

**Agreement No. CE 21/2012 (WS)**

**Desalination Plant  
at Tseung Kwan O –  
Feasibility Study**

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EIA Project Profile

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8901/B&V/0013

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## 1 Introduction

### 1.1 Background

- 1.1.1 A secure water supply is of utmost importance in sustaining Hong Kong's development. To better prepare Hong Kong for uncertainties such as acute climate changes and low rainfall, the Total Water Management (TWM) strategy has been promulgated by the Hong Kong SAR Government in 2008. The TWM strategy is an integrated, multi-sectoral approach built on good water demand and supply management initiatives. Under this strategy, one of the initiatives is to explore new water resources. In the 2011-2012 Policy Address, it was mentioned that as a responsible member of the Pearl River Delta (PRD) Economic Zone, the Hong Kong SAR Government strived to explore other sources of water supply to meet Hong Kong's water demand.
- 1.1.2 To this end, the Water Supplies Department (WSD) has kept abreast of the latest developments in desalination technology and prepared for the related planning and studies so that other water sources can be tapped in good time in case of water shortage. A Feasibility Study (CE 71/2000 (WS)) and a Pilot Plant Study (CE 97/2002 (WS)) on developing desalination facilities in Hong Kong have been conducted in 2002 and 2007 respectively. These studies confirmed the technical feasibility of using desalination technologies to produce potable water complying with the World Health Organisation (WHO) standards. WSD is now conducting a detailed study to assess the feasibility and cost-effectiveness of building a medium-sized desalination plant in Hong Kong, at a site reserved in Tseung Kwan O (Area 137).
- 1.1.3 In 1975, a 182 MLD (million liters per day) multi-stage flash desalination plant was commissioned in Lok On Pai, Tuen Mun. Due to high operation cost, the Lok On Pai desalination plant was decommissioned in 1981.
- 1.1.4 Unlike the energy intensive multi-stage flash distillation process used in Lok On Pai desalination plant, the proposed Tseung Kwan O desalination plant is a Seawater Reverse Osmosis (SWRO) plant. SWRO is a mature and preferred technology, which dominates the market due to its reliability and progressive reduction in cost as the technology advances. SWRO desalination plants are currently operated worldwide at countries in various regions including China, Singapore, Australia, Middle East, Africa, Europe, and North America. Some overseas municipal SWRO plants of production capacity greater than 100 MLD are listed in Table 1-1.

**Table 1-1 Examples of Overseas Municipal SWRO Desalination Plants**

Region	Country	Name of SWRO Plant
Asia	China	Qingdao
Asia	China	Tianjin
Asia	Singapore	Singspring
Asia	Singapore	Tuaspring

Region	Country	Name of SWRO Plant
Australia	Australia	Wonthaggi (Melbourne, Victoria)
Australia	Australia	Adelaide
Australia	Australia	Sydney (Kurnell)
Middle East	Bahrain	Ad Dur
Middle East	Israel	Sorek
Middle East	Israel	Hadera
Middle East	Israel	Ashkelon
Middle East	Saudi Arabia	Jeddah
Middle East	Saudi Arabia	Shuqaiq
Middle East	Saudi Arabia	Shoiaba
Middle East	Kuwait	Shuwaikh
Middle East	Kuwait	Az-Zour South
Middle East	Oman	Barka II
Middle East	United Arab Emirates	Al Fujairah 1
Middle East	United Arab Emirates	Al Fujairah 2
Middle East	United Arab Emirates	Jebel Ali
Africa	Algeria	Magtaa
Africa	Algeria	Tlemcen-Honaine
Africa	Algeria	Beni Saf
Africa	Algeria	El Hamma
Europe	Spain	Torre Vieja
Europe	Spain	El Prat del Llobregat
Europe	Spain	Aguilas Guadalentin
Europe	Spain	Valdelentisco
Europe	Spain	Campo de Dalías
North America	United States of America	Tampa Bay

## 1.2 Purpose of this Project Profile

- 1.2.1 Under the Environmental Impact Assessment Ordinance (EIAO), an Environmental Permit (EP) will be required for the construction and operation of the proposed desalination plant at Tseung Kwan O (hereinafter referred to as 'the Project').
- 1.2.2 This document, the Project Profile, is prepared for application for an EIA Study Brief which sets out the technical requirements for the EIA study to be completed for the application of the EP. It includes a brief description of the potential environmental impacts associated with the preliminary construction and operation plans of the Project as well as baseline information describing the condition at the Study Area, i.e. an area within 500 m of the site boundary of the proposed Project.

## **2 Basic Information**

### **2.1 Project Title**

Desalination Plant at Tseung Kwan O

### **2.2 Purpose and Nature of the Project**

2.2.1 The proposed Project comprises the following:

- Construction of a new desalination plant in TKO Area 137 with a capacity of 50 million m<sup>3</sup> per annum, expandable to 90 million m<sup>3</sup> per annum in the future.
- Natural slope mitigation works consist of construction of debris barriers and boulder traps at the toe of and stabilization of natural slopes and boulders on the natural slope within the Clear Water Bay Country Park (see Appendix II), which overlooks the northeast boundary of the new desalination plant at TKO Area 137.
- Construction of a dedicated trunk feed system for the transfer of fresh water output from the desalination plant to the existing Tseung Kwan O Primary Fresh Water Service Reservoir (TKOPFWSR). The system consists of a new pumping station, a new treated water storage tank, about 9 km of 1200 mm diameter fresh water mains along Wan Po Road, Po Hong Road and Tsui Lam Road (fresh water main is indicated in Appendix I), and the associated pipeworks and ancillary facilities including fittings/valves, leakage, flow and pressure monitoring facilities etc.
- All the associated civil, structural, geotechnical, landscaping, electrical and mechanical works.

### **2.3 Name of Project Proponent**

Water Supplies Department (WSD)

### **2.4 Location and Scale of the Project & History of the Site**

2.4.1 The proposed site for the desalination plant is located in Tseung Kwan O (TKO) Area 137 with a reserved site area of about 10 hectares. TKO Area 137 is located to the south of the Southeast New Territories (SENT) Landfill and the Tseung Kwan O Industrial Estate. It faces the Clearwater Bay Country Park to its east, the Joss House Bay to its south and the Tathong Channel to its west. The nearest residential area is the LOHAS Park which is located about 2.5 km from the site. Appendix I shows the location of the proposed desalination plant.

2.4.2 The site is on reclaimed land which was reclaimed between 1998 and 2000. According to the Tseung Kwan O Outline Zoning Plan (OZP) S/TKO/20, the TKO Area 137 is zoned as "Other Specified Use" annotated "Deep Waterfront Industry" ("OU (DWI)") which is intended for special industries which require marine access, access to deep water berths or water frontage. The industries to be accommodated are usually capital intensive and land-intensive and cannot be accommodated in conventional industrial buildings. It is considered that amendment to the OZP is required to zone the site to "Other Specified Uses" annotated "Desalination Plant" ("OU (DP)"). Appendix II shows the proposed Project site and the major elements of the surrounding environment.

