



HONG KONG GOVERNMENT
DRAINAGE SERVICES DEPARTMENT

Agreement No. CE 49/95

Outlying Islands Sewerage - Stage I Phase I

Executive Summary

Final

September 1997

Maunsell

MAUNSELL CONSULTANTS ASIA LTD

in association with

CES Consultants in Environmental Sciences (Asia) Ltd
MVA (Asia) Ltd
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DRAINAGE SERVICES DEPARTMENT

Outlying Islands Sewerage Stage 1 Phase 1
Environmental Impact Assessment Study

Final Assessment Report
Executive Summary

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September 1997

IN ASSOCIATION WITH
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DRAINAGE SERVICES DEPARTMENT

**Outlying Islands Sewerage Stage I Phase I
Environmental Impact Assessment Report**

for : Package B - Siu Ho Wan Sewage Treatment Works Upgrading
Package C - Yung Shue Wan Sewage Treatment Works and Outfall
Package D - Peng Chau Sewage Export Scheme
Package E - Cheung Chau Outfall Replacement

**Final Assessment Report
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1 INTRODUCTION

1.1 Background

In 1993 the Environmental Protection Department (EPD) commissioned a Sewerage Master Plan (SMP) study of the Outlying Islands. The areas studied included Lantau, Lamma, Cheung Chau, Peng Chau and some other smaller islands to the west and south of Hong Kong. The SMP was completed in 1994 and made recommendations which included some improvements and extensions to the existing sewerage infrastructure.

Further to this study, in mid 1995 EPD completed a Preliminary Project Feasibility Study (PPFS) for those proposals made in the SMP which were considered unconstrained by private land issues and which could therefore be implemented quickly. These projects were collectively termed the Outlying Islands Sewerage Scheme Stage 1 Phase 1 works. The PPFS identified no major problems that would prevent the project from proceeding to the implementation stage.

On 3rd May 1996 the Drainage Services Department (DSD) commissioned Maunsell Consultants Asia Ltd as lead consultants to implement the Outlying Islands Sewerage Scheme Stage 1 Phase 1 works. The commencement date for this assignment was 6th May 1996. An Environmental Impact Assessment (EIA) study is a required component of this assignment in order to assess the likely environmental impacts due to construction and operation of the proposed works. This Executive Summary is intended to present a stand-alone synopsis, in non-technical terms, of the key issues, findings and recommendations in the Final Assessment Report (FAR). The FAR represents the most detailed environmental assessment of these works under the current study.

The general locations of the Packages are indicated in Figure 1, and an outline of the proposed works involved for the four Packages presented in the FAR is as follows:

Package B - Upgrading of Siu Ho Wan Sewage Treatment Works on Lantau Island

This would involve upgrading existing facilities from the present preliminary treatment to a chemically enhanced primary treatment level. This would be achieved through addition of a detritor, primary sedimentation tanks and sludge handling facilities etc.

