

## **15 SUMMARY OF ENVIRONMENTAL OUTCOMES AND CONCLUSIONS**

### **15.1 Introduction**

This section summarises the key environmental outcomes arising from the assessments completed in this EIA Report for the proposed Project in Tseung Kwan O Area 137. For each of the environmental components assessed, a summary of key environmental sensitive receivers is completed, together with an overview of the key potential environmental impacts and key mitigation measures, highlighting their benefits where necessary.

### **15.2 Considerations of Alternatives**

This EIA Study has examined a series of Alternatives as follows:

- Consideration of Alternative Sites (Section 2.2);
- Consideration of Alternative Development Options (Section 2.3);
- Consideration of Alternative Construction Methods (Section 2.4); and,
- Consideration of Alternative Works Sequences (Section 2.5).

Based on the review and consideration of project alternatives presented in the preceding sections, the preferred alternative to be taken forward to this EIA study is the provision of submarine pipelines for intake and outfall, desalination plant by Reverse Osmosis, slope mitigation of 0.49 ha of the country park area by soil nailing, flexible barriers and rock stabilization, and construction of a 9 km rising mains along Wan Po Road. Both open-cut excavation method and trenchless construction method will be used for the construction of desalination plant and the truck feed system. The proposed submarine intake and outfall will be constructed by trenchless method with minor seabed dredging for the installation of the diffusers. Within the proposed Desalination Plant, bored piling and *in situ* concreting will be used for foundation and superstructure construction, respectively.

The selection of the preferred scenario and construction method has brought about a series of environmental benefits to the Project, including:

- The provision of alternative potable water source and alleviate the shortage of freshwater resources due to climate change and subsequent adverse weather;
- The trunk feed system are proposed to be constructed underneath Wan Po Road to minimize disturbance to sensitive receivers and natural habitats;
- The mixed-use of localized soil nailing, localized flexible barrier and localized rock slope stabilization for slope mitigation has minimized the disturbance to the natural habitats at the Clear Water Bay Country Park;
- The alignment and length of submarine utilities are at sufficient distances from sensitive receivers to reduce potential impacts on water quality, marine ecology

and fisheries;

- The use of micro-tunnel boring machine for construction of the proposed submarine utilities reduces the extent of seabed dredging and dredging volume, thereby reducing the marine footprint of this project and the potential impacts on water quality, marine ecology and fisheries; and,
- The recommended land-based construction methods are expected to avoid prolonged construction duration and hence reduce potential disturbance to the environment and the local public.

This summary of environmental outcomes is completed upon completion of EIA Study. The summary of each of the components is structured as follows:

- List of sensitive receivers;
- Protection of Environmentally Sensitive Areas;
- Key Environmental Problems Avoided / Environmental Outcomes;
- Assessment Methodology and Criteria;
- Key Construction Impacts;
- Key Operation Impacts;
- Key Mitigation Measures;
- Residual Impacts; and
- Compliance with the guidelines and criteria of the *Environmental Impact Assessment Ordinance - Technical Memorandum (EIAO-TM)*.

### **15.3 Air Quality Impact**

**Table 15.1** presents a summary of findings of the assessment of impacts to air quality as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 4* of the *EIA Report*.

**Table 15.1 Summary of Environmental Assessment & Outcomes - Air Quality**

<b>Items</b>	<b>Description</b>
Air Sensitive Receivers (ASRs)	In accordance with the <i>EIA Study Brief Section 3.4.2.2</i> of the Project, the Study Area for the air quality impact assessment is generally defined by a distance of 500m from the boundary of the Project Site. A total of 20 ASRs were identified and illustrated in Figure 4.1 of the <i>EIA Report</i> .

Items	Description
Protection of Environmentally Sensitive Areas	With the implementation of the recommended dust control measures and adoption of good construction site practices, no adverse fugitive dust impact is anticipated within the assessment areas and associated ASRs.
Key Environmental Issues Avoided/ Environmental Outcomes	Potential impacts to the identified ASRs are not anticipated by strictly following the dust control measures stipulated in the <i>Air Pollution Control (Construction Dust) Regulations</i> and good site practices.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> <li>• The principal legislation for the management of air quality in Hong Kong is the <i>Air Pollution Control Ordinance (APCO)</i> (Cap 311). The APCO Amendment was passed in July 2013 and a set of new Air Quality Objectives (AQOs) has been effective from 1 January 2014. The new AQOs were used as the evaluation criteria for this assessment.</li> <li>• A maximum hourly TSP level of 500 µg m<sup>-3</sup> at ASRs is also stipulated in <i>Annex 4</i> of the <i>EIAO-TM</i> to assess potential construction dust impacts. The measures stipulated in the <i>Air Pollution Control (Construction Dust) Regulation</i> should also be followed to ensure that any dust impacts are minimised.</li> <li>• <i>Annex 4</i> of the <i>EIAO-TM</i> also stipulates that any predictive assessment of the odour impact should meet 5 odour units based on an averaging time of 5 seconds.</li> </ul>
Key Construction Impacts	Soil excavation, materials handling, truck movements on unpaved roads and wind erosion from open stockpiling of dusty materials within the Project Site are identified to be the potential dust generating activities.
Key Operation Impacts	Potential gaseous emission from the standby generator and potential odour nuisance may be resulted from the transportation, storage and handling of sludge produced during the desalination process.
Key Mitigation Measures	<p>Construction Phase:  Dust control measures stipulated in the <i>Air Pollution Control (Construction Dust) Regulation</i> will be implemented during the construction of the desalination plant and freshwater rising main to reduce the potential fugitive dust emissions and also gaseous emission from construction plant.</p> <p>Operational Phase:  No exceedance of the AQO criteria is anticipated at the ASRs and therefore no mitigation measures are required.</p>
Residual Impacts	<p>Construction Phase:  With the implementation of the recommended dust control measures, no residual impacts are anticipated.</p> <p>Operational Phase:  No adverse residual operational air quality impact is anticipated.</p>

