Drainage Services Department

Agreement No.
CE 66/2001(EP)

EIA and TIA Studies for the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal (YLKTSSD)

Environmental Impact Assessment (Final)

Drainage Services Department

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Environmental Impact Assessment (Final)

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CONTENTS

APPENDICES

ABBREVIATIONS

AAB	Antiquities Advisory Board
AMO	Antiquities and Monuments Office
ANLs	Acceptable Noise Levels
APCO	Air Pollution Control Ordinance
AQOs	Air Quality Objectives
Arup	Ove Arup and Partners
ASR	Air Sensitive Receptors
BNLs	Base Noise Levels
BOD5	5 day Biochemical Oxygen Demand
CNP	Construction Noise Permit
COD	Chemical Oxygen Demand
dB	Decibels
DEP	Director of Environmental Protection
DO	Dissolved Oxygen
DPWCZ	Deep Bay Water Control Zone
DSD	Drainage Services Department
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EM&A	Environmental Monitoring and Audit
EP	Environmental Permit
EPD	Environmental Protection Department
FMC	Fill Management Committee
HKPSG	Hong Kong Planning Standards and Guidelines
LR	Physical Landscape Resources
LCA	Landscape Character Areas
NWWCZ	North Western Water Control Zone
NCO	Noise Control Ordinance
NSRs	Noise Sensitive Receivers
OZP	Outline Zoning Plan
PCW	Prescribed Construction Work
PME	Powered Mechanical Equipment
ProPECC PN	Practice Note for Professional Person
PRCRG	Peoples' Republic of China Regulations and Guidelines
RPCC	Recommended Pollution Control Clauses for Construction Contracts
RSP	Respirable Suspended Particulates
SPME	Specified Powered Mechanical Equipment
SPS	Sewage Pumping Station
SWL	Sound Power Level
SWSTW	San Wai Sewage Treatment Works
TIN	Total Inorganic Nitrogen
TMs	Technical Memoranda
TM-CW	Technical Memorandum on Noise from Construction Work other than Percussive Piling
TM-DA	Technical Memorandum on Noise from Construction Work in Designated Areas
TM-PP	Technical Memorandum on Noise from Percussive Piling
TM-EIAO	Technical Memorandum on Environmental Impact Assessment Process
TM-IND	Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites
TM-Water	Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TOC	Total Organic Carbon
TSP	Total Suspended Particulates
VSR	Visually Sensitive Receivers
WCZ	Water Control Zone
WDO	Waste Disposal Ordinance
WPCO	Water Pollution Control Ordinance
WQI	Water Quality Index

WQO	Water Quality Objectives
WSRs	Water Sensitive Receivers
YLEPS	Yuen Long Effluent Pumping Station
YLSTW	Yuen Long Sewage Treatment Works
YLKTSSD	Yuen Long and Kam Tin Sewerage and Sewage Disposal

1.0 INTRODUCTION

1.1 The Consultancy

Ove Arup & Partners Hong Kong Ltd (Arup) was commissioned by the Drainage Services Department (DSD) of the Government of the Hong Kong Special Administrative Region to provide consultancy services in respect of the environmental and traffic impacts arising from the Stage 2 of PWP Item No. 215DS - Yuen Long and Kam Tin Sewerage and Sewage Disposal (YLKTSSD) under Agreement No CE 66/2001(EP), on 30 April 2002 for a study period of about 18 months.

1.2 The Project Background

The design and construction supervision of the Project are/will be undertaken by the in-house staff of DSD. The Chief Engineer/Sewerage Projects, DSD, is responsible for the civil engineering works while the Chief Engineer/Electrical and Mechanical Projects, DSD, is responsible for the electrical and mechanical works.

The Project is part of the "Yuen Long and Kam Tin Sewerage and Sewage Disposal" (YLKTSSD) scheme as recommended in the "Review of Yuen Long and Kam Tin Sewerage and Sewage Treatment Requirements" study (completed in January 1999). The YLKTSSD scheme is aimed at phased implementation of sewerage extension in the Northwest New Territories to cope with the existing and planned developments. This Stage 2 Project involves the following key items of works: -

- to provide a pumping system for conveying treated effluent from Yuen Long Sewage Treatment Works (YLSTW) to San Wai Sewage Treatment Works (SWSTW);
- to provide a trunk sewerage system consisting of gravity sewers, rising mains and pumping stations for San Tin areas, for conveying sewage to the YLSTW via another downstream trunk sewerage system;
- to provide a trunk sewerage system consisting of gravity sewers, rising mains and pumping stations for conveying sewage generated from Lau Fau Shan areas, to SWSTW; and
- to provide a trunk sewerage system consisting of gravity sewers, rising mains and pumping stations for Yuen Long South areas for collection and conveyance of sewage generated from the areas to SWSTW via another trunk sewerage system and the existing Ha Tsuen Pumping Station.

1.3 The Site Location and Works

The general overview of the sewerage system in the North NT is illustrated in Figure 1.0. The Project is divided into several works packages (Figure 1.0a). Each works package comprises several works items which are detailed in Table 1.1 and Figures 1.1 to 1.4. The overall study area and the interfacing boundary are shown in Figures 1.5 to 1.8. The whole extent of the sewerage system is about 28km, and careful consideration has been made such that the majority part of the sewer will be laid underneath existing or future roads (upto 83% of the sewer). This can significantly reduce the overall disturbance and environmental impact to the residents.

Table 1.1: Details of works packages

Works Package	Works Item	Location
Works Packages and Works Items for Stage 2 Works		
Tin Shui Wai and San Wai Areas		
2A-1T	**OP1**	**Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station) where treated effluent will be handled**
	OS1	**Twin rising mains from item OP1 to Tin Tsz Road in Tin Shui Wai**
	OS2	Twin rising mains from Tin Tsz Road via Tin Wah Road to Tin Ying Road in Tin Shui Wai
	OS3	Twin rising mains along Tin Ying Road in Tin Shui Wai
	OS4	Twin rising mains from Tin Ying Road to Ping Ha Road
	OS5	Twin rising mains from Ping Ha Road via Tin Ha Road to SWSTW
Tin Shui Wai and San Wai Areas		
Alternative scheme of 2A-1T	**AP1**	**Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station) where treated effluent will be handled**
	AS1	**Twin rising mains in the northwestern side of YLSTW**
	AS2	Twin rising mains from item AS1 to Fuk Shun Street
	AS3	Twin rising mains from Fuk Shun Street to Tin Wah Road in Tin Shui Wai
	AS4	Twin rising mains between Tin Wah Road and Tin Ying Road in Tin Shui Wai
	AS5	Twin rising mains from item AS4 to Ping Ha Road
	AS6	Twin rising mains from Ping Ha Road to SWSTW

Works Package	Works Item	Location
Ngau Tam Mei and San Tin Areas		
2A-2T and 2B-1T	**P1**	**Ngau Tam Mei sewage pumping station**
	S1	Sewers along Ngau Tam Mei Main Drainage Channel Phase 1 from P1 to Nam San Wai sewage pumping station (SPS)
	S2	Branch sewers from Fairview Park to S4 along Ngau Tam Mei Main Drainage Channel Phase 1 opposite to S1
	P2	Tam Mei Barracks SPS (Tam Mei Camp SPS)
	S3	Branch sewers from P2 to P1 along Main Drainage Channel for Ngau Tam Mei Phase 2
	S4	Sewers from P3 to P1 along Castle Peak Road-San Tin near Yau Mei San Tsuen, Mai Po San Tsuen and Mai Po Lo Wai
	P3	San Tin SPS
	S5	Sewer upstream of P3 near Tsing Lung Tsuen
	P4	San Lung Tsuen SPS
	S6	Branch sewers from P4 to S5 along the village tracks in Fan Tin Tsuen
	P5	San Tin Barracks sewage pumping station (Cassino Line SPS)
	S7	Sewer from P5 to S5
Lau Fau Shan and Mong Tseng Areas		
2A-3T	A1	Lau Fau Shan SPS
	G1	Sewers from A1 to Tin Shui Wai Reserved Zone pumping station (TSWRZPS)
	A2	Mong Tseng SPS
	G2	Sewers along Lau Fau Shan Road from A2 to TSWRZPS
Shap Pat Heung Area		
2B-2T	B1	Shan Ha Tsuen SPS
	H1	Sewers from B1 to the connection sewer at Yuen Long Highway
	B2	Muk Kiu Tau Tsuen SPS
	H2	Sewers along Kung Um Road from B2 to the connection sewer at Yuen Long Highway
	B3	Sham Chung Tsuen SPS
	H3	Sewers from B3 to the connection sewer at Yuen Long Highway
	B4	Shui Tsiu San Tsuen SPS
	H4	Sewers from B4 to B3
	H5	Sewers from Tai Tong Tsuen to B4
	B5	Shung Ching San Tsuen SPS
	H6	Sewers along Tai Tong Road from Hung Tso Tin Tsuen to B5
	H7	Sewers from B5 to the connection sewer at Yuen Long Highway
	B6	Nga Yiu Tau SPS
	H8	Sewers along Tai Shu Ha Road East from Tong Tau Po Tsuen to B6
	H9	Sewers along Tai Shu Ha Road East from B6 to the connection sewer at Yuen Long Highway
	B7	Pak Sha Tsuen SPS
	H10	Sewers along Kung Um Road from Wong Nai Tun Tsuen to B7
	H11	Sewers from B7 to B2

Legend: - Designated Elements

- Non-Designated Elements

1.4 Previous Studies

A Preliminary Project Feasibility Study has been completed in January 1998 and an Adoptive Review on Package 2A-1T (Yuen Long Effluent Pipeline) was circulated for departmental comments on 25 September 2001. The capacities of some pumping stations have been upgraded to cater for future detailed design.

According to the latest design information provided by DSD dated Feberary 2004, the following works items are classified as Designated Elements:

- OP1 (Treated effluent pumping station in the north of YLSTW – 2A-1T Conforming Scheme) by virtue of Item Q.1 of Schedule 2, Part I under the EIAO
- OS1 (Twin rising mains from item OP1 to Tin Tsz Road in Tin Shui Wai – 2A-1T Conforming Scheme) by virtue of Item Q.1 of Schedule 2, Part I under EIAO
- AP1 (Treated effluent pumping station in the north of YLSTW – 2A-1T Alternative Scheme) by virtue of Item Q.1 of Schedule 2, Part I under the EIAO
- AS1 (Twin rising mains in the northwestern side of YLSTW – 2A-1T Alternative Scheme) by virtue of Item Q.1 of Schedule 2, Part I under EIAO
- P1 (Ngau Tam Mei sewage pumping station – 2A-2T and 2B-1T) by virtue of F.3(b) of Schedule 2, Part I under the EIAO

In the previous Adoptive Review, reports had been circulated to various departments. It indicated that the 2A-1T conforming scheme was a "No-built" option; especially with significant impact on the Deep Bay Buffer Zone. A more detailed comparison is listed in Section 2.

1.5 Environmental Needs and Benefits

A Yuen Long and Kam Tin Sewerage Masterplan Study (SMP) was conducted in 1992 to address the overall demand in sewerage system in the region. It was recommended that a regional sewerage network, for the existing unsewered villages and new developments, was required in the NWNT and all sewage flows within the planned catchment area shall be collected and then discharged via Urmston Road outfall. This plan can contribute substantially to the aim of zero discharge to Deep Bay. Subsequently, a supplementary PPFS Report to PWP Item 4215DS admitted in 1998 RAE. With the incorporation of the latest planned development of the area, based on the best available information development projections in mid-1998. The report concluded that the need for an overall sewage transfer strategy was verified and found valid. The report reviewed that the pipe sizes and capacities of pumping stations shall be revised to reflect the latest population demand. In accordance with the recommendation in the supplementary PPFS, option/site selection had been conducted by DSD and subsequently a preliminary design of the sewerage system is being carried out. An Environmental Impact Assessment for PWP item 215DS is therefore conducted to identify any potential environmental impact.

It is anticipated that by the completion of this Project, all untreated village sewage/new development flows within the planned catchment will be treated and then diverted away from Yuen Long Sewage Treatment Works to Urmston Road outfall so as to achieve the long-term ultimate aim of zero discharge to Deep Bay. The wild life within the Deep Bay Water Control Zone and Deep Bay Buffer Area will be benefited. The proposed system has been planned for a total population of about 900,000 people.

1.6 Structure of the Environmental Impact Assessment (EIA) Report

The structure of this EIA report is outlined below for easy reference:

Table 1.2: Report structure

Section	Title	Aims
1	Introduction	An introduction of the background information and the layout of the EIA report
2	Project Description	A description of the extent and details of the proposed project
3	Study Objectives and Scope	Outline the objectives and scope for various environmental aspects
4	Available Technical Information	List the key information reviewed in this EIA study
5	Alignment Options Consideration	Describes the options considered and presents the associated benefits and disbenefits
6	Dust Impact Assessment	Present the legislation, methodology and recommendations for air quality impacts during construction phase
7	Odour Impact Assessment	Present the legislation, methodology and recommendations for odour impacts during operational phase
8	Construction Noise Assessment	Present the legislation, methodology and recommendations for the construction phase
9	Operational Noise Assessment	Present the legislation, methodology and recommendations for the operational noise impacts from pumping stations
10	Water Quality Assessment	Present the legislation, methodology and recommendations for water quality impacts
11	Waste Management	Present the legislation, methodology and recommendations for waste management
12	Land Contamination Implications	Present the legislation, methodology and recommendations for potential land contamination implication
13	Ecological Assessment	Present the legislation, methodology, survey findings and recommendations for ecological impact
14	Landscape and Visual Impacts	Present the legislation, methodology and recommendations for landscape and visual impacts
15	Cultural Heritage Assessment	Present the legislation, methodology, survey findings and recommendations for cultural heritage
16	Fishery Assessment	Present the legislation, methodology, survey findings and recommendations for fishery impact
17	Environmental Monitoring and Auditing Programme	Present the legislation, methodology and recommendations for EM&A
18	Summary of Envionmental Outcomes	Summary of the findings and recommendations
19	Conclusion	Concluding the study
20	References	List of relevant reference

2.0 PROJECT DESCRIPTION

2.1 Construction Phasing and Details in North West New Territories

The Project involves the phasing development of sewerage in the North West New Territories to match the planned development of this area. The sewerage development is divided into four principal areas: Kam Tin; Ngau Tam Mei and San Tin; Lau Fau Shan; and Yuen Long South. The first priority will be the construction of a trunk sewer to transfer sewage from Kam Tin Core Area to Yuen Long Sewage Treatment Works, which are being designed in the Stage 1 of YLKTSSD. The sewage generated from Yuen Long Town, Areas 13 & 14, Tin Shui Wai Reserve Zone and Au Tau is collected and discharged to Ha Tsuen Sewage Pumping Station and then to San Wai STW eventually. As such, expansions of San Wai STW and Ha Tsuen Sewage Pumping Station under PWP Item No. 4215DS Stage 1 Package 1A-2T are required to accommodate such sewage flows. The remaining packages under PWP Item No. 4215DS Stage 1 are 1A-1T - Kam Tin Trunk Sewerage Phase 1 and 1B-1T - Kam Tin Sewerage Phase 2. The EIA report of Stage 1 YLKTSSD was approved on 26 Aug 2002, and the tentative construction programme was scheduled between Aug 2003 to Nov 2006. Nonetheless, the actual programme for each individual package will be determined at the detailed design stage, while the total flow could reach the Stage 1 capacities by 2006.

The expansions of the San Wai STW and Ha Tsuen Pumping station are required to accommodate such flows and to ensure that these facilities will not constrain medium term development planning. A separate EIA study report has therefore been submitted and approved by EPD on 12 May 2003. The construction of the sewerage works under the Package 1A-2T - Expansion of San Wai STW and Ha Tsuen PS and Package 1A-1T – Kam Tin Trunk Sewerage Phase 1 were tentatively scheduled between June 2006 to January 2010 and June 2005 to December 2007 respectively. The actual implementation programmes and works details of the projects are being under review and yet to be finalised. The current status of the San Wai STW is classified as "Cat. B under Planning".

The initial phases of the trunk sewers for Ngau Tam Mei and the rest of Kam Tin will follow closely behind to provide the possibility of connection of impending development and also existing development which is served by small treatment plants which can then be decommissioned. However, prior to the connection of sewerage from Fairview Park, Tam Mei Camp and other parts of the Ngau Tam Mei catchment, a major pumping station at Yuen Long STW and a new rising main to transfer flows from the treatment plant to SWSTW should be constructed.

The second stage also includes connections from Lau Fau Shan/Mong Tseng and San Tin areas followed by branch sewers at Yuen Long South which is the last phase.

Many of the main trunk transfer systems rely on pressure mains because of the topography of the area. Consequently, collector sewer systems will need to be constructed either with or following closely behind the trunk system.

The tentative construction details for pumping stations and sewerage systems are listed in Tables 2.1 and 2.2 respectively.

Table 2.1: Tentative construction details of pumping stations

Package	Pumping Stations	Dry Weather Flow (m^3/day)	Excavation Depth (m)	Dimension (m x m)
2A-1T (Conforming and Alternative)	**Yuen Long Effluent (OP1/AP1)**	**14,760**	**15**	**100 x 70**
2A-2T and 2B-1T	Cassino Line (P5)	200	9	25 x 20
2A-2T and 2B-1T	Fan Tin San Tsuen/ San Lung Tsuen (P4)	1,000	13	40 x 30
2A-2T and 2B-1T	San Tin (P3)	1,200	10	40 x 30
2A-2T and 2B-1T	Tam Mei Camp (P2)	100	11	40 x 30
2A-2T and 2B-1T	**Ngau Tam Mei (P1)**	**13,000**	**13.5**	**40 x 40**

Package	Pumping Stations	Dry Weather Flow (m^3/day)	Excavation Depth (m)	Dimension (m x m)
2A-3T	Mong Tseung (A2)	100	10	40 x 30
2A-3T	Lau Fau Shan (A1)	200	10	25 x 20
2B-2T	Shan Ha Tsuen (B1)	400	10	40 x 30
2B-2T	Nga Yiu Tau (B6)	500	9	25 x 20
2B-2T	Pak Sha Tsuen (B7)	500	9	25 x 20
2B-2T	Sham Chung Tsuen (B3)	1,000	7	25 x 20
2B-2T	Muk Kiu Tau Tsuen (B2)	900	8.5	40 x 30
2B-2T	Shiu Tsiu San Tsuen (B4)	1,000	7.5	25 x 20
2B-2T	Shung Ching San Tsuen (B5)	1,200	9	25 x 20

Legend: - Designated Elements

- Non-Designated Elements

Table 2.2: Tentative construction details of sewerage system

Package	Twin Rising Mains (TRM)/ Gravity Sewers (GS), Diameter (m)	Excavation Width (m)	Excavation Depth (m)	Length (m)
2A-1T	TRM, 1.4m	5	3.8	8000
2A-2T and 2B-1T	TRM, 0.2m	1.4	2.6	1460
	TRM, 0.3m	1.9	2.6	450
	TRM, 0.3m	1.9	2.7	125
	TRM, 0.4m	2.3	27	1100
	TRM, 0.6m	2.95	2.9	1450
	GS, 0.525m	1.2	5	420
	GS, 0.525m	1.2	6.6	750
	GS, 0.6m	1.35	5.5	1000
	GS, 0.75m	1.5	6.5	2000
	GS, 1.05m	2.05	6	800
2A-3T	TRM, 0.2m	1.4	2.6	510
	TRM, 0.3m	1.9	2.6	1535
	GS, 0.45m	1.15	3.5	315
	GS, 0.45m	1.15	6	1125
2B-2T	TRM, 0.15m	1.2	2.6	165
	TRM, 0.2m	1.4	2.6	270
	TRM, 0.25m	1.5	2.6	90
	TRM, 0.3m	1.9	2.6	330
	GS, 0.3m	0.75	4	750
	GS, 0.3m	0.75	6	710
	GS, 0.375m	1.05	3.5	720
	GS, 0.375m	1.05	4	710
	GS, 0.375m	1.05	4.5	450
	GS, 0.375m	1.05	5	1375
	GS, 0.375m	1.05	6.5	885
	GS, 0.45m	1.15	6	390
	GS, 0.45m	1.15	7	580

The proposed trunk will convey sewerage to the rest of the system and reach the YLSTW for secondary treatment. Afterwards, the effluent from YLSTW will be conveyed to SWSTW for centralized disinfection through YLSTW Effluent Pipeline. Discharge of final effluent will be through the NWNT effluent tunnel to the outfall at Urmston Road.

2.2 Neighbouring Environment

Except for Tin Shui Wai area, the Sites are located within rural areas where the population density is low. During site inspections, it was observed that the work nature in general was car repairing, container parking, low-density residential, and some industrial activities. Details of sensitive receivers are identified in Sections 6 - 15.

2.3 Planning Issue

In accordance with the latest approved Outline Zoning Plan (OZP), there are several Sewage Pumping Stations located in areas with incompatible land use. According to the Notes attached to the OZP, the proposed use will require planning permission from the Town Planning Board (TPB). As for the proposed sewers, the development is always permitted and no planning permission from the TPB is required. In accordance with the DSD practice, the planning application / rezoning exercise will be conducted during the detailed design stage before the gazetting plans are issued. Planning application/rezoing request will be required for the proposed sewage pumping stations in various zones of respective OZPs. The existing types of landuse are listed in Table 2.3.

Table 2.3: Types of land use for the pumping stations

Works Package	Works Item	Location	Current Land Status	Type of Land Use (Reference)
Tin Shui Wai and San Wai Areas				
2A-1T	OP1	Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station) **[1]**	Vacant site (non fish pond) – disturbed urban land	Conservation Area (S/YL-LFS/5)
Tin Shui Wai and San Wai Areas				
Alternative scheme of 2A-1T	AP1	Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station) **[1]**	Vacant site (non fish pond) – disturbed urban land	Conservation Area (S/YL-LFS/5)
Ngau Tam Mei and San Tin Areas				
2A-2T	P1	Ngau Tam Mei sewage pumping station	Construction site next to drainage channel	Open Storage (S/YL-NTM/8)
and	P2	Tam Mei Barracks sewage pumping station (Tam Mei Camp Sewage Pumping Station)	Barrack (restricted) area	Comprehensive Development Area (S/YL-NTM/8)
2B-1T	P3	San Tin sewage pumping station	Temporary site office	Residential (Group D) (S/YL-ST/5)
	P4	San Lung Tsuen sewage pumping station	Vacant site next to a toilet	Village Type Development (S/YL-ST/5)
	P5	San Tin Barracks sewage pumping station (Cassino Line Sewage Pumping Station)	Construction site next to drainage channel	-
Lau Fau Shan and Mong Tseng Areas				
2A-3T	A1	Lau Fau Shan sewage pumping station	Vacant site next to a temporary car park	Residential (Group D) (L/YL-LFS/5)
	A2	Mong Tseng sewage pumping station	Occupied by local villagers	Village Type Development (S/YL-LFS/5)
Shap Pat Heung Area				
2B-2T	B1	Shan Ha Tsuen sewage pumping station	Vacant site next to village houses	Village Type Development (S/YL-TYST/6)
	B2	Muk Kiu Tau Tsuen sewage pumping station	Vacant site next to village houses	Agriculture & Village Type Development (S/YL-TT/10)
	B3	Sham Chung Tsuen sewage pumping station	Vacant site next to village houses	Residential (Group D) (S/YL-TT/10)
	B4	Shui Tsiu San Tsuen sewage pumping station	Vacant site next to village houses	Village Type Development (S/YL-TT/10)
	B5	Shung Ching San Tsuen sewage pumping station	Vacant site next to village houses	Village Type Development (S/YL-TT/10)
	B6	Nga Yiu Tau sewage pumping station	Vacant site next to village houses	Residential (Group D) & Village Type Development (S/YL-TT/10)
	B7	Pak Sha Tsuen sewage pumping station	Vacant site next to village houses	Village Type Development (S/YL-TYST/7)

Remark **[1]**: DSD had already confirmed the Option 1 was the only feasible site location for the construction of the proposed YLEPS in terms of engineering feasibility and other operational/maintenance considerations.

The proposed PME locations (detailed in the noise section) at the open area of San Lung Tsuen fall within the "Village Type Development" zone on the approved San Tin Outline Zoning Plan No. S/YL-ST/5. Planning permission from the Town Planning Board is required.

Except for several small sections encroaching earth bunds of four fish ponds at Shan Pui within the Wetland Buffer Zone (Fish ponds are actually located within the WSD Reserve and no work will be carried out within the WSD boundary area), most of the sewers alignment will be located underneath existing/future roads.

It has been reminded by PlanD that a rezoning request for OP1/AP1 shall be carried out well in advace before the commencement of the project to the Town Planning Board (TPB) for consideration as the site falls within an area zoned "Conservation Area" (CA). According to the Notes of the OZP, 'sewage pumping station' is neither a Column 1 nor 2 use of the CA zone. Meanwhile, the site also falls within the Wetland Conservation Area (WCA) according to the TPB Guidelines for Application for Developments within Deep Bay Area under section 16 of the Town Planning Ordinacne (TPB PG No. 12B). According to the Guidelines, the planning intention of the WCA is to conserve the ecological value of the fish ponds which form an integral part of the wetland ecosystem in the Deep Bay Area. It comprises the existing and contiguous, active or abandoned fish ponds in the Deep Bay Area, which should all be conserved. New development within the WCA would not be allowed unless it is required to support the conservation of the ecological value of the area or the development is an essential infrastructural project with overriding public interest. Any such development should be supported by an ecological impact assessment during the rezoning request.

The proposed landscaping planting/compensation area at the grassy area of San Pun Pond falls within an area designated for Kam Tin and Yuen Long Drainage Channels on the approved Lau Fau Shan and Tsim Bei Tsui Outline Zoning Plan (OZP) No. S/YL-LFS/5. This area also falls within the Wetland Conservation Area (WCA) according to the Town Planning Board Guidelines for Application for Developments within Deep Bay Area (TPB PG-No. 12B), planning application to the Town Planning Board is also required.

2.4 Preliminary Construction Programme

The tentative schedule to commence the construction works is in mid 2005 and to complete in late 2007.

2.5 Concurrent Projects

The following potential interfacing projects have been identified in the DSD study brief:

- West Rail Projects
- Main Drainage Channels in Yuen Long, Kam Tin, Ngau Tam Mei and San Tin
- Yuen Long Bypass Floodway
- Widening of Yuen Long Highway
- The Planning and Development Study on NWNT
- Deep Bay Link
- Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage I
- Upgrading of San Wai Sewage Treatment Works and Expansion of Ha Tsuen Pumping Station
- Light Rail Expansion in Tin Shui Wai
- Tin Shui Wai Further Development
- Ping Ha Road Improvement – Remaining Works

Other following projects are located within the region but would not contribute cumulative impact:

- Relevant RPIS projects (Based on rezoning and section 16 information from Planning Department, these projects are small (e.g. small village houses) and not closed to the current sites. Therefore, the cumulative impact is insignificant and can be discarded from cumulative impact assessment);
- Fung Lok Wai Development and nearby fish ponds are far away from the site, and only a small section of 50m sewer will be laid at the same time. The potential cumulative impact is minimal (details in the ecological section);
- Northern Link (Planned at 2011 to 2016 that will not be concurrent to this project);
- Regional Express Line (Currently neither solid programme nor concrete planning before implementation of the DSD project. The need for development will depend on future cross-boundary rail passenger growth);

- Hung Shui Kiu Development (Referring to the information from DSD, PlanD and TDD, there is no plan to proceed with the Hung Shui Kiu Development before construction of the DSD project).

The construction programmes and the separation distances of the genuine concurrent projects within the study limit are listed out to identify whether there is any overlapping period (Tables 2.4 & 2.6).

Table 2.4: Interfacing Projects for Package 2A-1T (Tin Shui Wai Area) and Package 2A-3T (Lau Fau Shan Area)

Item	Concurrent Project	Scheduled Construction Period [2]		Overlapping Months	Distance to the site boundary [2]	Potential to Cause Cumulative Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	-	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	-	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	-	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	>500m	×
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	-	×
6	Deep Bay Link (San Wai Section)	Jul 2003	Jun 2006	12	-	✓
	Deep Bay Link (Lau Fau Shan Section)	Jul 2003	Jun 2006	12	>500m	×
7	San Wai Sewerage Treatment Works	2004	2007	30	<300m	✓
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	>500m	×
9	Hung Shui Kiu New Development Area (HSK NDA)	After this project	After this project	0	<300	×
10	Ping Ha Road Improvement Remaining Works	---	2006	6	<300m	✓
11	Alternative 4 Bypass Culvert	2003	2007	18	-	✓
12	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	-	×
13	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1B-2T)	Aug 2004	Feb 2008	30	<300m	✓
14	Tin Shui Wai Further Development	July 1998	2003	0	-	×
15	157DS Phase 3B/3C San Wai and Tung Tau Tsuen	June 2005	June 2007	24	<300m	✓

Note [1]: MDC-Eastern Section is more than 300 m from the present project
[2] The setback distance and construction programme have been provided for genuine concurrent projects only (ie. Both within the study limit and constructed at the same time as the DSD project.)

Table 2.5: Interfacing Projects for Package 2B-2T (Shap Pat Heung Area)

Item	Concurrent Project	Scheduled Construction Period[2]		Overlapping Months	Distance to the site boundary[2]	Potential to Cause Cumulative Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	-	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	-	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	-	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	<500m	✓
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	-	×
6	Deep Bay Link	Jul 2003	Jun 2006	12	>500m	×
7	San Wai Sewerage Treatment Works	2004	2007	30	>500m	×
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	>500m	×
9	Hung Shui Kiu New Development Area (HSK NDA)	After this project	After this project	0	>500m	×
10	Ping Ha Road Improvement Remaining Works	---	2006	6	>500m	×
11	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	-	×

Item	Concurrent Project	Scheduled Construction Period[2]		Overlapping Months	Distance to the site boundary[2]	Potential to Cause Cumulative Impact
		Start	Complete			
12	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1A-1T)	Aug 2003	Feb 2006	8	>500m	×
13	Tin Shui Wai Further Development	July 1998	2003	0	-	×
14	157DS Phase 2 Yuen Long South Pumping Station, Rising Main to Castle Peak Road and Sewers	Jan 2003	May 2006	12	<300m	✓
15	274DS Phase 1 Shap Pat Heung Rising Main and Gravity Sewer; Au Tau Sewage Pumping Station and Ancillary Works	Jan 2003	May 2006	12	<300m	✓
16	274DS Phase 7A/ 7B San Sang Tsuen and Tin Sum, Shan Ha and Tai Tong Tsuen	June 2007	July 2009	6	<300m	✓

Note [1]: MDC-Eastern Section is more than 300 m from the present project
[2] The setback distance and construction programme have been provided for genuine concurrent projects only (ie. Both within the study limit and constructed at the same time as the DSD project.)

Table 2.6: Interfacing Projects for Package 2A-2T and 2B-1T (Ngau Tam Mei Area)

Item	Concurrent Project	Scheduled Construction Period [2]		Overlapping Months	Distance to the site boundary [2]	Potential to Cause Cumulative Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	-	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	-	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	-	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	>500m	×
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	-	×
6	Deep Bay Link	Jul 2003	Jun 2006	12	>500m	×
7	San Wai Sewerage Treatment Works	2004	2007	30	>500m	×
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	>500m	×
9	Hung Shui Kiu New Development Area (HSK NDA)	After this project	After this project	0	>500m	×
10	Ping Ha Road Improvement Remaining Works	---	2006	6	>500m	×
11	Main Drainage Channels and Poldered Village Protection Schemes for San Tin [1]	Jun 2001	Dec 2003	0	-	×
12	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1A-1T)	Aug 2003	Feb 2006	8	< 300m	✓
13	Tin Shui Wai Further Development	July 1998	2003	0	-	×
14	92CD Package NTM1	Nov 2003	Jun 2006	12	>500m	×

Note [1]: MDC-Eastern Section is more than 300 m from the present project
[2] The setback distance and construction programme have been provided for genuine concurrent projects only (ie. Both within the study limit and constructed at the same time as the DSD project).

2.6 Future Planned Use

The works packages 2A-1T and 2A-3T would have interface with the Hung Shui Kiu developments, notably the planned Hung Shui Kiu New Development Area (HSK NDA) and Hung Shui Kiu North New Development Area (HSK North NDA). The issue is further complicated by the revised alignment of Deep Bay Link (DBL) and the potential Easterly Link Road being studied under the DBL D&C Assignment. The corresponding Recommended Outline Development Plans will therefore be subject to further changes, but confirmation and formal approval of these plans would not likely meet the programme of this Study. In view thereof and after some deliberation with DSD, Planning Department (PlanD) and Territory Development Department (TDD), it is suggested that a worst-case land use plan for HSK and HSK North NDAs is to be developed based on best-known information currently available, for assessment purpose of this Study. With reference to the latest information from the "Consultation Digest of the Development Proposals for Hung Shui Kiu Consultation Digest, Planning and Development Study on North West New Territory, 1999", the proposed HSK

Development Plan with incorporation of the latest DBL alignment has been extracted. The use of this plan will have to be agreed by the relevant departments including DSD, PlanD, TDD and EPD (Figure 2.1).

Furthermore, the originally proposed alignment of a section of Yuen Long effluent pipeline may have conflicts with the planned developments in HSK North. One possibility would be to re-align the pipeline along Ping Ha Road instead of through future CDA area. In agreement between DSD, PlanD and TDD, the revised alignment will be further reviewed during detailed design stage by DSD, if necessary.

Based on DSD, PlanD and TDD latest information, the development programme for HSK NDA and HSK North NDA will not conincide with the construction of the DSD project; therefore, there is no cumulative impact during construction phase. With regard to this EIA study, the key concern will be on the potential impacts during the operational phase. Representative Sensitive Receivers for the future planned use has been identified at the worst-case scenario. Nonetheless, these locations are beyond 500m from the site and therefore potential impact during operational phase is not anticipated.

Other planned uses located at San Tin NDA and Tin Shui Wai (rezoning/Section 16 application) have also been reviewed, it is identified that there are other existing sensitive receiver locations closer to the pollution source. Therefore, those existing sensitive receivers were instead selected as the worst-case scenario.

3.0 STUDY OBJECTIVES

This Assignment comprises of 2 studies: an Environmental Impact Assessment Study and a Traffic Impact Assessment Study. The TIA study has been submitted separately for approval. For the EIA study, the objectives are:

- To identify the EIA study area;
- To carry out the necessary background studies to identify, collect and analyse existing information relevant to the EIA Study;
- To carry out any necessary environmental surveys, investigations and baseline monitoring work to achieve the objectives;
- To consider all aspects of the activities arising from the construction and operation of the Project in any stage/phase of implementation. Due consideration should be given to existing and future land-uses and sensitive receivers with reference to relevant Outline Zoning Plans, Outline Development Plans and Recommended Outline Development Plans in the Planning and Development Study on North West New Territories;
- To take into account all relevant existing, committed and planned projects including those related to NDA developments and quantify by use of models or other predictive methods, the residual and cumulative environmental impacts (specifying whether these are transient, long term and/or irreversible), arising from the construction and operation of the Project. Consideration should be given to beneficial and adverse effects, including short and long term, secondary and induced, cumulative, synergistic and transboundary. With respect to the water quality model, the effects of the planned/unplanned discharges into Deep Bay and/or the waters at/near the Outfall at Urmston Road will be addressed;
- To identify all possible and probable causes of overflow discharges from the sewers, rising mains and pumping stations; assess the direct/indirect impacts of such overflow discharges and propose mitigation measures; recommend precautionary measures to prevent the occurrence of overflow discharges and formulate contingency plans for the consideration of the Director's Representative in the event that such overflow discharges occur;
- To conduct qualitative reviews on the individual and cumulative water quality impact in Deep Bay and Urmston Road at various stages of implementation of the YLKTSSD scheme;
- To propose practicable, effective and enforceable methods, measures and standards to effectively mitigate any environmental impacts;
- To outline a programme by which the environmental impacts of the Project can be assessed, monitored and audited;
- To consult Agriculture, Fisheries and Conservation Department and Environmental Protection Department on aspects which will require environmental protection and pollution abatement measures;
- To consult Leisure and Cultural Services Department on aspects which will require cultural protection;
- To consult Planning Department on aspects which will require protection and mitigation measures regarding potential landscape and visual impact associated with the project;
- To recommend cost-effective mitigation measures to eliminate or minimise such identified impacts;
- To carry out the services in accordance with the EIAO Procedures; and
- To identify any major change in design that will cause substantial changes in the key scopes of the EIA study brief during the course of the study.

3.1 Study Scope

3.1.1 Statutory Requirements for Stage 2 Works

The works at the Stage 2 works are a Designated Project under the Environmental Impact Assessment Ordinance (EIAO)[1]. One of the main objectives of this Project is to undertake an EIA study to fulfil the statutory EIAO requirements. EIA report will be prepared to comply with the technical requirements listed in the EIA Study Brief (ESB-082/2001 issued on 21 Sept 2001) and the Technical Memorandum of EIAO.

3.1.2 Scope for Stage 2 Works

With reference to the study brief for Stage 2, the EIA study shall address the following aspects:

- Air quality impact;
- Noise impact;

- Water quality impact;
- Waste management;
- Land contamination implications;
- Ecological impact;
- Landscape and visual impact;
- Impact on cultural heritage;
- Impact on fishery; and
- Environmental Monitoring and Audit (EM&A) requirements.

4.0 AVAILABLE TECHNICAL INFORMATION

A summary of the information reviewed in this EIA study is given in Table 4.1:

Table 4.1: Summary of available information

Description	Completed/ Approved Date
Yuen Long and Kam Tin Sewerage Masterplan Study	Mar 1992
PPFS for Yuen Ling and Kam Tin Sewerage and Sewage Disposal	Jan 1998
Supplementary PPFS for Yuen Ling and Kam Tin Sewerage and Sewage Disposal	Jan 1999
Final Report on Review of Yuen Long and Kam Tin Sewerage and Sewage Treatment Requirements by EPD, Jan 1999	Jan 1999
Development Proposals for Hung Shui Kiu Consultation Digest, Planning and Development Study on North West New Territory	1999
Final Report on 1st Stage of Planning and Development Study on North West New Territories	Sep 2001
Agreement No. CE31/99 (EP), Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage, Final EIA (DE) Report	26 Aug 2002
Agreement No. CE31/99 (EP), Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage, Environmental Study (NDE) Report	Mar 2002
PWP Item 4215DS, Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage II, Package 2A-1T, Yuen Long Effluent Pipeline, Adoptive Review	Sep 2001
Tuen Mun Sewerage, Eastern Coastal Sewerage Extension, Final Environmental Impact Assessment Report	7 June 2000
Agreement No. CE 109/98, Deep Bay Link Investigation and Preliminary Design, Environmental Impact Assessment	13 Sep 2002
Environmental Impact Assessment Study for Upgrading and expansion of San Wai Sewage Treatment Works and Expansion of Ha Tsuen Pumping Station, CE 62/2000	12 May 2003
Outline Zoning Plans	2002/2003

5.0 CONSIDERATIONS ON ALIGNMENT OPTIONS AND ALTERNATIVE PUMPING STATION LOCATIONS

5.1 Consideration on Alternative Alignment (on Designated Element)

For the design of the Yuen Long Effluent pipline, two alignment options have been reviewed. Considerations have been given comprehensively in order to identify the preferred alignment that would achieve an optimal balance between environmental, engineering, connectivity, work programme etc, in accordance with the latest available information.

5.1.1 Conforming Scheme of 2A-1T (Figure 1.4 & Figures 1.4.1 to 1.4.6)

The proposed works under the conforming scheme are divided into six works items. The whole section is 7,350m long of twin rising mains of 1400mm in diameter. Major parts of the sewage alignment (2,140m) and the Yuen Long Effluent Pumping Station will be located within the Deep Bay Buffer Zone, Wetland Conservation Area and Wetland Buffer Area.

5.1.2 Alternative Scheme of 2A-1T (Figure 1.1 & Figures 1.1.5 to 1.1.9)

The proposed works under the alternative scheme are divided into seven works items. The whole section has been reduced to 6,990m long of twin rising mains of 1400mm in diameter. Except for the small-scale Yuen Long Effluent Pumping Station (same SPS location as the Conforming Scheme) on a plantation area, the alignment will run away from the Deep Bay Buffer Zone. This factor, together with other considerations as detailed in Section 5.2, concluded this scheme as the Preferred Option.

5.2 Evaluation of Alignment Options

The evaluation criteria are based on key factors associated with both the environmental impact and engineering constraints, as discussed in the following sections.

The 2A-1T conforming scheme was considered as a "No-built" option, while the 2A-1T alternative scheme was concluded as the preferred option. A summary of the critical factors that dictated the route selection process is given below.

5.2.1 Ecological and Fishery Impacts

For the conforming alignment, rising mains will be laid within Deep Bay Buffer Zone, and some existing fishponds and wetland areas will be run across. Sheet piles will be driven into the ground and excavation and extensive dewatering will be required. The affected fishponds are not isolated, and support moderate bird abundance (see Section 13.3). These fishponds are also feeding habitats of nesting ardeids in the Shing Uk egretry (same as the egretry at the north of Wan Chau Fresh Water Service Reservoir in the EIA study brief). It is anticipated that the construction of rising mains and associated construction haul road will cause significant impact to the environment. In accordance with the Guidelines TPB PG-No. 12B, the planning intention of the WCA is to conserve the ecological value of the fishponds which form an integral part of the wetland ecosystem in the Deep Bay Area. However, a lot of fishponds will need to be resumed/dewatered in order to carry out the construction and subsequent maintenance work. This alignment will cause significant impact on the existing and contiguous, active or abandoned fish ponds in the Deep Bay Area (2,140m of sewer within WCA/WBA with fish ponds). With such a large area of impact, compensation or enhancement by provision of more wetland areas in the area are not feasible. Since such alignment will have detrimental effect the conservation of the ecological value in the WCA, negative disturbance impact and major loss in wetland function, the development will not be allowed. Excessive noise and dust generation from active construction site and haul road would affect wild life within the CA.

The alternative alignment would avoid these fishponds and other impact on the wetland functions; and therefore is preferred.

5.2.2 Landscape Impact

Impacts on Landscape Resources

The Conforming Alignment, at its departure from the alternative scheme at the north east of the pipeline, passes through an area of RAMSAR protected fishponds. The alignment is likely to affect key landscape resources including fishponds; waterways and creeks and reed beds. The sensitivity of these landscape resources is generally high and the residual impact significance is likely to be substantial during the construction phase and moderate during the operational phase, as there will be little opportunity to mitigate impacts.

By contrast, the key landscape resources affected by the Alternative Alignment are groups of trees and fields. These have a medium to low sensitivity to change and residual impacts will not be significant for both the construction and operational phases as these impacts can be mitigated to a significant extent.

Impacts on Landscape Character

The landscape character of the Conforming Alignment is generally an open and simple large-scale landscape of fishponds. The sensitivity to change of this landscape is high and the works will during the construction stage, generally contrast unfavourably with the rural and open character of the landscape. Residual impacts on landscape character are likely to be moderate for the construction phase and slight for the operational phase.

By contrast, the landscape character of the Alternative Alignment is varied, slightly degraded and incoherent as it passes through industrial areas, villages (Shing Uk Tsuen & Tai Tseng Wai) and rural areas. The sensitivity of this landscape is variable, from low to high. This means that the disturbance caused by the Works is unlikely to contrast significantly with existing landscape character. Residual impacts for both the construction and operational phases will be insubstantial.

As identified above, landscape impacts are likely to be consistently higher for the Conforming Alignment than for the Alternative Alignment.

5.2.3 Visual Impact

Impacts on Visual Sensitive Receivers

Visual receivers likely to be affected by the Conforming Alignment (OS3-5) are residential (high sensitivity), occupational (low sensitivity) and travellers (medium sensitivity). The number of these receivers is not very high. They will have partial - full view of the construction works. However, given the indifferent existing character of views across this landscape, residual impacts for both the construction and operational phases are likely to be insubstantial.

Visual receivers affected by the Alternative Alignment (AS5-AS6) will be largely occupational (low sensitivity) and travellers (medium sensitivity). The number of these receivers is few and they will have a partial - full view of the construction works. Again, given the indifferent existing character of views across this landscape, residual impacts for both the construction and operational phases will be insubstantial.

Therefore, visual impacts are likely to be consistently higher for the Conforming Alignment than for the Alternative Alignment.

5.2.4 Cultural Heritage Impact

The conforming alignment will encroach the permitted burial ground YL/64 and there will be potential cultural heritage and Fung Shui impacts. It will also result in impacts on potential archaeological deposits on the lower slopes of the hill to the north of Ng Uk Tsuen.

Alternative scheme was assessed during desk-based research and a field evaluation. The desk-based results indicate the area of the sewer alignment between the historic villages of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen has archaeological potential. Archaeological monitoring is recommended during the construction works. The lower hill slopes at Wang Chau was assessed to have no archaeological potential after a field evaluation was carried out.

5.2.5 Noise Impacts

For the conforming alignment, rising mains will be laid within Deep Bay Buffer Zone with some low rise village houses. Whereas, the alternative alignment will pass through some low-rise residential building next to Yuen Long Industrial estate and potential construction noise impact will be anticipated. With the incorporation of appropriate mitigation measure, the noise impact for both conforming and alternative schemes will be reduced to practically low level. It is anticipated that the noise impact will be similar in magnitude for both schemes.

5.2.6 Air Quality Impacts

For the conforming alignment, rising mains will be laid within Deep Bay Buffer Zone, and dust generated from active construction site and haul roads would affect some low rise village houses. Whereas, the alternative alignment will pass through some low-rise residential building next to Yuen Long Industrial estate. Potential dust impact will be anticipated. With the incorporation of good site practice, dust impact for both conforming and alternative schemes will be reduced to acceptable level. It is anticipated that the dust impact will be similar in magnitude for both schemes.

5.2.7 Waste Management and Land Contamination

For the conforming alignment, the alignment will encroach the Inner Deep Bay Special Measure Zone (SMZO and the length of sewer will be longer and the amount of excavated material will be larger. Whereas, for the alternative alignment, the sewerage will pass through industrial areas, where the possibility of land contamination will be relatively higher. Nonetheless, with a proper waste management plan and proper conformatory testing before treatment, the potential impact on both alignments will be similar.

5.2.8 Resumption of Private Buildings/Lands

For the conforming alignment, resumption of a number of private lots and encroachment upon the permitted burial ground YL/64 will be required for the rising mains. For construction and future maintanance, large-scale area of fish ponds need to be resumed within the WCA and CA. Provision of wetland compensation within the WCA/CA would not be feasible. The time for land resumption will be lengthened and the cost will be higher.

5.2.9 Compatibility with Future Land Use

For the conforming alignment, resumption of a number of private lots and encroachment upon the permitted burial ground YL/64 will be required for the rising mains. There will be potential cultural heritage and Fung Shui impacts. The time for land resumption will be lengthened, and the cost on remediation of environmental impacts will be higher. The alignment of the alternative scheme will be laid along future road, and there is no constraint on future development. Nonetheless, the alignment of the conforming scheme may lay across existing and future planned area. Further land resumption and agreement on land use would be required.

5.2.10 Accessibility

For the conforming alignment, rising mains will be laid within Deep Bay Buffer Zone. Part of the construction site is fallen within the restricted area and special permit is required for entry and construction. The arrangement for access will be more difficult.

5.2.11 Engineering

The proposed works of conforming scheme is 7,350m long of twin rising mains, while that for alternative scheme is 6,990m long. Higher pressure and more energy are required to convey the sewage in the conforming scheme. Septicity problem will be much prominent with a longer length of rising mains. Operating and maintenance costs will also be much higher. Massive dewatering would be required at fishponds during construction; otherwises, future settling and damage to sewer would be anticipated;

5.3 Evaluation Results

In accordance with the arguments discussed above, a summary on the evaluation of the 2 options is given below.

Table 5.1 : Summary of reasoning for route alignment selection

Criteria	Alignment Options (1)	
	Conforming Scheme (Yuen Long Effluent pipline) as the "No-built" Option	Alternative Scheme (Yuen Long Effluent pipline) as the Preferred Option
Environmental Factors Ecology and Fishery	Excessive noise and dust generation from active construction site and haul road would affect wild life within CA; Significant impact with major construction works within Deep Bay Wetland Conservation Area (WCA) and Conservation Area; Affecting feeding habitats of nesting ardeids in the Shing Uk egretry and have detrimental effect the conservation of the ecological value in the WCA; Affecting fish pond and wetland and have negative disturbance impact and major loss in wetland function.	Minor impact with only YLEPS (on a urbanized/ disturbed land) within the Deep Bay WCA; In accordance with the ecological assessment, there will be no residual impact and there is no net loss in wetland function.
Landscape resources/character	High impact with significant portion of construction works within RAMSAR protected fishponds; Sensitivity of the landscape resources is high but little opportunity to mitigate; Sensitivity to change on landscape character is high and unfavourable.	Only affect groups of trees and fields; Residual impact will not be significant; The landscape character varies and the residual impact will be insubstantial
Visual resources/character	Affected receivers will be from high sensitivity to low sensitivity; Indifferent existing character of views and the residual impact are insubstantial.	Affected receivers will be from medium sensitivity to low sensitivity; Indifferent existing character of views and the residual impact are insubstantial.
Heritage Buildings	Some impact on the permitted burial ground YL/64; Potential Fung Shui impact; Potential impact on archaeological deposits on the lower hill slopes at the north of Ng Uk Tsuen	Potential impact needs to be further confirmed by archaeological monitoring; Desktop study indicated the area of the sewer alignment between the historic villages of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen has archaeological potential. Archaeological monitoring is recommended during the construction works.
Waste generation & contaminated sediment	No impact with proper waste management plan and contaminated land treatment.	No impact with proper waste management plan and contaminated land treatment.
Noise	Short term localized construction noise impact; Residual impact after mitigation at some NSRs	Short term localized construction noise impact; Residual impact after mitigation at some NSRs
Air Quality	No major impact at ASR with good site practice and controlled requirement under APCO.	No major impact at ASR with good site practice and controlled requirement under APCO.
Other Factors		
Land/Building resumption	For construction and future maintanance, large-scale area of fish ponds need to be resumed within the WCA and CA; Provision of wetland compensation within the WCA/CA would not be feasible; Resumption of public lots; Longer time for land resumption.	Not required
Compatibility with Future Land Use	Potential impact; Encroachment on burial ground YL/64; The land use in NDA and alignment to be further confirmed with various department.	No impact; Alignment has already taken into account in the future NDA developments.
Accessibility	Area within restricted area and special permit is required; Poor accessibility with construction of haul road within Buffer Zone	No problem
Engineering	Massive dewatering is required at fishponds; otherwises, future settling and damage of sewer would be anticipated; Higher construction and operating cost; Septicity problem for longer rising mains.	Less construction and operating cost.

Results indicate that there are negative distubance impact and will have detrimental effect on the Wetland fuction of the conforming scheme in both environmental and engineering considerations. Since the major part of the alignment will be fallen within the Deep Bay Buffer Zone where resumption of a large area of fish pond

is anticipated. The integral part of the wetland ecosystem in the Deep Bay Areas, including the existing and contiguous, active or or abandoned fish ponds, will have severely detrimental impacts and is considered as a "No-built" Option. Comparison has been made with the alternative scheme of 2A-1T, and it is found that with the provision of mitigation measures, there is no major environmental impact and therefore selected as the preferred option for further focused assessment.

5.4 Consideration on Alternative Pumping Station Locations

5.4.1 Alternative Sites for YLEPS (Designated Element)

For the selection of the Yuen Long Effluent pumping station, three alternative sites have been investigated in the vicinity of YLSTW (Appendix 5.1). DSD has therefore conducted a detailed utility search, ground review and engineering investigations on the alternative sites and other nearby areas. The following observations were made by DSD during the planning stage:

- The proposed size of YLEPS is confirmed to be the minimum requirements for construction, operation and maintenance purposes.
- The Wetland Conservation Area (WCA) is located on three sides (N, E and W) of YL Sewage Treatment Plant (YLSTW). There is limited land to house the future YLEPS.
- On the west side of the YLSTW, the topograph (hill) is higher than the STW and natural gravity flow of effluent is impossible. In addition, the hill is a local permitted burial ground. Therefore, siting of YL Effluent Pumping Station on the west side is not engineering feasible.
- On the east side, it is the Shan Pui River, both the river and the adjoining undisturbed fishpond at the C.A will be affected during construction and operational phase. The impact will be significant.
- For Option 2 (existing public car park in the Yuen Long Industrial Estate), based on the existing utility record and available space of YLSTW, it is observed that apart from the 3.5m wide carriageway, there is no other available space within YLSTW large enough to accommodate the 1.8m diameter gravity sewer conveying the treated effluent from the discharge outfall of YLSTW to the YLEPS. To make sufficient space for the gravity sewer within the 3.5m wide carriageway which is congested with existing underground utilities (DN450 gravity sewers, DN375 storm water drains and their associated manholes), diversion of the utilities must be required leading to substantial modification works to YLSTW. It will interrupt the treatment process and disturb the normal operation of YLSTW. In addition, the proposed gravity sewer has to be laid at depths of about 7m to achieve gravity flow. Deep sewer will make the future inspection and maintenance difficult and increase the risk of damaging nearby structures/utilities within YLSTW. Therefore, DSD considers this option is a "No-built" option because of the extreme engineering constraint. However, there is also objection from the management agency of the Option 2 site.
- For Option 3 (100m south of YLSTW), the exact route within the YLSTW as option 2 will be followed. Based on the same considerations, DSD also considers this option is a "No-built" option because of the extreme engineering constraints.
- Other vacant areas in the YL Industrial Estate are too far away, and natural gravity flow design is impossible. The utility within the area is also not avoidable. Therefore, it is not considered engineering feasible.
- For Option 1 (current selected location), the site was originally recommended in the Yuen Long and Kam Tin Sewerage Master Plan published by EPD in 1992 and its subreview in 1999. The current land status of the site is Government land and resumption of private land lots is not required. Based on the existing utility record of YLSTW, no major underground utilties in the vicinity of the proposed 1.8m gravity sewer conveying the treated effluent from the discharge outfall of YLSTW to the YLEPS, substantial modification works to YLSTW resulting from diversion of utilities will not be required. In addition, the site was filled up many years ago. Currently, there are only few immature plantations in the area. The future YLEPS is a minor encroachment of the "disturbed urbanised land" within the WCA. The sewer will be laid underneath existing road or earth bund of fish ponds, of which the construction works will be temporary in nature. Based on the detailed EIA findings on ecological, landscaping, visual and other aspects, there is no significant residual impact on the environment.
- In short, judging from the respective pros and cons of the three options as well as the surrounding site conditions as mentioned above, Option 1 is the most preferable and viable site option for the YLEPS from engineering, environmental and land points of view.

Detailed engineering justifications, maintenance problems and supportive reasoning have been sent to relevant authorities to justify Option 1 (the current design) is the only feasible option. Other options, including Options 2 and 3 are technically/engineering infeasible. The correspondences are listed in Appendix 5.1 for reference.

5.4.2 Alternative Sites for San Lung Tsuen SPS (Non-Designated Element)

For the selection of the San Lung Tsuen pumping station, DSD has conducted a detailed utility search, ground review and engineering investigations on the site. The following considerations were made for selecting a pumping station and rising mains systems:

- Under the review of PWP Item No. 4215DS, sewege generated from the San Tin catchment area should be conveyed to the proposed trunk sewer located downstream at Castle Peak Road;
- The topographical levels at the Castle Peak Road and the catchment area are in the range of +9.4mPD and +4.0mPD. Therefore, if gravity sewer system is adopted, construction of deep sewer at depth of 7m below ground level will be required;
- All the nearby villages are limited in space. Therefore, deep sewers will make the construction as well as future inspection and maintenance difficult and increase the risk of damaging nearby village houses/utilities/structures;
- Other villages in this catchment are also packed with village houses. Isolated ancestral halls or declared momument can be found in most villages, and are unavoidable in terms of engineering design;
- Deep sewers construction will be timely and costly. Long construction period will also cause inconvenience to the local villagers;
- Pumping station with pressure mains at shallow depths is considered necessary in engineering terms; and
- San Lung Tsuen is located at the centre of the catchment area, and therefore is the most preferable site. The connecting upstream gravity sewers collecting sewage directly from village houses to the pumping station can be made as shallow as possible.

Two sites for the San Lung Tsuen SPS had been proposed by DSD for initial engineering consideration (Figure 5.1). However, owing to the fact that the land is a private site and there is currently a new building development under construction, this proposal for alternative site had been discarded. No other vacant site can be found in the nearby area. The current site is selected in accordance with the following justifications:

- The selected site is large enough to accommodate the pumping station and is located at the centre of the catchment area;
- The site is free from major underground utilities (rediversion of utilities will cause inconvenience to the villager);
- The pumping station (P4) will be located behind a public toilet and next to an existing electricity transformer station. Screening by existing structures is anticipated;
- All construction equipment and construction vehicles will be parked outside the village. This parking area will be more than 150-200m away from the pumping station;
- Owing to the narrow access road, sewer will only be laid in a small section. Small-scale hand-digging method will be applied to lay the sewer within the village. Care will be taken to avoid any potential damage to any Declared Monument;
- Prefabrication works can be used to reduce the construction work of pumping station;
- Landscaping/planting or textual improvement have been proposed to reduce the visual impact;
- For works located closed to temple and ancestral halls, a condition survey will be carried out in advance of works and a report compiled and submitted to AMO for approval; and
- As discussed in later sections, there will be no adverse cultural heritage and other environmental impacts on the current site selection.

The correspondences are listed in Appendix 5.2 for reference.

6.0 CONSTRUCTION PHASE AIR QUALITY ASSESSMENT

6.1 Legislation and Standards

Stage 2 works are assessed in accordance with the following relevant environmental legislations, guidelines and references:

** Study Brief for EIA study for Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2;*
** Hong Kong Planning Standards and Guidelines (HKPSG)[21];*
** Air Pollution Control Ordinance (APCO)[2];*
** Air Pollution Control (Construction Dust) Regulation[5].*

6.1.1 Construction Dust Regulation

For construction dust impact, reference should be made to the Air Pollution Control (Construction Dust) Regulation, TM-EIAO and EPD Pollution Control Clauses for Construction Contract[3]. An hourly averaged Total Suspended Particulate (TSP) concentration of 500μg/m^3 measured at 298K and 101.325kPa should not be exceeded.

6.2 Baseline Environmental Conditions

EPD has been conducting TSP (dust) monitoring in Yuen Long area for several years using High Volume Samplers. The recent monitoring results for Year 2000 show the annual average TSP concentration at 95μg/m^3 and the 24-hour average at 288 μg/m^3. Both results exceeded the annual AQOs of 80μg/m^3 and 24-hour AQO of 260μg/m^3, respectively[2].

6.3 Air Sensitive Receivers (ASRs)

ASRs are identified in accordance with TM-EIAO. The worst affected ASRs during the construction phase of the proposed works have been considered. The landuses in the vicinity of the proposed works include schools and residential developments. The locations of ASRs are shown in Figures 6.1 to 6.3, and a comprehensive list of the key representative ASRs for construction dust review in Appendix 6.1.

6.4 Potential Sources for Dust Impact

In general, construction dust sources will be generated from the following activities:

- Materials handling;
- Wind erosion of stockpiles;
- Truck movements on any unpaved road;
- Excavation and backfilling of soil for site formation and trenching;
- Stockpiling of excavated materials;
- Foundation works for Sewage Pumping Station (SPS)
- Civil construction and E&M installation of SPS

6.5 Cumulative Dust Impact

Based on the latest information from studies of nearby projects, active areas of these sites will be small. In addition, the separation from the large-scale active construction projects are far away and proper mitigation measures had been proposed in their EIA studies, as a result, miminal cumulative impact from the nearby construction works is therefore anticipated. Respective project specific EM&A manual and monitoring requirements had been stipulated for these major infrastructure projects. The respective Contractor will be responsible for the ultimate construction method and construction plants, proper mitigation measures and event/action plan for implementation of the effectiveness of dust control measurement. With the continual monitoring and review of dust impact in the area, cumulative impact would not be anticipated.

6.6 Construction Dust Impact Review

Similar to the previous EIA report (Designated Project) on CE31/99 "Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1", the sewer and rising mains will be constructed in 50m segments. With such small scale of construction works, the potential dust impact would be limited and short term in nature. Regarding the

sewage pumping stations, most part of the structures will be constructed underground while the pumping station building will be about 1-storey above ground level. Similar to other pumping stations in HK, the sizes of SPS are relatively small (except YLEPS – but with a great setback distance to ASR). Scaffolding with effective dust screens, sheeting or netting and automatic water spraying equipment shall be erected around the perimeter of the building during construction. It is anticipated that the enclosed scaffolding can effectively minimize dust impact from the pumping station. All the construction works are controlled under the Air Pollution Control (Construction Dust) Regulation [5], and appropriate pollution control clauses will be implemented in the contract documentation. With good site practices and proper precautionary measures, dust impact would be maintained within the criteria.