Package C - Yung Shue Wan Sewage Treatment Works and Outfall

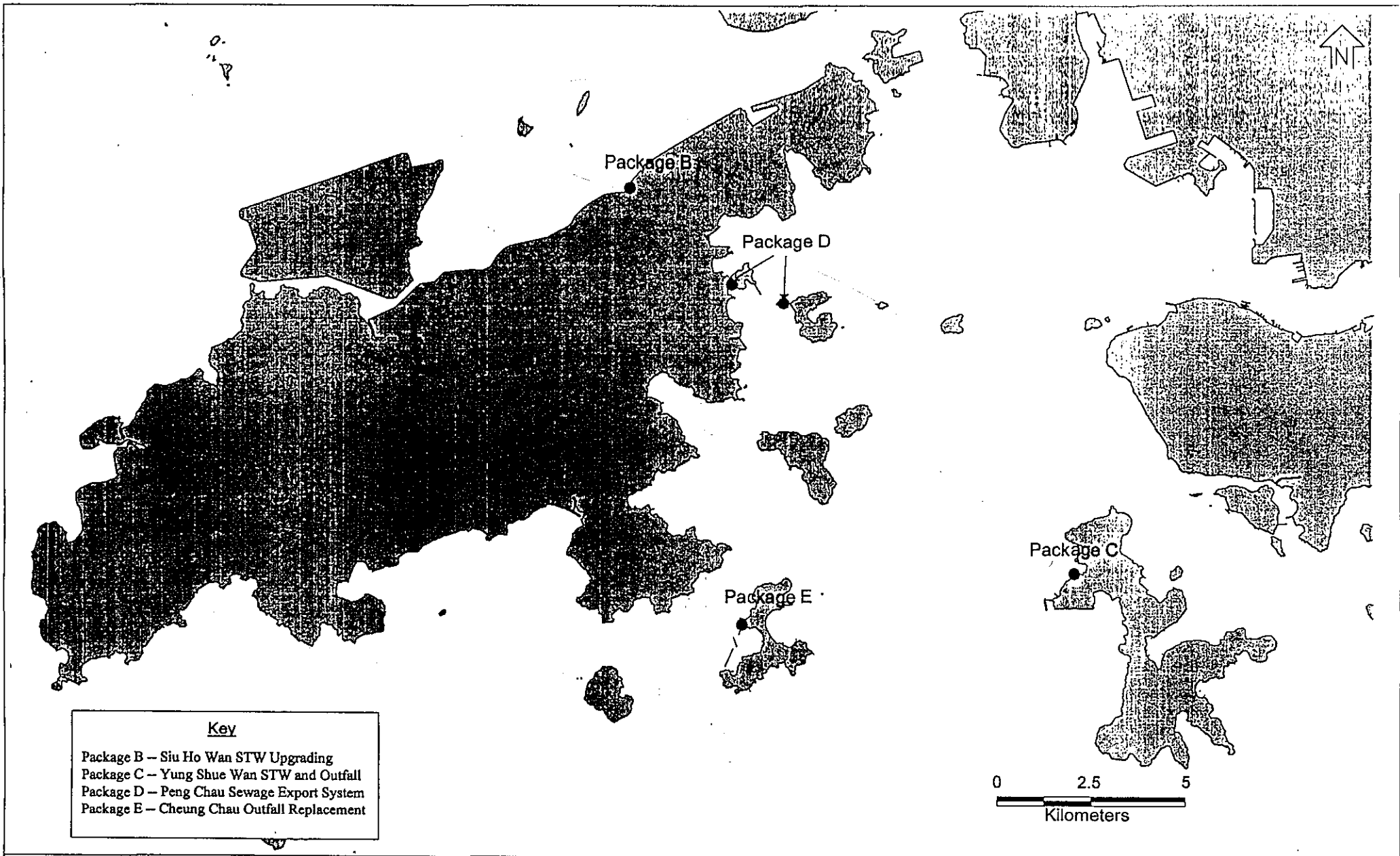
This would comprise the construction of a secondary level sewage treatment works and submarine effluent outfall at Yung Shue Wan on Lamma Island.

Package D - Peng Chau Sewage Export Scheme

This would comprise the construction of a pumping station at Peng Chau and the laying of a submarine pipeline to link with the sewerage system at Discovery Bay for the export of sewage to Siu Ho Wan Sewage Treatment Works on Lantau Island.

Package E - Cheung Chau Outfall Replacement

This would comprise the construction of a new submarine effluent outfall from Cheung Chau Sewage Treatment Works to replace the existing outfall.



TITLE

Locations of Works Packages

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PROJECT NO.	B060Vfar	DATE	September 1997
DESIGNED	Fanny Lau	DRAWING NO.	Figure 1

1.2 Study Objectives and Scope

The objectives of the EIA study were:

- to describe the nature of the Project and any associated works;
- to identify and describe sensitive receivers likely to be affected by the Project, and factors likely to affect the Project;
- to identify and quantify emission sources and the significance of these on sensitive receivers;
- to identify and quantify any potential losses or damage to flora, fauna and natural habitats;
- to propose mitigation measures required to reduce any impacts towards acceptable levels for both construction and operational phases of the Project, and to evaluate any residual impacts and/or side effects of mitigation;
- to design and specify environmental monitoring and audit requirements to ensure the efficacy of mitigation proposals; and
- to identify any necessary additional studies.