2.4.3 The natural slope overlooking the northeast boundary of the new desalination plant at TKO Area 137 has a history of minor landslides and contains some potentially unstable boulders.

Landslide and boulder hazard mitigation works including mainly passive debris barriers and boulder traps along the toe of the natural slope, some soil nailing at local steep spots on the slope, stabilization of individual boulders by buttressing and dowelling may be required to protect the new desalination plant for the landslide and boulder hazards from this slope. Appendix I shows the indicative area of potential landslide mitigation works. While such mitigation works may be required to be implemented within the Clear Water Bay Country Park, the mitigation works will be avoided and minimized as far as practicable to minimize any potential environmental impact to the Country Park.

2.4.4 No permanent major infrastructure has been built in and around the proposed site. At present, three major facilities are located in the vicinity of the site, namely a temporary public fill bank, a temporary explosive magazine and an explosives off-loading barging pier. These are discussed in detail in Section 3.3.

## 2.5 Brief Project Description

2.5.1 The desalination plant comprises the following major facilities:

- Seawater intake system
- Pre-treatment system
- Reverse Osmosis (RO) treatment system
- Post-treatment system
- Backwash and chemical cleaning system
- Sludge handling system
- Concentrate discharge system
- Auxiliary systems

2.5.2 Construction of the Desalination Plant

Hoarding will be erected around the site prior to the commencement of the foundation work. Pile foundation with reinforced concrete pile caps will be used for the foundations of the buildings. Reinforced concrete slab and raft foundation will be built for the desalination plant. The reinforced concrete buildings will be constructed on site using ready-mix concrete and conventional construction method. All pipework will also be properly supported. Major construction activities would include driving of piles, shaft excavation, micro-tunneling, pipe jacking, pipe laying, building construction, and installation of electrical & mechanical plant and equipment.

It is anticipated that open onshore intake or submerged intake (approximately 150m - 200m long) and outfall pipes (approximately 200m - 250m long) will be constructed. Intake and outfall will be constructed with trenchless technologies. While localized dredging works for the construction of intake structures and outfall diffusers will be required, dredging works will be minimized as far as practicable to avoid or reduce any potential environmental impacts.

Furthermore, prefabricated intake and outfall structures (e.g. intake openings and diffuser heads) will be transferred and installed onsite.

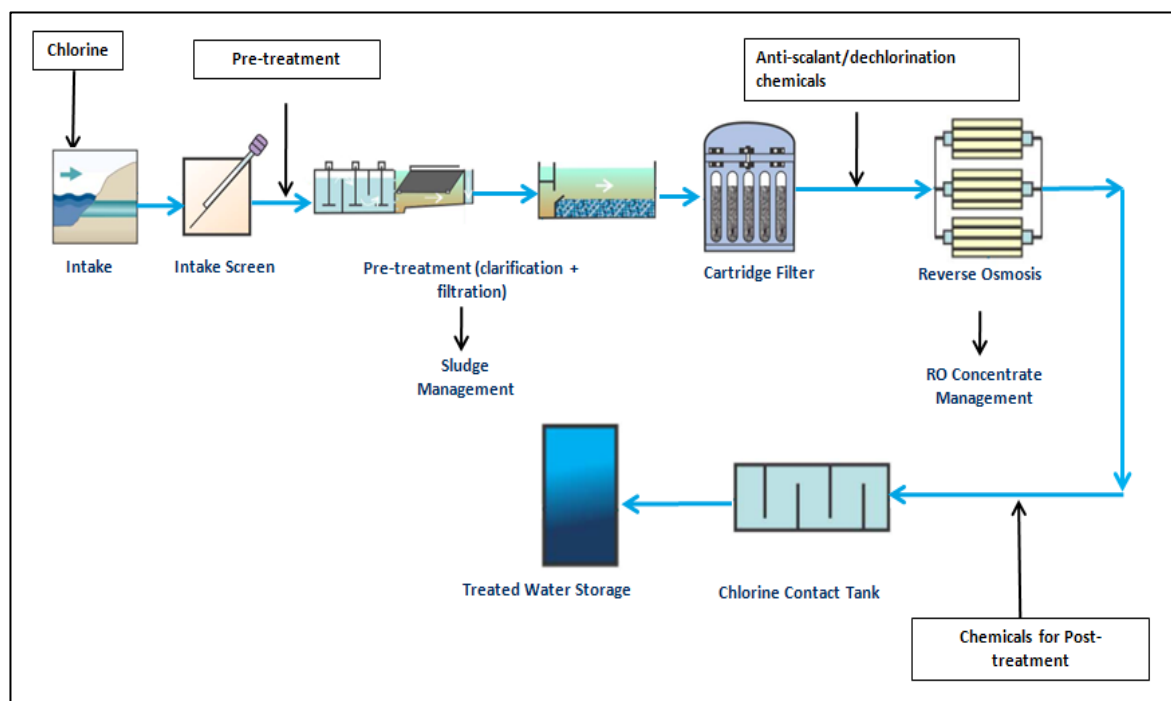
2.5.3 Operation of the Desalination Plant

Seawater will be drawn from the seawater intake system for the desalination process. Chlorine is dosed periodically into the intake seawater for control of microbial growth at the intake and the associated screening system.

Seawater will be delivered to the pre-treatment system for pre-treatment by clarification followed by filtration prior to the Seawater Reverse Osmosis (SWRO) process. Coagulant/polymer will be added to feed water for coagulation and flocculation. Residual chlorine left over from the intake chlorination will be removed by dechlorination process. Process waste streams will be generated from the pre-treatment processes. The process waste streams will include sludge from clarifiers and backwash waste from filters (also known as residual streams).

High pressure feed pumps will drive the seawater through the RO system. The pressurized seawater will be split into two streams, a low pressure permeate stream (product stream) and a high pressure concentrate stream (RO concentrate or waste stream) which is the rejected flow from the RO membranes. The permeate produced in the RO system will be passed into the post-treatment system prior to pumping into the distribution system for potable water uses. The RO membranes will require cleaning with chemicals (i.e. clean-in-place or CIP) on periodic basis. The waste generated from the RO cleaning process is neutralized and blended with the concentrate for discharge.

Post-treatment processes will include disinfection using chlorine and fluoridation, pH correction and stabilization via hydrated lime and carbon dioxide dosing. A typical Process Flow Diagram of a SWRO desalination plant is illustrated in Figure 2-1.



