3. Desalination Concepts Adopted for This Feasibility Study

The following concepts have been adopted to evaluate the feasibility of seawater desalination for Melbourne and were used to develop schemes for the locations that have been evaluated.

3.1 Desalination Plant and Pre-treatment

The water quality required to be supplied by the plant has an influence on the overall design concepts. Various drinking water guidelines and other factors were considered and a risk assessment was performed. Preliminary water quality targets have been set to enable development of a conceptual design. The key parameters that drive the design are set out in the following table. These parameters are similar to those adopted in other Australian cities where desalination is under consideration. These targets would be refined further if seawater desalination is adopted for Melbourne.

Table 3 Key Water Quality Targets

Water Quality Parameter	Preliminary Target Value Adopted
TDS (mg/L)	Minimum possible while managing corrosivity. Likely to be in the range of 30 – 100 mg/L
Boron	(<0.5 mg/L)
Bromide	(<0.2 mg/L)
General water quality	To 'match' that currently supplied *(see later notes on potabilisation)*
Other parameters	Meet the Australian Drinking Water Guidelines and Victorian Safe Drinking Water Act

Note: Boron and bromide are included here as they are parameters that are not generally a problem in surface water supplies, but are more difficult to manage in seawater desalination.

Reverse Osmosis (RO) has been adopted for the design basis. A two pass RO system would be used to achieve the target water quality which is driven by the targets for TDS, boron and bromide.

Plant operational regime and reliability defined at 300 ML/day with ~ 90% reliability, which would lead to annual production of 100 GL/yr. Larger plant sizes lead to larger annual water production. Operation is typically possible down to 25% of capacity.

The bays have higher turbidity and more variable water quality therefore requiring different levels of pre-treatment. For the bays, dissolved air flotation (DAF) followed by filtration. This has been selected on balance to allow for the elevated suspended solids sometimes encountered as well as potential oils and algal blooms. For the open ocean locations on Bass Strait, media filtration has been selected.

3.2 Plant Buildings

A site of 20 – 40 ha would be required for the plant and to provide an operational buffer area. Additional area may be needed to provide space needed during construction. At the upper end of this range of site sizes, it would be possible to accommodate a plant providing up to 200 GL per year.

For some kinds of adjoining land use, there may be a need to provide a buffer area. This means that the effective site size could be much larger in some cases.

The treatment plant, including all pumps and plant components will be housed in a range of buildings to reduce noise levels at the plant boundary. There are therefore opportunities to utilise different architectural approaches to provide a facility that takes into account the visual features of the local landscape.

3.3 Seawater Intake and Concentrate Outlet

The seawater intake and concentrate outlet could both be constructed using tunnel boring machines and then lining the tunnel with concrete segments. A tunnelling approach has been adopted at this stage to reduce any impacts on the coastal area crossed by the intake and outlet alignment. Alternative arrangements such as trenching and laying pipes have been used elsewhere for seawater intakes (for example in Perth), and in Victoria for other intakes and outfalls. The following figure and picture (Figure 14) provide some understanding of the tunnelling approach.

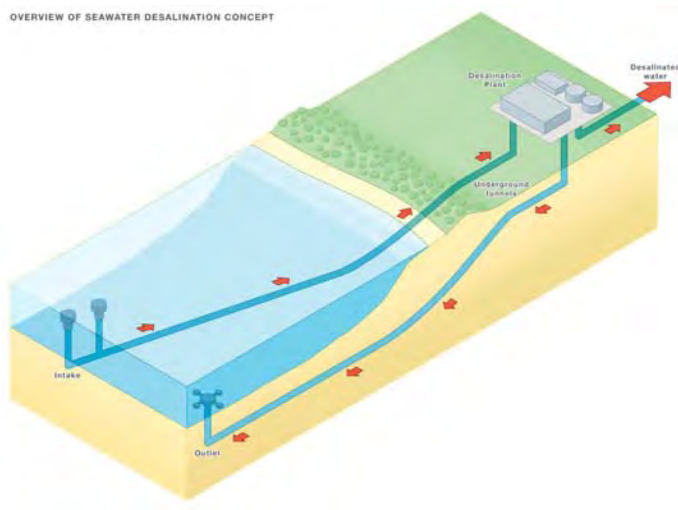

Figure 14 – Schematic of Intake and Outlet Tunnels and Example of Tunnel Boring Machine

As an initial design basis, it is proposed that the intake would be located in a minimum of 10m water in the bays and 15m in the ocean. This approach was then modified for specific locations where unique local factors needed to be accommodated.