The assessment work presented in the FAR was conducted on the basis of the design details proposed and available at the time of the study. Impacts have been assessed in terms of effects on existing and planned sensitive receivers in the vicinity of all Packages for both the construction and operational phases of proposed works. These assessments addressed:

- marine and fresh water quality impacts;
- air quality impacts arising from construction (dust) and operation (odour);
- noise levels;
- solid waste management considerations;
- ecological and conservation related impacts; and
- landscape and visual impacts.

All quantitative methodologies employed for these assessments were agreed with the government agency concerned.

The following sections provide a self contained summary of environmental assessment and findings for each of the four Packages.

2

PACKAGE B -
SIU HO WAN

2 PACKAGE B - SIU HO WAN

2.1 Site Context and Proposed Works

The proposed site for the upgrading of the existing STW at Siu Ho Wan is located on newly reclaimed land on a stretch of former coastline to the north east of Lantau Island. The Siu Ho Wan treatment works would serve as a centralized facility to handle the sewage from the area comprising North Lantau, the New Airport and Port Development, Discovery Bay and Peng Chau. The upgraded STW would have a capacity to handle and discharge a daily average flow of 169,000 tonnes of wastewater during operation. No marine works would be required, since the outfall here is already in place. The works would include the construction of, *inter alia*: a workshop, welfare facilities and an electrical substation. Further, up to twelve single storey rectangular tanks would be installed for chemically enhanced primary sedimentation and anaerobic sludge digestion, and two additional sludge handling treatment buildings would be constructed for sludge dewatering. All required associated pipelines would also be constructed on recently reclaimed land. In addition, it is expected that modifications to existing treatment facilities may involve the installation of supplementary screening equipment and a third detritor.

The area around the Brothers and Sha Chau is a popular fishing ground. A mariculture zone is situated in the western side of Ma Wan. In particular, dolphins have been sighted in the waters near the Brothers. Although neither the north-eastern coastal water of Lantau Island nor the water around the Brothers are designated as a secondary recreational contact subzone or bathing beaches, recreational uses such as diving and wind-surfing are occasionally found in the area. Six gazetted beaches lie along the opposite shore near Tuen Mun: Butterfly Beach, Castle Peak Beach, Cafeteria Beaches, Kadoorie Beach, and Golden Beach. The closest secondary recreational contact subzone to the outfall is a narrow strip of coastal water along the coastline of Tuen Mun and Siu Lam, opposite and far away from north Lantau. The closest existing noise and air quality sensitive receiver is more than 500m away from the project site. It is understood that future residential development is planned in Planning Area 10 in Siu Ho Wan, which is more than 300 metres away from the boundary of the proposed STW on the seaward side.

2.2 Water Quality

Assessment has been carried out to compare the environmental impacts from sewage discharged via the Siu Ho Wan submarine outfall for three treatment scenarios: primary treatment (PT), chemically enhanced primary treatment (CEPT) and chemically enhanced primary treatment with disinfection (CEPTD). Near and intermediate field modelling of sewage plume transport has been carried out. Results have indicated that statutory limits for water quality for suspended solids and nitrogen were met at a distance 20 m downstream of the diffuser ports for all three scenarios. Environmental impact from the Siu Ho Wan outfall in terms of statutory limits for water quality should be acceptable in terms of near field water quality under all three scenarios. Nonetheless, the decision on which scenario should be adopted would involve consideration of other factors, such as impacts on marine ecology, cost, land requirement and public expectation. Some of these factors are beyond the scope of the current environmental impact study. In light of these additional considerations the Engineer has made a recommendation for a treatment level of CEPT, although PT would meet the statutory water quality objectives. Details of the evaluation can be found in the draft Briefing Notes on Treatment Issues at Siu Ho Wan Sewage Treatment Works (June 1997) for this study, as appended to the FAR.

During construction, properly maintained facilities like chemical toilets, and septic tanks would be provided for control wastewater generated from the workforce. Mitigation measures to control site run-off would be carefully designed and implemented, following the guidance given in the ProPECC EN 1/94.