6.7 Mitigation Measures during Construction Phase

With the implementation of the following the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation, the potential dust impact can be reduced to acceptable level:

- The work programme will be staggered and the active work area will be limited to 50m segments in order to avoid cumulative impact from any nearby concurrent construction site;
- Where a scaffolding is erected around the perimeter of a building under construction, effective dust screens, sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the pumping station;
- Automatic waterspraying system should be provided on the top of the building structure/scaffolding of SPS if there is nearby sensitive receivers within 15m;
- Use of side enclosure and covering of any aggregate or dusty material storage to reduce emission. Where it is impracticable owing to frequent access and usage, watering should be adopted to reduce the fugitive emission. Open stockpiles should be avoided, covered or placed far away from sensitive receivers;
- Use of movable wind shield close to the site and air sensitive receiver;
- Every vehicle should be washed to remove any dusty materials from its body and wheels immediately before leaving a construction site;
- Use of speed control for vehicles on dusty site area.
- All dusty materials on the transport vehicle should be covered entirely with tarpaulin to ensure that the dusty materials do not disperse from the vehicle;
- Water should be continuously sprayed on the surface at where mechanical breaking operation that causes dust emission is being carried out, unless the process is accompanied by the operation of an effective dust extraction and filtering device;
- The working area of excavation should be sprayed with water immediately before, during and immediately after the operation so as to maintain the entire surface wet; and
- To exercise an effective EM&A monitoring works in order to ensure the dust suppression measures are effective, and that the event action plan is properly executed.

7.0 OPERATIONAL PHASE AIR QUALITY ASSESSMENT

7.1 Odour Impact Regulation

Sewage will be transferred within an enclosed system, and there is no pollution source from the operation of sewers and rising mains.

Odour impact would be a potential concern for Sewage Pumping Stations (SPS). For Designated Elements, an odour level criterion of 5 OU applies to Air Sensitive Receiver (ASR) in accordance with Annex 4 of TM-EIAO[4]. The odour level criterion at ASR is assessed on a 5-second averaging time.

7.2 Baseline Environmental Conditions

There is no EPD odour monitoring stations and background information is not available. In addition, it is understood that there is currently no odour-monitoring programme on the existing SPS and STWs within the study area; therefore, ambient data and cumulative impact information are not available.

7.3 Air Sensitive Receivers (ASRs)

Representative ASRs within 500m from the improvement works were identified. The assessment will focus on the nearest ASRs that may be affected by the proposed works. With regard to the EIA, the focus will be on the odour impact during operational phase. Representative Air Sensitive Receivers (ASR) for the existing and future planned use will be selected to assess the worst-case scenario (Figures 6.1 to 6.3). A summary of these ASRs is given Appendix 7.2.

7.4 Septicity

Septicity in a sewerage system will result from the activity of bacteria, growing in sewage and on submerged surfaces which, under anaerobic conditions, reduce sulphur-containing organic compounds and sulphates to form sulphides and other malodorous sulphur compounds. This situation will occur where there is inadequate ventilation and sewage re-aeration to prevent anaerobic conditions developing, and is frequently found when completely-filled sewers out of contact with the atmosphere are being pumped up. Prevention of septicity can be achieved by maintaining aerobic conditions by aeration, oxygenation or addition of nitrates. Provision of oxygen (dissolved or as nitrate) will satisfy BOD and result in partial treatment of sewage which may have a significant economic benefit on the subsequent cost of sewage treatment at the receiving works.

Lack of adequate ventilation, low velocity of sewage in small diameter rising mains, and high temperature and BOD of sewage, will inevitably result in septicity which in turns cause odour nuisance where septic sewage is exposed to the atmosphere.
Septicity can be contained or prevented by the following:

- An adequate supply of oxygen (either dissolved or chemically available as nitrate or peroxide);
- The use of metal cations (such as iron salts) to precipitate sulphide;
- Deodorizing vented air through suitable filters;
- The use of protective coatings applied during construction of concrete structures; or
- Providing adequate ventilation to reduce humidity and to achieve dilution; and
- Using corrosion-resistant materials for construction of sewers, manholes and fittings.

In the context of this EIA study, the EIAO study brief stipulates control of odour impact to the nearby environment. The enclosures and the provision of suitable odour removal filters, as mitigation measures are carefully considered in the assessment. The engineering design is taken up by DSD.

7.5 Potential Sources of Odour Impact

The potential sources of odour impact during operation of SPS are as follows:

- Wet wells; and
- Screening collection areas.

Screenings will be removed from the pumping stations throughout operation and maintenance. A removal frequency of 1-2 times per week is common but otherwise dependent upon the quantity of screenings collected during the initial period of operation. Also, under typical operational procedure, these screenings will be stored and transported in a covered container, and the transfer process will be confined within the pump house. Similar to general refuse, screenings will be transported and disposed of by licensed collector. Since the SPS building structure is enclosed, the generation rate of screening will be small with the provisions of a mechanical ventilating system, odour impact from screening will not be significant.

Air relief valves will be installed along the rising mains. These valves will be placed inside manholes at underground confined spaces. Covers of manholes will be constructed of heavy-duty metal and sealed with watertight sealent. Since the air relief valves is designed for safety purposes during extreme pressure changes, odour release from the valve will be very small in quantity and temporary in nature. It is anticipated that the potential odour impact will be insignificant and can be disregarded in the assessment.

7.6 Establishment of Odour Emission Rate

Among the many potential odour sources within any sewerage system, hydrogen sulphide (H_2S) is the most commonly known and prevalent odorous gas. In this regard the concentration of H_2S will be employed as a representative odour indicator for odour modelling.

The Pomeroy's equation as stated in the "Design Manual: Odour and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants (1985), USEPA [80]," will be adopted:

$$flux_{H2S} = \{0.69 * (s * u)^{3/8} * j * [DS]\}$$

where
$flux_{H2S}$ = H_2S emission flux from surface, g/m^2-hr
s = slope of the energy grade line of the stream or total energy head gradient, m/m
u = sewage velocity, m/s
j = proportion of dissolved sulphide present as H_2S. Values of 0.1 at pH 7.8 and 0.06 at pH 8.2 are applied based on the Pomeroy's equation with measured temperature at 35^{o}C Acidities were measured at pH 7.8 for the discharge treated effluent and pH 8.2 for the inlet raw sewage (worst case information from DSD ver Mar 04).
[DS] = dissolved sulphide concentration in the wastewater, mg/L.

These parameters were measured on 22 May 03 and analysed by an accredited laboratory appointed by YLSTW of DSD. Based on the latest released statistical data on sewage volume, temperature and sewage nature for the last year (ver Mar 04), the results including concentration of dissolved sulphide in the wastewater have been confirmed by DSD as the representative worst case scenario and is used for the odour assessment. In view of the industrial reform in the last decade, it is confirmed by DSD that the nature of effluent collected in YLSTW is mainly domestic in nature for the entire catchment area. With a similar geological condition and development nature in the New Territories North region, it is estimated that the sewage strength and nature at the existing YLSTW will be similar to that in other SPS under study. Based on the Pomeroy's equation, the dissociated equilibria for hydrogen sulphide in aqueous solution are also not sensistive to temperature change. Therefore, the measured dissolved sulphide concentration in YLSTW is considered as the best available information for the odour assessment of the SPS. These assumptions have been agreed with DSD based on the long-term operational experience. These data are listed in Table 7.1 for reference:

Table 7.1: Measured soluble sulphide concentrations at YLSTW (worst-case of a.m. and p.m. data)

Measured locations	Dissolved sulphide concentration in wastewater, mg/L [(1)]	pH [(2)]
Inlet works (before the screw pump)	0.112	8.2
Final sedimentation tank (connected to the discharge point)	0.026	7.8

Remark: [(1)] Measured temperature at 32 to 35^{o}C
[(2)] Acidity of pH 7.8 was measured at outlet treated effluent & 8.2 at inlet raw sewage (reconfirmed by DSD as worst case during the last year measurement, ver Mar 04)

7.7 Establishment of Ventilation Effect

In order to take account of the dilution effect of the ventilation system, the following equation is applied (same equation adopted in the CE62/2000, EIA Study for Upgrading and Expansion of San Wai Sewage Treatment Works and Expansion of Ha Tsuen Pumping Station):

Concentration of H_2S vented from the SPS = ($flux_{H2S}$ * surface areas of inlet channels and wet well on plan)/ (total room volume x Air Change Rate)

As recommended in the Sewerage Manual [80] and subsequently reviewed by DSD in the previous Working Paper, a typical air change rate of 15ACH is adopted for SPS in the HKSAR.

7.8 Estimation of Odour Emission Strength

The volumes and H_2S emission fluxes of wet/submerged well and inlet/screening room of SPS were estimated from engineering drawings and are shown in Table 7.2.

Table 7.2: Air volumes of various pumping stations

Works Package	Works Item	Location	Air Volume, chamber and well (m^3)	H_2S Emission Rate, µg/s, from chamber and well (without air ventilation and filters) (2)
Tin Shui Wai and San Wai Areas				
2A-1T	OP1	Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station)	5864.2 (1)	2.808E+2
Tin Shui Wai and San Wai Areas				
Alternative scheme of 2A-1T	AP1	Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station)	5864.2 (1)	2.808E+2
Ngau Tam Mei and San Tin Areas				
2A-2T and 2B-1T	P1	Ngau Tam Mei sewage pumping station	1471.17	1.918E+2
	P2	Tam Mei Barracks sewage pumping station (Tam Mei Camp Sewage Pumping Station)	696.21	3.535E+1
	P3	San Tin sewage pumping station	1017.45	1.268E+2
	P4	San Lung Tsuen sewage pumping station	753.98	3.806E+1
	P5	San Tin Barracks sewage pumping station (Cassino Line Sewage Pumping Station)	350.2	1.77E+1
Lau Fau Shan and Mong Tseng Areas				
2A-3T	A1	Lau Fau Shan sewage pumping station	350.2	1.77E+1
	A2	Mong Tseng sewage pumping station	721.68	3.652E+1
Shap Pat Heung Area				
2B-2T	B1	Shan Ha Tsuen sewage pumping station	721.68	3.652E+1
	B2	Muk Kiu Tau Tsuen sewage pumping station	721.68	3.652E+1
	B3	Sham Chung Tsuen sewage pumping station	350.2	1.77E+1
	B4	Shui Tsiu San Tsuen sewage pumping station	350.2	1.77E+1
	B5	Shung Ching San Tsuen sewage pumping station	350.2	1.77E+1
	B6	Nga Yiu Tau sewage pumping station	350.2	1.77E+1
	B7	Pak Sha Tsuen sewage pumping station	350.2	1.77E+1

Remark: (1) The functional area of the inlet chambers have been reduced in latest design (Feb 04 version)
(2) H_2S emission rates are estimated based on the latest released operating parameters from YLSTW (version Feb 04)

As recommended in the "EPD's Guidelines on Choice of Models and Model Parameters [81]", odour dispersion modelling was undertaken using the ISCST3 model. An averaging time of 1-hour was adopted as the worst-case scenario assessment. This 1-hr averaged value was then converted to 3-min averaged value in accordance with a stability dependent power law relationship[12] as follows:

$$X_l = X_s(t_s / t_l)^P$$

where X_l = concentration for the longer time averaging time;
X_s = concentration for the shorter time averaging time;
t_s= shorter averaging time;
t_l = longer averaging time;
P = power law exponent (Stability Class A: 0.5, B: 0.5, C: 0.333, D: 0.2, E:0.167, F: 0.167)

The 3-min averaged value was then converted to a 5-second averaged value, in response to the requirement of the odour level criterion. Reference [13] suggests that typical maximum or peak 5 second averaged concentrations within any 3-minute period appear to be of the order of 5 times the 3-min average and during very unstable conditions, larger ratios of perhaps 10:1 are more appropriate. Table 7.3 shows the conversion factors applied to determine the 5-second value under different stability classes.

Table 7.3: Multiplying factors for odour assessment

Atmospheric Stability Class	Conversion Factor from 1 hour to 3 min	Conversion Factor from 3 min to 5s	Overall Conversion from 1 hr to 5s
A	4.47	10	44.7
B	4.47	10	44.7
C	2.71	5	13.6
D	1.82	5	9.1
E	1.65	5	8.25
F	1.65	5	8.25

The USEPA regulatory default settings were selected for the model runs. The rural mode dispersion option was adopted to take account of the topography of the study area. Each SPS is assumed a point source location with the exhaust height taken at its roof. Typical exhaust velocities are estimated from similar existing SPS. The exhaust lourve areas and velocities of various SPS are listed in Table 7.4. Wind data from the nearest weather station, Lau Fau Shan Automatic Weather Station and mixing height data from King's Park weather station were considered the best available data set for the analysis. A continuous 3-year meteorological data sets from Yr 1999 to 2001 have been adopted for assessment following examples of other DSD studies including EIA study for Wan Chai East and North Point Sewerage and EIA study for Ngong Ping Sewage Treatment Works and Sewerage.

Table 7.4: Exhaust grille areas and exhaust velocities of various pumping stations (inlet and wet well)

Works Package	Works Item	Location	Exhaust Air Volume of inlet and wetwell with 15ACH (m^3/s)	Total Exhaust Grille Area/ Stack diameter [(1)] (m^2)	Exhaust Vel (m/s) [(2)] / Stack Height [(3)] (m)
Tin Shui Wai and San Wai Areas					
2A-1T	OP1	Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station)	24.434 [(4)]	3.054 / 1.972	8 / 8
Tin Shui Wai and San Wai Areas					
Alternative scheme of 2A-1T	AP1	Pumping station in the north of YLSTW (Yuen Long Effluent Pumping Station)	24.434 [(4)]	3.054 / 1.972	8 / 8
Ngau Tam Mei and San Tin Areas					
2A-2T and 2B-1T	P1	Ngau Tam Mei sewage pumping station	6.130	0.766 / 0.988	8 / 8
	P2	Tam Mei Barracks sewage pumping station (Tam Mei Camp Sewage Pumping Station)	2.901	0.363 / 0.679	8 / 4.1
	P3	San Tin sewage pumping station	4.239	0.530 / 0.821	8 / 7
	P4	San Lung Tsuen sewage pumping station	3.142	0.393 / 0.707	8 / 4.1
	P5	San Tin Barracks sewage pumping station (Cassino Line Sewage Pumping Station)	1.459	0.182 / 0.482	8 / 4.1
Lau Fau Shan and Mong Tseng Areas					
2A-3T	A1	Lau Fau Shan sewage pumping station	1.459	0.182 / 0.482	8 / 4.1
	A2	Mong Tseng sewage pumping station	3.007	0.376 / 0.692	8 / 4.1
Shap Pat Heung Area					
2B-2T	B1	Shan Ha Tsuen sewage pumping station	3.007	0.376 / 0.692	8 / 4.1
	B2	Muk Kiu Tau Tsuen sewage pumping station	3.007	0.376 / 0.692	8 / 4.1
	B3	Sham Chung Tsuen sewage pumping station	1.459	0.182 / 0.482	8 / 4.1
	B4	Shui Tsiu San Tsuen sewage pumping station	1.459	0.182 / 0.482	8 / 4.1
	B5	Shung Ching San Tsuen sewage pumping station	1.459	0.182 / 0.482	8 / 4.1
	B6	Nga Yiu Tau sewage pumping station	1.459	0.182 / 0.482	8 / 4.1
	B7	Pak Sha Tsuen sewage pumping station	1.459	0.182 / 0.482	8 / 4.1

Remark: [(1)] Assuming point source in the ISCST model (Circular stack area)
[(2)] Exhaust air vel of 8m/s as extracted from similar pumping station at Ha Tsuen PS
[(3)] The emission stack is assumed to be on the roof of the pumping station
[(4)] The functional area of the inlet chambers have been reduced in latest design (Feb 04 version)

Assessments were conducted at 1.5m, 5m, 10m, 15m, 20m, 25m and 30m (40m for the 2A-1T package) above ground. Contours were produced at the level of maximum concentration during the worst-case year.

In accordance with the "Environmental Guidance Note for Sewage Pumping Station which is Not a Designated Project, EPD[14]", an established odour threshold correlation factor of 1 Odour Unit (OU) is equivalent to 0.66μg/m^3 H_2S for conversion.

YLEPS will convey treated effluent with minimal odourous substances, and the setback distance from the nearest ASR is more than 400m. Since a standard odour removal filter system with an efficiency of not less than 99.5% will also be adopted, contribution from the pumping station is minimal. Direct comparision has been made with other SPS conveying odourous raw sewage with far less setback distance (less than 100m) to the ASR, provision of such standard odour removel filter has been proven to be an effective precaustionary measures. No odour impact was anticipated even for ASR with much shorter setback distance. These examples included Designated Projects of Yuen Long South SPS and Au Tau SPS.

Based on the survey record, there is no major STW within 500m from P1 pumping station, and therefore, the cumulative impact will be minimal.

It was understood from DSD that except for Tam Mei Barrack STW and Yuen Long South SPS, there was no other sewage treatment plant and pumping station within 500m of the pumping stations of this project. Several site inspections conducted between April 2002 and Jan 2003 also confirmed the same. Table 7.5 provides a summary of potential cumulative background sources to the sewage pumping station.

Table 7.5: Cumulative background sources

Works Package	Works Item	Location	Remark
Tin Shui Wai and San Wai Areas			
2A-1T	OP1	Yuen Long Effluent Pumping Station (Designated Element)	The YLEPS is not a potential odour source since treated sewer will be conveyed and the nearest ASR is mor e than 400m away.
Tin Shui Wai and San Wai Areas			
Alternative scheme of 2A-1T	AP1	Yuen Long Effluent Pumping Station (Designated Element)	The YLEPS is not a potential odour source since treated sewer will be conveyed and the nearest ASR is mor e than 400m away.
Ngau Tam Mei and San Tin Areas			
2A-2T and 2B-1T	P1	Ngau Tam Mei sewage pumping station (Designated Element)	No cumulative source, 0 OU cumulative background
	P2	Tam Mei Barracks sewage pumping station (Tam Mei Camp Sewage Pumping Station)	Cumulative source: Tam Mei Barracks STW serves only a small number of PRC soldiers, and there is a future plan to phase out this STW. Cumulative impact, if any would be minor and short term [1]
	P3	San Tin sewage pumping station	No cumulative source, 0 OU cumulative background
	P4	San Lung Tsuen sewage pumping station	No cumulative source, 0 OU cumulative background
	P5	San Tin Barracks sewage pumping station (Cassino Line Sewage Pumping Station)	No cumulative source, 0 OU cumulative background
Lau Fau Shan and Mong Tseng Areas			
2A-3T	A1	Lau Fau Shan sewage pumping station	No cumulative source, 0 OU cumulative background
	A2	Mong Tseng sewage pumping station	No cumulative source, 0 OU cumulative background
Shap Pat Heung Area			
2B-2T	B1	Shan Ha Tsuen sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]
	B2	Muk Kiu Tau Tsuen sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]
	B3	Sham Chung Tsuen sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]
	B4	Shui Tsiu San Tsuen sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]
	B5	Shung Ching San Tsuen sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]
	B6	Nga Yiu Tau sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]
2B-2T	B7	Pak Sha Tsuen sewage pumping station	Cumulative source: Yuen Long South SPS, cumulative background has been incorporated [2]

Remark: [1] DSD advised that there is a long term plan to divert the sewage from Tam Mei Barrack to YLSTW. In future, Tam Mei Barracks STW will be decommissioned and any cumulative odour impact would be minor and short term.

[2] A filtering system with a H2S removal efficiency of not less than 99.5% has been incorporated in the DSD specification for the Yuen Long South SPS. (Appendix 7.2)

7.9 Odour Assessment Results

Assessments have been conducted for Yr 1999 to Yr 2001 and Yr 2001 is identified as the worst-case scenario. The emission rate calculation sheet is attached in Appendix 7.3 for reference. Detailed results are given in Appendix 7.4. Based on the assessment findings, the required odour removal efficiency is recommended to minimize any potential impact on the ASRs. Odour contours are presented for the general dispersion pattern.

7.9.1 Tin Shui Wai and San Wai Areas (Alternative 2A-1T)

The YLEPS (OP1/AP1) is designed to convey the treated effluent (effluent with minimal odourous substances) to the San Wai STW. In addition, the distance from the nearest sensitive receiver to YLEPS is more than 400m. With the provision of the best available odour filter with a removal efficient of not less than 99.5%, the maximum odour concentration would be reduced to 0.016OU which represents only 0.3% of the criterion. This small level of odour is hard to detect by human nose. The odour contour for the YLEPS at the nearest ASR under the worst-case scenario (25m above ground level) is presented in Figure 7.1.

Comparison had also been made with other Designated Projects on SPS conveying odourous raw sewage, and the odour level at 400m was insignificant with the provision of the same standard odour removal filter. Therefore, these findings have reconfirmed that the odour discharge from YLEPS is insignificant, and therefore concluded YLEPS is not a potential odour source.

7.9.2 Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

Results indicated that the odour concentrations at some ASRs would exceed the odour criterion under the "Without odour control measures" scenario. Therefore, odour removal filtering system with not less than 99.5% H_2S removal efficient will be included as a control measure. This type of filtering system has been adopted in some planned SPS, such as Yuen Long South SPS. With this measure, the maximum odour concentration at the ASRs would be reduced to 0.093OU which is 1.9% of the criterion. The odour contour for worst-case scenario (20m above ground level) is presented in Figures 7.2a to 7.2e.

7.9.3 Lau Fau Shan and Mong Tsuen Areas (2A-3T)

Results indicated that the odour concentrations at some ASRs would exceed the odour criterion under the "Without odour control measures" scenario. Therefore, odour removal filtering system with not less than 95% H_2S removal efficient will be included as a control measure. This type of filtering system has been commonly adopted in existing SPS. With this measure, the maximum odour concentration at the ASRs would be reduced to 0.32OU which is 6.4% of the criterion. The odour contour for the worst-case scenario (20m above local ground) is presents in Figures 7.3a & 7.3b.

7.9.4 Shap Pat Heung Area (2B-2T)

Results indicated that there would be potential exceedance of odour impact at some representative ASRs under the "Without odour control measures" scenario. Therefore, odour removal filtering system with not less than 95% H_2S removal efficient will be included as a control measure. This type of filtering system has been commonly adopted in existing SPS. With this measure, the maximum odour concentration at the ASRs would be reduced to 0.504OU which is 10.1% of the criterion including cumulative background odour level from Yuen Long South PS. The odour contour for the worst-case scenario (15m above ground level) is presented in Figures 7.4a to 7.4g.

7.10 Precautionary Measures during Emergency Discharge

During operational phase, temporary odour nuisance as a result of pumping station failure, repairing and maintenance of pressurized sewers may be experienced. Under these circumstances, raw sewer will be overflown from the emergency discharge and enters the nearby water body where ASRs are identified. The following precautionary measures are recommended to minimize the potential odour impact:

- Hand-cleaned screens should be provided at the overflow bypass to prevent the discharge of floating solids into receiving water bodies;
- In case the weather condition is very stagnant with very low dispersion effect, deodorization with oxidants, such as sodium hydroxide, chlorine solution and sodium hypochlorite can be considered to oxidize the odorous chemicals;
- Standby pump and sewers/rising mains should be provided to facilitate maintenance and repairing of equipment; and
- Sewage pumping vehicles/tankers could be deployed to divert some of the effluent to the nearby STW/SPS.

7.11 Mitigation Measures during Operational phase

The following odour precautionary measures should be implemented as far as possible during operation of SPS:

- The entire SPS; especially wet wells and screening collection areas should be enclosed in a building structure (Similar to that shown in Figure 14.62 of the EIA report);
- Discharge point of the odour removal system should be directed away from the adjacent sensitive uses, and the discharge height should not be less than those assumed in Table 7.4;
- Screened material from SPS should be stored in a covered container;
- The transportation of screened material during maintenance should be transported in an enclosed type vehicle and disposed off on the same working day;
- Checking and maintenance of the odour removal system should be implemented at least once every half year to maintain the removal efficiency; and
- Odour removal systems, e.g activated carbon filters, should be provided to reduce the odour emissions. Filtering systems with an H_2S removal efficiency:
  - of not less than 99.5% for the YLEPS (OP1/AP1) (where OP1/AP1 is a D.E.) ;
  - of not less than 99.5% for all SPS at 2A-2T and 2B-1T (P1 to P5) (where P1 is a D.E);
  - of not less than 95% for all SPS at 2A-3T (A1 to A2); and
  - of not less than 95% for all SPS at 2B-2T (B1 to B7).

8.0 CONSTRUCTION NOISE ASSESSMENT

8.1 Legislation and Standards

Control over the generation of construction noise in Hong Kong is governed by the Noise Control Ordinance (NCO)[6] (Cap 400) and its subsidiary requirements. Various Technical Memoranda (TMs) have been issued under the NCO to stipulate control approaches and criteria. These TMs prescribe the maximum permitted noise levels for the use of Powered Mechanical Equipment (PME) and certain construction activities and processes, according to the type of equipment or activity, the perceived noise climate of the area, and the working hours of equipment operation and usage. The applicable TMs to the control of noise from construction activities in the current proposed works are:

** Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO)[1]*
** Technical Memorandum on Noise from Construction Work other than Percussive Piling (TM-CW)[7];*
** Technical Memorandum on Noise from Construction Work in Designated Areas (TM-DA) [8]; and*
** Technical Memorandum on Noise from Percussive Piling (TM-PP) [9].*

8.1.1 Noise Standards for Normal Working Hours

Assessments of construction noise impacts shall make reference to Annex 13 of TM-EIAO[4]. The daytime noise limits for construction works as stipulated in Annex 5 of TM-EIAO are given in Table 8.1 below.

Table 8.1: Noise standards for daytime (0700 to 1900 hours) construction activities

Uses	Acceptable Noise Standards $L_{eq\ (30mins)}$, dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostels	75
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (During examinations)

Note: The above standards apply to uses which rely on open windows for ventilation.

The noise criteria as laid down in Table 8.1 for the construction of the project shall be met as far as practicable. All practicable mitigation measures should be exhausted and the residual impacts should be minimized.

For the control of percussive piling, noise criteria shall make reference to TM-PP for determining the permitted hours of operation which depend upon the predicted noise levels at the worst affected NSR.

8.1.2 Noise Standards for Restricted Hours

The NCO provides statutory controls on general construction works during the restricted hours (ie 1900 to 0700 hours from Monday to Saturday and at any time on Sundays or public holidays). The use of PME for construction works during the restricted hours would require a CNP. The TM-CW details the procedures adopted by EPD for assessing such application. The granting of a CNP is subject to conditions stated in the permit and it may be revoked at any time for failure to comply with the stated conditions.

Areas in Tin Shui Wai, Wan Chau and Mai Po are classified as Designated Area as defined in the Noise Control Designated Area Plan no. EPD/NP/NT-04a. Maximum noise levels due to the Specific Powered Mechanical Equipment (SPME) from construction activities during the restricted hours at affected NSRs are controlled under the TM-DA and shall not exceed the specified Acceptable Noise Levels (ANLs). These ANLs are stipulated in accordance with the Area Sensitivity Ratings (ASR) established for the NSRs. The corresponding Basic Noise Levels (BNLs) are stated in Table 8.2 below.

Table 8.2: BNLs for construction noise other than percussive piling in designated area under NCO

Time Period	Area Sensitivity Ratings		
	A	B	C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	45	50	55
All days during the night-time (2300 to 0700 hours)	30	35	40

For those areas, which are not classified as non-designated area, the noise limits are listed in Table 8.3.

Table 8.3: BNLs for construction noise other than percussive piling in non-designated area under NCO

Time Period	Area Sensitivity Ratings		
	A	B	C
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	60	65	70
All days during the night-time (2300 to 0700 hours)	45	50	55

Despite any description or assessment made in this report on construction noise aspects, there is no guarantee that a CNP will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant Technical Memoranda issued under the Noise Control Ordinance. The Noise Control Authority will take into account contemporary conditions/situations of adjoining land uses and any previous complaints against construction activities at the site before making the decision in granting a CNP. Nothing in this Report shall bind the Noise Control Authority in making his decision. If a CNP is to be issued, the Noise Control Authority shall include in it any condition he thinks fit. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution action under the NCO.

8.2 Baseline Condition

The Project involves the construction of a trunk sewerage system with 4 sections of sewers/rising mains and 15 pumping stations. The Project will be located in the sub-urban areas of Yuen Long and Kam Tin. According to the proposed sewer alignments and locations of Sewage Pumping Stations, most of the proposed sewers/rising mains will be laid along existing paved roads with the proposed pumping stations located nearby.

The areas, except for Tin Shui Wai, are generally rural in nature and with scattered residential developments, villages and open storage sites. For Tin Shui Wai, the area consists of several public and private estates. Most of the buildings are high-rise.

8.3 Interfacing Projects

During the construction periods from mid 2005 to late 2007, different interfacing projects are identified and they are summarized in Table 8.3a – 8.3d. For ease of reference, the setback distance and construction programme have been provided for genuine concurrent projects only (ie. Both within the study limit and constructed at the same time as the current project).

Table 8.3a: Interfacing projects for package 2A-1T (Tin Shui Wai Area)

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 300m from first layer NSR	Potential to Cause Cumulative Noise Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	No	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	No	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	Yes	×
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	Yes	×
6	Deep Bay Link (San Wai Section)	Jul 2003	Jun 2006	12	No	✓
7	San Wai Sewerage Treatment Works	2004	2007	30	No	✓
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×
9	Ping Ha Road Improvement Remaining Works	---	2006	6	No	✓
10	Alternative 4 Bypass Culvert	2003	2007	18	No	✓
11	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	Yes	×
12	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1B-2T)	Aug 2004	Feb 2008	30	No	✓
13	Tin Shui Wai Further Development	July 1998	2003	0	Yes	×

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 300m from first layer NSR	Potential to Cause Cumulative Noise Impact
		Start	Complete			
14	157DS Phase 3B/3C San Wai and Tung Tau Tsuen	June 2005	June 2007	24	No	✓
15	Lau Fau Shan Remaining Development	No construction schedule		---	Yes	×

Note [1] : MDC-Eastern Section is more than 300 m from the present project

Table 8.3b: Interfacing Projects for Package 2A-3T (Lau Fau Shan Area)

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 300m from first layer NSR	Potential to Cause Cumulative Noise Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	Yes	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	Yes	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	Yes	×
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	Yes	×
6	Deep Bay Link	Jul 2003	Jun 2006	12	Yes	×
7	San Wai Sewerage Treatment Works	2004	2007	30	Yes	×
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×
9	Ping Ha Road Improvement Remaining Works	---	2006	6	No	✓
10	Alternative 4 Bypass Culvert	2003	2007	18	Yes	×
11	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	Yes	×
12	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1B-2T)	Aug 2004	Feb 2008	30	Yes	×
13	Tin Shui Wai Further Development	July 1998	2003	0	No	×
14	157DS Phase 3B/3C San Wai and Tung Tau Tsuen	June 2005	June 2007	24	Yes	×
15	Lau Fau Shan Remaining Development	No construction schedule		---	No	×

Note [1] : MDC-Eastern Section is more than 300 m from the present project

Table 8.3c: Interfacing Projects for Package 2B-2T (Shap Pat Heung Area)

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 300m from first layer NSR	Potential to Cause Cumulative Noise Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	Yes	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	Yes	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	No	✓
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	No	×
6	Deep Bay Link	Jul 2003	Jun 2006	12	Yes	×
7	San Wai Sewerage Treatment Works	2004	2007	30	Yes	×
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×
9	Ping Ha Road Improvement Remaining Works	---	2006	6	Yes	×
10	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	Yes	×
11	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1A-1T)	Aug 2003	Feb 2006	8	Yes	×
12	Tin Shui Wai Further Development	July 1998	2003	0	Yes	×

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 300m from first layer NSR	Potential to Cause Cumulative Noise Impact
		Start	Complete			
13	157DS Phase 2 Yuen Long South Pumping Station, Rising Main to Castle Peak Road and Sewers	Jan 2003	May 2006	12	No	✓
14	274DS Phase 1 Shap Pat Heung Rising Main and Gravity Sewer; Au Tau Sewage Pumping Station and Ancillary Works	Jan 2003	May 2006	12	No	✓
15	274DS Phase 7A/ 7B San Sang Tsuen and Tin Sum, Shan Ha and Tai Tong Tsuen	June 2007	July 2009	6	No	✓
16	Lau Fau Shan Remaining Development	No construction schedule		---	Yes	×

Note [1]: MDC-Eastern Section is more than 300 m from the present project

Table 8.3d: Interfacing Projects for Package 2A-2T and 2B-1T (Ngau Tam Mei Area)

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 300m from first layer NSR	Potential to Cause Cumulative Noise Impact
		Start	Complete			
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	Yes	×
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	Yes	×
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	Yes	×
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	Yes	×
6	Deep Bay Link	Jul 2003	Jun 2006	12	Yes	×
7	San Wai Sewerage Treatment Works	2004	2007	30	Yes	×
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×
9	Ping Ha Road Improvement Remaining Works	---	2006	6	Yes	×
10	Main Drainage Channels and Poldered Village Protection Schemes for San Tin [1]	Jun 2001	Dec 2003	0	Yes	×
11	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1A-1T)	Aug 2003	Feb 2006	8	No	✓
12	Tin Shui Wai Further Development	July 1998	2003	0	Yes	×
13	92CD Package NTM1	Nov 2003	Jun 2006	12	Yes	×
14	Lau Fau Shan Remaining Development	No construction schedule		---	Yes	×

Note [1] : MDC-Eastern Section is more than 300 m from the present project

8.4 Noise Sensitive Receivers (NSRs)

The land uses in the vicinity of the proposed works include mainly G/IC and residential developments. The locations of the NSRs are shown in Figures 8.1 to 8.3. A comprehensive list of the key representative NSRs for construction noise assessment is listed in Appendix 8.3.

8.5 Construction Noise Sources

During the construction phase of the Project, Power Mechanical Equipment (PME) will be the major noise sources. Basically, the construction works will involve four types of activities: the construction of Sewers and Rising Mains using Open Trench method, the construction of Sewers and Rising Mains across local streams by Pipe Jacking method, Road Pavement & Finishes and the Construction of the Pumping Stations.

Gravity sewers and rising mains will be constructed by open trench method along the existing road. This necessible the closure of one traffic lane, which will form the workfront for the sewers and rising mains construction. Sewer construction will be in segments of up to 50m in length at any one time and each workfront will be separated by a clearance distance of ~ 600m. Hence, it is expected that the identified NSRs will only be affected by the construction activities associated with one workfront at any one time. Pipe jacking method will

be adopted where the sewers cross existing watercourses. For this method, the construction noise will be restricted to the pit area only.

Cumulative noise impact during the construction period with the interfacing projects listed in Section 8.3 is assessed to obtain the maximum noise level at the identified NSRs.

The construction plant inventory for each type of activities are shown in Table 8.6, which is adopted from the YLKTSSD Stage 1 EIA report. Their corresponding PME sound power levels are summarized in Appendix 8.1.

Table 8.6: Construction plant inventory

Activities	Plant	TM ref	Unit
1. Sewers and Rising Mains using Open Trench Method			
G1. Site Preparation	Pilling, oscillator	CNP 165	1
	Excavator with Mini Attachment	CNP 081	1
	Breaker, excavator mounted	CNP 028	1
G2. Trench excavation and earth work	Excavator	CNP 081	1
	Dump Truck	CNP 067	2
	Roller / Vibrating Roller	CNP 186	1
G3. Finishes	Concrete Mixer Truck	CNP 044	1
	Concrete Poker Vibrator	CNP 170	1
	Crawler Crane with Concrete Skip	CNP 048	1
	Flat Bed Lorry	CNP 141	1
	Generator	CNP 101	1
2. Sewer and Rising Mains using the Pipe Jacking Methods at crossing streams			
G1. Site Preparation	Air Compressor (Air Flow > 30m^3/min)	CNP 003	1
	Excavator with Mini Attachment	CNP 081	1
	Breaker, excavator mounted	CNP 028	1
	Generator	CNP 101	1
G2. Pipe Jacking	Concrete Mixer Truck	CNP 044	1
	Crawler Crane with Concrete Skip	CNP 048	1
	Dump Truck	CNP 067	2
	Generator	CNP 101	1
	Water Pump	CNP 281	2
3. Road Pavement and Finishes			
G1. Road Pavement and Finishes	Ballast Temper	CNP 029	2
	Compactor	CNP 050	1
	Road Roller	CNP 185	1
	Lorry	CNP 141	1
	Asphalt Paver	CNP 004	1
	Loader	CNP 081	1
	Generator	CNP 101	1
4. Construction of Pumping Stations			
P1. Foundation Work	Pilling, large diameter bored, reverse circulation drill	CNP 166	2
	Wheeled Excavator / Loader	CNP 081	1
	Air Compressor (Air Flow > 30m^3/min)	CNP 003	1
	Dump Truck	CNP 067	1
	Generator	CNP 101	1
	Mobile Crane	CNP 048	1
P2. Superstructure	Air Compressor (Air Flow > 30m^3/min)	CNP 003	1
	Handheld Breaker (mass > 35kg)	CNP 026	1
	Concrete Lorry Mixer	CNP 044	1
	Poker Vibrator	CNP 170	1
	Bar tender and cutter	CNP 021	1
	Lorry	CNP 141	1
	Mobile Crane	CNP 048	1
	Saw, circular, wood	CNP 201	1

8.6 Construction Noise Prediction Methodology

Detailed construction schedule for the works is currently not available. The current study assumes that the construction activities will occur during the normal working hours (ie 0700 to 1900 hours on any day other than Sunday or public holiday). The construction noise impacts will be assessed as follows:

- locate representative NSRs that may be affected by the works;
- determine the selected construction method and construction period.

- determine plant items for corresponding construction activities based on the agreed plant inventories with DSD;
- determine the sound power levels of the plant items according to the information stated in the TM-NCO or other recognised sources of reference, where appropriate;
- calculate the correction factors based on the distance between the NSRs and the notional noise source positions of the work sites;
- apply corrections including façade, distance, barrier attenuation, acoustic reflection where applicable, in the calculations;
- predict construction noise levels at the NSRs in the absence of any mitigation measures;
- conduct assessment of noise impacts at NSRs to quantify the level of impact, in accordance with TM-CW, BS 5228; and
- predict the cumulative noise impacts for any concurrent construction works in the vicinity of the NSR.

An in-house program is used for the analysis of the construction noise impact. The initial program runs are conducted without any mitigation measures. Where noise level exceedances are identified, further runs will have been made assuming different combinations of mitigation measures to be incorporated to control the impacts. Typical noise mitigation measures often include selection of quiet plant and working methods, erecting temporary barriers/enclosure, reducing number of plant items, and controlling operating time, etc. If all best practicable noise mitigation measures have been exhaustively reviewed but found to be ineffective, the extent and duration of the noise exceedance, and the number of dwellings affected are assessed in details.

There will be no construction work during restricted hours. If any works during the restricted hours are required by the Contractors, the Contractors shall apply for a CNP separately.

8.7 Assessment Results

8.7.1 ***Unmitigated Scenario***

Tin Shui Wai Area (2A-1T)

The predicted unmitigated noise levels at the representative NSRs for each construction activity in Tin Shui Wai Area are shown in Table 8.7, taking into account the distance attenuation and façade effect. Detailed calculation is shown in Appendix 8.3.

Table 8.7: Predicted noise level at the representative NSRs without mitigation measures

NSR	Sewer Const[1]	Deep Bay Link	Ping Ha Road Widening	YLKTSS1 1B-2T	SWSTW Const	Alternative 4 Box Culvert Construction	157DS	Cumulative, dBA	Criteria, dBA
NT01	78.5	53.0		54.1	66.3	74.1		**80.1**	75
NT02	73.2	53.0		56.7	66.3	62.4		74.5	75
NT03	73.9	54.0		57.9	67.3	63.4		75.2	75
NT04	66.5	49.0		53.1	62.3	66	58	70.5	75
NT05	86.1	48.0		51.3		68	62.7	**86.2**	75
NT06	91.3					63	58.2	**91.3**	75
NT07	78.9		47.5					**78.9**	75
NT08	90.6		88.0				59.4	**92.5**	75
NT09	80.5		46.6					**80.5**	65[4] (70)
NT10	90.6		46.2					**90.6**	75
NT11	90.2							**90.2**	75
NT12	0.0							**87**	75
NT13	80.8							**80.8**	75
NT14	88.6							**88.6**	75
NT15	90.6							**90.6**	75
NT16	100.1							**100**	75
NT17	98.2							**98.2**	75
NT18	96.6							**96.6**	75
NT20	98.2		31.1					**98.2**	75
NT21	98.2							**98.2**	75
NT22	96.6							**96.6**	75
NT23	83.8							**83.8**	75
NT24	96.6							**96.6**	75
NT25	90.6							**90.6**	75

NSR	Sewer Const[1]	Deep Bay Link	Ping Ha Road Widening	YLKTSS1 1B-2T	SWSTW Const	Alternative 4 Box Culvert Construction	157DS	Cumulative, dBA	Criteria, dBA
NT28	85.3							**85.3**	65[4](70)
NT08a	89.2		68.0					**89.2**	75
NT22a	96.6							**96.6**	75
NT24a	98.2							**98.2**	75
NT29	86.1			43				**86.1**	65[4](70) / 75[6]
NT30	90.6			42.9				**90.6**	65[4](70) /75[6]

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] Bolded values indicate the exceedance of noise limit
[4] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).
[5] For construction activities of distance greater than 300m, the noise levels are not shown here
[6] Axcillary Block consists of carparks, kindergarden and House for senior centizen

As shown in Table 8.7, exceedance of cumulative noise levels (2 – 25 dB(A) higher) are predicted at all sensitive receivers. Different noise mitigation measures proposed in Section 8.8 should be adopted to minimize the noise impacts.

Lau Fau Shan Area (2A-3T)

The predicted unmitigated noise levels at the representative NSRs for each construction activity in Lau Fau Shan Area are shown in Table 8.8, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.8: Predicted noise level at the representative NSRs without mitigation measures

NSR	Sewer Construction[1]	SPS Construction	Ping Ha Road Widening	Cumulative dB(A)	Criteria dB(A)
NL02	89.2	74.1	41.3	**89.3**	75
NL03	92.1	71.3	40.6	**92.2**	75
NL04	89.9	77.3	41.1	**90.1**	75
NL05	87.5	70.3	42.4	**87.6**	75
NL06	90.6	66.7	44.5	**90.6**	75
NL07	90.6		46.3	**90.6**	75
NL08	92.1		48.4	**92.1**	75
NL09	88.6		48.4	**88.6**	75
NL10	92.1		52.0	**92.1**	75
NL11	83.8		59.7	**83.9**	75
NL12	83.8		60.4	**83.9**	75
NL13	96.6		69.9	**96.6**	75
NL14	77.2		45.7	**77.2**	75
NL15	77.3		42.8	**77.3**	75
NL16	77.3			**77.3**	75
NL18	77.7			**77.8**	75
NL19	77.3			**77.4**	75
NL20	76.6			**76.7**	75
NL21	77.3			**77.5**	75
NL22	94.1	73.1		**94.1**	75
NL23	90.6	82.7		**91.2**	75
NL24	92.1	80.1		**92.4**	75
NL25	84.2	84.6		**87.4**	75
NL26	86.1	85.8		**89.0**	75
NL27	83.3	81.1		**85.4**	75
NL28	85.3	84.6		**88.0**	75
NL15a	78.0		44.7	**78.0**	75
NL15b	77.3			**77.3**	65[3] (70)
NL29	93.1	74.4		**93.1**	75
NP01	98.2		54.9	**98.2**	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).

As shown in Table 8.8, exceedance of cumulative noise levels (2 – 24 dB(A) higher) are predicted at all NSR. Different noise mitigation measures proposed in Section 8.8 should be adopted to minimize the noise impacts.

Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

The predicted unmitigated noise levels at the representative NSRs for each construction activity in Ngau Tam Mei and San Tin areas are shown in Table 8.9, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.9: Predicted noise level at the representative NSRs without mitigation measures

NSR	Sewer Construction[1]	SPS Construction	YLKTSS1 1A-1T S6	YLKTSS1 1A-1T P3	Cumulative dB(A)	Criteria dB(A)
NN02	102.6				**102.6**	75
NN03	77.5				**77.5**	65[3](70)
NN04	86.1				**86.1**	65[3](70)
NN05	92.1				**92.1**	75
NN06	90.6				**90.6**	75
NN07	87.3	74.4			**87.5**	75
NN08	82	78.1			**83.5**	65[3] (70)
NN09	96.6	71.8			**96.6**	75
NN10	87.0	77.6			**87.5**	65
NN11	88.1	78.9			**88.5**	75
NN12	82.0	70.0			**82.3**	75
NN13	81	64.6			**81.1**	75
NN14	75.5	67.1			**76.1**	75
NN15	88.6	87.1			**90.9**	75
NN17	95.9				**95.9**	75
NN18	81.8				**81.8**	75
NN19	91.3				**91.3**	75
NN20	81.0				**81.0**	75
NN21	93.1				**93.1**	75
NN22	95.2				**95.2**	75
NN23	96.6				**96.6**	65[3](70)
NN24	95.2				**95.2**	75
NN25	98.2				**98.2**	75
NN26	95.2				**95.2**	75
NN27	95.2	66.2			**95.2**	75
NN28	77.3	74.1			**79.0**	75
NN29	87.3	78.1			**87.8**	65[3](70)
NN30	87.0	73.0			**87.2**	75
NN31	88.6	66.0			**88.6**	75
NN31a	112.1	71.6			**112.1**[4]	75
NN33	108.6	72.3			**108.6**[4]	75
NN34	108.6	74.4			**108.6**[4]	75
NN35	108.6	74.1			**108.6**[4]	75
NN36	101.3	76.2			**101.3**[4]	75
NN37	90.2	70.7			**90.2**	75
NN38	101.3	75.6			**101.3**[4]	75
NN39	108.6	93.1			**108.7**[4]	75
NN40	108.6	88.7			**108.7**[4]	75
NN41	112.1	91.8			**112.2**[4]	75
NN42	94.1	64.7			**94.1**	65[3](70)
NN43	93.1				**93.1**	75
NN44	92.1				**92.1**	75
NN45	102.6				**102.6**	75
NN46	106.1				**106.1**	75
NN47	100.1	66.3			**100.1**	75
NN48	87.0	66.7			**87.1**	75
NN50	95.2	89.6			**96.3**	75
NN51	96.6	75.8			**96.6**	75
NN52	97.3				**97.3**	75

NSR	Sewer Construction[1]	SPS Construction	YLKTSS1 1A-1T S6	YLKTSS1 1A-1T P3	Cumulative dB(A)	Criteria dB(A)
NN53	80.8				**80.8**	75
NN12a	82.3	66.3			**82.4**	75
NN12b	82.6				**82.6**	75
NN14a	80.3	73.1			**81.1**	75
NN16	78.0	75.1			**79.8**	75
NN19a	94.1				**94.1**	75
NN25a	87.0				**87.0**	75
NN26a	95.2				**95.2**	75
NN29a	91.3	76.2			**91.4**	75
NN32	106	71.6			**106**	75
NN42a	91.3				**91.3**	75
NN43a	90.6				**90.6**	75
D13	75.5		65.4	66.4	**76.4**	75
D42	69.3		75.0	61.5	**76.2**	75
NN01	88.1				**88.1**	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).
[4] The exceptional high noise level is due to the narrow width of the inner road in the village. Hence, the NSR will be very close to the workfront. In the mitigation measures proposed in next section, some of the equipment are proposed to locate in the open space outside the village

As shown in Table 8.9, exceedance of cumulative noise levels (1 – 37 dB(A) higher) are predicted at most NSR. Different noise mitigation measures proposed in Section 8.8 should be adopted to minimize the noise impact.

Shap Pat Heung Area (2B-2T)

The predicted unmitigated noise levels at the representative NSR for each construction activity in Shap Pat Heung Area are shown in Table 8.10, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.10: Predicted noise level at the representative NSRs without mitigation measures

NSR	Sewer Construction[1]	SPS Construction	274DS	157DS	YL Highway	Cumulative dB(A)	Criteria dB(A)
NS01	91.8	77.9	88	47	42.5	**93.4**	75
NS02	84.2	79.5	88	45.5	41.9	**89.9**	75
NS03	86.1	77.8	88	46	41.5	**90.4**	75
NS04	85.3	85.8	88	45.1	41.5	**91.3**	75
NS05	79.8		52.4	61.1	42.8	**80**	75
NS06	87.2	84.3	88	45.2	41.7	**91.5**	75
NS07	88.9	75.7	88	46.8	43.1	**91.6**	75
NS08	87.5		55.3	54.5	49.9	**88**	75
NS09	83.8		53	64.5	59.1	**84**	75
NS10	82.6		55.7	63.4	58.4	**82.8**	75
NS11	104		72.4		49.5	**104**	75
NS12	89.9		58.7		54.4	**89.9**	75
NS13	93.1	69.0	54		50.7	**93.1**	75
NS14	89.2	72.7	51.6		48.8	**89.3**	75
NS15	82.8	73.2	49.4		45.7	**83.3**	75
NS16	98.2	73.4	49.2		46.4	**98.2**	75
NS17	96.6	83.7			43.7	**96.8**	75
NS18	88.1	84.7			43.9	**89.7**	75
NS19	88.1	69.3			40.5	**88.1**	75
NS20	90.6	76.1				**90.7**	75
NS21	80.5	76.9				**82.1**	75
NS22	86.1	78.0				**86.7**	75
NS23	89.2	77.7				**89.5**	75
NS24	94.1	69.7	48.6			**94.1**	75
NS25	96.6		56.2			**96.6**	75
NS26	104		51.7			**104**	75
NS27	96.6		66.8			**96.6**	75
NS28	94.1		88			**95**	75

NSR	Sewer Construction[1]	SPS Construction	274DS	157DS	YL Highway	Cumulative dB(A)	Criteria dB(A)
NS30	90.6		68			**90.6**	75
NS31	101	73.9				**101**	75
NS32	90.6		60.9		54.6	**90.6**	75
NS34	103	67.6	55.9		51.8	**103**	75
NS35	100	82.1			41	**100**	75
NS36	94.1	94.7			41	**97.4**	75
NS37	85.3	82.2			40.6	**87**	75
NS38	81.5	76.6			40.2	**82.7**	75
NS39	89.2	78.6				**89.6**	75
NS40	87	87.9				**90.5**	75
NS41	88.1	80.2				**88.7**	75
NS42	100		58.4			**100**	75
NS43	83.8		69.9			**84.1**	75
NS44	83.2		88			**89.2**	75
NS45	96.6	74.5			42.2	**96.6**	75
NS46	100	77.5			41.5	**100**	75
NS47	96.6		82		64.4	**96.7**	75
NS48	92.1		54.2		50.6	**92.2**	75
NS50	82	80.1			43.8	**84.2**	75
NS51	100	71.0			43.2	**100**	75
NS52	92.1	84.8			42.7	**92.9**	75
NS53	92.1	83.8			42.5	**92.7**	75
NS54	98.2	70.9				**98.2**	75
NS55	94.1					**94.1**	75
NS56	100					**100**	75
NS57	100					**100**	75
NS58	91.3					**91.3**	75
NS59	93.1					**93.1**	75
NS60	96.6					**96.6**	75
NS61	94.1					**94.1**	75
NS64	103		69.9		61.9	**103**	75
NS65	90.6		61.2		55.6	**90.6**	75
NS66	106		53.7		50.4	**106**	75
NS67	87.5	68.9	48.1		45.3	**87.6**	75
NS68	103	69.9			44.7	**103**	75
NS69	89.2	86.5			41.8	**91.1**	75
NS70	90.6	87.1			41.1	**92.2**	75
NS71	87	81.2			41.2	**88**	75
NS72	104	69.3				**104**	75
NS73	90.6	68.1				**90.6**	75
NS19a	98.2					**98.2**	75
NS19b	98.2	68.7				**98.2**	75
NS19c	89.2	68.0				**89.2**	75
NS37a	95.2	77.2				**95.3**	75
NS37b	106	74.1				**112**	75
NS39a	96.6	71.7				**96.6**	75
NS39b	103	71.9				**103**	75
NS42a	96.6					**96.6**	75
NS48a	90.6				54.4	**90.6**	75
NS49a	100		50.8		52	**100**	75
NS52a	100	90.7			42.7	**101**	75
NS70a	104	84.7			40.9	**104**	75
NS74	90.6				46.8	**90.6**	75
NS49b	86.6	70.0				**86.7**	65[3](70)
NS76	103	74.1				**103**	75
NS76b	94.1	74.1				**94.1**	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).

As shown in Table 8.10, exceedance of cumulative noise levels (5 – 31 dB(A) higher) are predicted at most NSRs. Different noise mitigation measures proposed in Section 8.8 should be adopted to minimize the noise impacts.

8.8 Mitigation Measures for Construction Phase

Noise emission from construction activities can be minimized through good site practice, selecting quiet plant, adopting quieter working methods, erection of noise barriers to screen the noise source, where appropriate, and imposing restrictions on the use of noisy equipment.

8.8.1 Good site Practice

In view of the different construction activities and items of construction equipment used, adverse construction noise impacts on the surrounding environment are likely unless mitigation measures are implemented. Good site practice and proper on-site measurement are required by Contractors at all times in order to minimize noise emissions from the works. The following measures are recommended.

- Only well-maintained plant shall be operated on site and plant shall be serviced regularly during the construction work.
- Machines and plant that may be in intermittent use (such as breakers) shall be shut down between work periods or should be throttled down to a minimum.
- Silencers or mufflers on construction equipment shall be utilised and be properly maintained during the construction works.
- Mobile plant shall be sited as far away from NSRs as possible.
- Material stockpiles and other structures shall be effectively utilised, where practicable, to screen noise from on-site construction activities.
- Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs.

Although it is difficult to quantify the level of noise reduction achieved from implementation of these practices, the environmental performance of the works would be improved with these control measures.

8.8.2 Quieter Plant

One feasible method to reduce the noise level is the adoption of quieter plant. Quieter plant is defined as the PME with actual SWL being less than the value specified in the TM-CW. In fact, the contractor shall obtain particular models of plant that are quieter than the standard type as stipulated in the TM-CW. Example of SWLs for specific silenced PME can be found in BS 5228 Part I:1997 "Noise Control on Construction Open Sites,".

The silenced PME that known to be used are given in Table 8.11. With the use of quieter plant, the noise level could be reduced by 1 - 15 dB(A).

Table 8.11: Quieter construction plant inventory

PME	CNP Code	SWL dB(A)	BS 5228	SWL dB(A)	Reduction dB(A)
1. Sewers and Rising Main using Open Trench Method					
Pilling, oscillator	CNP 165	115	EIA[1]	104	11
Excavator with Mini Attachment	CNP 081	112	C8-33	102	10
Breaker, excavator mounted	CNP 028	122	C8-13	110	12
Dump Truck	CNP 067	117	C9-19	102	15
Roller / Vibrating Roller	CNP 186	108	C3-115	102	6
Concrete Mixer Truck	CNP 044	109	C6-35	100	9
Concrete Poker Vibrator	CNP 170	113	C6-32	100	13
Crawler Crane with Concrete Skip	CNP 048	112	C7-106	99	13
Flat Bed Lorry	CNP 141	112	C9-19	102	10
Generator	CNP 101	108	CNP 103	95	13
2. Sewers and Rising Main Using Pipe Jacking Method					
Air Compressor (Air Flow > 30m^3/min)	CNP 003	104	C7-44	103	1
Excavator with Mini Attachment	CNP 081	112	C3-35	106	6
Breaker, excavator mounted	CNP 028	122	C8-13	110	12
Generator	CNP 101	108	CNP 103	95	13
Concrete Mixer Truck	CNP 044	109	C6-35	100	9
Crawler Crane with Concrete Skip	CNP 048	112	C7-106	99	13
Dump Truck	CNP 067	117	C9-19	102	15

PME	CNP Code	SWL dB(A)	BS 5228	SWL dB(A)	Reduction dB(A)
Water Pump	CNP 281	88	N/A	N/A	N/A
3. Road Pavement and Finish					
Ballast Temper	CNP 029	105	N/A	N/A	N/A
Compactor	CNP 050	105	N/A	N/A	N/A
Road Roller + Lorry	CNP 185 / CNP 141	108 / 112	C8-25	96	17
Asphalt Paver	CNP 004	109	C8-24	101	8
Loader	CNP 081	112	C8-15	103	9
Generator	CNP 101	108	CNP 103	95	13
4. Construction of the Sewage Pumping Station					
Pilling, large diameter bored, reverse circulation drill	CNP 166	100	N/A	N/A	N/A
Wheeled Excavator / Loader	CNP 081	112	C3-80	106	6
Air Compressor (Air Flow > 30m^3/min)	CNP 003	104	C7-44	103	1
Dump Truck	CNP 067	117	C9-27	105	12
Generator	CNP 101	108	CNP 103	95	13
Mobile Crane	CNP 048	112	C7-110	106	6
Handheld Breaker (mass > 35kg)	CNP 026	114	C2-10	110	4
Concrete Lorry Mixer	CNP 044	109	C6-35	100	9
Poker Vibrator	CNP 170	113	C6-32	100	13
Bar tender and cutter	CNP 021	90	N/A	N/A	N/A
Lorry	CNP 141	112	C9-27	105	7
Mobile Crane	CNP 048	112	C7-109	103	6
Saw, circular, wood	CNP 201	108	C7-75	105	3

Note [1] : Adopted from EIA report of Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1

It should be noted that various type of silenced equipment are available in Hong Kong. However, when processing a CNP application, the EPD will apply the noise levels contained in the TM-CW, unless the noise emission of a particular equipment can be validated.

8.8.3 Restrict the type of PME used Concurrently

During the construction of gravity sewer and rising mains, PME such as excavator mounted breakers and excavators will not be operated concurrently as the works are usually carried out using same equipment in sequence. In addition, the use of handheld breaker instead of excavator mounted breakers is recommended for the road opening works. The refined plant groups are summarized in Table 8.12.

Table 8.12: Refinement of plant group

Activities	Plant	TM ref	Quiet Plant ref	Unit
1. Sewers and Rising Main using Open Trench Method				
G1. Site Preparation	Pilling, oscillator	CNP 165	By contractor[1]	1
G2. Road opening	Handheld Breaker (mass > 35kg)	CNP 048	C2-10	1
G3. Trench excavation and earth work	Excavator for trenching	CNP 081	C8-33	1
G4. Sewer Laying	Loader	CNP081	C8-15	1
	Medium Size Truck	CNP 141	C9-19	1
G5. Earthworks	Roller / Vibrating Roller	CNP 186	C3-115	1
G6. Finishes	Concrete Lorry Mixer	CNP 044	C6-35	1
	Concrete Poker Vibrator	CNP 170	C6-32	1
	Crawler Crane with Concrete Skip	CNP 048	C7-106	1
	Medium Size Truck	CNP 141	C9-19	1
2. Sewers and Rising Main using Pipe Jacking Method crossing streams				
G1. Site Preparation	Breaker, excavator mounted	CNP 026	C8-13	1
G2. Earthwork excavation	Excavator with Multi Attachment	CNP 081	C3-35	1
G3. Pipe Jacking	Concrete Mixer Truck	CNP 044	C6-35	1
	Crawler Cane with Concrete Skip	CNP 048	C7 -106	1
	Lorry	CNP 067	C9-19	1
	Generator	CNP 101	CNP 103	1
	Water Pump	CNP 281	N/A	1
3. Road Pavement and Finishes				
R1. Ballast Laying	Ballast Tamper	CNP 029	N/A	1
R2. Compacting	Compactor	CNP 050	N/A	1

Activities	Plant	TM ref	Quiet Plant ref	Unit
R3. Road Paving	Road Roller + Lorry	CNP 185/ CNP141	C8-25	1
	Asphalt Paver	CNP 004	C8-24	1
	Loader	CNP 081	C8-15	1
	Generator	CNP 101	C7-62	1

Note [1] : Adopted from EIA report of Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1

8.8.4 Use of Temporary or Movable Noise Barriers

In general, purpose-built noise barriers or movable noise barrier constructed of appropriate material (with a superficial density of at least 20kg/m^2) and located close to the PME could give a further noise reduction of 5dB(A), according to TM-CW. Certain types of PME, such as generator, can be completely screened giving a total reduction of 10dB(A) or more. However, as the present works area for the sewer laying works and road Pavement and Finish Works will be very small (~ 3 to 3.5m in width) and the excavated trench is expected to occupy most of the area. The use of the moveable noise barrier is therefore not feasible for these works.