**Figure 2-1 Typical Process Flow Diagram of a SWRO Desalination Plant**

As described above, a number of chemicals are required for the efficient and effective operation of the desalination plant. The actual chemical dosing regime will be determined at the EIA study. Chemicals that may be dosed in the water stream for main treatment are summarized in Table 2-1.

**Table 2-1 Chemicals that may be Dosed in the Water Stream**

Chemical	Purpose
Sodium Hypochlorite	Pretreatment - Bio growth control
Ferric Chloride or Alum	Pretreatment - Coagulation
Sulphuric Acid	Pretreatment - pH Adjustment
Polymer	Pretreatment - Flocculation
Sodium meta Bisulphite	Pretreatment - Dechlorination
Antiscalant	RO membranes - Scaling control
Sodium Hydroxide	RO membranes - pH adjustment (if required)
Carbon Dioxide	Post Treatment - pH adjustment and remineralisation
Hydrated Lime	Post Treatment - pH adjustment and remineralisation
Sodium Silicofluoride	Post Treatment - Fluoridation for teeth protection
Liquid Chlorine	Post Treatment - Final disinfection
Polymer	Sludge Conditioning - Sludge Thickening/Dewatering

In addition to the above chemicals the cleaning chemicals for RO include sodium hydroxide, citric acid, hydrochloric acid, and sodium laurel sulphate. Chemical cleaning of RO membranes are typically carried out once a month. Such cleaning waste will be neutralized appropriately to stabilize the pH before blending with RO concentrate for discharge.

All process waste streams, including the concentrate produced as the result of RO process, supernatants from residual processes, and the neutralized RO chemical cleaning waste will be discharged via the concentrate discharge system to the outfall.

In accordance with EPD Waste Disposal Ordinance, sludge generated from clarification and filter backwash will be thickened and dewatered to 30% solids content for subsequent disposal to landfill. Traces of chemicals that are not captured by the sludge generated may be found in the supernatants of these residual processes. Any residual chlorine left in the streams will be quenched (or removed) using sodium meta bisulphite before discharge to the sea through the outfall. RO concentrate will represent a significant portion of these streams (i.e. about 90% of flow). Since RO concentrate is free from particulate contaminants (which are removed in pre-treatment processes), the only constituents that are present are soluble cations/anions. The key constituents that may be found in the RO concentrate discharge stream blended with supernatants from residuals streams and neutralized RO chemical cleaning waste are summarized in Table 2-2.

**Table 2-2 Key Constituents in the RO Concentrate Discharge Stream**

Constituent	Concentration (mg/l)
Sodium	18,000-20,000
Potassium	700-900
Calcium	700-900
Magnesium	2500-2800
Strontium	14-20
Sulphate	5000-7000
Chloride	35000-38000
Boron	8-9
Total Dissolved Solids	60,000-70,000
Total Suspended Solids	Less than 25

Auxiliary systems of the desalination plant include the following:

- Instrument and service air system
- Cooling water system
- RO modules cleaning system
- Chemical waste treatment and disposal system
- On-site laboratory
- Chemicals store
- Chlorine storage, containment, absorb, alarm, and detection system
- Chemical dosing and preparation systems
- Dechlorination facilities
- Heating, ventilation, and air conditioning system
- Firefighting, alarm, and detection system
- Dangerous goods stores
- Electrical buildings housing transformers switchgears and other electrical facilities
- Maintenance workshops
- Operation and control center
- Visitor center
- Other miscellaneous utilities and facilities

Operational discharges from the auxiliary systems, except sewage which will be discharged into the public sewerage system, will be discharged via the submarine outfall.

The intake and outfall will be designed and constructed such that maintenance dredging work will not be required for routine maintenance. Typical maintenance of submarine structures will consist of periodic inspection, and cleaning of the diffuser nozzles at the outfall.

With a view to reducing potential environmental impacts, chlorine use in the form of chlorine gas at the desalination plant will be kept to the minimum. The alternatives of sodium hypochlorite and onsite generation will be considered for the chlorine use at the intake. Designated dangerous goods, including sodium hypochlorite solution, carbon dioxide, caustic soda, hydrochloric acid and sulphuric acid, with a total storage of over 500 tonnes will be stored on-site to support the plant's operational activities.

## **2.6 Number and Type of Designated Project to be Covered by the Project Profile**

- 2.6.1 The proposed Project covers the following Designated Project (DP) as described under the EIAO:
- a) Schedule 2, Part I, Item E.2 – Water treatment works with a capacity of more than 100,000 m<sup>3</sup> per day
  - b) Schedule 2, Part I, Item K.13 – A dangerous goods godown with a storage capacity exceeding 500 tonnes.
  - c) Schedule 2, Part I, Item Q.1 – Earthworks partly in an existing country park

## **2.7 Name and Telephone Numbers of Contact Persons**

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## **3 Outline of Planning and Implementation Programme**

### **3.1 Project Planning & Implementation**

- 3.1.1 WSD is the project proponent with overall responsibility for the planning, design, construction and operation of the Project. The project proponent commissioned Black & Veatch Hong Kong Ltd (B&V) to undertake the feasibility study which includes an investigation of preliminary engineering design and an Environmental Impact Assessment (EIA) study. The Project will be implemented by contractor(s) to be appointed by the project proponent at a subsequent stage.

### **3.2 Project Programme**

- 3.2.1 The detailed design of the Project is tentatively planned to be carried out between 2016 and 2017. Tendering of the construction works will then be carried out in 2017. Construction is tentatively scheduled to commence in 2018 for completion in end 2020. Details of the tentative project programme are shown in Table 3-1.

**Table 3-1 Tentative Project Development Programme**

Task	Timeline
Investigation and EIA Study	2013 Q1 – 2014 Q4
Project Inclusion and Funding Application	2015 Q1 – 2016 Q1
Engineering Design	2016 Q2 – 2017 Q4
Pre-qualification and Tendering	2017 Q1 – 2017 Q4
Construction	2018 Q1 – 2020 Q4
Testing and Commissioning	2020 Q4 – 2020 Q4
Project Completion	End 2020