2.3 Air Quality

Modelling results have shown that dust impacts at distances greater than 150 metres from the construction site boundary would not be great. Compliance with guideline and statutory standards for total suspended particulates (TSP) has been predicted at distances greater than 150 metres from the construction site boundary. Therefore, in light of the lack of existing sensitive receivers, impacts were predicted to be acceptable. In addition to regular watering of the site area as assumed in the model, a commitment to adopt good construction practices for dust minimization and the implementation of practicable dust suppression measures were recommended.

Modelling results of the operational phase assessment have shown that odour impacts from the proposed sewage treatment works upgrading would be minimal provided the effectiveness of proposed odour mitigation for open sources, such as primary sedimentation tanks, is satisfactory. It has been proposed that primary sedimentation tanks would not be covered. Therefore, it is considered that a chemical dosing system, in conjunction with other practicable odour reduction measures (such as effluent aeration) would ensure any odour impacts at future sensitive receivers would comply with the required standards. The required level of chemical dosing would be determined at the detailed design stage when further information on the incoming sewage quality becomes available. Other proposed odour mitigation measures include covering or enclosure of the pressing and sludge thickening facilities, and ventilating air to a biological treatment unit with 95% odour removal efficiency prior to stack exhaust.

2.4 Noise

Due to the absence of existing sensitive receivers in the vicinity of the proposed upgrading of Siu Ho Wan STW, it was considered that no unacceptable noise levels would be caused at sensitive receivers. Therefore, no specific mitigation measures would be required beyond normal good site practice.

Specific plant must be installed at the STW in order to allow normal function of the facility. Assessment has been undertaken on the basis of the layout, installation and housing of proposed operational phase plant. Due to the large distance (>300m) of the nearest proposed sensitive receivers to the proposed site, statutory limits for operational phase noise levels would be complied with.

2.5 Waste Disposal

Construction work would generate various types of wastes; general construction waste, excavated spoil, work force waste and chemical waste. Proper waste management and handling procedures previously outlined should be adopted for each type of waste. It is anticipated that all wastes, except for the excavated spoil, would constitute a relatively small amount of material. The excavated spoil would mainly consist of fill material previously used for the newly formed reclamation. It is therefore recommended that the excavated surplus spoil should where possible be re-used for other reclamations, or disposed at a public dump.

A relatively large quantity of sludge would be generated at the site during the operational phase: CEPT would produce about 520m³ per week. It is recommended that this sludge should be dewatered to a solids content of 30%. The dewatered sludge would be disposed of to landfill.

2.6 Ecology

Potential impacts upon the Chinese White Dolphin population and their prey base were predicted to be the major ecological issue associated with the Siu Ho Wan Package. It was difficult to predict the effects of the discharged Siu Ho Wan treated effluent on the Chinese White Dolphin population and its prey base, due to a lack of international and local research. The only prediction that could be made was while primary sewage treatment or (preferred) CEPT would improve effluent quality and reduce negative impacts on fish and dolphins, increased effluent discharges would by and large have a negative effect on fish and dolphins. In the future, this residual impact (the extent of which remains unknown at present) could be reduced through the introduction of disinfection at Siu Ho Wan.

A programme of water quality monitoring has been recommended to record changes in pollutant and pathogen concentrations in the area. This would offer an indirect indication of how pollutants may be affecting the dolphin population and its fish prey base.

In addition, it has been recommended that continued systematic dolphin surveying in this area would provide data on numbers of sightings and estimates of abundance. These data would show changes in patterns of dolphin distribution and numbers during the construction and operation of the treatment plant. It is not considered necessary to supplement the existing AFD monitoring programme (or HK University monitoring programme) with additional surveys specifically for the Siu Ho Wan outfall project until such time as these ongoing studies are discontinued, as the area to be surveyed and the data to be collected would overlap.