During the road opening work, acoustic shed of dimension 2m × 2m × 2.7m can be used to shield the noise emitted from handheld breaker. A maximum of 10 dB(A) can be attained.

For the construction of the sewerage pumping station, the works area will allow the installation of moveable barrier and construction of hoarding. As most of the NSRs are 2 to 3 storeys high and the pumping station construction site is of area ~15m × 15m, hoarding of 3m high shall be erected around the pumping station construction site. Table 8.13 summarizes the SWL of the PME with the barrier / or enclosure included.

Table 8.13: SWL of the PME with barrier/ enclosure included.

	CNP Code	SWL	Barrier type	Barrier effect	SWL
Construction of Sewer					
Road Opening					
Handheld Breaker	C2-10	110	Acoustic Shed	10	100
Construction of Pumping Station					
Foundation Work					
Pilling, large diameter bored, reverse circulation drill	CNP 166	100	Movable Barrier	5	95
Wheeled Excavator / Loader	C3-80	106	Movable Barrier	5	101
Air Compressor (Air Flow > 30m^3/min)	C7-44	103	Movable Barrier	10	93
Dump Truck	C9-27	105	Movable Barrier	5	100
Generator	CNP103	95	Movable Barrier	10	85
Mobile Crane	C7-110	106	Movable Barrier	5	101
Superstructure Work					
Air Compressor (Air Flow > 30m^3/min)	C7-44	103	Movable Barrier	10	93
Handheld Breaker (mass > 35kg)	C2-10	110	Acoustic Shed	10	100
Concrete Lorry Mixer	C6-35	100	Movable Barrier	5	95
Poker Vibrator	C6-32	100	Movable Barrier	5	95
Bar tender and cutter	CNP 021	90	Movable Barrier	10	80
Lorry	C9-27	105	Movable Barrier	5	100
Mobile Crane	C7-110	106	Movable Barrier	5	101
Saw, circular, wood	C7-75	105	Movable Barrier	10	95

The potential construction noise impact after mitigation measures is summarized in Table 8.14 – Table 8.17. The SWL of the construction plant inventory with mitigation measures are given in Appendix 8.2.

Tin Shui Wai Area (2A-1T)

The predicted mitigated noise levels at the representative NSRs for each construction activity in Tin Shui Wai Area are shown in Table 8.14, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.14: Predicted noise level at the representative NSRs with mitigation measures

NSR	Sewer Const[1]	Deep Bay Link	Ping Ha Road Widening	YLKTSS1 1B-2T	SWSTW Const	Alternative 4 Box Culvert Construction	157DS	Cumulative dB(A)	Criteria dB(A)
NT01	61.8	53		54.1	66.3	74.1		75	75
NT02	56.5	53		56.7	66.3	62.4		68.6	75
NT03	57.1	54		57.9	67.3	63.4		69.5	75
NT04	49.7	49		53.1	62.3	66	58	68.3	75
NT05	69.4	48		51.3		68	62.7	72.3	75
NT06	74.6					63	58.2	75	75
NT07	62.2		47.5					62.4	75
NT08	73.8		88				59.4	**88.1**	75
NT09	67.4		46.6					**67.5**	65[4] (70)
NT10	73.8		46					73.8	75
NT11	73.5							73.5	75
NT12	70.3							70.3	75
NT13	64							64.1	75
NT14	71.9							71.9	75
NT15	73.8							73.8	75
NT16	83.4							**83.4**	75
NT17	81.4							**81.4**	75
NT18	79.8							**79.8**	75
NT20	81.4							**81.4**	75
NT21	81.4							**81.4**	75
NT22	79.8							**79.8**	75
NT23	67.1							67.1	75
NT24	79.8							**79.8**	75
NT25	73.8							73.8	75
NT28	68.6							**68.6**	65[4] (70)
NT08a	72.5		68				56.1	73.8	75
NT22a	79.8							**79.8**	75
NT24a	81.4							**81.4**	75
NT29	69.4			43				**69.4**	65[4] (70) /75[5]
NT30	73.8			42.9				73.8	65[4] (70) /75[5]

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] Bolded values indicate the exceedance of noise limit
[4] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).
[5] Axcillary Block consists of carparks, kindergarden and House for senior centizen

As shown in Table 8.14, residual exceedance in noise levels (1 – 13 dB(A) higher) are still predicted at most sensitive receivers. As a general mitigation strategy for the affected schools, construction should be given to scheduling the construction work at the school workfront outside the examination period in order to reduce the noise impact. This applies to NT09 (Tung Hoi Lee Primary School), NT28 (Lee Shau Kee Primary School) and NT29 (Kindergarden in Tin Wah Estate Auxillary Facility Block). However, for NT30 (Kindergarden in Tin Yuet Estate Auxillary Facility Block), the mitigated noise level still exceeds the riteria for both the examination period and normal school days. Hence, the construction work shall be scheduled outside the normal school days and examination period. The construction of sewer and Ping Ha Road widening should also not be taken place concurrently as they dominate the noise impact at NT08 (scattered village house). Hence, it is suggested to schedule the sewer construction in the workfront of NT08 before or after the Ping Ha Road Widening.

Lau Fau Shan Area (2A-3T)

The predicted mitigated noise levels at the representative NSRs for each construction activity in Lau Fau Shan Area are shown in Table 8.15, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.15: Predicted noise level at the representative NSRs with mitigation measures

NSR	Sewer Construction[1]	SPS Construction	Ping Ha Road Widening	Cumulative dB(A)	Criteria dB(A)
NL02	72.5	60.8		72.8	75
NL03	75.4	58.1		**75.5**	75
NL04	73.1	64.1		73.6	75
NL05	70.8	57.1		71.0	75
NL06	73.8	53.4		73.9	75
NL07	73.8			73.9	75
NL08	75.4			75.4	75
NL09	71.9			71.9	75
NL10	75.4		52.0	75.4	75
NL11	67.1		59.7	67.9	75
NL12	67.1		60.4	68.0	75
NL13	79.8		69.9	80.3	75
NL14	60.4			60.6	75
NL15	60.6			60.7	75
NL16	60.6			60.7	75
NL18	61.0			61.1	75
NL19	60.6			60.7	75
NL20	59.8			60.1	75
NL21	60.6			60.9	75
NL22	77.3	59.9		**77.4**	75
NL23	73.8	69.4		75.2	75
NL24	75.4	66.8		**76.0**	75
NL25	67.5	71.4		72.8	75
NL26	69.4	72.5		74.2	75
NL27	66.6	67.8		70.3	75
NL28	68.6	71.4		73.2	75
NL15a	61.3			61.4	75
NL15b	60.6			60.7	65[3] (70)
NL29	76.3	61.1		**76.5**	75
NP01	81.4		54.9	**81.4**	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).

As shown in Table 8.15, residual exceedance in noise levels (1 – 6 dB(A) higher) are still predicted at most sensitive receivers. The construction of sewer and sewage pumping station should also not be taken place concurrently as they dominate the noise impact at NL03 and NL24.

Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

The predicted mitigated noise levels at the representative NSRs for each construction activity in Ngau Tam Mei and San Tin areas are shown in Table 8.16a, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.16a: Predicted noise level at the representative NSRs with mitigation measures

NSR	Sewer Construction	SPS Construction	YLKTSS1 1A-1T S6	YLKTSS1 1A-1T P3	Cumulative dB(A)	Criteria dB(A)
NN02	85.9				**85.9**	75
NN03	60.8				60.8	65[4] (70)
NN04	69.4				**69.4**	65[4] (70)
NN05	75.4				75.4	75
NN06	73.8				73.8	75
NN07	70.6	61.1			71.0	75
NN08	65.3	64.8			**68.1**	65[4](70)/75[6]
NN09	79.8	58.5			**79.9**	75
NN10	70.3	64.3			71.3	65
NN11	71.3	65.6			72.4	75
NN12	65.3	56.8			65.9	75
NN13	64.3	51.4			74.5	75
NN14	58.8	53.9			60	75
NN15	71.9	73.9			**76.0**	75

NSR	Sewer Construction	SPS Construction	YLKTSS1 1A-1T S6	YLKTSS1 1A-1T P3	Cumulative dB(A)	Criteria dB(A)
NN17	79.2				**79.2**	75
NN18	65.0				65.1	75
NN19	74.6				74.6	75
NN20	64.3				64.4	75
NN21	76.3				**76.3**	75
NN22	78.5				**78.5**	75
NN23	79.8				**79.8**	65[4] (70)
NN24	78.5				**78.5**	75
NN25	81.4				**81.4**	75
NN26	78.5				**78.5**	75
NN27	78.5	52.9			**78.5**	65
NN28	62.6	60.8			64.8	75
NN29	70.6	64.9			71.6	65[4] (70)
NN30	70.3	59.7			70.7	75
NN31	71.9	52.8			71.9	75
NN31a	95.4	58.3			**95.4**	75
NN33	91.9	59.1			**91.9**	75
NN34	91.9	61.1			**91.9**	75
NN35	91.9	60.8			**91.9**	75
NN36	85.5	63.0			**84.6**	75
NN37	73.5	57.4			73.6	75
NN38	84.5	62.3			**84.6**	75
NN39	91.9	79.9			**92.2**	75
NN40	91.9	75.4			**92.0**	75
NN41	95.4	78.5			**95.5 (85.5)[5]**	75
NN42	77.3	51.5			**77.4**	65[4] (70)
NN43	76.3				**76.3**	75
NN44	75.4				**75.4**	75
NN45	85.9				**85.9**	75
NN46	89.4				**89.4**	75
NN47	83.4	53.0			**83.4**	75
NN48	70.3	53.4			70.4	75
NN50	78.5	76.4			**80.6**	75
NN51	79.8	62.6			**79.9**	75
NN52	80.6				**80.6**	75
NN53	64.0				64.1	75
NN12a	65.6	53.0			65.8	75
NN12b	65.9				66.0	75
NN14a	63.6	59.9			65.1	75
NN16	61.3	61.8			64.6	75
NN19a	77.3				**77.4**	75
NN25a	70.3				70.3	75
NN26a	78.5				**78.5**	75
NN29a	74.6	63.0			74.9	75
NN32	89.4	58.3			**89.4**	75
NN42a	74.6				74.6	75
NN43a	73.8				73.8	75
D13	58.8		65.4	66.4	69.4	75
D42	52.6		75.0	61.5	75.2	75
NN01	71.3		54.4	55.4	71.5	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] From Table 8.16a
[4] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).
[5] Presence of high boundary wall outside the Tse Tong, which will provide an attenuation of 10dB

As shown in Table 8.16a, residual exceedance in noise levels (1 – 20 dB(A) higher) are still predicted at most sensitive receivers. The construction of sewer and sewage pumping station should also not be taken place concurrently as they dominate the noise impact at NN15 and NN37. In order to reduce the noise impact on schools at NN04, NN23, NN29 (planned) and NN42, the mitigation measures proposed in Table 8.16b are suggested.

Table 8.16b: Mitigation measures for schools in San Tin

NSR	Noise Level	Noise Criteria	Mitigation Measures
NN04 (School)	69.4	65 (70)[1]	No Construction work in the workfront during Examination Periods
NN08 (School)	68.1	65 (70)	No simultaneous sewerage and sewage pumping station construction works in the work front during examination period
NN23 (School)	79.8	65 (70)	No Construction work in the workfront at Normal School days and Examination Periods
NN29 (planned School)	70.6	65 (70)	No mitigation measures required if the school is not built No Sewerage work in the work front at Normal School days No Construction work in the work front during Examination Periods
NN42 (School)	77.3	65 (70)	No Construction work in the workfront during Normal School days and Examination Periods

[1] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).

NN41 is the Man Tung Fung Tse Tong, which is surrounded by high boundary walls. It is anticipated that the boundary walls will greatly attenuate the noise due to the sewer construction. Nevertheless, it is suggested that there should be no construction works during any ceremony activities inside the Man Tung Fung Tse Tong.

The predicted noise levels at some NSRs in San Lung Tsuen have reached 95 dB(A). Given that the inner roads of San Lung Tsuen are extremely narrow (~4m), PME such as lorry, generator, crawler crane, truck, etc will be relocated in the open space just outside the village and away from the workfront. The narrow site constraints also mean material transportation and sewage laying work will need to be performed manually. As the sewer construction is on a small and narrow local road, smaller power mechanical equipment (e.g. road breaker and concrete vibratory poker) can be used. Besides, the percentage on time for some PME (e.g. road roller) can be further reduced. All these will contribute to the reduction of the noise impact. The proposed PME locations at the open area of San Lung Tsuen (S6) are shown in Appendix 8.5. As agreed with DSD, either one of the sites can be selected as the temporary works areas. Hence, the present noise calculation was based on temporary work area A. Application for the inclusion in the works site boundary will be carried out at the detailed design stage by DSD. The revised cumulative noise levels at the NSRs in San Lung Tsuen are shown in Table 8.16c. Detailed noise calculations are given in Appendix 8.4.

Table 8.16c: Revised predicted noise level at the representative NSRs in San Lung Tsuen taking site constraint into consideration

NSR	Sewer Construction[1]	SPS Construction	YLKTSS1 1B-2T	YLKTSS1 1A-1T	Previous noise level [3], dB(A)	Cumulative dB(A)	Criteria dB(A)
NN31a	**90**	58.3			**95.4**	**90**	75
NN32	**84**	58.3			**89.4**	**84**	75
NN33	**86.5**	59.1			**91.9**	**86.5**	75
NN34	**86.5**	61.1			**91.9**	**86.5**	75
NN35	**86.5**	60.8			**91.9**	**86.5**	75
NN36	**79.1**	63.0			**85.5**	**79.3**	75
NN38	**79.1**	65.9			**84.5**	**79.3**	75
NN39	**86.5**	73.9			**91.9**	**86.7**	75
NN40	**85.5**	75.4			**87.7**	**86.8**	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).

With the relocation of the PME, the noise levels at the NSRs in San Tung Tsuen have been reduced by ~ 5 dB(A). Higher noise level is still predicted at NN31a. Site inspection indicated that NN31 is one storey house. Hence, a moveable barrier of 3m high can be erected in front of the house. This will further reduce the noise level to 80 dB(A).

NN34 is another Tse Tong in San Lung Tsuen. However, the Tse Tong is not surrounded by high boundary walls. Hence, it is suggested that there should be no construction works during any ceremony activities inside the Tse Tong.

Shap Pat Heung Area (2B-2T)

The predicted unmitigated noise levels at the representative NSRs for each construction activity in Shap Pat Heung Area are shown in Table 8.17, taking into account the distance attenuation and façade effect. Detailed calculation is given in Appendix 8.3.

Table 8.17: Predicted noise level at the representative NSRs with mitigation measures

NSR	Sewer Construction[1]	SPS Construction	274DS	157DS	YL Highway	Cumulative	Cumulative Programme (Re-schedule to after 274DS) dB(A)	Criteria dB(A)
NS01	75.1	64.6	88	47	42.5	**88.2**	**75.5**	75
NS02	67.5	66.2	88	45.5	41.9	**88**	69.9	75
NS03	69.4	64.6	88	46	41.5	**88.1**	70.7	75
NS04	68.6	72.5	88	45.1	41.5	**88.1**	74	75
NS05	63.1		52.4	61.1	42.8	65.7	65.4	75
NS06	70.5	71	88	45.2	41.7	**88.1**	73.8	75
NS07	72.2	62.4	88	46.8	43.1	**88.1**	72.6	75
NS08	70.8	64.6	55.3	54.5	49.9	71.9	71.8	75
NS09	67.1		53	64.5	59.1	69.6	69.5	75
NS10	65.9		55.7	63.4	58.4	68.6	68.4	75
NS11	87.5		72.4		49.5	87.6	**87.5**	75
NS12	73.1		58.7		54.4	73.4	73.2	75
NS13	76.3	55.7	54		50.7	76.4	76.4	75
NS14	72.5	59.4	51.6		48.8	72.7	72.7	75
NS15	66.1	60	49.4		45.7	67.2	67.1	75
NS16	81.4	60.2	49.2		46.4	**81.5**	**81.5**	75
NS17	79.8	70.4			43.7	**80.3**	**80.3**	75
NS18	71.3	71.4			43.9	74.4	74.4	75
NS19	71.3	56			40.5	71.5	71.5	75
NS20	73.8	62.9				74.2	74.2	75
NS21	63.8	63.6				66.7	66.7	75
NS22	69.4	64.7				70.7	70.7	75
NS23	72.5	64.5				73.1	73.1	75
NS24	77.3	56.4	48.6			**77.4**	**77.4**	75
NS25	79.8		56.2			**79.9**	**79.9**	75
NS26	87.5		51.7			**87.5**	**87.5**	75
NS27	79.8		66.8			**80.1**	**79.9**	75
NS28	77.3		88			**88.3**	**77.4**	75
NS30	73.8		68			74.8	73.8	75
NS31	84.5	60.7				**84.5**	**84.5**	75
NS32	73.8		60.9		54.6	74.1	73.9	75
NS34	85.9		55.9		51.8	**85.9**	**85.9**	75
NS35	83.4	68.8			41	**83.5**	**83.5**	75
NS36	77.3	81.5			41	**82.9**	**82.9**	75
NS37	68.6	68.9			40.6	71.8	71.8	75
NS38	64.8	63.3			40.2	67.1	67.1	75
NS39	72.5	65.4				73.3	73.3	75
NS40	70.3	74.6				**76**	76	75
NS41	71.3	67				72.7	72.7	75
NS42	83.4		58.4			**83.4**	**83.4**	75
NS43	67.1		69.9			71.8	67.2	75
NS44	66.5		88			**88**	66.6	75
NS45	79.8	61.3			42.2	**79.9**	**79.9**	75
NS46	83.4	64.2			41.5	**83.4**	**83.4**	75
NS47	79.8		82		64.4	**84.1**	**80**	75
NS48	75.4		54.2		50.6	**75.5**	**75.5**	75
NS50	65.3	66.8			43.8	69.1	69.1	75
NS51	83.4	57.8			43.2	**83.4**	83.4	75
NS52	75.4	71.5			42.7	**76.9**	76.9	75
NS53	75.4	70.5			42.5	**76.6**	76.6	75
NS54	81.4	57.7				**81.5**	**81.5**	75
NS55	77.3					**77.4**	**77.4**	75
NS56	83.4					**83.4**	**83.4**	75
NS57	83.4					**83.4**	**83.4**	75
NS58	74.6					74.6	74.6	75
NS59	76.3					**76.3**	**76.3**	75
NS60	79.8					**79.9**	**79.9**	75
NS61	77.3					**77.4**	**77.4**	75
NS64	85.4		69.9		61.9	**86**	**85.9**	75

NSR	Sewer Construction[1]	SPS Construction	274DS	157DS	YL Highway	Cumulative	Cumulative Programme (Re-schedule to after 274DS) dB(A)	Criteria dB(A)
NS65	73.8		61.2		55.6	74.2	73.9	75
NS66	89.4		53.7		50.4	**89.4**	**89.4**	75
NS67	70.8	55.7	48.1		45.3	71	70.9	75
NS68	85.9	56.6			44.7	**85.9**	**85.9**	75
NS69	72.5	73.2			41.8	**75.9**	**75.9**	75
NS70	73.8	73.9			41.1	**76.9**	**76.9**	75
NS71	70.3	67.9			41.2	72.3	72.3	75
NS72	87.5	56				**87.5**	**87.5**	75
NS73	73.8	54.9				73.9	73.9	75
NS19a	81.4	55.4				**81.4**	**81.4**	75
NS19b	81.4	55.5				**81.4**	**81.4**	75
NS19c	72.5	54.7				72.6	72.6	75
NS37a	78.5	64				**78.7**	**78.7**	75
NS37b	89.4	60.8				**89.4**	**89.4**	75
NS39a	79.9	58.5				**79.9**	**79.9**	75
NS42a	79.8					**79.9**	**79.9**	75
NS48a	73.8				54.4	73.9	73.9	75
NS49a	83.4		50.8		52	**83.4**	**83.4**	75
NS52a	83.4	77.4			42.7	**84.4**	**84.4**	75
NS70a	87.5	71.4			40.9	**87.6**	**87.6**	75
NS74	73.8				46.8	73.9	73.9	75
NS49b	69.8	56.7				70	70	65[3] (70)
NS76	85.9	60.9				**85.9**	**85.9**	75
NS76b	77.3	60.8				**77.4**	**77.4**	75

Note: [1] For sewer construction, the noise level represents the highest of the group activities of the Open Trench Method, Pipe Jacking Method and Road Pavement and Finish Works
[2] The construction of Sewage Pumping Station is 300m away from the NSR. Hence, the impact of SPS is not taken into account
[3] For school, the noise limit is 70 dB(A). However, during examination, the noise limit is 65 dB(A).

As shown in Table 8.17, residual exceedance of noise levels (1 – 19 dB(A) higher than the noise criteria) are still predicted at most NSRs. Since the dominated noise impacts are originated from 274DS construction at some of the sensitive receivers, it is suggested that the site construction works in the workfront of NS01 – NS04, NS06, NS07, NS28 and NS44 should be scheduled before or after the construction work of 274DS. With the rescheduling, the number of affected NSRs will be reduced. In addition, sewer construction work and Sewage Pumping Station construction should not be taken place concurrently. It will reduce the noise levels at NS01, NS40, NS48, NS52 and NS70 to an acceptable level. In addition, there should be no construction works during the examination periods of S49b.

8.9 Residual Construction Noise Impact

Practical noise abatement measures, such as the use of quieter plant, rescheduling of works to avoid the concurrent undertaking of noise activities, the erection of temporary noise barriers along site boundaries and the use of movable noise barriers / enclosures, where practicable, have been considered in the project. However, as shown in Table 8.14-8.17, exceedances of the daytime construction noise criterion are still predicted at some of the NSRs located close to the construction site.

The causes of the noise exceedances are primarily from the construction of the sewers and rising mains in which the noisiest activities are anticipated to be the Road Pavement and Finishes Work, as mitigation measures such as moveable noise barriers could not be deployed due to practical constraints.

Pipe Jacking technique has been explored. However, due to the constraint of underground pipeline and utilities, this method is not practical.

Due to the nature of the construction work, it is envisaged that the exceedances are likely limited only to time periods when the construction work is being carried out adjacent to the NSRs (within a radius of about 50m). It is anticipated that the sewers and the rising mains will be constructed in segments of up to a maximum of 50m

in length at any one time, and therefore the impacts would only last for a relatively short period of time. Table 8.18 summarizes the construction period of each type of construction activities.

Table 8.18: Construction period of different construction activities

Construction Activities for each 50m segment	Construction Period
Site Preparation	0.5 month
Sewer laying Work	1 – 2 weeks
Road Surfacing Work	1 – 2 day

However, the progress of works is subject to other variables, such as inclement weather, conflicts with existing utilities and restrictions on road closure during peak hours. Beyond a distance of 50m, the cumulative noise levels arising from the sewer construction works and pumping station construction work will be reduced to within the daytime construction noise limit.

The extent and duration of the predicted residual impacts are summarized in Table 8.19 – 8.23. In addition, the approximate number of dwellings being affected by the residual impacts is also indicated.

Tin Shui Wai Area (2A-1T)

Table 8.19: Predicted residual impact at the representative NSRs with mitigation measures

NSR	Max Residual Noise Level dB(A)	Activities							No. of dwelling affected
		Sewer Construction					Road Surfacing		
		Site Preparation (SWL:104)	Road Opening (SWL:100)	Trench Excavat-ion / Earth Work (SWL:102)	Sewage Laying (SWL:105.5)	Finishes (SWL:106.4)	Ballast Laying/ Concrete Compact-ion (SWL:105)	Road Pave-ment (SWL:106)	
		G1	G2	G3	G4	G5	G6a	G6b	
		Duration							
		2 weeks	1 weeks	2 weeks	2 days	2 days	1 - 2 days	1 - 2 days	
		Residual Noise Level of Individual Activity, dB(A)							
NT16	**83.4**	**81.0**	**77.0**	**79.0**	**82.5**	**83.4**	**82.0**	**83.0**	9
NT17	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	3
NT18	**79.8**	**77.4**	73.4	75.4	**78.9**	**79.8**	**78.4**	**79.4**	9
NT20	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	15
NT21	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	52
NT22	**79.8**	**77.4**	73.4	75.4	**78.9**	**79.8**	**78.4**	**79.4**	15
NT24	**79.8**	**77.4**	73.4	75.4	**78.9**	**79.8**	**78.4**	**79.4**	6
NT22a	**79.8**	**77.4**	73.4	75.4	**78.9**	**79.8**	**78.4**	**79.4**	9
NT24a	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	25

Lau Fau Shan Area (Alternative 2A-3T)

Table 8.20: Predicted residual noise level at the representative NSRs with mitigation measures

NSR	Max Residual Noise Level dB(A)	Activities							No. of dwelling affected
		Sewer Construction					Road Surfacing		
		Site Preparation (SWL: 104)	Road Opening (SWL:100)	Trench Excavat-ion / Earth Work (SWL:102)	Sewage Laying (SWL:105.5)	Finishes (SWL:106.4)	Ballast Laying/ Concrete Compact-ion (SWL:105)	Road Pave-ment (SWL:106)	
		G1	G2	G3	G4	G5	G6a	G6b	
		Duration							
		2 weeks	1 weeks	2 weeks	2 days	2 days	1 - 2 days	1 - 2 days	
		Residual Noise Level of Individual Activity, dB(A)							
NL13	**80.3**	**77.9**	73.9	**75.9**	**79.4**	**80.3**	**78.9**	**79.9**	3
NL22	**77.4**	75.0	71.0	73.0	**76.5**	**77.4**	**76.0**	**77.0**	9

NL29	**76.5**	74.1	70.1	72.1	**75.6**	**76.5**	75.1	**76.1**	3
NP01	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	3

Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

Table 8.21: Predicted residual noise level at the representative NSRs with mitigation measures

NSR	Max Residual Noise Level dB(A)	Activities							No. of dwelling affected
		Sewer Construction					Road Surfacing		
		Site Preparation (SWL:104) G1	Road Opening (SWL:100) G2	Trench Excavat-ion / Earth Work (SWL:102) G3	Sewage Laying (SWL:105.5) G4	Finishes (SWL:106.4) G5	Ballast Laying/ Concrete Compact-ion (SWL:105) G6a	Road Pave-ment (SWL:106) G6b	
		Duration							
		2 weeks	1 weeks	2 weeks	2 days	2 days	1 - 2 days	1 - 2 days	
		Residual Noise Level of Individual Activity, dB(A)							
NN02	**85.9**	**83.5**	**79.5**	**81.5**	**85.0**	**85.9**	**84.5**	**85.5**	51
NN09	**79.9**	**77.5**	73.5	**75.5**	**79.0**	**79.9**	**78.5**	**79.5**	28
NN13	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	5
NN14	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	3
NN17	**79.2**	**76.8**	72.8	74.8	**78.3**	**79.2**	**77.8**	**78.8**	9
NN21	**76.3**	73.9	69.9	71.9	75.4	**76.3**	74.9	**75.9**	15
NN22	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	33
NN24	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	7
NN25	**81.4**	**79.0**	75.0	**77.0**	**80.5**	**81.4**	**80.0**	**81.0**	72
NN26	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	3
NN27	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	6
NN43	**76.3**	73.9	69.9	71.9	75.4	**76.3**	74.9	**75.9**	2
NN45	**85.9**	**83.5**	**79.5**	**81.5**	**85.0**	**85.9**	**84.5**	**85.5**	27
NN46	**89.4**	**87.0**	**83.0**	**85.0**	**88.5**	**89.4**	**88.0**	**89.0**	21
NN47	**89.4**	**87.0**	**83.0**	**85.0**	**88.5**	**89.4**	**88.0**	**89.0**	18
NN50	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	6
NN51	**79.8**	**77.4**	73.4	75.4	**78.9**	**79.8**	**78.4**	**79.4**	9
NN52	**80.6**	**78.2**	74.2	**76.2**	**79.7**	**80.6**	**79.2**	**80.2**	6
NN19a	**77.3**	74.9	70.9	72.9	**76.4**	**77.3**	**75.9**	**76.9**	9
NN26a	**78.5**	**76.1**	72.1	74.1	**77.6**	**78.5**	**77.1**	**78.1**	5

Note [1]: Erection of 3m barrier in front of house

San Lung Tsuen Area (2B-2T)

Table 8.22: Predicted residual noise level at the representative NSRs with mitigation measures

NSR	Max Residual Noise Level dB(A)	Activities								No. of dwelling affected
		Sewer Construction						Road Surfacing		
		Site Preparation	Road Opening (SWL:100)	Trench Excavation	Sewage Laying	Earth Work (SWL: 101)	Finishes (SWL: 100)	Ballast Laying/ Concrete Compact-ion (SWL:100)	Road Pave-ment (SWL: 105.3)	
		G1	G2	G3	G4	G5	G6	G6a	G6b	
		Duration								
		2 weeks	1 weeks	3 weeks	2 weeks	1 Week	2 days	1 - 2 days	1 - 2 days	
		Residual Noise Level of Individual Activity, dB(A)								
NN31a	**80**	No piling oscillator	74.7	No excavator for trench	Manual	**75.7**	74.7	74.7	**80.0**	1
NN32	**84**		**78.7**			**79.7**	**78.7**	**78.7**	**84.0**	3
NN33	**86.5**		**81.2**			**82.2**	**81.2**	**81.2**	**86.5**	18
NN35	**86.5**		**81.2**			**82.2**	**81.2**	**81.2**	**86.5**	9
NN36	**79.3**		74.0			75	**74.0**	74.0	**79.3**	15
NN38	**79.3**		74.0			75	**74.0**	74.0	**79.3**	24
NN39	**86.7**		**81.4**			**82.4**	**81.4**	**81.4**	**86.7**	1
NN40	**86.8**		**81.5**			**82.5**	**81.5**	**81.5**	**86.8**	3

Shap Pat Heung Area (2B-2T)

Table 8.23: Predicted residual noise level at the representative NSRs with mitigation measures

NSR	Max Residual Noise Level dB(A)	Activities							No. of dwelling affected
		Sewer Construction					Road Surfacing		
		Site Preparation (SWL:104)	Road Opening (SWL:100)	Trench Excavat-ion / Earth Work (SWL:102)	Sewage Laying (SWL:105.5)	Finishes (SWL:106.4)	Ballast Laying/ Concrete Compact-ion (SWL:105)	Road Pave-ment (SWL:106)	
		G1	G2	G3/G5	G4	G6	R1/R2	R3	
		Duration							
		2 weeks	1 weeks	2 weeks	2 days	2 days	1 - 2 days	1 - 2 days	
		Residual Noise Level of Individual Activity, dB(A)							
NS01	**75.5**	73.1	69.1	71.1	74.6	**75.5**	74.1	75.1	3
NS11	**87.5**	**85.1**	**81.1**	**83.1**	**86.6**	**87.5**	**86.1**	**87.1**	2
NS13	**76.4**	74	70	72	**75.5**	**76.4**	75	**76**	18
NS16	**81.5**	**79.1**	**75.1**	**77.1**	**80.6**	**81.5**	**80.1**	**81.1**	24
NS17	**80.3**	**77.9**	73.9	**75.9**	**79.4**	**80.3**	**78.9**	**79.9**	12
NS24	**77.4**	75	71	73	**76.5**	**77.4**	**76**	**77**	45
NS25	**79.9**	**77.5**	73.5	**75.5**	**79**	**79.9**	**78.5**	**79.5**	21
NS26	**87.5**	**85.1**	**81.1**	**83.1**	**86.6**	**87.5**	**86.1**	**87.1**	6
NS27	**79.9**	**77.5**	73.5	**75.5**	**79**	**79.9**	**78.5**	**79.5**	15
NS28	**77.4**	75	71	73	**76.5**	**77.4**	**76**	**77**	3
NS31	**84.5**	**82.1**	**78.1**	**80.1**	**83.6**	**84.5**	**83.1**	**84.1**	3
NS34	**85.9**	**83.5**	**79.5**	**81.5**	**85**	**85.9**	**84.5**	**85.5**	15
NS35	**83.5**	**81.1**	**77.1**	**79.1**	**82.6**	**83.5**	**82.1**	**83.1**	15
NS36	**82.9**	**80.5**	**76.5**	**78.5**	**82**	**82.9**	**81.5**	**82.5**	9
NS40	**76**	73.6	69.6	71.6	75.1	**76**	74.6	**75.6**	24
NS42	**83.4**	**81**	**77**	**79**	**82.5**	**83.4**	**82**	**83**	24
NS45	**79.9**	**77.5**	73.5	**75.5**	**79**	**79.9**	**78.5**	**79.5**	18
NS46	**83.4**	**81**	**77**	**79**	**82.5**	**83.4**	**82**	**83**	9
NS47	**80**	**77.6**	73.6	**75.6**	**79.1**	**80**	**78.6**	**79.6**	33

NSR	Max Residual Noise Level dB(A)	Activities							No. of dwelling affected
		Sewer Construction					Road Surfacing		
		Site Preparation (SWL:104) G1	Road Opening (SWL:100) G2	Trench Excavat-ion / Earth Work (SWL:102) G3/G5	Sewage Laying (SWL:105.5) G4	Finishes (SWL:106.4) G6	Ballast Laying/ Concrete Compact-ion (SWL:105) R1/R2	Road Pave-ment (SWL:106) R3	
		Duration							
		2 weeks	1 weeks	2 weeks	2 days	2 days	1 - 2 days	1 - 2 days	
		Residual Noise Level of Individual Activity, dB(A)							
NS48	**75.5**	73.1	69.1	71.1	74.6	**75.5**	74.1	**75.1**	21
NS51	**83.4**	**81**	**77**	**79**	**82.5**	**83.4**	**82**	**83**	18
NS52	**76.9**	74.5	70.5	72.5	**76**	**76.9**	**75.5**	**76.5**	33
NS53	**76.6**	74.2	70.2	72.2	**75.7**	**76.6**	**75.2**	**76.2**	9
NS54	**81.5**	**79.1**	75.1	**77.1**	**80.6**	**81.5**	**80.1**	**81.1**	27
NS55	**77.4**	75	71	73	**76.5**	**77.4**	**76**	**77**	63
NS56	**83.4**	**81**	77	**79**	**82.5**	**83.4**	**82**	**83**	18
NS57	**83.4**	**81**	77	**79**	**82.5**	**83.4**	**82**	**83**	24
NS59	**76.3**	73.9	69.9	71.9	**75.4**	**76.3**	74.9	**75.9**	33
NS60	**79.9**	**77.5**	73.5	**75.5**	**79**	**79.9**	**78.5**	**79.5**	15
NS61	**77.4**	75	71	73	**76.5**	**77.4**	**76**	**77**	12
NS64	**85.9**	**83.5**	**79.5**	**81.5**	**85**	**85.9**	**84.5**	**85.5**	39
NS66	**89.4**	**87**	**83**	**85**	**88.5**	**89.4**	**88**	**89**	27
NS68	**85.9**	**83.5**	**79.5**	**81.5**	**85**	**85.9**	**84.5**	**85.5**	52
NS69	**75.9**	73.5	69.5	71.5	75	**75.9**	74.5	**75.5**	3
NS70	**76.9**	74.5	70.5	72.5	**76**	**76.9**	**75.5**	**76.5**	3
NS72	**87.5**	**85.1**	**81.1**	**83.1**	**86.6**	**87.5**	**86.1**	**87.1**	39
NS19a	**81.4**	**79**	75	**77**	**80.5**	**81.4**	**80**	**81**	12
NS19b	**81.4**	**79**	75	**77**	**80.5**	**81.4**	**80**	**81**	27
NS37a	**78.7**	**76.3**	72.3	74.3	**77.8**	**78.7**	**77.3**	**78.3**	9
NS37b	**89.4**	**87**	**83**	**85**	**88.5**	**89.4**	**88**	**89**	12
NS39a	**79.9**	**77.5**	73.5	**75.5**	**79**	**79.9**	**78.5**	**79.5**	21
NS42a	**79.9**	**77.5**	73.5	**75.5**	**79**	**79.9**	**78.5**	**79.5**	18
NS49a	**83.4**	**81**	**77**	**79**	**82.5**	**83.4**	**82**	**83**	12
NS52a	**84.4**	**82**	**78**	**80**	**83.5**	**84.4**	**83**	**84**	9
NS70a	**87.6**	**85.2**	**81.2**	**83.2**	**86.7**	**87.6**	**86.2**	**87.2**	18
NS76	**85.9**	**83.5**	**79.5**	**81.5**	**85**	**85.9**	**84.5**	**85.5**	12
NS76b	**77.4**	75	71	73	**76.5**	**77.4**	**76**	**77**	24

Note [1]: Erection of 3m barrier in front of house

8.10 Environmental Monitoring and Auditing

The recommended mitigation measures, monitoring procedures and locations are presented in detail in the Environmental Monitoring and Audit (EM&A) Manual. The effectiveness of on-site control measures could also be evaluated through the monitoring. All the recommended mitigation measures should be incorporated into the EM&A programme for implementation during construction.

9.0 OPERATIONAL PHASE NOISE ASSESSMENT

9.1 Legislation and Guidelines

Noise from pumping stations will be considered as fixed noise source. In accordance with Annex 5 of TM-EIAO, fixed plant noise levels should be 5dB(A) below the appropriate Acceptable Noise Levels (ANLs) or the prevailing noise level, whichever is the lowest. These noise limits apply to uses, which rely on open windows for ventilation.

The prevailing noise levels at the closest representative sensitive receivers in the nearby areas have been measured during daytime and nighttime to establish the appropriate noise criteria. A summary of the noise limits for the fixed plant is given in Table 9.1.

Table 9.1: Noise criteria for fixed plant source

Pumping Station Location	Noise Limit, $L_{eq, 30\ min}$ dB(A)		
	Prevailing Background[3]	Night Time	Adopted Noise Criteria
Ngau Tam Mei and San Tin (Package 2A-2T and 2B-1T)			
Ngau Tam Mei Sewage Pumping Station	68.5 (at NN08)	50 (ASR B)	50
Tam Mei Barrack Sewage Pumping Station	54 (at NN15)	45	45
San Tin Sewage Pumping Station	51 (at NN29)	50 (ASR B)	50
San Lung Tsuen Sewage Pumping Station	68.1 (at NN41)	45	45
San Tin Barracks Sewage Pumping Station	52 (at NN50)	45	45
Yuen Long South (Package 2B-2T)			
Shan Ha Tsuen Pumping Station	55.3 (at NS04)	45	45
Mui Kiu Tau Tsuen Pumping station	50.6 (at NS18)	45	45
Pak Sha Tsuen Pumping Station	52.7 (at NS21)	45	45
Sham Chung Tsuen Sewage Pumping Station	55.9 (at NS36)	45	45
Shui Tsiu San Tsuen Sewage Pumping Station	53.1 (at NS40)	45	45
Shung Ching San Tsuen Sewage Pumping Station	61.7 (at NS52a)	45	45
Nga Yiu Tau Sewage Pumping Station	55.3 (at NS70)	45	45
Lau Fau Shan and Mong Tseng (Package 2A-3T)			
Lau Fau Shan Sewage Pumping Station	51.7 (at NL04)	45	45
Mong Tseng Sewage Pumping Station	55.2 (at NL26)	45	45
Yuen Long (Package 2A-1T and the alternatives)			
Sewage Pumping Station near the Yuen Long STW	54.3 near Ng UK Tsuen (> 300m from STW)	50 (ASR B)	50

Note [1]: Night time: 2300 to 0700 hours
[2]: ANL –5dB(A) or prevailing background noise levels, whichever is lower
[3]: Measured at the closest representative receivers

As the prevailing background level is greater than the nighttime noise criteria stipulated in TM-EIAO, these noise criteria are adopted as the noise limit.

9.2 Baseline Condition

The background noise environment for most of the surrounding areas is generally tranquil except for Yuen Long Industrial Area and areas located along major roads, in particular the Yuen Long Highway, Route 3, San Tin Highway and Castle Peak Road, Lau Fau Shan Road and Ping Ha Road. In Yuen Long Industrial Area, the background noise environment generally consists of noise from industrial operation. Prevailing noise levels in terms of L_{eq} have been measured at the NSRs close to the SPSs to determine the appropriate noise criteria. The characteristics of nearby noise sensitive receivers in the vicinity of the pumping stations are summarized in Table 9.2.

Table 9.2: Characteristics of nearby environment in the vicinity of the Sewage Pumping Stations

Pumping Station	Description	Characteristics of nearby land use	ASR	Influencing Factors
Ngau Tam Mei and San Tin (Package 2A-2T and 2B-1T)				
P1	Ngau Tam Mei Sewage Pumping Station	Village Type Development	B	San Tin Highway
P2	Tam Mei Barrack Sewage Pumping Station	Barrack, Village Type Development	A	
P3	San Tin Sewage Pumping Station	Village Type Development and Residential (Group D) (S/YL-ST/5)	B	San Tin Highway

Pumping Station	Description	Characteristics of nearby land use	ASR	Influencing Factors
P4	San Lung Tsuen Sewage Pumping Station	Village Type Development	A	
P5	San Tin Barracks Sewage Pumping Station	Village Type Development	A	
Yuen Long (Package 2A-1T and the alternatives)				
OP1	Sewage Pumping Station near the Yuen Long STW	No sensitive receivers within 300m	-----	Yuen Long Industrial Estate
Lau Fau Shan and Mong Tseng (Package 2A-3T)				
A1	Lau Fau Shan Sewage Pumping Station	Village Type Development	A	
A2	Mong Tseng Sewage Pumping Station	Village Type Development	A	
Yuen Long South (Package 2B-2T)				
B1	Shan Ha Tsuen Sewage Pumping Station	Village Type Development	A	
B2	Muk Kiu Tau Tsuen Sewage Pumping Station	Village Type Development	A	
B3	Sham Chung Tsuen Sewage Pumping Station	Residential (Group D)	A	
B4	Shui Tsiu San Tsuen Sewage Pumping Station	Village Type Development	A	
B5	Shung Ching San Tsuen Sewage Pumping Station	Village Type Development	A	
B6	Nga Yiu Tau Sewage Pumping Station	Residential (Group D) & Village Type (S/YL-TT/10)	A	
B7	Pak Sha Tsuen Sewage Pumping Station	Village Type Development	A	

9.3 Noise Sensitive Receivers (NSRs)

Representative NSRs within 300m of the sewage pumping stations are given in Appendix 8.3 and shown in Figures 8.1 to 8.3. The assessment will focus on the first layer of NSRs that have direct line of sight to the proposed works. NSRs that are screened off by substantial barriers such as buildings are not included. The area sensitivity rating of the NSR is determined according to TM-NCO and they are shown in Table 9.2.

9.4 Potential Noise Sources

The potential noise sources for a standard pumping station include extraction fans, deodourisation system and operation of air valves in the rising mains.

9.5 Operational Noise Prediction Methodology

The major operational noise sources are from the pumping facilities. The sound power level of the pumping facilities can be determined by the CIBSE Guide, ASHARE Handbook or measurement on similar pumping station. However, as detailed information such as the number and location of extraction fans, location of air valves and building layout is currently unavailable, detailed noise calculations could not be undertaken.

In order to ensure the operation of the standard pumping station will comply with the TM-EIAO noise criteria, the maximum permissible SWL at the louvre of the pumping station is calculated based on the measured distance to the closest NSRs. As a conservative approach, a -6 dB tonal correction and a -3 dB façade correction have been applied in accordance with the TM-NCO. A hemispherical radiation model is adopted to determine the permissible SWL. In addition, on applying the above backward assessment, the cumulative impact from active concurrent projects in the vicinity of the pumping station is also taken into account.

9.6 Assessment Results for Operational Phase

Based on the methodology as described in Section 9.5, the maximum permissible SWLs at the louvres of the pumping station are calculated based on the noise criteria and measured distance from the closest NSRs. The recommended maximum permissible SWLs for the proposed SPS are presented in Tables 9.3 – 9.5.

9.6.1 Tin Shui Wai and Yuen Long Areas (Alternative 2A-1T)

There is no pumping station proposed in the Tin Shui Wai Area. For the Yuen Long Effluent Pumping Station, there are no noise sensitive receivers identified within 300m in the vicinity of the site. Therefore, no operational noise impact is anticipated for this area.

9.6.2 Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

The permissible SWL for the Pumping Stations in Ngau Tam Mei and San Tin Areas are summarized in Table 9.3.

Table 9.3: Permissible sound power level (SWL) for the proposed sewage pumping station in Ngau Tam Mei and San Tin Area

Pumping Stations	NSR No.	Distance from pumping station[1] (m)	Night-time Noise Criteria[2]	Permissible SWL at the Louvre dB(A)[4,5]
Ngau Tam Mei Pumping Station	NN08	52	50	83.3
Tam Mei Barrack Pumping Station	NN15	24	45	71.6
San Tin Pumping Station	NN29	67.5	50	85.6
San Lung Tsuen Pumping Station	NN41	14	45	66.9
Cassino Line Pumping Station[3]	NN50	32	45	74.1

Note: [1] Distance is estimated from notional source to the façade of the NSR
[2] As the pumping station will operate 24 hour, the night time noise level is selected.
[3]:Cassino Line Pumping Station is inside San Tin Barrack. Due to security reason, the land use inside the San Tin Barrack cannot be disclosed. The closest buildings inside the Barrack are thus assumed as the NSR
[4] It is assumed that there is no intermittent effect. The detail designer should further review the fan/pump specification and make suitable adjustment.
[5] SWL = Noise Criteria +10log(2π(distance)^2)- 6 (tonal effect) –3 (façade effect)

9.6.3 Lau Fau Shan and Mong Tseng Areas (2A-3T)

The permissible SWL for the Pumping Stations in Lau Fau Shan and Mong Teng Areas are summarized in Table 9.4.

Table 9.4: Permissible sound power level (SWL) for the proposed sewage pumping station in Lau Fau Shan and Mong Tseng Areas

Pumping Stations	NSR No.	Distance from pumping station[1] (m)	Night-time Noise Criteria[2]	Permissible SWL at the Louvre dB(A) [3,4]
Lau Fau Shan Pumping Station	NL04	74	45	81.4
Mong Tseng Pumping Station	NL26	28	45	72.9

Note [1] Distance is estimated from notional source to the façade of the NSR
[2] As the pumping station will operate 24 hour, the night time noise level is selected.
[3] It is assumed that there is no intermittent effect. The detail designer should further review the fan/pump specification and make suitable adjustment.
[4] SWL = Noise Criteria +10log(2π(distance)^2)- 6 (tonal effect) –3 (façade effect)

9.6.4 Shap Pat Heung Area (2B-2T)

The permissible SWL for the Pumping Stations in Shap Pat Heung Area are summarized in Table 9.5.

Table 9.5: Permissible sound power level (SWL) for the proposed sewage pumping station

NSR No.	NSR No.	Distance from pumping station[1] (m)	Night-time Noise Criteria[2]	Permissible SWL at the Louvre dB(A) [3,4]
Shan Ha Tsuen Pumping Station	NS04	28	45	72.9
Mui Kui Tau Tsuen Pumping Station	NS18	32	45	74.1
Pak Sha Tsuen Pumping Station	NS21	16	45	68.1
Sham Chung Tsuen Pumping Station	NS36	10	45	64.0
Shui Tsiu San Tsuen Pumping Station	NS40	22	45	70.8
Shung Ching San Tsuen Pumping Station	NS52a	16	45	68.1
Nga Yiu Tau Tsuen Pumping Station	NS70	24	45	71.6

Note [1] Distance is estimated from notional source to the façade of the NSR
[2] As the pumping station will operate 24 hour, the night time noise level is selected.
[3] It is assumed that there is no intermittent effect. The detail designer should further review the fan/pump specification and make suitable adjustment.
[4] SWL = Noise Criteria +10log(2π(distance)^2)- 6 (tonal effect) –3 (façade effect)

Tables 9.3 – 9.5 give the permissible SWL at the louvre of the pumping station. It will adopted as the pump room noise design criterion in the contractor specification.

9.7 Mitigation Measures for Operational Phase

With reference to the measurement carried out in the existing Ha Tsuen Sewage Pumping Station (see Table A5-1 in Annex A of the EIA report of YLKTSSDS-1), a noise level of 81 dB(A) was measured at 1m from the

louvre opening (which is equivalent to Sound Power Level of 94dB(A) at Louvre on assuming area source of louve size of 1.65m × 1.65m , SWL = Measured SPL + 10log(Conformal surface), where the conformal surface at 1m is approximate 19.4m^2). According to the EIA report of YLKTSSDS-1, the existing Ha Tsuen SPS is currently without any acoustics treatment. In view of the above calculation, the recommended maximum permissible SWLs are not particularly onerous and could be achieved by using conventional plant with the adoption of proper acoustic treatments and building design, where necessary. From Table 9.3, Table 9.4 and 9.5, the lowest sound power level at louvre to be achieved is 64dB(A), which is 30 dB(A) lower than that of the common Pumping Station without mitigation measures. Table 9.6 proposes the mitigation measures that are required in practice to reduce the noise levels.

Table 9.6: Proposed Mitigation Measures for Pumping House

Sources	Proposed Mitigation Measures	Reduction dB(A)
Fan	Acoustic Enclosure Silencer at inlet and outlet	20 – 30
Pump	Acoustic Enclosure Anti-vibration Spring Mount	20 – 30
Louvre	Acoustic Lounre	10 – 20

By incorporating the above recommendations, the recommended maximum permissible SWLs could be achieved and therefore adverse noise impacts are not expected.

It is recommended that further noise assessment should be carried out during the detailed design stage of the proposed sewage pumping station to determine the type of mitigation measures required for meeting the recommended maximum permissible SWLs. Basic building design such as to avoid any opening or louvres facing the nearest NSR should always be considered.

10.0 WATER QUALITY ASSESSMENT

10.1 Legislation and Standards

The following legislation, standards and guidelines are considered in the water quality assessment:
** Water Pollution Control Ordinance (WPCO) CAP 358[11]: The WQOs for the Deep Bay Water Control Zone (DBWCZ) are shown in Appendix 10.1;*
** Water Pollution Control Ordinance (WPCO) CAP 358[11]: The WQOs for the North Western Water Control Zone (NWWCZ) are shown in Appendix 10.2;*
** Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems Inland and Coastal Waters[12]: The effluents discharge limits for the DBWCZ are shown in Appendix 10.3;*
** Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems Inland and Coastal Waters[12]: The effluents discharge limits for the NWWCZ are shown in Appendix 10.4;*
** Water Quality Index proposed by the Netherlands Ministry of Transport;*
** Practice Note for Professional Persons ProPECC PN 1/94 "Construction Site Drainage"[13].*
** Recommended Pollution Control Clauses for Construction Contracts*
** Environmental Guidance Note for Sewage Pumping Stations which is not a designated Project[14]*
** Marine Water Quality in Hong Kong in 2000, EPD, 2001[84]*
** River Water Quality in Hong Kong in 2000, EPD, 2001[16].*

10.2 Baseline Condition

10.2.1 Inland Water Quality

In the vicinity of the study area, lots of natural streams and channels are identified. These streams or channels will join into several main watercourses (Tin Shui Wai Nullah, Yuen Long Creek and Fairview Park Nullah) before discharging into the Deep Bay. Table 10.1 shows the baseline data of the EPD routine river quality monitoring stations in some main streams. The station locations are given in Figure 10.1.

Table 10.1: Key EPD routine river quality monitoring data at Year2000

Water Quality Parameter	Tin Shui Wai Nullah TSR1	Yuen Long Creek		Fairview Nullah FVR1
		YL1	YL2	
Dissolved Oxygen (mg L^{-1})	6.7	6.1	7.6	4.4
PH	7.5	7.5	7.6	7.2
Suspended Solids (mg L^{-1})	18	19	14	28
BOD_5 (mg L^{-1})	8	15	9	7
COD (mg L^{-1})	20	39	33	28
E. coli (cfu 100mL^{-1})	1,050,000	263,000	90,200	47,600
Ammonia-nitrogen (mg L^{-1})	2.1	11.30	9.75	3.65
Oil & grease (mg L^{-1})	0.5	0.9	0.6	0.5
Nitrate-Nitrogen (mg L^{-1})	1.0	1.45	1.25	1.45
Total Kjeldahl nitrogen (mg L^{-1})	2.95	14	12	4.60
Ortho-phosphate (mg L^{-1})	0.2	2.2	2.2	0.51
Total phosphorous (mg L^{-1})	0.44	3.2	2.85	1.05

Notes:
Data from River Water Quality in Hong Kong in Year 2000, EPD(2001)
Data presented are in annual medians of monthly samples; except for E. coli which are in annual geometric means
cfu – colony forming unit

Tin Shui Wai Nullah is a concrete channel draining into Deep Bay. Due to the vigorous enforcement actions taken against pollution farms and construction sites, the water quality of the Nullah has improved substantially. Suspended Solid, COD and BOD_5 are reduced. The Water Quality of the nullah is considered as fair and the compliance rate was 88% in Year 2000.

Yuen Long Creek is 60km long and covers an area of 26.7km^2. It passes through Yuen Long Town before flowing into inner Deep Bay. The water quality of Yuen Long Creek was unsatisfactory and the E. Coli counts remained very high due to pollution from nearby unsewered villages and livestock farms. The compliance rate was 48% in Year 2000.

Fairview Park Nullah is a man-made nullah passing through the Fairview Park, and Mai Po Nature Reserve before discharging into the Deep Bay. The water quality of Fairview Park Nullah is considered as fair with the compliance rate of 53% in Year 2000. The major source of pollutants is from the upstream livestock waste.

10.2.2 Maine Water Quality

Most of the streams within the study area will discharge into inner Deep Bay ultimately. Tidal current inside Deep Bay are extremely slow, resulting in long residence times in the marine waters. There is one routine EPD water quality monitoring station, DM1, located in the vicinity of the discharge locations for the streams, which may be affected by the construction works. The marine water quality data and locations of the EPD Routine Marine Water Quality Monitoring locations are shown in Table 10.2 and Figure 10.2 respectively.

After the commencement of the YLKTSSD Stage II Scheme, the effluent from Yuen Long STW, sewage collected from Lau Fau Shan and Southern Yuen Long will be delivered to the San Wai Sewerage Treatment Works (San Wai STW) for treatment before discharging into the North Western Water Control Zone (NWWCZ). The representative monitoring station near the outfall is NM5. The monitored data is shown in Table 10.2 for comparison.

Table 10.2 : EPD marine water quality monitoring data in Year 2000

Water Quality Parameter	Inner Deep Bay DM1	North Western NM5
Temperature (^oC)	22.8 (14.0-30.7)	23.6 (17.6 – 28.2)
Salinity (ppt)	18.2 (4.8-25.8)	27.7 (20.4 –32.2)
Dissolved Oxygen (mg L^{-1})	4.8 (3.6-6.2)	6.0 (3.7 – 8.6)
BOD_5 (mg L^{-1})	2.7 (1.2-5.5)	0.8 (0.2 –2.0)
Suspended Solids (mg L^{-1})	30.8 (15.0-69.0)	11.1 (2.0 – 26.1)
Total Inorganic Nitrogen (mg L^{-1})	4.08 (2.42-9.52)	0.51 (0.27 – 0.99)
Unionised Ammonia (mg L^{-1})	0.053 (0.024-0.127)	0.005 (0.002 - 0.014)
Chlorophyll-a (µg L^{-1})	4.3 (0.9 – 9.7)	3.8 (0.2 – 25.0)
E. coli (cfu $100mL^{-1}$)	3600 (150-130000)	480 (170 – 2300)

Notes:
Data from Marine Water Quality in Hong Kong in 2000, EPD (2001)
Data presented are depth averaged, except as specified.
Bolded values indicate the exceedance of WQOs
Data presented are annual arithmetic means except for *E. coli* which are geometric means
Data enclosed in brackets indicate the ranges.

For station DM1 in inner Deep Bay, exceedance of the WQOs for Total Inorganic Nitrogen (TIN), Unionised Ammonia and *E. Coli* was reported in Year 2000. The marine waters of Deep Bay were heavily affected by discharges from rivers in both Hong Kong and Shenzhen. The high level of TIN and Unionised Ammonia reflect the high nutrient inside Deep Bay, while that the high *E. Coli*. level indicates the high sewage contamination of the water. In summary, Deep Bay faces long-term pollution problems including: nutrient enrichment, ammonia toxicity and bacterial contamination, which threaten the sensitive ecosystem and oyster culture in Deep Bay.

The water quality in the North Western Water Control Zone (NWWCZ) is influenced by the discharge from major sewage outfalls and the Pearl River flow. In the vicinity of the study area, there are three major sewage outfalls, namely Northwest New Territories (NWNT), Pillar Point and Siu Ho Wan sewage outfalls. The monitoring results in Year 2000 indicated that higher E. Coli and faecal coliform counts were observed at NM5 near the outfalls. This is due to the increasing sewage discharge from the NWNT outfall into Urmston Road. In addition, the NWWCZ also exhibited decreasing nitrogen and phosphorus gradients from North to South in line with the direction of Pearl River flow.

10.3 Water Sensitive Receivers

10.3.1 Inland Waters

Representative inland WSRs, such as ponds, streams and nullahs in the vicinity of the study area, are identified and shown in Table 10.3 – Table 10.6 and Figure 10.3 – Figure 10.5.

Major Streams

Table 10.3: Major streams

WSR No.	WSR Description
IW 1	Yuen Long Creeks
IW 2	Tin Shui Wai Nullah
IW 3	Fairview Nullah

Other Local Ponds, Streams and Nullahs

Table 10.4: Local ponds, streams and nullahs in Lau Fau Shan

WSR No.	WSR Description
IL1	Local stream in Hang Hau Tsuen
IL2	Ponds along the western bank of the Tin Shui Wai Nullah
IL3	San Pui River
IL4	Ponds in Fung Kong Tsuen
IL5	Ponds in San Wai
IL6	Ponds in Mong Tseng Tsuen
IL7	Ponds in Tai Tseng Wai

Table 10.5: Local ponds, streams and nullahs in San Tin

WSR No.	WSR Description
IS1	Kam Tin River
IS2	Local streams in San Wai Tsuen and Man Yuen Chuen
IS3	Local streams in Yau Mei Shan Tsuen
IS4	Ngau Tam Mei Main Drainage Channel
IS5	Local stream in San Lung Tsuen
IS6	Ponds along the northern bound of Castle Peak Road – San Tin Section
IS7	Ponds in San Tin Tsuen

Table 10.6: Local ponds, streams and nullahs in Shap Pat Heung

WSR No.	WSR Description
IP1	Local stream in San Ha Tsuen
IP2	Kung Um Road Nullah
IP3	Drainage Channel from Sham Chung Tsuen to Shui Tsiu San Tsuen
IP4	Tai Shu Ha Road Nullah

10.3.2 ***Marine Waters***

The Water Control Zones in concern in this study are DBWCZ and NWWCZ. The WSRs in these regions are shown in Table 10.7 and Figure 10.6.

Table 10.7: Marine water sensitive receivers

No.	WSR Description	Potential Impact
MW 1	Inner Deep Bay and Mai Po Marshes Site of Special Scientific Interest (SSSI)	Pumping stations emergency discharge to Deep Bay through channels or other local stream
MW 2	Shellfish culture ground	
MW 3	Tsim Bei Tsui Site of Special Scientific Interest (SSSI)	
MW 4	Pak Nai Site of Special Scientific Interest (SSSI)	Discharge from SWSTW through Urmston Road outfall in normal operation.
MW 5	Cooling water intake for CLP Black Point Power Station	
MW 6	Chinese White Dolphin feeding ground in the Urmston Road	
MW 7	Marine Park at Sha Chau / Lung Kwu Chau	
MW 8	Non-gazetted beaches	
MW 9	Gazetted beaches	
MW 10	Cooling water intake for CLP Pillar Point Power Station	
MW 11	Seawater abstraction point (cooling)	
MW 12	Seawater abstraction point (flushing)	
MW 13	Tuen Mun Typhoon Shelter	
MW 14	Ma Wan Fish Culture Zone	
MW 15	Secondary contact recreational areas	

10.4 Assessment Methodology for Construction Phase

The types of discharge within the construction site of the proposed project and other interfacing projects are identified in this study. Their potential water quality impacts are assessed accordingly. Mitigation measures as recommended on ProPECC PN 1/94 and RPCC are proposed.

10.5 Assessment Methodology for Operational Phase

Emergency Discharge

During operational phase, potential water quality impact issue as a result of pumping station failure, repairing and maintenance of pressurized sewers may be experienced. Under these circumstances, raw sewer will be overflown from the emergency discharge and enters the nearby water body. Section 10.6.4 gives recommendations for minimizing the duration of untreated sewage discharges.

