Chapter 3 – Description of Project
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3.1 Introduction

This Chapter describes the proposed Desalination Plant. It discusses the desalination process, the proposed site of the development at Port Stanvac and the three key components of the proposal, including the Desalination Plant, intake and outfall systems and the power supply infrastructure.

The design and environmental performance criteria for the key components are outlined along with SA Water’s proposed management arrangements and project execution timeframes.

The EIS has been prepared on the basis of the Concept Design developed for the Desalination Plant that includes consideration of design options, project feasibility and associated environmental assessments. The Concept Design is expressed as drawings that set out indicative arrangements and locations for the Desalination Plant structures, marine works (comprising intake and outfall structures and conduits), buildings, civil and electrical works.

The successful Contractor will be required to design and deliver the proposed Desalination Plant in accordance with specified environmental and engineering performance objectives and functional requirements established by SA Water for the proposed development (Table 3.1). The final design may vary from the Concept Design but must meet the detailed environmental and engineering performance criteria.

It should be noted that both the transfer pipeline system for pumping treated water from the proposed Desalination Plant to the HWTP and the ETSA infrastructure are subject to separate development approval processes.

3.1.1 Project Description

The proposed ADP project is a reverse osmosis Desalination Plant with an initial production capacity of 50 GL per annum and infrastructure designed for future expansion to supply up to 100 GL per annum of drinking water. The intake and outfall systems will draw or take seawater into the facility and return saline concentrate to Gulf St Vincent.

The proposed Desalination Plant is designed to be a flexible load plant, capable of operating at full capacity (i.e. 100 GL per annum), or at lower levels of production. Given the array of factors likely to affect the level of production required, the Desalination Plant needs to have sufficient flexibility to be efficiently operated at full capacity or at lower production levels.

The flexible load Desalination Plant complements the South Australian Government’s *Four Way Water Security Strategy*, in that the supply of water sourced from desalination is not intended to replace other measures, but has been designed to diversify, enhance and secure a reliable water supply for metropolitan Adelaide.

A description of the proposed Desalination Plant, its constituent parts and associated works is provided below.

3.1.2 The Desalination Process

The process of desalination removes dissolved salts and impurities from a water source such as seawater to convert it to drinking water. The benefit of the desalination process
is that the raw water source does not depend on rainfall, making it climate independent and capable of providing water throughout the year.

Reverse osmosis desalination works by using high pressure semi-permeable membranes. Fresh water, with a very small quantity of salt, passes through the membrane leaving a concentrated salt stream that is then discharged back to the ocean. Typically for every 100 litres of raw seawater, approximately 40 to 45 litres of drinking water is produced.

Reverse osmosis technology has been adopted for all of the large seawater desalination plants recently constructed or planned in Australia, including plants in Perth, the Gold Coast, Sydney and Melbourne.

An overview of the desalination process based on reverse osmosis is shown in Figure 3.1 below.

![Desalination Process Diagram](image)

**Figure 3.1  Desalination Process**

The desalination process can be summarised as follows:

- Seawater is drawn into the intake structure, which is designed to minimise the entrainment and entrapment of marine biota, sand and debris. The intake water is screened to remove large matter and then pumped to the pre-treatment process.

- The pre-treatment process (described below) removes suspended solids, oil and grease and other particle matter that could block, damage or foul the reverse osmosis membranes.

- The seawater is then pumped at high pressure through the reverse osmosis membranes to separate water from the seawater. The membranes retain the salts and other impurities, while the clean water (containing little salt) passes through the membranes and is termed permeate. Periodically, the membranes must be chemically cleaned to remove accumulated materials. Spent chemical solutions are neutralised prior to disposal via a trade waste point or, if appropriate, released at a controlled rate to the outfall, subject to compliance with EPA requirements.
• The saline concentrate produced as part of the reverse osmosis process is passed through an energy recovery system prior to discharge to the marine environment via the outfall. The diffuser structure located at the end of the outfall pipe will be designed to ensure that the discharge will be well mixed with the receiving water.

• The permeate water is re-mineralised via a post-treatment process. This process ensures that the desalinated water satisfies the health and aesthetic requirements of the Drinking Water Specification and the Australian Drinking Water Guidelines. Fluoridation and chlorine disinfection form part of the post-treatment process. Compliance with these standards has been included as part of SA Water’s contractual obligations imposed on the Contractor.

• The treated water is stored temporarily in a balancing storage tank prior to pumping to the Happy Valley System via the transfer pump station and pipeline for blending with conventionally treated surface water and reticulation via the Adelaide water supply network.

3.1.3 Environmental Drivers and Performance Criteria

The proposed Desalination Plant is to be developed to meet specified performance criteria for design, construction and operation to ensure that environmental protection objectives are achieved. These objectives have been fundamental in driving the Concept Design of the proposed Desalination Plant.

The following Table 3.1 outlines the key environmental objectives and performance criteria for the Desalination Plant. The objectives and criteria have been developed from the environmental impact assessment process undertaken as part of the EIS.