2.7 Visual/Landscape

The site would be located on a wedge of reclaimed land associated with the North Lantau Expressway and rail line reclamation. The site would be visible from the Expressway, rail line and walking trails above the site. The visual impact has been considered moderate due to the limited clear views into the site and the service area environment in which it would sit. Building placement and architectural design along with screen planting have been proposed as visual mitigation approaches.

3

PACKAGE C -
YUNG SHUE WAN

3 PACKAGE C - YUNG SHUE WAN

3.1 Site Context and Proposed Works

The proposed secondary level STW at Yung Shue Wan would be located on an area of reclaimed land to be formed by others. The proposed area of reclamation (average width 24 m over the 120 m usable length) required for the STW is approximately 2,880 m² and would be formed within a section of the southern coastline of Yung Shue Wan Harbour. Outfall construction would include dredging of the seabed to form a trench for pipeline laying prior to backfilling.

There is no natural stream nearby the site and the water quality sensitive receivers are those related to beneficial uses of the marine waters off Yung Shue Wan. The southern waters of Hong Kong support a wide range of beneficial uses, including both primary and secondary contact recreation, fish production, ship navigation and anchorage. The submarine outfall would be situated close to a secondary contact recreation subzone off the shore of Yung Shue Wan, and the minimum distance between the outfall and the subzone is in the order of 100m. Marine water sensitive receivers include the marine waters in Yung Shue Wan, the cooling water intake for the Hong Kong Electric power plant to the south, the two gazetted beaches Hung Shing Yeh Wan and Lo So Shing further south, and the non-gazetted Tung O Wan to the eastern side of the island. Two mariculture zones are also located in Sok Kwu Wan and Luk Chau Wan on the eastern side of Lamma Island. There is no WSD seawater intake in the area. Several representative air and noise sensitive receivers in closest proximity to the proposed facility were identified for the purpose of assessment.

3.2 Water Quality

The sewage plume mixing zone has been predicted to be within 20 m of the point of discharge. Residual water quality impacts should be insignificant. Although the proposed outfall would be situated very close to a secondary contact recreation subzone at Yung Shue Wan, bacteria concentrations at this subzone would still comply with the statutory limits, and there is no evidence that disinfection would be required.

During construction, properly maintained facilities such as chemical toilets and septic tanks would be provided for the wastewater generated from the workforce. Mitigation measures to control site run-off would be carefully designed and implemented, following guidance given in the ProPECC PN 1/94. Dredging impacts have been assessed and it has been demonstrated that the elevation of suspended solid levels at the sensitive receivers would not exceed 30% above ambient levels. Therefore, overall impacts would be insignificant. Nonetheless, dredging works would be carried out carefully to minimize the quantity of sediment lost to the water column.

3.3 Air Quality

The modelling results have shown that dust impacts at air quality sensitive receivers would not be significant, and compliance with the guideline levels and AQOs for TSP would be expected. In addition to regular watering of the site area as assumed in the model, a commitment to adopt good construction practices for dust minimization was recommended.

As indicated by the modelling results of the operational phase assessment, odour impacts from the proposed sewage treatment works would be minimal provided more than 90% of the odorous sources within the facility are mitigated. To this end, proposed odour mitigation measures include

the covering of the sequential batch reactor units, enclosure of odour generating activities and the ventilation of odour emissions to a biological treatment unit with 95% odour removal efficiency prior to stack exhaust.

3.4 Noise

Without any mitigation in place it has been predicted that only one sensitive receiver would experience exceedances of the non-statutory day time limit of 75 dB(A) for some of the construction tasks associated with the construction of the sewage treatment works (STW). It was therefore proposed that an acoustic barrier, or equivalent measures, should be installed at the receiver for the duration of construction works in agreement with the residents concerned. This would reduce noise levels to acceptable levels at all sensitive receivers.

During the operation phase specific plant must be installed at the STW in order to allow normal function of the facility. Assessment has been undertaken on the basis of the layout, installation and housing of proposed operational phase plant. It has been predicted that operational phase noise levels would comply with statutory limits at all noise sensitive receivers.

