site. • No substantiated complaints relating to dust impacts.						
• Civil and construction works.	Air/windborne pathway	Communication with local residents providing specific information on construction activities which may impact the local area	Prior to and during construction		Maintain a register of any	• ERD (Water Corporation, 2022a)

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
• Vehicle movements on unsealed access roads. • Stockpiling.		Identify specific dust control measures that will be available on site and document within the TCEMP. These may include the use of water carts, sprinklers, soil binding agents and avoiding dust raising activity during periods of high winds.	Prior to and during construction	• Monitor daily weather conditions prior to the commencement of work to determine the potential for dust generation. • Weekly visual inspections of dust suppression activities and soil stockpile stability • Monitor airborne dust levels and evaluate control measure efficiency	non-conformances or public complaints and provide the register to Water Corporation at a frequency required by the Corporation.	• RTS (Water Corporation, 2023a) • TCEMP (Water Corporation, 2023b)
		Plan construction to minimise the potential for airborne dust	Prior to construction			
		Vehicle movement to be minimised and to remain on designated tracks and maintain appropriate speed to minimise dust generation	During construction			
		Stabilise soil stockpiles to prevent erosion and dust emissions	During clearing and construction			
		Dust producing activities to be suspended immediately if dust suppression measures prove ineffective	During clearing and construction			
Chlorine Flushing / Disposal of Disinfection Water						
Management Objectives / Targets • Prevent leaks of chlorinated water to land, surface water or groundwater • No uncontrolled spills of chlorinated water • No disposal of hyper-chlorinated water without prior treatment • Prevent the contamination of water or soils as a result of commissioning works • Chlorinated water to be discharged safely and as specified in a site-specific TCEMP						
Commissioning of drinking water infrastructure	Overland flow and infiltration to soil and groundwater	Implementation of the TCEMP	Prior to commissioning	As per the TCEMP approved under EPBC 2019/8453 and assessed under EPA Assessment No. 2210.	As per the TCEMP	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a) • TCEMP (Water Corporation, 2023b)
		Appropriate treatment of hyper-chlorinated water prior to disposal	During commissioning			
		Ensure discharge of chlorine-treated water is directed to an identified and approved discharge location/system.	During commissioning			
		Ensure all approvals and licences are obtained prior to the planned discharge of chlorinated water used in the flushing of pipes (including liaison with DBCA prior to disposal to any wetland areas)	Prior to commissioning			
Uncontrolled Spills / Discharges of Chemicals, Hydrocarbons or Contaminants						
Management Objectives / Targets • Prevent impacts to land, surface water or groundwater resulting from chemical storage or use • 100% adherence to Safety Data Sheet information for each chemical used • No uncontrolled spills of dangerous goods to hazardous substances • All activities comply with the International Maritime Organisation International Convention for the Prevention of Pollution from Ships						
• Civil and construction works. • Installation of infrastructure. • Refuelling of vehicles, plant and equipment.	Overland flow and infiltration to soil and groundwater.	A site-specific TCEMP to be prepared prior to construction and commissioning works commencing		Prior to construction and commissioning.		• ERD (Water Corporation, 202a) • RTS (Water Corporation, 2023a) • TCEMP (Water Corporation, 2023b)
		All chemicals are to be stored in accordance with relevant Australian standards including: o AS1940: The Storage and Handling of Flammable and Combustible Liquids o AS3780: The Storage and Handling of Corrosive Substances		During construction and commissioning		