Items	Description
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 4 & 12 and applicable assessment standards/ criteria.

#### 15.4 Noise Impact

**Table 15.2** presents a finding summary of the impact assessment to noise as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 5* of the *EIA Report*.

**Table 15.2 Summary of Environmental Assessment & Outcomes - Noise**

Items	Description
Noise Sensitive Receivers (NSRs)	In accordance with the <i>EIA Study Brief Section 3.4.3.2</i> of the Project, the Study Area for the noise assessment includes all areas within 300 m from the Project Boundary. A total of 36 NSRs were identified and illustrated in Figure 5.3 of the <i>EIA Report</i> .
Protection of Environmentally Sensitive Areas	The environmentally sensitive areas where the identified NSRs along Wan Po Road, Po Hong Road and Tsui Lam Road are protected as a result of adoption of the environmentally friendly options and designs. Adverse noise impacts on noise sensitive receivers within the assessment areas have been minimized with the practicable mitigation measures implemented.
Key Environmental Issues Avoided/ Environmental Outcomes	The maximum number of workfronts and working duration has been optimized to minimize the exceedances of daytime construction noise criteria.
Assessment Methodology and Criteria	<ul style="list-style-type: none"> <li>The methodology for the noise impact assessment is in accordance with the procedures outlined in the <i>GW-TM</i>, which is issued under the <i>NCO</i> and the <i>EIAO-TM</i>.</li> <li>Using a conservative approach, each work activity has been assumed to operate simultaneously. Based on the construction programme, cumulative noise impact throughout the construction phase has been assessed.</li> </ul>
Key Construction Impacts	Potential sources of noise impacts during the construction phase of the Project will mainly arise from powered mechanical equipment (PME) operating at the land-based construction work sites. No NSR was identified within 300 m from the marine-based works area, hence the potential construction noise impacts are expected to be minimal.
Key Operation Impacts	No noise sensitive receivers were identified within 300m of the operational site area of the proposed desalination plant at Tseung Kwan O, thus no noise impact is anticipated in operation phase.

Items	Description
Key Mitigation Measures	<p>In view of the predicted noise exceedances at some of the NSRs along Wan Po Road during the construction of the Project, the following mitigation measures have been considered:</p> <ul style="list-style-type: none"> <li>• Good construction site practice;</li> <li>• Use of quite PME;</li> <li>• Adoption of movable noise barriers and noise enclosures;</li> <li>• Use of noise insulation sheet; and</li> <li>• Scheduling of PME / construction activities.</li> <li>• The construction work in the influence areas near educational institutions shall be scheduled during long school holidays (eg summer holiday, Easter holiday or Christmas holiday, etc) as far as practicable.</li> </ul>
Residual Impacts	<p>Construction Phase:</p> <ul style="list-style-type: none"> <li>• With the implementation of all practical mitigation measures and works scheduling , no residual impacts are anticipated and predicted noise levels at all NSRs are predicted to comply with the EIAO requirement.</li> </ul> <p>Operational Phase:</p> <ul style="list-style-type: none"> <li>• No adverse residual operational noise impact is anticipated.</li> </ul>
Compliance with EIAO-TM	<p>The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 5 &amp; 13 and applicable assessment standards/ criteria.</p>

## 15.5 Water Quality Impact

**Table 15.3** presents the summary findings of the impact assessment on water quality as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 6* of the *EIA Report*.

**Table 15.3 Summary of Environmental Assessment & Outcomes – Water Quality**

<b>Items</b>	<b>Description</b>
Sensitive Receivers (SRs)	<p>The following SRs have been identified:</p> <ul style="list-style-type: none"> <li>• Fisheries Sensitive Receivers Fish Culture Zones at Tung Lung Chau and Po Toi O</li> <li>• Ecological Sensitive Receivers Coral Communities: Junk Bay, Fat Tong Chau, Tai Miu Wan, Cape Collinson, Tung Lung Chau, Tai Long Pai, Kwun Tsai, Tit Cham Chau, Joss House Bay</li> <li>• Water Quality Sensitive Receivers Gazetted Bathing Beaches: Big Wave Bay, Clear Water Bay, Shek O, Rocky Bay Coastal Protection Areas: Clear Water Bay Po Toi O Tai Miu Wan Cape Collinson Big Wave Bay Tai Tam</li> <li>• Seawater Intakes: Tseung Kwan O New Town, Siu Sai Wan, Heng Fa Chuen</li> </ul>
Protection of Environmentally Sensitive Areas	<p>With the implementation of the suggested mitigation measures, full WQO compliance is predicted at identified WSRs that does not show exceedance in WQO criteria within the environmentally sensitive areas for all parameters in both dry and wet seasons. For Tung Lung Chau Fish Culture Zone, exceedance in WQO DO criteria is observed in baseline condition. The predicted level of DO depletion brought by the Project would be very minimal and would not result in unacceptable adverse impact to the receiver.</p>
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> <li>• Disturbance to sensitive receivers has been avoided as a result of the site/ route selection process of the pipelines.</li> <li>• Impacts to water quality have been reduced by the adoption of trenchless techniques for most sections of the pipelines.</li> <li>• The amount of material to be dredged and hence disposed of has been reduced by optimising project design and phasing, thereby reducing impacts to water quality during dredging and disposal operations.</li> </ul>