3.5 Waste Disposal

Construction work would generate various types of wastes; general construction waste, excavated spoil, marine sediments, work force waste and chemical waste. It is anticipated that quantities of excavated spoil and approximately 31,250 m³ of marine sediment would be generated and would require off-site disposal. For marine sediment, it is recommended that, in light of the low to moderate levels of contamination present in surface layers, disposal should be to gazetted marine dumping areas. A small amount of sludge would be generated during the operational phase. This sludge should be dewatered and disposed of to landfill.

3.6 Ecology

No rare or endangered species were recorded on the intertidal area, therefore the impacts of habitat loss due to construction of the treatment plant were predicted to be minimal. Temporary construction related disturbance to the subtidal infaunal community would occur in the area where the submarine outfall would be laid. Minor long-term impacts on the subtidal community near the outfall discharge point were predicted due to the influx of treated sewage effluent.

Impacts of the sewage outfall on marine mammals were predicted to be minimal due to the overall improvement in water quality associated with the proposed works, combined with the infrequency of marine mammal sightings in the area.

3.7 Visual/Landscape

The proposed site would be located on a highly visible area of reclaimed land in Yung Shue Wan Harbour. The potential visual impact of locating the proposed facility in such a visually sensitive area was considered high unless a co-ordinated visual mitigation approach would be carried through into the detailed design phase. To this end, building placement and architectural design along with vegetative screen planting have been proposed as visual mitigation measures.

4

PACKAGE D -
PENG CHAU

4 PACKAGE D - PENG CHAU

4.1 Site Context and Proposed Works

The proposed works for this Package would comprise modifications to the existing STW at Peng Chau and the installation of a submarine pipeline for the export of sewage to Nim Shue Wan, located to the south east of Discovery Bay. Proposed works at this site would involve modifications to the existing STW required to service a sewage export facility to Nim Shue Wan. These works would include a pumping station and the installation of approximately 1,520 m of submarine pipeline. Construction would include demolition of some existing structures to allow for modifications at the existing Peng Chau STW.

The general water quality in the Southern Water Control Zone has been shown to be good (as reported in the Outlying Islands SMP and EPD routine marine water quality monitoring programme). Although water quality can deteriorate at semi-enclosed locations where flushing is poor, like Discovery Bay. The narrow channel between Tai Lei Island and Discovery Bay and inner Nim Shue Wan are fishing grounds. Nearby beaches include Discovery Bay, Nim Shue Wan, Peng Chau Tung Wan and Silver Mine Bay further to the south (all non-gazetted except Silver Mine Bay). Secondary contact recreation subzones are located on both sides of the channel and the subzone on the west covers the whole Discovery Bay. There are no WSD seawater intake or mariculture zones in the area. Residential developments are found on both sides of the channel between Peng Chau and Discovery Bay and representative sensitive receivers were selected from these for air and noise assessments.

4.2 Water Quality

Operational water quality impacts from the pumping station would be minimal, except when the pump fails and preliminarily treated sewage would be disposed of via an emergency outfall. In the event of an emergency discharge, sewage would be diluted considerably before it reached Discovery Bay. The major concern would be the elevated bacteria concentration that may be experienced at Discovery Bay. Action plans have been formulated and recommended to respond to such an emergency.

During construction, properly maintained facilities like chemical toilets and/or septic tanks would be provided to treat any wastewater generated from the workforce. Mitigation measures would be carefully designed and implemented to control site run-off. This should be undertaken in accordance with the guidance given in the ProPECC PN 1/94. Dredging impacts have been assessed and it has been concluded that the elevation of suspended solids levels at sensitive receivers would not exceed 30% above ambient levels, and therefore impacts would be insignificant. Nonetheless, dredging works should be carried out carefully to minimize the quantity of sediment lost to the marine environment.

4.3 Air Quality

Modelling results have shown that dust impacts at air quality sensitive receivers would not be significant, and compliance with the guideline and statutory standards for TSP would be expected. In addition to regular site watering, as assumed in the model, it has been recommended that good construction practices be adopted for dust minimization and to ensure the implementation of practicable dust suppression measures.