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		Identify all additives that will be used and demonstrate their suitability and safe use procedures		During construction and commissioning		
		Each operator using a given chemical to read and fully understand the Safety Data Sheet		During construction and commissioning		
		Spill kits are to be readily available at chemical storage locations and during maintenance, refuelling or transfer of chemicals		During construction and commissioning		
		Any refuelling and servicing of plant, vehicles and equipment is to occur on a bunded area at least 100 m away from any National Park, State Forest, TEC, PEC, Bush Forever Sites, waterways or wetlands		During construction and commissioning		
		The contractor is to record all spills and the management of the spill in a register maintained on site. Ensure contractors have access to and know how to use hydrocarbon spill kits; and maintain access to all necessary materials for mitigation of accidental spill events.		During construction and commissioning		
• Marine civil and construction works • Installation of marine infrastructure. • Refuelling of vehicles, plant and equipment. • Release of chemicals due to storage failure • Release of chemicals due to equipment failure	Discharge to marine environment	• A site-specific TCEMP to be prepared prior to construction and commissioning works commencing. • Prepare a Project Execution Plan, documenting the agreed refuelling, chemical storage and management procedures together with the management responses that will be implemented in the event of a spill.		Prior to marine construction works		• CMEMP (Water Corporation, 2023c) • ERD (Water Corporation, 2023a) • RTS (Water Corporation, 2023a)
		• In the event of an unplanned spill, implement an appropriate management response to minimise impacts to the marine environment. • In the event of a spill, the contractor shall document the spatial extent of the hydrocarbon spill using visual cues and GPS. • Implement appropriate management strategies to wherever practicable, avoid accidental hydrocarbon spills in the marine environment. • In the event of a spill, the proponent shall submit a Summary Report documenting the spatial extent of the spill, and the outcomes of the management response.		Hourly in the event of a spill		• CMEMP (Water Corporation, 2023c) • ERD (Water Corporation, 2023a) • RTS (Water Corporation, 2023a)
Acid Sulfate Soils and Dewatering						
Management Objectives / Targets • No detrimental environmental impact from acid sulfate soils or dewatering as a result of project activities. • Prevent acidification of land or water resulting from the disturbance of ASS • Prevent impacts to surrounding users of ground water or surface water • Prevent impacts to surrounding vegetation as a result of dewatering • Prevent impacts to the quality of surface water and groundwater						
• Exposure of acid, sulfidic soils and/or mobilisation of metals from dewatering, excavations and construction activities.	Soil, groundwater, surface water and marine pathways.	• Develop a site-specific Acid Sulfate Soils and Dewatering management Plan(s) in accordance with '*Identification and investigation of acid sulfate soils and acidic landscapes*' (DER, 2014) and '*Treatment and management of soil and water in acid sulfate soil landscapes' (DER, 2015)* guidelines prior to any works that may cause disturbance to ASS, including but not limited to, groundwater abstraction, dewatering, tunnelling, excavations in risk areas.	Prior to construction works activities in locations that have the potential to disturb ASS including, dewatering activities, excavations, tunnelling etc.	As per the requirements of the ASS and Dewatering Management Plan(s).	As per the requirements of the ASS and Dewatering Management Plan(s) and 5C licence	• TCEMP (Water Corporation, 2023b). • ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a)

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		• The ASS and Dewatering Management Plan(s) are to be submitted to DWER where required. • Obtain and comply with a 5C Licence to take groundwater for the project				
Light Emissions						
• Ensure that the activities do not unreasonably affect the amenity of surrounding landowners • No substantiated light emissions related complaints						
• Construction and safety lighting.	Air dispersal	Lighting required for the construction of the ASDP will be designed to be directionally positioned into the facility to minimise light spill outside of the Prescribed Premises boundary, where possible.	During construction	N/A	Report any light emission related complaints.	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a)
Waste Management						
Management Objectives / Targets • Prevent the contamination of land or soils as a result of waste storage or disposal • All waste removed from site at completion of construction/commissioning works • Prevent the spread of contaminated soils or substances • All contaminated material treated or disposed in accordance with an appropriate Hazardous Waste Management Plan • Reduce the generation of waste/resource use of the project						
Construction waste	• Air/windborne pathway • Overland flow and infiltration to soil and groundwater	Separate and clearly marked waste bins will be kept at the site office for all major waste streams including, but not limited to: • General waste • Recyclables • Steel recycling • Hydrocarbons	During construction	As per the TCEMP approved under EPBC 2019/8453 and assessed under EPA Assessment No. 2210.	As per TCEMP	• TCEMP (Water Corporation, 2023b). • ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a) •
		All waste bins on site will have securely fitted lids to prevent the attraction of fauna or movement of waste in wind/weather.	During construction			
		Provide secure toilet facilities located in an appropriate position which prevents any potential spills from being detrimental to the environment	During construction			
		Remove all general waste from site, and dispose of to suitable landfill facility, as often as required to prevent overflow of waste receptables	During construction			
		Safely contain hazardous/controlled waste and prevent exposure of harmful substances to personnel or the public through correct handling and disposal	During construction			
		Hydrocarbon waste to be disposed of to an appropriate Controlled Waste Contractor licenced under the *Environmental Protection (Controlled Waste) Regulations 2004*	During construction			
		Wastes, other than excess overburden (excluding spoil) will not be buried on any construction site	During construction			
		Excess overburden produced from trenchs/tunnelling excavations will be disposed of to: • The excavated trench; or	During construction			

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		• Suitable location agreed with the Landowner (the Landowner has first preference to retain excess overburden from their own property) • A suitable location agreed with adjacent landowners • A local landfill as inert waste Other suitable sites for disposal of excess overburden may be identified by the Contractor but shall be approved by Water Corporation.				