The intake head will typically be designed to achieve a maximum intake velocity of 0.1 m/s. This velocity is comparable to background currents in the ocean and should reduce the potential for entrainment. This can be altered to match particular local circumstances.

Diffuser head design can achieve a maximum of a 1 part per thousand (ppt) increase in salinity from background levels outside the mixing zone above the ocean floor, and even better diffuser designs are possible (note that background salinity is around 35 ppt). This is in line with the Victorian SEPP. Specific local hydrodynamic modelling and environmental assessment is required to determine actual design details for the concentrate outlet.

A minimum diameter of the intake tunnel to provide enough seawater for production of 100 GL/yr desalinated seawater is 2.5 m based on hydraulic constraints alone. However there are practical constraints on tunnel construction at such diameters. As a consequence, the likely internal tunnel diameter is approximately 3 m. A plant of 200 GL/yr would need a tunnel with an internal diameter of approximately 4 m.

A minimum distance of 500 m between the intake and outlet has been adopted to avoid short-circuiting between the two. This is based on hydrodynamic modelling for a generalised case. In situations with higher ambient currents, the two might be closer together with more detailed design development.

Intermittent or ‘shock’ chlorine dosing will be used to manage marine growth in the inlet.

Shafts will be sunk to provide access for tunnel boring machines. These shafts will then form part of the seawater pump station and provide a volume to allow surge. These are expected to be around 6 – 9 m in diameter and up to 40 m deep depending on the location.

Downstream of the inlet pump station, either drum or travelling band wire screens would achieve fine screening of the seawater. Screenings will be collected and sent to landfill. These are typically stored in an enclosure designed to minimise odour impacts.

3.4 Potabilisation

The final water is expected to be treated with the following processes before it is sent to the system. The actual design doses of chemicals and controls approach will vary depending on the site selected and the consequent approach to introducing the water to the supply system.

Desalinated water from a two-pass reverse osmosis process will have very low concentrations of dissolved constituents. The water is aggressive and needs to be further treated before it is suitable for transfer into the supply network. Carbon dioxide and lime are added to increase the residual alkalinity and hardness of the water.

Dose rates considered as part of the conceptual design work been aimed at producing a final water quality similar to Melbourne. The TDS, pH and calcium carbonate precipitation potential have all been considered.

It is anticipated that the final water quality will be in the range of 30 – 100 mg/L TDS, comparable to Melbourne's existing supply. The desalinated water is likely to be lower in dissolved sodium but higher in dissolved calcium than Melbourne's water. Further development is required.

Table 4 Potabilisation Process Description

Process	Comment
pH control and Stabilisation by dosing with Lime and CO_2.	The level of calcium and alkalinity added can be varied. Setting targets involves a compromise between protection of pipeline assets and keeping levels low, which might provide benefits to some customers (e.g. industrial customers). Further study including customer consultation is required.
Disinfection with chlorine by dosing with sodium hypochlorite.	Water from the desalination plant is unlikely to have any microbial contamination after two passes of membrane filtration. However, it will then pass through tanks and pipelines where some recontamination could occur. In addition slimes could build over time. So a small dose of chlorine is normally added, which will be similar to the dose currently applied to Melbourne's existing supply.
Fluoridation	Melbourne's water supply is currently fluoridated. If the water from the desalination plant forms 100% or the majority of the supply to an area of consumers, then fluoride addition may be required.

3.5 Transfer Pipeline

A transfer pipeline corridor has been identified to deliver water into storages on the same side of the city as the locations selected. On the west, the pipeline corridors will delivers water to Preston Tanks and Cowies Hill Tank. On the east, water will be delivered to Cardinia and potentially Silvan Reservoir via the Cardinia – Pearcedale pipeline. The system connection to the west is limited to 100 GL per year whereas on the east 200 GL per year or more can be delivered to the system.