Normal Operation

In normal operation, the sewage will be collected and treated in the upgraded San Wai STW before final discharge to the Urmston Road. The capacity of the upgraded San Wai STW has already catered for the future population change. The potential cumulative impact is addressed in the approved EIA report of "Upgrading and Expansion of San Wai Sewage Treatment Works and Expansion of Ha Tsuen Pumping Station[82]". The findings have been incorporated in this assessment.

10.6 Assessment Results and Recommendation

10.6.1 Findings for Construction Phase

Potential impacts during the construction phase will be arisen from pollutants in surface run-off, which may enter surface water or the stormwater drain directly before discharging into Deep Bay.

Temporary site facilities may also generate wastewater from different activities. Such activities may include sewage effluent from toilets and water from plant maintenance facilities, which may be contaminated with lubricant and other petroleum products.

For sewers crossing the local streams, the sewers will be laid using the trenchless pipe jacking method. This method avoids direct disturbance of any sediments on the bed of the channels. The trenchless pipe jacking methodology is shown in Appendix 10.5. However, in the event of malfunction of the tunnelling machine, a rescue pit would be sunk into the streams. Dredging works will be required. This could potentially cause localised impacts on water quality, particularly if the sediments are contaminated.

Mitigation measures will be necessary to prevent the transport of sediment in suspension away from the works area. In addition, embankments along the sides of the channels will need to be removed and reinstated once the sewers have been laid, which could result in spillage of material to the channels. Besides, if pumped groundwater is not controlled properly, it will have potential adverse impacts on the nearby surface water quality.

10.6.2 Recommendations for Construction Phase

In accordance with Practice Note for Professional Persons on "Construction Site Drainage", Environmental Protection Department, 1994 (ProPECC PN 1/94), construction phase mitigation measures will include the following:

Construction Runoff and Site Drainage

- In advance of site formation works of the sewage pumping station or excavation, perimeter cut-off drains to direct off-site water around the site should be constructed, with internal drainage works, erosion and sedimentation control facilities implemented. Channels, earth bunds or sand bag barriers should be provided on site to direct stormwater to silt removal facilities. The design of the temporary on-site drainage system will be undertaken by the contractor prior to the commencement of construction.

- Efficient silt removal facilities should be designed based on the guidelines in *Appendix A1* of ProPECC PN 1/94, which states that the retention time for silt/sand traps should be 5 minutes under maximum flow conditions. As sizes may vary depending upon the flow rate, for flow rate of 0.1 m^3s^{-1} a sedimentation basin of 30m^3 would be required and for a flow rate of 0.5 m^3 s^{-1} the basin would be 150 m^3. The detailed design of the sand/silt traps will be undertaken by the contractor prior to the commencement of construction.
- Construction works should be programmed to minimise surface excavation works during the rainy seasons (April to September). All exposed earth areas should be completed and vegetated as soon as possible after earthworks have been completed, or alternatively, within 14 days of the cessation of earthworks where practicable. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means.
- The overall slope of the site should be kept to a minimum to reduce the erosive potential of surface water flows, and all trafficked areas and access roads protected by coarse stone ballast. An additional advantage accruing from the use of crushed stone is the positive traction gained during prolonged periods of inclement weather and the reduction of surface sheet flows.
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit should be removed regularly and disposed of by spreading evenly over stable, vegetated areas.
- Measures should be taken to minimise the ingress of site drainage into excavations. If excavation of trenches in wet seasons is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations should be discharged into stormwater drains via silt removal facilities.
- Open stockpiles of construction materials (for example, aggregates, sand and fill material) of more than 50 m^3 should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.
- Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and storm runoff being directed into foul sewers.
- Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecasted, and actions to be taken during or after rainstorms are summarised in *Appendix A2* of ProPECC PN 1/94. Particular attention should be paid to the control of silty surface runoff during storms events, especially for areas located near steep slopes.
- All vehicles and plant should be cleaned before leaving a construction site as far as possible to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing bay should be provided at the exit of Sewage Pumping Station construction site and wash-water should have sand and silt settled out and removed at least on a weekly basis to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains.
- On-site drainage system should be equipped with oil interceptors to separate oil / fuel from contaminated storm water.

General Construction Activities

- Construction solid waste, debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts. Requirements for solid waste management are detailed in Section 11 of this Report.
- All fuel tanks and storage areas should be provided with locks and sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching water sensitive receivers nearby.

Sewage Effluent from Construction Work Force

Construction work force sewage should be handled by portable chemical toilets or sewage holding tanks with the sewage regularly collected by a reputable sewage collector for disposal at for example, Yuen Long STW.

Stream Crossings

The adoption of Pipe Jacking method in crossing stream will prevent adverse impacts on water quality, as discussed in Section 10.6.1.

If there is a malfunction of pipe jacking machine at one end of the tunnel, jacking can be operated at another end of the tunnel for rescue operation. The chance of failure at both ends is very low unless the rock type is extreme hard. If there is equipment malfunction when crossing the stream, a rescue pit may need to be excavated. However, in accordance with DSD previous experience, there was no such excavation exercise in the past since the sediment underneath the stream is generally soft in nature. If a rescue pit is required in an extreme worse case situation then the following precautionary/ mitigation measures should be implemented during excavation:

- Containment of suspended solid by silt curtain. However, this method is only effective at current velocity less than 0.01 m/s. A second silt curtain shall be applied at a further downstream location (10-20m away) from the first silt curtain. These configurations will mininise the dispersion of containment.
- Shielding the cutterhead or using specially design cutterheadand enclosures to minimize the leaking of suspended solid during excavation.
- Mechanical grab shall be seal tightly to avoid spillage while being lift.
- Marine works shall not cause visible foam, oil, grease, scrum, litter or other objectionable matter to be present on the waters within the site.

If vessels are going to be used in wide nullah (e.g Tin Shui Wai Nullah), the following additional mitigation measures shall be adopted:

- Vessels should be sized such that adequate clearance is maintained between vessels and the seabed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.
- Barges and grab dredgers shall be fitted with tight-fitting seals to their bottom opening to prevent leakage of material.
- Excess materials shall be cleaned from the decks and exposed fittings of barges and grab dredgers before the vessel departs.
- Adaquate freeboard shall be maintained on barges to ensure that decks are not washed.

Material excavated from any rescue pits is likely to be stockpiled for disposal. This material should be covered with impermeable sheets and placed on an impermeable liner in order to prevent rainfall eroding the material leading to stormwater runoff or other surface runoff with high suspended solid concentrations. The disposal of excavated material will be discussed in Section 11.

Cumulative Impact

In the vicinity of the proposed project site, numerous interfacing projects are identified. Table 10.8a – 10.8d summarizes the projects in different work areas and their proposed mitigation measures.

Table 10.8a: Interfacing projects for package 2A-1T (Tin Shui Wai Area)

Item	Concurrent Project	Scheduled Construction Period		Over-lapping Months	Distance > 500m from represent-ative WSR	Potential to Cause Cumulative Water Quality Impact	Mitigation Measures
		Start	Compl-ete				
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×	---
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	No	×	---
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	No	×	---
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung	Aug 2003	Dec 2005	6	Yes	×	---

Item	Concurrent Project	Scheduled Construction Period		Over-lapping Months	Distance > 500m from represent-ative WSR	Potential to Cause Cumulative Water Quality Impact	Mitigation Measures
		Start	Compl-ete				
	Interchange						
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	Yes	×	---
6	Deep Bay Link (San Wai Section)	Jul 2003	Jun 2006	12	No	✓	Implement mitigation measures stated in approved EIA report AEIAR 064/2002
7	San Wai Sewerage Treatment Works	2004	2007	30	No	✓	Implement mitigation measures stated in approved EIA report AEIAR 072/2002
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×	---
9	Ping Ha Road Improvement Remaining Works	---	2006	6	No	✓	ProPECC Note PN 1/94
10	Alternative 4 Bypass Culvert	2003	2007	18	No	✓	ProPECC Note PN 1/94
11	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	Yes	×	---
12	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1B-2T)	Aug 2004	Feb 2008	30	No	✓	Implement mitigation measures stated in approved EIA report AEIAR 063/2002
13	Tin Shui Wai Further Development	July 1998	2003	0	Yes	×	---
14	157DS Phase 3B/3C San Wai and Tung Tau Tsuen	June 2005	June 2007	24	No	✓	ProPECC Note PN 1/94
15	Lau Fau Shan Remaining Development	No construction schedule		---	Yes	×	---

Note [1] : MDC-Eastern Section is more than 300 m from the present project

Table 10.8b: Interfacing Projects for Package 2A-3T (Lau Fau Shan Area)

Item	Concurrent Project	Scheduled Construction Period		Overlap ping Months	Distance > 500m from represent-ative WSR	Potential to Cause Cumulative Water Quality Impact	Mitigation Measures
		Start	Comple te				
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×	---
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	Yes	×	---
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	Yes	×	---
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	Yes	×	---
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	Yes	×	---
6	Deep Bay Link	Jul 2003	Jun 2006	12	Yes	×	---
7	San Wai Sewerage Treatment Works	2004	2007	30	Yes	×	---
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×	---
9	Ping Ha Road Improvement Remaining Works	---	2006	6	No	✓	ProPECC Note PN 1/94

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 500m from represent-ative WSR	Potential to Cause Cumulative Water Quality Impact	Mitigation Measures
		Start	Complete				
10	Alternative 4 Bypass Culvert	2003	2007	18	Yes	×	---
11	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	Yes	×	---
12	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1B-2T)	Aug 2004	Feb 2008	30	Yes	×	---
13	Tin Shui Wai Further Development	July 1998	2003	0	No	×	---
14	157DS Phase 3B/3C San Wai and Tung Tau Tsuen	June 2005	June 2007	24	No	✓	ProPECC Note PN 1/94
15	Lau Fau Shan Remaining Development	No construction schedule		---	No	×	---

Note [1] : MDC-Eastern Section is more than 300 m from the present project

Table 10.8c: Interfacing Projects for Package 2B-2T (Shap Pat Heung Area)

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 500m from represent-ative WSR	Potential to Cause Cumulative Water Quality Impact	Mitigation Measures
		Start	Compl-ete				
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×	---
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	Yes	×	---
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	Yes	×	---
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	No	✓	Implement mitigation measures stated in approved EIA report AEIAR 059/2002
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	No	×	---
6	Deep Bay Link	Jul 2003	Jun 2006	12	Yes	×	---
7	San Wai Sewerage Treatment Works	2004	2007	30	Yes	×	---
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×	---
9	Ping Ha Road Improvement Remaining Works	---	2006	6	Yes	×	---
10	Main Drainage Channels and Poldered Village Protection Schemes for San Tin[1]	Jun 2001	Dec 2003	0	Yes	×	---
11	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1A-1T)	Aug 2003	Feb 2006	8	Yes	×	---
12	Tin Shui Wai Further Development	July 1998	2003	0	Yes	×	---
13	157DS Phase 2 Yuen Long South Pumping Station, Rising Main to Castle Peak Road and Sewers	Jan 2003	May 2006	12	No	✓	ProPECC Note PN 1/94
14	274DS Phase 1 Shap Pat Heung Rising Main and Gravity Sewer; Au Tau Sewage Pumping Station and Ancillary Works	Jan 2003	May 2006	12	No	✓	ProPECC Note PN 1/94
15	274DS Phase 7A/ 7B San Sang Tsuen and Tin Sum, Shan Ha and Tai Tong Tsuen	June 2007	July 2009	6	No	✓	ProPECC Note PN 1/94
16	Lau Fau Shan Remaining Development	No construction schedule		---	Yes	×	---

Note [1]: MDC-Eastern Section is more than 300 m from the present project

Table 10.8d: Interfacing Projects for Package 2A-2T and 2B-1T (Ngau Tam Mei Area)

Item	Concurrent Project	Scheduled Construction Period		Overlapping Months	Distance > 500m from represent-ative WSR	Potential to Cause Cumulative Water Quality Impact	Mitigation Measures
		Start	Compl-ete				
1	DD901 – West Rail Environmental Support Services Essential Public Infrastructure Works: Yuen Long, Tin Shui Wai and Tuen Mun Centre	May 99	Nov 03	0	Yes	×	---
2	Tin Shui Wai Phase 4 Extension	2001	2004	0	Yes	×	---
3	Light Rail Transit (LRT) Extension in Tin Shui Wai Reserve Zone and Grade Separation of the LRT with Pui To Road and Tsing Lung Road in Tuen Mun	2001	2004	0	Yes	×	---
4	Widening of Yuen Long Highway between Lam Tei and Shap Pat Heung Interchange	Aug 2003	Dec 2005	6	Yes	×	---
5	Yuen Long Bypass Floodway - Feasibility Study	Mar 2001	Dec 2003	0	Yes	×	---
6	Deep Bay Link	Jul 2003	Jun 2006	12	Yes	×	---
7	San Wai Sewerage Treatment Works	2004	2007	30	Yes	×	---
8	Shenzhen Western Corridor	Mar 2003	Dec 2005	6	Yes	×	---
9	Ping Ha Road Improvement Remaining Works	---	2006	6	Yes	×	---
10	Main Drainage Channels and Poldered Village Protection Schemes for San Tin [1]	Jun 2001	Dec 2003	0	Yes	×	---
11	Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 (1A-1T)	Aug 2003	Feb 2006	8	No	✓	Implement mitigation measures stated in approved EIA report AEIAR 063/2002
12	Tin Shui Wai Further Development	July 1998	2003	0	Yes	×	---
13	92CD Package NTM1	Nov 2003	Jun 2006	12	Yes	×	---
14	Lau Fau Shan Remaining Development	No construction schedule		---	Yes	×	---

Note [1] : MDC-Eastern Section is more than 300 m from the present project

Most of the interfacing works listed in Table 10.8 are land-based operation and similar in nature. The release of construction runoff into Deep Bay may result in cumulative impacts. For the designated projects identified, the mitigation measures listed in the corresponding EIA reports are supposed to be implemented in their construction sites. For the non-designated projects, the mitigation measures listed in ProPECC Note PN 1/94 would also be adopted. Basically, construction site run-off will be effectively controlled by appropriate mitigation measures including site drainage system, effluent monitoring and audit. Generation of wastewater, sewage from workforce, accidental spillage will be minimized through the provision of chemical toilets, wastewater treatment facilities, off site disposal and spill contingency plan.

In order to assess the effectiveness of these mitigation measures, a similar existing construction project "Village Flood Protection Works for Mai Po Lo Wai & Mai Po San Tsuen" has been reviewed for this study. The major items of the project are to construct the Village Flood Protection Works for Wang Chau, Mai Po Lo Wai and Mai Po San Tsuen and drainage improvement works at Tan Kwai Tsuen. Water quality mitigation measures proposed in its EIA report were adopted. According to their monthly EM&A monitoring data, the monthly average suspended solid concentration varied from 25 to 186 mg/L, which are well below the triggering level of 203mg/L. Hence, it is considered that the mitigation measures are very effective.

Based on the review, with the proposed mitigation measures, the interfacing construction projects will not have imparted detrimental impact on the nearby water environment. Cumulative impacts from other interfacing construction projects are, thus, not anticipated. Hence, no water quality monitoring will be required.

10.6.3 ***Findings for Operational Phase***

Emergency Discharge

The operation of Yuen Long / Kam Tin Sewerage and the associated Sewage Pumping Stations will result in an improvement to the quality of inland waters through enhancement of the efficiency of the sewer system. However, during the maintenance periods of the pumping stations and pressurized sewers, or the failure of the pumping station, potential environmental impact will be the discharge at emergency bypass on adjacent streams as well as accidental damage and subsequent repair of the pressurized sewers causing overspillage.

In case emergency discharge occurs (due to emergency repair and maintenance works of pressurized sewers) the raw sewage from the emergency discharge (except that of the Yuen Long Effluent Pumping Station) will be directly discharged to the nearest nullahs, streams or stormwater drainage leading to Deep Bay. As a worst scenario, the emergency discharge is assumed to continue for approximately 15 days (such as urgent repair / replacement of the main control panel). During this period, the water quality in the nearby nullahs, streams and stormwater drainage will be affected. One potential impact will include the reduction of light into the water due to the suspended solid in the sewage, which will affect the aquatic organism. However, the ecological value of the nullahs and streams in the vicinity of the project site is low and long-term impact on the nullahs, and streams is therefore not expected. Normally the decay of pollutants inside the nullahs, streams and stormwater drainage are very low. Once the pollutants reach the Deep Bay, it will cause an increase in *E. Coli*, Unionised Ammonia (UIA) and TIN concentrations.

Given that the capacities of the proposed pumping stations are smaller than that of the Ha Tsuen Pumping station (246,000m^3/day) and most of the emergency outflow of the proposed pumping stations will be discharged into the inner deep bay (except the Lau Fau Shan SPS), the findings of the approved EIA report for "Updating and Expansion of San Wai STW and the Expansion of Ha Tsuen PS" (EIA-SWSTW) can be applied here.

According to the approved EIA-SWSTW report, the emergency discharge of raw sewage into the Inner Deep Bay will cause an increased in E. Coli, UIA and TIN in the Tsim Bei Tsui SSSI in both wet and dry seasons. The influence on water quality at EPD Marine Monitoring stations at DM1, DM2, DM3 and Pak Nai SSSI (which is located further away) will be reduced with increasing distance. Normally, the pollutant levels will be reduced rapidly after termination of emergency discharge. The approved EIA report predicts that the TIN and UIA levels will drop to levels almost the same as the baseline conditions in 5 - 8 days. For E.Coli, its concentration will decrease rapidly and return to the baseline level in a shorter period after the emergency discharge ceases. Since the capacities of the proposed pumping stations are much smaller than that of the Ha Tsuen Pumping Station, it is anticipated that the time required for E. Coli, UIA and TIA to return to the baseline value would be much shorter.

For the Lau Fau Shan SPS, the emergency discharge will be near Hang Hau Tsuen in Deep Bay, which is far away from the Tsim Bei Tsui SSSI. Hence its impact on the Tsim Bei Tsui SSSI will be minor. For the Yuen Long Effluent Pumping Station, it conveys the treated effluent from the Yuen Long STW to San Wai STW through the Effluent Pipeline. As the effluent is already treated, the emergency discharge from the Yuen Long Effluent Pumping Station will not cause adverse water quality impact on Deep Bay.

Due to the presence of backup facilities (standby pumps, backup power and twin rising mains), the occurrence of emergency discharge is exceptionally rare. According to DSD's record, emergency discharge in the vicinity of the study area has been occurred. Should a breakdown of the pumping station occur due to power supply failure, based on the past experience in Hong Kong, the pumping station operation will be recovered in hours. In the proposed sewerage system, twin rising mains are adopted. During sewer repair, either one of the twin sewers will be left operational. The chance of failure of both sewers in twin rising mains is very low.

Table 10.9 summarizes the emergency bypass locations at each pumping station site. Detailed mitigation measures, which would serve to minimise the risk of failure and facilitate a rapid response in the event of failure, are described in *Section 10.6.4*.

Table 10.9 Pumping stations and emergency bypass locations

Item	Sewage Pumping Station	Emergency Bypass Locations
Lau Fau Shan Area		
A1	Lau Fau Shan SPS	Streams near Hang Hau Tsuen
A2	Mong Tseng Tsuen SPS	Nearby stormwater drains or surface channel
Yuen Long Area		
AP1	Yuen Long Effluent SPS	San Pui River
San Tin Area		
P1	Ngau Tam Mei SPS	Planned Main Drainage Channel, Local steams near Yau Mei San Tsuen
P2	Tam Mei Barrack SPS	Yau Tam Mei Main Drainage Channel
P3	San Tin SPS	Local streamwater drains near San Tin Tsuen Road
P4	San Lung Tsuen SPS	Nearby stormwater drains or surface channel
P5	San Tin Barrack SPS	Nearby stormwater drains or surface channel
Shap Pat Heung		
B1	Shan Ha Tsuen SPS	Nearby stormwater drains or surface channel
B2	Muk Kiu Tau SPS	Kung Um Road Nullah
B3	Sham Chung Tsuen SPS	Kung Um Road Nullah
B4	Shui Tsiu San Tsuen SPS	Planned drainage channel near Shui Tsiu San Tsuen
B5	Shung Ching San Tsuen SPS	Planned drainage channel near Shung Ching San Tsuen
B6	Nga Yiu Tau SPS	Tai Shiu Ha Road Nullah
B7	Pak Sha Tsuen SPS	Kung Um Road Nullah

Normal operation

The sewage collected from the proposed sewer mains will be connected and delivered to San Wai STW, where the sewage will be treated and discharged into the NWWCZ. This will result in an increase in treated sewage effluent discharges from the San Wai STW. However, due to the upgrading of the San Wai STW, it will not increase the total pollutant load to NWWCZ. Potential interfacing project during the operation will include the Yuen Long Kam Tin Sewerage and Sewage Disposal Stage 1. The potential cumulative water quality impact on NWWCZ would be the same as that derived from the water quality modelling in the EIA-SWSTW.

The detailed derivation of the input parameters for the water quality modelling was presented in EIA-SWSTW. Four treatment level options were investigated in the EIA-SWSTW, and the options of chemical enhanced primary treatment (CEPT) with disinfection are proposed in the study. The modeling results of the preferred option are presented in this study.

The modelling results allow a comparison to be made with the relevant Water Quality Objectives for both the Baseline Condition and Commissioning Scenarios (the cumulative water quality impact). The statistical analysis of water quality changes are presented in the following parameters:

- depth averaged 90%ile dissolved oxygen;
- bottom values 90%ile dissolved oxygen;
- depth averaged mean total inorganic nitrogen;
- depth averaged mean suspended sediment;
- depth averaged mean unionised ammonia;
- depth averaged geometric mean of *E. coli*; and
- depth averaged mean of 5-day biochemical oxygen demand.

The results of the water quality modelling at the WSRs identified in this study are incorporated from the EIA-SWSTW and are summarized in Tables 10.11 and 10.12 for both wet and dry seasons respectively.

Table 10.11: Wet season water quality modelling results

WSR	Pos. No in EIA - SWSTP	DO (mg/L)		DO (Bottom) (mg/L)		TIN (mg/L)		NH_3-N (mg/L)		SS (mg/L)		E. Coli (cfu $100mL^{-1}$)		BOD5 (mg/L)	
		Base	Com	Base	Com	Base	Com	Base	Com	Base	Com	Base	Com	Base	Com
MW1	A1	0.4	0.6	0.4	0.5	3.52	3.21	0.247	0.221	63.0	60.7	2560	2309	12.12	11.27
MW2	DM 3	3.3	3.4	3.3	3.4	1.15	1.11	0.024	0.021	21.2	20.8	94	89	1.03	0.99
MW3	F1	2.1	2.4	2.1	2.3	2.48	2.14	0.159	0.127	43.1	40.7	4031	2696	6.27	5.25
MW4	F2	4.4	4.4	4.4	4.4	0.90	0.87	0.010	0.008	18.0	17.7	4630	2823	0.78	0.69
MW5	D1	3.9	3.9	3.8	3.9	0.80	0.79	0.004	0.004	15.2	15.2	293	47	0.47	0.46

WSR	Pos. No in EIA - SWSTP	DO (mg/L)		DO (Bottom) (mg/L)		TIN (mg/L)		NH_3-N (mg/L)		SS (mg/L)		E. Coli (cfu 100mL^{-1})		BOD5 (mg/L)	
		Base	Com	Base	Com	Base	Com	Base	Com	Base	Com	Base	Com	Base	Com
MW6	G1	4.0	4.1	4.1	4.1	0.75	0.75	0.004	0.004	13.4	13.3	518	22	0.42	0.41
MW7	H1	4.0	4.0	4.0	4.0	0.76	0.75	0.003	0.003	13.3	13.2	111	6	0.40	0.39
MW8	B1	4.4	4.4	4.0	4.1	0.76	0.76	0.004	0.004	12.9	12.8	41	25	0.40	0.39
	B2	4.2	4.2	4.1	4.1	0.77	0.77	0.004	0.004	11.9	11.8	183	101	0.50	0.49
MW9	E1	5.1	5.1	5.0	5.0	0.48	0.48	0.002	0.002	7.0	7.0	32	32	0.26	0.26
	E2	5.0	5.0	5.0	5.0	0.50	0.50	0.002	0.002	6.9	6.8	24	23	0.24	0.24
	E3	5.0	5.0	4.9	4.9	0.51	0.50	0.002	0.002	6.9	6.9	93	92	0.24	0.24
	E4	5.0	5.0	4.9	4.9	0.51	0.51	0.002	0.002	6.9	6.9	33	31	0.24	0.24
	E6	5.0	5.0	5.0	5.0	0.50	0.49	0.002	0.002	6.9	6.8	17	15	0.24	0.24
	E7	5.0	5.0	5.0	5.0	0.50	0.50	0.002	0.002	7.0	7.0	22	20	0.24	0.24
	E8	4.8	4.8	4.6	4.6	0.63	0.62	0.002	0.002	8.6	8.5	146	138	0.31	0.31
	E11	4.9	5.0	4.7	4.7	0.62	0.62	0.002	0.002	8.4	8.3	154	149	0.33	0.33
	E13	4.6	4.6	4.5	4.5	0.63	0.63	0.002	0.002	8.9	8.9	88	71	0.31	0.30
MW10	D2	4.3	4.4	4.4	4.4	0.67	0.66	0.003	0.003	10.6	10.6	64	8	0.31	0.31
MW11	D3	5.4	5.4	4.7	4.7	0.57	0.57	0.002	0.002	9.2	9.2	147	147	0.54	0.54
MW12	J1	5.0	5.0	4.6	4.6	0.60	0.60	0.002	0.002	8.8	8.8	197	196	0.43	0.43
MW14	C1	4.9	5.0	5.0	5.0	0.52	0.51	0.002	0.002	7.2	7.1	3	2	0.24	0.24

Note: 1. Base refers to the Baseline Scenario, and Com refers to the Commissioning Scenario under the preferred option
2. MW13 & MW15 are not included in the EIA-SWSTW waster quality assessment

Table 10.12: Dry season water quality modelling results

WSR	Pos. No in EIA-SW STP	DO (mg/L)		DO (Bottom) (mg/L)		TIN (mg/L)		NH_3-N (mg/L)		SS (mg/L)		E. Coli (cfu 100mL^{-1})		BOD5 (mg/L)	
		Base	Com	Base	Com	Base	Com	Base	Com	Base	Com	Base	Com	Base	Com
MW1	A1	3.0	3.1	3.0	3.1	3.69	3.29	0.117	0.104	50.3	45.7	6715	4462	10.17	8.56
MW2	DM 3	5.5	5.6	5.5	5.5	1.00	0.97	0.015	0.015	17.5	17.1	460	431	2.17	2.09
MW3	F1	4.6	4.6	4.6	4.6	2.64	2.35	0.072	0.063	38.8	35.2	15210	10090	7.58	6.23
MW4	F2	6.2	6.2	6.1	6.2	0.93	0.89	0.013	0.012	17.1	16.6	7527	4522	2.20	2.04
MW5	D1	6.0	6.1	6.0	6.0	0.47	0.47	0.004	0.004	9.2	9.1	454	78	0.83	0.81
MW6	G1	6.1	6.1	6.1	6.1	0.40	0.40	0.004	0.004	8.0	7.9	387	38	0.69	0.67
MW7	H1	6.1	6.1	6.1	6.1	0.40	0.40	0.003	0.004	8.1	8.1	177	12	0.70	0.69
MW8	B1	6.2	6.2	6.0	6.0	0.40	0.40	0.003	0.003	8.9	8.8	115	53	0.79	0.78
	B2	6.2	6.2	6.0	6.1	0.40	0.40	0.004	0.004	8.3	8.2	602	422	0.75	0.74
MW9	E1	7.4	7.4	7.3	7.3	0.14	0.14	0.002	0.002	5.1	5.0	1	1	0.56	0.56
	E2	6.4	6.4	6.3	6.3	0.19	0.19	0.002	0.002	4.8	4.8	51	49	0.32	0.32
	E3	6.3	6.3	6.3	6.3	0.19	0.19	0.002	0.002	4.8	4.8	146	143	0.33	0.33
	E4	6.3	6.4	6.3	6.3	0.19	0.19	0.002	0.002	4.8	4.8	83	78	0.34	0.34
	E6	6.4	6.4	6.3	6.3	0.19	0.19	0.002	0.002	4.8	4.8	31	29	0.32	0.32
	E7	6.3	6.4	6.3	6.3	0.19	0.19	0.002	0.002	4.8	4.8	31	28	0.33	0.33
	E8	6.5	6.5	6.3	6.4	0.22	0.22	0.002	0.002	6.1	6.0	174	167	0.52	0.52
	E11	6.6	6.7	6.3	6.3	0.21	0.21	0.002	0.002	7.0	7.0	168	166	0.71	0.70
	E13	6.3	6.4	6.3	6.3	0.24	0.24	0.002	0.002	5.8	5.7	232	177	0.46	0.46
MW10	D2	6.2	6.2	6.2	6.2	0.31	0.31	0.003	0.003	6.6	6.5	141	31	0.53	0.52
MW11	D3	7.2	7.3	6.8	6.8	0.18	0.18	0.002	0.002	7.6	7.5	453	452	0.99	0.99
MW12	J1	7.0	7.0	6.6	6.6	0.20	0.20	0.002	0.002	6.2	6.2	602	597	0.71	0.71
MW14	C1	6.4	6.4	6.3	6.3	0.20	0.20	0.002	0.002	4.9	4.9	9	6	0.34	0.34

Note: 1. Base refers to the Baseline Scenario, and Com refers to the Commissioning Scenario under the preferred option
2. MW13 & MW15 are not included in the EIA-SWSTP water quality assessment

The data in Tables 10.11 and 10.12 illustrate that the SWSTW would significantly improve the water quality in inner Deep Bay as a result of collecting and diverting a great portion of pollution loads into the SWSTW and then discharge through the Urmston Road outfall. The overall reduction of NH_3-N, TIN, E. Coli and BOD_5 levels at MW1 in the Inner Deep Bay are 18%, 12%, 33%, and 17% respectively.

The water quality near the Urmston Road Outfall has also shown improvement due to the upgrading of the plant. Based on the modeling result, the E. Coli level will be significantly reduced and the predicted E.Coli levels at the sensitive receivers near the Urmston Road Outfall (e.g MW 5 and MW6) are well below the relevant WQOs under the preferred treatment option of SWSTW.

10.6.4 ***Recommendations for Operational Phase***

Emergency Operation of Pumping Stations

In order to prevent the uncontrolled discharge of untreated sewage effluent to surface waters there will be a need to minimise the risk of failure of the pumping stations.

The following measures should be implemented to reduce the risk of failure of the pumping stations, which could result in an emergency discharge of untreated sewage effluent.

Design Phase

- Twin rising mains are provided for backup and repairing purpose;
- The discharge point of the overflow bypass should be below the low water mark (i.e. location of minimum water level in stream in dry season);
- The discharge point of the overflow bypass should be away from sensitive receivers such as fish ponds, water gathering grounds, country parks, nature reserves, sites of special scientific interest, marine parks/marine reserves, streams with water for human consumption, etc.; and
- A contingency plan for emergency discharge shall be developed.

Operational Phase

- The overflow bypass should be operated only in an emergency, such as prolonged power failure. Overflow mechanism must not occur to facilitate routine maintenance on a regular basis;
- If the pumping station is unmanned, a telemetry system should be provided to the nearest manned station/plant so that swift actions could be taken in the case of malfunction of the unmanned facilities;
- Hand-cleaned screens should be provided at the overflow bypass to prevent the discharge of floating solids into receiving water bodies. The clear spacing of the bar screen should normally be about 25mm;
- Standby pump should be provided to facilitate maintenance and repairing of equipment; and
- Dual (back-up) power supply should be provided. Dual power supply could be in the format of ring main, or an automatic-operated emergency generator with sufficient capacity to cope with the demand loading of the essential plant equipment.

With the above mitigation measures incorporated, it is anticipated that the chance of emergency discharge and consequently its impact on the adjacent environment will be minimal.

Normal Operation

The normal operation of the Yuen Long / Kam Tin Sewerage and Sewage Disposal Stage 2 works will result in improvement of water quality in both the inland and marine waters in the NWWCZ and Deep Bay WCZ after the treatment of the San Wai Sewage Treatment Plant. Therefore no other mitigation measures will be required.

Damage/ Emergency Situation on Rising Main

In order to prevent the uncontrolled discharge of untreated sewage effluent to surface waters there will be a need to minimise the risk of failure of the rising mains:

- Twin rising mains are provided for backup and repairing purpose
- Spare/Standby parts for rising mains should be provided to facilitate maintenance and repairing of equipment; and
- Should the twin rising mains be failure, tankers will be used to store the emergency discharge and transport to the YLSTW or SWSTW for disposal.

11.0 WASTE MANAGEMENT

11.1 Legislation and Standards

The following legislations relate to the handling, treatment and disposal of waste in HKSAR, and are considered in assessing potential impacts and their avoidance or mitigation:
** Waste Disposal Ordinance (Cap 354) [17];*
** WBTC No. 6/2002A Enhanced Specification for Site Cleanliness and Tidiness;*
** Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) [18];*
** Land (Miscellaneous Provisions) Ordinance (Cap 28) [19]; and*
** Public Health and Municipal Service Ordinance (Cap 132) – Public Cleansing and Prevention of Nuisances (Regional Council) By-laws [20].*

11.1.1 ***Waste Disposal Ordinance (WDO)***

The *Waste Disposal Ordinance (WDO)* prohibits the unauthorised disposal of wastes. Construction and Demolition (C&D) waste is not directly defined in the WDO but is considered to fall within the category of "trade waste". Trade waste is defined as waste from any trade, manufacturer or business, or any wasted building, or civil engineering materials, but does not include animal waste. Under the WDO, wastes can only be disposed of at sites licensed by EPD. A breach of these regulations can lead to the imposition of a fine and/or prison sentence. The WDO also provides for the issuing of licenses for the collection and transport of wastes. Licenses are not, however, currently issued for the collection and transport of C&D waste or trade waste.

11.1.2 ***Waste Disposal (Chemical Waste) (General) Regulation***

Chemical waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulation, if such a substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable to a fine and/or imprisonment. Procedures of chemical wastes must treat their waste, utilising on-site plant licensed by the EPD or have a licensed collector take the wastes to a licensed facility. For each consignment of wastes, the waste producer, collector and disposer of the wastes must sign all relevant parts of a computerised trip ticket. The system is designed to allow the transfer of wastes to be traced from cradle-to-grave.

The regulation prescribes the storage facilities to be provided on site including labeling and warning sign. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from storage of chemical wastes. The waste producer must also provide employees with training in such procedures.

11.1.3 ***Land (Miscellaneous Provisions) Ordinance (Cap 28)***

The inert portion of Construction and Demolition Materials (C&DM) (also called Public Fill) may be taken to public filling facilities. Public filling areas usually form part of land reclamation schemes and are operated by the Civil Engineering Department (CED) and others. The *Land (Miscellaneous Provisions) Ordinance* requires that Dumpling Licenses are obtained by individuals or companies, who deliver public fill to the public filling areas. The licenses are issued by the CED under delegated authority from the Director of Lands.

Individual Licenses and windscreen stickers are issued for each vehicle involved. Under the license conditions public filling area will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, individual and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the Filling Supervisor.

11.1.4 Public Cleansing and Prevention of Nuisances by-Laws

These by-laws provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to a fine and imprisonment.

Table 11.1 summarises documents that are related to waste management and disposal in Hong Kong.

Table 11.1 : Other relevant documents and information

Bureau / Department	Documents / Guidelines / Technical Circulars
Planning, Environmental and Lands Branch, Hong Kong Government Secretariat;	Waste Disposal Plan for Hong Kong (December 1989) Waste Reduction Framework Plan, 1998 to 2007
Environment, Transport and Works Bureau	Works Bureau TC No. 32/92, The Use of Tropical Hard Wood on Construction Site Works Bureau TC Nos. 2/93, Public Dumps Works Bureau TC No 2/93B, Public Filling Facilities Works Branch TC No. 16/96, Wet Soil in Public Dumps Works Bureau TC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Project Works Bureau TC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers Works Bureau TC No. 12/2000, Fill Management Works Bureau TC No. 19/2001, Metallic Site Hoardings and Signboards Works Bureau TC No. 06/2002, Enhanced Specification for Site Cleanliness and Tidiness Works Bureau TC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates Works Bureau TC No. 21/2002, Trip-ticket System for Disposal of Construction and Demolition Material Environment, Transport and Works Bureau Technical Circular (Works) No, 33/2002, Management of Construction and Demolition Material Including Rock. Environment, Transport and Works Bureau Technical Circular (Works) No, 15/2003, Waste Management on Construction Sites
EPD / CED	New Disposal Arrangements for Construction Waste (1992)
EPD	Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992)
-	Environmental Guidelines for Planning In Hong Kong (1990), Hong Kong Planning Standards and Guidelines [21]

According to Environment, Transport and Works Bureau Technical Circular (Works) No, 33/2002, Management of Construction and Demolition Material Including Rock dated August 2002, A C&D Material Management Plan has to be submitted to the Public Fill Committee in case the C&DM to be generated would exceed 50,000m^3.

11.1.5 Landfill Disposal Criteria for Contaminated Soil

Excavated contaminated soil has to meet certain criteria before disposal to landfill is allowed. The criteria as set out in the Guidance Notes for Investigation and Remediation of Contaminated Sites of: Petrol Filling Stations; Boatyards and Car Repair/Dismantling Workshops[22] issued by the EPD and relate primarily to Toxic Characteristic Leaching Procedure (TCLP) limits, as shown in Table 11.2.

Table 11.2 : Landfill disposal criteria for contaminated soil

Parameter	TCLP Limits (ppm)
Cadmium (Cd)	10
Chromium (Cr)	50
Copper (Cu)	250
Nickel (Ni)	250
Lead (Pb)	50
Zinc (Zn)	250
Mercury (Hg)	1
Tin (Sn)	250
Silver (Ag)	50
Antimony (Sb)	150

Parameter	TCLP Limits (ppm)
Arsenic (As)	50
Beryllium (Be)	10
Thallium (Tl)	50
Vanadium (V)	250
Selenium (Se)	1
Barium (Ba)	1000

11.2 Assessment Methodology For Construction Phase

11.2.1 Potential Impacts During Construction Phase

During the construction phase, the main activities, which will potentially result in waste generation involve site clearance, trench excavation and construction of pumping station.

The typical waste types associated with these activities include:
- Site clearance waste;
- Construction and Demolition Materials (C&DM);
- Chemical waste;
- Sewage; and
- General refuse.

Site Clearance Waste

Most of the sewers/rising mains will be laid under existing roads/pavement and the pumping stations will only occupy a small area, and hence minimal site clearance waste is expected. If not properly managed, the handling and disposal of the clearance waste may cause adverse environmental impacts.

Construction and Demolition Materials (C&DM)

As most of the sewers/rising mains will be laid under existing roads/pavement, excavated materials will be generated from excavation of the pipe trenches. These materials are expected to be mostly soil, plus concrete/tarmac, which are inert. The anticipated quantities of excavated and backfilling material are presented in Table 11.4 (in the subsequent section).

Two sections of the proposed twin rising mains of Yuen Long Effluent Pipeline in Tin Shui Wan will be laid by the trenchless pipe jacking method. Those two trenchless sections are:
- Twin rising mains (approx. 200m) across the drainage channel beside Tin Wah Estate; and
- Twin rising mains (approx. 380m) across the Lai Yeun Fishing Pond beside Kenswood Court, Kingswood Villas.

Jacking pits and receiving pits will need to be constructed in the vicinity of the channel embankments and the existing channel embankment will need to be demolished, removed and subsequently reinstated. It should be noted that one of the risks inherent to the trenchless pipe jacking method is that the lead shield may breakdown before it reaches the receiving pit. In such an event, a rescue pit will be sunk to remove the studded shield and therefore some dredging works over the drainage channel and fishing pond may be required. In order to avoid dredging and excavation of sediment from the drainage channel and fishing pond, it is proposed to use the trenchless pipe jacking method to lay the twin rising mains. The mains will be laid at 1 to 2 m below the bottom of the drainage channel and fishing pond. It is estimated that approximately 1,790m^3 of inert materials will need to be excavated, of which about 1,250m^3 (about 70%) could be used for backfilling the launch and reception shafts. Approximately 540m^3 of surplus excavated materials will need to be disposed of off-site.

In the event that the lead shield of the tunnelling machine is broken before it completes the whole length, a rescue pit will be sunk to remove it and therefore some dredging works over the channel and/or fishing pond

will be required. It is estimated that about 50m^3 of sediment will be required to be excavated for the construction of the rescue pit. Some of these sediments will be used for backfilling of the rescue pit.

C&DM from Construction of Pumping Station

The construction of the proposed pumping stations will generate C&DM which includes packaging wastes, excess or damaged materials, hoarding etc. The proposed pumping stations will typically consist of a superstructure and a substructure. Most of the E&M equipment will be housed within the superstructure. The best means to estimate the generate rate of C&DM will be to base the estimate on the gross floor area. The typical floor areas of the proposed pumping stations are shown in Table 11.3.

Table 11.3 : Typical floor areas of proposed pumping stations

Pumping Station	Dimensions (m)	Gross Floor Area (m^2)
Cassino Line PS	25 x 20	500
Fan Tin San Tsuen/San Lung Tsuen PS	40 x 30	1,200
San Tin PS	40 x 30	1,200
Ngau Tam Mei PS	40 x 40	1,600
Tam Mei Camp PS	40 x 30	1,200
Mong Tseng PS	40 x 30	1,200
Lau Fau Shan PS	25 x 20	500
Proposed PS beside Yuen Long Sewage Treatment Works	100 x 70	7,000
Shan Ha Tsuen PS	40 x 30	1,200
Muk Kiu Tau Tsuen PS	40 x 30	1,200
Pak Sha Tsuen PS	25 x 20	500
Sham Chung Tsuen PS	25 x 20	500
Shiu Tsiu San Tsuen PS	25 x 20	500
Shung Ching San Tsuen PS	25 x 20	500
Nga Yiu Tau PS	25 x 20	500
Total		**19,300**

Chemical Waste

Chemical waste, as defined under the Waste Disposal (Chemical Waste) (General) Regulation, includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulation. A complete list of such substances is provided under the Regulation; however, substances likely to be generated from the construction activities for the proposed gravity sewers/rising mains and pumping stations will, for the most part, arise from the maintenance of equipment. These may include, but need not be limited to the following:

- Scrap batteries or spent acid/alkali from their maintenance;
- Used paint, engine oils, hydraulic fluids and waste fuel;
- Spent mineral oils/cleaning fluids from mechanical machinery; and
- Spent solvents/solutions, some of which may be halogenated, from equipment cleaning activities.

Chemical waste may pose serious environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Packing, Labelling and Storage of Chemical Waste* [23]. These hazards may include:

- Toxic effects to workers;

- Adverse effects on air, water and land from spills; and
- Fire hazards.

Sewage

Sewage will arise from amenity facilities used by the construction workforce and site office's sanitary facilities. Night soil from chemical toilets will also be generated. If not properly managed, the sludge could cause odour and potential health risks to the workforce by attracting pests and other disease vectors.

General Refuse

The presence of a construction site with workers and site office will result in the generation of a variety of general refuse requiring disposal. General refuse will mainly consist of food waste, aluminium cans and waste paper.

The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently (for example, daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The sites may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and cleared regularly. In addition, disposal of wastes at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

11.2.2 Assessment Approach for Construction Phase

The potential environmental impacts associated with the handling and disposal of waste arising from the construction and operation of the Project were assessed in accordance with the criteria presented in EIA study brief No. ESB-082/2001 and Annexes 7 and 15 of the EIAO-TM, which are summarised as follows:

- Estimation of the types, timing and quantities of the wastes to be generated;
- 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
- Assessment of the potential impact on the capacity of waste collection, transfer and disposal facilities.

11.3 Assessment Findings and Recommendations

11.3.1 Construction Phase

Site Clearance Waste

As the proposed sewers/rising mains are located under existing roads/pavement and the pumping stations only occupy a small area, the quantity of vegetation that needs to be cleared will be minimal. No adverse waste impact from the disposal of site clearness waste is expected.

C&DM from Excavation (Excavated Materials)

As indicated in Table 11.4, most of the excavated materials could be used for backfilling the trenches. The quantities of excavated materials and the volume to be disposed of are also summarised in Table 11.4. It is expected that the majority of excavated material will be inert soil.

Table 11.4: Disposal of excavated materials (with detailed breakdown)

Works Package	Works Item (DE/NDE)[c]	Excavation Volume (m^3)	Backfilling Volume (m^3)	Volume to be Disposed (m^3)	Construction Period	Disposal Rate (Average/Peak[a]) (m^3/day)
Works Packages and Works Items for Stage 2 Works						
Tin Shui Wai and San Wai Areas						
2A-1T	OP1 (DE)	105,000	68,113	36,887	11/05 – 10/06 (≅365 days) [b]	101.06 / 151.59
Conforming	OS1 (DE)	37,240	31,205.6	6,034.4	11/05 – 11/07 (≅763 days)	7.91 / 11.87
	OS2, OS3, OS4 & OS5 (NDE)	12,4378	10,3973.4	20,404.6	11/05 – 11/07 (≅763 days)	26.74 / 40.11
					Combined:	135.71 / 203.57
Tin Shui Wai and San Wai Areas						
Alternative scheme of	AP1 (DE)	105,000	68,113	36,887	11/05 – 10/06 (≅365 days) [b]	101.06 / 151.59
2A-1T	AS1 (DE)	10,450	8,756.7	1,693.3	11/05 – 11/07 (≅763 days)	2.22 / 3.33
	AS2, AS3, AS4, AS5 & AS6	143,348	119,857.2	23,490.8	11/05 – 11/07 (≅763 days)	30.79 / 46.19
					Combined:	134.07 / 201.11
Ngau Tam Mei and San Tin Areas						
2A-2T	P1 (DE)	21,600	14,011.8	7,588.2	11/05 – 10/06	20.79 / 31.19
and	P2	13,200	8,562.8	4,637.2	(≅365 days) [b]	12.70 / 19.05
2B-1T	P3	12,000	7,784.3	4,215.7		11.55 / 17.33
	P4	15,600	10,119.6	5,480.4		15.01 / 22.52
	P5	4,500	2,919.1	1,580.9		4.33 / 6.50
	S1, S2, S3, S4, S5, S6 & S7	72,639	69,257.6	3,381.8	11/05 – 11/07 (≅763 days)	4.43 / 6.65
					Combined:	68.81 / 103.24
Lau Fau Shan and Mong Tseng Areas						
2A-3T	A1	5,000	3,243.5	1,756.5	11/05 – 10/06	4.81 / 7.22
	A2	12,000	7,784.3	4,215.7	(≅365 days) [b]	11.55 / 17.33
	G1 & G2	23,286	22,634.6	651.4	11/05 – 11/07 (≅763 days)	0.85 / 1.28
					Combined:	17.21 / 25.83
Shap Pat Heung Area						
2B-2T	B1	12,000	7,784.3	4,215.7	11/05 – 10/06	11.55 / 17.33
	B2	10,200	6,616.7	3,583.3	(≅365 days) [b]	9.82 / 14.73
	B3	3,500	2,270.4	1,229.6		3.37 / 5.06
	B4	3,750	2,432.6	1,317.4		3.61 / 5.42
	B5	4,500	2,919.1	1,580.9		4.33 / 6.50
	B6	4,500	2,919.1	1,580.9		4.33 / 6.50
2B-2T	B7	4,500	2,919.1	1,580.9		4.33 / 6.50
	H1. H2, H3, H4, H5, H6, H7, H8, H9, H10 & H11	37,297	36,503.9	793	11/05 – 11/07 (≅763 days)	1.04 / 1.56
					Combined:	42.38 / 63.60
2A-1T (conforming) +2A-2T/2B-1T+2A-3T+2B-2T:		DE: 163,840 NDE: 362,850 Comb: 526,690	DE: 113,330 NDE: 300,645 Comb: 413,975	DE: 50,510 NDE: 62,206 Comb: 112,716	DE: 129.76/194.65 NDE: 134.35/201.59 Comb: 264.11 / 396.24	
2A-1T (alternative) +2A-2T/2B-1T+2A-3T+2B-2T:		DE: 137,050 NDE: 381,820 Comb 518,870	DE: 90,882 NDE: 316,528 Comb: 407,410	DE: 46,168 NDE: 65,292 Comb: 111,460	DE: 124.07/186.11 NDE:138.4/207.67 Comb: 262.47 / 393.78	

Note: (a) Assume a peak generation rate of 1.5
(b) Assume the materials will be excavated in the first 12 months of construction
(c) DE – Designated Element; NDE – Non Designated Element

From the detailed breakdown, it is estimated that approximately 137,050m^3 and 381,820m^3 of material will be extracted from 3 DE items and 38 NDE items respectively under four separated packages. Due consideration should be taken for reuse of as much excavated material as possible (approximately 90,882m^3 of material from DE and 316,528m^3 from NDE, i.e. about 79% of the excavated materials should be reused for the Project).

Under four separated work packages, there will be 46,168m^3 C&D generated from the Designated Elements (3 work items – AP1, AS1 & P1), and 65,292m^3 from the non-Designated Elements (38 work items).

In accordance with the ETWB's Technical Circular No. 33/2002, which was enacted (13 Aug 02) well after the issue of the EIA study brief (ESB-082-2001 version 21 Sept 01), submission of C&D Material Management Plan (C&DMMP) is not required under the EIAO legislative framework for less than 50,000m^3 C&D material from Designated Element and less than 300,000m^3 from the non-Designated Elements.

As confirmed by DSD, there is neither a programme nor funding earmarked for the construction of the pumping stations and sewerage for Stage 2 works. A separate C&DMMP will be prepared by the DSD project office for departmental vetting before upgrading of this project to Category "A" in Public Works Programme. An overall Waste Management Plan (WMP) should incorporate DEP's comments and be approved by DEP. Since the project site is located closed to the WBA or WCA, it is important to put control clauses in the contract to disposal waste away from the ecological sensitive areas. The WMP should also include the following:

- The type of C&D generated;
- The amount for each type of C&D material;
- The location of waste sorting; and
- The location of disposal.

The average and peak disposal rates for excavated materials are approximately 262m^3/day and 394m^3/day, respectively (DE: average 124.07 m^3/day and peak 186.11 m^3/day; NDE: average 138.4 m^3/day and peak 207.67 m^3/day). Due to the relatively small volume of excavated materials requiring disposal, it is not envisaged to have adverse impacts on the capacity of the available public filling facilities.

There are currently only a few development projects being planned that may require fill material for reclamation works which match the anticipated disposal schedule of C&D surplus material. These development projects, together with their tentative dates for reclamation and earth filling activities are shown below:

Table 11.5: Major development projects accept C&D materials

Development project	Tentative date for reclamation activities
Central Reclamation Phase III	April 2003 to mid 2007
Wan Chai Development Phase II	January 2004 to December 2007
Penny's Bay Reclamation Phase II	mid 2003 to mid 2007
South East Kowloon Development	July 2004 to December 2010

In order to minimise the reuse option, DSD is requested to review whether there will be any confirmed concurrent projects that would take up some of the C&D material (mid 2005 until late 2007). If such projects exist, DSD should advise the possibility, timing and amount of material that could be reused within the department.

The final destinations of the excavated materials will be determined, subject to the availability of public filling facilities, by the Waste Management Plan to be submitted by the Contractors and agreed with CED. DSD has also formulated a master plan for handling C&D material from all DSD projects. The plan will be updated annually and submitted to CED. Regarding this project, DSD should consult the Public Fill Committee of the CED about the possible outlets for such excavated materials when the actual construction programme is finalized or this project is upgraded to Category A. This can ensure that the C&D material from all projects can be best utilised.

A Traffic Impact Assessment (TIA) has been prepared for this Project and the report indicated that the construction traffic generated by this Project (including the traffic associated with the of-site disposal of the surplus excavated material) volume is insignificant and will not cause adverse traffic impacts, provided that the recommended temporary traffic measures are implemented.

As certain sections of the proposed sewers/rising mains alignments pass close to potentially contaminated sites in some areas (e.g. car repair / dismantling works and mechanics cleaning activities), there is the possibility that the excavated materials will be contaminated. Section 12 addresses the land contamination issues. The disposal

of contaminated materials, if any, needs to comply with the *Landfill Disposal Criteria for Contaminate Soil* as stipulated in Table 11.2.

The actual quantities of contaminated soil can only be estimated after conducting intrusive site investigation works after land resumption and hence cannot be estimated at this stage. If contaminated soils are found, the remediation methods proposed in Section 12 shall be followed.

Standard formwork should be used as far as practicable in order to minimise the arising of C&D materials. The use of more durable formwork or plastic facing for the construction works should be considered. The purchasing of construction materials should be carefully planned in order to avoid over ordering and wastage. The Contractor should recycle as much of the C&D materials as possible on-site. Public fill and C&D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. Where practicable, concrete and masonry can be crushed and used as fill. Steel reinforcing bar can be used by scrap steel mills. Different areas of the sites should be considered for such segregation and storage. The use of wooden hoardings should be avoided, and metal hoarding should be used to enhance the possibility of being recycled.

A charging policy for the disposal of waste to landfill will be enforced in the HKSAR. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to encourage proper segregation of inert material for disposal to public filling areas.

Excavated sediment (less than 50 m^3) will be generated in the event that a rescue pit is required during pipe jacking across the drainage channel or fishing pond. They should be reused as far as possible and disposal of surplus excavated sediment to landfill should be considered as the last resort. The sediment should be dewatered and the disposal of the sediment should also comply with the *Landfill Disposal Criteria for Contaminated Soil* as stipulated in Table 11.2. The final disposal management should be agreed in advance with EPD (for landfill disposal) via the Waste Management Plan to be submitted by the Contractor.

If the excavated soil contains other contaminants in addition to the parameters in Table 11.2, approval for disposal will be assessed on a case-by-case basis by the EPD. It should be noted that in situ remediation methods for the contaminated soil should be adopted wherever possible and disposal of at landfill should always be considered as the last resort. Apart from landfill, another disposal outlet is the Chemical Waste Treatment Center (CWTC) if volume is small and the concentration of contaminants is too high that the soil can be classified as chemical waste.

C&DM from Construction of Pumping Station

As indicated in Section 11.2.1, the best means to estimate the generation of C&DM is based on the floor area. Table 11.3 indicates that the total floor area to be constructed is approximately 19,300m^2. In accordance with the Reduction of Construction Waste Final Report[85], the C&DM generation rate of 0.1 m^3 per 1m^3 of gross floor area (GFA) is adopted for assessing the C&DM from construction of pumping stations. It is estimated that approximately 1,930m^3 of C&DM will be generated from the construction of the pumping stations over a period of 25 months between November 2005 to November 2007. This represents the average and peak C&DM generation of 2.5m^3/day and 3.8m^3/day, respectively. With proper segregation, the volume of C&DM that could be reused as public fill is approximately 1,540m^3 and the volume to be disposed of to landfills (C&D waste) is approximately 390m^3. The average and peak generation of C&D waste which requires disposal at landfill is approximately 0.50m^3/day and 0.76m^3/day, respectively. The public fills will be transported to public filling areas at average and peak rate of 2.0m^3/day and 3.0m^3/day, respectively.

The generation of C&DM from construction of pumping stations is considered to be small and is not envisaged to have any adverse impact on the capacity of landfills and public filling area.

Chemical Waste

It is difficult to quantify the amount of chemical waste, which will arise from the construction activities as it will be highly dependent on the Contractor's on-site maintenance intention and the quantities of plant and vehicles utilized. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance will be small and in the order of less than hundred liters per month.

The chemical waste to be generated from the construction activities will be readily accepted by the Chemical Waste Treatment Center (CWTC) at Tsing Yi.

Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste* published by the EPD. Provided that this is followed, the potential environmental impacts arising from the handling, storage and disposal of a small amount of chemical waste generated from the construction activities will be negligible.

Sewage

The number of construction workers to be employed on site is not available at this stage, however, it is expected to be small. As the workers will be scattered along the proposed gravity sewer alignment, a cost-effective solution will be to provide adequate number of portable toilets along the alignment to ensure that domestic sewage from site staff is properly collected. Depending on site conditions, land availability and site activities, the locations and number of portable toilets should be determined in the Waste Management Plan to be submitted by the Contractors and agreed by Engineer or Project Proponent. No adverse waste impact is envisaged provided that maintenance by licensed contractors is conducted regularly.

General Refuse

The number of workers to be employed for the project is not available at this stage, however it is expected to be small. Provided that the mitigation measures recommended in Section 11.6 are adopted, the potential environmental impacts caused by the storage, handling, transport and disposal of general refuse should be minimal. It is recommended that the general refuse should be collected on a daily basis and be delivered to the WENT or NENT Landfill for disposal. With respect to the anticipated small quantity of general refuse to be disposed of, adverse impacts to the operation of the landfills are not expected.

11.4 Potential Impact During Operational Phase

11.4.1 ***Waste from Operation of Pumping Station***

During the operational phase, the main waste types will include screenings and chemical waste generated from the operation of the pumping stations and the silt and debris from the maintenance of the sewers. If not properly managed, these could have potential to cause adverse environmental impacts. These include odour if the waste is not collected frequently and water quality impacts if waste enters water bodies.

The screenings, silt and debris, from the operation and maintenance of the proposed pumping stations and the maintenance of the gravity sewer will be disposed of at the WENT or NENT Landfill. Based on record from existing Ha Tsuen Pumping Station and associated sewer/rising mains (average daily flow of 60,000m^3/day generated approximately 17m^3 of screening, solid waste, silt and debris per month), it is estimated that the total volume of screenings, solid waste, silt and debris, arising from the fifteen proposed pumping stations, will amount to approximately 14.5m^3 per month (Table 11.6).

Table 11.6: Screening generation rates

Package	Pumping Stations	Averaged hourly flow (m^3/hr)	Average daily flow (m^3/day)	Estimated Production Rate Per Month for Screening, Solid Waste, Silt and Debris (m^3)
2A-1T (Conforming and Alternative)	Yuen Long Effluent (OP1/AP1)	6,240	149,760	- (1)
2A-2T and 2B-1T	Cassino Line (P5)	43	1,032	0.2924
2A-2T and 2B-1T	Fan Tin San Tsuen/ San Lung Tsuen (P4)	147	3,528	0.9996
2A-2T and 2B-1T	San Tin (P3)	230	5,520	1.564
2A-2T and 2B-1T	Tam Mei Camp (P2)	153	3,672	1.0404
2A-2T and 2B-1T	Ngau Tam Mei (P1)	882	21,168	5.9976
2A-3T	Mong Tseung (A2)	108	2,592	0.7344
2A-3T	Lau Fau Shan (A1)	63	1,512	0.4284
2B-2T	Shan Ha Tsuen (B1)	150	3,600	1.02
2B-2T	Nga Yiu Tau (B6)	46	1,104	0.3128
2B-2T	Pak Sha Tsuen (B7)	71	1,704	0.4828
2B-2T	Sham Chung Tsuen (B3)	42	1,008	0.2856
2B-2T	Muk Kiu Tau Tsuen (B2)	99	2,376	0.6732
2B-2T	Shiu Tsiu San Tsuen (B4)	32	768	0.2176

Package	Pumping Stations	Averaged hourly flow (m^3/hr)	Average daily flow (m^3/day)	Estimated Production Rate Per Month for Screening, Solid Waste, Silt and Debris (m^3)
2B-2T	Shung Ching San Tsuen (B5)	64	1,536	0.4352
Total:			200,880	14.484

Note: (1) YLEPS will only convey treated effluent; therefore, there is no screening generation.

Small quantities of chemical waste (mainly lubricant oil and paints) to be generated from the maintenance of the pumping station could be readily accepted at the CWTC. Provided that this occurs, the potential environmental impacts arising from the handling, storage and disposal of a small amount of chemical waste generated from the operation activities will be negligible.

11.5 Summary

Table 11.7 summarises the impacts during the construction and operation of the Project.