The environmental objectives and performance criteria will be applied throughout the project life cycle and will be subject to ongoing refinement by SA Water based on community feedback. They will also be implemented and monitored in order to meet the overall project objectives presented in Chapter 2.
### Table 3.1 Environmental Objectives and Performance Criteria.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Objective</th>
<th>Performance Criteria/ Requirements and Environmental Management Measures</th>
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</table>
| **Terrestrial Environment** | Protect biodiversity values of the site and avoid impacts to native vegetation or fauna. | • Comply with the requirements of the Native Vegetation Act 1991 (SA).  
• No removal of native vegetation is to be undertaken at the site without prior approval of SA Water.  
• Design to ensure that impacts to terrestrial flora and fauna are avoided or minimised during, construction, commissioning and operation.  
• Design to incorporate opportunities for habitat restoration and regeneration at the site.  
• A Construction Environmental Management and Monitoring Plan is to be developed to identify ‘no go’ zones including the cliff zone (comprising the area at the top of the cliff still influenced by coastal instability and erosion (approximately 10 metres back from the cliff edge) to the edge of the intertidal zone). The plan should address biodiversity protection, including flora and fauna management at the site.  
• Develop and implement a site ‘pest and weed management plan’ that includes:  
  o weed management strategies, hygiene procedures and the control of any declared weeds at the site;  
  o management of construction equipment, vehicles and any imported materials (eg soil) used during construction to ensure such equipment and imported materials are weed and pathogen free; and  
  o compliance with the requirements of SA Water’s Phytophthora Management Guidelines.  
• A Land Management Plan for the site is to be developed and implemented that incorporates opportunities to improve current biodiversity at the site though revegetation with locally indigenous species and ongoing management of weeds. Consultation on the plan should be undertaken with the Adelaide and Mt Lofty Ranges Natural Resources Management Board and Onkaparinga Council to ensure it integrates with broader Regional Strategies.  
• Ensure site stormwater management is in accordance with a Soil Erosion Drainage Management Plan.  
• Ensure management of noise, dust, fill and excavation are in accordance with construction management plans that identify management requirements to minimise disturbance or impacts to site flora and fauna. |
| **Terrestrial flora and fauna** | | |
| **Geology** | Protect the cliff zone. The cliff zone comprises the area at the top of the cliff still influenced by coastal instability and erosion (approximately 10 metres back from the cliff edge) to the offshore edge of the intertidal zone. | • Design to ensure that infrastructure footprint does not impact the cliff zone, including ensuring that any works are located at a sufficient distance so as to not impact cliff stability.  
• Construction Environmental Management Plan to be developed that includes a work site map that identifies ‘no go’ zones, including any works that may adversely impact the cliff zone and minimise any impacts on neighbouring areas. |
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<tr>
<th>Issue</th>
<th>Objective</th>
<th>Performance Criteria/ Requirements and Environmental Management Measures</th>
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<tbody>
<tr>
<td>Greenhouse gases</td>
<td>Minimise energy use and greenhouse gas emissions throughout design, construction and operation.</td>
<td>• Development and implementation of Sustainability Management Plans for each phase of the project to minimise the greenhouse footprint through design, construction and operation.</td>
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<td>• Incorporation of energy efficiency into the layout and design of the Desalination Plant.</td>
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<td>• Selection and sourcing of materials for the Desalination Plant must take into account whole-life impacts and embodied energy.</td>
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<td>• Incorporation of opportunities to include solar or other small scale on-site energy generation opportunities as part of the final design.</td>
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<td>• Specific energy consumption to be equal to or better than national / international benchmark standards and achieve less than 4.5 kWh per KL of drinking water produced for the plant, excluding the Transfer Pumping Station.</td>
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<td>• Incorporation of energy recovery systems in the process plant and outfall system.</td>
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<td>• Incorporate energy efficient equipment within the Desalination Plant to minimise energy consumption.</td>
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<td>• The environmental impact of energy use to be minimised during construction and operation by minimising the consumption of all forms of energy (fuels, electricity), minimising production of emissions.</td>
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<td>Aboriginal Heritage</td>
<td>Protect sites of Aboriginal Heritage significance and avoid impacts. Manage interactions with known and unknown heritage sites.</td>
<td>• Ensure compliance with the requirements of the Aboriginal Heritage Act 1988 (SA).</td>
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<td>• Ensure ongoing consultation with the local Aboriginal Community on the project through the Kaurna Heritage Board.</td>
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<td>• Design the plant footprint to avoid any areas of identified Aboriginal heritage significance.</td>
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<td>• Develop and implement a Cultural Heritage Management Plan for the works that includes induction requirements and cultural awareness training for contractors and protocols for the management of items of heritage significance, if found.</td>
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<td>• Ensure the Construction Environmental Management and Monitoring Plan (CEMMP) site map that identifies known areas or sites to avoid.</td>
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<td>• Actively identify and incorporate opportunities in the project to acknowledge and recognise Kaurna connection with the land and waters, including recognition of the Tjilbruke trail through signage and other mechanisms to be developed in consultation with the KHB.</td>
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<td>• Establish a keeping place for any artefacts salvaged during the construction process.</td>
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<td>Non-Aboriginal Heritage</td>
<td>Protect historic places and sites from disturbance where impacts can be avoided. Manage interactions with known and unknown heritage.</td>
<td>• Development and implement a Cultural Heritage Management Plan for the construction and operation of the Desalination Plant.</td>
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| Groundwater            | Protect the quantity and quality of groundwater consistent with relevant State water policies                                                   | • Design and construction must protect groundwater during any tunnelling and drilling in relation to groundwater movement and associated migration of contaminants.  
• All below ground concrete structures must be designed such that the concrete is not affected by any contaminated groundwater, is vermin proof and sealed. Structures that convey or contain water should be designed to be fully enclosed and leak proof (to avoid groundwater ingress).  
• Development of a Construction Management Plan that addresses groundwater management, including disposal of groundwater if dewatering is required during construction. The management plan should be developed in consultation with the EPA and should meet EPA licensing requirements.  
• Development of the Operational Environmental Management and Monitoring Plan to include measures for the ongoing protection of groundwater. |
| Sediment and Erosion   | Minimise erosion and sediment movement.                                                                                                        | • Comply with the requirements of the Environment Protection (Water Quality) Policy 2003 and other relevant regulations.  
• Develop and implement a Construction Environmental Management and Monitoring Plan to address the management of excavated material and fill, including incorporating measures to suppress dust and to control the transport of dirt and mud onto local roads.  
• Develop and implement a Soil Erosion and Drainage Management Plan for the construction and operation phases of the project. The plan should be in accordance with EPA requirements, and comply with the Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry (1999). The plan should include the following management and monitoring strategies:  
  o Minimising areas disturbed, location of stockpiles to protect drainage lines, installation of erosion control devices and ongoing monitoring of erosion control measures;  
  o Maintenance of erosion control devices and sediment control measures; and  
  o Progressive rehabilitation and stabilisation (including revegetation) of disturbed areas. |
| Stormwater management  | Ensure stormwater management is incorporated into the construction and operation of the plant.                                                   | • Comply with the requirements of the local council, the Environment Protection (Water Quality) Policy 2003 and other regulatory requirements.  
• The design must ensure stormwater management measures comply with relevant guidelines, including EPA Stormwater Guidelines, and incorporate Water Sensitive Urban Design (WSUD) principles.  
• Implement opportunities (where possible) for roof runoff and stormwater containment and / or reuse on site. Where feasible, this should incorporate opportunities for stormwater reuse as an alternative to mains water.  
• Develop and implement a Soil Erosion Drainage Management Plan for the construction and operation phases of the project.  
• Take all reasonable and practical steps necessary to protect the environment and in particular provide erosion management. |
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<td>and sediment control measures required by the EPA. This should include compliance with the Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry (1999).</td>
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<td>• Chemical storage and delivery areas must be bunded in accordance with the South Australia EPA Bunding and Spill Management guidelines, and must ensure that any spills do not enter the site stormwater system.</td>
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<td>• Develop and implement a Construction Environmental Management and Monitoring Plan that ensures no adverse impact to waterways, including the development of a Soil Erosion Drainage Management Plan for the construction and operation phases of the project to protect the site drainage line from erosion, sedimentation and pollution.</td>
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<td>• Adopt Water Sensitive Urban Design (WSUD) principles for the design, construction and operation of the Desalination Plant as part of surface water management at the site.</td>
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<td>• During detailed design, undertake modelling of stormwater management at the site to ensure compliance with the requirements of the Environment Protection (Water Quality) Policy 2003 and other regulatory requirements.</td>
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<td>Waterways</td>
<td>Protect waterways and surface water quality.</td>
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<td>• Hazardous materials (including chemicals and fuels) must be stored within bunded areas in accordance with the South Australia EPA Bunding and Spill Management guidelines, and must ensure that any spills do not enter the site stormwater system.</td>
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<td>• Limit the on-site storage of hazardous substances.</td>
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<td>• Emergency response and contingency plans must be developed that include procedures that deal with the management and reporting of any spills. Spill response kits to be available on site (including for offshore works) and maintained to relevant standards.</td>
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<td>Hazardous Materials</td>
<td>Protect the environment and human health from the impacts of hazardous materials.</td>
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<td>• The Contractor must ensure that waste produced as a result of construction activities is minimised.</td>
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<td>• In assessing waste management options, adopt the waste management hierarchy in order of preference:</td>
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<td>o Waste avoidance and reduction;</td>
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<td>o Maximise waste reuse, recovery and recycling;</td>
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<td>o Waste treatment; and</td>
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<td>o Waste disposal.</td>
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<td>• Waste to be disposed of in accordance with EPA guidelines.</td>
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<td>• Where possible, design excavation works should balance cut to fill to minimise the requirement for offsite disposal.</td>
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<tr>
<td>Waste</td>
<td>Minimise waste production and manage wastes consistent with relevant State waste policies and guidelines.</td>
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<tr>
<td>Resource Efficiency</td>
<td>Maximise efficient use of resources including minimising resource use and maximising recovery and recycling.</td>
<td>• Develop a Sustainability Management Plan for each project phase.</td>
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<td>• Incorporate reuse or recycling of materials where possible.</td>
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<td>• Minimise water use and as part of the design, construction and operation for temporary and permanent works.</td>
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<td>• Incorporate reuse or recycling of water including rainwater harvesting and stormwater recycling and reuse of construction water where possible.</td>
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| Noise and Vibration    | Protect local amenity and minimise noise during construction and operation, including from marine noise and vibration. | • Comply with the South Australian *Environment Protection (Noise) Policy* 2007.  
• Incorporate noise abatement into the design of the plant.  
• Ensure Noise and Vibration Management Plans are developed for both construction and operation. These plans should be developed in consultation with the EPA. The plans must accurately predict noise or vibrations levels generated from noisy activities and identify mitigation measures to minimise noise impacts, particularly to residential areas. Such measures should include, where feasible:  
  o Controlling noise at the source, incorporating less noisy construction techniques;  
  o Scheduling noisy activities for daytime hours in accordance with any authorisations required under *Environmental Protection Act 1993 (SA)*;  
  o Equipment maintenance and use of mufflers and silencers; and  
  o Use of noise barriers.  
• The Noise and Vibration Management Plan should include monitoring (either on a regular or where required continuous basis) to verify that the noise levels generated are not exceeding the criteria set by the EPA. |
| Air quality            | Protect air quality during construction and operation.                    | • Atmospheric emissions to comply with regulatory requirements, including the National Environmental Pollution Measure for Air Quality (NEPM), the *Environment Protection (Air Quality) Policy 1994 (SA)* and the *Environment Protection Act 1993 (SA)*.  
• Develop and implement a Construction Air Quality Management Plan, including specific measures to manage dust and limit dust emissions.  
• Minimise areas disturbed and potential dust emissions and ensure disturbed areas are protected and revegetated as soon as possible.  
• All construction vehicles must be maintained and have covers (as required) to prevent any loss of load, whether in the form of dust, liquid, solids or otherwise.  