Items	Description
Assessment Methodology and Criteria	<ul style="list-style-type: none"> <li>• The potential impacts due to the construction and operation of the Project and associated developments were assessed following the <i>EIAO-TM Annex 6</i> guidelines and the impacts evaluated based on the criteria in <i>EIAO-TM Annex 14</i>.</li> <li>• Impacts due to the dispersion of fine sediment in suspension during the construction of the submarine pipelines have been assessed using computational modelling (Delft3D and CORMIX models).</li> <li>• The simulation of operation impacts on water quality has also been studied by means of computational modelling. The models have been used to simulate the effects of the physical presence of hydrodynamic regime, flushing and sedimentation patterns, and water quality changes.</li> </ul>
Key Construction Impacts	<p>The water quality modelling works have indicated that the construction works (i.e. dredging and backfilling) can proceed at the recommended working rates without causing unacceptable impacts to water quality sensitive receivers.</p> <ul style="list-style-type: none"> <li>• <i>Suspended Solids (SS)</i>: The majority of SS elevations in water have been predicted to remain within relatively close proximity to the dredging works and, as such, the majority of sediment has been predicted to settle within relatively close proximity to the works areas. Thus, no unacceptable impacts are expected to be posed by the works.</li> <li>• <i>Water Quality (Dissolved Oxygen, Nutrients, and Heavy Metals)</i>: The dispersion of sediment due to dredging is not expected to impact the general water quality of the receiving waters. Effects will be transient, localised in extent, of small magnitude and compliant with applicable standards. Thus, no unacceptable impacts are expected to be posed by the works.</li> <li>• <i>Other Discharges</i>: Land based construction activities, vessel discharges and contaminants are not predicted to cause unacceptable impacts to the water quality sensitive receivers.</li> </ul>
Key Operation Impacts	<p>The discharge of RO concentrate from the desalination process is the main environmental concern for the Project operation. Results of the modelling works indicate that no observable mixing zone is predicted for most discharge scenarios for most chemical constituents and thus potential impacts on water quality and hydrodynamics are predicted to be within acceptable levels.</p>
Key Mitigation Measures	<p>Appropriate preventive and mitigation measures are recommended, for example deployment of silt curtain around grab dredger, reduce the dredging rate at intake, to minimize the potential water quality impact from these works. Environmental monitoring and audit is recommended to ensure the proper implementation of these measures.</p>

Items	Description
Residual Impacts	<p>Construction Phase:</p> <ul style="list-style-type: none"> <li>No adverse residual construction impact on water quality is anticipated.</li> </ul> <p>Operational Phase:</p> <ul style="list-style-type: none"> <li>Modelling assessment for operation phase effluent discharge indicated that no unacceptable adverse water quality impact from the RO concentrate discharge and other relevant discharge.</li> </ul>
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 6 & 14 and applicable assessment standards/ criteria.

## 15.6 Sewerage and Sewage Treatment Implication

**Table 15.4** presents a summary of findings of the assessment of impacts to sewage treatment as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 7* of the *EIA Report*.

**Table 15.4 Summary of Environmental Assessment & Outcomes – Sewerage**

Items	Description
Key Environmental Issues Avoided/ Environmental Outcomes	The proposed strategy is considered feasible in terms of regional sewerage strategy, land, environmental impact and construction considerations. The proposed plant is considered sustainable in terms of sewerage.
Assessment Methodology and Criteria	<p>The sewage flow discharge from the proposed Desalination Plant is based on the following standards, guidelines and reference for the sewerage and sewage treatment design:</p> <ul style="list-style-type: none"> <li><i>Technical Memorandum on Effluent Standards (Water Pollution Control Ordinance, Cap. 358 section 21)</i>;</li> <li><i>Sewerage Manual</i> published by Drainage Services Department (DSD);</li> <li><i>EPD Report No. EPD/TP 1/05 Guidelines for Estimating Sewage Flows for Sewerage Infrastructure Planning Version 1.0</i></li> </ul>
Key Construction Impacts	Construction of the section of gravity sewer from the plant to connect with the existing public sewer would mainly involve conventional technology such as cut-and-cover excavation techniques. There is no significant constraint in terms of complexity by general civil contractors.