The transfer pipeline corridors have been selected to follow routes which provide the least amount of disturbance to residential areas, existing services and vegetation. Where possible, existing easements and road and railway reserves have been selected. The pipe diameter has been determined to achieve the required velocity with consideration of the pump head required. Pipe diameters range from 1.7 to 2.5 m for different locations and plant sizes.

Construction of a 2 m diameter pipeline requires a corridor of around 15 - 20 m in width to allow trenching, spoil management and access for pipe-laying (Figure 15).

It is expected that a construction width of 15 - 20 m will not be a problem for construction through rural areas. However for urban areas, significant traffic management and partial or full road closures will be required to achieve a 15 – 20 m construction width, and a narrower width may have to be considered, noting that a slower rate of progress would then result.

Figure 15 – Construction of a 1700 mm water main in rural and suburban areas

3.6 Concept Design Features

The following tables (Table 5 to Table 7) describe some of the concept design features adopted for this study. Note that the sizes and various details for plant capacities other than those listed can be interpolated from the data provided. Figure 16 illustrates the inside of a typical seawater reverse osmosis desalination plant based on a similar concept to that which has been adopted for this feasibility study.

Table 5 Adopted Design Basis for the Seawater Intake and Concentrate Outlet

Aspect of Design	Description	Adopted Design Basis (100 GL/y)	Adopted Design Basis (200 GL/y)
Design of intake structure.	Multiple mushrooms above the seafloor with local bar screens at approximately 250 mm spacing.	Expect four of around 10 m diameter for the 100 GL/y plant.	Expect eight of around 10 m diameter for the 200 GL/y plant.
Design of outlet diffuser structure.	Multiple examples of multi port diffusers to achieve local velocity of greater than 7 m/s.	Expect four structures each with four diffusers of 360 diameter for the 100 GL/y plant.	Expect eight structures each with eight diffusers of 360 diameter for the 200 GL/y plant.
Depth of intake and outlet.	Intakes in 10 m of water in less active areas, and 15 m in high wave climate. Outlets in 10 m of water. Other local factors may also influence depth for particular sites.		
Construction methods and geotechnical considerations.	Shaft down to approximately 20 to 30 m under AHD. Tunnel out under ocean. Drill through seabed from jack-up barge to make connections to tunnels. Slurry and or pressure tunnel approach if geotechnical studies suggest is possible. If not need to go deeper to get to more suitable rock.		
Length and Diameter of tunnels.	Diameter of 4.0 m for 200 GL/y. Lengths vary from 500 m to more than 4 km for each tunnel depending on sites chosen.		

Table 6 Adopted Design Basis for the Desalination Plant

Aspect of Design	Adopted Design Basis (100 GL/y)	Adopted Design Basis (200 GL/y)
Pre-treatment.	Media filtration operating at 8 m/h on Bass Strait. Addition of DAF on the bays. Based on currently available water quality data. Could change with more data or pilot testing results.	
First Pass of RO.	13 trains (+1 Standby) each producing 26 ML/d.	26 trains (+1 standby) each producing 26 ML/d.
Second Pass of RO.	9 trains (+1 standby) each producing 33 ML/d.	19 trains (+1 standby) each producing 33 ML/d.
Total number of membrane modules in both passes.	38,850	77,700
Recovery through entire plant	42.5%	42.5%

Figure 16 –Reverse osmosis racks inside a large seawater desalination plant (under construction)

Table 7 Adopted Design Basis for the Transfer Pipeline

Aspect of Design	Adopted Design Basis
Diameter	From 1.7 – 2.5m depending on size of scheme and location of plant
Length	From 20 to 90 km depending on location of plant
Material of construction	Welded mild steel pipes with concrete and bituminous lining.
Pump Head	A maximum pump head of 200-220 metres, including multiple pump stations and surge management where required.

4. Environmental Considerations

4.1 Greenhouse Gas and Mitigation Strategies

The lifecycle greenhouse impact of the project has been estimated including direct emissions from equipment used during the construction and operational phases of the project, and indirect emissions associated with the electricity used during construction and operation and emissions embedded in the materials of construction and chemicals used in the process. The assessment covers the intake and outlet tunnels, the desalination plant itself and the transfer pipelines.