• The Contractor must ensure that all plant and equipment at the site, or used in connection with the Contractor’s activities, are maintained and operated in a proper and efficient manner.  
• Ensure minimal odour to sensitive receptors with regular disposal of waste and with waste disposal practices fully compliant with regulatory requirements.  
• Undertake regular inspections and reviews to confirm compliance with regulatory requirements. Maintain a compliance register. |
| Visual amenity         | Protect visual amenity, including landscape and amenity values of the coastline. | • Design of Desalination Plant infrastructure and buildings to consider visual amenity and the outcomes of the visual impact assessment. This should include:  
  o Buildings and plant layout to screen unsightly features from view, including use of site levels;  
  o Use of muted colours (eg ochres and greys) for external finishes and the use of light reflecting |
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|                       |                                                                           | polished finishes, were appropriate; and                                                                                       | • Ensure landscaping and screening of the Desalination Plant is undertaken, incorporating locally indigenous species.  
• Minimise impacts associated with light spill during both construction and operation, including:   
  o the use of screens, where potential impacts are identified; and  
  o the use of lighting systems that illuminate the minimum areas required for the minimum period of time.                                                                                                                      |
|                       |                                                                           | Any mounding or other landforms should be integrated into the broader landscape to appear as natural as possible.                                                                                      |                                                                                                                                                                                                                                                                                                                                 |
|                       |                                                                           | Ensure landscaping and screening of the Desalination Plant is undertaken, incorporating locally indigenous species.                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                 |
|                       |                                                                           | Minimise impacts associated with light spill during both construction and operation, including:   
  o the use of screens, where potential impacts are identified; and  
  o the use of lighting systems that illuminate the minimum areas required for the minimum period of time.                                                                                                                      |                                                                                                                                                                                                                                                                                                                                 |
| Traffic and Transport | Manage effects of increased traffic and transportation during construction and operation to minimise impacts to the community and protect public safety. | Develop and implement a Traffic Management Plan in consultation with relevant Authorities to manage and minimise any adverse traffic impacts to the local community and businesses during construction and operation.  
• Access to the site to consider impacts on the local and regional road network and to incorporate measure to reduce these impacts.  
• Ensure ongoing communication with the local community and businesses to manage any impacts associated with traffic.                                                                                                                     |                                                                                                                                                                                                                                                                                                                                 |
| Social                | Manage and maintain ongoing communication with the local community.        | Develop and implement a Stakeholder Engagement Strategy and Action Plan to ensure community and stakeholder engagement is undertaken to inform the community about the project during all project stages. The plan should incorporate:  
  o ongoing communication with potentially affected communities to identify and address concerns;  
  o the communication of measures to minimise any adverse impacts or perceived adverse impacts;  
  o measures to encourage community support and ownership of the project.  
• The Contractor will be required to implement measures to maximise opportunities for local Indigenous employment, where possible, particularly through the Kaurna Heritage Board.  
• The Contractor will be required to maximise opportunities to involve local industry group, businesses and service providers to encourage local employment and business benefits.                                                                                      |                                                                                                                                                                                                                                                                                                                                 |
| Contaminated Land     | Protect human health and the environment through management of any contamination. | Assess risk and management requirements associated with identified contamination issues in accordance with the National Environment Protection (Assessment of Site Contamination) Measures, NEPC 1999, and any EPA regulatory requirements.  
• Develop a Management Plan, in accordance with EPA requirements, that outlines measures for the assessment, management or removal of any contaminated material.  
• Where practicable, re-use and remediate any contaminated material encountered on site. Where disposal of contaminated material is required, this should be undertaken in accordance with appropriate EPA licensed landfill. |                                                                                                                                                                                                                                                                                                                                 |
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| **Land Management**        | Manage the site to enhance site environment values. | • Develop a Land Management Plan for the site that incorportates opportunities to improve current biodiversity at the site though revegetation with locally indigenous species and ongoing management of weeds.  
• Consultation on the plan should be undertaken with the Adelaide and Mt Lofty Ranges Natural Resources Management Board and Onkaparinga Council to ensure it integrates with broader Regional Strategies. |
| **Site rehabilitation**    | Restore and rehabilitate disturbed areas including incorporating opportunities for enhancing site environmental values | • Ensure that the site is progressively rehabilitated during construction works.  
• Incorporate opportunities in the design for habitat restoration and regeneration on the site, including undertaking revegetation at the site using locally indigenous plant species. |
| **Marine Environment**     |                                                     | • Develop and implement a Marine Management Plan that includes:  
  o a Marine Pest Risk Assessment And Monitoring Plan, including quarantine and cleaning protocols for all marine vessels and equipment used on the Desalination Plant. The plan should address risks associated with aquatic animal diseases, including Abalone Viral Ganglioneuritis (AVG). |
| **Marine Pests**           | Avoid the introduction, spread and establishment of marine pests. | • Develop and implement management systems, including communication protocols with recreational fishers and divers to minimise disruption to recreational activities.  
• Minimise the potential for damage caused by recreational and commercial vessels with the establishment of an exclusion zone in accordance with DTEI requirements.  
• Provision of navigation aids to identify locations of marine structures in accordance with DTEI and regulatory requirements. |
| **Marine amenity**         | Minimise impacts to marine recreational activities. | • Ensure the design minimises impacts to habitats and the risk to marine biota during construction, commissioning and operation.  
• Marine structures to be designed and constructed to meet the following:  
  o Infrastructure footprint does not impact the cliff zone (comprising approximately 10 metres back from the cliff edge to the edge of the intertidal zone) and any infrastructure works do not adversely impact the cliff stability;  
  o No explosive blasting to be undertaken within the intertidal and subtidal zone and minimised elsewhere within the marine environment. If blasting is required it must be in accordance with Construction Environmental Management and Monitoring Plan and consistent with the procedures outlined under EPBC Act Policy Statement 2.1; and  
  o Intake pumping station must not be located within the intertidal zone. |
<p>| <strong>Marine and Coastal integrity</strong> | Protect the ecological integrity and values of the marine environment. | • |</p>
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<td><strong>Coastal processes</strong></td>
<td>Protect existing coastal processes.</td>
<td>• Demonstrate through hydrodynamic modelling that the project will not adversely impact on coastal processes such as sediment transport and current movements during operation of the Desalination Plant.</td>
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<td><strong>Underwater noise and vibration</strong></td>
<td>Protect marine mammals.</td>
<td>• Develop a Construction Environmental Management and Monitoring Plan that includes for management of underwater noise, consistent with the procedures outlined under EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales.</td>
</tr>
</tbody>
</table>
| **Marine flora and fauna**   | Protect marine flora and fauna and associated habitats. | • Minimise the impacts on marine flora, fauna and habitats during construction, commissioning and operation including: Design and Construction (general)  
  • Location and operation of marine structures to be designed to minimise impacts upon the marine environment.  
  • Avoid construction of the seawater pumping station within the intertidal zone.  
  • No blasting to be undertaken within the intertidal and subtidal zone and must be minimised elsewhere within the marine environment. If blasting is required it must be in accordance with Construction Environmental Management and Monitoring Plan, and consistent with the procedures outlined under EPBC Act Policy Statement 2.1.  
  • Any dredging and entrenching must comply with all regulatory requirements, including EPA licensing requirements.  
  • Construction Environmental Management and Monitoring Plan to be developed with specific environmental management plans and work procedures to address:  
    • Dredge management incorporating:  
      - best practice measures to minimise dredge footprint;  
      - sediment/turbidity control including a monitoring plan and turbidity trigger levels that when exceeded work will cease;  
      - management of spoil from dredging works, including any spoil to be disposed of in accordance with EPA licence requirements and national Ocean Disposal Guidelines for Dredged Material. Where feasible land based disposal and reuse of material should be considered; and  
      - timing of dredging to avoid dodge tides and recruitment periods for key reef species (July to December), where feasible.  
    • Construction marine noise management;  
    • Water quality during marine works;  
    • Marine pest management;  
    • Contingency, spill management and emergency response plan for risks associated with potential spillage of chemicals and contaminants to marine environment.  
  • An Environmental Management and Monitoring Plan to be developed for construction and operation that includes receiving water monitoring in accordance with project approvals and demonstrating compliance with project environmental objectives.                                                                                                                                                                                                                                                                                                                                                   |
<table>
<thead>
<tr>
<th>Issue</th>
<th>Objective</th>
<th>Performance Criteria/ Requirements and Environmental Management Measures</th>
</tr>
</thead>
</table>
| Marine flora and fauna| Protect marine flora and fauna and associated habitats. | **Intake Structure**  
Design and operation to ensure:  
- Location of the intake structure must be within the mid benthic zone (envelope/zone shown on Figures 3.4 and 3.5).  
- Intake structure to be located at a sufficient distance from the subtidal reef area to minimise the risk of entrainment or entrapment of reef species.  
- Location of the seawater intake structure at a height above the seabed to minimise the risk of entrainment of sediment or floating debris.  
- Seawater intake velocity at the entry to the intake structure should not exceed 0.15 m/s under any operating condition  
- Seawater intake to incorporate screen/grill to restrict ingress of marine biota with a maximum clear grille spacing of 75 millimetres (as installed).  
- Any chlorination (or approved biocide) dosing system from the intake structure must ensure that there is no backflow of chemical dosing into the marine environment.  
- Develop and implement a monitoring program (as part of the Operational Environment Management and Monitoring Plan) in accordance with Major Development approval and EPA licence, including:  
  - Monitoring and reporting on entrainment on marine biota. |
| Marine flora and fauna| Protect marine flora and fauna and associated habitats. | **Outfall**  
The saline concentrate discharge must comply with EPA licence conditions and any other regulatory requirements.  
Design and operation to ensure:  
- The outfall structure must be positioned within the envelope zone shown on Figures 3.4 and 3.5 and far enough from the intake to avoid any short circuiting.  
- The outfall system must terminate with diffusers designed to promote rapid dispersion of the saline concentrate into the surrounding seawater.  
- The outfall must achieve the required initial dilution of 50:1 at the seabed, or as otherwise agreed with the EPA, under all current scenarios for the full range of operating conditions / flows.  
- The design of the outfall system should include consideration of the use of bypass flows or other measures to ensure the achievement of the target dilution requirements, particularly under low discharge flows.  
- The outfall diffuser shall be capable of:  
  - being extended; and  
  - being modified to reduce the number of diffuser outlets and/or to adjust dispersion rates from each diffuser outlet.  
- The saline concentrate discharge must not contain Cleaning in Place (CIP) chemicals or any other preservation chemicals, unless permitted by the regulatory authorities.  
- Ecotoxicity testing (Direct Toxicity Assessment) of the saline concentrate, with representative process chemicals,
**Issue** | **Objective** | **Performance Criteria/ Requirements and Environmental Management Measures**
--- | --- | ---
| | | should be undertaken to confirm species sensitivity and the dilution requirements to protect 95% of species (in accordance with ANZECC guidelines slight to modified ecosystems).
- Develop and implement an Operational Environmental Management and Monitoring Plan that incorporates a monitoring program in accordance with the Major Development approval and EPA licensing requirements. The monitoring program shall include:
  - process monitoring to confirm that performance is within acceptable range (as supported by environmental assessments);
  - discharge water quality monitoring;
  - diffuser performance validation; and
  - habitat / receiving environment monitoring and water quality.
- Demonstrate through modelling and field measurements that the outfall design system achieves the required mixing and dispersion requirements.