### 3.3 Interactions with Other Surrounding Projects

- 3.3.1 At present, the Civil Engineering and Development Department (CEDD) is operating a temporary fill bank facility at TKO Area 137. The site is now stockpiled or filled with Construction and Demolition Material (C&D Material) with access roads between various parts of the site. The temporary fill bank will occupy the site up to the end of 2018 under the current TGLA. However, CEDD has agreed to hand over the 10 ha site cleared of stockpile for this project by late 2015 for the construction of the Project. As such, operation of the temporary fill bank will be considered as a concurrent project interacting with this Project during the construction period.
- 3.3.2 In addition, the MTR Corporation Limited has currently set up a temporary explosive magazine for its Shatin to Central Link and Kwun Tong Line Extension projects at the TKO Area 137. Whilst the site for the temporary explosive magazine encroaches considerably upon the reserved site for the desalination plant, the site will be returned to WSD by late 2015 for the construction of the desalination plant. As such no interaction with this Project is expected.
- 3.3.3 A barging pier at TKO Area 137 for off-loading explosives is operated (TGLA No. SK 567) by the Mines Division of the Civil Engineering and Development Department (CEDD). The temporary allocation of the land for the explosive off-loading facilities has been extended to 30 June 2015 with a lease condition that the CEDD will return the site at some time during early 2014 if required by the WSD for the construction of the desalination plant by giving 6 months written notice. There is, however, a potential for the possible coexistence of the explosive off-loading facilities with this Project. The feasibility of the coexistence of the explosive off-loading facilities with the desalination plant will be confirmed by a hazard to life assessment to be included in the EIA study.
- 3.3.4 There are other on-going and planned projects such as the Tseung Kwan O Cross Bay Link, Tseung Kwan O – Lam Tin Tunnel and Associated Works, Biodiesel Plant at TKO Industrial Estate, C&D Material Handling Facility and the Southeast New Territories (SENT) Landfill Extension in the broad Tseung Kwan O area. For all these projects except the SENT Landfill Extension, the separation distance from this Project is such that cumulative impacts are unlikely to occur. This Project will consider the SENT Landfill Extension as an existing facility and a landfill leachate and gas hazard assessment will be included in the EIA study.
- 3.3.5 The above assumptions will be re-examined and confirmed during the EIA stage.

#### **4 Possible Impacts on the Environment**

The following sections identify potential impacts to the environment.

##### **4.1 Air Quality**

###### Construction phase

- 4.1.1 No unacceptable impact to air quality is expected.
- 4.1.2 With the implementation of standard site practice and dust suppression measures stipulated under the Air Pollution Control (Construction Dust) Regulation, no unacceptable construction dust impact is anticipated.
- 4.1.3 The site for the Project has been formed and is currently occupied by others for different uses. The current occupants will hand over the site to WSD for this Project cleared of stockpiles and structures. No major earthwork or site formation works will be required.
- 4.1.4 Some level of dust nuisance is expected during Project construction. The predominant dust sources on site will be the construction activities (e.g. excavation, material handling and vehicle movements on unpaved site areas, etc.). No air sensitive receivers are identified in close proximity of the Project. Standard site practice and dust suppression measures will be implemented to minimize any potential impacts as far as practicable.

###### Operation phase

- 4.1.5 No unacceptable impact to air quality is expected.
- 4.1.6 No significant emissions are identified for Project operation.

##### **4.2 Noise**

###### Construction phase

- 4.2.1 With the adoption of appropriate mitigation measures, potential noise impact is expected to be negligible.
- 4.2.2 Noise will be generated from construction activities which involve the use of powered mechanical equipment (PME) such as generators, excavators, concrete breakers, concrete lorry mixers, and mobile/tower cranes.
- 4.2.3 No noise sensitive receivers are identified in close proximity of the Project.

###### Operation phase

- 4.2.4 No unacceptable noise nuisance is expected.
- 4.2.5 Fixed noise sources during operation of the plant will include the high pressure pumps, exhaust fans for ventilation systems and emergency generator set (if required). The sources will be enclosed in the building structures to minimize noise generated.

### 4.3 Water Quality

#### Construction phase

- 4.3.1 No unacceptable changes in water quality due to submarine installation works are expected.
- 4.3.2 Construction phase impacts of the Project are mainly associated with the installation of submarine structures including the submerged pipes for the intake and outfall. The main concern will be related to the release of suspended solids into the water column and potential effects on water quality sensitive receivers. Non-dredged or trenchless method, such as tunneling method, is proposed to be adopted for the installation works to minimize the extent of marine dredging and to reduce potential impacts as far as practicable.
- 4.3.3 Impacts on water quality arising from the proposed marine works are expected to be largely confined to the specific works areas and of short duration. The expected elevations of suspended sediment due to the Project are not expected to exceed environmental standards.
- 4.3.4 Other minor water quality impact resulting from the construction works will be mainly related to construction site runoff and discharges, and sewage from the construction workforce. General site practice will be implemented in accordance with the Practice Note for Professional Persons on Construction Site Drainage (ProPECC PN1/94) and other relevant guidelines, thus no unacceptable water quality impact is anticipated.

#### Operation phase

- 4.3.5 The operation of this Project is not expected to cause unacceptable impacts to water quality.
- 4.3.6 Operational discharges from this Project will be regulated for compliance with the relevant standards stipulated under the Water Pollution Control Ordinance (WPCO).
- 4.3.7 Concentrate with high salinity and trace amount of residual chemicals and other operational discharges from auxiliary systems will be discharged into the surrounding waters during plant operation. The location of the outfall will be reviewed and selected to allow rapid dilution upon discharge and with due consideration of water quality sensitive receivers nearby.
- 4.3.8 The diffusers at the outfall will be designed to have high velocities to allow rapid dispersion and dilution of the RO concentrate upon discharge. The size of the mixing zone will be determined by near-field and far-field modeling at the EIA stage.
- 4.3.9 The RO concentrate is primarily composed of soluble compounds generated from the RO process. Sediment deposit will be minimal with diffuser system that is designed to provide adequate dispersion. Outfall hydraulics, including the design of the diffuser system will be carried out by hydraulic calculations and modeling such that vertical stratification (due to salinity difference) will be minimized.
- 4.3.10 Sewage generated from the operation of the project will be discharged into the public sewerage system for treatment and disposal. The existing capacity of the public sewerage system is expected to be sufficient to handle the sewage from this Project and thus no unacceptable impact is expected. Sewerage impact assessment will be undertaken as part of the EIA study to confirm the assumption.

#### **4.4 Terrestrial Ecology**

##### Construction phase

- 4.4.1 Construction activities of Desalination Plant are unlikely to cause impacts on ecology.
- 4.4.2 The proposed desalination plant is situated on reclaimed land with no encroachment into the surrounding natural habitats. Minor landslide mitigation works including stabilization of natural slopes and boulders will be proposed for the natural slope adjacent to the northeast boundary of the proposed desalination plant, which is within the boundary of the Clear Water Bay Country Park (see Appendix II). Potential impact during construction stage may include direct loss of habitat and associated organisms, and disturbance to habitats and associated fauna due to construction activities. Since the landslide mitigation works will be minor, significant impact to the Clear Water Bay Country Park is not anticipated.
- 4.4.3 Indirect disturbance to fauna and flora include noise, dust nuisance, site runoff and human activities is expected to be insignificant given implementation of good site practices and fence off the construction works area from surrounding natural habitats.

##### Operation phase

- 4.4.4 Indirect disturbance to fauna and flora due to increase in human activities and noise is expected to be negligible.
- 4.4.5 Operation activities of the desalination plant will be limited to within the boundary of the plant site.