Table 11.7 : Summary of waste management impacts

Waste Type	General Evaluation
Construction Phase	
Site Clearance	Vegetation cleared from proposed pumping stations site can be disposed of as general refuse. As most of the proposed pumping stations are located on developed land, the amount of site clearance waste will be minimal.
C&DM	Excavated Materials With detailed breakdown, it is estimated that approximately 137,050m^3 and 381,820m^3 of material will be extracted from 3 DE items and 38 NDE items respectively under four separated packages. Due consideration should be taken for reuse of as much excavated material as possible (approximately 90,882m^3 of material from DE and 316,528m^3 from NDE, i.e. about 79% of the excavated materials should be reused for the Project). Under four separated work packages, there will be 46,168m^3 C&D generated from the Designated Elements (3 work items), and 65,292m^3 from the non-Designated Elements (38 work items). The average and peak disposal rates for excavated materials from various packages are approximately 262m^3/day and 394m^3/day, respectively. Due to the relatively small volume of excavated materials, which requires disposal, it is not envisaged that this will have adverse impacts on the capacity of the public filling facilities. The final destinations of the excavated materials will be determined, subject to availability of public filling facilities, by the Waste Management Plan to be submitted by the Contractors and agreed by CED. A Traffic Impact Assessment has been conducted for this Project it concluded that the construction traffic generating from this Project (including the traffic associated with the off-site disposal of the surplus excavated material) will not cause adverse traffic impacts, provided that the temporary traffic measures as recommended are properly implemented. The actual quantities of contaminated soil can only be estimated after conducting intrusive site investigation works after land resumption. If contaminated soils are found, they shall be managed in accordance with the procedures as stipulated in the Working Paper for Land Contamination Assessment. C&DM from Construction of Pumping Stations Based on the C&DM generation rate of 0.1 m^3 per 1m^3 of gross floor area (GFA) constructed, it is estimated that approximately 1,930m^3 of C&DM will be generated from the construction of the pumping stations over a period of 25 months between November 2005 to November 2007. This represents the average and peak C&DM generation of 2.5m^3/day and 3.8m^3/day, respectively. With proper segregation, the volume of C&DM that could be reused as public fill is approximately 1,540m^3 and the volume to be disposed of to landfills (C&D waste) is approximately 390m^3. The average and peak generation of C&D waste which requires disposal at landfill is approximately 0.50m^3/day and 0.76m^3/day, respectively. The public fills will be transported to public filling areas at average and peak rate of 2.0m^3/day and 3.0m^3/day, respectively. With respect to the small quantity of C&DM to be generated from the Project, it is not envisaged that the disposal of which to landfills and public filling areas will have affect the operations of these facilities.
Chemical Waste	It is difficult to quantify the amount of chemical waste, which will arise from the construction activities as it will be highly dependent on the Contractor's on-site maintenance intention and the quantities of plant and vehicles utilized. However, it is anticipated that the quantity of chemical waste produced will be small and in the order to a few hundred litres per month. The chemical waste to be generated from the construction activities will be readily accepted at the Chemical Waste Treatment Center (CWTC) at Tsing Yi. Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste* published by the EPD. Provided that this occurs, the potential environmental impacts arising from the handling, storage and disposal of a small amount of chemical waste generated from the construction activities will be negligible.
Sewage	The number of construction workers to be employed on site is not available at this stage, however, it is expected to be small. As the workers will be scattered along the proposed gravity sewer alignment, the more cost-effective solution will be to provide adequate number of portable toilets along the alignment. No adverse waste impact is envisaged provided that maintenance by licensed contractors is conducted regularly.
General Refuse	The number of workers to be employed for the project is not available at this stage, however it is expected to be small. Provided that the mitigation measures recommended in Section 11.6 are adopted, the potential environmental impacts

Waste Type	General Evaluation
	caused by the storage, handling, transport and disposal of general refuse are expected to be minimal. With respect to the anticipated small quantity of general refuse to be disposed of, there will be no adverse impacts to the operation of the strategic landfills.
Operational Phase	
Screenings, Silt and Debris from Operation and Maintenance	The screenings, silt and debris, from the operation and maintenance of the proposed facilities will be disposed of at the WENT or NENT Landfill. With respect to their relatively small quantity (i.e. at a total of 14.5m^3 per month of screenings, solid waste, silt and debris from the proposed pumping stations), it is not anticipated that the disposal of these wastes will cause any adverse impacts to the operation of the strategic landfills.
Chemical Waste	It is anticipated that the quantity of chemical waste arising during operation, such as lubricant oil and paints will be small and no adverse environmental impacts are envisaged.

11.6 Mitigation Measures

This section recommended the mitigation measures to avoid or minimize potential adverse environmental impacts associated with handling, collection and disposal of waste arising from the Project. The Contractors should incorporate these recommendations into a Waste Management Plan for the construction works. The Contractors should submit the plan to the Engineer for approval prior to the commencement of the construction works. Such a management plan should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

It is the Contractor's (for the construction phase) and the Project Proponent's (for the operational phase) responsibility to ensure that only reputable licensed waste collectors are used and that appropriate measures to minimize adverse impacts, including windblown litter and dust from the transportation of these wastes are in place. In addition, the Contractor must ensure that all the necessary waste disposal permits are obtained throughout the construction and operational phases.

11.6.1 ***Construction Phase***

C&DM

Wherever practicable, excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public filling areas or land formation or reclamation sites and avoiding the need for disposal at landfill. The Contractor should obtain approval from EPD, and written agreement from relevant third party of those land formation or reclamation sites such as the Project Proponent, Engineer and Contractor for disposal. The priority for off-site disposal of surplus excavated material should be as follows:

- Transport to other land formation or reclamation sites for re-use as fill materials; and
- Transport to public filling areas.

Measures Taken in the Planning and Design Stages to Reduce the Generation of C&DM

The various waste management options can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in the long term. Hence, the waste management hierarchy is adopted as follows:

- Avoidance and minimisation, that is, not generating waste through changing or improving practices and design;
- Reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- Recovery and recycling, thus avoiding disposal (although reprocessing may be required); and
- Treatment and disposal, according to relevant law, guidelines and good practice.

This hierarchy should be used to evaluate the waste management options, thus allowing maximum waste reduction and often reducing costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of the purchasing of raw materials and in disposing of wastes. Records of quantities of wastes generated, recycled and disposal (locations) should be properly kept.

Standard formwork should be used as far as practicable in order to minimise the arising of C&DM. The use of more durable formwork or plastic facing for the construction works should be considered.

Any uncontaminated soil should be reused on site as far as possible, e.g. for landscape works, in order to minimise the amount of public fill to be disposed off-site. The Project Proponent should liaise with the Public Fill Committee to identify as far as possible suitable reclamation or site formation projects near the project site to reuse the material.

The design of the foundation works will minimise the amount of excavated material to be generated. Should piling be required, H-piling should be used as far as practical.

The purchasing of construction materials should be carefully planned in order to avoid over ordering and wastage.

Measures to be Taken in the Construction Stage to Reduce the Generation of C&DM

The Contractor should recycle as much of the C&DM as possible on-site. Public fill and C&D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. Concrete and masonry, for example, can be crushed and used as fill. Steel reinforcing bar can be used by scrap steel mills. Different areas of the sites should be designated for such segregation and storage.

The use of wooden hoardings shall not be allowed. An alternative material, which can be reused or recycled, for example, metal (aluminium, alloy, etc) shall be used.

Government has developed a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation to allow disposal of inert material to public filling areas.

Chemical Waste

Chemical waste producers should be registered with the EPD. For those processes which generate chemical waste, it may be possible to find alternatives which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

Chemical waste that is produced, as defined by Schedule 1 of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows. Containers used for storage of chemical wastes should:

- Be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- Have a capacity of less than 450 L unless the specification has been approved by the EPD; and
- Display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

The storage area for chemical wastes should:

- Be clearly labelled and used solely for the storage of chemical wastes;
- Be enclosed on at least 3 sides;
- Have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in the area, whichever is greater;
- Have adequate ventilation;
- Be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste, if necessary); and
- Be arranged so that incompatible materials are adequately separated.

Disposal of chemical waste should:

- Be via a licensed waste collector; and
- Be to a facility licensed to receive chemical waste, such as the CWTC which also offers a chemical waste collection service and can supply the necessary storage containers; or
- Be to a re-user of the waste, under approval from the EPD.

Sewage

Adequate numbers of portable toilets should be provided for the number of workers along the proposed gravity sewer alignment. The portable toilets should be maintained in a state, which will not deter the workers from utilizing these portable toilets. Night-soil should be collected by the licensed collectors regularly.

Management of General Refuse

General refuse generated on-site should be stored in enclosed bins or compaction units separately from construction and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to minimize odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated and made easily accessible, so separate labelled bins for their deposit should be provided if feasible.

Office wastes can be reduced through the recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available. In addition, waste separation facilities for paper, aluminium cans, plastic bottles etc., should be provided.

Management of Waste Disposal

A trip-ticket system should be established in accordance with *Works Bureau Technical Circular No. 21/2002* to monitor the disposal of public fill and solid wastes at public filling facilities and landfills, and to control fly-tipping. A trip-ticket system will be included as one of the contractual requirements and implemented by the Engineer. The Engineer should audit the result of the system.

A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) should be established during the construction stage.

Staff Training

Owing to the close proximity to the Wetland Conservation Area at Mai Po and North of Yuen Long EPS, training should be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the Contract.

11.6.2 Operational Phase

The main type of wastes generated during operational phase will be screenings from the pumping stations and silt and similar materials removed during the maintenance of the sewers/raising mains, which will be similar in nature to general refuse. The waste generated at the proposed pumping stations and sewer/raising mains should be stored in enclosed bins or compaction units separately. A reputable waste collector should be employed by the operators to remove the screenings from the pumping stations, on a daily basis to minimize odour, pest and litter impacts.

For chemical wastes generated during the operational phase, the mitigation measures are the same as those in Section 11.6.1 for Construction Phase.

11.7 Residual Environmental Impacts

With the implementation of recommended mitigation measures, in particular the establishment and implementation of a Waste Management Plan, minimal residual impacts are anticipated from either the construction or operation of the proposed Project.

11.8 Environmental Monitoring and Audit

It is recommended that audit of each waste stream should be periodically carried out during the construction phase to determine if wastes are being managed in accordance with the Waste Management Plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, transport and disposal. Attention should also be paid to the site areas close to the Wetland Conservation Area (Mai Po and South of Yuen Long STW) to ensure there is no waste impact. Staff and workforce training should also

emphasis on the prohibition of waste dumping. An appropriate audit programme would be to undertake a first audit at the commencement of the construction works and then quarterly audits, thereafter.

12.0 LAND CONTAMINATION IMPLICATIONS

12.1 Legislation and Standards

The specific guidelines and guidance notes applicable for the land contamination assessment are given below:
** Professional Persons Environmental Consultative Committee Practice Note 3/94 [24]; and*
** Guidance Notes for Investigation and Remediation of Contaminated Sites of: Petrol Filling Stations; Boatyards; and Car Repair/Dismantling Workshops.*

The following legislations, documents and guidelines also cover or have some bearing upon land contamination and the handling, treatment and disposal of contaminated waste in HKSAR, and are also considered in assessing potential impacts and their avoidance or mitigation:
** Waste Disposal Ordinance (Cap 354);*
** Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);*
** Water Pollution Control Ordinance (WPCO); and*
** Code of Practice on the Packaging, Labelling and Storage of Chemical Waste, Environmental Protection Department (1992).*

12.2 Baseline Environmental Conditions

The present land uses that give rise to potential concerns for land contamination including vehicle and mechanic maintenance and repair yards, and storage yards. The *Lands Department Central Database of the Task Force (Blackspots) on Flytipping Control of Yuen Long District (March 2002)* [25] was reviewed to identify if any concerned area is listed in the database.

12.3 Methodology of Land Contamination Impact Assessment

The evaluation of the potential impacts associated with the presence of these potentially contaminating uses is presented below.

12.3.1 ***Sources of Impacts***

As the various premises in question are all fairly small in size, land contamination potential is judged to be localized. Although all the identified potential areas of concern lie within the current 50m Consultation Boundary, the alignment of the sewer/raising mains and the location of the pumping stations do not lie within the potential contaminated premises. Overall, contamination concerns from these facilities would only arise if any leakage or spillage of chemicals or contaminants have migrated from the specific premises through to areas where construction workers might come into contact with the soil.

Since the incidence of any spillage or leakage is unknown, there still remains a small, yet un-quantified potential for impacts to arise from the migration of contaminants from these premises to the Project site, or from other unidentified sources such as illegal dumping. With regard to the migration of contaminants from these premises, it is considered that a certain volume of contaminants could have been accidentally spilled, and resulting in negative impact to the works areas.

12.3.2 ***Potential Impacts from Contamination***

Typical contaminants associated with vehicle and mechanic maintenance and related activities include petroleum hydrocarbon, fuels and lead. Potential impacts may arise from localized spillage and the possible presence of underground or aboveground storage tanks. These contaminants may cause negative impacts to sensitive receivers, including humans, during construction works or during the operational phase. Descriptions of the general hazardous premises of typical compounds, which may have been used or stored at these premises, are presented in Table 12.1.

Table 12.1: General hazardous substances potentially present in project site

Typical Material	General Hazardous Material
Petroleum Hydrocarbons (including Benzene, Toluene, Xylene, and Ethyl Benzene – BTEX)	Can be toxic by inhalation, ingestion and contact May be flammable at high concentrations
Oils, oily wastes	Can be toxic by contact Concentration may be flammable
Thinners, solvents, degreasants*	Can be toxic by inhalation, ingestion and contact
Heavy Metals* (including Copper, Chromium, Lead, and Zinc)	Can be toxic by ingestion and contact Most are toxic to fish, plants and marine plants (especially copper) Specific precautions may be required in relation to monitoring and dust control in excavation and site formation works
Acids (batteries)*	Toxic and harmful by contact Corrosive to metal, concrete

*** Note:** These materials are considered likely, although not solely restricted to being present at vehicle repair or service sites. The presence of such material has not been confirmed as no access was allowed at these premises.

Based on the available information on the proposed sewer/raising main alignment and the location of pumping stations, trench widths and the identified potentially contaminated premises, it is estimated that under the theoretical worst scenario (i.e. assuming all excavated materials from the trench adjacent to potentially contaminated premises as shown in Table 12.4 are contaminated), the amount of contaminated soil to be treated and disposed of will be in the order of approximately 9,297m^3, i.e. 2066m (L) x 1.5m (W) x 3m (D). However, it should be noted that this is a very conservative assumption. As indicated by visual inspection, land contamination, if any, is judged to be localised. Therefore, the potential for off-site migration of contaminants from the potentially contaminated premises to the excavation areas is considered to be very low. Hence it is expected that the actual quantity of contaminated soils, if any, to be excavated will be much less than that estimated under the theoretical worst-case scenario.

12.3.3 Potential Impact on Receptors

The potential impacts to the Project from contaminated soil and groundwater are judged to be the following:

- Health risks to site workers;
- Disposal of contaminated soils, where encountered;
- Disposal of contaminated groundwater, where encountered; and
- Potential health risks to future users of the sites.

Health Risk to Site Workers

Site construction workers may become exposed to contaminated soils and groundwater during earth moving operations and the laying of pipelines or underground services. The main exposure routes for site construction workers are accidental direct ingestion of contaminated materials through poor hygiene and eating or smoking on site, or through direct contact with potentially toxic or harmful contaminants in excavated soil.

Disposal of Contaminated Soil

In the event that any contaminated soils are identified during site investigation (SI) works or further environmental investigations, they may require remediation or disposal prior to or as part of the construction programme. Prior agreement will need to be reached with EPD to ensure that these materials are dealt with appropriately in accordance with *ProPECC Note 3/94*. Any contaminated soils which are excavated will require treatment and/or off site disposal at an appropriate site which is licensed to accept "contaminated" soils. The actual type(s) and concentration(s) of contaminants will determine the final disposal requirements, following agreement of the proper disposal option with the Waste Facilities Management Group, and Waste Policy and Service Group of the EPD.

Contaminated Groundwater Disposal

Where excavations for sewers/raising mains or pumping stations take place below the groundwater table, there may be a need to dewater the pits for safety and construction purposes. Where dewatering takes place through layers of contaminated material or where any contaminated soil is being excavated, the groundwater may become contaminated, thereby requiring appropriate handling and disposal. Depending on the level of contamination encountered, and subject to the agreement of the EPD, groundwater will need to be disposed of in an appropriate manner, compliant with the *WPCO*.

Potential Health Risks to Future Users of the Site

During the operational phase, there is little potential for impacts associated with contaminated soils. However, maintenance workers or workers who may be commissioned to perform extensions or alterations to the sewers, mains or at the pumping stations at a later stage may come into contact with such materials, at which time all of the above mentioned impacts may be applicable. However, if contaminated material is identified during the construction stage, it is expected that appropriate remedial measures will have been undertaken either to ensure this material is mitigated or removed, or to ensure that future, direct contact with *in-situ* materials is avoided.

12.4 Assessment Approach

12.4.1 ***Identification Of Environmental Impact***

The primary information collected on potentially contaminated premises was obtained from the *Lands Department Central Database of the Task Force (Blackspots) on Flytipping Control of Yuen Long District (March 2002)* along with carrying out site appraisal and review of aerial photographs and survey maps. The data was used to determine the potentially contaminated land within and adjacent to the proposed works areas of the Project.

The site appraisal was undertaken in the period from July 2002 to September 2002 to confirm locations of premises and extent of potential contaminating activities that are showing evidence of contamination.

12.4.2 ***Sources of Information***

Reference was made to the following sources of information and a list of the aerial photographs reviewed during the course of the study is presented in Table 12.2:

- Hong Kong Ordinance Survey maps (1:1000 and 1:1500 scale) from various years along the proposed alignment;
- Selected aerial photos along the alignment from different years;
- Outline Zoning Plans (OZP's) along the alignment;
- Hong Kong Geological Survey Memoir No.3, *Geology of the Western New Territories*;
- Hong Kong Geological Survey Solid and Superficial Geology Series Map No.6, Yuen Long; and
- Lands Department Blackspots Database for Yuen Long District (March 2002).

Table 12.2: Aerial photographs reviewed

Study Section	Date/Year	Photograph No.	Notes
Yuen Long South Branch	2000	CN27943 & CN27944 CN27963 CN28005 to CN28008	3500ft 3500ft 3500ft
	1999	CN22599 & CN59600 CN24579 & CN24580 CN24582 CN24591 & CN24592 CN24632 to CN24635	4000ft 3500ft 3500ft 4000ft 4000ft
	1995	CN10300 to CN10302 CN10385 to CN10387 CN10625 to CN10627 CN13047 CN13082 CN13100 to CN13102	3200ft 3200ft 3500ft 3500ft 3500ft 3500ft

Study Section	Date/Year	Photograph No.	Notes
	1990	A22920 to A22923 A22946 to A22950 A22970 to A22973 A22996 & A22997	2000ft 2000ft 2000ft 2000ft
Lau Fan Shan/Mong Tseng and Yuen Long Effluent Pipeline	2001	CW30641 CW33005 to CW33010 CW33016 CW36580 to CW36581	1200ft 4000ft 4000ft 5400ft
	1999	A49106 CN22453 CN24515	4000ft 3500ft 3500ft
	1995	CN10141 to CN10147 CN10225 & CN10226 CN13135	3200ft 3200ft 3500ft
	1990	A21587 & A21588 A21980 & A21981 A22177 A22236 A22238 to A22239	2000ft 2000ft 4000ft 4000ft 4000ft
Ngau Tam Mei and San Tin	2001	CN30026 & CN30027 CN30033 CW30507 CW31528 & CW31529 CW33574 CW33708 & CW33709 CW33853 & CW33854 CW35089	4000ft 4000ft 4500ft 2400ft 4000ft 4000ft 4000ft 2000ft
	1999	A49244 to A49245 A49753 A49773 CN23692 CN23751 CN24396 CN24460	3500ft 4000ft 4000ft 3500ft 3500ft 3500ft 3500ft
	1995	CN9797 to CN9799 CNCN10601 to CN10604 CN11869 CN11874 CN12952 CN12979 CN13004	3000ft 3000ft 3500ft 3500ft 3500ft 3500ft 3500ft
	1990	A21610 to A21611 A21631 A21633 A21676 A21709 A21976 A21988 & A21989 A22173 to A22174 A22185 A22686 A22693 A22841	2000ft 2000ft 2000ft 2000ft 2000ft 2000ft 2000ft 4000ft 4000ft 2000ft 2000ft 2000ft

Note: Photographs were reviewed for generalized land changes, as well as development of specific premises along the Project alignment.

12.4.3 ***General ProPECC Approach***

In accordance with *ProPECC PN 3/94* and the EPD's Guidance Notes, an assessment evaluation should:

- Provide a clear and detailed account of the present use of the land in question and the relevant past land use history, in relation to possible land contamination;
- Identify those areas of potential contamination and associated impacts, risks or hazards; and
- If required, submit a plan to evaluate the actual contamination conditions for soil and/or groundwater.

The EPD's Guidance Notes include a summary of the general steps of a detail contamination assessment study (Figure 12.1).

12.5 Site-specific Approach

However, as access for the premises is anticipated as restricted at this stage, it is not practicable to undertake a detailed sampling and analysis. The following alternative approach is adopted for the land contamination assessment.

(i) Review of the current and historical land uses was undertaken using information from aerial photographs, site visits, and government and public information on potential "blackspot" area. The objective is to identify any potentially contaminative land uses within the study area. Information about the locations of premises falling within the category of, or associating with, potentially contaminative land uses, as identified in the Section 3.1 of Annex 19 of the EIAO-TM is complied. Such information is shown on the maps in Figures 12.2 to 12.14.

(ii) Verification and visual inspection was undertaken to confirm the general environmental conditions associated with each of the identified premises. This non-intrusive approach serves to make an initial appraisal of the likely nature of any potential contamination, and where identified, to evaluate whether there are any significant evidences of land contamination associated with these premises.

(iii) A site appraisal profile was developed for each of the premises identified as having the potential for contamination. This profile identified the major potential land contamination concerns. For these premises, a preliminary review is made of potential environmental impacts or health concerns that may arise from, or during, future use of the land as a result of exposure to potentially contaminated materials.

(iv) Based on the profile results and type of land uses identified, an overview of the typical mitigation measures is undertaken.

The presence of any potential contamination along the Project alignment is related to the historical and current uses to which land has been put, both within and adjacent to the planned development. A review of current and historical land uses has been undertaken and the findings are presented below.

12.5.1 ***Review of Land Use Types***

A review of historical maps and selected historical aerial photos indicated that the majority of the proposed Project is to be developed on open or slightly developed land, along roadway, public access corridors and vehicular access road of the drainage channels. The selected historical aerial photos also indicate that several types of industrial and commercial activities have been started along different sectors of the proposed alignment of the Project in the past decade. However, there is little information to indicate that any major industrial usage along the proposed alignment of the sewers/rising mains and the site for pumping stations. This was confirmed with site visits, which indicated that the proposed alignment would generally be located outside the boundaries of the potential premises of concern. The land uses of the potentially contaminated premises adjacent to the works area include:

- Vehicle and mechanic maintenance and repair yards;
- Car dismantling and dumps yards;
- Construction material and equipment storage yards;
- Metal scrap yards;
- Uncontrolled dumps or debris fields; and
- Cargo storage yards.

12.5.2 ***Current Land Uses***

A summary of the current potentially contaminated land uses along the Project alignment is given in Table 12.3. These premises are identified in Figures 12.2 to 12.14, which cover only the premises with potential land contamination activities in the vicinity. A total of 79 premises have been identified based on the EPD's criteria set in EIAO-TM and Guidance Notes. 31 premises are currently listed on the March 2002 edition of the Land's Department "Blackspots" database. Premises located in excess of 50m from the proposed Project alignment have not been considered, as all of the premises identified are fairly small in size (all less than 0.5ha) except for the cargo storage yards, and there have been no reported cases of large scale spillage or leakage of potential contaminants. Land contamination potential has been judged to be localized. Furthermore, only the soil along the alignment will be disturbed during the earth and trench excavation.

Table 12.3: Potentially contaminated premises in the vicinity of the project sites

Site No.	Current Land Use	Observed Evidence of Contamination	Approximate Setback Distance from the Premises Boundary to the Sewer Alignment (m)
Yuen Long South Branch			
1*	No Name	Open area with several container offices. Oil stain observed on unpaved area. Petrol filling activities was observed.	6
2*	No Name	Vehicles (Dump Truck) repairing workshop. Oil stain observed on unpaved area	4
3*	No Name	Metal hardware workshop. Unpaved area. Cannot access.	32
4*	Refuse Collection Point	Open dumping on unpaved area.	6
5	No Name	Vehicle repairing workshop. Oil stain on unpaved area observed.	8
6	Wah Seng General Construction Ltd.	Storage of construction materials.	8
7	No Name	Vehicle dismantling workshop and scrap yard.	6
8	Open area	Dismantled vehicle observed.	6
9	No Name	Warehouse of tupes and wheels.	6
10	No Name	Dismanlted dump truck. Minor oil stain observed on paved area with crack.	6
11*	Junic Construction Company	Storage of construction materials.	6
12	Tin To Transportation Ltd.	Cannot access.	7
13*	No Name	Vehicle repairing workshop. Oil stain observed on cracked paved area.	8
14	Wah Sing Company	Cannot access. (look like industrial building)	6
15	No Name	Storage of oil (petroleum/diesel)	8
16	No Name	Vehicle repairing workshop. Dismantled parts observed. Oil stain observed.	6
17	No Name	Vehicle repairing and dismantling workshop. Paved area with minor oil stain.	8
18	No Name	Woodworks workshop. Paved but cracked area.	6
19	Ho Chi Vehicular Engineering	Oil stain observed on paved area.	6
20	Shui Hing Construction Material	Cannot access.	6
21	Fung Sing Metal Company	Cannot access (Metal hardware workshop).	10
22	Fung Yuen Warehouse	Cannot access.	6
23	No Name	Former factory building/warehouse.	6
24	No Name	Parking area of fuel tanker vehicle.	20
25	Maintenance Workshops	Maintenance workshop and petrol filling station observed.	6
Lau Fan Shan/Mong Tseng and Yuen Long Effluent Pipeline			
1	Sin Chun Mechanic (HK) Co., Ltd.	Storage (warehouse) of scaffolding. Several oil stains on unpaved area observed.	6
2	Wo Ping Vehicle Repairing Workshop	Vehicle maintenance and repairing. Oil stains on unpaved area observed.	6
3	Wo Hing Wooden Workshop	Cannot access but looks like no operation.	6
4	Chun Wun Container Co., Ltd.	Former container parking/storage yard. Minor oil stain observed.	8
5	Shun Fat Reynold Container Services Ltd.	Most of the area was paved, but cannot access inside.	7

Site No.	Current Land Use	Observed Evidence of Contamination	Approximate Setback Distance from the Premises Boundary to the Sewer Alignment (m)
6	No Name	Unpaved area with oil stains. Several cargo and vehicle were parked.	7
7	PCL Container Services Limited	Container maintenance and storage.	7
8	Lung Fai Vehicle Repairing Workshop	Truck maintenance and repairing. Oil stain observed on unpaved area.	7
9	A&A Warehouse	Container yard. Cannot access inside.	12
10	No Name	Storage of metal supporter (scrap yard). Unpaved area with oil stain. Several oil drum observed.	12
11	Hung Lee Container Yard	Container yard but cannot access inside.	7
12	Ho Yip Container Yard	Container yard but cannot access inside.	7
13	Asia Machinery Trading and Motor Services Co.	Truck maintenance and repairing workshop. Major oil stain observed.	7
14*	No Name	Container yard. Cannot access inside.	8
15*	No Name	Heavy equipment storage (excavator). Unpaved area maintenance workshops.	12
16*	No Name	Parking area. Major oil stain observed from fuel tanker.	12
17*	Ling Fung Container Rental Co.	Maintenance workshop observed on unpaved area.	12
18*	No Name	Dismantled vehicle and oil stain observed on unpaved area.	12
19*	No Name	Vehicle dismantling workshop. Major oil stain on unpaved area.	12
Ngau Tam Mei and San Tin			
1	Leader Container Port	Container port/storage area.	52
2	Universal Car Limited	Vehicle parking. Warehouse was observed.	52
3	No Name – Cargo Truck Parking Area	Unpaved site. Several oil stain observed.	8
4	Ming Kee Car Repairing Workshop	Maintenance activities observed. Oil stains observed on paved area.	6
5	Express Car Repairing and Cleaning Workshop	Vehicle repairing workshop. Maintenance activities on paved area.	6
6	Chee Fu Vehicle Repairing Workshop	Several dismantled vehicles observed.	14
7	Yuen Fung Metal Hardware Workshop	Metal cutting in operation. Oil stain on unpaved area was observed.	14
8	Yeung Yuk Motor Ltd.	Vehicle repairing workshop. Oil stain on unpaved area observed.	14
9	Kin Kee Vehicle Dismantling Company	Dismantled vehicles and oil stains observed on unpaved area.	14
10	No Name (Cargo Truck Parking)	Cargo truck and excavator parked on unpaved area.	14
11*	Wo Kee Vehicle Repairing Co.	Dismantled vehicles observed. Major oil stains on unpaved area.	6
12*	No Name	Storage of fabricated material for housing project.	6
13*	No Name (Vehicle Repairing Workshop)	Vehicle printing and repairing activities observed. Major oil stain observed on unpaved area.	6
14	Wing Pat Cargo Truck Parking	Unpaved parking area.	6
15	Tong Kee Vehicle Repairing Workshop	Dismantled vehicle and oil stains on unpaved area observed.	6
16	Wai Wong Company	Cargo trucks and excavators parking on unpaved area.	6
17	Hung Hing Tire Repairing	Cargo truck parking and tyre repairing area.	6
18*	Wah Tong Mechanic Trading (HK) Ltd.	Parking of heavy equipment (e.g. excavators). Oil stain on unpaved area observed.	6

Site No.	Current Land Use	Observed Evidence of Contamination	Approximate Setback Distance from the Premises Boundary to the Sewer Alignment (m)
19*	Sun Hing Tire Repairing Ltd.	Cargo parking. Oil stains on unpaved area observed.	6
20*	Hing Yip Transportation Company	Cargo truck parking. Oil stain on unpaved area observed.	6
21*	King Tat Vehicle Repairing Workshop	Maintenance bay with major oil stain observed.	6
22*	Yet Tong Vehicle Repairing Workshop	Oil stain observed on unpaved area.	6
23*	Ng Chow Tire Repairing Company	Oil stains on unpaved area observed.	6
24*	Ko Tat Vehicle & Mechanic Company	Major oil stains observed on cracked area.	6
25*	Kong Ming & King Tat Car Repairing Workshops	Oil stains observed on cracked area.	6
26*	Way Chun Vehicle Repairing Company	Major oil stains on cracked/unpaved areas.	6
27*	Kong Lung Cargo Storage Area	Storage of cargo containers on unpaved area.	6
28*	Man Ming Mechanic Repairing Co.	Major oil stains observed on unpvaed area.	6
29*	Cheung Lung Truck Trading Co.	Maintenance workshop and scrap yard observed. Major oil stains on unpaved area.	6
30*	No Name	Cargo truck parking on unpaved area. Oil stains observed.	6
31*	Wai Wo Vehicle Repairing Co.	Oil stains observed on unpaved area.	6
32*	Hang Fung Vehicle Repairing Co.	Oil stains observed on unpaved area.	6
33*	Esso Petrol Filling Station	Normal Operation.	6
34	No Name	Cargo truck storage. Major oil stains on unpaved area.	6
35	No Name	Cargo truck storage. Oil stains on unpaved area.	6

Note*: Premises currently listed on the March 2002 edition of the Land's Department "Blackspots" database.

As the identified potential contaminated premises were in operation, access to the premises for inspection was usually not permitted. Therefore, only a limited, preliminary visual assessment of these premises could be made.

12.6 Findings and Recommendations

The preliminary investigation identified the land uses adjacent to the proposed alignment of the sewers/raising mains with the minimal potential to give rise to land contamination, as defined in the EPD's guidance documents. However, as the various premises in question are all fairly small in size and the land contamination potential is judged to be localised, therefore, the overall contamination concerns to the Project site area are considered to be very low. It is considered that the preparation of the Contamination Assessment Plan (CAP) for the detail site investigation, as stipulated in Section 12.4.3, is not required and not practical for the Project sites, as the proposed sewers/raising mains alignment and the location of pumping stations do not lie within the potential contaminated premises.

Although the risk of land contamination of the Project site area is very low, it is still recommended to conduct the "Confirmatory Soil Test" during the excavation to further safeguard the construction workers. Since great portion of the alignments are located underneath major roads, road closure for confirmatory testing is not feasibility. Therefore, it is suggested that the testing should be conducted during detailed design stage or the commencement of work when site access is still feasible.

12.6.1 Confirmatory Soil Testing

In accordance with preliminary information provided by the Project Proponent, it is anticipated that approximately 29.6km of trench excavation (excavation widths from 0.75m to 5.0m and excavation depth from 2.6m to 7.0m) will be required for the lining of the twin rising mains and gravity sewer. It is proposed to collect

the confirmatory soil sample at the "High Sensitive" locations along the excavation alignment. These locations have relative short setback distances from the potentially contaminated premises that are operated with the potential usage of mobile contaminants, such as TPH.

The proposed sampling locations for the confirmatory soil samples are shown in Figures 12.2 to 12.14, and described in Table 12.4. There will be a total of 30 confirmatory sampling locations along the alignment.

Table 12.4: Sampling locations for the confirmatory soil samples along the alignment

Site No.	Current Land Use	Observed Evidence of Contamination	Approximate Length of Sewer close to the Premises Boundary (m) [2]
Yuen Long South Branch			
1*	No Name	Open area with several container offices. Oil stain observed on unpaved area. Petrol filling activities was observed.	225
2*	No Name	Vehicles (Dump Truck) repairing workshop. Oil stain observed on unpaved area	20
5 and 6	No Name Wah Seng General Construction Ltd.	Vehicle repairing workshop. Oil stain on unpaved area observed. Storage of construction materials.	68
7	No Name	Vehicle dismantling workshop and scrap yard.	32
10	No Name	Dismanlted dump truck. Minor oil stain observed on paved area with crack.	30
11*	Junic Construction Company	Storage of construction materials.	52
13*	No Name	Vehicle repairing workshop. Oil stain observed on cracked paved area.	45
16	No Name	Vehicle repairing workshop. Dismantled parts observed. Oil stain observed.	52
17 and 18	No Name No Name	Vehicle repairing and dismantling workshop. Paved area with minor oil stain. Woodworks workshop. Paved but cracked area.	77
19	Ho Chi Vehicular Engineering	Oil stain observed on paved area.	39
25	Maintenance Workshops	Maintenance workshop and petrol filling station observed.	26
Lau Fan Shan/Mong Tseng and Yuen Long Effluent Pipeline			
2	Wo Ping Vehicle Repairing Workshop	Vehicle maintenance and repairing. Oil stains on unpaved area observed.	32
8	Lung Fai Vehicle Repairing Workshop	Truck maintenance and repairing. Oil stain observed on unpaved area.	71
13	Asia Machinery Trading and Motor Services Co.	Truck maintenance and repairing workshop. Major oil stain observed.	10
15* and 16*	No Name No Name	Heavy equipment storage (excavator). Unpaved area maintenance workshops. Parking area. Major oil stain observed from fuel tanker.	140
17* and 18*	Ling Fung Container Rental Co. No Name	Maintenance workshop observed on unpaved area. Dismantled vehicle and oil stain observed on unpaved area.	130
19*	No Name	Vehicle dismantling workshop. Major oil stain on unpaved area.	70
Ngau Tam Mei and San Tin			
4	Ming Kee Car Repairing Workshop	Maintenance activities observed. Oil stains observed on paved area.	77
5	Express Car Repairing and Cleaning Workshop	Vehicle repairing workshop. Maintenance activities on paved area.	25
6	Chee Fu Vehicle Repairing Workshop	Several dismantled vehicles observed.	13
7	Yuen Fung Metal Hardware Workshop	Metal cutting in operation. Oil stain on unpaved area was observed.	58

Site No.	Current Land Use	Observed Evidence of Contamination	Approximate Length of Sewer close to the Premises Boundary (m) [2]
8 and 9	Yeung Yuk Motor Ltd. Kin Kee Vehicle Dismantling Company	Vehicle repairing workshop. Oil stain on unpaved area observed. Dismantled vehicles and oil stains observed on unpaved area.	52
11*	Wo Kee Vehicle Repairing Co.	Dismantled vehicles observed. Major oil stains on unpaved area.	65
13* and 15	No Name (Vehicle Repairing Workshop) Tong Kee Vehicle Repairing Workshop	Vehicle printing and repairing activities observed. Major oil stain observed on unpaved area. Dismantled vehicle and oil stains on unpaved area observed.	97
18* and 21*	Wah Tong Mechanic Trading (HK) Ltd. King Tat Vehicle Repairing Workshop	Parking of heavy equipment (e.g. excavators). Oil stain on unpaved area observed. Maintenance bay with major oil stain observed.	148
22*	Yet Tong Vehicle Repairing Workshop	Oil stain observed on unpaved area.	45
23*, 24*, 25* and 26*	Ng Chow Tire Repairing Company Ko Tat Vehicle & Mechanic Company Kong Ming & King Tat Car Repairing Workshops Way Chun Vehicle Repairing Company	Oil stains on unpaved area observed. Major oil stains observed on cracked area. Oil stains observed on cracked area. Major oil stains on cracked/unpaved areas.	129
28* and 29*	Man Ming Mechanic Repairing Co. Cheung Lung Truck Trading Co.	Major oil stains observed on unpvaed area. Maintenance workshop and scrap yard observed. Major oil stains on unpaved area.	161
31* and 32*	Wai Wo Vehicle Repairing Co. Hang Fung Vehicle Repairing Co.	Oil stains observed on unpaved area. Oil stains observed on unpaved area.	45
33*	Esso Petrol Filling Station	Normal Operation.	32

Note: * Premises currently listed on the March 2002 edition of the Land's Department "Blackspots" database.
[2] Assuming an average trench width of 1.5m and average trench depth of 3m

Except for Shan Ha Tsuen PS (B1) and Shung Ching San Tsuen PS (B5) (Figure 12.2), other pumping stations are located more than 65m away from the potentially contaminated industrial premises (Table 12.5). The chance of potential land contamination is therefore minimal and thus confirmatory soil test is not required for the distant pumping staions. For pumping stations B1 and B5, a total of seven sampling locations will be required. As the pumping stations pose different dimension and excavation depth, therefore, a specific confirmatory soil sampling strategy is designed and summarized in Table 12.5.

Table 12.5: Sampling strategy of confirmatory soil testing for pumping stations

Pumping Station	Distance from site boundary to the potential site of contamination	Dimensions (m)	Pumping Station Excavation Depth (m)	Sampling Locations [1]	Sampling & Testing Strategy
Cassino Line PS (P5)	>200m	25 x 20	9	Not required	Sampling Depth: In between the depth of 0.5m to 3m subject to the decision of the Land Contamination Specialist. No of Samples: One soil sample shall be collected from each sampling location. Analytical Parameters: The analytical parameters stipulated in Table 12.6 shall be tested on each
Fan Tin San Tsuen/San Lung Tsuen PS (P4)	>200m	40 x 30	13	Not required	
San Tin PS (P3)	~ 65m	40 x 30	10	Not required	
Ngau Tam Mei PS (P1)	>200m	40 x 40	13.5	Not required	
Tam Mei Camp PS (P2)	>200m	40 x 30	11	Not required	
Mong Tsueng Tsuen PS (A2)	>500m	40 x 30	10	Not required	
Lau Fau Shan PS (A1)	>120m	25 x 20	10	Not required	

Pumping Station	Distance from site boundary to the potential site of contamination	Dimensions (m)	Pumping Station Excavation Depth (m)	Sampling Locations (1)	Sampling & Testing Strategy
Proposed PS beside Yuen Long Sewage Treatment Works (reclaimed fish pond) (OP1/AP1)	> 300m	100 x 70	15	Not required	shall be tested on each sample.
Shan Ha Tsuen PS (B1)	~18m	40 x 30	10	Four (from boundary)	
Muk Kiu Tau Tsuen PS (B2)	>300m	40 x 30	8.5	Not required	
Pak Sha Tsuen PS (B7)	>180m	25 x 20	9	Not required	
Sham Chung Tsuen PS (B3)	>200m	25 x 20	7	Not required	
Shiu Tsiu San Tsuen PS (B4)	>300m	25 x 20	7.5	Not required	
Shung Ching San Tsuen PS (B5)	~12m	25 x 20	9	Three	
Nga Yiu Tau PS (B6)	>300m	25 x 20	9	Not required	

Remark: (1) Simplified sampling point method - Guidance Notes for Investigation and Remediation of Contaminated Sites of: Petrol Filling Stations; Boatyards; and Car Repair/Dismantling Workshops.

Since the alignment of the sewer/rising mains and the location of pumping stations do not lie within the potential contaminated premises, the land contamination potential is judged to be localized. Therefore, the analytical parameter for the confirmatory test shall be confined to those mobile contaminants, such as TPH. The analytical parameters for relevant confirmatory soil testing (both for trench alignment and pumping stations) are summarised in Table 12.6.

Soil sampling shall be conducted immediately after the sampling point is excavated. For each sampling point, 3 confirmatory soil samples shall be collected from depths of 0.5m, 1.5m and 3m. The free product, if any, floating on the top of groundwater (if encountered) shall also be removed/recovered and analyzed. The collected soil samples and free product, if any, shall be analysed by a HOKLAS accredited laboratory.

The entire soil sampling programme shall be supervised by a qualified Land Contamination Specialist, who should have at least 7 years experience in land contamination assessment and be employed by the Contractor before the construction activities commence. In the event that any suspected contaminated soils (e.g. discoloured soil or visual/olfactory signs of contamination) were observed, additional confirmatory soil samples shall also be collected subject to the instruction of the Land Contamination Specialist. The Land Contamination Specialist shall also be responsible for the interpretation of the analytical results of the confirmatory soil samples for evaluation of the potential contamination levels.

For soil along the concerned sewer alignment, if the analytical results of any confirmatory soil sample exceeded the Dutch B value of the "Dutch List", the segment of the excavated soils from 3m in front of the sampling point to 3m behind the sampling point shall be treated as contaminated. The sampling regime shall be repeated at both endpoints of the 3m-section contaminated soils until no exceedence of Dutch B value is detected.

For soil at the concerned pumping station, if the analytical results of any confirmatory soil sample exceeded the Dutch B value of the "Dutch List", the section of the excavated soils of 3m horizontal radius and 1m vertical depth above and below of the sampling point shall be treated as contaminated. After the section of contaminated soil is excavated, at least 8 additional soil samples (i.e. the sampling location shall be decided by the Land Contamination Specialist) shall be collected at the boundary of the excavated hole and analysed for the same parameters. The excavation and sampling regime shall be repeated until no exceedence of Dutch B value is detected.

Before any excavated soils is confirmed as non-contaminated, it shall be assumed as "suspected contaminated material", and stockpiled beside the excavated trench or within pumping station location. The excavated soils shall be covered by tarpaulin or other similar materials to prevent generation of site runoff. Fencing with

warning sign shall also be erected around the stockpiled soils to prevent unauthorized entry. The stockpiled soils could be used, as the backfill material only if the confirmatory soil testing results confirmed the excavated soils is un-contaminated.

Table 12.6: Analytical parameters of confirmatory soil test

Parameters	Reference Analytical Method	Detection Limit (ug/L)
Total Petroleum Hydrocarbons		
Volatiles (C6 – C9)	USEPA 8260A	20
Extractable (C10 – C14)		50
Extractable (C15 – C28)	USEPA 8015A	100
Extractable (C29 – C36)		100

12.6.2 ***Remediation Method***

In the absence of current legislation applicable to the clean-up of soil contamination in Hong Kong, the following remediation method will be adopted, if any excavated soil is confirmed as contaminated.

No matter what kind of contaminants is detected (i.e. TPH, BTEX, PAHs, Metals or halogenated & non-halogenated solvents), the contaminated soils shall be handled properly. For soils of high contaminants (exceeding Butch B value), it should be treated as chemical waste, and handled in accordance with the related documents under the Waste Disposal (Chemical Waste) (General) Regulation. For less contaminated soils, approval from the Facilities Management Group (FMG) of EPD shall be obtained prior to the disposal of the contaminated soils to co-disposal landfill or other authorised disposal sites. Nevertheless, in-situ remediation methods should be adopted wherever possible and disposal to landfill should always be the last resort. A licensed contractor shall be appointed for the collection, transportation and disposal of the contaminated soils.

However, as Metal contaminants are of inorganic nature and they will not be degraded after disposal of at the landfill. Therefore, the Toxicity Characteristic Leaching Procedure (TCLP) shall be conducted if metal contaminants are detected and exceeded the Dutch B Value of the Dutch List. If the TCLP testing requirements (i.e. Table E1 of EPD's Guidance Notes) are complied, the metal contaminated soils could be disposed of at the landfill directly with the approval of FMG of EPD. If the TCLP limits are exceeded, the metal contaminated soils shall be stabilised by ex-situ mixing with cement to form stabilised blocks, which can then be disposed of at the landfill site. The cement stabilisation method is summarised in the following section:

Cement Stabilisation

As only small quantities of metal contaminated soils is anticipated (if any), that are required to be treated, mixing can be undertaken by using excavator or similar small plant, although it is important to ensure adequate mixing of the cement and soil material. A designated area shall be reserved during the detailed design stage in case the cement stabilisation is required.

In order to ensure the cement/soil mixing ratio is sufficient to achieve the TCLP disposal criteria and to allow the mixture to set to form a solid matrix, trial tests shall be carried out to ascertain the correct mixing ratio required. Cement stabilisation shall only be conducted after the completion of trial tests and the correct mixing ratio of cement/soil is determined. The mixture shall be placed in moulds made from wooden formwork to set for approximately 1 week. The blocks shall be of a suitable size to allow handling and transport using standard construction plant, although larger blocks may be broken into smaller sizes for transport. After setting, sampling of the blocks should be subject to TCLP testing for the standard suite of metals as given in Table 11.2 in the previous Waste Management Section, to verify that the leachable contaminant concentrations have been reduced to below the threshold limits for landfill disposal.

During the stabilisation works, adequate measures shall be taken to prevent the generation of dust, to safeguard both workers and occupants of nearby areas. Particular attention shall be given to minimise dust generation during excavation and mixing, e.g. by use of dust suppression sprays. To prevent rainwater entering the mixture, each batch of mixture shall be covered throughout the entire setting and the stabilisation area shall be covered

by means of a temporary shed. In addition, the stabilisation area shall be paved and bunded to prevent runoff coming out from the mixture.

The entire cement stabilisation works, (if required), shall be supervised by a Land Contamination Specialist. The Land Contamination Specialist shall also be responsible for the supervision of the trial tests, deciding the correct cement/soil mixing ratio. Such cement stabilization method should be approved by DEP and the progress of the stabilisation works should be reported to EPD periodically.

12.7 Mitigation Measures

It is considered unlikely that contaminated land issues will be a significant concern during either the construction or operational stage of the Project. The Contractor shall provide all information related to the analytical results of the samples, quantities of contaminated soil requiring treatment to EPD for approval prior to disposal and commencing construction activities. The qualified Land Contamination Specialist shall prepare a detailed sampling and treatment plan for submission to and agreement with EPD.

Apart from the confirmatory soil testing, it is also recommended that standard good practice measures are implemented during the construction phase to minimise any potential exposure to contaminated soils or groundwater as follows:

- The bulk earth-moving excavator equipment shall be used to minimise construction worker's potential contact with contaminated materials where practical. Manual excavation shall be avoided.
- Exposure to any contaminated materials may be minimised by the wearing of appropriate clothing and Personal Protective Equipment (PPE) such as gloves (when interacting directly with contaminated material), preventing smoking and eating during such activities, and providing adequate hygiene and washing facilities.
- Vehicle containing any contaminated materials should be suitably covered to limit potential dust emissions or contaminated wastewater run-off, and truck bodies and tailgates should be sealed to prevent any discharge during transport or during wet conditions.
- Only reputable waste hauliers should be used to collect and transport any contaminated material to an appropriate disposal site and procedures should be developed to ensure that illegal disposal of wastes does not occur.
- The necessary waste disposal permits should be obtained, as required, from the appropriate authorities, in accordance with the Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354), as required.
- Records of the quantities of wastes generated and disposed of should be maintained.
- In accordance with good construction practice, silt traps should be used to reduce the impact to drainage caused by suspended solids (SS) arising from disturbed ground, or any construction materials such as cement and gravel. Groundwater should be disposed of in accordance with the WPCO, and its discharge licence requirements.

13.0 ECOLOGICAL ASSESSMENT

13.1 Legislation and Standards

The Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO) has been used as a guideline for the current project. Other relevant environmental legislations, guidelines and references include:
** Environmental Impact Assessment Ordinance (Cap. 499)*
** Relevant Study Brief;*
** Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10;*
** Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation the Forestry Regulations;*
** Wild Animals Protection Ordinance (Cap. 170);*
** Country Parks Ordinance (Cap. 208) and associated subsidiary legislation;*
** Ecological Baseline Survey For Ecological Assessment (EIAO Guidance Note No. 7/2002);*
** Town Planning Ordinance (Cap. 131), in particular, Town Planning Board Guidelines for Application for*
** Developments within Deep Bay Area under Section 16 of the Town Planning Ordinance;*
** United Nations Convention on Biodiversity (1992);*
** Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention); and*
** PRC relevant Regulations and Guidelines.*

13.2 Assessment Methodology

A literature review of the ecological conditions within the study area was conducted. The review included Government and private sector reports, as well as unpublished information.

- The requirements of ecological impact assessment of the Project area followed Section 3.4.6, Appendix 3 of the Study Brief. The study brief specified at least 6 months of ecological surveys covering both wet and dry seasons.

The study area for terrestrial ecology included all areas within 500m from the site boundary of the works area (Figure 13.1). Relevant ecological studies were reviewed. Data gaps that might hinder the assessment of ecological impacts were filled by implementing field surveys. Field surveys focused on the proposed alignment and the pumping station but also included the 500m study area. Preliminary field surveys were performed in June 2002 to update and field check the validity of the information gathered during literature review, to identify ecological sensitive receivers and to select representative areas for detailed baseline surveys. Ecological surveys covering wet and dry seasons were undertaken from July 2002 to January 2003 to record ecological data within the assessment area and establish the ecological profile for incorporation into this report. Data analysis and discussion described habitats and species found in the assessment area, highlighting those that are rare, of conservation concern, or protected by law. Species groups surveyed and survey methods are as below.

For aquatic ecology, the assessment area is the same as that for water quality assessment described in Section 3.4.3.2, Appendix C of the Study Brief, i.e. “all areas within 500m from the Project boundary, plus any stream courses and the associated water system in the vicinity that will be affected by the project”.

13.2.1 ***Habitats and Vegetation***

Surveys were performed on 13 June, 25 July, 8 August, 26 September, 27 November, 19 December 2002, and 6 January 2003. Habitats were mapped based on the 2001 and 2002 government aerial photos and field ground truthing. Representative areas of each habitat type were surveyed on foot. Plant species of each habitat type encountered and their relative abundance were recorded with special attention to rare or protected species. Nomenclature and conservation status of plant species follow Xing *et al.* (2000)[79] and Wu and Lee (200) [75]. Coloured photographs of all habitats encountered on site and of ecological features of special importance were provided. Habitat map of the site was produced at the required scale using GIS software.

13.2.2 ***Avifauna***

The bird communities of selected habitats within the Study Area were surveyed using the point count method. Locations of sampling points are shown in Figure 13.2. Surveys were carried out on 27 May, 13 and 27 June (breeding season and summer migration), 22 August, 26 September (autumn migration), 22 and 27 November, 9 December 2002 and 6 January 2003 (winter migration). Ten minutes were spent counting birds at each

sampling point, and all birds seen or heard within 30 m of each point were counted and identified to species where possible. Bird species encountered outside counting points but within the assessment area were also recorded to produce a complete species list. Signs of breeding (e.g. nests, recently fledged juveniles) within the study area were also recorded. Relative abundance and species richness of birds were computed. Ornithological nomenclature in this report follows Carey *et al*. (2001) [42].

The three active egretries within the Study Area – Mai Po Village, Mai Po Loong and Shing Uk egretries – were surveyed on 27 May and 27 June 2002. The breeding species and number of nests with incubating adults or chicks of each species in each egretry were recorded. The annual estimate of the ardeid breeding population was taken to be the sum of the highest counts for each species in the surveys.

13.2.3 ***Other Terrestrial Fauna***

Herpetofauna seen within the Study Area were conducted through active searching. All reptiles and amphibians sighted and heard were recorded. Herpetofauna surveys were carried out on 25 July and 9 December 2002. A night survey of amphibians was performed on 30 August 2002. Nomenclature used in this report for reptiles follows Karsen *et al*. (1998) [51] while that for amphibians follows Lau and Dudgeon (1999) [60].

Dragonflies and butterflies of selected habitats within the Study Area were surveyed using the point count method. Locations of sampling points for dragonflies and butterflies were same as those for birds (Figure 13.2). Five minutes were spent counting dragonflies and butterflies at each sampling point, and all dragonflies and butterflies seen within 10 m of each point were counted. Dragonflies and butterflies encountered outside counting points but within the assessment area were recorded in order to produce a complete species list. Nomenclature for butterflies follows Walthew (1997) [68] and dragonfly nomenclature follows Wilson (1995) [67]. Dragonfly and butterfly surveys were carried out on 25 July and 26 August (wet season), and 9 December 2002 and 6 January 2003 (dry season). Relative abundance and species richness of dragonflies and butterflies in each type of habitat were computed.

Surveys of mammals within the Study Area were conducted. All sightings, tracks, and signs of mammals found were recorded. Mammal surveys were performed on 25 July and 8 August (wet season), and 9 December 2002 and 6 January 2003 (dry season). A night survey of mammals was performed on 30 August 2002. Nomenclature for mammals follows Wilson and Reeder (1992) [69].

13.2.4 ***Aquatic fauna***

Aquatic fauna were surveyed on 13 and 27 June, 8 August, 9 December 2002 and 6 January 2003 by active searching and direct observation at streams and channels identified during the wet season and dry seasons. Boulders in the streams, if encountered, were overturned to locate aquatic animals beneath. A dip net was used to collect organisms along the streams. All encountered organisms were identified to the lowest possible taxon and recorded. Colour photographs were taken. Special attention was paid at the stream crossings (where the proposed sewage alignment cuts across existing streams or drainage channels).

13.3 Ecology Baseline Condition

Figure 13.1 shows the sites of conservation importance (Note 1, Appendix A of Annex 16 of TM) within or near the study area. These include:

- Mai Po and Inner Deep Bay Ramsar Site
  About 1,500 ha of wetland in the Mai Po and Inner Deep Bay was listed as a Ramsar Site in 4 September 1995. The area is the largest wetland in Hong Kong. The wetland acts as a refueling station and wintering site for thousands of migratory birds during their migrations between the Arctic Russia and Australia. The total migratory birds using the area may be over 120,000. Some of them are globally threatened species such as Black-faced Spoonbill, Saunders' Gull, Baikal Teal, Baer's Pochard and Dalmatian Pelican. The site is also of special value for its large mangrove stands and reed beds (AFCD's web site http://www.afcd.gov.hk/conservation/con_e.htm).

- Site for Special Scientific Interest (SSSIs) (Mai Po Marshes, Inner Deep Bay, Mai Po Village)

Mai Po Marshes SSSI was designated in 1976 and is the only area in Hong Kong where large number of duck, shore and marsh birds can regularly be seen and, as such have a very considerable scientific and educational potential. Inner Deep Bay SSSI was designated in 1986 and is the largest and most importance mudflats for dwarf mangroves and feeding site for migrating birds in Hong Kong. Mai Po Village SSSI was an egretry and was designated in 1979 (Anon, updated) [32]. However, the location of the nesting site has been shifted away to nearby locations outside the SSSI boundary since 1998.

- Wetland Buffer Area and Wetland Conservation Area
  The planning intention of the WCA is to protect and conserve the ecological value of the fishponds in which form an integral part of the wetland ecosystem in the Deep Bay Area.

  All the existing active and abandoned fishponds (excluding SSSIs) forming a continuous wetland habitat in Ma Tso Lung, San Tin, Mai Po, Nam Sang Wai and Tsim Bei Tsui, covering an area of around 1,400 hectares, have been zoned as a Wetland Conservation Area (WCA) under the OZPs. The principle for landuse control is avoidance of loss of fishponds and negative off-site disturbance from undesirable landuses, and habitat fragmentation within the WCA. The types of activities whicih may be considered within the WCA include conservation, environmental education and essential infrastructural projects.

  The main objective of the Wetland Buffer Area (WBA) is to protect the ecological integrity of the WCA through the designation of a 500m wetland buffer along the boundary of the WCA. (Source: Town Planning Board Guidelines TPB PG-No. 12B)

  In addition to above, based on Note 2, Appendix A of Annex 16 of TM, important habitats found within the study area where an ecological assessment will be necessary include:

- Egretries (Mai Po Loong, Mai Po Village and Shing Uk)
  Other than Mai Po Village, two more egretries were identified within the study area. Shing Uk egretry is the same as egretry at the north of Wan Chau Fresh Water Reservoir referred in the ESB. It was active during the ecological surveys for this study but has now been abandoned in 2003. Detailed description is in the result section of bird surveys below.

- Dragonfly hot spot (Tai Tong)
  Tai Tong is a hot spot for dragonflies identified by Wilson (1995) [67]. Half of the site is located inside Tai Lam Country Park (Wilson 1997) [86]. Detailed description is in the result section of literature review of other terrestrial fauna below.

Habitats and Vegetation

(a) Literature Review

The study area boundary of YLKTSSD Stage 1 covers part of the study area of the current proposed alignment (Figure 13.1). Survey results relevant to this study are reviewed. According to the 12-month ecological survey results, habitats found within the current study area included cultivated land, streams/channel, fishponds, woodland, grassland/shrubland and urbanised. No plant species of conservation interest were found during the Stage 1 study within the current study area.

A review of the results of biodiversity surveys of Hong Kong flora (Xing *et al*. 2000 and Siu 2000) [79] & [64] found 3 rare or very rare plant species, *Spiranthes hongkongensis* recorded in "Yuen Long", *Sphenoclea zeylanica* in "Tin Shui Wai", and *Ruppia maritima* in gei wais of "Mai Po", (Appendix 13.1a), which are presumably located within or in the vicinity of the current Study Area. These species were not recorded during the field surveys for the current study.

(b) Field survey

Most of the study area, particularly the area to be directly affected by the proposed Project is highly urbanised and degraded by existing and on-going development, including village housing, roads and drainage channels. Habitats found within the study area include plantation, mixed woodland, grassland/shrubland, cultivated land/orchard, fishpond, stream/channel, mangrove, and disturbed/urbanized/wasteland areas (Figure 13.2). A total of 249 plant species were recorded, 34% of which are exotics (Appendix 13.1b). One locally rare fern, *Ceratopteris thalictroides,* and one locally restricted sedge, *Schoenoplectus littoralis* subsp. *subulatus,* were recorded within the study area. No other plant species of conservation interest was recorded.

The "Important Habitats Where an Ecological Assessment Will Be Necessary" listed in Note 1, Appendix A, Annex 16 to the TM-EIAO existing in or near to the study area are:

- Woodlands larger than 1 ha in size (young, mixed woodland in this study);
- Natural stream courses over 100 metres (semi-natural stream course).

Most of these habitats are located away from areas to be directly impacted by the Project. Table 13.1 lists the area of each habitat type recorded within the study area.

Table 13.1 : Habitat types recorded within the study area

Habitat type	Area (ha)	No. of plant species recorded
Plantation	20.8	62
Mixed Woodland	93.4	78
Grassland/Shrubland	309.1	79
Cultivated Land/Orchard (active and abandoned)	338.5	98
Fishpond (active and abandoned)	292.8	59
Stream/ Channel	89.9	-
Mangrove	9.4	10
Urbanised/Disturbed/Wasteland	1601.4	74

(c) Plantation

Plantation was found along roads, on "managed" hillsides (e.g. at Cassino Line) and near villages. Most of the trees planted ranged between 10-15m. Species commonly planted were exotics, including *Acacia confusa, Casuarina equisetifolia, Eucalyptus citriodora*, and *Melaleuca quinquenervia*. Little understorey was developed under plantation, which was mostly densely planted as a monotypic stand and/or under active management such as weeding and pruning. Sixty-two plant species were recorded within this habitat.

(d) Mixed Woodland

Mixed woodland was found on hillsides scattered within the study area. Woody canopies of native species were found to be gradually established under old plantation or at grave sites where hill fires were less frequent. The mixed woodland habitats are young in age and have an open canopy and an understorey densely overgrown with grasses and shrubs. Canopy species reached a height of 8-12 m and included both exotic species (e.g. *Acacia confusa, Casuarina equisetifolia,* and *Eucalyptus citriodora*) and pioneer native species (e.g. *Celtis tetrandra* subsp. *sinensis*, *Macaranga tanarius* and *Litsea glutinosa*). Understorey species consisted of a variety of tree, shrub and herb species, including *Alocasia macrorrhiza, Psychotria rubra, Ligustrum sinensis*, and *Uvaria microcarpa*. The secondary woodland habitats within the study area had moderate species diversity; 78 plant species were recorded. No rare/protected species were found in this habitat.