Figures 3.4 and 3.5 below illustrate the proposed locations of the intake and outfall structures and the marine zones in which these structures are to be sited. It is important to emphasise that the environmental objectives and performance criteria listed in Table 3.1 require that the intake and outfall structures are to be located in the mid benthic and deep benthic zones respectively. Chapter 7 provides further detail of the characteristics of these zones.

### 3.1.4 Compliance with Environmental Performance Criteria

The proposed Desalination Plant will be designed to achieve the above performance criteria. SA Water will require the Contractor to have a current and certified Environmental Management System (EMS) in place, compliant with ISO 14001:2004. Requiring an EMS provides some assurance that the Contractors have a framework in place to identify environmental impacts associated with their operations and have company-enforced strategies to manage and minimise these impacts.

SA Water will also require the Contractor to prepare a comprehensive Environmental Management and Monitoring Plan (EMMP) which will include the Construction Environmental Management and Monitoring Plan (CEMMP) and the Operational Environmental Management and Monitoring Plan (OEMMP).

- The CEMPP will be developed for the construction of the Desalination Plant. This CEMMP will detail environmental risks and associated impacts during the construction phase and provide mitigation measures for the Contractor to follow.
- The OEMMP will be required for the operation of the proposed Desalination Plant. This OEMMP will identify potential environmental risks and impacts associated with the Desalination Plant operations and present mitigation measures to minimise or avoid impacts, as well as specify ongoing monitoring requirements.

SA Water and the Contractor will jointly appoint an Independent Verifier for the Desalination Plant. The roles of the Independent Verifier include:
• Verifying that the processes employed by the Contractor in the design, construction, commissioning of the works comply with the requirements of the Contract; and

• Verifying that the Contractor’s activities and works comply with the requirements of the Contract, including verification of milestones in the completion of works.
3.2 Description of Existing Environment

3.2.1 Description of the Port Stanvac Site

3.2.1.1 Selection of the Northern Land at Port Stanvac

Port Stanvac was selected as the preferred location for the proposed Desalination Plant because of:

- Its proximity to existing infrastructure;
- Relatively deep water providing for superior marine dispersion characteristics;
- Ease of integration into Adelaide’s existing water supply system;
- Suitable land use zoning; and
- Lower potential life cycle costs than the other sites.

Within the Port Stanvac site, two options were identified as possible locations for the proposed Desalination Plant; the Northern site and the Southern site. These are shown in Figure 3.2.

![Desalination Plant Site Options](image)

Figure 3.2 Desalination Plant Site Options

A range of environmental and technical investigations were undertaken at both sites to determine the most appropriate land parcel to acquire for the Desalination Plant. A further multi-criteria assessment incorporating a number of economic, environmental, social and engineering factors was then employed to assist in the decision-making process.
The following conclusions were made based on the multi-criteria assessment:

- Economic – the likely difference in development costs presents nominally a $25 million saving for the Northern site option. This excludes remediation costs for either site;

- Environment (Marine) – results indicate there is an insignificant difference between the Northern and Southern sites in terms of marine biology, seabed topography and water quality and currents;

- Environment (Terrestrial) – the Southern site presents a considerably greater risk for the management of groundwater contamination. The vegetation assessment indicates that the Southern site has the greater potential to impact on significant flora and fauna habitat and, as such, the Northern site is preferred;

- Heritage – both sites have been subject to an Aboriginal Heritage Survey and monitoring by the Kaurna people;

- Noise – the Northern site has a greater buffer to residential areas; and

- Traffic – the traffic report concludes that the Southern site option is marginally preferred, as it presents less impact to the regional traffic network, including impacts on local residents. However, there will be insignificant additional interaction and risks associated with Mobil’s current operations at the Southern site.

For both the Northern and Southern sites, engineering evaluations were undertaken to assess the impacts and viability of constructing and operating the proposed Desalination Plant over a 20-year horizon. Conceptual plant layouts were developed for each site that considered numerous factors, including topography, existing vegetation, potential buffers from adjacent land users, visual impacts, operational efficiency, noise, geotechnical conditions, accessibility, location and likely impacts on the terrestrial and marine environments of the proposed intake and outfall structures.

The outcome of these investigations was that the Northern site at Port Stanvac was identified as the most appropriate site for the establishment of the proposed Desalination Plant.

### 3.2.1.2 Northern Site Description

The Northern site is presently owned by Mobil Oil Australia (‘Mobil’). SA Water is currently in negotiations with Mobil to acquire the land. The Northern site comprises both terrestrial and marine components. In relation to the terrestrial components, the site has been disturbed through clearance and historical land use, including cropping and grazing. The Northern site is bounded by Christie Road to the east and an unsealed access road and open (undeveloped) land to the north. Beyond the northern boundary, the land is within the City of Marion council area.