Items	Description
Key Operation Impacts	The sewerage facilities provided as part of the proposed plant will be maintained by the government after completion. No specific maintenance operations are envisaged but it is considered desirable that the facilities will be inspected regularly to ensure that these sewers can function properly. The maintenance responsibility of those proposed sewerage facilities will be confirmed with relevant authorities in the detailed design stage of this project.
Key Mitigation Measures	The detailed design of the proposed sewerage system should be circulated to DSD, EPD and other relevant parties for comment during planning and detailed design stage to ensure acceptance by relevant parties. Access for sewers, equipment and personnel for maintenance of the works should be adequately provided. The maintenance responsibility of those proposed sewerage facilities will be confirmed with relevant authorities in the detailed design stage of this project.
Residual Impacts	Construction Phase: <ul style="list-style-type: none"> <li>No adverse residual construction impact on sewage treatment is anticipated.</li> </ul> Operational Phase: <ul style="list-style-type: none"> <li>No adverse residual construction impact on sewage treatment is anticipated.</li> </ul>
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annex 14 and applicable assessment standards/ criteria.

## 15.7 Waste Management Implication

**Table 15.5** presents a summary of findings of the assessment of impacts to waste management as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 8* of the *EIA Report*.

**Table 15.5 Summary of Environmental Assessment & Outcomes – Waste Management**

Items	Description
Key Environmental Issues Avoided/ Environmental Outcomes	Potential project layouts, construction design and methods, use of trenchless method and phasing of dredging and reuse of excavated materials, were examined on the basis of their potential environmental impacts. The preferred alternatives have led to the reduction in the amount of dredged material expected to be produced and, therefore, have brought about an overall reduction in waste management impacts.

<b>Items</b>	<b>Description</b>
Assessment Methodology and Criteria	<p>The potential environmental impacts associated with the handling and disposal of waste arising from the construction and operation of this Project are assessed in accordance with the criteria presented in <i>Annexes 7 and 15</i> of the <i>EIAO-TM</i>:</p> <ul style="list-style-type: none"> <li>• Estimation of the types and quantities of the wastes to be generated;</li> <li>• Assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and traffic; and,</li> <li>• Assessment of the potential impacts on the capacity of waste collection, transfer and disposal facilities.</li> </ul>
Key Construction Impacts	<p>The key potential impacts during the construction phase are related to wastes generated from dredging, and land-based construction works. All the wastes produced during the construction phase are of small to moderate quantity and will be disposed of accordingly to their nature and relevant regulations, avoiding any potential adverse impact.</p>
Key Operation Impacts	<p>General refuse, dewatered sludge and chemical waste will be produced during the operation phase. The potential environmental impacts associated with waste storage, handling, collection, transport and disposal will meet the criteria specified in the <i>EIAO-TM</i>, thus no unacceptable operational waste management impact is anticipated.</p>
Key Mitigation Measures	<p>A Waste Management Plan, which will form as part of the Environmental Management Plan, will be devised which incorporates mitigation measures that have been proposed to avoid or reduce potential adverse environmental impacts associated with handling, collection and disposal of waste arising from the construction and operation of this Project.</p>
Residual Impacts	<p>With the implementation of the recommended mitigation measures, in particular the establishment and implementation of the Waste Management Plan, no adverse residual impacts are anticipated from the construction and operation of this Project.</p>
Compliance with EIAO-TM	<p>The assessment and the impacts are acceptable and in compliance with the <i>EIAO-TM Annexes 7 &amp; 15</i> and applicable assessment standards/ criteria.</p>

## **15.8 Land Contamination Assessment**

**Table 15.6** presents a summary of findings of the assessment of impacts to land contamination as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 8A* of the *EIA Report*.

**Table 15.6 Summary of Environmental Assessment & Outcomes – Land Contamination**

<b>Items</b>	<b>Description</b>
Key Environmental Issues Avoided/ Environmental Outcomes	Potential project layouts, construction design and methods, use of trenchless method and phasing of excavation, were examined on the basis of their potential environmental impacts. The preferred alternatives have led to the avoidance of contaminated land and, therefore, have brought about an overall reduction in land contamination risk.
Assessment Methodology and Criteria	<p>The following legislation covers the handling, treatment and disposal of wastes in Hong Kong, and has been considered in the assessment.</p> <ul style="list-style-type: none"> <li>• Annex 19 of the Technical Memorandum on Environmental Impact Assessment (Annex 19 of EIAO-TM);</li> <li>• Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management (The RBRGs Guidance Manual);</li> <li>• Guidance Note for Contaminated Land Assessment and Remediation (The Guidance Note); and</li> <li>• The Practice Guide for Investigation and Remediation of Contaminated Land (The Practice Guide).</li> </ul> <p>Apart from the abovementioned, the following legislation, documents and guidelines may cover or have some bearing upon the assessment of contamination and the handling, treatment and disposal of contaminated materials for the Project:</p> <ul style="list-style-type: none"> <li>• Water Pollution Control Ordinance (WPCO) (Cap 358);</li> <li>• Waste Disposal Ordinance (WDO) (Cap 354);</li> <li>• Waste Disposal (Chemical Waste) (General) Regulation (Cap 354C); and</li> <li>• Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.</li> </ul>
Key Construction Impacts	<p>Based on the review of historical aerial photographs, the TMS Site was once part of the sea prior to reclamation finished in 2000. After the completion of the reclamation work, the TMS Site was left vacant until the magazine storages and other associated facilities were constructed in 2012. Therefore the risk of potential land contamination due to land use prior to the 2012 is anticipated to be low.</p>
Key Operation Impacts	Same as above.