7.3 Commissioning and Operations Phases

Table 5 - Operations Phase Environmental Risks, Controls, Management and Monitoring

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
Noise and Vibration Emissions						
Management Objectives / Targets • Ensure the activities do not unreasonably affect the amenity of surrounding sensitive receptors • No substantiated complaints on noise/vibration emissions						
Operations of ASDP	Air/windborne	Plant layout has been designed to reduce noise levels with lower-emitting activities/processes situated closer to the edges of the prescribed premises and higher noise emitting activities/processes screened by other buildings.	During operations	N/A	Receipt of complaints will be managed by Water Corporation's internal management system.	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a)
		The design and construction of the Western Berm to screen noise emissions from the ASDP The design and construction of the Western Berm to reduce noise emissions from the ASDP				
		Detailed design of the ASDP to ensure operational noise meets the *Environmental Protection (Noise) Regulations 1997* and in accordance witt the PER				
Odour Emissions						
Management Objectives / Targets • Ensure the activities do not unreasonably affect the amenity of surrounding sensitive receptors • No substantiated complaints on odour emissions						
Operations of the ASDP including: • Production and storage of liquid/solid waste • Seawater intake screenings	Air/windborne	The ASDP process and containment infrastructure will be designed and constructed to limit the potential for odour emissions by using covers or other odour reduction measures on infrastructure and/or locating containment/process infrastructure within buildings, where possible.	During operations	N/A	Receipt of complaints will be managed by Water Corporation's internal management system.	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a)
		Minimise the emissions of odours from waste products by through regular transportation and disposal of waste to appropriately licenced waste facilities to reduce storage time at the ASDP.	During operations			
		The design and construction of the Western Berm to screen noise emissions from the ASDP	During operations			
Light Emissions						
Management Objectives/Targets • Ensure the operations of the ASDP does not unreasonably affect the amenity of surrounding landowners • No substantiated complaints on light emissions						
Operations of the ASDP	Air/windborne	Lighting required for the operations of the ASDP will be designed to be directionally positioned into the facility to minimise light spill outside of the Prescribed Premises boundary.	During operations	N/A	Receipt of complaints will be managed by	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a)

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		The Western Berm will be designed and constructed to provide a barrier to the adjacent future residential land development area from light emissions from the ASDP.	During operations		Water Corporation's internal manegement system.	
Discharge to Surface Water (marine)						
Management Objectives/Targets • Ensure the 99% species protection guideline 'trigger' levels are achieved in the High Ecological Protection Areas • Discharge of process effluent to surface water (marine) is not to exceed a salinity of greater than 75,200 mg/L.						
• Brine waste from desalination process including from the following streams: • Seawater intake screen washings • Membrane backwash effluent from membrane filter • RO plant chemical clean wasteater • Neutralised membrane filter plant chemical clean wastewater • RO plant flushing wastewater • Stormwater in the event stormwater containment systems overflow		The ASDP has been designed to reduce the potential environmental impacts associated with the discharge of brine effluent to the marine environment,.	During commissioning and operations	• Conduct two years of baseline data for salinity in the local receiving environment • Undertake monitoring and reporting as per approved COMEMP	As per COEMP	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a) • COMEMP (Water Corporation, 2023d)
		Implement the COMEMP outcome based provisions for commissioning.	During commissioning, prior to operations	• Undertake monitoring and reporting as per approved COMEMP •	As per COEMP	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a) • COMEMP (Water Corporation, 2023d)
		Implement the COMEMP outcome based provisions for operations.	During operations	• Undertake monitoring and reporting as per approved COMEMP	As per COEMP	• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023a) • COMEMP (Water Corporation, 2023d)
Uncontrolled Spills / Discharges of Chemicals, Hydrocarbons or Contaminants						
Management Objectives / Targets • Prevent impacts to land, surface water or groundwater resulting from chemicals and hydrocarbons use/storage • 100% adherence to Safety Data Sheet information for each chemical used • No uncontrolled spills of dangerous goods to hazardous substances						
• Operations and maintenance activities. • Refuelling of vehicles, plant and equipment. • Storage/containment of process effluent • Storage/containment of process solids • Overflows of containment infrastructure • Overflows of stormwater containment infrastructure	Overland flow and infiltration to soil and groundwater.		During operations	N/A		• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023b) • COMEMP (Water Corporation, 2023d) •
		All chemicals are to be stored in accordance with relevant Australian standards including: o AS1940: The Storage and Handling of Flammable and Combustible Liquids o AS3780: The Storage and Handling of Corrosive Substances	During operations	N/A		
		Identify all additives that will be used and demonstrate their suitability and safe use procedures	During operations	N/A		
		Each operator using a given chemical to read and fully understand the Safety Data Sheet	During operations	N/A		