As indicated by the modelling results for the operational phase assessment, odour impacts from the pumping station would comply with the required standards provided the proposed odour mitigation measures are effectively constructed and operated. These proposed mitigation measures include the enclosure of the new pumping station with air ventilation to an odour scrubbing unit with 95% odour removal efficiency prior to stack exhaust. In addition, the proposed addition of a chemical dosing facility would further reduce any odour impacts at nearby sensitive receivers.

4.4 Noise

During the construction phase, and without any mitigation in place it has been predicted that only two sensitive receivers would experience exceedances of the non-statutory day time limit of 75 dB(A) due to pipe laying and roadworks at Nim Shue Wan. Both of these tasks comprise linear and mobile activities which would be difficult to effectively mitigate at source in a practical way. It has therefore been proposed that, in addition to observing recommended good site practices and the use of mobile acoustic screens for relatively immobile items of powered mechanical equipment (PME), the contractor should instigate close liaison with the affected residents prior to the commencement of construction works. In this way it should be possible to identify the key concerns of both parties and from there to define a mutually agreed course of action.

During the operational phase, new plant must be installed at the existing Peng Chau STW in order to allow normal function of the sewage export facility. Assessment has been undertaken on the basis of the layout, installation and housing of proposed operational phase plant. It has been predicted that operational phase noise levels would comply with statutory limits at all noise sensitive receivers.

4.5 Waste Disposal

Construction work would generate various types of wastes; general construction waste, excavated spoil, marine sediments, work force waste and chemical waste. The key waste management issue would be handling the quantity of approximately 93,750 m³ of marine sediment that must be dredged and disposed of. For marine sediment, it is recommended that, in light of the low to moderate levels of contamination present in surface layers, disposal should be to gazetted marine dumping areas. With regard to operational phase waste arisings, only a very small amount of waste would be generated from screening and gritting processes.

4.6 Ecology

This Package would cause limited disturbance to intertidal and terrestrial habitats. The intertidal community present in this area has been shown to be typical of rocky and boulder shores in Hong Kong, and is of little ecological significance. Subtidal habitats would be disturbed as the pipes are laid, but recolonisation has been predicted to be rapid following completion of construction. Impacts upon marine mammals would be short-term and were not predicted to be serious. No specific ecological protection or mitigation measures were recommended beyond basic practices of good site management during the construction phase.

4.7 Visual/Landscape

The proposed site would be located on a small service island connected to the main island of Peng Chau by an access bridge. The site is visible when entering Peng Chau by boat and from recently completed high rise housing development. Due to the existing and proposed service buildings on the

site the visual impact was considered low. Screen planting was proposed as a visual mitigation measure.

5

PACKAGE E-
CHEUNG CHAU

5 PACKAGE E - CHEUNG CHAU

5.1 Site Context and Proposed Works

Cheung Chau is located to the south east of Lantau. Although relatively densely populated, the island is essentially rural in character. The proposed works at Cheung Chau STW would comprise the replacement of the existing outfall. This would necessitate the demolition of some existing structures and the construction of an outfall chamber. The formation of a temporary works area with sea access would also be required for the construction and assembly of the submarine outfall pipeline.

The southern waters of Hong Kong support a wide range of beneficial uses including primary and secondary contact recreation, fish production, ship navigation and anchorage. The Adamasta Channel is heavily utilized by marine traffic and a typhoon shelter is situated on the western side of Cheung Chau. Major sensitive receivers also include nearby beaches, namely Tai Kwai Wan to the north of the treatment plant, Kwun Yum Wan and Tung Wan to the east of Cheung Chau, and Chi Ma Wan, Tai Long Wan and Yi Long Wan on Lantau. Sea Ranch, a private residential development, is located at Yi Long Wan. Several noise and air quality sensitive receivers in closest proximity to the proposed construction works were selected for assessment. These receivers comprised existing buildings located in the proximity of the project site along Cheung Kwai Road, facing the existing sewage treatment works. No future sensitive receivers were identified in this assessment.