Items	Description
Key Mitigation Measures	In order to minimize the potential adverse impact to the environment due to the handling of contaminated materials, the following environmental mitigation measures are proposed during the course of site remediation. <ul style="list-style-type: none"> <li>Excavation profiles shall be properly designed and executed;</li> <li>An impermeable surfacing shall be placed under the stockpile and a cover should be employed to prevent dust emission and possible cross contamination. If not applicable, regular watering shall be applied; and</li> <li>Trucks carrying contaminated materials shall be enforced with speed control.</li> </ul>
Residual Impacts	With the implementation of the recommended mitigation measures, in particular the establishment and implementation of the Contamination Assessment Plan (CAP), no adverse residual impacts are anticipated from the construction and operation of this Project.
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annex 19 and applicable assessment standards/ criteria.

## 15.9 Ecological Impact (Terrestrial and Aquatic)

**Table 15.7** presents a summary of findings of the assessment of impacts to ecological resources as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 9* of the *EIA Report*.

**Table 15.7 Summary of Environmental Assessment & Outcomes – Ecological Impact**

Items	Description
Sensitive Receivers (SRs)	In accordance with the <i>EIA Study Brief Section 3.4.7</i> of the Project, the ecological sensitive receivers were identified and detailed in Section 9.
Protection of Environmentally Sensitive Areas	The Clear Water Bay Country Park is the recognized ecologically important /sensitive sites located within the Study Area. Only one flora species of conservation interest <i>Marsdenia lachnostoma</i> was recorded along the alignment for flexible barriers of slope mitigation works. The other flora species of conservation interest were recorded outside of the works areas for natural slope mitigation works, hence the impacts on these species are avoided.

Items	Description
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> <li>• Disturbance to the Country Park Area has been minimized as a result of the selection of slope mitigation method.</li> <li>• Potential project layouts, construction design and methods were examined on the basis of their potential environmental impacts. The adopted layout has reduced the works extent to natural habitats in the Clear Water Bay Country Park.</li> <li>• Impacts to marine ecology have been reduced through the adoption of trenchless installation technique for the pipelines. This results in less adverse effect on water quality of surrounding areas and thus to the marine ecosystems.</li> </ul>
Assessment Methodology and Criteria	<ul style="list-style-type: none"> <li>• A literature review was supplemented by a programme of field surveys that covered terrestrial and aquatic assemblages and habitats.</li> <li>• The potential impacts due to the construction and operation of the proposed Project were assessed following the <i>EIAO-TM Annex 16</i> guidelines and the impacts evaluated based on criteria in <i>EIAO-TM Annex 8</i> and <i>Guidance Notes</i>.</li> </ul>
Key Construction Impacts	<ul style="list-style-type: none"> <li>• Potential construction phase impacts to ecological resources, as well as impacts to flora and fauna, may arise from the permanent loss of habitats for desalination plant development and permanent loss of naturalness of habitat (0.49 ha) due to slope mitigation works and disturbances to benthic habitats within the dredging footprint.</li> <li>• Water quality impacts arising from the proposed dredging works will be compliant with assessment criteria, transient and confined to the works areas and, therefore will not give rise to adverse impacts to marine ecological resources.</li> </ul>
Key Operation Impacts	<p>Unacceptable operation phase impacts to ecological resources are not expected to arise from the change in hydrodynamic regime, RO concentrate discharge, and water quality changes.</p>

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<b>Items</b>	<b>Description</b>
Key Mitigation Measures	<ul style="list-style-type: none"><li>• Avoid direct and reduce indirect Impacts to ecologically sensitive habitats.</li><li>• For slope mitigation works within the Clear Water Bay Country Park, no trees will be felled and vegetation clearance to enable the slope works will be kept to a minimum.</li><li>• The alignment for flexible barriers of slope mitigation works would be at a sufficient distance from the recorded flora species of conservation interest <i>Marsdenia lachnostoma</i>.</li><li>• The alignment chosen for the submarine facilities is away from key ecological sensitive habitats</li><li>• The use of trenchless techniques during the installation of the submarine facilities will reduce the severity of perturbations to water quality and hence allow compliance with the impact assessment criteria at sensitive receivers.</li><li>• The modelling work has demonstrated that the selected working rates for dredging works will not cause unacceptable impacts to the receiving water quality. The mitigation measures designed to mitigate impacts to water quality to acceptable levels (compliance with assessment criteria) are also expected to mitigate impacts to marine ecological resources.</li></ul>
Residual Impacts	No adverse residual construction and operational ecological impact is anticipated.
Compensation Areas Included	Since habitat loss/ disturbance due to other land-based construction and marine dredging works for laying the submarine intake and outfall of the Project only occurs on the habitats of low or low to moderate ecological value where species of conservation interest will be avoided, ecological compensation is not required.
Compliance with EIAO-TM	The assessment and the residual impacts are acceptable and in compliance with the EIAO-TM Annexes 8 and 16 and applicable assessment standards/criteria.