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		Spill kits are to be readily available at chemical storage locations and during maintenance, refuelling or transfer of chemicals	During operations	N/A		
		Any refuelling and servicing of plant, vehicles and equipment is to occur on a bunded area at least 100 m away from any National Park, State Forest, TEC, PEC, Bush Forever Sites, waterways or wetlands	During operations	N/A		
		Any spills of desalination effluent and solid waste outside of an engineered containment system will be immediately recovered, or removed and appropriately disposed of.	During operations	N/A		
		All solid and liquid waste produced from the desalination process will be stored within vessels or compounds that are impervious containers (except for seawater intake screening collection baskets which have a meshed bottom for drainage of liquid back to the brine outfall).	During operations	N/A		
		All processing and liquid/solid waste storage infrastructure will be situated on impervious hardstand areas that have been designed to capture and contain any spilled or overflowed process or waste liquids/solids.	During operations	N/A		
		The design and construction of the ASDP will ensure stormwater is managed separately from process operations and activities of the ASDP. The stormwater systems are to be able to contain up to a 1 in 100 year ARI weather event.	During operations	N/A		
Waste						
Management Objectives / Targets • Prevent the contamination of land or soils as a result of waste storage or disposal • Prevent the spread of contaminated soils or substances • All contaminated material treated or disposed in accordance with an appropriate Hazardous Waste Management Plan						
• General waste (office buildings • CIP effluents • Sludge • Intake screen debris • Used RO membranes • Seawater intake screen washings	• Air/windborne pathway • Overland flow and infiltration to soil and groundwater •	Contractor to develop site specific Waste Management plan of Operational Wastes.	During operations			• ERD (Water Corporation, 2022a) • RTS (Water Corporation, 2023b) • Waste Management Plan (to be developed)
		Remove all general waste from site, and dispose of to suitable landfill facility, as often as required to prevent overflow of waste receptables	During operations			
		Safely contain hazardous/controlled waste and prevent exposure of harmful substances to personnel or the public through correct handling and disposal	During operations			
		Hydrocarbon waste to be disposed of to an appropriate Controlled Waste Contractor licenced under the *Environmental Protection (Controlled Waste) Regulations 2004*	During operations			

Source	Pathways	Management Action	Timing / Frequency of Actions	Monitoring	Reporting / Evidence	Referenced Management Plan
		Solid waste produced by the ASDP process will be stored on site in impervious containers prior to being transported to an appropriately licenced waste facility offsite for disposal.	During operations			
		Liquid waste including CIP chemicals and other wastes will be transported and disposed of to a licensed facility.	During operations	During operations		