The Northern site comprises two irregular-shaped land parcels along with four regular-shaped land parcels with an approximate total area of 60 hectares of which approximately 30 hectares will be required for the Desalination Plant. The land has a notable slope grading from east to west, is free from built-form development, cleared of native vegetation and is presently being used for grazing and cropping. The site is currently zoned for industrial activities.

The western portion of the Northern site includes the coast and marine environment with the western boundary of the subject land extending to the high water mark, which abuts the coastal cliffs. The coastal cliffs are approximately 30 metres above sea level.
and typically form the backdrop to the coastal environment. The Certificates of Titles for the subject land show a public road reserve located between this land and the foreshore. The Desalination Plant footprint does not encroach onto the road reserve. No Crown Land or coastal reserve exists between this land and Gulf St Vincent while a Marine Restricted Area extends from the high water mark out to Gulf St Vincent for a considerable distance (approximately 500 metre radius). There is presently restricted public access along the foreshore and the marine environment.

3.2.1.2.1 Utility Services

The existing Port Stanvac facility has a variety of existing services and infrastructure, which may support the proposed Desalination Plant. These services, and the degree of augmentation required to support the proposed development, are discussed in Chapter 4.

3.2.1.3 Description of Surrounding Locality

The locality of the Northern site is largely dominated by industrial land uses, with dispersed smaller industrial and commercial activities. The existing (non-operational) oil refinery is the most dominant feature in the immediate and wider locality. The industrial land use pattern continues to the east of the subject land, with industrial activities extending both north-eastwards and southwards along Dyson and Lonsdale Roads and the railway corridor.

As noted, the northern boundary of the subject site abuts relatively open and undeveloped land and comprises a mix of land within the City of Onkaparinga (zoned Industry) as well as land within the City of Marion (zoned Landscape (Buffer)). Residential development lies beyond this buffer at a distance of between 350 metres to 400 metres from the site’s northern property boundary.

The rail corridor, large open storage areas and industrial land uses extend the entire length of the eastern side of Christie Road and largely dominate the site’s eastern boundary. A 66 kV overhead power line also traverses Christie Road.
3.3 Nature of Proposal

As indicated above, the various components and elements of the proposed Desalination Plant and marine works, including its location, treatment processes and expected area footprint, are based on the Concept Design developed for the proposal.

During the development of the Concept Design, options for system design and construction have been considered and assessed against SA Water’s environmental and engineering performance objectives, functional requirements and constraints. Whilst some options present feasible alternatives and are described in some detail, others have not been pursued on the basis that they do not meet environmental and/or engineering performance objectives.

As previously stated, the successful Contractor will undertake the final design of the proposed Desalination Plant within the environmental and engineering objectives and performance criteria listed in Table 3.1 above.

Management of wastes anticipated to arise from the construction and operation of the proposed Desalination Plant is described in Chapter 9.

3.3.1 Description of Desalination Plant

The proposed Desalination Plant comprises the following key elements:

- Seawater intake structure and connecting tunnel/s or pipelines;
- Intake pumping station and screening system;
- Pre-treatment system and associated buildings;
- Reverse osmosis treatment system and associated buildings;
- Outfall structure with diffusers and connecting tunnel/s and pipelines;
- Post-treatment system and associated buildings; and
- Waste treatment area, including solids thickening and dewatering.

In addition, the proposed Desalination Plant will include:

- Transfer pump station for pumping desalinated water to the HVWTP. As indicated in Chapter 1, this pump station is not part of the Major Development assessment process and has been subject to a separate assessment under Section 49 (Crown Development) of the Development Act 1993;
- Hardstand areas for unloading and storage of chemicals associated with the Desalination Plant;
- Electrical substation, power cabling and switchgear for distributing power within the site;
- Energy recovery facility for the saline concentrate prior to its discharge to the Gulf St Vincent;
- Site access roads, internal access roads and parking areas;
- Stormwater management infrastructure and other buried services across the site;
• Site offices and administration buildings, control rooms, laboratory, research and development test facility, and a visitor education/interpretive centre; and
• Site landscaping, lighting and security fencing across the site.

Figure 3.3 illustrates the proposed layout of the terrestrial elements of the Desalination Plant, which are described in further detail in the sections below.

Figure 3.3 Proposed Layout of Desalination Plant.
Note: The shaded sections of the buildings show possible expansion layout space.

3.3.1.1 System Capacity

The proposed Desalination Plant will be a reverse osmosis plant with the capacity to initially supply 50 GL per annum (150 ML of drinking water per day) and with infrastructure to support future augmentation of up to 100 GL per annum (300 ML of drinking water per day). The Desalination Plant would be capable of being expanded to the ultimate capacity of 100GL per annum without interrupting operation. Major civil works, such as the intake and outfall structures and conduits have been designed to accommodate the ultimate capacity of the proposed Desalination Plant at 100GL per annum. All of the studies and investigations undertaken as part of this EIS have considered both 50 GL per annum and up to 100 GL per annum capacity.

A summary of the design flows used for the Concept Design for the intake and outfall structures is shown in Table 3.2 below.

The Concept Design has assumed a minimum recovery from the reverse osmosis membrane system of approximately 40% of the total flow. This may increase up to 45% in the future.
<table>
<thead>
<tr>
<th>Raw seawater intake flow (ML per day)</th>
<th>Drinking water produced (ML per day)</th>
<th>Return to outfall flow (ML per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>383 (note 1)</td>
<td>150 (note 1)</td>
<td>233 (note 1)</td>
</tr>
<tr>
<td>765 (note 2)</td>
<td>300 (note 2)</td>
<td>465 (note 2)</td>
</tr>
<tr>
<td>77 (minimum operating flow)</td>
<td>30 (minimum operating flow)</td>
<td>47 (minimum operating flow)</td>
</tr>
</tbody>
</table>

Note 1: Raw seawater flow to meet 50 GL per annum capacity.
Note 2: Raw seawater flow to meet 100 GL per annum capacity.

3.3.1.2 Plant Footprint

The Concept Design allows for a land area of approximately 20–30 hectares (200,000 square metres to 300,000 square metres) to accommodate the proposed development. This includes land for all associated infrastructure and buffer zones, as well as necessary environmental treatments and safeguards.

In considering the conceptual layout and footprint at the site, a number of technical, social and environmental issues were considered including:

- Taking advantage of the natural slope of the land to assist with hydraulic design of treatment systems to minimise energy consumption and the extent of earthworks required for construction of buildings;
- Locating noisy components of the Desalination Plant at appropriate buffer distances from residential areas located to the north of the site;
- Locating infrastructure to avoid identified and recorded entries for Aboriginal sites (as per the Central Archive);
- Locating infrastructure to avoid or minimise disturbance to areas of environmental sensitivity, including the coastal cliff zone, drainage lines and marine features where possible;
- Allowing for a nominal 100 metres by 100 metres space (10,000 square metre footprint) for the proposed new ETSA substation, which will be capable of expansion to support the electrical loads from the proposed Desalination Plant to meet the future capacity of up to 100 GL per annum of drinking water; and
- Allowing for heavy vehicle access loads and requirements during construction, as well as chemical, waste and equipment transport vehicles during operation of the Desalination Plant.

3.3.1.3 Intake Pumping Station and Screening

The intake system will convey seawater from the intake structure via an intake conduit to the intake pumping station.

Marine material and debris that is able to pass through the coarse screens at the intake structure will need to be removed prior to the pre treatment process. The Concept Design has proposed the use of rotating band screens for this purpose, located in the inlet chamber/pump sump prior to the intake pumps. Alternative screening devices may
be pursued during the final design, subject to meeting the overall environmental and engineering performance objectives. Waste management, including screenings, is described in Chapter 9.

A pump station will pump the screened seawater to the pre-treatment plant, located within the Desalination Plant footprint. During the Concept Design, a number of locations for the intake pump station were considered, including on the foreshore area (if tunnelling was not employed) or inside a shaft to the intake tunnel (if tunnelling was employed). The Concept Design has been based on locating the pump station inside the tunnel shaft behind the cliff.

Based on the environmental performance requirements the intake seawater pump station will not be located within the cliff zone or the sensitive intertidal reef zone, which precludes the foreshore option.

Figures 3.4 and 3.5 illustrate the proposed location of the intake and outfall structures in relation to the marine zones adjacent the Desalination Plant site.