This analysis shows that the electricity use dominates the overall impacts of the project: approximately 95 % of the total greenhouse impact after 25 years. Therefore the greenhouse gas mitigation approach adopted has been to seek greenhouse neutrality for this electricity use. Figure 17 shows the cumulative greenhouse impact of a Victorian desalination project over a 25 year period.

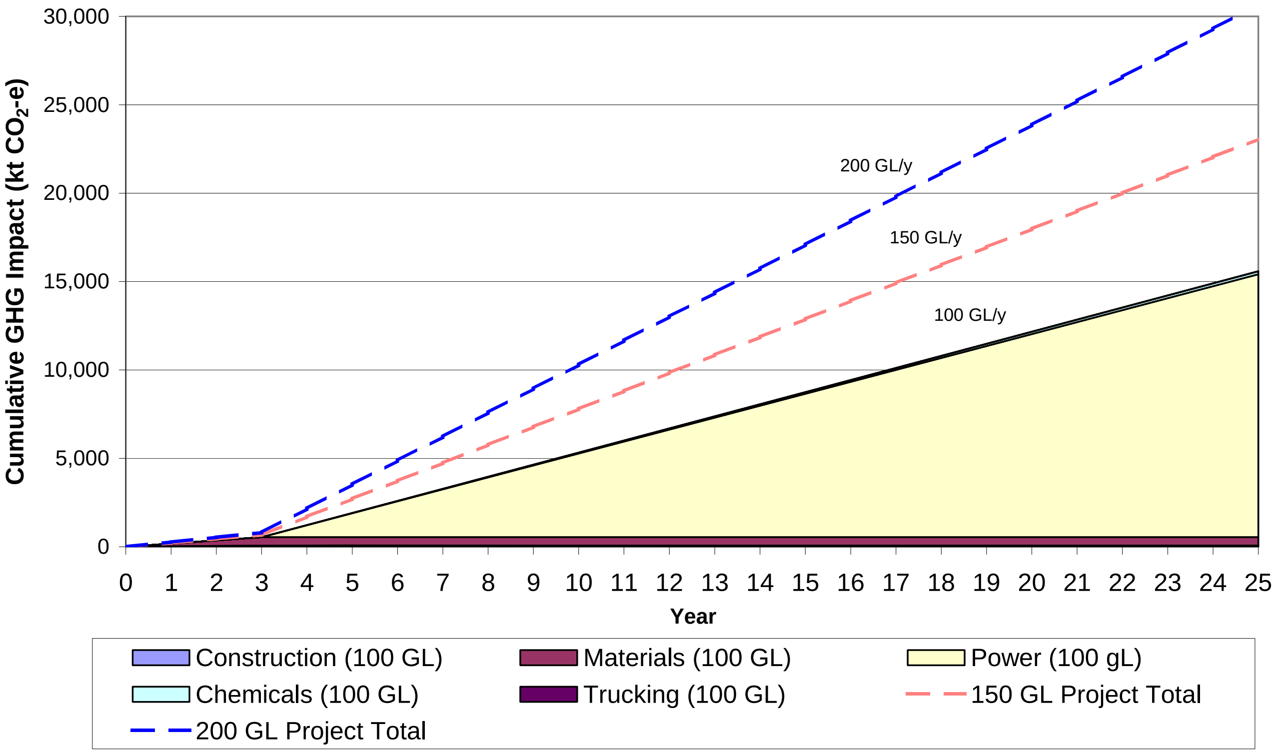

Figure 17 – Cumulative Greenhouse Impact

An investigation of available options for an energy supply, resulting in no net greenhouse gas emissions from power supply, has examined 17 energy supply options. A ranking system has been used which has three main ranking criteria: economic, environmental and operational.

Renewable generation options include: wind, hydroelectric (mini hydro), bioenergy and the emerging technologies of tidal, wave and solar. Non-renewable options with emissions below the grid baseline combined with offset purchases include gas fired generation, cogeneration and large combined cycle gas turbine.