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## 15.10 Fisheries Impact

**Table 15.8** presents a summary of findings of the assessment of impacts to fisheries resources as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 10* of the *EIA Report*.

**Table 15.8 Summary of Environmental Assessment & Outcomes – Fisheries Impact**

Items	Description
Sensitive Receivers (SRs)	The identified fisheries sensitive receivers are: <ul style="list-style-type: none"> <li>Recognized spawning and nursery ground of commercial fisheries resources at Port Shelter (located at least 2 km east from the proposed Project);</li> <li>Artificial reefs at Outer Port Shelter area (located at least 5 km east from the proposed Project); and,</li> <li>Fish Culture Zone at Tung Lung Chau (south to the proposed Project at a distance of about 1 km).</li> </ul>
Protection of Environmentally Sensitive Areas	Environmentally sensitive areas including spawning and nursery ground of commercial fisheries resources at Port Shelter, artificial reefs at Outer Port Shelter area and Fish Culture Zone at Tung Lung Chau have been identified; however, the assessment of water quality impacts demonstrated that these areas will not be affected.
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> <li>Potential project layouts, construction and operation design and methods were examined on the basis of their potential environmental impacts.</li> </ul>
Assessment Methodology and Criteria	<ul style="list-style-type: none"> <li>A literature review was conducted to establish the fisheries importance of the area surrounding the proposed Project.</li> <li>The potential impacts due to the construction and operation of the Project and associated developments were assessed following the <i>EIAO-TM Annex 17</i> guidelines and the impacts evaluated based on the criteria in <i>EIAO-TM Annex 9</i>.</li> </ul>
Key Construction Impacts	<ul style="list-style-type: none"> <li>Direct disturbances of fisheries habitat and fishing ground; and,</li> <li>Perturbations to key water quality parameters.</li> </ul>
Key Operation Impacts	<ul style="list-style-type: none"> <li>Loss of seabed habitat within the small footprint of the submarine facilities;</li> <li>Impingement and entrainment of fisheries resources</li> <li>Change in water quality</li> </ul>

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<b>Items</b>	<b>Description</b>
Key Mitigation Measures	<ul style="list-style-type: none"><li>• The mitigation measures designed to mitigate impacts to water quality to acceptable levels (compliance with assessment criteria) are expected to mitigate impacts to fisheries resources.</li><li>• Construction impacts to fisheries resources and fishing operations have largely been avoided through the planning and design of the marine works; in particular those associated with the dredging. No fisheries-specific mitigation measures are required during construction.</li><li>• Unacceptable operation phase impacts are not expected and so no additional fisheries-specific mitigation measures are required during operation.</li></ul>
Residual Impacts	Impacts to fisheries resources, habitats and fishing operations during construction and operation phase are considered to be within acceptable level. The permanent loss of 0.11 ha of seabed fisheries habitat for the installation of submarine utilities is considered to be of negligible significance and within acceptable level.
Compensation Areas Included	No additional fisheries-specific compensation are required during operation.
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 9 & 17 and applicable assessment standards/ criteria.

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## 15.11 Landscape & Visual Impacts

**Table 15.9** presents a summary of findings of the assessment of impacts to landscape and visual as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 11* of the *EIA Report*.

**Table 15.9 Summary of Environmental Assessment & Outcomes – Landscape & Visual**

Items	Description
Visually Sensitive Receivers (VSRs), Landscape Resources (LRs) and Landscape Character Areas (LCAs)	A total of 31 VSRs, 11 LRs and 4 LCAs were identified.
Key Environmental Issues Avoided/ Environmental Outcomes	<ul style="list-style-type: none"> <li>• Sensitive VSRs have been avoided by choosing an appropriate plant layout.</li> <li>• Slope mitigation works have been carefully considered to ensure there is minimal disturbance to the landscape.</li> <li>• No tree fell as a result of the slope mitigation works.</li> </ul>
Protection of Environmentally Sensitive Areas	<p>The landscape impact assessment confirms that the majority of project site is currently with landscape of low quality with little valuable vegetation or amenity value and thus in general the Project at construction and operation is considered to have little landscape impact.</p> <p>For visual impact, the Project includes buildings up to a maximum of 20 m height and is situated in an area that is naturally shielded by topography to the north east and separated by at least 2 km from viewers across the Tathong Channel on Hong Kong Island to the south east, and thus the represents a low number of viewers.</p>
Assessment Methodology and Criteria	<ul style="list-style-type: none"> <li>• The methodology of the LVIA was based on <i>Annexes 10</i> and <i>18</i> in the <i>EIAO-TM</i> under the <i>EIA Ordinance</i> and associated <i>Guidance Notes</i>.</li> <li>• The landscape assessment considered the impact of the proposed development on the existing landscape and particularly on the landscape character units within 500 m of the development site.</li> <li>• The visual assessment examined the impact of the proposed development on the existing views and the visual amenity, particularly from the VSRs within the viewshed.</li> <li>• In order to illustrate the visual impacts of the proposed desalination plant, photomontages prepared from selected viewpoints compare the existing conditions with the view after construction. The residual impacts are evaluated qualitatively, in accordance with the requirements of <i>Annex 10</i> of the <i>EIAO-TM</i>.</li> </ul>