(e) Grassland/Shrubland

Patches of grassland/shrubland were found on hillsides with graves present, in areas frequently burnt by fires. These areas had low plant cover (mostly between 1-2m) and were dominated by a mixture of native ferns and grasses and weedy species. Species commonly seen include *Dicranopteris linearis, Neyraudia reynaudiana, Panicum maximum Rhodomyrtus tomentosa* and *Ilex asprella*. The grassland habitat within the study area has moderate species diversity and a simple structure. A total of 79 plant species were recorded in these habitats.

(f) Cultivated Land/Orchard

Cultivated lands within the study area were mainly located in Yuen Long South and were mostly abandoned. Remnants of crops (e.g. *Rorippa nasturtium-aquaticum, Colocasia esculenta,* and *Lactuca sativa*) were also found in abandoned fields together with grasses, herbs and weeds (e.g. *Mikania micrantha, Bidens pilosa*, and *Urochloa mutica*) that naturally colonised the land. Orchards were scattered around villages and on hillsides within the study area. Major fruit trees included *Dimocarpus longan, Litchi chinensis* and *Musa paradisiaca*. Most orchards seemed to be actively managed as the fruit trees were in good form and the understorey were well maintained. Ninety-eight species were recorded in this habitat. The cultivated land/orchard habitat within the study area represents man-made habitat and is of little floristic importance.

(g) Fishponds

Fishponds were mainly located inside the Wetland Conservation Area at San Tin, Tai Sang Wai and Yuen Long North. About 80% of the fishponds within the study area were still active. Pond bunds consisted of grasses, fruit trees and weeds typically found in this type of habitat in Hong Kong. Dominant species included *Urochloa mutica, Panicum maximum*, and *Mikania micrantha*. Reeds, floating vegetation and other herbs including *Phragmites australis, Cyperus* spp., *Eichhornia crassipes* and *Alocasia macrorrhiza* also colonized abandoned fishponds. 59 species were recorded in this habitat. One locally rare fern (Wu and Lee 2000) [75], *Ceratopteris thalictroides*, and the locally restricted sedge (Xing *et al*. 2000), *Schoenoplectus littoralis* subsp. *subulatus,* were found in an abandoned fishpond near Shing Uk (Figure 13.2). *Ceratopteris thalictroides* has been recorded in paddy fields and ditches along with other weeds (So 1994) [36], while *Schoenoplectus littoralis* subsp. *subulatus* has been recorded in coastal wetlands in Hong Kong (Xing *et al*. 2000) [79]. These two species are located within the 500m boundary but outside the project area.

(h) Stream / Channel

Two main drainage channels, the Kam Tin River Section 60CD and Tin Shui Wai Western Drainage Channel fall within the study area. Except the stream sections near Tai Tong (Stream B) and Shun Shan New Village (Stream C) with semi-natural banks and the one in San Wai (Stream A) still being generally natural, all other stream sections or nullahs are channelled and/or polluted (For locations of streams A, B and C, please refer to Figure 13.2). Plant species was not recorded separately for this habitat due to the lack of riparian vegetation and disturbed nature of the channel bank. Plant species recorded along the stream/channels can be referenced to nearby disturbed/urbanised habitat and cultivated lands, while plant species recorded along the stream/channels near the estuary can be referenced to mangrove habitat.

(i) Mangroves

Narrow belts of mangroves were planted or naturally colonized along sections of the drainage channels and nullahs under tidal influence. A few individual mangrove trees were also found along the coast of Lau Fau Shan within the study area. Common species found include *Acanthus ilicifolius*, *Aegiceras corniculatum* and *Kandelia candel*. The mangroves within the study areas were small in size, young and simple in structure.

(j) Urbanised/Disturbed/Wasteland

This habitat type consists mainly of village houses, roads, parks, construction sites, container yards and wasteland. Over 60% of the vegetation recorded within this habitat type was exotic species weedy in nature or planted for landscaping purposes. Species commonly found include *Leucaena leucocephala, Mikania micrantha, Bidens pilosa, Panicum maximum* and *Celtis tetrandra subsp. sinensis*. This habitat was highly disturbed in nature and was of little ecological interest. Most of the proposed pumping stations and sewers were on this habitat.

Bird

(a) Literature Review

A total of 63 bird species was recorded within or near the Study Area by members of Hong Kong Bird Watching Society between 1993 and 1998 (Appendix 13.2). Twenty-two species were identified as breeding species (e.g., White-breasted Waterhen *Amaurornis phoenicurus*, Chinese Bulbul *Pycnonotus sinensis*). Most are common and widespread in Hong Kong (Carey *et al*. 2001) [42]. Uncommon breeding species included Striated Heron *Butorides striatus*, Yellow Bittern *Ixobrychus sinensis*, Spot-billed Duck *Anas poecilorhyncha* and White-shouldered Starling *Sturnus sinensis* were recorded breeding. Striated Heron and Yellow Bittern bred in mangrove habitats, Spot-billed Duck mainly in *gei wais* of Mai Po Marshes Nature Reserve and White-shouldered Starling in old houses near cultivated lands (*ibid*.) [42].

Bird species of conservation importance included Black Baza *Aviceda leuphotes*, Black-winged Kite *Elanus caeruleus*, Black Kite *Milvus lineatus*, Crested Goshawk *Accipiter trivirgatus*, Japanese Sparrowhawk *A. gularis*, Besra *A. virgatus*, White-bellied Sea Eagle *Haliaeetus leucogaster*, Crested Goshawk *Accipiter trivirgatus*, Crested Serpent Eagle *Spilornis cheela*, Bonelli's Eagle *Hieraaetus fasciatus*, Eurasian Hobby *Falco subbuteo*, Peregrine Falcon *F. peregrinus*, Greater Coucal *Centropus sinensis*, Lesser Coucal *C. bengalensis*, Asian Barred Owlet *Glaucidium cuculoides* and Hwamei *Garrulax canorus* (Zheng and Wang 1998) [78]. White-bellied Sea Eagle is primarily maritime (Carey *et al*. 2001) [42]. Black-winged Kite, Black Kite, Eurasian Hobby, Japanese Sparrowhawk and Peregrine Falcon can be found in many types of habitats

(*ibid*.) [42]. Black Baza, Crested Goshawk, Besra, Crested Serpent Eagle, Bonelli's Eagle and Asian Barred Owlet are inhabitants of forest (*ibid*.) [42]. The two coucal species and Hwamei are mainly found in shrubland (*ibid*.) [42]. All raptor species are Class 2 Protected Animals of China and listed in Appendix II of CITES (Zheng and Wang 1998) [78]. The two coucal species are Class 2 Protected Animals of China and Hwamei is listed in Appendix II of CITES (*ibid*.) [78].

(b) Field surveys

A total of 37 bird species (e.g., Little Egret *Egretta garzetta*) were recorded during quantitative surveys within the Study Area (Appendix 13.3). Eight bird species were recorded at proposed locations of pumping stations (urbanized/disturbed). All are common and widespread in Hong Kong (Carey *et al*. 2001) [42]. A total of 9 bird species (e.g., Black-crowned Night Heron *Nycticorax nycticorax* and Red-billed Starling *Sturnus sericeus*) were recorded between sampling points within the Study Area (Appendix 13.4). Birds habitats within the Study Area (e.g., cultivated lands) are mostly disturbed, fragmented and isolated, and were of small sizes. Urbanized/disturbed sites supported the lowest bird abundance and species richness, and were due to high human disturbance and lack of vegetation cover. Grassland/shrubland in the Study Area supported the second lowest bird abundance, and species richness was equally low as in urbanized/disturbed sites (Table 13.2). Grasslands are known to support low abundance and diversity of wildlife (Thrower 1984 [65], Dudgeon and Corlett 1994 [48], Kwok and Dahmer 2001 [54]). Bird abundance was equally high in cultivated lands/orchard and mixed woodland, and species richness was highest in mixed woodland (Table 13.2). However, all bird species recorded in these two types of habitats are habitat generalists (e.g., Spotted Dove *Streptopelia chinensis*, bulbuls). There are only a few previous studies on bird communities of woodlands and cultivated lands (e.g., Kwok and Corlett 1999, 2000 [52] [47], Kwok and Dahmer 2001 [54], Kwok and Lock 2002 [57]). Compared to the observations of these previous local studies, bird abundance in woodlands and cultivated lands in the Study Area can be considered moderate. Bird species of lesser flexibility in habitat uses (e.g., ardeids) were mainly recorded in fishponds. Density of waterfowls in fishponds in the Study Area is 4.4 birds ha^{-1}, and is slightly low to that in fishponds in nearby areas, Tsim Bei Tsui, in NWNT (6.6 birds ha^{-1}) (May 2001 – January 2002) (Carey 2002) [44]. This was due to the fact than some surveyed fishponds (e.g., San Wai) were isolated. Total bird density (waterfowls and non-waterfowls) in isolated ponds (8.3 birds ha^{-1}) (e.g., San Wai, Fong Kong Wai) are lower than less isolated ponds (13.6 birds ha^{-1}) (e.g., Shing Uk, San Tin).

Table 13.2 : Bird communities of each type of habitat in the Study Area

	Cultivated lands	Fishponds	Mixed Woodland	Grassland/ Shrubland	Mangroves	Urbanized/ Disturbed
Bird density (birds ha^{-1})	18.7	13.4	18.4	3.5	12.4	1.8
Species richness (species $point^{-1}$)	3.1	3.0	3.8	1.0	2.0	1.0

Bird species of conservation importance included Black Kite, Common Kestrel *Falco tinnunculus* and Greater Coucal. All three species are Class 2 Protected Animal of China, and Black Kite and Common Kestrel are listed in Appendix 2 of CITES (Zheng and Wang 1998) [78]. Black Kite was recorded in fishponds, Common Kestrel in cultivated lands and Greater Coucal in mixed woodlands (Figure 13.2).

Nine bird species were recorded nesting within the Study Area. These were Black-crowned Night Heron, Little Egret, Chinese Pond Heron *Ardeola bacchus*, Cattle Egret *Bubulcus ibis*, Great Egret *Casmerodius albus*, Spotted Dove *Streptopelia chinensis*, Great Tit *Parus major*, Black-collared Starling *Sturnus nigricollis* and Common Magpie *Pica pica*. All the ardeid species nested in the three egretries within the Study Area.

Three active egretries – the Mai Po Village Egretry, Mai Po Loong Egretry and Shing Uk Egretry – were located within the Study Area in 2002. The nesting ardeid species in these egretries are common in Hong Kong. However, due to the high hunting pressure of ardeids in Pearl Delta, the ardeid nesting population in the Deep Bay area is of regional importance (Landsdown *et al*. 2000) [59]. The ardeid nesting population in the Deep Bay area is similar to the summation of all known colonies in Pearl Delta in 1995, when the area of wetland habitats in the latter is 20 times bigger (Young and Cha 1995) [76].

Mai Po Village Egretry: Five ardeid species were recorded nesting in the Mai Po Village egretry in 2002 (Table 13.3). These were the Black-crowned Night Heron, Little Egret, Chinese Pond Heron, Cattle Egret and Great Egret. A total of 93 ardeid nests were recorded and Little Egret was numerically the dominant species

(48.4% of total nesting pairs). Ardeid nesting population of Mai Po Village egretry ranged between 12.7% and 14.5% of total ardeid nesting population in Hong Kong between 1999 and 2001 (Wong *et al*. 2000 [71], Kwok and Wong 2001[55], Wong 2002 [73], and was the biggest ardeid nesting colony in Deep Bay Area between 1998 and 2002 (Carey 1998 [39], Wong *et al*. 2000 [71], Kwok and Wong 2001 [55], Wong and Kwok 2002 [72], Wong 2003 [74]).

Table 13.3 : Number of ardeid nests of each ardeid species in the Mai Po Village Egretry during the monitoring study between 1998 and 2002

Species	1998 [1]	1999 [2]	2000 [3]	2001 [4]	2002
Black-crowned Night Heron	45	26	40	25	13
Little Egret	38	39	44	50	45
Chinese Pond Heron	34	12	6	7	20
Cattle Egret	16	22	10	15	12
Great Egret	0	6	8	12	3
Total	133	105	108	109	93

[1] Carey 1998, [2] Wong *et al*. 2000, [3] Kwok and Wong 2001, [4] Wong and Kwok 2002 [39] [71] [72] [55]

Use of feeding habitats of all nesting ardeid species in Mai Po Village egretry have been studied (Wong 1991[70], 2002[73], Pearson 1993 [61], Aspinwall & Company Hong Kong Ltd. 1997 [33], Young 1998 [76], City University of Hong Kong 2001) [46]. During breeding season, Chinese Pond Heron (Pearson 1993 [61], Aspinwall & Company Hong Kong Ltd. 1997 [33], Young 1998 [76], Wong 2002 [73]), Little Egret (Wong 1991 [70], Pearson 1993 [61], Aspinwall & Company Hong Kong Ltd. 1997 [33], City University of Hong Kong 2001 [46], Wong 2002 [73]), Great Egret (Wong 2002 [73]) and Black-crowned Night Heron (City University of Hong Kong 2001 [46]) feed most frequently in fishponds, while Cattle Egret feed most frequently on cultivated lands (Wong 2002 [73]).

Mai Po Loong Egretry: The Mai Po Loong egretry was first reported in 1996, and no survey was done in 1998 and 1999. Ardeid nesting population of this egretry were 2.0% and 4.8% of total ardeid nesting population in Hong Kong in 2000 and 2001 respectively (Kwok and Wong 2001 [55], Wong 2002 [73]). Uses of feeding habitats by ardeids nesting in Mai Po Loong egretry has never been studied, but the nesting ardeids probably feed in nearby fishponds and cultivated lands during breeding season.

Little Egret and Chinese Pond Heron nested in the Mai Po Loong egretry in 2002 (Table 13.4), as in previous years (L. Young, pers. comm. [59], Kwok and Wong 2001 [55], Wong and Kwok 2002 [72]). A total of 39 ardeid nests were recorded in 2002.

Table 13.4 : Number of ardeid nests of each ardeid species in the Mai Po Loong Egretry in 1996 and 1997

Species	1996 [1]	1997 [1]	2000 [2]	2001 [3]	2002
Little Egret	0	0	1	1	5
Chinese Pond Heron	10	20	14	43	34
Total	10	20	15	44	39

[1] L. Young, pers. comm., [2] Kwok and Wong 2001, [3] Wong and Kwok 2002

Shing Uk Egretry: The Shing Uk egretry was first reported in 2001, and made up 6% of total ardeid nesting population in Hong Kong in 2001 (Wong and Kwok 2002) [72]. Uses of feeding habitats by ardeids nesting in Shing Uk egretry was studied in 2001 (Wong 2002) [73]. Little Egret and Chinese Pond Heron feed most frequently on fishponds during breeding season. Cattle Egret feed most frequently in fishponds during low tide, and cultivated lands during high tide in breeding season.

Little Egret, Chinese Pond Heron and Cattle Egret nested in the Shing Uk egretry in 2002 (Table 13.5), as in 2001 (Wong and Kwok 2002) [72]. A total of 21 ardeid nests were recorded in 2002. This egretry was abandoned in 2003.

Table 13.5 : Number of ardeid nests of each ardeid species in Shing Uk Egretry

Species	2001 *	2002
Little Egret	40	16
Chinese Pond Heron	5	3
Cattle Egret	5	2
Total	50	21

* Wong and Kwok 2002 [72]

Other Terrestrial Fauna

(a) Literature Review

A roost of Japanese Pipistrelles *Pipistrellus abramus* has been reported near Shing Uk Village (Ades 1999) [28]. Japanese Pipistrelle is the commonest bat species in Hong Kong (*ibid*.) [28]. All bats are protected under WAPO (Cap. 170) in Hong Kong.

Eight species of amphibian (e.g., Brown Tree Frog *Polypedates megacephalus*) were recorded within the Study Area between November 1991 and December 1996 by Lau and Dudgeon (1999) [60] (Appendix 13.5). All are common or widely distributed in Hong Kong.

Sixteen species of dragonfly (e.g., *Ictinogomphus pertinax*) were recorded in lowland streams at Tai Tong near the Study Area by Wilson (1997) [86] (Appendix 13.6). This is the only locality for *Paragomphus capricornis*, and one of the two sites for *Lamelligomphus hongkongensis* in Hong Kong. Tai Tong also supported a number of stream specialists, such as *Macromia urania*, *Megalogomphus sommeri* and *Burmagomphus vermicularis*. Half of this site is located within Tai Lam Country Park (*ibid*.) [87].

(b) Field surveys

Japanese Pipistrelles were observed in fishponds and cultivated lands within Study Area. Japanese Pipistrelle is common and widespread in Hong Kong (Ades 1999) [28]. Javan Mongoose *Herpestes javanicus* was sighted at fishponds near San Tin. This species was first recorded in Hong Kong in 1990, and its recorded range has expanded rapidly since that time. Javan Mongoose, however, is recently considered as an introduced species (Corlett 2001) [47]. Both Japanese Pipistrelle and Javan Mongoose are protected under WAPO (Cap. 170) in Hong Kong. Burrows of rodents (*Rattus spp*.) were observed on grassy hillsides within the Study Area. *Rattus spp*. are commonly found near residential areas and the species known to occur in Hong Kong are of low conservation value.

Five species of amphibian were recorded in the Study Area. These were the Asian Common Toad Bufo melanostictus, Gunther's Frog *Rana guentheri*, Paddy Frog *R. limnocharis*, Brown Tree Frog *Polypedates megacephalus* and Asiatic Painted Frog *Kaloula pulchra*. All are common and widespread in Hong Kong (Karsen *et al*. 1998) [51]. Tadpoles of Asian Common Toads and Gunther's Frogs were found in water storage tanks in cultivated lands within the Study Area.

Six species of reptile were recorded in the Study Area. These were the Red-eared Slider *Trachemys scripta*, Chinese Gecko *Gekko chinensis*, Bowring' Gecko *Hemidactylus bowringii*, Changeable Lizard Calotes versicolor, Chinese Skink *Eumeces chinensis* and Long-tailed Skink *Mabuya longicaudata*. All are common and widespread in Hong Kong (Karsen *et al*. 1998) [51]. Chinese Gecko, Bowring' Gecko, Changeable Lizard, Chinese Skink and Long-tailed Skink were all recorded in cultivated lands in the Study Area. Red-eared Slider was recorded in fishponds in the Study Area, and is an exotic species.

Eight species of dragonflies were recorded within the Study Area during quantitative surveys (e.g., Wandering Glider *Pantala flavescens*) (Appendix 13.7). All are common and widespread in Hong Kong (Wilson 1995, 1997) [67 & 86]. No additional dragonfly species was recorded between sampling points within the Study Area. Both abundance and species richness of dragonfly were highest in cultivated lands, and lowest in urbanized/disturbed sites within the Study Area (Table 13.6).

Table 13.6 : Dragonfly communities of each type of habitat in the Study Area

	Cultivated lands (active and abandoned)	Fishponds (active and abandoned)	Woodland	Grassland	Urbanized/ disturbed
Density (individuals ha^{-1})	54.6	42.4	19.1	10.6	2.0
Species richness (species $point^{-1}$)	1.5	1.0	0.6	0.3	0.1

A total of twelve species of butterfly were recorded within the Study Area during quantitative surveys (e.g., Great Eggfly *Hypolimnas bolina*) (Appendix 13.8). All are common or very common in Hong Kong (Walthew

1997) [68]. Abundance of butterfly was highest in cultivated lands, while species richness of butterfly was highest in woodland (Table 13.7). Both abundance and species richness of butterfly were lowest in urbanized/disturbed sites. An additional 9 species of butterfly (e.g., Great Orange Tip *Hebomoia glaucippe*) was recorded between sampling points within the Study Area (Appendix 13.9). All are common or very common in Hong Kong (Walthew 1997) [68].

Table 13.7 : Butterfly communities of each type of habitat in the Study Area

	Cultivated lands (active and abandoned)	Fishponds (active and abandoned)	Woodland	Grassland	Urbanized/ disturbed
Density (individuals ha^{-1})	63.7	31.8	31.8	21.2	4.0
Species richness (species $point^{-1}$)	2.0	1.4	2.2	1.0	0.1

Aquatic Fauna

(a) Literature Review

Literature review revealed little information on aquatic fauna within the assessment area. It is noted that the areas of Yuen Long, San Wai, Tin Shui Wai, Shan Pui and San Tin were not included in the Hong Kong-wide stream fish survey conducted by Chong & Dudgeon (1992)[45].

At least 8 species of freshwater fishes (Chinese barb *Puntius semifasciolatus*; Oriental weatherfish *Misgurnus anguillicaudatus*; Vietnam catfish *Silurus cochinchinensis*; Mosquito fish *Gambusia affinis*; Tilapia *Oreochromis mossambicus*; Sharphead sleeper *Eleotris oxycephalus*; Barcheek goby *Rhinogobius giurinus*; Chameleon goby *Tridentiger trigonocephalus*) were reported to occur in the western New Territories (Lam 2002)[58]. However, only the two exotic species, Chinese Barb and Oriental Weatherfish had records of occurrence inside or close to the assessment area of the present project. Both Chinese Barb and Oriental Weatherfish are common and widespread in Hong Kong.

Kam Tin River is well known to be severely impacted by sewage. Previous studies reported that Kam Tin River was heavily polluted with domestic and industrial sewage, and the pollution together with its anoxic condition together were responsible for a low species richness and diversity. (Binnie 1992; 1996)[37][38].

The section of Kam Tin River within the 43CD Works area was found to have a "very poor macrobenthic community" with only 2 to 4 species, dominated by oligochaetes (Binnie 1992)[37]. Catfish were sighted in the lower section under tidal influence. Mosquito fish *Gambusia affinis* and the Apple snail *Pomacea lineata* have been recorded in the Kam Tin area, and 4 individuals of terrapins of unidentified species, which were probably exotic and imported for food, were observed in the Kam Tin River (Kam Tin Bypass, Binnie 1996)[38].

Aquatic fauna surveys were undertaken at the Kam Tin River Section 60CD drainage channel during the EIA study for Stage 1 of this project in 2000 and 2001. Three-layer gill net was used to sample aquatic organisms. The dominant aquatic organism found in 60CD drainage channel during both the wet season and dry season surveys was the widespread Tilapia *Oreochromis* spp.. Other aquatic fauna found, in very low numbers, included Mud Crab *Scylla serrata* and Mullet *Mugil affinis*, and Mud Carp *Cirrhinus molitorella*.

(b) Field Surveys

Except the stream section near San Wai STW (Stream A), Tai Tong (Stream B) and Sung Shan New Village (Stream C) with semi-natural banks (Figure 13.2), all other stream sections or nullahs are channelled and/or polluted.

Despite the extensive size of the assessment area, aquatic fauna were found to have a limited distribution and were only recorded in a few isolated locations during the present study, primarily at the natural section at San Wai and semi-natural sections at Tai Tong and Sung Shan New Villages. There was no major difference in the aquatic fauna communities observed between the wet and dry seasons in the present survey.

The habitat survey and stream fauna survey of the present study confirmed that the majority of streams within the study area were channelled and polluted, especially where the streams passed through villages and lands used for agricultural purposes.

In these locations the stream water was odorous and with bubbles which indicate bacterial activities and low dissolved oxygen levels. The remaining streams were also poor in water quality. Other pollution influences observed included domestic wastewater from residential areas.

Freshwater snails, Apple snail *Pomacea lineata*, were recorded. In the natural section of stream and also the surrounding cultivated land at San Wai, the apple snail *Pomacea lineata* was found. This snail originates from South America. It was first introduced into China as a pond culture species, but like Tilapia, has become a naturalised fauna. In Hong Kong, there is no rearing of this snail and they are not taken as food. *Pomacea lineata* is considered an agricultural pest known to damage vegetables. A previous study reported its occurrence in the Kam Tin area agricultural fields in high abundance (Binnie 1996)[38].

Another freshwater snail *Melanoides tuberculatus* was also found in the Stream A. It is also common in streams in Hong Kong and also could be found in ponds in Northwest New Territories.

A species of atyid shrimp *Caridina cantonensis* was found in this stream and was in moderate abundance. The atyid shrimp *Caridina cantonensis* is the most widespread member among the three congeneric species in Hong Kong (Cai and Ng 1999). *C. cantonensis* is usually found in the mid- to upper reaches of natural streams. This aquatic species is a typical component of the stream fauna in fair to good quality waters in Hong Kong. The species is of no conservation concern.

Tilapia was also recorded in the two semi-natural streams (Stream B and Stream C). Tilapia (*Oreochromis* sp.) was first introduced to China in the early 1970s for pond culture. In Hong Kong, wild Tilapia is believed to be of pond stock origin. Their high adaptability make them successful in wild conditions and they are able to colonise habitats that most native fish species cannot survive in, such as polluted stream courses with low oxygen levels. Although they mainly feed on plant material, Tilapia can consume virtually every kind of organic material including zooplankton, phytoplankton, aquatic invertebrates, detritus and sediments. They are also capable of naturally breeding in many types of water bodies including small, static ponds. In many cases, including the present study, Tilapia dominates the aquatic habitats and is the only fish species found.

Two main drainage channels, the Kam Tin River Section 60CD and Tin Shui Wai Western Drainage Channel fell within the study area. The dominant aquatic organism found in the two drainage channels during both the wet season and dry season surveys was the widespread Tilapia *Oreochromis* spp. Abundant individuals were found in the shallow water inside the channels during the low tide. The characteristic circle-shaped nests were also spotted in a large number on the bottom of the channels.

Table 13.8 : Results of the stream survey for the present study during June 2002 to January 2003

Location	Common name	Species name	Abundance*
San Wai	Apple snail	*Pomacea lineata*	++
	Freshwater snail	*Melanoides tuberculata*	+
	Atyid shrimp	*Caridina cantonensis*	++
Tai Tong	Tilapia	*Oreochromis* sp.	++
Shun Shan New Village	Tilapia	*Oreochromis* sp.	++
Tin Shui Wai Western Drainage Channel	Tilapia	*Oreochromis* sp.	+++
60CD (Shan Pui River and Kam Tin River)	Tilapia	*Oreochromis* sp.	+++

***Abundance: +++: Abundant, ++: Common, +: Occasional**

None of the recorded species was rare or of conservation value. The majority of the streams within the Study Area are therefore of low ecological value to aquatic fauna.

In addition to the seriously polluted conditions, a main feature of the stream courses inside the Study Area observed during the survey was their high ratio of replacement by artificial channels. Stream courses surveyed

within the Study Area were, or are currently, largely being modified or re-routed by various channelisation projects.

13.4 Evaluation of Species and Habitat of Conservation Importance

Habitats found within the study area were evaluated in terms of ecological importance using the criteria set forth in Annex 8, Table 2 of the TM-EIAO. Details are listed in Tables 13.9 to 13.19.

Table 13.9 : Evaluation of ecological importance of plantation

Criteria	Remarks
Naturalness	Man-made, planted. Some natural colonization.
Size	20.8 ha in total within the study area
Diversity	Moderate diversity of plant (62 species), low structural complexity and low fauna diversity.
Rarity	None recorded
Re-creatability	Easy to recreate
Fragmentation	Moderately fragmented.
Ecological linkage	Not functionally linked to any highly valued habitat in close proximity in a significant way.
Potential value	Moderate, becoming mature woodland given time and appropriate management (e.g. thinning, fire prevention).
Nursery/breeding ground	No significant nursery or breeding ground recorded during the survey.
Age	Young (mostly less than 30 years) based on tree size, structure and species composition.
Abundance/Richness of wildlife	The abundance of avifauna was moderate and other terrestrial fauna was low.
Overall Ecological value	Low.

Table 13.10 : Evaluation of ecological importance of mixed woodland

Criteria	Remarks
Naturalness	Secondary, semi-natural, formed of a mixture of planted and native species. Moderately disturbed by presence of the grave sites.
Size	93.4ha in total within the study area
Diversity	Moderate diversity of plant (78 species), moderate structural complexity and low fauna diversity.
Rarity	Protected species recorded during the survey was Greater Coucal *Centropus sinensis*.
Re-creatability	Habitat characteristics and species composition are difficult to recreate. It will take 10-40 years for the secondary woodlands to be re-created.
Fragmentation	Moderately fragmented. Isolated patches scattered within the study area.
Ecological linkage	Not functionally linked to any highly valued habitat in close proximity in a significant way.
Potential value	Moderate, becoming mature woodland given time and protection from disturbance.
Nursery/breeding ground	No significant nursery or breeding ground recorded during the survey, but could provide breeding habitats for birds and butterflies.
Age	Young (mostly less than 30 years) based on tree size, woodland structure and species composition.
Abundance/Richness of wildlife	The abundance of avifauna was moderate and other terrestrial fauna was low.
Overall Ecological value	Moderate.

Table 13.11 : Evaluation of ecological importance of grassland/shrubland

Criteria	Remarks
Naturalness	Semi-natural, subject to high level of human disturbance
Size	Moderate, with total approximately 309.1ha.
Diversity	Moderate diversity in flora (79 species) and fauna.
Rarity	Neither rare nor protected species were recorded during the survey.
Re-creatability	Could be re-created.
Fragmentation	Continuous patch within study area.
Ecological linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential value	Limited due to presence of graves and consequent frequent fire disturbance.
Nursery/breeding ground	No significant nursery or breeding ground recorded.
Age	Young, early stage of succession or in an arrested climax imposed and maintained by hillfires.
Abundance/Richness of wildlife	The abundance of avifauna and other terrestrial fauna was low.
Overall Ecological value	Low.

Table 13.12 : Evaluation of ecological importance of cultivated land/orchard

Criteria	Remarks
Naturalness	Man-made habitat.
Size	Total approximately 338.5 ha.
Diversity	Moderate for vegetation (totally 98 species for the whole area, mostly crops or exotic species) and fauna
Rarity	Protected species recorded during the survey was Kestrel *Falco tinnunculus*.
Re-creatability	Readily creatable.
Fragmentation	Most formed a relatively continuous cover, although some scattered within the developed area and were therefore fragmented.
Ecological linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential value	Low.
Nursery/breeding ground	No significant nursery or breeding ground recorded. May provide breeding habitats of dragonflies and amphibians.
Age	Young
Abundance/Richness of wildlife	The abundance of avifauna was moderate and other terrestrial fauna was low.
Overall Ecological value	Low.

Table 13.13 : Evaluation of ecological importance of fishpond

Criteria	Remarks
Naturalness	Man-made habitat.
Size	Moderate 292.8ha in total
Diversity	Low to moderate, 52 plant species recorded.
Rarity	One rare plant species Water Fern Ceratopteris thalictroides found in an abandoned pond. Black-eared Kite *Milvus lineatus* is Class 2 Protected Animal of PRC and listed in Appendix 2 of CITES.
Re-creatability	Readily re-creatable.
Fragmentation	Contiguous in Wetland Conservation Area, isolated ponds in urbanized/disturbed area.
Ecological linkage	In Wetland Conservation Area, form part of the remaining contiguous piece of wetland in NWNT.
Potential value	Feeding habitats of nesting ardeids of egretries within the Study Area
Nursery/breeding ground	No nursery or breeding ground recorded. Limited as breeding habitats of amphibian and dragonfly since fishes are present.
Age	Not applicable.
Abundance/Richness of wildlife	The abundance of avifauna was moderate and other terrestrial fauna was low.
Overall Ecological value	High in Wetland Conservation Area, Low in other area.

Table 13.14 : Evaluation of ecological importance of stream/channel

Criteria	Remarks
Naturalness	Semi-natural (stream) to man-made (channel).
Size	The total length of all channels and stream courses are about 13.8km.
Diversity	For aquatic fauna, moderate in only one section of natural stream, low in two semi-natural sections and very low in channels. Low to moderate for dragonflies.
Rarity	None recorded
Re-creatability	Drainage channel – readily re-creatable. Semi-natural stream course – re-creatable Natural stream course - difficult to re-create.
Fragmentation	Not applicable.
Ecological linkage	Flows eventually converged into Inner Deep Bay. Not functionally linked to any highly valued habitat in close proximity.
Potential value	Low ecological potential as the ongoing Main Drainage Channel projects have been transforming the remaining natural stream courses into concrete channels.
Nursery/breeding ground	No significant nursery or breeding ground recorded, but semi-natural streams could provide breeding habitats for dragonflies and amphibians.
Age	Young for channel, not applicable for stream
Abundance/Richness of wildlife	Low in natural and semi-natural sections, high in drainage channels (60CD, Tin Shui Wai Western Drainage Channel).
Overall Ecological value	Moderate for natural section of stream, low for semi-natural section and low for drainage channels.

Table 13.15 : Evaluation of ecological importance of mangroves

Criteria	Remarks
Naturalness	Semi-natural (planted/naturally colonized)
Size	9.4 ha in total
Diversity	Low for plants
Rarity	None recorded during the survey for this study
Re-creatability	Readily creatable through planting.
Fragmentation	Quite fragmented within study area.
Ecological linkage	Linked to Mai Po and Inner Deep Bay Ramsar Site.
Potential value	Limited as extent constrained by drainage channels.
Nursery/breeding ground	No significant nursery or breeding ground recorded
Age	Young
Abundance/Richness of wildlife	Low during the survey for this study
Overall Ecological value	Low (Lau Fau Shan) to moderate (along 60CD).

Table 13.16 : Evaluation of ecological importance of urbanised/disturbed/wasteland

Criteria	Remarks
Naturalness	Man-made habitat.
Size	Large in size, with total approximately 1061.4 ha.
Diversity	Low in terms of flora (74 species recorded, mostly exotics), low in terrestrial fauna.
Rarity	None recorded
Re-creatability	Readily re-creatable.
Fragmentation	Formed a continuous cover within the study area.
Ecological linkage	Not functionally linked to any highly valued habitat in close proximity.
Potential value	Low.
Nursery/breeding ground	No significant nursery or breeding ground recorded.
Age	Not applicable.
Abundance/Richness of wildlife	Low in terms of terrestrial fauna and avifauna.
Overall Ecological value	Low.

Table 13.17 : Evaluation of ecological importance of Mai Po Village Egretry

Criteria	Remarks
Naturalness	Egretry in several stands of roadside *Melaleuca* plantations
Size	Large, supporting 93 pairs of ardeids in 2002
Diversity	High; five species: Chinese Pond Heron, Little Egret, Cattle Egret, Night Heron, Great Egret
Rarity	Uncommon nesting species Great Egret, which only nest in 6 out of the 19 egretires in HK in 2002.
Re-creatability	Bamboo and trees can be transplanted, but egretry may not be easy to create
Fragmentation	No applicable
Ecological linkage	Near fishpond and inter-tidal mudflat feeding areas
Potential value	High
Nursery/breeding ground	Ardeid nesting site
Age	Unknown
Abundance/Richness of wildlife	High number of nesting pairs and species richness by local standard
Overall Ecological value	Moderate. Supports 9% of all nesting pairs in HKSAR in 2002, and largest in Deep Bay area between 1998 and 2002

Table 13.18 : Evaluation of ecological importance of Mai Po Loong Egretry

Criteria	Remarks
Naturalness	Egretry in several stands of *Casuarina* plantation behind a vehicle maintenance workshop.
Size	Moderate, supporting 39 pairs of ardeids in 2002
Diversity	Low; two species: Chinese Pond Heron and Little Egret
Rarity	Both are the commonest ardeid nesting species in Hong Kong
Re-creatability	Bamboo and trees can be transplanted, but egretry may not be easy to create
Fragmentation	No applicable
Ecological linkage	Near fishpond feeding areas
Potential value	Moderate
Nursery/breeding ground	Ardeid nesting site
Age	Unknown
Abundance/Richness of wildlife	Small number of nesting pairs and species richness by local standard
Overall Ecological value	Moderate. Supports 4.8% of all nesting pairs in HKSAR in 2002

Table 13.19 : Evaluation of ecological importance of Shing Uk Egretry

Criteria	Remarks
Naturalness	Egretry in orchard
Size	Small to moderate, supporting 21 pairs of ardeids in 2002

Criteria	Remarks
Diversity	Moderate; three species: Chinese Pond Heron, Little Egret and Cattle Egret
Rarity	Common ardeid nesting species in Hong Kong
Re-creatability	Bamboo and trees can be transplanted, but egretry may not be easy to create
Fragmentation	No applicable
Ecological linkage	Near fishpond feeding areas
Potential value	Small
Nursery/breeding ground	Ardeid nesting site
Age	Unknown
Abundance/Richness of wildlife	Small number of nesting pairs and species richness by local standard
Overall Ecological value	Moderate. Supports 2.8% of all nesting pairs in HKSAR in 2002, but abandoned in 2003

The list and evaluation of the floral and faunal species of ecological interest recorded within the study area, according to the TM-EIAO, are given in Tables 13.20 and 13.21:

Table 13.20 : Evaluation of floral species with ecological interest within the study area

Species	Growth Form	Location	Protection status	Distribution	Rarity
Ceratopteris thalictroides	fern	In an abandoned pond near Shing Uk	Not protected by local or regional regulations	Sam A Tsuen, Lai Chi Chong, Kam Tin, Po Toi Island and Ping Chau (Mirs Bay)	Rare (Wu and Lee 2000) [75]
Schoenoplectus littoralis subsp. subulatus	sedge	In an abandoned pond near Shing Uk	Not protected by local or regional regulations	Coastal wetland	Restricted (Xing et al. 2000) [79]

Table 13.21 : Evaluation of faunal species of ecological interest recorded within the study area

Species	Protection status	Distribution	Rarity	Relevant to project
Black Kite	Wild Animals Protection Ordinance (Cap 170) Class II Protected Animal in PRC CITES Appendix II	Distribute widely in Hong Kong, can be in many types of habitats.	Common in Hong Kong	No
Common Kestrel	Wild Animals Protection Ordinance (Cap 170) Class II Protected Animal in PRC CITES Appendix II	Distribute widely in Hong Kong, mainly found in open areas	Common/uncommon in Hong Kong	No
Greater Coucal	Wild Animals Protection Ordinance (Cap 170) Class II Protected Animal in PRC CITES Appendix II	Found in shrubland habitats	Common in Hong Kong	No
Nesting ardeids	Wild Animals Protection Ordinance (Cap 170)	Distribute widely in Hong Kong, all nest in lowlands, and sometimes near areas of high disturbance	Mostly common breeders in Hong Kong,	Yes

Habitats of Black Kite, Common Kestrel and Greater Coucal are not going to be affected by this project as the construction works are mainly confined to developed/disturbed areas (see Table 13.22). Ardeids are nest-bound during breeding season. The sewerage works at the Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T) will bypass the Mai Po Village and Mai Po Loong egretries. Nesting ardeids are therefore the potential sensitive receiver of this project.

13.5 Impact Identification and Evaluation for Construction Phase

The significance of ecological impacts is evaluated based primarily on the criteria set forth in Table 1, Annex 8 of the TM-EIAO:

- habitat quality;
- species affected;
- size/abundance of habitats/organisms affected;
- duration of impacts;
- reversibility of impacts; and
- magnitude of environmental changes.

Impacts are generally ranked as "minor", "moderate" or "severe", although in a few cases a ranking of "minimal" (less than "minor") may be given. The ranking of a given impact will vary based on the criteria listed above. For example, an impact might be ranked as "minor" if it affected only common species and habitats, or if it affected only small numbers of individuals or small areas, whereas it might be ranked as "severe" if it affected rare species or habitats, large numbers of individuals or large areas. The major factors giving rise to a ranking are explained in the text. As noted in Annex 16 of the TM-EIAO, a degree of professional judgment is involved in the evaluation of impacts.

The proposed sewage disposal works would include construction of pumping stations, laying of underground rising mains and gravity sewers with various excavation widths at various depths (see Chapter 4 for details). Only 3 items are Designated Elements under this project: pumping stations in Ngau Tam Mei and north of Yuen Long and a section of rising main in the northwestern side of Yuen Long (See Chapter 2). Potential ecological impacts identified during construction phase include habitat loss due to site formation, noise and disturbance, construction dust and surface runoff. Five proposed pumping stations and part of the proposed sewage alignment fall within the Wetland Conservation Area (WCA) or the Wetland Buffer Area (WBA) (Figure 13.1). Loss of habitats to pumping stations would be permanent. However, most of the pumping stations would be constructed in urbanized/disturbed habitats. Loss of habitats to sewers and areas with the site limits would be temporary as most of the sewers will be buried underneath the existing road or along drainage channels which will be reinstated after construction. The potential impacts of each works package and designated/non-designated element will be evaluated separately for easy reference.

13.5.1 ***Tin Shui Wai and San Wai Areas (Alternative 2A-1T)***

The proposed sewage disposal works at Tin Shui Wai and San Wai would cause a permanent loss of 0.23 ha of urbanised/disturbed/wasteland, 0.23ha of plantation and 0.05 ha of fishpond (underneath planned road of HSKNTD) and a temporary loss of 13.27 ha of urbanised/disturbed/wasteland, 0.46 ha of mixed woodland, 0.24 ha of grassland/shrubland, and 0.20 ha of fishpond (mainly underneath earth bund).

The ecological impacts are considered minor due to limited area of habitats to be affected, temporary nature of the impacts and the low ecological values of the habitats to be lost. The abandoned fishpond where the rare fern *Ceratopteris thalictroides* and the restricted sedge *Schoenoplectus littoralis* subsp. *subulatus* were located was more than 500m away from the sewers and would not be affected by the project. Use of pipe-jacking will avoid loss and disturbance of stream channel/nullah at the Tin Shui Wai channel crossing.

The proposed Yuen Long Effluent pumping station (YLEPS) is located within WCA. It will encroach 0.23 ha of disturbed habitats as well as 0.23 ha of 60CD plantation area. These plantation trees are young, composed of common species and of simple structure. The potential ecological impact due to loss of these plantation trees is therefore minor, but will be mitigated by compensatory planting to ensure no unacceptable loss of ecological function of the original MDC mitigation planting area (see Section 13.6.1 for details).

Four fishpond bunds will be disturbed by this works package (Figures 13.2 and 13.5a). Three are within the WCA near the proposed Yuen Long Effluent pumping station (YLEPS), while the fourth one is located at the San Wai area. As investigated by DSD (Section 5), the current alignment is the only feasible option in consideration of various engineering constraints. Both the YLEPS and YLSTW are all surrounded by fish ponds/river on three sides, while laying of sewer underneath the earth bund of fish pond (about 430m in length) is unavoidable (fish ponds are located within the WSD Reserve and no work will be carried out within the WSD boundary area). Regarding the fishpond at San Wai area, the sewer will be laid underneath future major road (about 30m in length) at HSKNTD. As agreed with DSD, PlanD and TDD, this alignment will have minimal implication on future planning and development zoning. Since only sewer laying will be carried out around the affected fish ponds, the construction period will be short term in nature and confined to 1 to 2 months.

The affected fishpond at San Wai area lies outside the Wetland Buffer Area. It is small (about 0.27ha), isolated and surrounded by newly fill area and therefore is of limited ecological value. Only the northern section of the pond (0.05ha) will be encroached by the sewers and will be permanently resumed for the project. According to the 1999 HSKNTD Digest, this section of the alignment will be underneath a vehicular road. Therefore the resumed section of the pond will be earth-filled after construction. Due to the temporary nature of impact (for

sewer laying) and small portions (earth bunds only) of the 3 ponds to be impacted, and the small size, isolated nature of the one pond and the limited area to be permanently lost (for road construction by the HSKNTD-sewer will be laid underneath the planned road), the ecological impact of pond loss is considered minor. There will be no-net-loss in wetland area at the WCA and CA.

The mixed woodland is young and moderate in species richness. Only common plant species were recorded. Loss of the woodland habitat would be temporary, as the works area will be reinstated after construction. Potential ecological impacts to the mixed woodland are therefore considered minor. Revegetation with native woodland species is proposed to mitigate the loss.

The shrubland/grassland is young and moderate in species richness. Only common plant species were recorded. Loss of 0.24 ha of the shrubland/grassland habitat would be temporary, as the works area will be reinstated after construction. Potential ecological impacts to the shrubland/grassland are therefore considered minor.

This element of the project would involve only one crossing at stream/channel habitat, i.e. Tin Shui Wai Western Drainage Channel, where pipe will be installed. Trenchless method (pipe-jacking) will be used for the pipe laying underneath the channel. No dredging work will be required. The indirect impacts to stream fauna including sedimentation or disturbance are considered to be minimal.

Table 13.22 : Habitat loss caused by Alternative 2A-1T

Item	Works Item No.	DE	NDE	Within WCA	Habitat Loss (ha)				
					Urbanised/ Disturbed Wasteland	Mixed Woodland	Grassland/ Shrubland	Fish Pond	Plantation
Pumping Station	AP1	Yes	-	Yes	0.23	-	-	-	0.23
Sewers	AS1	Yes	-	430m of AS1 within WCA	0.24	-	-	0.20	-
Sewers	AS2-AS5		Yes	-	13.03	0.46	0.24	0.05	-

DE = Designated Element, NDE= Non-Designated Elements

Bird species and terrestrial fauna recorded in mixed woodlands within the Study Area are mainly habitat generalists and disturbance tolerant. The potential impact to terrestrial fauna due to temporary loss of 0.46 ha of mixed woodland is ranked as minor.

The Shing Uk egretry is about 100m from the proposed alignment, and will not be affected by noise and visual disturbance arising from the project. No feeding habitats of nesting ardeids of Shing Uk egretry will be affected. This egretry was abandoned in 2003.

Noise and visual disturbance may be generated during site formation and construction, potentially affecting the distribution and behavior of fauna in adjacent habitats. In particular, the proposed location of the Yuen Long effluent pumping station, although only encroaches disturbed habitat and plantation, is within WCA and close to the mangrove plantation and inter-tidal mudflat of Channel 60 CD Contract A, which is an important feeding habitat of many species of waterbirds in winter. Although no species of conservation interest was recorded during the current study, construction works may potentially cause disturbance to the wintering waterbirds. Mitigation is therefore required to minimise the impacts to the wintering birds within the WCA. For the other sewer alignment, due to the highly urbanized nature of the surrounding areas along the alignment, limited conservation potential and disturbance tolerance of the species recorded, and the temporary nature of the impact, potential impacts to fauna from this source are ranked as minor.

13.5.2 Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

The proposed sewage disposal works at Ngau Tam Mei and San Tin areas would cause a permanent loss of 0.57 ha of urbanised/disturbed/wasteland and a temporary loss of 5.05 ha of urbanised/disturbed/wasteland. The ecological impacts are considered minor due to limited area of habitats to be affected and the low ecological values of the habitats to be lost.

Table 13.23 : Habitat loss caused by 2A-2T and 2B-1T

Item	Works Item No.	DE	NDE	Within WCA	Within WBA	Habitat Loss (ha)
						Urbanised/ Disturbed/ Wasteland
Pumping Station	P1	Yes	-	No	Yes	0.16
Pumping Station	P2-P5	-	Yes	No	Yes (P3 and P4 only)	0.41
Sewers	S1-S7	-	Yes	Yes (564m of S1)	Yes (928m of S2, whole S4, S5, and S6)	5.05

DE = Designated Element, NDE= Non-Designated Elements

Noise and visual disturbance may be generated during site formation and construction, potentially affecting the distribution and behavior of fauna in adjacent habitats. In particular, a section of S1 to be constructed along the access road of 100CD is within WCA and close to the mangrove plantation and inter-tidal mudflat of Channel 60 CD Contract A, which is an important feeding habitat of many species of waterbirds in winter. Although no species of conservation interest was recorded during the current study, construction works may potentially cause disturbance to the wintering waterbirds. Mitigation is therefore required to minimise the impacts to the wintering birds within the WCA. For other sewer sections, due to the highly urbanized nature of the surrounding areas along the alignment, limited conservation potential and disturbance tolerance of the species recorded, and the temporary nature of the impact, potential impacts to fauna from this source are ranked as minor.

The construction works of this project would not cause direct loss of feeding habitats of ardeids. Indirect impact due to the project will include visual disturbance, dust and noise generated from construction work of the sewerage alignment near the Mai Po Village Egretry and Mai Po Loong Egretry. These two egretries are located near Castle Peak Road section of the proposed sewers. The Mai Po Loong Egretry is also located near a vehicle maintenance workshop. Nesting ardeids in these two egretries are used to traffic noise, and ardeids can tolerate human disturbance to certain degree (Landsdown et al. 2000) [59]. In fact, a number of local big ardeid nesting colonies are found within or near sources of disturbance, e.g., Ho Sheung Heung egretry (in storage backyard of village houses), former Tai Po Market egretry (adjacent to Tai Po KCRC Railway Station). However, recent observations showed that there is a decline in breeding populations, which may be related to high levels of cumulative disturbance caused by various construction works during breeding season (Wong, L.C. per comm.). To take a precautionary approach, it is therefore recommended that construction work near these two egretries to be carried out from September to March outside breeding season to minimise the impacts.

No stream crossing would be involved in the sewage alignment of this element. The sewage alignment will mostly follow existing roads or drainage channels (100CD which is under construction). The only concern would be site runoff at the works site close to 100CD and 60CD. Potential impacts on aquatic fauna are ranked as minimal.

13.5.3 Lau Fau Shan and Mong Tseng Areas (2A-3T)

The proposed sewage disposal works at Lau Fau Shan and Mong Tseng areas would cause a permanent loss of 0.17 ha of urbanised/disturbed/wasteland and a temporary loss of 4.06 ha of urbanised/disturbed/wasteland, 0.02 ha of plantation, and 0.04 ha of shrubland/grassland. Where the alignment and/or the site limit encroach the bank of Tin Shui Wai Channel, pipe-jacking construction method would be used and therefore no loss of stream channel or mangrove established on embankment is anticipated. The ecological impacts are considered minor due to limited area of habitats to be affected and the low ecological values of the habitats to be lost.

Table 13.24 : Habitat loss caused by 2A-3T

Item	Works Item	DE	NDE	Within WBA	Habitat Loss (ha)		
					Urbanised/Disturbed/ Wasteland	Plantation	Shrubland/ Grassland
Pumping Station	A1-A2	-	Yes	Yes (A2)	0.17	-	-
Sewers	G1-G2	-	Yes	736m of G2 within WBA	4.06	0.02	0.04

DE = Designated Element, NDE= Non-Designated Elements

Noise and visual disturbance may be generated during site formation and construction, potentially affecting the distribution and behavior of fauna in adjacent habitats. Due to the highly urbanized nature of the surrounding areas along the alignment, limited conservation potential and disturbance tolerance of the species recorded, and the temporary nature of the impact, potential impacts to fauna from this source are ranked as minor.

The proposed alignment would be in the vicinity of some isolated fishponds. The potential impact to bird is considered minor due to the temporary nature of the impact and low bird abundance in isolated fishponds.

No stream crossing would be involved in the sewage alignment of this element. The sewage alignment will mostly follow existing roads or drainage channels. No impacts on aquatic fauna from this element would be expected.

There was also a small area of marine and coastal habitat located at the northeast end of this part of the assessment area. Given the distance between this habitat and the alignment (at least 300m), no direct or indirect (e.g. site runoff) impacts from the project would be expected.

13.5.4 ***Shap Pat Heung Area (2B-2T)***

The proposed sewage disposal works Shap Pat Heung areas would cause a permanent loss of 0.37 ha of urbanised/disturbed/wasteland and 0.12ha of cultivated land and a temporary loss of 3.35 ha of urbanised/disturbed/wasteland, and 0.14 ha of cultivated land. Use of pipe-jacking construction method will avoid loss and disturbance at the stream crossing. The ecological impacts are considered minor due to limited area of habitats to be affected and the low ecological values of the habitats to be lost.

Table 13.25 : Habitat loss caused by 2B-2T

Item	Works Item	DE	NDE	Habitat Loss (ha)	
				Urbanised/Disturbed/Wasteland	Cultivated Land
Pumping Station	B1-B7	-	Yes	0.37	0.12
Sewers	H1-H11	-	Yes	3.35	0.14

DE = Designated Element, NDE= Non-Designated Elements

Noise and visual disturbance may be generated during site formation and construction, potentially affecting the distribution and behavior of fauna in adjacent habitats. Disturbance sensitive species will leave the site during site formation. Due to the highly urbanized nature of the surrounding areas along the alignment, limited conservation potential and disturbance tolerance of the species recorded, and the temporary nature of the impact, potential impacts to fauna from this source are ranked as minor.

This element of the project would involve only one crossing at stream/channel habitat near Shung Ching San Tsuen where pipe will be installed. Trenchless method (pipe-jacking) will be used for the pipe laying underneath the channel. No dredging work will be required. The indirect impacts to stream fauna including sedimentation or disturbance are considered to be minimal. The two semi-natural stream sections were located at the southern end (Stream B, Tai Tong) and southeast end (Stream C, Shun Shan New Village) of the boundary of this part of assessment area. Both of them are upstream to the alignment of the sewer. The dragonfly hotspot at Tai Tong is located upstream of the construction area and will not be encroached by this element of the project. In addition, this element only affects the channelised portion of the stream channel in Tai Tong. Therefore, no impacts on aquatic fauna from this element would be expected.

Total habitat loss caused by the project is summarised in Table 13.26, while potential impacts of project construction are summarised in Table 13.27.

Table 13.26 : Habitat loss caused by the proposed project

	Potential Loss (ha)	
Habitat	Designated Element	Non-Designated Element
Temporary Loss	-	-
Urbanised/Disturbed Wasteland	0.24	25.49

	Potential Loss (ha)	
Habitat	**Designated Element**	**Non-Designated Element**
Mixed Woodland	-	0.46
Grassland/ Shrubland	-	0.28
Fish Ponds	0.20	-
Plantation	-	0.02
Cultivated Land	-	0.14
Permanent Loss		
Urbanised/Disturbed Wasteland	0.39	0.95
Fishpond	-	0.05
Cultivated Land	-	0.12
Plantation	0.23	-

Table 13.27: Construction-stage Impacts.

Activity	Receiver	Potential Impacts	Nature of Impacts	Severity	Mitigation Recommended
Site formation	Habitats and species associated (mainly urbanised/disturbed/ wasteland, but also include channel, cultivated land, woodland, plantation)	Total loss of flora and habitats within site formation boundary. Loss of habitats for fauna	Permanent for pumping stations, Temporary for sewers, reversible, small scale, limited species affected	Minor	Reinstatement of works area to its original conditions and compensatory planting at San Pui ponds to mitigate loss of plantation to YLEPS
Noise and disturbance	Wildlife species on adjacent habitats	Changes in distribution, activity patterns	Temporary, reversible, small scale, limited species affected	Minor	Good site practice Avoid winter for construction of elements within WCA and avoid breeding season near egretries
Construction dust	Vegetation	Inhibition of vegetation growth	Temporary, reversible, small scale, limited species affected	Minor	Good site practice
Surface runoff	Aquatic fauna	Changes in distribution, and/or activity patterns of associated fauna	Reversible, small scale, limited species affected	Minimal in Tin Shui Wai and San Wai Areas & Ngau Tam Mei and San Tin Areas. No impact in Lau Fau Shan and Mong Tsang Areas & Shap Pat Heung Area	Good site practice. Prevention of runoff to streams and marine habitats, desilt runoff

13.5.5 ***Cumulative Impacts***

There are a number of major infrastructure projects currently implemented or planned in the study area. These include YLKTSSD Stage 1, San Wai Sewerage Treatment Works, West Rail and various Main Drainage Channels (60CD, 22CD, 29CD, 113CD).

In accordance with paragraph 2.1(ix) of the EIA study brief, the EIA report shall "identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts, the cumulative effects expected to arise due to other committed or planned development(s) at area near the project site and the total environmental impacts of the projects under the YLKTSSD including (i) YLKTSSD Stage 1; and (ii) YLTSSD Stage 2; and (iii) the Upgrading and Pumping Station project, the construction and operation phases of the proposed project in relation to the sensitive receivers and potential affected uses." Construction of YLKTSSD Stage 1 caused direct habitat loss of approximately 0.26 ha cultivated lands of moderate ecological value, approximately 0.15 ha of abandoned and partially filled fishpond and approximately 1.02 ha of urbanised/developed areas. No adverse residual impact is expected due to the construction and operation of the sewerage system and pumping stations after the implementation of the proposed mitigation measures. The Upgrading and Pumping Station project is a non-designated project where minimal area of disturbed/urbanised habitats was affected. Due to the limited size of habitat to be lost and the disturbed nature of the development area, the current project will not cause significant adverse cumulative ecological impacts to the study area.

The proposed San Wai STW, expansion of Ha Tsuen Pumping Station and alignments for emergency outfall (Alternative 1) would cause a permanent loss of 1.75 ha of fishponds, 0.01 ha of grassland, 0.29 ha of mixed woodland, 9.91ha of urbanised habitats, and a temporary loss of 0.01 ha of grassland, 0.02 ha of stream channel/nullah and 2.65 ha of urbanised/disturbed habitats. The project will mainly cause permanent loss of habitats of low ecological importance, hence ecological impact is considered minor. This project will largely reduce the chance of discharging raw sewage into Deep Bay and therefore the project has an overall positive ecological impact. The potential cumulative ecological impacts due to the San Wai STW project are expected to be low.

Quite a number of sections of the proposed sewers will lie on the access roads of these MDCs and will be constructed after completion of these MDCs and may therefore affect the mitigation areas (e.g. landscape planting areas and isolated abandoned meanders) of these projects. The landscape plans of these MDC projects were reviewed. The proposed sewer alignment and sewerage pumping stations will not encroach any abandoned meanders of 22CD, 29CD and 113CD. Direct impact on these meanders would be minimal. Noise and visual disturbance may be generated during site formation and construction of the sewerage alignment at Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T), and Shap Pat Heung Area (2B-2T), potentially affecting the distribution and behavior of fauna using these meanders. Due to the highly urbanized nature of the surrounding areas along the alignment, and the temporary nature of the impact, cumulative impacts to fauna from this source are ranked as minor.

The landscape plans show that part of the sewer alignment and sewerage pumping stations will encroach some roadside trees, shrubs to be planted or areas to be hydroseeded along the channels under the MDC projects. In particular, about 0.23ha of the mitigation planting areas of 60CD within the WCA zone will be encroached by Yuen Long Effluent Pumping Station. Potential ecological impacts are minor due to the linear nature of these plantation and limited area to be affected. The extent of disturbance at 113CD and 29CD cannot be quantified at this stage, but a list of potential species to be affected is given in Table 13.28. Mitigation is recommended to compensate for the loss of these planting areas by replanting with the same species of the same quantity by the contractor upon completion of construction.

The proposed alternative alignment of 2A-1T will not encroach and affect the fishponds and the proposed private development at Fung Lok Wai, a designated project under EIAO. The development is located within the CA zone and is located at least 120m away from the proposed alignment and would not cause net loss of wetland within the CA zone. No direct, indirect, or cumulative impacts are anticipated.

Overall, the contribution of the development projects to the cumulative ecological impacts in the NWNT region is not expected to be high as most of the affected areas have been developed previously and each project has/will provide specific mitigation measures. In addition, the proposed project would mainly cause loss of habitats of low ecological values. The residual impacts from the various development projects are acceptable and therefore would not affect the area. The proposed works in this Study aim to provide a sewerage system to cater for the existing and additional developments in the NWNT area thereby improving the water quality of a polluted region and ultimately benefiting the environment in the future. The proposed works in this Study would encroach some of the mitigation areas for MDCs. However, with the implementation of the standard site practice and recommendations proposed in Section 13.6, no unacceptable cumulative impacts are anticipated. Cumulative impacts predicted to arise from the proposed project in conjunction with concurrent projects are not expected to result in greater adverse ecological impacts than impacts arising from the concurrent projects independently.

Table 13.28: Landscape and mitigation planting area of MDCs potentially affected by this project.

Section	Item encroaching MDC	MDC	Species/Planting Mix to be encroached
Alternative 2A-1T	Pumping Station AP1	60CD	Mitigation planting area including: *Melaleuca quinquenervia* *Ficus microcarpa* *Sapium sebiferum* *Casuarina equisetifolia* *Hibiscus tiliaceus* *Celtis tetrandra subsp. sinensis* *Melastoma candidum*
2B-2T	Sewer Section H3	113CD	Landscape planting area including: *Gossampinus malabaricum* *Rhapis excelsa* *Caryota ochlandra* *Casuarina equisetifolia*
	Pumping Station B3		Unspecified Tree
	Pumping Station B4		*Schima superba* Unspecified Tree
2A-2T	Sewer Section S3	29CD	Woodland Shrub Mix Hydroseeded Area Amenity Shrub and Groundcover Planting
	Pumping Station P2		*Cinnamomum camphora* *Ficus microcarpa*

13.6 Impact Avoidance and Mitigation Measures for Construction Phase

During the detailed design stage, the following issues should be considered as possible to further minimise the impacts:

- Refinement of the site limit to avoid or minimise use of fish ponds as temporary works area
- Refinement of site limit to minimise use of mixed woodland as temporary works area
- Interface problem with MDC projects, and refinement of the site limit to minimise the disturbance and encroachment to landscape planting areas of various MDC projects.