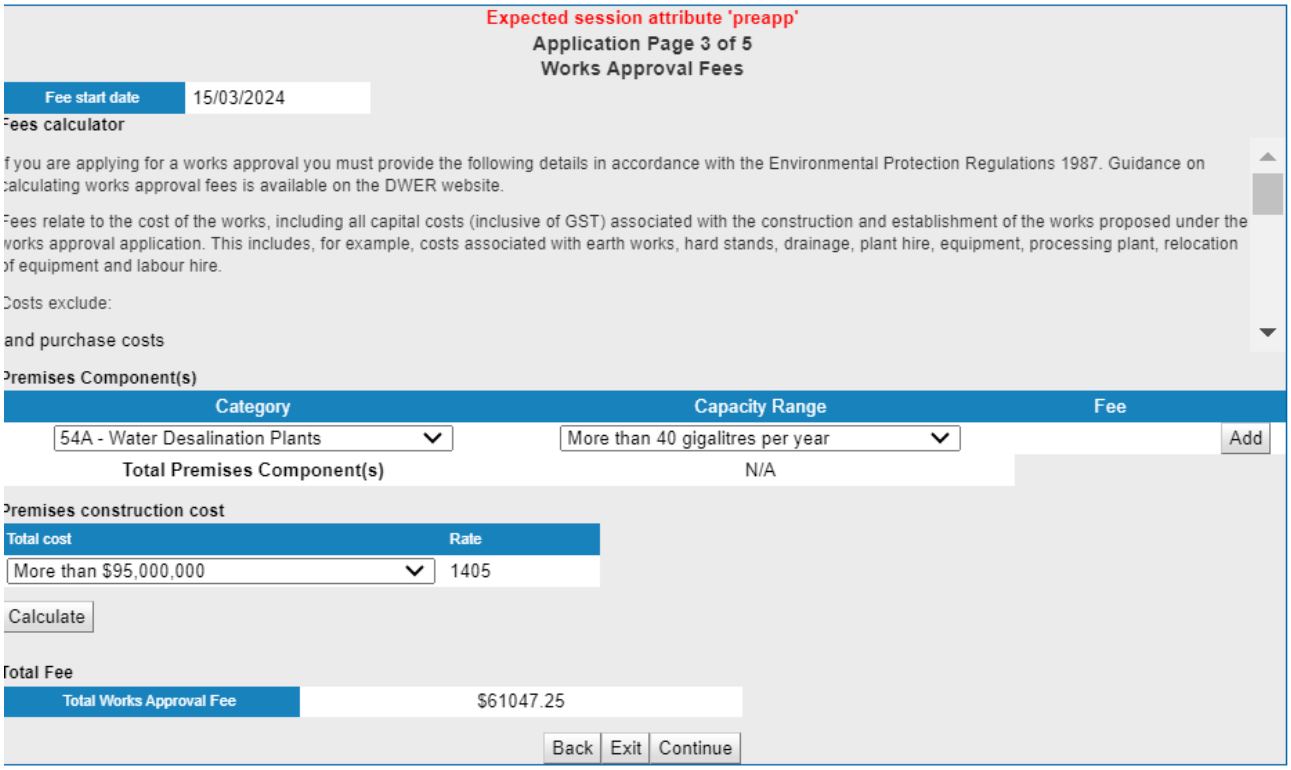
8 Monitoring and Reporting

Monitoring and reporting of construction emissions and impacts will be undertaken as per the approved Environmental Management Plans (section 7.2).

Operational monitoring and reporting of the brine discharge to the marine environment is regulated and managed in accordance with MS 1207 and associated management plans.

9 Fee Calculation

The fees have been calculated on an estimated capital cost of $2.6 billion. The fee for the Works Approval is $61,047.25, as shown below.



10 Conclusion

Water Corporation is proposing to construct a new seawater desalination plant to provide an additional source of drinking water for Perth's IWSS.

The ASDP Proposal has been assessed under Part IV of the EP Act by the WA EPA. This assessment process concluded in August 2023, when MS1207 was issued.

The ASDP Proposal approved under MS1207 was for a capacity of 100GL. This application is to construct the first 50GL of the total capacity. This throughput is considered a Category 54A prescribed activity under Part V of the EP Act, therefore Water Corporation is seeking a Works Approval prior to construction.

Water Corporation referred the proposed action to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 23 July 2019.

The Proposal was determined to be a 'Controlled Action' on 29 October 2019 as it will, or is likely to have, a significant impact on Matters of National Environmental Significance (MNES). On 4 March 2020, it was determined the Proposal would be assessed as an 'accredited assessment' in accordance with the Bilateral Agreement between the State and Commonwealth Governments. The ASDP proposal was approved subject to conditions under Section 133(1) of the EPBC Act on 8 November 2023 (EPBC Ref: 2019/8453).