![Figure 3.4 Proposed Envelope of Intake and Outfall Structures. Overlaid on DEH Habitat Map (DEH 2008 b).](image-url)
3.3.1.4 Pre-Treatment System

The purpose of the pre-treatment process is to remove suspended solids, oil and grease or other matter that could block, damage or significantly foul the reverse osmosis membranes.

The pre-treatment process incorporates a number of stages, similar to that used in the conventional treatment of surface waters for drinking supplies.

A number of engineering options for the pre-treatment stage may be pursued and the final selection for the detailed design would be determined by factors such as raw seawater quality, available land area and filtered seawater quality requirements.

Two pre-treatment systems were considered in developing the Concept Design as follows:

- Conventional treatment, which includes chemical coagulation, clarification and media filtration; and
- Membrane filtration, which involves the use of synthetic polymer filters that act as a physical barrier, capable of removing particles as small as 0.02 microns.

The Concept Design has been based on the development of a conventional treatment desalination plant. The reason for this is that the use of membranes for pre-treatment is relatively new and the long-term reliability and performance for a desalination plant of the proposed size is not yet to be proven. This has allowed for a conservative estimate of the proposed Desalination Plant’s footprint due to the larger size of a conventional treatment plant as opposed to a membrane filtration plant. The final design may utilise membrane or other alternatives that may help reduce the proposed Desalination Plant’s overall footprint whilst meeting the specified performance and durability requirements.
The conventional pre-treatment system may also include a number of options. For the Concept Design, the following has been adopted:

- A chemical coagulant (most likely an iron based coagulant) would be dosed into the screened seawater. It may be necessary to add another chemical to adjust the pH to maintain the optimum coagulation pH. Sodium hydroxide or sulphuric acid is normally used for this purpose. The Concept Design includes the use of mechanically stirred mixing tanks to enable effective coagulation to take place at the minimum production rate.

- The next stage of the pre-treatment process is flocculation and clarification. Slow mixing tanks allow the floc to grow to a size that aids sedimentation or flotation. In the Concept Design, dissolved air flotation (DAF) has been proposed for the clarification stage.

- In DAF, a saturated air/water stream is mixed with the flocculated water to create micro bubbles to float the floc material, rather than settle it. Alternative equipment, such as lamella settlers rely on enhanced gravity settling. A flocculant (polyelectrolyte) is normally added to aid the flocculation and clarification processes for lamella sedimentation.

- The final stage of the pre-treatment process is filtration, where the clarified seawater (containing little floc) is filtered through beds containing different types of media. The Concept Design has incorporated conventional dual-media (coal/sand) rapid gravity filters. A second ‘polishing’ filtration stage has been included on the basis of a conservative design and area footprint.

The filtered seawater will be stored in a balancing tank(s) prior to pumping to the reverse osmosis system. Low-medium pressure pumps will push the filtered seawater through a bank of cartridge filters to the suction lines of the high-pressure pumps. The balancing tank(s) also allow the use of filtered seawater for filter backwashing during the pre-treatment process. Cartridge filters have been included in the Concept Design to provide some protection for the reverse osmosis membranes from significant particulate fouling in the event of a significant failure of the pre-treatment system.

### 3.3.1.5 Reverse Osmosis System

The reverse osmosis process is designed to remove salt from the seawater using semi-permeable membranes. The seawater is forced at high pressure through reverse osmosis membranes to overcome the osmotic pressure of the seawater. Salts are concentrated on the feed side, while the water molecules permeate through the membrane.

For the Concept Design, a two-pass reverse osmosis process has been adopted to achieve the required drinking water quality. The first-pass reverse osmosis removes most of the dissolved salts (over 99%). All or a portion of the first-pass permeate is polished in a low pressure brackish reverse osmosis membrane system to reduce the levels of boron, chloride and bromide in order to satisfy the Drinking Water Specification, which constitutes a performance objective and contractual requirement of the detailed design.

Prior to the reverse osmosis process, the filtered seawater would be dosed with acid and/or antiscalant to prevent or minimise the precipitation of sparingly soluble salts in the membrane elements. Sodium metabisulphite (SMBS) or an alternative may be dosed to remove any residual chlorine in the feed water to control biological growth in
the intake system. Chlorine attacks and degrades the desalination capability of thin-film composite reverse osmosis membranes. The removal of free chlorine prior to the reverse osmosis membrane system is therefore of critical importance. Adjustment of pH, if required, is normally achieved through the use of sulphuric acid.

The first pass reverse osmosis membranes will produce a saline concentrate stream, which will be discharged to the ocean via the outfall (see below). This stream would also contain traces of chemicals added during the treatment process. The reject stream from the second pass is of relatively low salinity and can be returned to the head of the reverse osmosis process to increase the overall recovery and efficiency of the process. An alternative would be to discharge this stream to the outfall if it complies with EPA discharge criteria.

In the Concept Design, the first pass reverse osmosis plant will be configured to have a train size of 15 ML/d, requiring approximately 10 trains to produce the 150 ML/d output from the initial phase of the project (or approximately 20 trains to produce 300 ML/d). The membranes to be used comprise thin film composite spiral wound membranes developed for seawater desalination. The main components of the reverse osmosis trains include high pressure pumps, energy recovery devices, the first pass reverse osmosis membranes, saline concentrate line, permeate tank, booster pumps for the second pass system, second pass reverse osmosis membranes and second pass reject stream.

The first pass concentrate will be fed to energy recovery devices (ERDs) before being discharged via the outfall. The ERDs facilitate transfer of pressure energy from the concentrate to the incoming reverse osmosis feed water.

3.3.1.6 Post-Treatment System

Permeate from the reverse osmosis process will have very low mineral and alkalinity content and would therefore be corrosive to materials such as concrete in the Transfer Pipeline and reticulation pipe-work, as well as domestic fittings containing copper or brass. The permeate is rendered non-corrosive and suitable for drinking via the addition of calcium salts, such as lime (or hydrated lime) and carbon dioxide. The Concept Design is based on the use of lime and CO₂, although alternatives such as calcite (marble chip) filtration may be considered.

Following remineralisation, the treated water will be dosed with fluoride (added as hydro-fluorsilicic acid) to satisfy the requirements of the Department of Health, and chlorine to ensure disinfection integrity.

3.3.1.7 Treated Water Storage

A covered treated water storage tank(s) will be constructed on-site to temporarily store the water prior to pumping to the HVWTP. A minimum storage capacity of 50 ML has been adopted for the Concept Design. This will provide up to 8 hours storage (for the 50 GL per year capacity), providing some buffer against variations in the pumping flow into and out of the storage with varying demands in the Happy Valley system.

3.3.1.8 Plant Control System

The proposed Desalination Plant will have a comprehensive computer-based monitoring and control system.
The control system will enable full automatic control and operation of the Desalination Plant and permit the operator to remotely monitor and to control discrete aspects of the Desalination Plant.

The control system will be capable of expansion to meet the future capacity requirements, with minimal disruption to Desalination Plant operation.

### 3.3.1.9 Buildings and Civil Structures

The buildings and civil structures will comply with architectural requirements as outlined by SA Water. These include:

- Being consistent with an overall conceptual scheme to achieve an integrated and well-ordered presentation;
- Being proportioned to achieve an aesthetically pleasing appearance;
- Maintaining order and purpose in the location and number of rooftop features, such as flues, skylights, cowls and vents;
- Meeting the minimum energy efficiency requirements described in the Building Code of Australia;
- Taking account of the visual impact assessment and environmental performance objectives and criteria for the project; and
- Being designed to maximise the use of natural lighting and ventilation.

The inlet chamber, flocculators and DAF tanks, filters and treated water storage tanks in the Concept Design are of reinforced concrete construction. In general, buildings are likely to be clad, steel framed structures on concrete foundations. Specific buildings, such as the control/administration, visitor centre and main switchgear building may be of masonry construction. The buildings making up the Desalination Plant will be required to meet proposed architectural criteria.

Concrete works in contact with seawater will require cathodic protection to meet the functional requirements for durability. Proposed intake and outfall structures and wet areas of the intake pumping station will require induced current cathodic protection.

The site will require cut and fill earthwork operations, including excavation for inter-process pipe-work, construction of partially buried structures, levelling of steep areas of the site and for road embankments and drainage.

The site will incorporate a security system that includes a security fence, secure access, site CCTV and building intruder detection.