The highest ranked renewable option is wind-generated power. The consumption of a 150 GL/yr desalination is approximately 800 GWh/yr including transfer of the water. A typical load (capacity) factor of a wind farm in Victoria is reported to be approximately 35% due to the intermittency of the wind. A wind farm of approximately 270 MW capacity would be required to provide the annual generation to match the desalination plant's consumption.

There are reported to be 1300 MW of new wind farms proposed for Victoria that have received planning approval, made up of nine major projects ranging from 30 MW rated power to 329 MW. There are currently an additional 340 MW of wind farms seeking development approval. Wind farms to provide 270 MW capacity would require around 100 wind turbines and would take approximately 18 months to construct once design and approvals were completed. The wind farms could be located anywhere in Victoria with connection to the electricity grid.

The current cost of wind generated power under wholesale Power Purchase Agreement is reported to be approximately $80/MWh. A power price of $100/MWh (10 cents/KWh) has been adopted in determining the operating costs of the desalination plant to provide some contingency for changes in cost.

4.2 Management of other Key Potential Environmental Impacts from a Seawater Desalination Plant and Associated Infrastructure

In the previous section, the key potential environmental impact of energy use and its consequential greenhouse gas production are discussed. The following section summarises some of the other potential environmental impacts a seawater desalination plant and its associated infrastructure could have, and sets out how those impacts are managed in the current concept.

Note that this discussion is general in the sense that it broadly applies to most possible locations for a plant. More specific discussion regarding the difference in impacts for different locations is provided later in the report.

4.2.1 Construction of the Desalination Plant and Connecting Pipeline: Impacts on Land

Possible Impacts

The desalination plant is a set of buildings over a site of approximately 20 Ha depending on the size of the plant. Once constructed the pipeline will be underground. During construction, a corridor of around 20 to 30m wide will be disturbed. Construction of the plant and pipeline on land could have impacts on the following environmental values: Flora, Fauna and Habitat, Ground and Surface Waters, Visual Amenity, Noise, Waste and Air (Dust). These could occur in both construction and ongoing operation.

The plant itself is mechanical equipment housed in a building with attendant operation, chemical storage etc. It is similar to a more conventional water treatment plants. So the well understood approaches currently used to design and manage site selection to minimise local impacts are relevant. The pipeline corridors can be researched and investigated on-ground during ongoing design and construction to manage specific local impacts.

Management Approach

It is proposed to use typical approaches for site selection to avoid high-risk ecologically sensitive areas. Design and construction management approaches for noise can be used, for example avoiding truck movements out of working hours, and by incorporating noise reduction in the plant appropriate for the local background noise level. If there is any clearing of native vegetation, a net gain approach is typical. Fundamentally, the approach is to consider and minimise impacts in design.

To consider and minimise impacts in pipeline design and construction, for example it is possible to alter the route, only build in appropriate seasons or use tunnelling and boring in particular areas. These additional details arise as part of detailed design development and once more detail about specific on-ground ecological risks is understood.

More detailed discussion on these approaches is provided later in the report for specific locations where the local risks are higher.

4.2.2 Marine impacts from intake of seawater

Possible Impacts

There is a need to drill through the seafloor to connect the tunnels to the ocean. This penetration of the sea floor is several mushrooms (say four to eight) say around 10 m in diameter. These will be in 10 to 15 m of water. This impact is unlikely to be significant provided there is sufficient investigation into the local conditions and ecology on the seafloor.

There is separate risk of entraining marine life into the intake. This risk is managed through appropriate design. Note that regardless of the design approach, some organisms will choose to enter the intake, and may in fact colonise it if not managed effectively. Many intakes have been compromised by mussel growth for example. This is a separate risk that is managed by an operational approach.

Management Approach

The risk of entrainment is managed by designing the intakes with low velocity to minimise chance of ‘sucking in’ marine life (eg 0.1 m/s or less). This is less than typical sea current velocity, so organisms are adapted to coping with such water movement. In addition, it is typical to use local screening of approximately 250 mm to prevent larger marine life swimming in. Most importantly, the risks are managed by choosing a location with relatively low conservation significance.

Note that designers and operators want to avoid marine life as much as possible as it causes operational difficulties for the plant, so these two objectives are complementary.