The project will be constructed and operated in accordance with MS 1207 and EPBC Act Approval 2019/8453 and the management plans that are approved under those approvals:

- Construction Marine Environmental Management Plan (CMEMP), Water Corporation, 2023c – as approved under MS 1207.
- Commissioning and Operations Marine Environmental Management Plant (COMEMP), Water Corporation, 2023d – as approved under MS 1207.
- Terrestrial Construction Environment Management Plan (TCEMP), Water Corporation, 2023b – as assessed (EPA Report 1739).

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Appendix A

Environment Policy

https://nexus.watercorporation.com.au/otcs/cs.exe/app/nodes/58564684

Environment Policy

Environmental leadership and improvement

Water Corporation provides essential water, wastewater and drainage services to our customers across Western Australia. We take water from, and then return drainage water, treated wastewater and by-products to the environment.

We are committed to accelerating environmental sustainability of the water cycle as our climate changes.

Taking personal ownership

We're all responsible for protecting the environment and understanding and meeting our environmental obligations while improving performance.

Managing risks

We build our knowledge and processes to proactively identify, manage and eliminate environmental risks. We seek to prevent pollution and enhance the environments we work in.

Governance and performance

We have strong governance structures supporting our environmental objectives.

Our objectives include:

- accelerating our road to net zero; by achieving net zero for scope 1 and 2 greenhouse gas emissions by 2035
- impacting positively the land and water we influence, including no net clearing of native vegetation
- restoring and regenerating ecosystems
- educating the community on climate change impacts and maximise waterwise outcomes through water efficient programs to conserve resources
- using resources sustainably with increased wastewater recycling.

We'll regularly review our environmental objectives and measures to ensure they remain relevant. We'll report internally and publicly to measure our performance.

Pat Donovan
Chief Executive Officer, Water Corporation

This policy applies to all Water Corporation workers and includes all activities and services we provide in accordance with our operating licence. We will provide the necessary resources, systems, training and mechanisms to improve our environmental performance.

PCY230 Environment Policy
Date: March 2023
Next review: March 2026

WATER CORPORATION

Appendix B

Certificates of title

https://nexus.watercorporation.com.au/otcs/cs.exe/app/nodes/167890842

https://nexus.watercorporation.com.au/otcs/cs.exe/app/nodes/167889986

WESTERN AUSTRALIA

TITLE NUMBER	
Volume	Folio
2968	**329**

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 3000 ON DEPOSITED PLAN 415979

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

WATER CORPORATION OF 629 NEWCASTLE STREET LEEDERVILLE WA 6007
(AF O152455) REGISTERED 16/5/2019

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. EXCEPT AND RESERVING METALS, MINERALS, GEMS AND MINERAL OIL SPECIFIED IN TRANSFER 7033/1940.
2. L593933 NOTIFICATION SECTION 165 PLANNING & DEVELOPMENT ACT 2005 - SEE DEPOSITED PLAN 415979 LODGED 4/4/2011.
3. O152459 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 16/5/2019.
4. O152460 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 16/5/2019.
5. P017111 LEASE TO PUBLIC TRANSPORT AUTHORITY OF WESTERN AUSTRALIA OF PUBLIC TRANSPORT CENTRE 116 WEST PARADE PERTH WA 6000 EXPIRES: SEE LEASE. AS TO PORTION ONLY REGISTERED 20/1/2022.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	DP415979
PREVIOUS TITLE:	2945-85
PROPERTY STREET ADDRESS:	11 BRINDABELLA PWY, ALKIMOS.
LOCAL GOVERNMENT AUTHORITY:	CITY OF WANNEROO
RESPONSIBLE AGENCY:	WATER CORPORATION

NOTE 1: N344690 SECTION 138D TLA APPLIES TO CAVEAT H883407

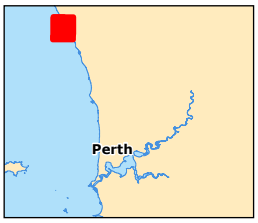
Appendix C

Figures

https://nexus.watercorporation.com.au/otcs/cs.exe/app/nodes/166934017

LEGEND

- Intake and Outfall points
- Proposed Alkimos SDP Prescribed Premises Boundary
- Terrestrial Development Envelope
- Intake
- Outfall