Standard site practice including the following, should be enforced to minimise the disturbance to the surroundings:

- Prevent stream/channel sedimentation during construction by erection of sediment barriers and operation of siltation traps in streams/channels which could potentially be affected.
- Treat any damage that may occur to individual major trees in the adjacent area with surgery.
- Reinstate work sites/disturbed areas immediately after completion of the construction works, in particular, through on-site tree/shrub planting along the woodland section at Tin Shui Wai, reinstatement of the 3 fishponds within WCA (Figure 13.5). Tree/shrub species used should make reference from those in the surrounding area.
- Regularly check the work site boundaries to ensure that they are not exceeded and that no damage occurs to surrounding areas. Appropriate construction method will be adopted to ensure that no dewatering of nearby fishpond is required.
- Owing to the close proximity to the Wetland Conservation Area at Mai Po and North of Yuen Long EPS, the training of staff on the concepts of site cleanliness and on appropriate waste management procedures should also emphasis on the prohibition of waste dumping at the nearby wetland.

In addition to standard site practice, recommendations specific to each Work Package are proposed below and are summarised in Figure 13.5. The recommendations as well as other mitigation measures and requirement will be put in the EP under EIAO under the standard legal procedure so that the Contractor will refer to the conditions in the EP and EM&A manual to reinstate the site.

13.6.1 ***Tin Shui Wai and San Wai Areas (Alternative 2A-1T)***

During this preliminary design phase, a tree survey and compensatory proposal had been completed and the draft tree survey report has been submitted to relevant departments for comment. A detailed tree survey should be performed during the detailed design phase (with the ultimate alignment) by the DSD at the mixed woodland in order to provide information for site reinstatement by the contractor.

Although no ecological sensitive species were recorded during the study, it is recommended that the construction period of items within WCA, i.e. the pumping station AP1 and 430m of AS1 be restricted to April through October to avoid the potential disturbance to wintering waterbirds (Figure 13.5). In order to reduce the impact on the nearby fishpond within WCA, laying of sewer will be conducted in 20m segment. The construction works will also be scheduled during non rainy days. It is anticipated that the construction works within WCA would last for two calender-years. Appropriate construction method will be adopted to ensure that no dewatering of nearby fishpond is required. Such construction method shall be agreed by DSD before commencement of works.

Replanting area would also be provided (Figure 13.5) to compensate for the loss of 60CD mitigation planting area on a like-to-like basis by using the native species recorded in the existing 60CD planting (Table 13.28). A potential replanting area is located at Shan Pui Ponds. These abandoned ponds are within WCA and are government ponds. These ponds form an island between 60CD and are accessible by boat. The grassy area highlighted in Figure 13.5 is above high tide zone and will not be subject to tidal action. About 0.35 ha will be planted, which can compensate for the loss from YLEPS at a 1.5:1 ratio to off-set the time loss and to reduce of risk of poor survival. Saplings of native tree species recorded in 60CD plantation including *Sapium sebiferum, Hibiscus tiliaceus* and *Celtis tetrandra* subsp. *sinensis* and others including *Macaranga tanarius* and *Melia azedarach* will be used in the replanting area. These trees except *Hibiscus tiliaceus* bear berries which can provide food for frugivorous birds. Plant and bird diversities and therefore the ecological values of the area will be enhanced. These trees can also provide a screening effect for the waterbirds using San Pui ponds as well as serve as a roosting site for birds, and thereby enhance the wetland function of the area. Maintenance schedule should be specified in the landscape contract and should include irrigation and weeding on a bimonthly basis for the first year of establishment to enhance survival. Tree seedlings dead within the first year should be replaced by the landscape contractors. Upon completion of the landscape contract the plantation should be handed over to AFCD. A detailed replanting plan should be included during the detailed design stage.

13.6.2 ***Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)***

Although no ecological sensitive species were recorded during the study, it is recommended that the construction period of items within WCA, i.e. 560m of S1 along 100CD, be restricted to April through October to avoid the potential disturbance to wintering waterbirds (Figure 13.5).

Due to the potential noise disturbance from construction works, it is recommended that construction period of the alignment sections within 100m from Mai Po Village and Mai Po Loong egretries be restricted to September through March to avoid breeding season as possible to reduce disturbance to breeding birds (Figure 13.5).

13.6.3 ***Lau Fau Shan and Mong Tseng Areas (2A-3T)***

No mitigation measure is required, as the ecological impact is considered minor.

13.6.4 ***Shap Pat Heung Area (2B-2T)***

No mitigation measure is required, as the ecological impact is considered minor.

13.7 Impact Identification and Evaluation for Operational Phase

The sewage pipeline will be underground and the operation will not pose any observable impact to the surrounding habitats and the associated flora or fauna. Noise from operating the pumping stations will not pose any significant impact to nesting ardeids and other fauna which are disturbance tolerant. No impact on the stream/channel habitat or on aquatic fauna is anticipated. The potential operational impact is ranked as minor.

13.8 Impact Avoidance and Mitigation Measures for Operational Phase

No mitigation measure is required for any of the Works Package as the ecological impact is considered minor.

13.9 Residual Impacts

No residual ecological impacts are anticipated as a result of the construction and operation of the proposed sewerage system and pumping stations.

13.10 Conclusion

Most of the study area, particularly the area to be directly affected by the proposed Project is highly urbanised and degraded by existing and on-going development. Habitats found within the study area include plantation, mixed woodland, grassland/shrubland, cultivated land/orchard, fishpond, stream/channel, mangrove, and disturbed/urbanized/wasteland areas. Two species of plants and 4 species/groups of birds of conservation interest were recorded. The designated elements would cause a permanent loss of 0.39 ha of urbanized/disturbed/wasteland and 0.23ha of plantation for construction of pumping stations, and a temporary loss of 0.24 ha of urbanized/disturbed/wasteland and 0.20 ha of fishponds for construction of sewers. There will be no-net-loss in wetland area at the WCA and CA.

The non-designated element would cause a permanent loss of 0.95 ha of urbanized/disturbed/wasteland, 0.05 ha of fishponds and 0.12 ha of cultivated land and a temporary loss of 25.49 ha of urbanized/disturbed/wasteland, 0.46 ha of mixed woodland, 0.28 ha of shrubland/grassland, 0.02 ha of plantation, and 0.14 ha of cultivated land. The overall ecological impacts are ranked as minor. Standard site practice and recommendations to each works package are made. No residual impacts are anticipated.

On top of the EIAO application, a rezoning request to change the landuse for some pumping stations are required by DSD during detailed design stage. Supporting ecological impact assessment is required to justify the case. Without the approval from the Town Planning Board, land right for construction will not be given.

14.0 LANDSCAPE AND VISUAL ASSESSMENT

14.1 Introduction

This chapter of the report outlines the landscape and visual impacts associated with the Stage 2 Trunk Sewerage Extension of the packages (listed below) of the Yuen Long and Kam Tin Sewerage and Sewage Disposal (hereinafter called 'the Project') under Agreement No. CE 66/2001(EP) in accordance with the Environmental Impact Assessment Ordinance, which became law in Hong Kong on 1st April 1998. Both construction and operation impacts are assessed. In particular, the following sections of the works are included in this assessment:

- Area A1, Package 2A - 3T (Lau Fau Shan / Mong Tseng);
- Area A2, Package 2A - 1T (Yuen Long);
- Area B, Packages 2A-2T & 2B-1T (Ngau Tam Mei/San Tin); and
- Area C, Package 2B - 2T (Yuen Long South Branch).

The assessment includes:

- A listing of the relevant environmental legislation and guidelines;
- A definition of the scope and contents of the study, including a description of the assessment methodology;
- A review of the relevant planning and development control framework;
- A review of comments on landscape and visual issues received during previous consultation with the public and/or advisory bodies and how these have been addressed in the design;
- A baseline study providing a comprehensive and accurate description of the baseline landscape and visual character;
- Recommendation of appropriate mitigation measures and associated implementation programmes for both designated and non-designated elements;
- Identification of the potential landscape and visual impacts and prediction of their magnitude and potential significance, before and after the mitigation measures; and
- An assessment of the acceptability or otherwise of the predicted residual impacts, according to the five criteria set out in Annex 10 of the TM-EIA.

All potential impacts and proposed mitigation measures are clearly mapped and illustrated with clear annotation and cross-referencing between text, tables and illustrations. Colour photographs showing baseline conditions, and photomontages and illustrative materials supporting conclusions are provided. The locations of all viewpoints are clearly mapped.

14.2 Environmental Legislation and Guidelines

The following legislation, standards and guidelines are applicable to the evaluation of landscape and visual impacts associated with the construction and operation of the project:

** Environmental Impact Assessment Ordinance (Cap.499.S.16) and the Technical Memorandum on EIA Process (EIAO TM), particularly Annexes 3, 10, 18, 20 and 21;*
** Hong Kong Planning Standards and Guidelines;*
** WBTC No. 25/93 - Control of Visual Impact of Slopes;*
** WBTC No. 14/2002 - Management and Maintenance of Natural Vegetation and Landscape Works and Tree Preservation;*
** WBTC No. 25/92 - Allocation of Space for Urban Street Trees;*
** WBTC No. 17/2000 – Improvements to the Appearance of Slopes;*
** HyDTC No. 10/2001 – Visibility of Directional Signs;*
** WBTC No. 19/98 - The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS);*
** WBTC 17/2000 - Improvement to the Appearance of Slopes;*
** WBTC No. 7/2002 - Tree Planting in Public Works;*
** EIAO Guidance Note 8/2002 on Preparation of Landscape and Visual Impact Assessment; and*
** Outline Zoning Plans as listed in Section 14.4 below.*

In addition, reference has been made to the EIA(DE) Report and ES(NDE) Report of Stage 1.

14.3 Scope and Content of the Study

14.3.1 Limits of the Study Area

The limits of the visual impact studies are the Zones of Visual Influence (ZVIs) of the Works during the construction and operational phases, which are illustrated in Figures 14.26 to 14.33 inclusively.

14.3.2 Assessment Methodology

Landscape and visual impacts have been assessed separately for the construction and operational phases. The assessment of landscape impacts has involved the following procedures:

Identification of the baseline landscape resources (physical and cultural) and landscape character found within the study area. This is achieved by site visit and desk-top study of topographical maps, information databases and photographs.

Assessment of the degree of sensitivity to change of the landscape resources and landscape character. This is influenced by a number of factors including whether the resource/character is common or rare, whether it is considered to be of local, regional, national or global importance, whether there are any statutory or regulatory limitations/ requirements relating to the resource, the quality of the resource/character, the maturity of the resource, and the ability of the resource/character to accommodate change. The sensitivity of each landscape feature and character unit is classified as follows:

- High: Important landscape or landscape resource of particularly distinctive character or high importance, sensitive to relatively small changes
- Medium: Landscape or landscape resource of moderately valued landscape characteristics reasonably tolerant to change
- Low: Landscape or landscape resource, the nature of which is largely tolerant to change

Identification of potential sources of landscape impacts. These are the various elements of the construction works and operational procedures that would generate landscape impacts on individual Landscape Character Areas and Landscape Resources.

Identification of the magnitude of landscape impacts. The magnitude of the impact depends on a number of factors including the physical extent of the impact, the landscape and visual context of the impact, the compatibility of the project with the surrounding landscape; and the time-scale of the impact - i.e. whether it is temporary (short, medium or long term), permanent but potentially reversible, or permanent and irreversible. Landscape impacts have been quantified wherever possible. The magnitude of landscape impacts is classified as follows:

Large:	The landscape or landscape resource would suffer a major change
Intermediate:	The landscape or landscape resource would suffer a moderate change
Small:	The landscape or landscape resource would suffer slight or barely perceptible changes
Negligible:	The landscape or landscape resource would suffer no discernible change.

Identification of potential landscape mitigation measures. These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise adverse impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long term impacts. A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified and their approval-in-principle has been sought.

Prediction of the significance of landscape impacts before and after the implementation of the mitigation measures. By synthesising the magnitude of the various impacts and the sensitivity of the various landscape resources, it is possible to categorise impacts in a logical, well-reasoned and consistent fashion. Table 14.1 shows the rationale for dividing the degree of significance into four thresholds,

namely insubstantial, slight, moderate, and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of impact and a low-medium-high degree of sensitivity of landscape resource/character. The significant thresholds are defined as follows:

Substantial:	Adverse/ beneficial impact where the proposal would cause significant deterioration or improvement in existing landscape quality
Moderate:	Adverse/ beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing landscape quality
Slight:	Adverse/ beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in existing landscape quality
Insubstantial:	No discernible change in the existing landscape quality

Prediction of Acceptability of Impacts. An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the TM-EIAO. The prediction is made for both designated and non-designated elements of the Works.

Table 14.1 : Relationship between receptor sensitivity and impact magnitude in defining impact significance

Magnitude of Impact	Low	Medium	High
Large	**Moderate (Slight)***	**Moderate / Substantial**	**Substantial**
Intermediate	**Slight / Moderate**	**Moderate**	**Moderate / Substantial**
Small	**Insubstantial / Slight**	**Slight / Moderate**	**Moderate (Slight)***
Negligible	**Insubstantial**	**Insubstantial**	**Insubstantial**

Receptor Sensitivity

(of Landscape Resource, Landscape Character Area or VSR)

*In principle the assessment will be Moderate impact. However in certain circumstances the assessment maybe Slight.

The assessment of visual impacts has involved the following procedures:

Identification of the zones of visual influence during the construction and operational phases of the (project). This is achieved by site visit and desk-top study of topographic maps and photographs, and preparation of cross-sections to determine visibility of the (project) from various locations. Zones of Visual Influence can be defined as the area from within which any part of the development or construction works can be seen.

Identification of the visually sensitive receivers (VSRs) within the ZVIs at construction and operational phases. These are the people who would reside within, work within, play within, or travel through, the ZVIs.

Identification of baseline visual resources. These are key views, viewing corridors/viewing direction and visual character.

Identification of potential sources of visual impacts. These are the various elements of the construction works and operational procedures that would generate visual impacts.

Assessment of the degree of sensitivity to change of the VSRs. Factors considered include:

- the type of VSRs, classified according to whether the person is at home, at work, at play, or travelling. Those who view the impact from their homes are considered to be highly sensitive as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the impact from their workplace are considered to be low as the attractiveness or otherwise of the outlook will have a less important effect on their perception of their quality of life. Those who view the impact whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. Those who view the impact whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed of travel. But in general terms are deemed to be acceptable.
- Other factors, which are considered (as required by EIAO GN 8/2002) include the value and quality of existing views, the availability and amenity of alternative views, the duration or frequency of views, and the degree of visibility.
- Identification of the relative numbers of VSRs. This is expressed in terms of whether there are very few, few, many or very many VSRs in any one category of VSR.

Assessment of potential magnitude of visual impacts. Factors considered include:

- the compatibility with the surrounding landscape;
- the duration of the impact;
- the reversibility of the impact;
- the scale of the impact and distance of the source of impact from the viewer;
- the degree of visibility of the impact, and the degree to which the impact dominates the field of vision of the viewer.

Identification of potential visual mitigation measures. These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise adverse impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. Tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long term impacts. A programme for the mitigation measures is provided. The agencies responsible for funding, implementation, management and maintenance of the mitigation measures are identified and their approval-in-principle has been sought.

Prediction of the significance of visual impacts before and after the implementation of the mitigation measures. By synthesizing the magnitude of the various visual impacts and the sensitivity of the VSRs, and the numbers of VSRs that are affected, it is possible to categorise the degree of significance of impacts in a logical, well-reasoned and consistent fashion. Table 14.1 shows the rationale for dividing the degree of significance into four thresholds, namely, insubstantial, slight, moderate and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of impact and a low-medium-high degree of sensitivity of VSRs.

Prediction of acceptability of impacts. An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the TM-EIA and an assessment of the implications of this LVIA for the LVIA presented for stage 1 of the study.

In addition, the following assumption has been made in the assessment:

- It is assumed that funding, implementation, management and maintenance of the mitigation proposals can be satisfactorily resolved according to the principles in WBTC 14/2002. All mitigation proposals in this report are practical and achievable within the known parameters of funding, implementation, management and maintenance. The suggested agents for the funding and implementation (and subsequent management and maintenance, if applicable) are indicated in Tables 14.2, 14.3, 14.5 and 14.6.

Approval-in-principle to the implementation, management and maintenance of the proposed mitigation measures has been sought from the appropriate authorities.

14.4 Planning and Development Control Framework

A review has been undertaken of the current planning goals and objectives, statutory land-use and landscape planning designations for the study area. The final technical report on the Territorial Development Strategy Review, (1995), sets out the recommended planning and development strategy for the study area.

- The statutory designations for the study area are shown on the following Outline Zoning Plans (OZP's) (see Figures 14.6 to 14.9 inclusively):
- For Package A2, 2A - 3T Lau Fau Shan / Mong Tseng
- Tin Shui Wai OZP - S/TSW/7
- Lau Fau Shan OZP - S/YL-LFS/5
- For Package 2B, 2A - 1T Yuen Long Effluent Pipeline
- Ping Shan OZP - S/YL-PS/9
- Ha Tsuen OZP - S/YL-HT/4
- For Package B, 2A - 2T Ngau Tam Mei / San Wai
- Mai Po and Fairview Park OZP - S/YL-MP/4
- Ngau Tam Mei OZP - S/YL-NTM/8
- San Tin OZP - S/YL-ST/5
- For Package C, 2B - 2T Yuen Long South Branch Sewers
- Tai Tong OZP - S/YL-TT/10

It is considered that the project would be in accord with the planning goals and objectives for the study areas, as set out in the TDSR and the OZP's.

For individual sewage pumping station as proposed under the project, planning permission from the Town Planning Board will be sought as required under relevant OZP whereas the laying of sewage pipes are always permitted. Nevertheless, the project will be carefully designed to minimise any potential adverse impacts on the environment.

14.5 Baseline Study

14.5.1 Physical Landscape Resources and Character Areas

The Baseline Landscape Resources are mapped in Figures 14.10 to 14.13.1 inclusively. . For ease of reference, the Baseline Study has been split into four different sections:

- Package 2A-3T Lau Fau Shan / Mong Tseng Trunk Sewerage
- Package 2A-1T Yuen Long Effluent Pipeline
- Package 2A-2T Ngau Tam Mei/San Wai Trunk Sewerage Phase 1 and 2;
- Stage 2B-2T Yuen Long South Branch Sewers.

Location Plans and Extent of Works are illustrated in Figures 14.1 to 14.1.3 and 14.2 to 14.5 inclusively. Photo views illustrating the landscape resources, visually sensitive receiver's areas and landscape context are illustrated Figures 14.18 to 14.25.1 inclusively. Sensitivity to change of landscape resources is shown in Table 14.4. For ease of cross-reference between text, tables and figures, each key Landscape Resource and Landscape Character Area that may be affected by the works is given an identity number.

14.5.2 Landscape Descriptions

Package 2A - 3T Lau Fau Shan / Mong Tseng Trunk Sewerage

i. Landscape Context

The Sewer alignment lies on the Lau Fau Shan Peninsula, an area of undulating upland rising to a height of around 80 mPD. The Peninsula lies between Deep Bay to the west and what was formerly an area of reed bed

and salt marsh, now occupied by the new town of Tin Shui Wai and the Western Channel, a nullah discharging into Deep Bay.

ii. Landcover and Landuse

The uplands of the Peninsula are largely undeveloped and are covered by scrub and grassland. At lower elevations are found villages such as Lau Fau Shan and Mong Tseng, surrounded by largely remnant agriculture, fishponds and woodland. A limited number of lanes and narrow roads connect the villages.

In many areas, agriculture has given way to open storage as the predominant land use, whilst on the eastern side of the Peninsula, a new major road is under construction.

iii. Key Landscape Resources

Key landscape resources within the Study Area of this section of the alignment include:

- roadside amenity planting and trees;
- fish ponds;
- agricultural land (mainly disused); and
- nullah.

iv. Landscape Character

Whilst upland areas retain a largely, undeveloped, remote and tranquil character, the decline of traditional agricultural practice and the incursion of open storage and road infrastructure associated with the Tin Shui Wai area means that lowland areas have a fairly incoherent and degraded rural fringe character. This is particularly true of areas around Lau Fau Shan.

Landscape Character Areas / Areas falling within the Sewer Study Area include:

REF.	LANDSCAPE CHARACTER AREA	SENSITIVITY TO CHANGE
LCA1	Mong Tseng Tsuen historic village and environs	Medium
LCA2	Fish ponds at Mong Tseng	High
LCA3	Highways and amenity landscape west of Tin Shui Wai	Low
-	NOT USED	-
-	NOT USED	-
LCA6	Plains and isolated hills west of the nullah	Low
LCA7	Warehousing and factories south of Lau Fau Shan Road	Low
LCA8	Village landscapes north of Lau Fau Shan Road	Medium
LCA9	Warehousing and factories at Lau Fau Shan	Low
LCA10	Low density mixed urban landscape at Lau Fau Shan	Low
LCA11	Fish ponds on Deep Bay Road	High

Package 2A - 1T Yuen Long Sewage Effluent Pipeline (Alternative Scheme)

i. Landscape Context

The Sewer lies on an undulating coastal plain, south of Deep Bay. Most land is low-lying (typically below 20 mPD), but rising to around 60 mPD on low hills. The area lies south of Deep Bay and what was formerly an area of reed bed and salt marsh, now occupied by the new town of Tin Shui Wai. A number of small streams fall from higher ground, whilst the Western Channel is a major nullah discharging into Deep Bay.

ii. Landcover and Landuse

Higher ground and hills are largely undeveloped and are covered by scrub and grassland. On the lowlands are located villages such as San Wai and the new town of Tin Shui Wai, a medium and high-rise development located on land reclaimed from Deep Bay. Lower lying areas consist of largely remnant agriculture (in the south) and extensive areas of fish ponds in the west (except for the industrial estate and sewage treatment works in the far west of the Study Area. A limited number of lanes and tracks connect the villages and fishing communities, except in Tin Shui Wai which is connected to Yuen Long by major highways infrastructure.

A new Main Drainage Channel (MDC) with mitigation plantings at the south west of the alignment will be completed at the time of installation of the pipeline.

iii. Key Landscape Resources

Key landscape resources within the Study Area of this section of the alignment include:

- roadside amenity planting and trees (in and around Tin Shui Wai);
- areas of secondary woodland;
- young plantation woodland;
- scattered trees;
- TDD MDC mitigation plantings;
- extensive areas of fish ponds; and
- agricultural land (mainly disused);

iv. Landscape Character

In the eastern part of the area where fishponds predominate, the landscape has a fairly remote, open and exposed character. The generally intact pattern of landscape features means that the landscape retains a reasonable level of coherence. In Tin Shui Wai, the large scale and high rise buildings of the new town determine landscape character. This creates a fairly uniform landscape pattern of development and highways, which retains little sensitivity to further development. In the west outside the new town, the landscape is characterised by remnant rural features and retains, in part, its traditional landscape pattern of fields, fishponds, dwellings and scattered vegetation, resulting in a fairly coherent and tranquil agrarian landscape.

The following Landscape Resources fall within the study area of the Designated Project Yuen Long Effluent Pipeline:

REF.	LANDSCAPE RESOURCE	SENSITIVITY TO CHANGE	APPROX AREA (M² unless stated otherwise)
LR11	Shan Pui River The river channel is approximately 80m wide and has been channelised with stone embankments. This resource has a medium sensitivity to change	Medium	323571
LR11A	Small trees on site of proposed Yuen Long Effluent Pumping Station The trees within this resource group range in height between 3-5m and are very young, appearing to have been recently planted. Species include Melastoma candidum, Sapium sebiferum and Celtis tetandra. This resource has a medium sensitivity to change.	Medium	2300
LR12	Ponds north and west of Yuen Long Sewage Works This resource is an extensive networks of ponds western side of Shui Pui River. The area is low-lying with few features except the banks separating ponds and the occasion tree on the bank. This resource has a high sensitivity to change.	High	833615
LR12A	Ponds east of Shan Pui River This resource is an extensive networks of ponds on the eastern side of Shui Pui River. The area is low-lying with few features except the banks separating ponds and the occasion tree on the bank. This resource has a high sensitivity to change.	High	290862
LR13	Trees around Yuen Long Sewage Works The trees within this resource group range in height between 4-8m and are well established. Species include Melia azedarach, Macaranga tanarius, and Celtis sinensis. This resource has a medium sensitivity to change.	Medium	24 trees
LR14	Channelised waterway flowing into Shan Pui River The nullah flowing into Shan Pui River is approximately 5m wide with concrete embankments approximately 2m. This resource has a low sensitivity to change	Low	160m (length)
LR14A	Woodland vegetation to the north of Tai Tseng Wai The vegetation in this area is a mix of exotic and native species, consisting of both tree and shrub species. The quality of the vegetation is mixed with areas where it has been disturbed by humans. This resource has a medium sensitivity to change.	Medium	164808
LR15	Street trees in Yuen Long Industrial Estate The trees within this resource group range in height between 4-12m and are well established. Species include Melaleuca leucadendron, Bauhinia sp. and Aleurites moluccana. This resource has a medium sensitivity to change.	Medium	+300 trees

REF.	LANDSCAPE RESOURCE	SENSITIVITY TO CHANGE	APPROX AREA (M^2 unless stated otherwise)
LR16	Fields in Tai Tseng Wai The fields in this area are predominantly abandoned agricultural land with pockets of cultivation within the village area. The land is low lying with few features. This resource has a low sensitivity to change.	Low	19362
LR17	Fields west of Shing Uk Tseun The fields in this area are predominantly abandoned agricultural land with pockets of cultivation. The land is low lying with few features. This resource has a low sensitivity to change.	Low	5758
LR18	Fields east of Tin Shui Wai The fields in this area are predominantly abandoned agricultural land with small isolated ponds. The land is low lying with few features. This resource has a low sensitivity to change.	Low	28057
LR19	Tree belts above Shing Uk Tseun The vegetation in this area is a mix of exotic and native species, consisting of both tree and shrub species. The quality of the vegetation is mixed with areas where it has been disturbed by humans. The higher slopes are predominantly grassland. This resource has a medium sensitivity to change.	Medium	339994
LR19A	Amenity Planting around Residential developments in Tin Shui Wai The planting within the residential developments at Tin Shui Wai consist of large trees, 5-8m in height with a wide variety of species. This resource has a high sensitivity to change.	High	158003
LR19B	Tree Belt east of Tin Shui Wai The vegetation in this area is a mix of exotic and native species, consisting of both tree and shrub species. The height of vegetation ranges between 5-10m and is well established. This resource has a medium sensitivity to change.	Medium	18789
LR19C	Tree Belt adjacent to Tin Shui Wai The trees within this resource group range in height between 4-8m and are well established. Species consist predominantly of Leucaena leucocephala This resource has a medium sensitivity to change.	Medium	13543

Package 2A - 2T Ngau Tam Mei / San Wai Trunk Sewerage

i. Landscape Context

The Sewer alignment lies on the coastal plain, formed by sedimentary deposits, east of Deep Bay. Most land is low-lying (typically below 20 mPD), rising to the granitic uplands to the east. A number of streams fall from these uplands into Deep Bay. Work is nearing completion to construct major drainage channels to take run-off from the Ngau Tam Mei Valley across the plain to Deep Bay. Several abandoned meanders and TDD mitigation plantings are a result of these works.

ii. Landcover and Landuse

Close to the sea, land has historically been reclaimed to create an extensive area of fishponds. In this area lies the extensive low-rise residential development of Fairview Park. Inland, the landscape is more typically rural with the scattered villages, such as Yau Tam Mei, Fan Tin Tsuen, On Lung Tsuen and Mai Po Lo Wai, located on the edge of the coastal plain and in valleys. These areas contain active and disused agricultural land, fishponds as well as scattered factories, open storage areas and military camps, such as Ngau Tam Mei and Cassino Lines. These are interspersed by scattered woodland and trees. Castle Peak Road runs along the edge of the coastal plain, with smaller lanes winding into village's inland.

iii. Key Landscape Resources

Key landscape resources within the Study Area of this section of the alignment include:

- roadside amenity planting and trees (esp. in and around Fairview Park and Castle Peak Road)
- areas of secondary woodland;
- young plantation woodland;

- scattered trees;
- abandoned meanders (resulting from TDD MDC works);
- TDD MDC mitigation plantings;
- extensive areas of fish ponds; and
- agricultural land (mainly disused).

The following Landscape Resources fall within the study area of the Designated Project Yuen Long Effluent PipelineNgau Tam Mei Sewage Pumping Station:

REF.	LANDSCAPE RESOURCE	SENSITIVITY TO CHANGE	APPROX AREA (M^2) (unless stated otherwise)
LR30	Street Trees on Castle Peak Road The trees within this resource group range in height between 4-12m and are well established. Species include Eucalyptus sp., Ficus microcarpa and Leucaena leucocephala. This resource has a medium sensitivity to change.	Medium	200m (length) - approx. 200 trees
LR31	Street Trees on San Tin Highway The trees within this resource group range in height between 6-10 metres and are well established. Species include Eucalyptus sp., Macaranga tanarius, Ficus microcarpa and Leucaena leucocephala. This resource has a medium sensitivity to change.	Medium	70m (length) - approx. 50 trees
LR32	Ponds on Castle Peak Road The ponds along Castle Peak Road are a remnant of the original landscape before a lot of the area was drained. The ponds have few features and vegetation is limited to the surrounding banks. This resource has a high sensitivity to change.	High	1244
LR35	MDC under construction between Tam Mei Camp and Kam Tin River The MDC is approximately 40m wide and has been channelised with very linear banks. Planting is proposed for the banks but this is yet to establish. Due to its modified nature the MDC has a low sensitivity to change.	Low	68999
LR36	Ponds beside MDC under construction The ponds adjacent to the MDC are a remnant of the original landscape before a lot of the area was drained. The ponds have few features with vegetation limited to the surrounding banks. This resource has a high sensitivity to change.	High	4823
LR36A	Wooded hillsides behind Wai Tsai The vegetation in this area is a mix of exotic and native species, consisting of both tree and shrub species. The quality of the vegetation is mixed with areas where it has been disturbed by humans. This resource has a medium sensitivity to change.	Medium	39273
LR37	Fields beside MDC under construction The fields are low-lying often with water channels running between plant beds. The character of this resource is open but has been heavily modified with the construction of banks. Areas of abandoned fields also exist within this resource, This resource has a low sensitivity to change.	Low	345419
LR37A	Amenity Planting associated with Palm Springs and Royal Palms The planting within the residential developments at Tin Shui Wai consists of large trees, 5-8m in height with a wide variety of species. This resource has a high sensitivity to change.	High	94604
LR38	Channelised waterway east of Fairview Park This is a narrow drainage channel to the east of Fairview Park. This resource has a low sensitivity to change.	Low	240m (length)

iv. Landscape Character

In the western part of the area where fishponds predominate, the landscape has a fairly remote, open and exposed character, diminished slightly by the presence of Fairview Park and ongoing construction works. The generally intact pattern of landscape features means that the landscape retains a reasonable level of coherence.

In western parts, the landscape is more enclosed, intimate and agrarian, characterised by remnant rural features. It retains, in part, its traditional landscape pattern of fields, fishponds, dwellings and scattered vegetation, resulting in a fairly coherent and tranquil agrarian landscape.

The landscape along Castle Peak Road is influenced to a great extent by this highway and associated features. The presence of factories and storage yards in this area results in a somewhat degraded and incoherent rural fringe character.

Landscape Character Areas falling within the Designated Project Sewer Study Area include:

REF.	LANDSCAPE CHARACTER AREA	SENSITIVITY TO CHANGE	Approx Area (m²)
LCA35	Low rise suburban housing estates at Maple Gardens This character area is adjacent to San Tin Highway and is low rise residential. It has a low sensitivity to change.	Low	123594
LCA36	Warehousing and factories east of Palm Springs This character area contains large warehouses and factories adjacent to Deep Bay Road and Palm Springs. It has a low sensitivity to change.	Low	62168
LCA37	MDC landscape between Tam Mei Camp and Kam Tin River This character area contains the newly constructed MDC channel and fields on either side. Some ponds also still exist within this area. The visual dominance of the MDC gives the character area a low sensitivity to change.	Low	529661
LCA38	Palm Springs This character area is a low rise residential development with substantial landscape planting and amenity. It has a high sensitivity to change.	High	96343
LCA39	Fairview Park This character area is a low rise residential development with substantial landscape planting and amenity. It has a high sensitivity to change.	High	5578
LCA40	Chuk Yuen Tseun Village This character is located to the south of the MDC and contains the San Tin Highway and Deep Bay Road. Dwellings are low rise and the character area has a medium sensitivity to change.	Medium	155406
LCA41	Yam Tam Mei Tseun This character area is located to the south of the MDC. Dwellings are low rise and the character area has a medium sensitivity to change.	Medium	81837
LCA41A	Wai Tsai Village Area This character area is located to the north of the MDC on slightly elevated land. Dwellings are low rise and the character area has a medium sensitivity to change.	Medium	71557

Landscape Character Areas falling within the Non-Designated Project Sewer Study Area include:

REF.	LANDSCAPE CHARACTER AREA	SENSITIVITY TO CHANGE
LCA28	Military camps at Cassino Line	Low
LCA29	Plains and isolated hills east of Ka Leung Road	Low
LCA30	Historic villages and environs at San Leung Tsuen	High
LCA31	Fish ponds at Tsing Lung Tsuen	High
LCA32	Plains and isolated hills east of Castle Peak Road	Low
LCA33	Fish ponds north of Castle Peak Road	High
LCA34	Village landscape at Mai Po Lo Wai	Medium

Package 2B - 2T Yuen Long South Branch Sewers

i. Landscape Context

The Sewer alignments lie on the floor of a valley formed by granitic uplands at Shap Pat Heung, south of the town of Yuen Long. The valley floor is extensive and low lying (mostly below 20 mPD). Numerous streams run off higher ground to the valley floor where they are collected by a series of nullahs, which discharge into the drainage systems north of Yuen Long.

ii. Landcover and Landuse

The valley floor comprises a typical agrarian Hong Kong landscape of numerous scattered villages set amongst remnant and active agricultural fields, which are broken by scattered trees and woodland. Some villages contain historic features of landscape value, such as ancestral halls and are connected only by narrow roads and lanes, which wind through the countryside. Agriculture has in recent years given way to more intrusive land uses such as open storage and breaking yards. An MDC with associated mitigation plantings is currently under construction and borders several villages and open fields. The construction of the MDC has created several abandoned meanders, which are considered to be landscape resources (LR46A).

iii. Key Landscape Resources

Key landscape resources within the Study Area of this section of the alignment include:

- scattered woodland and secondary vegetation;
- abandoned meanders (resulting from TDD MDC works);
- TDD MDC mitigation plantings;
- agricultural land (active and disused); and
- nullahs.

iv. Landscape Character

Though slightly degraded by more recent land uses, the landscape retains mostly intact its traditional pattern of agrarian features. This results in a rural fringe landscape, which is for the most part intimate, coherent and tranquil in character.

Landscape Character Areas / Areas falling within the Sewer Study Area include:

REF.	LANDSCAPE CHARACTER AREA	SENSITIVITY TO CHANGE
LCA42	Historic villages and environs at Shan Ha Tsuen	Medium
LCA43	Plains and isolated hills south of Yuen Long Highway	Low
LCA44	Historic villages and environs north of Shan Ha Tsuen	Low
LCA45	Mixed urban fringe landscapes adjacent to Yuen Long Highway	Low
LCA46	Historic villages and environs at Tin Lau Tsuen and Muk Kiu Tau	Medium
LCA47	Plains and isolated hills west of Kung Um Road	Low
LCA48	Mixed urban fringe landscapes west of Kung Um Road	Low
LCA49	Plains and isolated hills east of Kung Um Road	Low
LCA50	Village landscapes at Pak Sha Tsuen	Medium
LCA51	Mixed urban fringe landscapes west of Pak Sha Tsuen	Low
LCA52	Mixed urban fringe landscapes west of Kung Um Road	Low
LCA53	Lowland valley floor west of nullah	Low
LCA54	MDC landscape between Tai Tong Tsuen and Yuen Long Highway	Low
LCA55	Plains and isolated hills west of Tai Tong Road	Medium
LCA56	Historic villages and environs of Shung Ching San Tsuen, Shui Tsiu Lo Wai and Hung So Tsuen	Medium
LCA57	Mixed urban fringe landscapes east of Tai Shu Ha Road East	Low
LCA58	Village landscapes west of Tai Shu Ha Road East	Medium
LCA59	Plains and isolated hills east of Tai Shu Ha Road East	Low
LCA60	Village landscapes east of Tai Shu Ha Road East	Medium
LCA61	Plains and isolated hills at Yau Cha Po	Low

14.6 Zone of Visual Influence (ZVI)

The ZVI will vary between the construction phase and operational phase. The two ZVI's are described below.

- Construction Phase

The ZVI for the construction phase is illustrated in Figures 14.26, 14.28, 14.30 & 14.32 respectively. It will extend from the roadway and back to the first line of village housing and / or tree belts set back from the works area. The extent of the zone is therefore variable from 5 m to approx. 300 m back from the works area.

- Operational phase

The ZVI for the operational phase is illustrated in Figures 14.14.27, 14.29, 14.31 & 14.33 respectively and describes the area from which the operational works can be seen.

14.6.1 Visually Sensitive Receivers (VSRs)

Table 14.7 lists the key VSRs found within the ZVI's for the construction and operational phases. For ease of reference, each VSR is given an identity number, which is used in the Table and also in Figures 14.54 to 14.59 inclusively, and which illustrate the residual visual impacts. The VSR's and their sensitivity during construction are listed below.

Package 2A - 3T Lau Fau Shan / Mong Tseng Trunk Sewerage

i. Views

Views from the various VSR's (listed in Table 14.7) are panoramic in rural parts of the study area, with high visual amenity. Due to the variable building densities of the scattered open storage areas, village settlements and high rise residential development of the remaining areas, views of the landscape are often broken and short with moderate to low visual amenity. Views experienced by various VSR's are shown in Figures 14.19, 14.21, 14.23, 14.25 & 14.25.1 respectively.

ii. Visually Sensitive Receivers (VSRs)

VSRs within the Study Area of this part of the alignment include:

Residential VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
R1	Residents of Mong Tseng Tsuen	High
R2	Residents of Tin Shui Wai east of nullah	High
R3	Residents of Tin Wah Estate	High
R3A	Planned Residents of R(C) zone	High
R4	Residents of Ngau Hom and San Hing Tsuen	High
R5	Residents of Lau Fau Shan	High
R5A	Planned Residents of C/R zone	High

Occupational VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
I1	Agricultural workers in fields east of Mong Tseng Tsuen	Low
I2	Workers in open storage between Lau Fau Shan Road and Sha Kong Wai	Low
I3	Workers in open storage south of Lau Fau Shan Road	Low
I4	Workers in open storage east of Deep Bay Road	Low
I5	Workers in open storage west of Deep Bay Road	Low

Travelling VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
T1	Travellers on Tin Wah Road between the nullah and Lau Fau Shan Road	Medium
T2	Travellers on Lau Fau Shan Road	Medium
T3	Travellers on Deep Bay Road	Medium

Package 2A - 1T Yuen Long Sewage Effluent Pipeline

i. Views

Views from the various VSR's (listed in Table 14.7) are panoramic in rural parts of the study area, with high visual amenity. Due to the variable building densities of the scattered open storage areas, village settlements and high rise residential development of the remaining areas, views of the landscape are often broken and short with moderate to low visual amenity.

ii. Visually Sensitive Receivers (VSRs)

VSRs within the Study Area of this part of the alignment include:

Residential VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
R6	Residents of Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen north of Fuk Shun Street (including Leon and Jade Courts)	High
R7	Residents of Tai Tseng Wai and Shing Uk Tsuen south of Fuk Shun Street (including Vienna Villa and Carole Garden)	High
R8	Residents of Tin Shui Wai north of Tin Wah Road	High
R9	Residents of Tin Shui Wai south of Tin Wah Road	High

Occupational VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
I6	Workers in Yuen Long Industrial Estate	Low
I6.1	Workers in fields and ponds beside Shan Pui River	Low
I7	Agricultural workers in Ng Uk Tsuen	Low
I8	Workers in open storage west of nullah	Low
I9	Workers in open storage between Tseung Kong Wai and Fung Kong Tsuen	Low

Travelling VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
T4	Travellers on Wang Lee Street	Medium
T5	Travellers on Fuk Hi Street	Medium
T6	Travellers on Fuk Yan Street	Medium
T7	Travellers on Fuk Shun Street	Medium
T8	Travellers on Tin Wah Road	Medium
T9	Travellers on road between nullah and Ping Ha Road	Medium
T10	Travellers on Ping Ha Road	Medium

Package 2A - 2T Ngau Tam Mei / San Wai Trunk Sewerage

i. Visually Sensitive Receivers (VSRs)

VSRs within the Study Area of this part of the alignment include:

ii. Views

Views from the various VSR's (listed in Table 14.7) are panoramic in rural parts of the study area, with high visual amenity. Due to the variable building densities of the scattered open storage areas and village settlements of the remaining areas, views of the landscape are often broken and short with moderate to low visual amenity.

Residential VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
R10	Residents of Man Yuen Chuen	High
R11	Residents of Fairview Park	High
R12	Residents of Chuk Yuen Tsuen	High
R13	Residents of Yau Mei San Tsuen	High
R13A	Residents of Palms Springs and Royal Palms	High
R14	Residents of Yau Tam Mei Tsuen	High
R14A	Residents of Villa Camellia and Royal Camellia	High
R15	Residents of Yau Tam Mei San Tsuen	High
R16	Residents of Casa Paradizo	High
R17	Residents of Maple Gardens	High
R18	Residents of Mai Po San Tsuen and Mai Po Lo Wai	High
R19	Residents of San Lung Tsuen / Fan Tin Tsuen	High
R20	Residents west of Ka Lung Road	High

Occupational VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
I10	Agricultural workers in Nam Sang Wai	Low
I11	Workers in open storage west of Chuk Yuen Tsuen	Low
I12	Agricultural workers between Fairview Park and Royal palms	Low
I13	Workers in open storage on west side of Castle Peak Road between Mai Po San Tsuen and Royal Palms	Low
I14	Workers in open storage on west side of Castle Peak Road between Mai Po Lo Wai and Tsing Lung Tsuen	Low
I15	Workers in open storage between Castle Peak Road and San Tin Highway	Low
I16	Workers in open storage on Ka Lung Road	Low
I17	Workers in Casino Lines Military Camp	Low

Travelling VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
T11	Travellers on Kam Pok Road	Medium
T12	Travellers on Fairview Park Boulevard	Medium
T13	Travellers on Castle Peak Road	Medium
T14	Travellers on San Tin Highway	Medium
T15	Travellers on Kwu Tung Road	Medium
T16	Travellers on Ka Lung Road	Medium

Recreational VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
O1	Recreational Users adjacent to Fairview Park	High

Package 2B - 2T Yuen Long South Branch Sewers

i. Views

Views from the various VSR's (listed in Table 14.7) are panoramic in rural parts of the study area, with moderate to high visual amenity. Due to the variable building densities of the scattered open storage areas and village settlements of the remaining areas, views of the landscape are often broken and short with moderate to low visual amenity.

ii. Visually Sensitive Receivers (VSRs)

VSRs within the Study Area of this part of the alignment include:

Residential VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
R21	Residents of Lam Hau Tsuen	High
R22	Residents of Shan Ha Tsuen	High
R23	Residents of Tin Liu Tsuen on King Um Road East (including Sun Mei Garden and In Keep Garden)	High
R24	Residents of Muk Kiu Tau Tsuen on King Um Road East (including Chun Fat Garden)	High
R25	Residents of Pak Sha Tsuen (including Golden Villa)	High
R26	Residents of Wong Nai Tun Tsuen on King Um Road East	High
R27	Residents of Sham Chung Tsuen facing west	High
R28	Residents of Muk Kiu Tau facing east	High
R29	Residents of Shui Tsiu San Tsuen facing west (including Round Profit Garden)	High
R30	Residents of Tai Tong Tsuen	High
R31	Residents of Sham Chung Tsuen facing Tai Tong Road (including Denon Garden)	High
R32	Residents of Shung Ching San Tsuen facing Tai Tong Road	High
R33	Residents of Shui Tsiu Lo Wai facing Tai Tong Road	High
R34	Residents of Shui Tsiu San Tsuen facing Tai Tong Road (including Chun Wah Villa)	High
R35	Residents of Nam Hang Tsuen facing (including Ka Fat Garden)	High
R36	Residents of Hang Tso Tin Tsuen	High
R37	Residents of Shung Ching San Tsuen facing Tai Shu Ha Road West	High

Type. ID of VSR	Key Visual Receiver	Sensitivity
R38	Residents of Tai Kei Leng	High
R39	Residents of Tong Tau Po Tsuen	High

Occupational VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
I18	Workers in agricultural fields between Lam Hau Tsuen and Shan Ha Tsuen	Low
I19	Workers in open storage south of Yuen Long Highway and west of King Um Road	Low
I20	Workers in open storage west of King Um Road	Low
I21	Workers in open storage south east end of King Um Road	Low
I22	Workers in open storage east side of King Um Road	Low
I23	Workers in open storage west of Sham Chung Tsuen	Low
I24	Workers in open storage west of Shui Tsiu San Tsuen	Low
I25	Workers in open storage east of Tai Tong Road	Low
I26	Workers in open storage west of Tai Tong Road	Low
I27	Workers in open storage on Tai Shu Ha Road West	Low

Travelling VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
T17	Travellers on King Um Road	Medium
T18	Travellers on Tai Tong Road	Medium
T19	Travellers on Tai Shu Ha Roads East and West	Medium

Other VSRs

Type. ID of VSR	Key Visual Receiver	Sensitivity
W1	Worshippers at Tai Shu Ha Temple	High

14.7 Landscape Impact Assessment

*14.7.1 **Potential Sources of Impacts***

The proposed development would involve:

- excavation of a 6 m wide trench (a vast proportion of which will be in the carriageway), and pipe jacking method when crossing waterways;
- installation and burial of approximately 28.5 km of sewerage pipe (a small length of which is a Designated Element in Package 2A - 1T); and
- construction of 12 No.'s of pumping stations (2 of which are Designated Elements (Yuen Long Effluent Pumping Station and Ngau Tam Mei Sewage Pumping Station)).

The proposed development would create varying levels of impact on the physical landscape resources and landscape character of the surrounding areas during the construction stage. Potential impacts would result from the following:

- site clearance works involving the removal of specified existing vegetation;
- construction of site access;
- excavation works for the installation and burial of the pipe within the road carriageway, footpath, fields, tree belts and pipe jacking method when crossing waterways;
- haulage off-site of excavated materials;
- materials stockpiling;
- importation and storage of construction materials and plant;
- hazard lighting for temporary traffic management;
- the laying down of utilities, including water and power;
- construction of temporary parking and working areas;
- hoarding for protection and screening of building works; and
- construction of pumping stations.

The proposed development would create varying levels of impact on the physical landscape resources and landscape character of the surrounding areas during the operational stage. Potential impacts would result from the following:

- Pumping Stations and associated access ways where necessary.

14.7.2 Nature and Magnitude of Landscape Impacts Before Mitigation in Construction Phase

The magnitude of the impacts, before implementation of mitigation measures, on the landscape resources and landscape character areas that would occur in the construction phase are described below and tabulated in Table 14.4. All impacts are adverse unless otherwise stated.

Tree Belts / Scattered Vegetation

Few tree belts and scattered vegetation will be affected during the course of the construction works if mitigation measures described in Tables 14.2 and 14.5 are adhered to.Landscape Resource LR11A will suffer a permanent loss of 0.23ha of woodland trees (approximately 220 nos.). The trees located around the Yuen Long Sewage Works (LR13) will have a small magnitude of change with 14 of 24 trees being lost in construction phase before mitigation. Within the designated project area, there is approximately 60.7ha of tree belts or scattered vegetation resources. The proposed works will have an impact on approximately 0.7ha of this resource during construction.

Street Trees

There is the potential for the trenching to impact upon a small number of street trees. This may in some cases include disturbance of the roots themselves with machinery. However, in vast majority of cases the trench will be in the carriageway and impacts on the trees will be negligible in magnitude.

Within the designated project areas, over 400 street trees were recorded. The location of the sewage line in the road will result in none of this resource being affected.

Abandoned Meanders

Several abandoned meanders are the result of TDD MDC works (LR35A & LR46A). However, in all cases where this occurs, the trench for pipeline works will be in the service road and there will be no impacts on the meanders.

TDD MDC Mitigation Plantings

TDD mitigation plantings along the recently constructed MDC's will be in place prior to installation of the pipelines. However, in all cases where this occurs, the trench will be in the centre of the service road and impacts on the plantings will be negligible in magnitude. The design of plantings associated with the MDC is still ongoing and DSD has agreed that the design can be adjusted/fine tuned in the detailed design stage so that the YKLTSSD Works do not result in any significant impacts on TDD mitigation plantings along the MDCs after TDD landscape design is completed in the future.

Ponds

The proposed route for the sewerage lines and locations for pumping stations will not affect any ponds.

Within the designated project area there is 113ha of Ponds. None of this resource will be impacted upon during construction.

Cultivation

A small proportion of the pipeline will be installed in cultivated areas during the course of the pipeline installation works (approximately 450 m of Area A2, Package 2A - 1T, whereby the route deviates from the road and passes through approximately 100 m of fields between Fuk Shun Street, Yuen Long and Tin Wah Road, Tin Shui Wai). The affects of the works will be minimised if mitigation measures described in Tables 14.2 and 14.5 are adhered to.

Within the desiginated project areas there is 39.8ha of fields, of which 0.12ha will be impacted upon during construction.

Landscape Character Areas - LCA1 to LCA61

There would be a large magnitude of temporary impact on the landscape character of road corridors during the course of construction works. Similarly, the impact during construction of the pumping stations there would be a large magnitude of temporary impact on the landscape character of rural and village areas, and to a lesser extent, industrial and high rise residential areas.

14.7.3 Nature and Magnitude of Landscape Impacts Before Mitgation in Operation Phase

The magnitude of the impacts, before implementation of mitigation measures, on the Landscape Resources and Landscape Character Areas that will occur in the operation phase are the same as the permanent and irreversible impacts described above for the construction phase. They are tabulated in Table 14.4. All impacts are adverse unless otherwise stated.

Landscape Resources

All impacts on landscape resources will be insubstantial during the operation period with the exception of LR11A which will suffer a permanent loss of 0.23ha of woodland trees. The trees are not yet well established and will be easily compensated by the planting of 0.40ha adjacent to the proposed Yuen Long Effluent Pumping Station.

Landscape Character Areas - LCA1 to LCA61

The Landscape Character Areas would generally have insubstantial impacts during the operation phase with the exception of Mong Tseng Tsuen historic village and environs (LCA1) which would have moderate adverse impact due to the location of the substation conflicting with the historical character of the village.

14.7.4 Landscape Mitigation Measures

Recommended landscape mitigation measures for impacts caused during the construction and operational phases are described below in Tables 14.2 and 14.3, together with the associated funding, implementation and management and maintenance agencies. All measures are on-site mitigation measures and are illustrated in Figures 14.34 to 14.37.1 inclusively.

Table 14.2: Proposed construction phase landscape mitigation measures

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency
CM1	NOT USED	-	-
CM2	Topsoil (uncontaminated), where identified, should be stripped and stored for re-use in the reinstatement of topography and soft landscape, where practical.	DSD	DSD
CM3	NOT USED	-	-
CM4	NOT USED	-	-
CM5	All existing trees shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this Specification, the Contractor shall be required to submit, for approval, a detailed working methodology for the protection of trees prior to undertaking any works adjacent to all retailed trees.	DSD	DSD
CM6	NOT USED	-	-
CM7	Reinstatement of turf grass cover disturbed during excavation of turfed areas.	DSD	DSD
CM8	NOT USED	-	-
CM9	Transplantation of affected trees to holding nursery with the view to relocation within the immediate vicinity towards the completion of construction works. Approximately 33 nos of affected trees were identified as being able to be successfully transplanted.	DSD	DSD

Table 14.3: Proposed operational phase landscape mitigation measures

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM1	Tree planting to compensate for any affected trees. 211 trees of heavy standard size are proposed to be planted as compensation around the proposed pumpinsg stations	DSD	DSD	LCSD or DSD	LCSD
OM2	NOT USED	-	-	-	-
OM5	Compensatory planting of approximately 0.35ha for the loss of 0.23ha of plantation (approximately 220 trees) at YLEPS	DSD	DSD	LCSD or DSD	LCSD

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM6	Application of grass turf to the roof of YLEPS of sewage pumpng stations (0.24ha)	DSD	DSD	DSD	DSD

*Management and Maintenance Agencies are identified as per WBTC 14/2002

Note: If the management and maintenance of the landscape mitigation measures cannot be agreed with other Government Departments the landscape mitigation measures will be the responsibility of the project proponent, DSD.

Programme of Implementation of Landscape Mitigation Measures

The construction phase measures listed above should be adopted from the commencement of construction and should be in place throughout the entire construction period. The operational phase measures listed above should be adopted during the detailed design, and built as part of the construction works so that they are in place at the date of commissioning of the project. However, it should be noted that the full effect of the compensatory plantings, wherever necessary, would not be appreciated for several years.

14.7.5 ***Prediction of Significance of Landscape Impacts***

The potential significance of the landscape impacts during the construction and operational phases, before and after mitigation, are provided below in Table 14.4 and mapped in Figures 14.38 to 14.45.1 inclusively. This assessment follows the methodology outlined in Section 14.3.2 (*Assessment Methodology*) and assumes that the appropriate mitigation measures identified in Tables 14.2 and 14.3 above would be implemented.

Construction Phase Residual Impact (Landscape)

In the Construction Phase, after the implementation of the proposed mitigation measures, there will still be some adverse residual landscape impacts as described below. These residual landscape impacts in the construction phase are mapped in Figures 14.38, 14.38.1, 14.40, 14.40.1, 14.40.2, 14.42, 14.42.1, 14.42.2, 14.42.3, 14.44 & 14.44.1 respectively and suggested mitigation measures shown in Table 14.2. The following is a summary of the findings in Table 14.4 below:

- Landscape Resources - Tree Belts

After mitigation, and particularly if tree protection measures are adhered to (CM5) and the reinstatement of turf grasses (CM7), residual affects will be insubstantial with the exception of LR19. Tree Belts above Shing Uk Tseun (LR19) will suffer a a slight impact significance before mitigation due to the construction works constituting a small magnitude of change. With mitigation the impact will be reduced to insubstantial.

There will be a slight negative impact upon a small group of young woodland tree species (Melastoma candidum, Sapium sebiferum and Celtis tetandra subsp. Sinensis) on the site of the proposed Yuen Long Effluent Pumping Station (LR11A). As these are very young (only 50 mm dia), they are not a particularly sensitive resource and new planting around the periphery of the pumping station site is proposed as mitigation for them.

The trees located around the Yuen Long Sewage Works (LR13) will have a small magnitude of change during the construction phase before mitigation reducing to insubstantial after mitigation (CM5, CM9, OM1). All other Tree Belt Resources will have insubstantial impact significance before mitigation.

- Landscape Resources - Cultivation

After mitigation, and particularly if boundaries, soil and soil erosion measures are adhered to (CM2 &), residual affects will be insignificant for all Cultivation resources with the exception of Fields east of Shan Ha Tseun (LR42) which will have a small magnitude of change constituting a slight adverse impact before mitigation. With mitigation the residual impact will be insubstantial.

- Landscape Resources - Trees along Roads

After mitigation, particularly maintaining a minimum of 2 m distance between the trees and trench excavation (CM6), and proper tree protection and working methodologies are adopted (CM5), residual affects will be insubstantial for all Trees along the Road Resources.

- Landscape Resources - Abandoned Meanders

Several abandoned meanders will result from TDD MDC works (LR35A & LR46A). However, in all cases where this occurs, the trench for pipeline works will be in the service road and there will be no impacts on the meanders.

- Landscape Resources - TDD MDC Mitigation Plantings (22CD, 29CD, 113CD)

TDD mitigation plantings along recently constructed MDC's will be in place prior to installation of the pipelines. However, in all cases where this occurs, the trench will be in the centre of the service road and impacts on the plantings will be negligible in magnitude. The design of plantings associated with the MDC is ongoing and TDD has agreed that the design will be amended so that the Works do not result in any significant impacts on their plantings.

- Landscape Character - LCA1 to LCA61

The impacts upon landscape character in the construction phase will be insubstantial in all areas except the villages of Mong Tseng Tsuen (LCA1), Yuen Long Industrial Estate (LCA13), San Leung Tsuen (LCA30), MDC Landscape between Tam Mei Camp and Kam Tin River (LCA37), Shan Ha Tsuen (LCA42), Historic villages and environs at Tin Lau Tseun and Muk Kiu Tau (LCA46), and Villages Landscapes at Pak Sha Tsuen (LCA50) where residual impacts will be slight to moderate, as identified in Table 14.4. This is due to the moderate to high landscape amenityof these areas, their high sensitivity to change and the fact that in these areas, construction works will contrast unfavourably with existing rural landscape qualities. The residual landscape impacts in the construction phase are mapped in Figures 14.46, 14.48, 14.49 and 14.52 respectively.

Operational Phase Residual Impact (Landscape)

In the Operational Phase, after the implementation of the proposed mitigation measures, there will be no adverse residual landscape impacts, as identified in Table 14.4 and mapped in Figures 14.39, 14.39.1, 14.41, 14.41.1, 14.41.2, 14.43, 14.43.1, 14.43.2, 14.43.3, 14.45 & 14.45.1 respectively and suggested mitigation measures shown in Table 14.3.

- Landscape Resources - Tree Belts

  Residual significance will be largely insubstantial following mitigation if tree replacement and transplanting is adopted (OM1) and all levels and turf grasses are reinstated to existing conditions. However, even with mitigation measures in place, residual impacts for LR19 will be insubstantial due to the significant loss of trees and maturity of canopy cover.

- Landscape Resources - Trees along Roads

  If a minimum of 2 m from the centre of the trees from trench excavation is maintained and if proper tree protection and working methodologies are adopted (OM1), the residual significance will be insubstantial.

- Landscape Resources - Cultivation

  There will be no affects upon cultivated areas during the operational phase.

- Landscape Character - LCA1 to LCA61

Following implementation of the proposed mitigation measures (OM1), the impacts on landscape character after mitigation will be insubstantial in most areas except where limited opportunities for mitigation have resulted in a commensurately increased significance of impact. This is due to the fact that the only visible evidence of the works will be the pumping stations and the affects of these will be mitigated to a certain extent by plantings and finishes to the structures. However, due to their close proximity to the operation, Historic villages and environs at San Leung Tsuen (LCA30), and MDC Landscape Tam Mei Camp and Kam Tin River (LCA37) will retain a slight residual impact at Year 10. In the case of the former, the new structure will contrast with existing older buildings whilst in the latter, the size of the building will represent a significant change to the landscape. These are indicated in Table 14.4 and mapped in Figures 14.47, 14.49, 14.51 and 14.53 respectively.