#### **4.5 Marine Ecology**

##### Construction phase

- 4.5.1 Impacts to marine ecological resources are likely to be negligible.
- 4.5.2 Potential impacts to marine ecological resources during submarine intake and outfall installation will include:
- Direct impacts on intertidal assemblages, subtidal benthic assemblages and corals (if any) within the works areas
  - Indirect impacts to marine ecological resources around the marine works areas as a result of perturbations to water quality due to activities described in Section 4.3
- 4.5.3 Works nearby corals, if any, will be avoided as far as practical to minimize potential impacts. The loss of intertidal and subtidal organisms (directly) within the marine footprint is not expected to represent an unacceptable ecological impact.
- 4.5.4 As explained in Section 4.3, no unacceptable impact on water quality is expected during Project construction.

##### Operation phase

- 4.5.5 Impacts to marine ecological resources are likely to be negligible.

4.5.6 Potential impacts on marine ecology during Project operation are related to changes in water quality due to concentrate and operational discharges. The potential water quality changes will be maintained within acceptable levels.

#### **4.6 Fisheries**

##### Construction phase

4.6.1 No unacceptable impact to the identified sensitive receiver is expected.

4.6.2 Potential impacts to fisheries resources and fishing operations may arise from disturbances to fisheries habitats during marine construction works, or through changes in water quality as a result of the marine construction works. The marine footprint of this Project is small, thus the minor disturbance to fisheries resources or fishing operations, if any, is unlikely to result in unacceptable impacts.

4.6.3 The nearest Tung Lung Chau Fish Culture Zone (FCZ) is the only identified sensitive receiver. It is located at sufficient distances (1.5 km) from the proposed site.

##### Operation phase

4.6.4 Impacts to capture and mariculture fisheries resources are likely to be negligible.

4.6.5 Concentrate and other operation discharges associated with Project operation may impact on capture and mariculture fisheries resources via changes in water quality. The potential water quality changes will be maintained within acceptable levels. Given that the FCZ is located sufficiently far away from the Project site, no unacceptable impacts on water quality is expected during operation phase.

#### **4.7 Landscape and Visual**

##### Construction phase

4.7.1 Unacceptable landscape and visual impact is unlikely to occur.

4.7.2 The proposed desalination plant will be located on reclaimed land with some vegetation. Potential impact on part of this vegetation is anticipated during the development of the desalination plant. Impact on existing trees would be minimized as far as practicable by well-defined the work area.

4.7.3 Potential impact on vegetation is anticipated due to the landslide hazard mitigation works on natural terrain. The scale of landslide mitigation works will be minimized as far as practicable to reduce the impact on landscape resource.

4.7.4 The technical circular ETWB TCW No. 03/2006 Tree Preservation will be followed to mitigate and compensate for the loss of trees. As such, no unacceptable impact on landscape resources is expected.

4.7.5 Visual impact associated with the construction work is expected to be negligible since the construction work of the desalination plant will be compatible with reclaimed land and fill bank operation.

Operation phase

- 4.7.6 No unacceptable landscape and visual impact is expected.
- 4.7.7 The Project will be located at TKO Area 137 which has an industrial setting in general. The desalination plant will be compatible with the existing environment and its visual character. The Project is not anticipated to be visually intrusive in the overall setting of the TKO Area 137.

**4.8 Waste Management**

Construction phase

- 4.8.1 No unacceptable environmental impact is anticipated.
- 4.8.2 Construction and demolition materials, non-inert construction wastes, dredged marine sediments, chemical waste (e.g. lubricating oils) and general refuse are the major sources of waste during Project construction. These will be managed in accordance with the relevant guidelines and standards, and with the implementation of standard waste management practices.

Operation phase

- 4.8.3 No unacceptable environmental impact is anticipated.
- 4.8.4 The key waste impact for the operation of this Project will be the handling and disposal of sludge generated from the treatment process. Sludge will be dewatered on site. The disposal of dewatered sludge will be under strict management in accordance with relevant guidelines by the EPD.
- 4.8.5 Operation of the plant will generate small amount of wastes during periodical chemical cleaning of the RO membranes. The waste generated from the RO cleaning process will be neutralized and blended with the concentrate for discharge.

**4.9 Land Contamination**

- 4.9.1 No land contamination concern is anticipated.
- 4.9.2 The proposed Project is situated on reclaimed land with no history of contaminative land-use.

**4.10 Cultural Heritage**

- 4.10.1 No impact on cultural heritage is expected.
- 4.10.2 There is no declared monument or graded historical building within and in proximity to the proposed site for this Project.

**4.11 Hazard to Life**

- 4.11.1 The desalination plant will use chlorine as a disinfectant. A significant amount of liquid chlorine and sodium hypochlorite solution is expected to be stored on site for its use.

4.11.2 The proposed desalination plant will be classified as a Potentially Hazardous Installation (PHI) in accordance with Section 4.2, Chapter 12.4 of the Hong Kong Planning Standards and Guidelines due to its liquid chlorine storage capacity, and hazards from storage of large amount of chlorine are considered to be of concern. A Hazard Assessment (HA) will be conducted to confirm the level of risk would be acceptable as per the individual and societal risk criteria stipulated in Annex 4 of the EIAO-TM.

4.11.3 A quantitative risk assessment will be conducted to assess the potential hazard to life associated with the operation of the plant as well as possible coexistence of the plant with the explosive off-loading barging pier.

#### **4.12 Landfill Gas Hazard**

4.12.1 The proposed SENT Landfill Extension site is located immediately to the north of the proposed Project site. The Project is located within the 250m Landfill Consultation Zone. It will be considered as an existing facility and a landfill gas hazard assessment will be included in the EIA study.

#### **4.13 Other Issues**

4.13.1 Night Time Operation

- a) General construction activities during restricted hours, i.e. 19:00-07:00 hours on any day and anytime on Sunday or general holiday, if any, will be undertaken in accordance with requirements of the Construction Noise Permits to be obtained for the Project under the Noise Control Ordinance.
- b) Visual impact due to glare from night time construction works and desalination plant operation, if any, will be negligible as the residential sensitive receivers are distant from the site, over 2.5 km away.

4.13.2 Traffic

- a) Increase in traffic associated with construction and operation activities is expected to be relatively small when compared with the background traffic along Wan Po Road.
- b) The possibility of using marine transport for shipping materials using the barging pier at TKO Area 137 will be sought.

### **5 Major Elements of the Surrounding Environment**

Major environmental elements surrounding the proposed Project are summarised below.

#### **5.1 Shipping Fairways**

5.1.1 The Tathong Channel to the west of the Project site is a major vessel fairway. Based on the current preliminary conceptual design, the proposed submarine facilities of the Project are expected to be located at sufficient separation distances from the Tathong Channel.