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Metres

Coordinate System: GCS GDA 1994
Vertical Datum: AHD

AUTHOR: POWERA0 | DATE: 13/03/2024

BRANCH: APDG – ENVIRONMENTAL BUSINESS UNIT

WATER CORPORATION

Alkimos Seawater Desalination Plant Works Approval Application

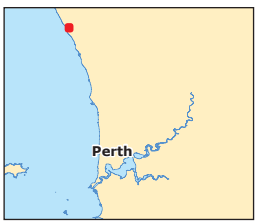
File: \\svntjt1-38\Environ\AA_EIA_GIS\1_Projects\Capital\CW03713 ASDP Enabling Earthworks\ArcMap\Figures\ProposedPrescribedPremiseBoundary_A4P.aprx

Figure 1 - Site Location

LEGEND

- Proposed Alkimos SDP Prescribed Premises Boundary
- Alkimos WWTP Prescribed Premise Boundary (L8434/2010/2)

NOTE: SDP layout is indicative only and subject to survey



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Metres

Coordinate System: GCS GDA 1994
Vertical Datum: AHD

AUTHOR: POWERA0	DATE: 14/03/2024

BRANCH: APDG – ENVIRONMENTAL BUSINESS UNIT

WATER CORPORATION

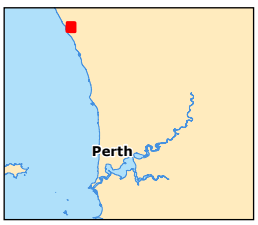
Alkimos Seawater Desalination Plant Works Approval Application

File: \\svntjt1-38\Environ\AA_EIA_GIS\1_Projects\Capital\CW03713 ASDP Enabling Earthworks\ArcMap\Figures\ProposedPrescribedPremiseBoundary_A4P.aprx

Figure 2 – Prescribed Premises Boundary

LEGEND

- Proposed Alkimos SDP Prescribed Premises Boundary
- Alkimos WWTP Prescribed Premise Boundary (L8434/2010/2)



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Metres

Coordinate System: GCS GDA 1994
Vertical Datum: AHD

AUTHOR: POWERA0 | DATE: 13/03/2024

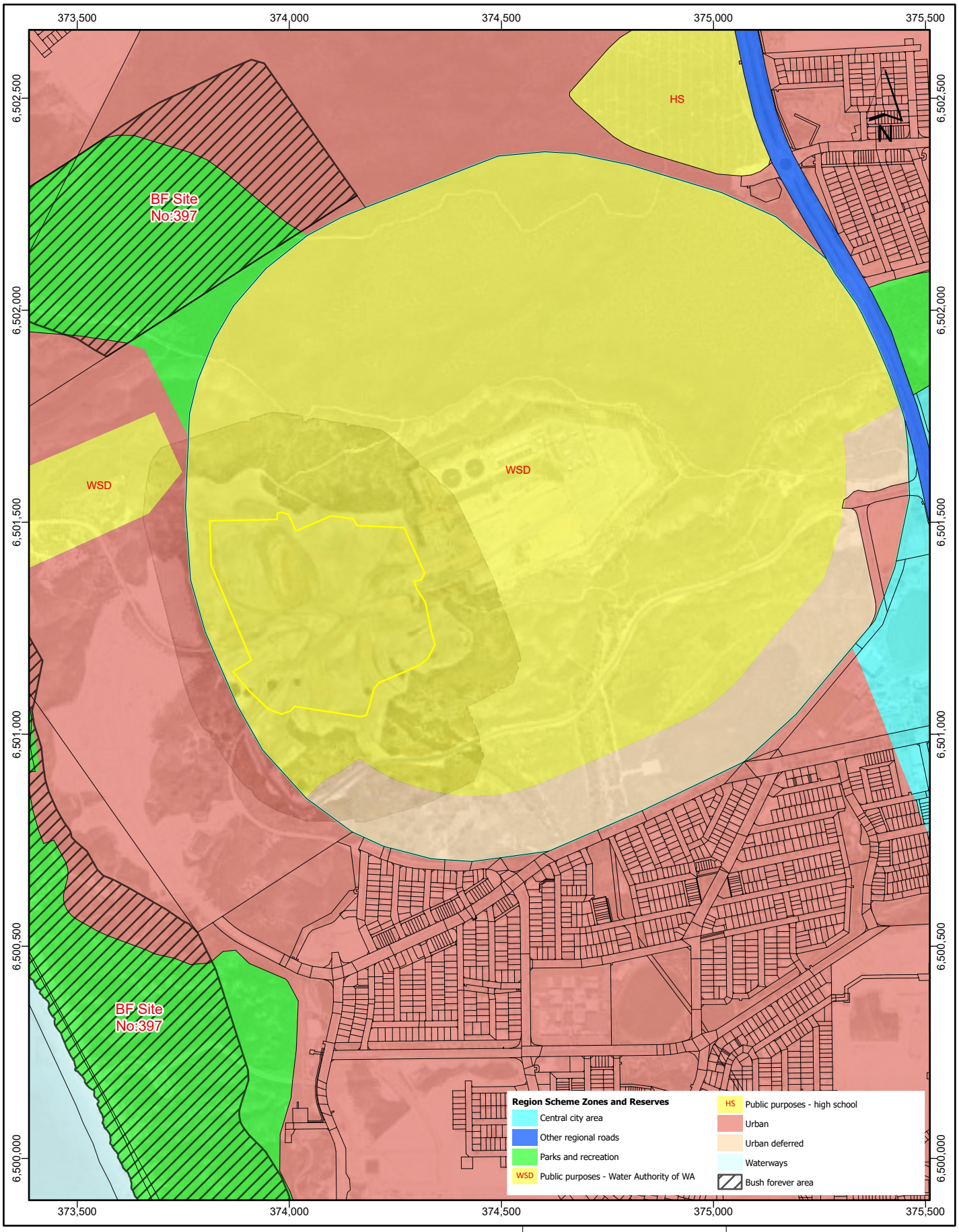
BRANCH: APDG – ENVIRONMENTAL BUSINESS UNIT