5.2 Water Quality

Two outfall locations have been modelled for water quality impact: the original alignment that would discharge near the centre of the Adamasta Channel; and the new alternative alignment that would discharge to the east of the navigation channel. The new alignment was modelled following comments on early assessments indicating that construction of the original alignment would not be permitted, due to unacceptable impacts on marine traffic. It should be stressed that there are not, therefore, two alternative alignments to select from, since the original alignment cannot be built. The performance of the new alignment is summarized as follows:

- residual water quality impact for suspended solids and un-ionized ammonia would be insignificant as the corresponding mixing zone for the sewage plume is predicted to be quite small (less than 20 m downstream of the diffuser);
- water quality impacts at the non-gazetted beach at Tai Kwai Wan would be insignificant;
- the main concern would be bacteria concentrations at the secondary contact recreation subzones on both sides of the Adamasta Channel;
- predicted *E. coli* concentrations would meet the WQO for secondary contact recreation subzones; and
- all water quality impacts were predicted to comply with the required standards.

Sewage and wastewater production on site would cause minimal impacts on the natural water environment provided that properly maintained facilities such as chemical toilets, and septic tanks are established and correctly employed. Surface run-off from the construction site would be controlled and mitigation measures implemented to reduce any impacts. Guidance given in the ProPECC PN 1/94 would be followed.

Dredging impacts have been assessed and it has been concluded that elevation of suspended solids at the sensitive receivers would not exceed 30% above ambient levels, and therefore impacts would

be insignificant. Nonetheless, dredging works should be carried out carefully to minimize the quantity of sediment lost to the marine environment.

5.3 Air Quality

Modelling results have shown that dust impacts at the selected air quality sensitive receivers would not be significant and compliance with guideline and statutory limits for TSP would be expected. In addition to regular watering of the site area as assumed in the model, a commitment to adopt good construction practices for dust minimization and implementation of practicable dust suppression measures were recommended.

Modelling was based on the proposals to install a new effluent pumping station and replace the existing outfall. Results indicated that odour impacts during the operational phase of the new pumping station would comply with the required standards, provided proposed odour mitigation measures are effectively constructed and operated. Proposed odour mitigation measures include the enclosure of the new pumping station with air ventilation to an odour scrubbing unit with 95% odour removal efficiency prior to stack exhaust.

5.4 Noise

During the construction phase, without any mitigation in place it has been predicted that two sensitive receivers would experience minor exceedances of the non-statutory day time limit of 75 dB(A) due to concreting activities. It has therefore been proposed that a mobile acoustic barrier is used to screen hand held breakers when these are used concurrently with other PME employed for concreting tasks. This would reduce predicted noise levels at all sensitive receivers to acceptable levels for all construction work to be undertaken.

During the operational phase, some additional plant would be required at the existing STW in order to allow normal function of the replacement outfall. Assessment has been undertaken on the basis of the layout, installation and housing of this proposed operational phase plant. It has been predicted that operational phase noise levels would comply with statutory noise limits at all affected noise sensitive receivers.

5.5 Waste Disposal

Construction work would generate various types of wastes; excavated spoil, marine sediments, work force waste and chemical waste. Proper waste management and handling procedures should be adopted as previously described. Approximately 56,250 m³ of marine sediment would be generated and would require off-site disposal. It has been recommended that, in light of the low to moderate levels of contamination present in surface layers, disposal should be to gazetted marine dumping areas.

There would be not much difference to the present waste arising situation during the operational phase: only a very small amount of waste would be generated from screening and gritting.

5.6 Ecology

The construction of a new submarine outfall close to the existing outfall would create minimal additional disturbance to the area. No specific mitigation measures have been recommended beyond

the practice of good site management measures. Construction and operations monitoring would not be required.

The quality of the effluent discharged from Cheung Chau would not be altered under this Package, and the location of the new outfall would not be substantially different from the location of the original outfall. In ecological terms, the long-term impacts due to operation of the outfall have been predicted to be no different than those of the existing outfall. No additional residual impacts were predicted beyond those caused by the existing outfall.

5.7 Visual/Landscape

The existing STW is highly visible to sea traffic, however as the proposed building would be set among the existing STW buildings, the visual impact was considered low. Integration of the architecture and screen planting have been proposed as visual mitigation measures.