4.2.3 Marine Impact from concentrate return to ocean:

Possible Impacts

See previous point on intakes related to construction. Concentrate outlets will employ similar design features.

The plant removes fresh water from the seawater, leaving behind a concentrate stream, which contains around twice seawater concentration of the various ions that were in the seawater originally. There are also some trace levels of antiscalant and other chemicals added prior to the RO plant. The concentrate is clear and odourless.

(Note that some desalination plants in the Middle East and elsewhere discharge the iron rich backwash from pre-treatment along with the concentrate. This approach is not proposed, and instead the iron rich sludge will be sent to landfill or recycled. This discharge is covered elsewhere below.)

Management Approach

The risks related to concentrate return are managed by the design of the concentrate diffusers to achieve significant initial dilution. If a target of no more than 1 ppt increase is adopted, then this is expected to be achieved within several metres of the diffuser heads. If the disposal happens within sufficient depth of water, then this dilution is achieved above the seabed. In other words, if we define a plume as having a boundary of no more than 1 ppt increase, then this plume does not reach the bottom.

The risks are also managed in the first instance by locating concentrate dispersal outlets in areas with low conservation significance. It is also typical to perform hydrodynamic modelling to determine whether there is a risk of accumulation.

4.2.4 Solid (Sludge) waste from the pre-treatment backwash:

Possible Impacts

The pre-treatment process includes media filters which have a backwash system, this is rich in iron due to the typical use of an iron-based coagulant. It will be settled and centrifuged to minimise the volume of water. The extracted water is returned to the head of the plant. The water in the sludge is seawater, and thus the waste stream is salty.

Management Approach

The current approach for other Australian plants is trucking to a suitable landfill. This waste can also be washed and recycled, which is a new and developing approach. This may be more energy intensive than landfill. One risk that needs long term management is determining whether there are long term landfills available.

5. Environmental Approvals

This section provides a brief discussion of some key approvals that could be required for the project.

5.1 Environment Protection and Biodiversity Conservation Act (EPBC Act) (Commonwealth)

Administered through the Commonwealth Department of Environment and Water Resources (DEW) the EPBC Act provides that certain actions that are likely to have a significant impact on a matter of National Environmental Significance are subject to an assessment and approval process. There are a number of matters of National Environmental Significance identified in the Act as triggers for the assessment and approval regime. The triggers that are likely to be encountered by the project are:

- RAMSAR Wetlands;
- Nationally threatened species and ecological communities;
- Migratory species, and;
- National Heritage Places.

History of EPBC Act referrals of Desalination Plants

The referrals made under the EPBC Act for both the Gold Coast and Sydney desalination plants have both been considered to be "Not a Controlled Action" which means that no further assessment apart from the referral itself was required. There were some conditions placed on the decision in respect of the Gold Coast desalination plant, however these conditions referred to the avoidance of terrestrial flora that may be impacted by the pipelines connecting the plant to the water supply system.

5.2 Environment Effects Act 1978 (Victoria)

Under sections 4 and 8 of the Environment Effects Act, individuals or organisations (proponents) putting up a proposal for a development can be asked to prepare a document called an Environment Effects Statement (EES) by the Minister of Planning. This statement summarises the proposal, any feasible alternatives to it and any expected environmental effects. It is expected that, in accordance with the guidelines for the assessment of EES's, a referral will need to be submitted to determine if an EES is required.

5.3 Planning and Environment Act 1987 (Victoria)

The Planning and Environment Act 1987 establishes a framework for land use planning in Victoria.

The planning permit requirements for the project are generally site-specific, triggered by the zones and overlays, and other relevant Clauses of the planning scheme. The relevant Council generally administers the Scheme and associated planning approvals unless otherwise requested by the applicant.

Natural and built environmental, cultural and amenity values are protected under the planning scheme. The following activities normally require planning approval:

- Building and works, in particular, any structure that may need to be located on the foreshore for construction and or operation;

- Shoreline and river crossing;
- Removal of native vegetation;
- Undertaking building and works on or adjacent to historical sites;
- Construction adjacent to a Highway or main road; and
- Earthworks.