#### **5.2 Submarine Utilities, Including Cables & Pipelines**

5.2.1 The utilities nearest to the Project include four existing submarine telecommunication cables and one sewage pipeline. These are located at the Tseung Kwan O Industrial Estate area and

thus at large separation distances from this Project. As such, no overlapping or encroachment of utility footprints is expected.

### 5.3 Gazetted Bathing Beaches

5.3.1 The gazetted bathing beaches in the vicinity of the Project site include Clear Water Bay Second Beach, Clear Water Bay First Beach and Big Wave Bay (Hong Kong Island), which are approximately 2.6 km, 3 km and 3.8 km from the proposed Project site respectively. Given the large separation distances, these beaches are unlikely to be affected by the construction and operation activities of this Project.

### 5.4 Seawater Intake

5.4.1 The nearest WSD seawater intakes are located in Junk Bay and Siu Sai Wan, which are approximately 3.7 km and 3.9 km from the Project site respectively. A cooling water intake of the Pamela Youde Nethersole Eastern Hospital is located at Heng Fa Chuen which is approximately 4.5 km from the Project site. These intakes are unlikely to be affected by the construction and operation activities of this Project given their distant locations.

### 5.5 Areas of Conservation Value

5.5.1 The proposed site lies between Tit Cham Chau and the Clear Water Bay Peninsula, both of which lie within the Clear Water Bay Country Park. The Clear Water Bay Country Park is a recognized area of conservation value within 500m of the Project Site boundary (see Appendix II). While a small area of the proposed Project Site at the southern end of existing TKO Area 137 is within the Country Park boundary near Tit Cham Chau, the proposed Project site will not extend further into the Country Park boundary.

5.5.2 The proposed landslide mitigation works will be implemented to stabilize the natural slopes and boulders within the Clear Water Bay Country Park overlooking the northeast boundary of the new desalination plant.

5.5.3 The proposed North Clearwater Bay Marine Park, in the coastal waters off the northern Clear Water Bay Peninsula lies 4 km from the site at its closest approach, but is separated from the site by the mass of the Clear Water Bay Peninsula, hence it will not be affected by this Project. Based on publicly available information, there is no implementation plan for this Marine Park.

### 5.6 Coastal Protection Area

5.6.1 The coastline from Cape Collinson to Big Wave Bay is designated as Coastal Protection Area (CPA). The shortest distance from the CPA to the proposed Project site is over 2.5 km.

5.6.2 CPA can also be found along the shores of Tai Miu Wan which is about 700 m from the Project site (see Appendix II).

### 5.7 Ecological Sensitive Receivers

5.7.1 Coral assemblages have been recorded in waters of Junk Bay and Tai Miu Wan and along the coastlines off Cape Collinson and north of Tung Lung Chau (see Appendix II).

a) *Platygyra acuta* was reported as the most abundant hard coral species in east Tai Miu Wan.

- b) Isolated colonies of the soft coral *Dendronephthya sp.* was recorded in west Tai Miu Wan.
- c) *Echinomuricea sp.* was reported as the dominated soft coral species in east and west of Junk Bay (Tseung Kwan O).
- d) *Goniopora stutchburyi* was the most abundant hard coral in west of Junk Bay <sup>(1)</sup>.

5.7.2 Octocorals (dominated by *Echinomuricea sp.* and *Euplexaura sp.* both are quite common in Hong Kong) were found along the natural coastline of Fat Tong Chau at about 1 km to the northwest of the Site.

5.7.3 Corals found within and in the vicinity of the Project marine footprints are regarded as key ecological sensitive receivers for this Project.

## 5.8 Fisheries Sensitive Receivers

5.8.1 The Tung Lung Chau FCZ is located about 1.5 km southeast of TKO Area 137, and has a zoned area of approximately 80,000 m<sup>2</sup>. Whilst the Po Toi O FCZ is located about 2 km east of the Project site (see Appendix II), it is separated from the site by the Clear Water Bay Peninsula, and thus is unlikely to be affected.

5.8.2 For capture fisheries, the AFCD Port Survey 2006 <sup>(2)</sup> reported a moderate level of fishing operation (100-400 vessels per hectare) with low to moderate level of fisheries production (100-400kg/ha) in the vicinity of the proposed Project site.

## 5.9 Sites of Cultural Heritage

5.9.1 The proposed desalination plant will be constructed on reclaimed land. No cultural heritage resources such as declared monument, graded historical building or site of archaeological interest listed by the Antiquities and Monuments Ordinance is identified within and in the vicinity of the Project site.

## 5.10 Other Sensitive Receivers

5.10.1 Sensitive receivers identified for hazard to life, air quality, noise and landscape and visual impacts are distant (see Appendix II), including mainly the following:

- Residents of LOHAS Park, about 2.5 km from the Project site
- Residents in the Island Resort and Fullview Garden at Siu Sai Wan, about 2.5 km away on the other side of the Tathong Channel
- Residents in residential developments in TKO Area 85, about 3 km from the Project site
- Residents of TKO New Town, over 4 km from the Project site
- Offices at the SENT Landfill and SENT Landfill Extension, about 600 m to 100 m from the Project site respectively
- Offices, workers in the TVB Broadcast and Production Centre and Tseung Kwan O Industrial Estate (TKOIE), about 800 m to 2 km from the Project site
- Users of the Clearwater Bay Golf and Country Club, about 2 km from the Project Site

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1 CDM (2004). Environmental and Engineering Feasibility Assessment Studies in Relation to the Way Forward of the Harbour Area Treatment Scheme, Working Paper 9 (HATS EEFS WP9).

2 Agriculture, Fisheries and Conservation Department  
<[http://www.afcd.gov.hk/english/fisheries/fish\\_cap/fish\\_cap\\_latest/fish\\_cap\\_latest.html](http://www.afcd.gov.hk/english/fisheries/fish_cap/fish_cap_latest/fish_cap_latest.html)>.

- Users of the Clear Water Bay Country Park, about 1 km from the Project site (from closest point of High Junk Peak Country Trail)
- Future users of the SENT Landfill open space, about 800 m from the Project site

## 5.11 Other Proposed Facilities or Amenities

5.11.1 At present, based on publicly available information, there are no facilities or amenities proposed in close proximity to this Project. Existing projects are described in Section 3.3.