Items	Description
Key Construction Impacts	<p>During the construction phase of the Project, potential impacts could result from the following:</p> <ul style="list-style-type: none"> <li>• Site clearance for the civil works, including removal of vegetation and tree felling where necessary (e.g. of weedy species);</li> <li>• Open-cut excavation and re-provision of surfaces within the reclamation area;</li> <li>• Clearance for temporary access to construction site;</li> <li>• Landscaping works;</li> <li>• Presence and operation of construction vehicles and machinery;</li> <li>• Temporary works area;</li> <li>• Stockpiling areas;</li> <li>• Construction of the new facilities;</li> <li>• Trenchless technologies for construction of the proposed submarine outfall; and</li> <li>• Seabed dredging for the installation of the intake structures and outfall diffuser.</li> </ul> <p>In addition, there is the potential for slope mitigation works, including:</p> <ul style="list-style-type: none"> <li>• Passive/ flexible debris barriers typically 4-5 m high, some soil nailing at the lower section of the natural slope and stabilization of boulders and rocks using local concrete infills dowelling.</li> </ul>
Key Operation Impacts	<p>During the operation phase of the Project, potential impacts could result from the following:</p> <ul style="list-style-type: none"> <li>• Operation of new buildings, machinery and plant and new access road; and</li> <li>• Landscaping works.</li> </ul>
Key Mitigation Measures	<p>Mitigation measures are proposed to be considered during planning, detailed design, construction and operation and often one measure can be relevant to both construction and operation phases of the proposed development. For example detailed design measures will be implemented during construction but will aim to reduce both construction and operation impacts. Equally soft landscape mitigation measures such as compensatory planting may be implemented during construction, but their full effect will often not be appreciated for up to 10 years. Tree felling and preservation will be undertaken in accordance with DEVB TCW No. 10/2013, in which on-site compensatory area has been provided. All measures should be implemented at the earliest stage possible i.e. at or before construction, particularly for soft landscaping.</p>
Residual Impacts	<p>No significant adverse residual impacts have been identified. The Landscape and Visual Mitigation Measures proposed will help to mitigate the impacts on the LCAs, LRs and VSRs. Overall the residual impacts are assessed as slight to insignificant.</p>

Items	Description
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 10 & 18 and applicable assessment standards/ criteria.

## 15.12 Landfill Gas Hazard

**Table 15.10** presents a summary of findings of the assessment of impacts to land contamination as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 12* of the *EIA Report*.

**Table 15.10 Summary of Environmental Assessment & Outcomes – Landfill Gas Hazard**

Items	Description
Key Environmental Issues Avoided/ Environmental Outcomes	A qualitative assessment of the hazard associated with the construction and operation of desalination plant, and construction of freshwater mains (i.e. the targets) was conducted based on the categorisation of the Source, Pathway and Target terms and the EPD assessment framework. The qualitative hazard to the proposed desalination plant and fresh water mains from landfill gas has assessed as being from low to medium for various targets.
Assessment Methodology and Criteria	In accordance with the Guidance Note, the risk due to landfill gas may be evaluated based upon the following three criteria: <ul style="list-style-type: none"> <li>• Source – the rate and concentration of gas generation by the landfill;</li> <li>• Pathway – the nature of and length of potential pathways through which landfill gas can migrate and leachate flow, such as geological strata, utility services; and</li> <li>• Target – the level of vulnerability of various elements of the development to landfill gas.</li> </ul> Following the determination of the categories of source, pathway and target, a qualitative assessment of the overall risk was made by reference to the <i>Guidance Note EPD/TR8/97</i> .
Key Construction Impacts	The qualitative hazard to the proposed desalination plant and fresh water mains from landfill gas has assessed as being from low to medium for various targets.
Key Operation Impacts	Same as above.

Items	Description
Key Mitigation Measures	In general, the restoration and aftercare of the TKO Stage II/III Restored Landfill and TKO Stage I Restored Landfill, and the control of landfill gas and leachate of the SENT Landfill and SENT Landfill Extension should not be relied upon to ensure the safety of adjoining developments; however, it must also be acknowledged that the restoration works and landfill gas control measures undertaken will have the effect of lowering the potential for an incident to occur off-site. Allowance for this has been made in the qualitative assessment undertaken. All recommended mitigation measures were detailed in <i>Section 12.7</i> .
Residual Impacts	With the implementation of the recommended mitigation/precautionary measures, no adverse residual impacts are anticipated from the construction and operation of this Project.
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 7 & 19 and applicable assessment standards/ criteria.

### 15.13 Hazard to Life

**Table 15.11** presents a summary of findings of the assessment of hazard to life as a result of the construction and operation of this Project. Full details of the assessment and mitigation measures are presented in *Section 13* of the *EIA Report*.