The project may be located within one or more Council areas. Each Council would assess the section of the project located within their municipality for planning approval, and in doing so:

- Must take into consideration State Planning Policies, and the relevant planning scheme;
- Must consider the decision of a formal referral authority, i.e. if a formal referral authority refuses the permit application, Council must also refuse approval of the permit;
- May also take into consideration the advice of an informal referral authority;
- Must follow internal policy and procedures and will sometimes take political considerations into account; and
- Must follow the statutory processes and timeframes defined in the Planning and Environment Act 1987.

Given the significance of the project to the State of Victoria, the Planning and Environment Act includes provisions for streamlining such approval processes.

5.4 Native Title Act 1993 (Commonwealth)

Under the Commonwealth Native Title Act 1993 indigenous people can claim native title on Crown Lands and waters in their traditional lands. There is a Native Title Claim currently over the Port Phillip Bay area lodged by representatives of the Bunurong people, although not over Western Port or the open ocean areas. Additional specialist advice is required here.

5.5 Aboriginal Heritage Act 2006 (Victoria)

This Act came into force on the 28th of May 2007 and an activity that may damage any aspect of Aboriginal cultural heritage will only be permitted to occur if there is in place a cultural heritage permit or approved cultural heritage management plan, which is likely to be required for this project.

5.6 Heritage Act 1995 (Victoria)

The Heritage Act administered by Heritage Victoria provides for the protection and conservation of places and objects of cultural heritage significance. Consultation with Heritage Victoria should be therefore undertaken in regard to the requirements for works affecting listed sites, and in regard to other cultural heritage places and objects. It is unlikely that this Act would have a significant impact on project approvals.

5.7 Land Acquisition and Compensation Act 1986 (Victoria)

The creation of easements or acquisition of land for a site associated with a project across individual land titles would typically be undertaken under a separate process after the required approvals are received. The land acquisition process will be subject to the provisions of the Land Acquisition and Compensation Act 1986 and other associated Acts such as the Crown Land Act and Land Act 1958.

The Land Acquisition and Compensation Act 1986 outlines the authorities which are able to compulsorily acquire land, or easements, and outlines the procedure for which land is to be acquired and compensation paid, of which Melbourne Water is such an authority. Generally, unless the project is designated of state significance, land must be reserved for a public purpose under a planning instrument (e.g. a Public Acquisition Overlay) prior to being acquired. However, under Section 6(a)(i) of the Land Acquisition and Compensation Act Regulations, if the area to be acquired is less than 10% of the total landholding and less than 10% of the value of the landholding, reservation under a planning instrument is exempt. The compulsory acquisition of an easement is strictly regulated and defined in this Act.

Experience on other major projects indicates that access to land can often be achieved by cooperative discussion with landowners.

5.8 Coastal Management Act 1995 (Victoria)

Under the Coastal Management Act written consent from the Minister for Planning must be obtained before coastal Crown Land can be used or developed. Under the definition of Coastal Crown Land provided in the Act, being ‘the seabed of any sea within the limits of Victoria’, it is apparent that the Minister’s consent could be required for any development.

The Costal Management Act 1995 provides for the development of a Victorian Coastal Strategy and Strategic Planning for the management of the Victorian coast. This Act establishes the Victorian Coastal and Bay Management Council and the Regional Coastal Boards. The regional coastal board which is relevant is the Victorian Coastal Council, Central Coastal Board.

The Coastal Management Act requires the Central Coastal Board to report to the Coastal Council on the state of coastal planning and implementation of the Victorian Coastal Strategy, coastal action plans and approved coastal guidelines.

5.9 Environment Protection (Schedules Premises and Exemptions) Regulations 1996 (Victoria)

The Environment Protection (Schedules Premises and Exemptions) Regulations 1996 designate certain industrial or commercial activities (scheduled categories) as belonging to one or more of six types as defined in the Environment Protection Act 1970.

These schedules include Schedule 2 that covers waste discharged or likely to be discharged onto any land or into any waters. Schedule 2 premises require an EPA Works Approval before they are built and an EPA licence to operate, unless specifically exempted from these requirements in the regulations, or unless an EPA apporoval has been obtained for research, development or demonstration purposes.

It is likely that a Works Approval will be required. The guidance for the EPA on potential environmental impacts will be given through the SEPPs (see below).