## 5.12 Summary

5.12.1 Key sensitive receivers of the proposed Project are summarised in Table 5-1.

**Table 5-1 Key Sensitive Receivers for this Project**

Name	Approximate Distance from Project Site	Remarks
<b>Hazard to Life, Air Quality, Noise, Landscape and Visual</b>		
Residents of LOHAS Park	2.5 km	Residential use
Residents in the Island Resort	2.5 km on the other side of the Tathong Channel	Residential use
Residents in Fullview Garden	2.5 km on the other side of the Tathong Channel	Residential use
Residents in residential developments in TKO Area 85	3 km	Residential use
Residents of TKO New Town	over 4 km	Residential use
Offices at the SENT Landfill	about 600 m	Commercial use
Offices at the SENT Landfill Extension	about 100 m	Commercial use
Offices, workers in the TVB Broadcast and Production Centre and Tseung Kwan O Industrial Estate (TKOIE)	about 800 m – 2 km	Commercial use
Users of the Clearwater Bay Golf and Country Club	about 2 km	Recreational use
Users of the Clear Water Bay Country Park	about 1 km (from closest point of High Junk Peak Country Trail)	Recreational use
Future users of the SENT Landfill open space	about 800 m	Recreational use
<b>Water Quality, Ecology, Fisheries</b>		
Clear Water Bay Second Beach	2.6 km	Gazetted Bathing Beach
Clear Water Bay First Beach	3 km	Gazetted Bathing Beach

Name	Approximate Distance from Project Site	Remarks
Big Wave Bay (Hong Kong Island)	3.8 km	Gazetted Bathing Beach
WSD seawater intakes – Junk Bay	3.7 km	Seawater Intake
WSD seawater intakes – Siu Sai Wan	3.9 km	Seawater Intake
Cooling Water Intake – Pamela Youde Nethersole Eastern Hospital	4.5 km	Seawater Intake
Clear Water Bay Country Park	Within 500m of the desalination plant site boundary; overlapped with the proposed areas for landslide mitigation works	Area of Conservation Value
Coastline from Cape Collinson to Big Wave Bay	2.5 km	Coastal Protection Area
Shores of Tai Miu Wan	700 m	Coastal Protection Area
Coral assemblages in waters of Junk Bay and Tai Miu Wan, and along the coastlines of Fat Tong Chau, Cape Collinson and north of Tung Lung Chau	> 1 km	Marine Ecological Sensitive Receiver
Tung Lung Chau Fish Culture Zone	1.5 km	Fisheries Sensitive Receiver
Po Toi O Fish Culture Zone	2 km	Fisheries Sensitive Receiver

## 6 Environmental Protection Measures to be Incorporated in Project Design

Potential measures are outlined below to minimize possible environmental impacts. These measures will be further reviewed in the EIA study.

### 6.1 Air Quality

6.1.1 Standard site practice and control measures will be implemented in accordance with the Air Pollution Control (Construction Dust) Regulation of Air Pollution Control Ordinance to control dust and fugitive emissions from the construction area. These measures will be incorporated into the specifications for the works contract.

### 6.2 Noise

6.2.1 The construction works will be undertaken in compliance with the provisions of the Noise Control Ordinance and with the implementation of standard site practice and noise abatement measures to control on-site noise generation. For Project operation, noise-

generating fixed plants are expected to be enclosed in building structures where possible to reduce noise impacts.

### **6.3 Waste Management**

- 6.3.1 Effective waste management measures will be adopted during Project construction to minimise and manage the waste generated. These measures may include the preparation of a Waste Management Plan, on-site sorting and reuse of C&D materials, reuse and recycling of non-inert construction wastes, implementation of a trip-ticket system and appropriate handling, storage and disposal of chemical waste in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Waste.
- 6.3.2 Dredged sediments, if any, will be handled in accordance with the requirements of the ADV-21 Management Framework for Disposal of Dredged/Excavated Sediment.
- 6.3.3 Dewatered sludge from plant operation will be stored, handled and disposed of under strict management and in accordance with requirements of the EPD.
- 6.3.4 The waste generated from the RO cleaning process will be neutralized and blended with the concentrate for discharge.

### **6.4 Water Quality**

- 6.4.1 Non-dredged method will be considered as far as practical for the construction of the proposed intakes and outfall in order to minimize potential water quality impact. Specific mitigation measures, such as the use of silt curtains during marine works, may be adopted if deemed needed to manage potential impacts to within acceptable levels. Effluent discharge from construction activities shall conform to relevant requirements under the WPCO.
- 6.4.2 The location and design of the outfall for discharging RO concentrate will be selected and developed to reduce potential impacts on the identified water quality sensitive receivers. The use of diffusers is the widely-adopted common method of salinity mitigation among the existing desalination plants throughout the world. Diffuser design that minimizes the environmental impacts of RO concentrate discharge can be achieved and has proven reliable performance. Two selected examples are as follows:
- a) Marine monitoring studies undertaken for Adelaide Desalination Plant in Australia have demonstrated minimal impact on surrounding environment with effective diffuser operation.
  - b) The diffuser system of the Victorian Desalination Plant in Australia was designed with high dilution ratio to allow sufficient mixing upon discharge.

### **6.5 Terrestrial Ecology**

- 6.5.1 The Contractor will be required to implement standard site practices (e.g. hoarding of works areas, placement of equipment or stockpile at designated area etc.) so as to minimize potential indirect impacts from nuisance and human activities.

### **6.6 Marine Ecology**

- 6.6.1 Impact on marine ecology can be reduced by minimizing the footprints of submarine facilities and marine works areas. The location for the concentrate discharge outfall will be reviewed to avoid impacts on significant coral assemblages in the surrounding waters, if any.

Mitigation measures designed to control water quality impacts to within acceptable levels are also expected to control and minimize impacts to marine ecological resources.

## **6.7 Fisheries**

6.7.1 Mitigation measures designed to control water quality impacts to within acceptable levels are also expected to control and minimize impacts to fisheries resources. No fisheries-specific mitigation measures would be expected to be required during Project construction and operation.

## **6.8 Landscape and Visual**

6.8.1 Standard site practice and control measures, such as conduct of construction activities in a neat and orderly manner, erection of hoarding at the site boundary, etc., will be implemented to reduce potential landscape and visual impacts. Other provisions, such as external surfaces and roof of the desalination facilities with architectural treatment to blend in well with the surrounding environment, green roof and landscaped/planting areas within the site boundary may be adopted wherever appropriate to enhance the landscape and visual value of the desalination plant during operation phase.

## **6.9 Cultural Heritage**

6.9.1 Since no impact on cultural heritage is anticipated, no environmental protection measure is recommended.

## **6.10 Hazard to Life**

6.10.1 Mitigation measures to reduce risks associated with chlorine storage may include installation of an emergency chlorine containment and absorb system in the chlorine handling and storage area for any chlorine leakage incident, and the provision of safe working procedures and staff training for working inside and around the chlorination house. Further specific mitigation measures will be proposed subject to the findings of the hazard assessment.

6.10.2 The storage area of all designated dangerous goods items will be constructed in accordance with the requirements specified in the Dangerous Goods Regulations. All safety procedures will be implemented to safeguard any potential hazards arise from the use of the dangerous goods on site. Bulk tanks for storage of corrosives and toxics will require to be certified and tested by competent persons. The EIA will identify those potentially hazardous/dangerous goods to be used with their potential risks and recommend appropriate mitigation measures.