### 3.3.1.10 Chemical Storage

A range of treatment chemicals will be required to be stored at the proposed Desalination Plant site.

The Concept Design assumes that a ferric-based coagulant will be used for pre-treatment, along with polyelectrolyte and sulphuric acid/caustic soda for pH adjustment. Bulk storage tanks will be provided, in accordance with relevant legislation and protocols, for the acid, liquid coagulant and caustic soda. A dry store and polyelectrolyte preparation kit will be provided for the solid polymer and chemical dosing will be via duty/standby dosing pumps.
Measures to protect the environment from potential spillage of chemicals will be incorporated within the final design in accordance with all relevant legislation and standards. The Contractor will be required to develop and implement an Operations Management Plan for the control of chemicals which would include contingency plans and incident response procedures.

### 3.3.2 Description of Marine Structures

#### 3.3.2.1 General

The marine structures for the proposed Desalination Plant comprise the intake structure, designed to reduce the entrapment or entrainment of marine biota, the outfall structure (diffuser) designed to diffuse the saline concentrate to the marine environment, and the intake and outfall conduits to convey seawater to the Desalination Plant and to return saline concentrate to the outfall structure.

#### 3.3.2.2 Seawater Intake Structure

The seawater intake structure will draw in seawater through screening grills and into the intake conduit (refer Figure 3.4). For the Concept Design, the intake system has been designed to operate by gravity with the intake structure located approximately 1.0 to 1.5 kilometres offshore, at approximately 15 to 18 metres depth to seabed. For the Concept Design, the intake conduit has a nominal diameter of approximately 2.5 metres.

The selection of the intake zone has included consideration of a range of factors including depth, constructability, hydraulics and the outcomes of investigations into the marine ecology at the site. The identified intake zone is to be located beyond the subtidal reef in the mid benthic zone, which comprises predominantly bare sand with low species diversity (see Chapter 7 and SARDI 2008a). The location of the intake structure must avoid short-circuiting of the saline concentrate from the outfall diffuser section.

##### 3.3.2.2.1 Entrapment and Entrainment Control

The intake structure will be designed to reduce the risk of entrapment and entrainment of marine biota through the inclusion of a screen/grill and by limiting the intake velocity to enable mobile marine organisms to swim away from the intake structure. A grill spacing of 75 millimetres (when clean) has been adopted for the Concept Design that has been included as part of the project performance criteria. To reduce the potential for entrainment, a maximum flow velocity of 0.15 m/s at the intake grill has been adopted for the project performance requirements. This velocity is in line with industry standards and has been based on a study of background sea current velocity profiles and transient variation, together with consideration of the nature of expected flora and fauna and proximity to their marine habitat. The final design will be required to comply with these specifications.

For the Concept Design, the intake structure has been located approximately 3 to 4 metres above the seabed to reduce the ingress of sediment, marine debris, and benthic marine biota, including eggs and larvae. This height is consistent with seawater intakes of other Australian desalination projects, and will ensure that there is a clear depth of water above the intake structure of 10 to 12 metres under various tidal conditions. This will reduce risks associated with intake water quality, such as sediment plumes following storm events, or navigation of marine vessels.
Marine material and debris that is able to pass through the coarse screening at the intake structure (eg seaweed and shells) will be removed by fine screening at the intake pumping station as described in Section 3.3.1 and Chapter 7.

3.3.2.2 **Disinfection System at the Intake**

The intake structure in the Concept Design is approximately 6 to 7 metres in diameter and has been designed with a closed lid and sloping grills, similar to a funnel.

The Concept Design allows for a chlorine dosing system to be installed in the intake conduit to control marine growth. The chlorination system has been configured at the base of the structure to prevent the backflow of chlorine solution into the marine environment, even during sudden power failure during a dosing event.

The intake chlorination system would operate in intermittent ‘shock’ dosing mode, with the seawater de-chlorinated prior to the reverse osmosis system. The chlorine delivery line could be run either within or external to the intake conduit. For the Concept Design, an external line encased in a second pipe with a leak detection system was adopted rather than an internal line, as this would restrict the ability to physically clean the intake using mechanical means, if necessary.

Alternative disinfection chemicals may be considered in the final design provided their use complies with the environmental and engineering performance objectives of the ADP.

3.3.2.3 **Outfall Structure (Diffuser)**

The desalination process generates a saline concentrate stream from the reverse osmosis process. The saline concentrate would be approximately 1.6 to 1.8 times the salinity of the background seawater, and contains trace amounts of chemicals added during the desalination process. The saline concentrate would be returned to the sea via a gravity-driven outfall. In the Concept Design, the outfall pipeline is proposed to have an approximate nominal internal diameter of 2.0 metres and extend approximately 1.5 to 2.0 kilometres offshore.

The outfall location is situated within the mid to deep benthic zones. Selection of this zone was based on ensuring that the discharge does not impact upon the biologically important inter tidal and sub tidal reef communities, and is sufficiently separated from the seawater intake to minimise the risks of flow short-circuiting to the intake.

Due to the higher salinity of the discharge, it is important that the saline concentrate is returned to the sea in such a way as to ensure that it is dispersed rapidly and completely with the background seawater. This mixing process is achieved with a diffuser structure that is designed to break up the flow of saline concentrate into small streams and ‘jet’ these streams into a large volume of surrounding seawater with sufficient velocity to mix and disperse the saline concentrate, and achieve target dilution requirements prior to the discharge reaching the seabed. The target initial dilution is 50:1 at the seabed under all operating and tidal current conditions and the final design will be required to comply with this specification.

For the Concept Design, the diffuser comprises numerous small ‘ports’ and incorporates a nominal 1.5 metre diameter pipe up to 250 metres in length submerged below the seabed. Vertical riser pipes (approximately 0.2 metres in diameter) protrude through the seabed to about 1 metre above the seabed, where the diameter reduces to that of the exit ports angled upwards at approximately 60° to the horizontal.
The exit velocity of the saline concentrate is considerably higher than the background seawater. As the saline concentrate ‘jet’ mixes rapidly with the ambient seawater, the jet velocity decreases and its trajectory bends toward the seabed. At this point, the initial discharge characteristics cease to influence mixing and the ambient currents and turbulence near the seabed control subsequent dispersion. The subsequent plume is slightly heavier than the ambient seawater and tends to flow down towards the deeper offshore water, while being transported by the typically shore-parallel currents of Gulf St Vincent.

The final diffuser design may include variations to the concept. Such variations would need to demonstrate that they meet SA Water’s environmental performance objectives and achieve the minimum dilution requirement of 50:1.

3.3.2.4 Intake and Outfall Conduits

The Concept Design for the proposed intake and outfall conduits considered three possible options based on construction methodology. These options included:

- Option 1 – Seabed Pipelines – this involves construction via trenched pipelines from the Desalination Plant to the intake structure and diffusers offshore.
- Option 2 – Full Tunnel(s) – this involves the construction of a tunnel(s) over the full distance to the intake structure and diffusers offshore.
- Option 3 – Combined Pipe-Jacked Tunnel(s) and Seabed Pipelines (hybrid option) – this involves the construction of a tunnel(s) to beyond the shore break (near the rock shelf extent), followed by trenched pipelines to the intake structure and diffusers.

A marine environmental risk and impact assessment concluded that the environmental issues related to the seabed pipeline (Option 1), particularly those associated with construction through the cliff, intertidal and subtidal areas, were too significant to proceed. Therefore, this option was not pursued further.

The final design may include variations to the concept options, such as a combined pipe-jacked and seabed pipeline. Any variations would need to demonstrate that they support the environmental performance objectives and result in an improved environmental outcome.

3.3.2.4.1 Full Tunnel Option

The full tunnel option includes the following key components:

- The construction of a deep shaft adjacent to the proposed Desalination Plant to enable construction of the tunnel(s);
- An intake pumping station located within the deep shaft; and
- Riser structure(s) from the end of the tunnel(s) upwards to the pipelines, located on the seabed, including an excavated cross-connection below the seabed.

Figure 3.6 illustrates the full tunnel option and the likely impacts of this option during construction and operation of the proposed Desalination Plant.
3.3.2.4.2 Hybrid Tunnel Option

The hybrid tunnel option includes a pipe-jacked tunnel past the intertidal zone so as not to impact on the intertidal environment. The hybrid tunnel is then trenched for the remainder of its length (see Figure 3.7).