5.10 State Environment Protection Policy (Waters of Victoria)

Any potential impacts on the marine environment will be regulated by the EPA under the SEPP (Waters of Victoria) and its schedules. There are schedules to the SEPP, which apply to specific parts of the marine environment. The SEPP seeks to protect defined beneficial uses of the environment. A mixing zone for a licensed waste discharge may be approved by the EPA where it is not practicable to avoid, reuse, recycle or otherwise manage wastewater. Within the mixing zone, designated environmental quality objectives do not need to be met. It needs to be shown that there will be no environmental harm beyond the mixing zone.

Port Phillip Bay

Port Phillip Bay is covered by SEPP (Waters of Victoria) Schedule F6 Waters of Port Phillip Bay.

Within the Schedule, the Bay is divided into segments. In this case the segments of interest are called General Segment (largely the main area of the Bay) and the Inshore Segment (that area whin 600 metres of the high water mark and outside other segments such as Werribee and Corio). The SEPP provides some objectives for water quality indicators. In the inshore and general segments these provide for a variation in salinity of ± 5% (for a salinity of 35 ppt this is a variation of 1.75 ppt). The beneficial uses of the Bay include impacts on natural ecosystems and recreational and commercial fishing as well as contact recreation. It will be necessary to demonstrate that these uses are not compromised.

Western Port

Western Port is covered by SEPP (Waters of Victoria) Schedule F8 Waters of Westernport and catchment. The areas of potential impact are in the Segment known as Entrances and North Arm. Environmental quality objectives are required to be attained to protect the defined beneficial uses. The environmental water quality indicators and objectives for the Entrance and North Arm Segment (as well as for the East Arm Segment) are ± 1 ppt. As well as the same beneficial uses as Port Phillip Bay, Westernport also has the protection of largely unmodified aquatic ecosystems. It will be necessary to demonstrate that these uses are not compromised.

Bass Strait Waters

Other waters within the Victorian area of jurisdiction are covered by the SEPP Waters of Victoria. These would occur within the segment, Open Coasts. The beneficial uses here are largely the same as for Westernport. It will be necessary to demonstrate that these uses are not compromised.

5.11 Fisheries Act 1995 (Victoria)

This Act provides for the Regulation, Management and Conservation of Victorian fisheries and aquatic habitats. The Aquaculture zones within Port Phillip Bay are established under this Act. It will be necessary to demonstrate that there are no adverse impacts on any fisheries as part of the approvals process for the project.

5.12 Flora and Fauna Guarantee Act 1988 (Victoria)

This Act provides for the conservation of Victoria's native flora and fauna. There are listed species, communities and threatening processes identified under this Act. Consideration will need to be given to any impact on such listed species in the assessment of environmental impacts of the project.

6. The Importance of Site Selection

The influence of site selection on the costs, environmental and social impacts of seawater desalination has been covered under various sections above. The following points are provided as a summary before moving on to the next section of the report, which covers the review undertaken of a range of possible locations in Victoria.

Table 8 The Importance of Site Selection

Area of Influence	Description
Influences On Cost	Sites that are near to the connection points in the city will reduce the cost of the interconnecting pipeline, and the costs of pumping water to the city. Sites that are close to deep water will have lower costs for the intake and outlet tunnels. Sites that are close to open ocean water will have lower costs for pre-treatment prior to the reverse osmosis membranes. Sites with ample open 'Greenfield' land will have lower construction costs (compared to constrained already developed 'Brownfield' sites). Sites closer to major grid assets will have reduced electricity connection costs.
Influences on Environmental and Social Impacts	Sites on 'industrial' land will have less impact on visual amenity. Sites close to bodies of water, which have high turnover and energetic mixing, are less likely to have environmental and social concerns regarding build up of salts. Sites where construction can occur with minimal impact on valued flora and fauna will have less overall impact. Sites with "clear runs" of suitable terrain and ecology to provide pipe corridors can allow the construction of the connecting pipeline to reduce impacts on flora and fauna, as well as minimising social impacts. Sites where ongoing water quality drivers do not constrain other activities (eg constraining shipping to avoid adverse water quality impacts) will have less overall social impact.