6.10.3 Mitigation measures to reduce risks associated with coexistence of the plant with the explosive off-loading barging pier and road transportation of explosives in vicinity of the plant may include the provisions of barriers between the two facilities. Further specific mitigation measures will be proposed subject to the findings of the hazard assessment.

6.10.4 The needs to have mitigation measures to reduce risk associated with landfill gas will be subject to the results of landfill gas hazard assessment. In general, mitigation measures include no smoking policy, control of welding, flame cutting or other hot works and provision of sufficient fire extinguishing equipment.

## 7 Use of Previously Approved EIA Reports

The approved EIA reports of projects that have relevance due to similarity in project nature and location are listed below in Table 7-1 and Table 7-2.

**Table 7-1 Relevant Approved EIA Reports with Similarity in Project Nature**

Register No.	Project Title	Date of Approval	Aspect of relevance
AEIAR-082/2004	Siu Ho Wan Water Treatment Works Extension (WSD)	15 Dec 2004	Water Quality and Hazard to Life assessments
AEIAR-158/2011	Integration of Siu Ho Wan and Silver Mine Bay Water Treatment Works (WSD)	13 Jan 2011	Water Quality and Hazard to Life assessments

**Table 7-2 Relevant Approved EIA Reports with Similarity in Location**

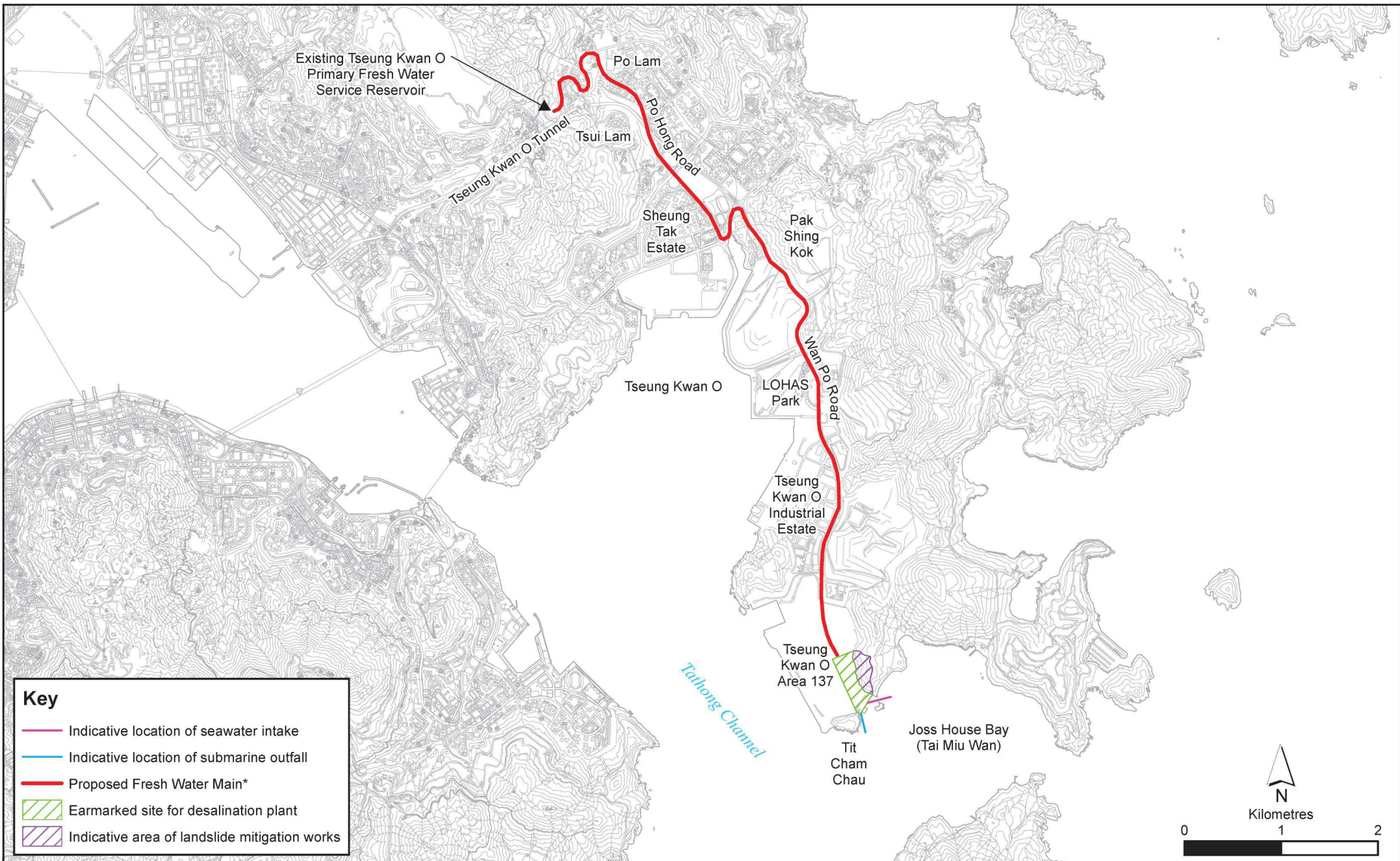
Register No.	Project Title	Date of Approval	Aspect of relevance
AEIAR-131/2009	EIA for Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate	26 Feb 2009	Surrounding environment and sensitive receivers
AEIAR-117/2008	South East New Territories (SENT) Landfill Extension	6 May 2008	Surrounding environment and sensitive receivers
AEIAR-060/2002	EIA for Fill Bank at Tseung Kwan O Area 137	27 Jun 2002	Surrounding environment and sensitive receivers

## 8 Summary

- 8.1.1 This Project Profile has presented information concerning the intention of WSD to construct and operate a desalination plant in TKO Area 137. Implementation of the Project will provide an alternative, reliable source of water supply to meet Hong Kong's water demand.
- 8.1.2 The EIA Study will pay particular attention to impacts to the sensitive receivers identified in this Project Profile. Key concerns are expected to be related to impacts on water quality, marine ecology, fisheries, waste management and hazard to life. Where necessary, mitigation measures will be proposed in accordance with the requirements of the EIAO.

***The English version of this Project Profile shall prevail wherever there is a discrepancy between the English version and the Chinese version***

**Appendix I**  
**Proposed Desalination Plant at Tseung Kwan O**



**Key**

- Indicative location of seawater intake
- Indicative location of submarine outfall
- Proposed Fresh Water Main\*
- Earmarked site for desalination plant
- Indicative area of landslide mitigation works

Appendix I

Location of the Proposed Desalination Plant at Tseung Kwan O

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Date: 28/11/2013

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## **Appendix II**

### **Major Elements of the Surrounding Environment**