**Table 15.11 Summary of Environmental Assessment & Outcomes – Hazard to Life**

Items	Description
Key Environmental Issues Avoided/ Environmental Outcomes	The location of chlorine storage has been considered to stay away from the surrounding populated areas.
Assessment Methodology and Criteria	The hazard assessment has been conducted with reference to the EIAO-TM Criteria with particular focus of the followings: <ul style="list-style-type: none"> <li>• Potentially Hazardous Installations (PHI) QRA: Storage, Use and On-site Road Transport of Chlorine (from TKO Area 137 Pier to Chlorination Store of the Desalination Plant)<sup>1</sup>;</li> <li>• Off-site Marine Transport of Chlorine (from Sham Shui Kok Dock to TKO Area 137 Pier);</li> <li>• Storage, Use and Transport of Sodium Hypochlorite associated with the Desalination Plant Operation;</li> <li>• Transport (On-site and off-site), Storage, Handling of Cryogenic and Pressurised Liquid Carbon Dioxide; and</li> <li>• Other Risk Associated Issues, including:</li> <li>• Storage, Use and Transport of other DGs associated with the Desalination Plant Operation;</li> <li>• Explosive Transport in TKO Area 137 (Existing, Committed and Planned Projects Requiring Explosive Transport from TKO 137 Pier); and</li> <li>• Explosive Offloading Operation at TKO Area 137 Pier.</li> </ul>

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<b>Items</b>	<b>Description</b>
Key Construction Impacts	Not anticipated.
Key Operation Impacts	In all cases, the Individual Risk complies with the Hong Kong Risk Guidelines and the Societal Risk lies in the acceptable region. The societal risk expressed in the form of FN curves, lies in the acceptable region of the HKRG for the use, transport and storage of chlorine at the Desalination Plant.
Key Mitigation Measures	With the implementation of safeguard measures as described in the assessment, no unacceptable risks are foreseen as a result of the operation of the Project. No mitigation measures are thus deemed necessary.
Residual Impacts	No residual impact is expected.
Compliance with EIAO-TM	The assessment and the impacts are acceptable and in compliance with the EIAO-TM Annexes 4 and applicable assessment standards/ criteria.

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#### **15.14 Environmental Outcomes and Environmental Benefits of the Project**

The environmental impact assessment (covering air quality, noise, water quality, sewage treatment, waste management, land contamination, ecology, fisheries, landscape and visual, landfill gas hazard and hazard to life) has concluded that no unacceptable environmental impacts are envisaged due to the construction and operation of the Project. No long-term unacceptable impact on the environment is anticipated.

##### **15.14.1 Major Environmental Benefits and Key Environmental Problems Avoid**

Hong Kong has uniquely relied mainly on importation of raw water from Guangdong Province. Whilst the quantity of water that is available will depend very much on rainfall in the region. The remote but possible event that there is a prolonged drought in Southeast China cannot be precluded and this could influence the raw water supply to Hong Kong. If an alternative potable water resource is not sought, the water supply in Hong Kong would face various challenges, including increasing local water demand rising from population and economic growth, occurrence of extreme weather and severe drought as a result of climate change, as well as competition for water resource due to rapid economic development in the Pearl Delta Area.

Over the past years, the cost of producing freshwater using desalination technologies has been decreasing. Further improvements to desalination technologies are being made worldwide, and desalination costs are expected to further decrease in future. As seawater availability is not dependent on rainfall and cost of desalination technologies is becoming increasingly competitive, the proposed desalination plant development would be a viable option to secure the freshwater resource for Hong Kong.

With the proposed desalination plant, an ultimate of 270 Mld would be produced to supply the water demand in Tseung Kwan O Area. This can provide a secure and alternative potable water resource in Hong Kong. Besides, the production of greenhouse gases due to landfilling of MSW will be reduced.

#### 15.14.2 Environmentally Friendly Design Recommended

A review of the latest development of various desalination technologies, including seawater reverse osmosis (SWRO) and Multi-stage Flash Distillation (MSF), was conducted. The results of the review reconfirmed the recommendations from the Total Water Management and Advisory Group on Water Resource and Quality of Water Supplies Meeting that SWRO is the preferred desalination technology.

The results indicated that SWRO is more suitable to be adopted as the desalination technology of the proposed Project, taking into consideration the following advantages:

- No boiler is required, thus no generation of NO<sub>x</sub> and with least energy consumption
- Proven technology with the capacity to treat large amount of seawater
- Long track record of operation
- Less land requirement for the treatment units
- Less operation complexity
- Less capital and operating costs

#### 15.14.3 Population and Environmentally Sensitive Areas Protected

The major sensitive areas within the study area include different type of residential high-rise residential buildings, industrial premises, waters in Eastern Buffer Water Control Zone, natural habitats, particularly the Clear Water Bay Country Park, in the close proximity of the Tseung Kwan O Area 137. With the implementation of the proposed control and mitigation measures, the sensitive receivers for different environmental aspects would be protected from adverse impacts arising from the Project during both construction and operation phases. The environmental benefits of environmental protection measures recommended, compensation areas included, and the population and environmental sensitive receivers protected are summarized in **Tables 15.1 - 15.11** above.

#### 15.14.4 Environmental Benefits

WSD has assessed 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) to cope with the projected water demand. The Project offers an appropriate solution to provide potable water and to alleviate the shortage of freshwater resources in Hong Kong. The reverse osmosis technology adopted in the Project desalination plant is a cost effective and environmental acceptable method to produce the potable water complying with the World Health Organisation (WHO) standards.