For both tunnelling options, the tunnel sections would be constructed by excavating a deep shaft on land, into which a tunnel-boring machine (TBM) would be placed to excavate and support the tunnels.

At the end of the tunnel sections, the conduits would rise to the seabed using a riser structure. This is a vertical shaft drilled or cut from a stationary jack-up barge (or similar equipment) above the tunnel, downwards to the tunnel. The excavation of the shaft may be undertaken underwater but could be achieved in a cofferdam if required.
From the intake and outfall conduit riser structure(s), pipelines would be laid and backfilled in trenches out to the intake and diffuser locations. One method of construction includes assembling sections on-shore before being floated into position offshore and lowered into place. Other options may be employed, however.

Construction methods for pipelines buried within the seabed involve dredging and entrenching, which will be required to comply with relevant approvals. For the Concept Design, burying and armouring was included to protect against scour and damage with minimum cover over the conduit of 0.5 metres.

### 3.3.3 Waste Management

The Desalination Plant generates a number of waste streams from the treatment process that will require appropriate management and these are discussed further in Chapter 9. Wastes from operation of the Desalination Plant relate to the following:

- Intake screenings;
- Pre-treatment wastes;
- Antiscalants;
- Clean-in-place (CIP) chemicals;
- Membrane preservative solutions;
- Membrane flushing solutions; and
- Other general wastes.

### 3.3.4 Water Quality Monitoring Systems

Continuous monitoring of water quality will be carried out at specified locations to enable the proposed Desalination Plant to be operated in a manner that safeguards public health, ensures no damage to equipment, protects the environment and enables the plant to deliver drinking water at the required water quality.

Analytical instrumentation will be connected to the site Supervisory Control And Data Acquisition (SCADA) system to alert operations staff in the event of one or more parameters exceeding preset limits.

The following is a summary of locations and parameters to be monitored:

- Entrance to intake pumping stations:
  - Total petroleum hydrocarbons;
  - Chlorine residual (if chlorination of intake system is adopted).
- Entrance to pre-treatment facilities:
  - Turbidity;
  - pH;
  - Conductivity;
  - Temperature;
  - Chlorine residual (and/or ORP);
  - Dissolved oxygen.
- Entrance to reverse osmosis plant:
  - Turbidity
• pH
• Cl\(_2\) residual
• Conductivity
• Silt Density Index
• Oxidation Reduction Potential.
• Boron (first pass permeate and final permeate before post-treatment).

• Entrance to delivery point:
  - Turbidity
  - Conductivity
  - Temperature
  - pH
  - Fluoride
  - Chlorine residual
  - Boron

• Outfall system – discharge to sea:
  - Conductivity
  - Flow rate
  - Temperature
  - pH
  - Dissolved oxygen
  - Turbidity
  - Chlorine residual or ORP equivalent.

• Manual sampling will also be required at specified locations.

### 3.3.5 Electricity Supply and Energy Requirements

The Concept Design includes infrastructure that needs to be installed to secure power supply rated at 50 MW for the 50 GL per annum Desalination Plant and 100 MW for the 100 GL per annum Desalination Plant. The infrastructure sizing allows for transient peaks, safety and system protection and so is significantly greater than the anticipated actual usage of electricity for operation of the Desalination Plant at full capacity.

Electricity for the proposed Desalination Plant will be supplied from the 66 kV electricity grid. A new substation will be constructed on-site to accommodate the large power base required. This substation will ensure the site supply voltage of 11 kV.

Temporary construction power supply for construction activities will also be required and arrangements are being put in place with ETSA for this purpose.

A description of the electricity supply and associated infrastructure proposed for the Desalination Plant is presented in Chapter 6.

#### 3.3.5.1 Specific Energy Consumption

The specific energy consumption of the proposed Desalination Plant has been specified to achieve better than 4.5 kWh per KL of drinking water produced.

The specific energy consumption requirement of the Desalination Plant is based on a specified range of seawater temperature, total dissolved solids (TDS) and determined on the basis of national and international benchmarks. This is subject to confirmation by the Contractors.
3.3.5.2 Backup Power

The Concept Design allows for backup power in the form of diesel generation to be provided for essential services, including ensuring ongoing operation of a battery powered uninterrupted power supply (UPS) for critical plant control systems and instrumentation.

3.3.5.3 Energy Recovery

In addition to the energy recovery devices that will recover energy from the first pass of the reverse osmosis system, investigations have been undertaken to determine the feasibility of installing a hydropower device to recover energy from saline concentrate prior to entering the outfall conduit, taking advantage of the height of the Desalination Plant site. There are however competing requirements to discharge energy as a certain amount is required to assist in the dispersion and mixing of the saline concentrate as it enters the Gulf St Vincent.

Any surplus energy recovered would be used on site for ancillary services, reducing the energy required from grid.
3.4 Management Arrangements

A number of design, construction and operational aspects of the proposed development will not be fully known until the final design has been completed. SA Water has proposed a set of environmental and engineering criteria to mitigate these effects (particularly for nearby communities likely to be affected by the construction and operation of the Desalination Plant) and will continue to consult with the EPA to ensure regulatory compliance.

SA Water will require the Contractor to have a current and certified Environmental Management System (EMS) in place, compliant with ISO 14001:2004 within their company structure. Requiring an EMS will help ensure the Contractor has identified environmental impacts associated with their operations and have company-enforced strategies to minimise and manage impacts as a result of their activities.

Additional information relating to management arrangements is given in Chapter 4.

3.4.1 Design Management

The Contractor will develop a tender design and is also required to submit draft management plans prior to award of a contract, including a design management plan.

The required design and documentation process to be followed by the Contractor will be prescribed in the Contract and allows for design development workshops and design review. The design report is to incorporate a sustainability plan, durability plan, risk assessment and include drawings and other descriptive information.

3.4.2 Site Management and Construction

The Contractor will be required to develop a comprehensive suite of management plans. These include a Construction Environmental Management and Monitoring Plan (CEMMP) that will be developed for the construction of the Desalination Plant. These management plans will detail environmental risks and associated impacts as well as provide mitigation measures for the Contractor to follow.

3.4.3 Operation and Maintenance

A detailed Operational Environmental Management and Monitoring plan (OEMMP) will also be required for the operation of the Desalination Plant. This plan will be developed to identify potential environmental risks and impacts associated with the Desalination Plant operations and specify mitigation measures to minimise impacts, as well as ongoing monitoring requirements.

3.4.4 Plant Reliability

A key element of the system design and layout is reliability of the plant. Key requirements for attaining an appropriate level of service and availability include:

- The system shall be permitted to be out of operation for any unplanned reason for a period not exceeding seven days in a 12-month period (other than intentional outages);
- The system shall be permitted to be out of operation for planned maintenance for a period not exceeding 14 days cumulative in a 12-month period, providing the outages occur during July to September; and

- The system shall also be permitted to be partially out of operation (i.e. reduced water supply to HVWTP) for planned maintenance by prior written agreement with SA Water.

The unplanned outages do not include *force majeure* incidents; however they do include potential plant shutdowns during foreseen natural events, such as dodge tides.
3.5 Decommissioning

3.5.1 Permanent Decommissioning

At some stage it may be necessary to permanently decommission the proposed Desalination Plant. Permanent dismantling of the plant, equipment, buildings and infrastructure would be required if the plant has either expended its useful life or circumstances arise where it is no longer required into the long term.

Permanent decommissioning is a separate matter to “mothballing” of the plant, which may be necessary in circumstances where it is foreseeable that the plant could be required in the future.

The proposed Desalination Plant and supporting infrastructure is being engineered to have an operational for 25 - 100 years. Civil assets such as the tunnels, shafts, buried pipelines and piles will need to be reconstructed or refurbished after approximately 100 years. Assets such as concrete structures, buildings, intake and outfall pipelines, and mechanical and electrical assets are expected to perform for approximately 20 to 50 years. These assets will be replaced during the life of the Desalination Plant as they become inoperable or as technologies advance.

3.5.2 Decommissioning Plan

A detailed decommissioning plan would be required to be developed prior to any decommissioning of Plant infrastructure. This plan would be in accordance with standard industry decommissioning procedures and the requirements of the appropriate authorities.

All surface equipment and structures will be removed. The marine conduits will be left and filled with sand. The Intake structure will be removed.