WATER CORPORATION

Alkimos Seawater Desalination Plant Works Approval Application

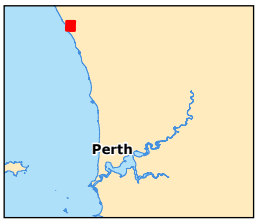
File: \\svntjt1-38\Environ\AA_EIA_GIS\1_Projects\Capital\CW03713 ASDP Enabling Earthworks\ArcMap\Figures\ProposedPrescribedPremiseBoundary_A4P.aprx

Figure 3 – ASDP and Alkimos Wastewater Treatment Plant Location



LEGEND

- Proposed Alkimos SDP Prescribed Premises Boundary
- Alkimos WWTP Prescribed Premise Boundary (L8434/2010/2)



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Metres

Coordinate System: GCS GDA 1994
Vertical Datum: AHD

AUTHOR: POWERA0 | DATE: 13/03/2024

BRANCH: APDG – ENVIRONMENTAL BUSINESS UNIT

WATER CORPORATION

Alkimos Seawater Desalination Plant Works Approval Application

File: \\svntjt1-38\Environ\AA_EIA_GIS\1_Projects\Capital\CW03713 ASDP Enabling Earthworks\ArcMap\Figures\ProposedPrescribedPremiseBoundary_A4P.aprx

Figure 4 – Surrounding Land Uses

Appendix D

Prescribed Premise GPS Coordinates

Point ID	X_GDA20_Z50	Y_GDA20_Z50	Point ID	X_GDA20_Z50	Y_GDA20_Z50
1	373813.4	6501505	19	374309.8	6501166
2	373972.4	6501508	20	374278.4	6501152
3	373972.8	6501523	21	374246.3	6501138
4	373982.6	6501525	22	374211.1	6501123
5	373999.2	6501520	23	374200.7	6501109
6	374016.3	6501481	24	374191	6501072
7	374100	6501517	25	374182.2	6501047
8	374151.3	6501510	26	374168.1	6501043
9	374160.7	6501493	27	374013.1	6501067
10	374271.1	6501489	28	374003.8	6501057
11	374320	6501382	29	373983	6501049
12	374312.8	6501366	30	373951.7	6501060
13	374294.9	6501362	31	373925.9	6501085
14	374301.2	6501345	32	373907.6	6501102
15	374321.8	6501313	33	373868	6501149
16	374335.6	6501245	34	373903.8	6501171
17	374344.4	6501212	35	373910.8	6501177
18	374327.5	6501180	36	373816.5	6501400
			37	373813.4	6501505