Table 14.4: Significance of residual landscape impacts in construction and operational phases (adverse impacts unless otherwise stated)

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
Part 1 - Physical Landscape Resources (Topography, Vegetation, Drainage, Soil, Open Space, Special Features, etc)												
LR1	Fields in Mong Tseng Tsuen	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR2	Ponds in Mong Tseng Tsuen	2A-3T	High	High	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR3	Tree belt between road beside nullah and ponds	2A-3T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR4	Trees on nullah banks	2A-3T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LR5	Nullah	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR5A	Tree amenity Planting adjacent to Tin Wah Road	2A-1T	High	High	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR5B	Amenity planting in the medium strip in Tin Wah Road	2A-1T	Medium	Medium	Small	Small	Slight	Slight	CM2	Insubstantial	Insubstantial	Insubstantial
LR6	Street trees on Tin Wah Road	2A-3T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR7	Street trees on Lau Fau Shan Road	2A-3T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR8	Fields beside Lau Fau Shan Road	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR9	Street trees on Deep Bay Road	2A-3T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR10	Channelised waterway on Deep Bay Road	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR11	Shan Pui River (32ha)	2A-1T	Medium	Medium	Negligible (0ha loss)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR11A	Small trees on site of proposed Yuen Long Effluent Pumping Station (0.23ha(220 trees))	2A-1T	Medium	Medium	Small (loss of 0.23ha, 220 trees felled)	Small	Slight	Slight	CM5, CM9 OM1	Slight	Insubstantial	Insubstantial
LR12	Ponds north and west of to Yuen Long Sewage works (82ha)	2A-1T	High	High	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR12A	Ponds east of Shan Pui River (29ha)	2A-1T	High	High	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR13	Trees around Yuen Long Sewage works (24 trees)	2A-1T	Medium	Medium	Small (14 to be felled)	Negligible	Slight	Insubstantial	CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LR14	Channelised waterway flowing into Shan Pui River (6.8km long)	2A-1T	Low	Low	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR14A	Woodland Vegetation to the north of Tai Tseng Wai (16.4ha)	2A-1T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR15	Street trees in Yuen Long Industrial Estate (approx. 300 trees)	2A-1T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR16	Fields in Tai Tseng Wai (1.9ha)	2A-1T	Low	Low	Small (0.06ha loss)	Negligible	Slight	Insubstantial	CM2, CM7	Insubstantial	Insubstantial	Insubstantial
LR17	Fields west of Shing Uk Tsuen (4.6ha)	2A-1T	Low	Low	Small (0.04ha loss)	Negligible	Slight	Insubstantial	CM2, CM7	Insubstantial	Insubstantial	Insubstantial
LR18	Fields east of Tin Shui Wai (2.8ha)	2A-1T	Low	Low	Small (0.02ha, 10 trees)	Negligible	Slight	Insubstantial	CM2, CM7	Insubstantial	Insubstantial	Insubstantial
LR19	Tree belts above Shing Uk Tsuen (33ha)	2A-1T	Medium	Medium	Small (0.6ha, 75 trees)	Negligible	Slight	Insubstantial	CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LR19A	Amenity Planting around residential developments in Tin Shui Wai (15.8ha)	2A-1T	High	High	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR19B	Tree Belt east of Tin Shui Wai (1.8ha)	2A-1T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR19C	Tree Belt adjacent to Tin Shui Wai (1.4ha)	2A-1T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR20	Street trees on Tin Ying Road	2A-1T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR21	Pond west of Ting Ying Road	2A-1T	High	High	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR22	Street trees between Ping Ha Road and nullah	2A-1T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR23	Tree belt south west of Ping Ha Road	2A-1T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR24	Tree belts on Ka Lung Road	2A-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR25	Fields west of Ka Lung Road	2A-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR26	Street trees on Ka Lung Road	2A-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR27	Street trees on Kwu Tung Road	2A-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR28	Tree belts on Castle Peak Road	2A-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR29	Street trees on road to Fan Kam Tsuen	2A-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR30	Street trees on Castle Peak Road (approx. 50 trees)	2A-2T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR31	Street trees on San Tin Highway (approx. 200 trees)	2A-2T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR32	Ponds on Castle Peak Road (0.12ha)	2A-2T	High	High	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR33	Channelised waterways on Castle Peak Road	2A-2T	Low	Low	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR34	Fields beside Castle Peak Road	2A-2T	Low	Low	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR35	MDC under construction between Tam Mei Camp and Kam Tin River (6.9ha)	2A-2T	Low	Low	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR35A	Abandoned meanders adjacent to newly constructed MDC	2A-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR36	Ponds beside MDC under construction (0.48ha)	2A-2T	High	High	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR36A	Wooded Hillside behind Wai Tsai (3.9ha)	2A-2T	Medium	Medium	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR37	Fields beside MDC under construction (34.5ha)	2A-2T	Low	Low	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR37A	Amenity Planting associated with Palm Springs and Royal Palms (9.4ha)	2A-2T	High	High	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR38	Channelised waterway east of Fairview Park (240m in length)	2A-2T	Low	Low	Negligible (No impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR39	Channelised waterways running into MDC under construction	2A-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR40	Street Trees along Yuen Long highway	2B-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR41	Tin Tsuen Channel east of Shan Ha Tsuen	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR42	Fields east of Shan Ha Tsuen	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR43	Fields along Kung Um Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR44	Nullah along Kung Um Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR45	Street trees along Kung Um Road	2B-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR46	MDC under construction between Sham Chung Tsuen and Tai Tong Tsuen	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR46A	Abandoned meanders adjacent to newly constructed MDC	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR47	Fields along MDC under construction	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LR48	Trees along MDC under construction	2B-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR49	Fields beside Tai Tong Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR50	Street trees along Tai Tong Road	2B-2T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR51	Nullah between Tai Shu Ha Roads East & West	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LR52	Fields along Tai Shu Ha Roads East & West	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
Part 2 -Landscape Character Areas												
LCA1	Mong Tseng Tsuen historic village and environs	2A-3T	Medium	Medium	Intermediate	Intermediate	Moderate	Moderate	CM2, CM5, CM9 OM1	Slight	Slight	Insubstantial
LCA2	Fish ponds at Mong Tseng	2A-3T	High	High	Small	Negligible	Slight	Insubstantial	OM1, OM6	Insubstantial	Insubstantial	Insubstantial
LCA3	Highways and amenity landscape west of Tin Shui Wai	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA4	Shui Pui River and Ponds (61.9ha)	2A-1T	High	High-	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA5	Hill Area north of Tai Tsuen Wai (13.2ha)	2A-1T	High	High	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA6	Plains and isolated hills west of the nullah	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA7	Warehousing and factories south of Lau Fau Shan Road	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA8	Village landscapes north of Lau Fau Shan Road	2A-3T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA9	Warehousing and factories at Lau Fau Shan	2A-3T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA10	Low density mixed urban landscape at Lau Fau Shan	2A-3T	Low	Low	Negligible	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA11	Fish ponds on Deep Bay Road	2A-3T	High	High	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA12	Fish ponds north of Yuen Long Industrial Estate (88.8ha)	2A-1T	High	High	Small (1.04ha)	Small (0.5ha)	Moderate	Slight	CM2, CM5, CM9, OM1, OM6	Moderate	Insubstantial	Insubstantial
LCA13	Yuen Long Industrial Estate (66.6ha))	2A-1T	Low	Low	Small (0.9ha)	Small	Slight	Slight	CM2, CM5, CM9 OM1	Slight	Insubstantial	Insubstantial
LCA14	Historic mixed urban landscape at Tai Tsuen Wai (13ha)	2A-1T	High	High	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA15	Village landscape at Shing Uk Tsuen (11.7ha)	2A-1T	Medium	Medium	Small (0.72ha)	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA16	Fish ponds west of Shing Uk Tsuen (7.5ha)	2A-1T	High	High	Small (No Impact)	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Slight	Insubstantial	Insubstantial
LCA17	Plains and isolated hills at Wang Chau Reservoir (4.6ha)	2A-1T	Medium	Medium	Small (0.3ha)	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Slight	Insubstantial	Insubstantial
LCA18	Mixed urban fringe landscape below Wang Chau Reservoir (29ha)	2A-1T	Low	Low	Small (0.36ha)	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA19	Future development area northeast of Tin Shui Wai (27.9ha)	2A-1T	High	High	Small (0.72ha)	Negligible	Slight	Insubstantial	CM2, CM5, CM7, CM9, OM1	Insubstantial	Insubstantial	Insubstantial
LCA20	High rise housing estates at Tin Shui Wai either side of Tin Wah Road (25.4ha)	2A-1T	Low	Low	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA21	Warehousing and factories west of Tin Shui Wai	2A-1T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA22	Plains and isolated hills at Tung Tau Tsuen	2A-1T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA23	Fields, villages and MDC	2A-1T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA24	NOT USED	2A-1T	-	-	-	-	-	-	-	-	-	-
LCA25	Chu Wong Ling Hill Area	2A-1T	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA26	Open storage area to the west of Yuen Long Industrial Area	2A-1T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA27	Kai Shan Upland Area (33.3ha)	2A-1T	High	High	Small (0.6ha)	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA28	Military camps at Cassino Line	2A-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA29	Plains and isolated hills east of Ka Leung Road	2A-2T	Low	Low	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA30	Historic villages and environs at San Leung Tsuen	2A-2T	High	High	Intermediate	Small	Moderate	Moderate	CM2, CM5, CM9 OM1	Moderate	Moderate	Slight
LCA31	Fish ponds at Tsing Lung Tsuen	2A-2T	High	High	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA32	Plains and isolated hills east of Castle Peak Road	2A-2T	Low	Low	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA33	Fish ponds north of Castle Peak Road	2A-2T	High	High	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA34	Village landscape at Mai Po Lo Wai	2A-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA35	Low rise suburban housing estates at Maple Gardens (12.4ha)	2A-2T	Low	Low	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA36	Warehousing and factories east of Palm Springs (6.2ha)	2A-2T	Low	Low	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA37 (53ha)	MDC landscape between Tam Mei Camp and Kam Tin River	2A-2T	Low	Low	Small (0.2ha)	Small	Slight	Slight	CM2, CM5, CM9 OM1	Slight	Slight	Slight
LCA38 (9.6ha)	Palm Springs	2A-2T	High	High	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA39 (0.5ha)	Fairview Park	2A-2T	High	High	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA40 (15.5ha)	Chuk Yuen Tsuen Village	2A-2T	Medium	Medium	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA41 (8.2ha)	Yam Tam Mei Tsuen	2A-2T	Medium	Medium	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA41A (7.2ha)	Wai Tsai Village Area	2A-2T	Medium	Medium	Negligible (No Impact)	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA42	Historic villages and environs at Shan Ha Tsuen	2B-2T	Medium	Medium	Small	Intermediate	Slight	Insubstantial	CM2, CM5, CM9 OM1	Slight	Slight	Insubstantial
LCA43	Plains and isolated hills south of Yuen Long Highway	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA44	Historic villages and environs north of Shan Ha Tsuen	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA45	Mixed urban fringe landscapes adjacent to Yuen Long Highway	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA46	Historic villages and environs at Tin Lau Tsuen and Muk Kiu Tau	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Slight	Slight	Insubstantial
LCA47	Plains and isolated hills west of Kung Um Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA48	Mixed urban fringe landscapes west of Kung Um Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA49	Plains and isolated hills east of Kung Um Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA50	Village landscapes at Pak Sha Tsuen	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Slight	Insubstantial	Insubstantial
LCA51	Mixed urban fringe landscapes west of Pak Sha Tsuen	2B-2T	Low	Low	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA52	Mixed urban fringe landscapes west of Kung Um Road	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA53	Lowland valley floor west of nullah	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA54	MDC landscape between Tai Tong Tsuen and Yuen Long Highway	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA55	Plains and isolated hills west of Tai Tong Road	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA56	Historic villages and environs of Shung Ching San Tsuen, Shui Tsiu Lo Wai and Hung So Tsuen	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA57	Mixed urban fringe landscapes east of Tai Shu Ha Road East	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA58	Village landscapes west of Tai Shu Ha Road East	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial

Table 14.4	Landscape Resource / Landscape Character	Package	Sensitivity to Change (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial)		
ID. No.										Construction	Operation	
			Construction	Operation	Construction	Operation	Construction	Operation			DAY 1	YEAR 10
LCA59	Plains and isolated hills east of Tai Shu Ha Road East	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial
LCA60	Village landscapes east of Tai Shu Ha Road East	2B-2T	Medium	Medium	Small	Negligible	Slight	Insubstantial	CM2, CM5, CM9 OM1	Insubstantial	Insubstantial	Insubstantial
LCA61	Plains and isolated hills at Yau Cha Po	2B-2T	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	N/A	Insubstantial	Insubstantial	Insubstantial

14.8 Visual Impact Assessment

14.8.1 Potential Sources of Visual Impacts

For the construction phase, the sources of visual impacts of the project will be:

- installation and burial of approximately 28.5 km of sewerage pipe under the carriageway (except for approximately 450 m of Package A2, 2A - 1T, whereby the route deviates from the road and passes through tree belts and fields between Fuk Shun Street, Yuen Long and Tin Wah Road, Tin Shui Wai);
- presence of construction plant;
- construction of pumping stations (both designated and non-designated elements) and associated accesses, hoardings, plant, materials and stockpiling;
- stockpile materials and hoardings; and
- wherever required, construction works for trenchless construction method, which would include excavation works, plant, stockpile material and hoardings.

The extent of the above works is indicated in Figures 14.54 to 14.61 inclusively.

For the operational phase, the sources of visual impacts of the project will be:

- presence of pumping stations (both designated and non-designated elements).

14.8.2 Visual Mitigation Measures

Recommended visual mitigation measures for impacts caused during the construction and operational phases are described below in Tables 14.5 and table 14.6, together with the associated funding, implementation and management and maintenance agencies, if applicable. All measures are on-site mitigation measures and are illustrated in Figures 14.34 to 14.37 inclusively.

Table 14.5 : Proposed construction phase visual mitigation measures

ID No.	Visual Mitigation Measure	Funding Agency	Implementation Agency
CM10	Ensure requirements for stockpiles are reduced wherever possible and that stockpiles do not transgress works site boundaries.	DSD	DSD
CM11	Ensure vegetation removal at any site of trench works, directional drilling or construction of pumping station does not include unnecessary trimming or disruption of tree roots and branches of adjacent vegetation.	DSD	DSD

Table 14.6 : Proposed operational phase visual mitigation measures

ID No.	Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency*	Maintenance Agency*
OM3	Sensitive architectural design to the pumping stations and perimeter fences should be implemented to reduce their visual impact and make them compatible with the surrounding rural environment. This is to include the use of dark brown clay tiles to provide texture and pattern to building surfaces as well as helping to minimize any visual impact. This treatment is shown in Figures 14.60 to 14.63 inclusively.	DSD	DSD	DSD	EMSD
OM4	Soft landscape works around the pumping stations will include multi-layered trees and shrubs to screen and enhance. Wherever possible, they will be continuous with nearby street trees and amenity plantings.	DSD	DSD	LCSD and DSD	LCSD

Programme of Implementation of Visual Mitigation Measures

The construction phase measures listed above should be adopted from the commencement of construction and should be in place throughout the entire construction period. The operational phase measures listed above should be adopted during the detailed design, and built as part of the construction works so that they are in place at the date of commissioning of the project. However, it should be noted that the full effect of the soft landscape mitigation measures would not be appreciated for several years.

14.8.3 Prediction of Significance of Visual Impacts

An assessment of the potential significance of the visual impacts during the construction and operational phases, before and after mitigation, is briefly described below, and listed in detail in Table 14.7. This follows the methodology outlined in section 14.3.2 (*Assessment Methodology*) above and assumes that the appropriate mitigation measures identified in Table 14.5 and Table 14.6 above would be implemented

Construction Phase - Residual Visual Impacts

In the construction phase, after the implementation of the proposed mitigation measures, although the visual impacts will be reduced, there will still be some adverse residual visual impacts, as the works will still be clearly visible to the VSR's. Residual visual impacts in the construction phase are mapped in in Figures 14.54, 14.56, 14.58 & 14.60 respectively and listed below in Table 14.7.

The Residents of Mong Tseng Tsuen (R1) and San Lung Tsuen / Fan Tin Tsuen (R19) will have full views of the construction works including trenching, pipe laying, stock piling of materials, hoarding and the construction of a sewage pumping station. These features will contrast unfavourably with the rural character of the surrounding visual environment. The magnitude of impact would be large and would constitute substantial adverse impacts before mitigation. The impact significance would remain substantial adverse after the implementation of the mitigation measures due to the close proximity of the VSR to the works.

Residents of Yau Tam Mei Tsuen (R14), Yau Tam Mei San Tsuen (R15) and Shan Ha Tsuen (R22) will have partial to full views of the construction works including trenching, pipe laying, stock piling of materials, hoarding and the construction of a sewage pumping station. These features will contrast unfavourably with the rural character of the surrounding visual environment. The magnitude of impact would be small to intermediate and would constitute moderate adverse impacts before mitigation. The impact significance would reduce to slight adverse after the implementation of the mitigation measures due to distance or partial screening between the VSR and the works.

Worshippers at Tai Shu Ha Temple (W1) would have partial to full views of the construction works from a close proximity. The construction works would involve trenching, pipe laying, stock piling of materials, hoarding and the construction of sewage pumping station. These features will contrast unfavourably with the rural character of the surrounding visual environment. The magnitude of impact would be intermediate and would constitute moderate adverse impacts before mitigation. The impact significance would reduce to slight adverse only after the implementation of the mitigation measures due to the ability to partially screen the works from the VSR.

Workers in the fields and ponds beside Shan Pui River (I6.1) would have full views of the construction works from a close proximity. The VSR would have a small magnitude of impact constituting a slight adverse impact significance from the construction works of the Yuen Long Effluent Pumping Station. The Residual Impact would remain slight after mitigation due to the close proximity of the VSR to the construction works.

The remaining VSRs would all suffer slight adverse or insubstantial impacts from the construction works due to compatability of the built works with the existing visual environment; the mitigating effects of distance or intervening screening helping to block views of the works or speed at which the works will be experienced. Generally works features will contrast unfavourably with the rural character of the surrounding visual environment. With the assistance of mitigation, the majority of these impacts are further reduced to insubstantial. These include the following VSRs of Designated Projects:

- R6 - Residents of Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen north of Fuk Shun Street (including Leon and Jade Courts)
- R7 - Residents of Tai Tseng Wai and Shing Uk Tsuen south of Fuk Shun Street (including Vienna Villa and Carole Garden)
- R8 - Residents of Tin Shui Wai north of Tin Wah Road
- R9 - Residents of Tin Shui Wai south of Tin Wah Road
- I6 - Workers in Yuen Long Industrial Estate
- I7 - Agricultural workers in Ng Uk Tsuen
- I8 - Workers in open storage west of nullah
- I9 - Workers in open storage between Tseung Kong Wai and Fung Kong Tsuen
- T4 - Travellers on Wang Lee Street

- T5 - Travellers on Fuk Hi Street
- T6 - Travellers on Fuk Yan Street
- T7 - Travellers on Fuk Shun Street
- T8 - Travellers on Tin Wah Road
- T9 - Travellers on road between nullah and Ping Ha Road
- T10 - Travellers on Ping Ha Road
- R10 - Residents of Man Yuen Chuen
- R11 - Residents of Fairview Park
- R12 - Residents of Chuk Yuen Tsuen
- R13 - Residents of Yau Mei San Tsuen
- R13A - Residents of Palms Springs and Royal Palms
- R14A - Residents of Villa Camellia and Royal Camellia
- R16 - Residents of Casa Paradizo
- R17 - Residents of Maple Gardens
- I11 - Workers in open storage west of Chuk Yuen Tsuen
- I12 - Agricultural workers between Fairview Park and Royal palms
- T12 - Travellers on Fairview Park Boulevard
- T13 - Travellers on Castle Peak Road
- T14 - Travellers on San Tin Highway
- O1 - Recreational Users adjacent to Fairview Park

Operational Phase - Residual Visual Impacts

In the operational phase, after the implementation of the proposed mitigation measures, there will generally be no adverse residual visual impacts except for the Residents of Mong Tseng Tsuen (R1) and San Lung Tsuen / Fan Tin Tsuen (R19) due to their close proximity to the works. They will have partial-full views of the sewage pumping stations at Mong Tseng and San Lung Tsuen respectively and will experience a large magnitude of impact constituting a moderate adverse residual impact significance at Day 1 of operation of the sewage pumping station. In these close views, the presence of the new structure at the centre of the village will contrast slightly with the exiting rural village environment. The limited use of planting as a mitigation measure will reduce the impact significance at Day 1 and will further reduce the impact significance to slight adverse at Year 10.

The residents of Shan Ha Tsuen (R22) will have close range partial to full views of the works associated with the Shan Ha Tsuen sewage pumping station. As a result, the magnitude of impact will be small constituting a moderate adverse impact before mitigation. The Residual impact significance will reduce to slight adverse at Day 1 and insubstantial at Year 10 with the establishment of the vegetation.

All other VSRs will experience an insubstantial or slight adverse residual impact at Day 1 with all visual impacts reducing to insubstantial at Year 10 due to the compatability of the built works with the existing visual environment; ability to screen all or part of the proposed sewage pumping stations from more distant VSRs or the speed at which the works will be experienced. . Only the residents of Yau Tam Mei (15)Tsuen will have a slight adverse residual impact at Year 10 due to their proximity to the sewage pumping station at Tam Mei Camp. These include the following VSRs of the Designated Projects:

- R11 - Residents of Fairview Park
- R12 - Residents of Chuk Yuen Tsuen
- R13 - Residents of Yau Mei San Tsuen
- R13A - Residents of Palms Springs and Royal Palms
- I12 - Agricultural workers between Fairview Park and Royal palms
- T13 - Travellers on Castle Peak Road
- T14 - Travellers on San Tin Highway

Residual visual impacts in the operational phase are tabulated in Table 14.7 and mapped in Figures 14.55, 14.57, 14.59 & 14.61 respectively.

Table 14.7: Significance of visual impacts in the construction and operational phases (Note: all impacts adverse unless otherwise noted)

Table 14.7 Type ID. of VSR	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
R1	2a-3t	Residents Of Mong Tseng Tsuen	Full	20	Large	Large	High Very Few	High Very Few	Substantial	Substantial	Substantial	Moderate	Slight
R2	2a-3t	Residents Of Tin Shui Wai East Of Nullah	Partial - Full	100	Negligible	No Impact	High Very Many	High Very Many	Slight	-	Insubstantial	-	-
R3	2a-3t	Residents Of Tin Wah Estate	Glimpse	150	Negligible	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R3A	2a-3T	Planned Residents of R(C) zone	Full	20	Small	Small	High Very Few	High Very Few	Slight	Slight	Insubstantial	Insubstantial	Insubstantial
R4	2a-3t	Residents Of Ngau Hom And San Hing Tsuen	Partial - Full	30	Small	No Impact	High Very Few	High Very Few	Slight	-	Insubstantial	-	-
R5	2a-3t	Residents Of Lau Fau Shan	Partial - Full	50	Small	Negligible	High Very Few	High Very Few	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R5A	2a-3T	Planned Residents of C/R zone	Full	20	Small	No Impact	High Very Few	High Very Few	Slight	-	Insubstantial	-	-
R6	2a-1t	Residents Of Ng Uk Tsuen, Tai Tseng Wai And Shing Uk Tsuen North Of Fuk Shun Street	Partial - Full	20	Small	No Impact	High Very Few	High Very Few	Slight	-	Insubstantial	-	-
R7	2a-1t	Residents Of Tai Tseng Wai And Shing Uk Tsuen South Of Fuk Shun Street	Partial - Full	20	Small	No Impact	High Very Few	High Very Few	Slight	-	Insubstantial	-	-
R8	2a-1t	Residents Of Tin Shui Wai North Of Tin Wah Road	Partial - Full	40	Negligible	No Impact	High Very Many	High Very Many	Slight	-	Insubstantial	-	-
R9	2a-1t	Residents Of Tin Shui Wai South Of Tin Wah Road	Partial - Full	40	Negligible	No Impact	High Very Many	High Very Many	Slight	-	Insubstantial	-	-

Table 14.7	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
Type ID. of VSR					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
R10	2a-2t	Residents Of Man Yuen Chuen	Glimpse	30	Negligible	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-
R11	2a-2t	Residents Of Fairview Park	Glimpse	150	Negligible	Negligible	High Very Few	-High Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R12	2a-2t	Residents Of Chuk Yuen Tsuen	Glimpse	100	Negligible	Negligible	High Very Few	High Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R13	2a-2t	Residents Of Yau Mei San Tsuen	Partial - Full	60	Small	Negligible	High Very Few	High Very Few	Slight	Insubstantial	Slight	Insubstantial	Insubstantial
R13A	2a-2t	Residents of Palm Springs and Royal Palms	Partial-Full	400	Small	Negligible	High, Many	High, Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R14	2a-2t	Residents Of Yau Tam Mei Tsuen	Partial - Full	30	Small	Small	High Very Few	High Very Few	Moderate	Slight	Slight	Slight	Slight
R14A	2a-2t	Residents of Villa Camellia and Royal Palms	Partial - Full	120	Small	Negligible	High, Few	High, Few	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R15	2a-2t	Residents Of Yau Tam Mei San Tsuen	Partial - Full	100	Small	Small	High Very Few	High Very Few	Moderate	Slight	Slight	Slight	Slight
R16	2a-2t	Residents Of Casa Paradizo	Partial - Full	50	Small	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-
R17	2a-2t	Residents Of Maple Gardens	Partial - Full	100	Small	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-
R18	2a-2t	Residents Of Mai Po San Tsuen And Mai Po Lo Wai	Partial - Full	30	Small	No Impact	High Very Few	High Very Few	Slight	-	Insubstantial	-	-
R19	2a-2t	Residents Of San Lung Tsuen / Fan Tin Tsuen	Partial - Full	10	Large	Large	High Very Few	High Very Few	Substantial	Substantial	Substantial	Moderate	Slight

Table 14.7	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
Type ID. of VSR					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
R20	2a-2t	Residents West Of Ka Lung Road	Partial - Full	40	Small	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-
R21	2b-2t	Residents Of Lam Hau Tsuen	Partial	200	Small	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-
R22	2b-2t	Residents Of Shan Ha Tsuen	Partial - Full	10	Intermediate	Small	High Very Few	High Very Few	Moderate	Moderate	Slight	Slight	Insubstantial
R23	2b-2t	Residents Of Tin Liu Tsuen On King Um Road East	Partial - Full	40	Small	Negligible	High Few	High Few	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R24	2b-2t	Residents Of Muk Kiu Tau Tsuen On King Um Road East	Partial - Full	30	Small	Negligible	High Few	High Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R25	2b-2t	Residents Of Pak Sha Tsuen	Partial - Full	40	Small	Negligible	High Few	High Few	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R26	2b-2t	Residents Of Wong Nai Tun Tsuen On King Um Road East	Partial - Full	20	Small	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R27	2b-2t	Residents Of Sham Chung Tsuen Facing West	Partial - Full	30	Small	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-
R28	2b-2t	Residents Of Muk Kiu Tau Facing East	Partial - Full	50	Small	Negligible	High Very Few	High Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R29	2b-2t	Residents Of Shui Tsiu San Tsuen Facing West	Partial - Full	30	Small	Negligible	High Very Few	High Very Few	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R30	2b-2t	Residents Of Tai Tong Tsuen	Partial - Full	30	Small	No Impact	High Very Few	High Very Few	Insubstantial	-	Insubstantial	-	-

Table 14.7	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
Type ID. of VSR					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
R31	2b-2t	Residents Of Sham Chung Tsuen Facing Tai Tong Road	Partial - Full	30	Small	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R32	2b-2t	Residents Of Shung Ching San Tsuen Facing Tai Tong Road	Partial - Full	30	Small	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R33	2b-2t	Residents Of Shui Tsiu Lo Wai Facing Tai Tong Road	Partial - Full	30	Small	Negligible	High Few	High Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R34	2b-2t	Residents Of Shui Tsiu San Tsuen Facing Tai Tong Road	Partial - Full	30	Small	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R35	2b-2t	Residents Of Nam Hang Tsuen Facing	Partial - Full	30	Small	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R36	2b-2t	Residents Of Hang Tso Tin Tsuen	Partial - Full	30	Small	No Impact	High Few	High Few	Insubstantial	-	Insubstantial	-	-
R37	2b-2t	Residents Of Shung Ching San Tsuen Facing Tai Shu Ha Road West	Partial - Full	30	Small	Negligible	High Few	High Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R38	2b-2t	Residents Of Tai Kei Leng	Partial - Full	30	Small	Negligible	High Few	High Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
R39	2b-2t	Residents Of Tong Tau Po Tsuen	Partial - Full	30	Small	Negligible	High Few	High Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I1	2a-3t	Agricultural Workers In Fields East Of Mong Tseng Tsuen	Partial - Full	20	Small	No Impact	Low Very Few	Low Very Few	Slight	-	Insubstantial	-	-
I2	2a-3t	Workers In Open Storage Between Lau Fau Shan Road And Sha Kong Wai	Glimpse	40	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-

Table 14.7 Type ID. of VSR	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
I3	2a-3t	Workers In Open Storage South Of Lau Fau Shan Road	Glimpse	40	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I4	2a-3t	Workers In Open Storage East Of Deep Bay Road	Glimpse	30	Negligible	Negligible	Low Very Few	Low Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I5	2a-3t	Workers In Open Storage West Of Deep Bay Road	Glimpse	10	Small	Small	Low Very Few	Low Very Few	Slight	Slight	Insubstantial	Insubstantial	Insubstantial
I6	2a-1t	Workers In Yuen Long Industrial Estate	Partial	20	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I6.1	2a-1t	Workers In Fields And Ponds Beside Shan Pui River	Full	20	Small	Small	Low, very few	Low, Very Few	Slight	Slight	Slight	Slight	Insubstantial
I7	2a-1t	Agricultural Workers In Ng Uk Tsuen	Partial	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I8	2a-1t	Workers In Open Storage West Of Nullah	Glimpse	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I9	2a-1t	Workers In Open Storage Between Tseung Kong Wai And Fung Kong Tsuen	Glimpse	10	Negligible	No Impact	Low Few	Low Few	Insubstantial	-	Insubstantial	-	-
I10	2a-2t	Agricultural Workers In Nam Sang Wai	Glimpse	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I11	2a-2t	Workers In Open Storage West Of Chuk Yuen Tsuen	Partial - Full	20	Negligible	No Impact	Low Few	Low Few	Insubstantial	-	Insubstantial	-	-
I12	2a-2t	Agricultural Workers Between Fairview Park And Royal Palms	Partial - Full	20	Negligible	Negligible	Low Very Few	Low Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial

Table 14.7 Type ID. of VSR	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
I13	2a-2t	Workers In Open Storage On West Side Of Castle Peak Road Between Mai Po San Tsuen And Royal Palms	Partial - Full	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I14	2a-2t	Workers In Open Storage On West Side Of Castle Peak Road Between Mai Po Lo Wai And Tsing Lung Tsuen	Partial - Full	30	Negligible	Negligible	Low Very Few	Low Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I15	2a-2t	Workers In Open Storage Between Castle Peak Road And San Tin Highway	Partial - Full	30	Negligible	Negligible	Low Very Few	Low Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I16	2a-2t	Workers In Open Storage On Ka Lung Road	Partial - Full	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I17	2a-2t	Workers In Casino Lines Military Camp	Partial - Full	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I18	2b-2t	Workers In Agricultural Fields Between Lam Hau Tsuen And Shan Ha Tsuen	Full	10	Small	No Impact	Low Very Few	Low Very Few	Slight	-	Insubstantial	-	-
I19	2b-2t	Workers In Open Storage South Of Yuen Long Highway And West Of King Um Road	Partial - Full	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I20	2b-2t	Workers In Open Storage West Of King Um Road	Partial - Full	30	Negligible	Negligible	Low Few	Low Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I21	2b-2t	Workers In Open Storage South East End Of King Um Road	Partial - Full	30	Negligible	No Impact	Low Few	Low Few	Insubstantial	-	Insubstantial	-	-
I22	2b-2t	Workers In Open Storage East Side Of King Um Road	Partial - Full	30	Negligible	Negligible	Low Very Few	Low Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial

Table 14.7	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
Type ID. of VSR					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
I23	2b-2t	Workers In Open Storage West Of Sham Chung Tsuen	Partial - Full	30	Negligible	No Impact	Low Very Few	Low Very Few	Insubstantial	-	Insubstantial	-	-
I24	2b-2t	Workers In Open Storage West Of Shui Tsiu San Tsuen	Partial - Full	30	Negligible	Negligible	Low Very Few	Low Very Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I25	2b-2t	Workers In Open Storage East Of Tai Tong Road	Partial - Full	30	Negligible	Negligible	Low Few	Low Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I26	2b-2t	Workers In Open Storage West Of Tai Tong Road	Partial - Full	30	Negligible	Negligible	Low Few	Low Few	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
I27	2b-2t	Workers In Open Storage On Tai Shu Ha Road West	Partial - Full	30	Negligible	No Impact	Low Few	Low Few	Insubstantial	-	Insubstantial	-	-
T1	2a-3t	Travellers On Tin Wah Road Between The Nullah And Lau Fau Shan Road	Full	5	Small	No Impact	Medium Many	Medium Many	Slight	-	Insubstantial	-	-
T2	2a-3t	Travellers On Lau Fau Shan Road	Full	5	Small	No Impact	Medium Many	Medium Many	Slight	-	Insubstantial	-	-
T3	2a-3t	Travellers On Deep Bay Road	Full	5	Small	Negligible	Medium Many	Medium Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
T4	2a-1t	Travellers On Wang Lee Street	Full	5	Small	No Impact	Medium Few	Medium Few	Insubstantial	-	Insubstantial	-	-
T5	2a-1t	Travellers On Fuk Hi Street	Full	5	Small	No Impact	Medium Few	Medium Few	Slight	-	Insubstantial	-	-
T6	2a-1t	Travellers On Fuk Yan Street	Full	5	Small	No Impact	Medium Few	Medium Few	Slight	-	Insubstantial	-	-

Table 14.7	Package	Key Visually Sensitive Receiver (VSR)	Degree of Visibility (Full, partial, glimpse)	Minimum Distance Between VSR and Source(s) of Impact (M)	Magnitude of Impact (Negligible, Small, Intermediate, Large)		Receptor Sensitivity & Number (Low, Medium, High) (Very Few, Few, Many, Very Many)		Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Day 1 after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance 10 years after Mitigation Measures (Insubstantial, Slight, Moderate, Substantial)
Type ID. of VSR					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
T7	2a-1t	Travellers On Fuk Shun Street	Full	5	Small	No Impact	Medium Few	Medium Few	Slight	-	Insubstantial	-	-
T8	2a-1t	Travellers On Tin Wah Road	Full	5	Small	No Impact	Medium Few	Medium Few	Slight	-	Insubstantial	-	-
T9	2a-1t	Travellers On Road Between Nullah And Ping Ha Road	Full	5	Small	No Impact	Medium Few	Medium, Few	Slight	-	Insubstantial	-	-
T10	2a-1t	Travellers On Ping Ha Road	Full	5	Small	No Impact	Medium Few	Medium Many	Slight	-	Insubstantial	-	-
T11	2a-2t	Travellers On Kam Pok Road	Full	5	Small	No Impact	Medium Few	Medium Many	Slight	-	Insubstantial	-	-
T12	2a-2t	Travellers On Fairview Park Boulevard	Full	5	Small	No Impact	Medium Few	Medium Many	Slight	-	Insubstantial	-	-
T13	2a-2t	Travellers On Castle Peak Road	Full	5	Small	Negligible	Medium Many	Medium Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
T14	2a-2t	Travellers On San Tin Highway	Glimpse	5	Small	Negligible	Medium Many	Medium Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
T15	2a-2t	Travellers On Kwu Tung Road	Full	5	Small	No Impact	Medium Few	Medium Few	Slight	-	Insubstantial	-	-
T16	2a-2t	Travellers On Ka Lung Road	Full	5	Small	No Impact	Medium Few	Medium Few	Slight	-	Insubstantial	-	-
T17	2b-2t	Travellers On King Um Road	Full	5	Small	Negligible	Medium Many	Medium Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial

Table 14.7	**Package**	**Key Visually Sensitive Receiver (VSR)**	**Degree of Visibility** (Full, partial, glimpse)	**Minimum Distance Between VSR and Source(s) of Impact (M)**	**Magnitude of Impact** (Negligible, Small, Intermediate, Large)		**Receptor Sensitivity & Number** (Low, Medium, High) (Very Few, Few, Many, Very Many)		**Impact Significance before Mitigation Measures** (Insubstantial, Slight, Moderate, Substantial)		**Residual Impact Significance Day 1 after Mitigation Measures** (Insubstantial, Slight, Moderate, Substantial)		**Residual Impact Significance 10 years after Mitigation Measures** (Insubstantial, Slight, Moderate, Substantial)
Type ID. of VSR					Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Operation
T18	2b-2t	Travellers On Tai Tong Road	Full	5	Small	Negligible	Medium Many	Medium Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
T19	2b-2t	Travellers On Tai Shu Ha Roads East And West	Full	5	Small	Negligible	Medium Many	Medium Many	Slight	Insubstantial	Insubstantial	Insubstantial	Insubstantial
W1	2b-2t	Worshippers At Tai Shu Ha Temple	Partial - Full	20	Intermediate	Small	Medium Few	Medium Few	Moderate	Slight	Slight	Slight	Insubstantial
O1	2a-2t	Recreational Users adjacent to Fairview Park	Partial - Full	75	Small	No Impact	High Very Few	High, very few	Slight	-	Insubstantial	-	-

14.9 Summary

14.9.1 Summary of Landscape and Visual Mitigation Measures

Construction Phase mitigation measures shall include the following mitigation measures (note: In all cases, the proposed mitigation measures for designated and non-designated elements will be the same):

- Regular checks should be carried out to ensure that the work site boundaries are not transgressed, hoardings are properly maintained and that no damage is being caused to the surrounding areas.
- Topsoil (uncontaminated), where identified, should be stripped and stored for re-use in the reinstatement of topography and soft landscape, where practical.
- The potential for soil erosion should be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (e.g. plastic sheeting or a grass cover established by hydroseeding) over newly exposed soil.
- Waste disposal and cleansing of equipment should be strictly controlled on site to prevent ground contamination.
- All existing trees shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this Specification, the Contractor shall be required to submit, for approval, a detailed working methodology for the protection of trees prior to undertaking any works adjacent to all retailed trees.
- Trench excavation for pipe laying to be located a minimum of 2 m from the nearest part of roadside tree trunks.
- Reinstatement of turf grass cover disturbed during excavation for installation of pipeline under the waterway.
- Reduce construction time to a minimum.
- Transplantation of affected trees to holding nursery with the view to relocation within the immediate vicinity towards the completion of construction works.
- Ensure requirements for stockpiles are reduced wherever possible and that stockpiles do not transgress works site boundaries.
- Ensure vegetation removal at any site of trench works, directional drilling or construction of pumping station does not include unnecessary trimming or disruption of tree roots and branches of adjacent vegetation.of adjacent vegetation.

Operational Phase measures shall include the following mitigation measures (note: In all cases, the proposed mitigation measures for designated and non-designated elements will be the same):

- Tree planting to compensate for any affected trees.
- Turfing/grassing of the roof of the YLEPS (Figure 14.67).
- Pumping Stations located so as to avoid sensitive landscape features as far as practicable.
- Pumping stations should be designed so as to complement the surrounding rural environment. In particular, a clay brick tile should be used as a building finish to reduce visual impact of the structures. This treatment is shown in Figures 14.62 to 14.66 inclusively.
- Soft landscape works around the pumping stations will include multi-layered trees and shrubs to screen and enhance the structures. Wherever possible, they will be continuous with nearby street trees and amenity plantings.

Mitigation measures for designated elements are shown in Figure 14.35 and 14.63 - Yuen Long Pumping Station.

14.9.2 Summary of Predicted Landscape and Visual Impacts

Construction Phase

Residual landscape impacts in the construction phase are listed in Table 14.4 and mapped in Figure 14.38, 14.38.1, 14.40, 14.40.1, 14.40.2, 14.40.3, 14.42, 14.42.1, 14.42.2, 14.42.3, 14.44 & 14.44.1 respectively. Residual visual impacts in the construction phase are listed in Table 14.7 and mapped in Figures 14.54, 14.56, 14.58 and 14.60 respectively.

Non-Designated Elements

The potentially most significant landscape impacts of Non-Designated Elements during the construction phase would be caused by construction works associated with pumping stations, trenching works outside of the carriageway (between Shing Uk Tsuen and Tin Wah Road and between the Tin Tsuen Channel and Shan Ha Tsuen Pumping Station), works associated with any directional drilling works (should they be necessary). The only Landscape Resource on which there is likely to be a potential impact is roadside trees at various locations along the alignments and SPSs. However, the residual impacts for Landscape Resources will all be insubstantial after mitigation.

The residual impacts of Non-Designated elements upon landscape character in the construction phase will be insubstantial in all areas except the villages of Mong Tseng Tsuen (LCA1), Yuen Long Industrial Estate (LCA13), San Leung Tsuen (LCA30), Shan Ha Tsuen (LCA42), Historic villages and environs at Tin Lau Tseun and Muk Kiu Tau (LCA46), and Villages Landscapes at Pak Sha Tsuen (LCA50) where a slight to moderate residual adverse impact will be experienced. This is due to the moderate to high landscape amenity of these areas, their high sensitivity to change and the fact that in these areas, construction works will contrast unfavourably with existing rural landscape qualities.

The Residents of Mong Tseng Tsuen (R1) and San Lung Tsuen / Fan Tin Tsuen (R19) will have full views of the construction works including trenching, pipe laying, stock piling of materials, hoarding and the construction of a sewage pumping station. These features will contrast unfavourably with the rural character of the surrounding visual environment and residual impacts willremain substantial adverse after the implementation of the mitigation measures due to the close proximity of the VSR to the works.

Residents of Yau Tam Mei Tsuen (R14), Yau Tam Mei San Tsuen (R15), Shan Ha Tsuen (R22) and worshippers at Tai Shu Ha Temple (W1) will have partial to full views of the construction works including trenching, pipe laying, stock piling of materials, hoarding and the construction of a sewage pumping station. The impact significance would reduce to slight adverse after the implementation of the mitigation measures due to distance or partial screening between the VSR and the works.

Designated Elements

The residual impacts of Designated Elements on Landscape Resources will all be insubstantial after mitigation with the exception of LR11A which will have a slight adverse impact. LR11A is a small group of young woodland tree species (Melastoma candidum, Sapium sebiferum and Celtis tetandra subsp. Sinensis) on the site of the proposed Yuen Long Effluent Pumping Station (LR11A). As these are very young (only 50 mm dia), they are not a particularly sensitive resource and new planting across the river is proposed as mitigation for them.

The residual impacts of Designated Elements upon landscape character in the construction phase will be insubstantial in all areas except the area of MDC Landscape between Tam Mei Camp and Kam Tin River (LCA37) where a slight residual adverse impact will be experienced. This is due to the moderate to high landscape amenity of these areas, their high sensitivity to change and the fact that in these areas, construction works will contrast unfavourably with existing rural landscape qualities.

All residual visual residual impacts resulting from the Designated Elements during construction will be insubstantial with the exception of the Workers in Fields and Ponds beside Shan Pui River (I6.1) which will experience a slight adverse impact as a result of the construction works associated with YLEPS.

Operational Phase

Residual landscape impacts in the operational phase are listed in Table 14.4 and mapped in Figures 14.39, 14.39.1, 14.41, 14.41.1, 14.41.2, 14.43, 14.43.1, 14.43.2, 14.43.3, 14.45 & 14.45.1 respectively. Residual visual impacts in the operational phase are listed in Table 14.7 and mapped in Figures 14.55, 14.57, 14.59 & 14.61 respectively. The impacts would be the same for designated and non-designated elements.

i. Non Designated Elements

Residual Impacts from Non-Designated Elements on Landscape Resources at Year 10 after mitigation would be insubstantial in all cases.

The potentially most significant Landscape Character impacts during the operation phase which result from Non-Designated Elements would be from the presence of the pumping station structures. No impacts would result from the trenching works during the operation phaseresulting in insubstantial residual impacts during the operation phase at Year 10. The only exceptions would be the Landscape Character Areas of San Leung Tsuen (LCA30) and the MDC landscape between Tam Mei Camp and Kam Tin River (LCA37) where the pumping stations would have a slight, but permanent, impact on the character of the village and MDC channel.

In the operational phase, after the implementation of the proposed mitigation measures, there will generally be no adverse residual visual impacts resulting from Non-Designated Elements except for the Residents of Mong Tseng Tsuen (R1), Yau Tam Mei Tsuen (R14), Yau Tam Mei San Tsuen (R15), and San Lung Tsuen / Fan Tin Tsuen (R19) who will experience impacts due to their close proximity to the works. In these close views, the presence of the new structure at the centre of the village will contrast slightly with the exiting rural village environment. The limited use of planting as a mitigation measure will reduce the impact significance at Day 1 and will further reduce the impact significance to slight adverse at Year 10.

ii. Designated Elements

Residual Impacts on from Designated Elements on Landscape Resources at Year 10 after mitigation would be insubstantial in all cases.

Residual impacts from Designated Elements on landscape character areas during the operational phase would be caused by the Ngau Tam Mei Sewage Pumping Station. With mitigation plantings associated with the pumping station structure, the residual impacts will be slight. Architectural design sympathetic to the rural environment should be used to reduce any visual impact. Any landscape character residual impacts resulting from the Yuen Long Effluent Pumping Station Package 2A-1T would be insubstantial at Year 10.

Any visual residual impacts from Designated Elements will be insubstantial at Year 10.

15.0 CULTUAL HERITAGE ASSESSMENT

15.1 Legislation and Standards

The following two Ordinances are the main tools for the protection of Cultural Heritage in Hong Kong:

15.1.1 ***Antiquities and Monuments Ordinance***

The Antiquities and Monuments Ordinance (Cap. 53) was enacted in 1976 and provides the statutory framework to provide for the preservation of objects of historical, archaeological and palaeontological interest.

The Ordinance contains the statutory procedures for the Declaration of Monuments. The proposed monument can be any place, building, site or structure, which is considered to be of public interest by reason of its historical, archaeological or palaeontological significance.

Under section 6 and subject to subsection (4) of the Ordinance, the following acts are prohibited in relation to certain monuments, except under permit;

- To excavate, carry on building works, plant or fell trees or deposit earth or refuse on or in a proposed monument or monument;
- To demolish, remove, obstruct, deface or interfere with a proposed monument or monument.

The discovery of an Antiquity, as defined in the Ordinance must be reported to the Authority, or a designated person. The Ordinance also provides that, the ownership of every relic discovered in Hong Kong after the commencement of this ordinance shall vest in the Government from the moment of discovery. The Authority on behalf of the government may disclaim ownership of the relic.

No archaeological excavation may be carried out by any person, other than the Authority, without a licence issued by the Authority. A licence will only be issued if the Authority is satisfied that the applicant has sufficient scientific training or experience to enable him to carry out the excavation and search satisfactorily, has sufficient staff and financial support.

15.1.2 ***Environmental Impact Assessment Ordinance***

The Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) provides additional legislative protection to sites of cultural heritage, which are threatened by development and the Environmental Protection Department is its authority. The Technical Memorandum contains the guidelines and criteria for the assessment of sites of cultural heritage interest.

The CHIA will follow the Antiquities and Monuments Office *Criteria for Cultural Heritage Impact Assessment* and will fulfill the requirements as set out in Annex 10 and 19 of the Technical Memorandum on EIA Process (EIA Ordinance, Cap. 499, S.16).

15.2 Existing/Baseline Condition

15.2.1 ***Existing development***

Many sections of the alignments are situated on existing roads and or/ existing or drainage channels currently under construction. The majority of the alignments are located outside the boundaries of the villages within the study area. The exception to this is the alignment located in Fan Tin Tsuen, San Tin. The majority of proposed pumping station sites are located on abandoned plots of land outside of the villages.

The specific existing impacts for each alignment will be given separately:

(a) Lau Fau San to Mong Tseng Tsuen;

- Lau Fau San Road
- Tin Wah Road
- Nullah running perpendicularly to Tin Wah Road

(b) San Tin to Ngau Tam Mei;

- Ka Lung Road (near Cassino Camp)
- Kwu Tung Road

- Village paths in San Tin
- Castle Peak Road (San Tin and Mai Po)
- Drainage channel access road between Yau Tam Mei and Nam Sang Wai
- Reclamations of former pond/marsh areas

Yuen Long South (Shap Pat Heung):

- Shan Ha Tsuen - Tin Tsuen drainage channel
- Kung Um Road - Nullah along Kung Um Road
- Sham Chung drainage channel (west of Tai Tong Road) -Nullah and access road
- Tai Tong Road (northern section) -Tai Tong Road
- Tai Shu Ha Road East - Nullah and road

Yuen Long Effluent Pipeline;

- Fuk Shun Street (Fung Lok Wai)
- Tin Wah Road (Tin Shui Wai)

*15.2.2 **Historical Background of the Study Area***

Declared Monuments

The following Declared Monuments were identified in the Study Area;
Man Lun Fung Ancestral Hall (San Tin)

Graded Buildings

The following Graded buildings have been identified in the Study Area;
Ming Yuen Tong (San Tin) Grade II
Shun Yue Tong (San Tin) Grade I
San Yeh Man Tong (San Tin) Grade II

Historical Villages

Lau Fau Shan Road/ Mong Tseng Tsuen
The history of the Lau Fau San area can be traced back many centuries, as a centre of oyster cultivation (Morton 1983). The village today consists of a mixture of commercial/ market and domestic structures, many dating to the 1960's and 70's. No resources were recorded in the survey in Lau Fau Shan. Three villages in the study area were found to contain heritage resources, San Hing Wai, Chung Yuen and Mong Tseng Tsuen.

San Hing Tsuen
The village of San Hing Wai was settled by members of the Wong clan over 100 years ago. The villagers originally subsisted through the growing of vegetables and rice.

Chung Yuen
The settlement is associated with Sha Kong Wai and was settled by members of the Mok clan during the 19th century. The villagers originally grew rice and vegetables to support themselves.

Mong Tseng Tsuen
The village of Mong Tseng Tsuen is over two hundred years old. The families associated with it are the Cheng (from Yuen Long) and the Tang, Wong and Lee clans from the neighbouring village of Mong Tseng Wai. All of the villagers originally came from Po On. The villagers grew rice, sweet potatoes and peanuts. They also engaged in fishing. The small well at the edge of the village was abandoned a decade ago.

San Tin/ Mai Po
A number of historical villages were located along this alignment. The majority of them were located in San Tin.

San Tin
San Tin was originally settled by members of the Man clan during the 14th and 15th centuries. The area was originally considered marginal because of its marshy nature, but later became a rich agricultural area. San Tin consists of a cluster of villages, centred around Fan Tin Tsuen. The aerial photographs from this area, dating from 2001 (GEO CN30028), show that whilst there are still a number of ponds in the vicinity of the villages, a lot of former agricultural areas have been taken over by light industrial operations, see Figure 15.1.

Mai Po Tsuen
Mai Po Tsuen is a small village situated between Castle Peak Road and ponds. The Wong clan is the predominant clan of the village, whose members arrived in the area several hundred years ago, according to local informants. Their ancestral hall "Hin Hing Tong" (AAHB-230) is a modern building. The other clans associated with the village are the, Man, Fung and Chan. These clans share the same gods hall (AAHB-236). All of the settlers came to the area from Guangdong and were Punti. The villagers originally supported themselves through fishing and rice farming.

Shap Pat Heung
Thirteen historical villages were located along five alignments in this study area. The alignments were all essentially isolated rural settlements until fairly recent development. This process can be seen in two aerial photographs of the Shap Pat Heung area, dating from 1963 (GEO Y09481), 2002 (GEO CW41000), figures 15.2 and 15.3, respectively. Several villages in the photographs, e.g. Shui Tsui Lo Wai, Tin Liu Tsuen and Muk Kui Tsuen can also be seen to have contained traditional fung shui features, such as ponds and woods, none of which have survived. The aerial photographs also show that even as late as 1963, the land not occupied by buildings was agricultural in nature. The 2002 photograph shows former fields either overgrown or occupied by new structures.

Shan Ha Tsuen
The village of Shan Ha Tsuen was settled by members of the Cheung clan, of Punti origin from Guangdong, approximately 400 years ago. The village was given the name Shan Ha Tsuen, because that was the name of the village in Guangdong from which the settlers originated. The village originally had a moat and fish pond in front of it, both of which were filled in approximately 15 to 20 years ago. The village well, which has been preserved, has been out of use since 1979. The village also previously had a fung shui wood, which was cut down for road construction 15 years ago. There are two cannons placed at the front of the village, which local informants said were used for protection against thieves and the Japanese during the Second World War.

Tin Liu Tsuen
The village of Tin Liu Tsuen is a mixed surname Punti village whose inhabitants came to the area approximately 100 years ago. The inhabitants were members of the Wu, Wong, Yip and Sit clans. The villagers supported themselves through rice and vegetable farming.

Pak Sha Tsuen
Pak Sha Tsuen is a mixed surname village, whose original inhabitants were of Punti origin from Guangdong. The villagers originally grew vegetables and rice.

Muk Kui Tau Tsuen
The village of Muk Kiu Tsuen ('head of wooden bridge') was named after a wooden bridge that used to be situated in front of the village. The village was settled by members of the Wu and Chan clans, Punti from Guangdong.

Tai Tong Tsuen
Tai Tong Tsuen was settled by members of the Lee and Leung clans, of Punti origins. The villagers originally supported themselves through growing rice and vegetables, for subsistence as well as for sale at the market in Yuen long.

Wong Nai Tun Tsuen
This village has been occupied by members of the Ho, Yu and Lai families for five generations. The settlers were originally from Po On province and were of Hakka background. The villagers maintained a similar

lifestyle to those of their neighbours in Tai Tong Tsuen, engaging in rice and vegetable cultivation. Collection of wood from the nearby hills was also undertaken by inhabitants of both of these villages.

Shui Tsiu San Tsuen
Shui Tsiu San Tsuen is a multi-clan village. The first arrivals were two families of the Wong clan, of Hakka origin. These were the original two houses in the settlement. Later, members of the Lam clan from Fujian arrived and after them, members of the Ching and Yeung and finally, the Cheung. The latter three groups moved here from Shui Tsui Lo Wai. The village originally had a fung shui wood which was cut down to make room for new houses. The villagers supported themselves through farming.

Sham Chung Tsuen
Sham Chung Tsuen is a Punti village. It was originally settled by members of the Chan clan, later members of the Kwan, Lam and Yip clans moved there. The villagers originally grew rice as a subsistence crop. The villagers also grew vegetables, which they sold at the Yuen Long market.

Shui Tsui Lo Wai
Shui Tsui Lo Wai is a multi-clan Hakka village. The clans associated with it are Kan, Cheung, Chan,Tse, Yeung and Lam. The villagers originally grew vegetables and sweet potatoes which were taken to Hong Kong Island and Yau Ma Tai for sale.

Hung Tso Tin
Hung Tso Tin was established by a father and son, named, Kan from Shui Tsui Lo Wai. They were Hakka. The village was named 'Red Date Field Image' by a fung shui master. The villagers originally grew vegetables for their own consumption as well as sale at Yuen Long market.

Cheng Chu Wai
Cheng Chu Wai was settled by members of the Chan and Tse clans. The village name means green brick village.

Nam Hang Tsuen
Nam Hang Tsuen was settled by members of the Cheung clan from the nearby village of Shui Tsui Lo Wai. This settlement dates almost as far back as Shui Tsui Lo Wai. The villagers supported themselves through rice and vegetable farming. The crops were eaten by the villagers and sold at Yuen Long market.

Tong Tau Po Tsuen
Tong Tau Po Tsuen was settled by members of the Cheung clan from Guangdong, who were Punti. The villagers originally grew rice which was sold at Yuen long market, but the practice was stopped approximately 20 years ago.

Fung Lok Wai
There are three villages located in this area, Tai Tseng Wai, Ng Uk Tsuen and Shing Ka Tsuen. Modern aerial photographs show the area around the villages to be built up.

Tai Tseng Wai
The village of Tai Tseng Wai was settled approximately 500 years ago. There are five surnames associated with the village; Cheng, Leung, Shing, Lam and Tang. All of the families came from Tai Peng, Tung Kwun in Guangdong. The Leung and Cheng families arrived first. The Shing, Lam and Tang arrived about 300 years ago. The people here supported themselves through fishing and farming in the area. Farming was abandoned approximately 20 years ago.

Shing Uk Tsuen
The village of Shing Uk Tsuen was settled approximately 400 years ago. It is a single family surname village, i.e. Shing. The families came from Guangdong province. The area behind the village was used to grow crops such as sweet potatoes and peanuts. Many of the men from the villages, traditionally worked abroad.

Ng Uk Tsuen
The village of Ng Uk Tsuen is a single surname village, Ng. The 1st generation ancestor was called Ng Hung Lan, who came from Nam Tau. The current generation is the 29th. The Ng family of Ng Uk Tsuen is related to the Shing family of Shing Uk Tsuen by marriage. The villagers supported themselves through farming rice, in rented fields and through fishing and catching crabs in Deep Bay.

15.2.3 ***Geological and topographical background***

Lau Fau San/ Mong Tseng Trunk Sewage

The pumping station and alignments run on Pleistocene terraced and Holocene alluvium in Mong Tseng. The main geology is schistose fine to medium granite. Pleistocene terraced alluvium extends to Lau Fau San where the main geology is fine to medium granite.

Yuen Long Effluent Pipe

The proposed alignment starts at the proposed Yuen Long Sewage Treatment Works Pumping Station, which is situated on 1980's reclamation. The alignment then proceeds on Pleistocene terraced alluvium and debris flow deposits. The lower hill slopes of Wang Chau consist of metasiltstone and phylite with metasandstone. The alignment will then continue on the reclaimed marine muds of Tin Shui Wai. North of Tung Tau the alignment will impact on Pleistocene terraced alluvium. The last stretch to the San Wai Sewage Treatment Works Upgrading runs on Pleistocene debris flow deposits and two outcrops of adasite with tuffs and tuffites connected to block bearing tuff and tuffites.

Ngau Tam Mei/ San Tin Trunk Sewerage

The alignment starts on marine muds and continues on to reclaimed land. Where the alignment meets Castle Peak Road, the geology comprises estuarine deposits. The alignment branch, which extends to the east into the Ngau Tam Mei area is located on Holocene alluvium. The alignment, which goes to the north and follows Castle Peak road, is situated on both estuarine deposits and Holocene alluvium. Near the Mai Po archaeological site, the alignment runs on filled land. The remainder of the alignment, i.e. both sections running north and south near San Tin are situated on a mix of solid geology of coarse ash crystal tuffs and Pleistocene debris flow deposits.

Yuen Long South Branch Sewer

The sewer alignments and proposed pumping station locations are located on Pleistocene terraces and Holocene alluvium.

15.2.4 ***Landform Background of the Study Area***

As informed by DSD/SP, there is no existing sewer in the existing site. The design of the gravity sewers and rising mains have been located away from the existing DSD's stormwater drains, nullah and box culverts. Therefore, there will be no impact on the existing DSD's facilities.

The following major impacts to the original landforms occur in the Study Areas:
- Ponds;
- Utilities;
- Road cutting; and
- Nullah.

The following tables show the types of impacts, which can be found for each works area:

Lau Fau San/ Mong Tseng Trunk Sewage

Mong Tseng Tsuen PS	Extent and nature of impacts
General description	5.5m PD, open area in front of rural village; Pleistocene terraced alluvium
Water Supplies Department	No impacts
CLP Power	CLP alignment within the proposed pumping station area
PCCW	telephone cable runs along southern edge of proposed pumping station
Towngas	No impacts

Sewer alignment from Mong Tseng to Lau Fau Shan Road	Extent and nature of impacts
General description	on a track along ponds and continuing along the nullah and crossing over an area of former ponds (geology map) to the Tin Wah Road
WSD	water mains are located along the nullah
CLP Power	CLP alignment impacts partly on track and partly on the area of former ponds
PCCW	telephone cable follows the track and crosses the areas of former ponds
Towngas	pipe crosses the former pond area

Sewer alignment along Lau Fau Shan Road	Extent and nature of impacts
General description	on Lau Fau Shan Road
WSD	water mains are located on both sides of the Lau Fau Shan Road and Deep Bay Road leading to the Lau Fau Shan PS
CLP Power	CLP alignment runs along both sides of the Lau Fau Shan Road and on the western edge of Deep Bay Road
PCCW	telephone cable runs along both sides of the Lau Fau Shan Road and on the western edge of Deep Bay Road
Towngas	gas pipe runs along the northern edge of Lau Fau Shan Road

Lau Fau Shan PS	Extent and nature of impacts
General description	5.3m PD; in open space area to west of Deep Bay Road, western half shows artificially cutting (CLP map); border of Pleistocene terraced alluvium and marine sediments
WSD	water mains cross the proposed pumping station on its eastern half
CLP Power	CLP alignment crosses on the western edge of Deep Bay Road
PCCW	telephone cable crosses on the western edge of Deep Bay Road
Towngas	no impacts

Yuen Long Effluent Pipe

YLEPS	Areas of impacts
general description	1982 Reclamation
Water Supplies Department	no impacts
CLP Power	no impacts
PCCW	no impacts
Hutchison Global Crossing	no impacts

Sewer alignment from YLEPS to Wang Chau	Areas of impacts
general description	3.5 to 5.4m PD.; Sewer alignment runs firstly on reclamation after which it follows the road between the historic villages of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen; Pleistocene terraced alluvium and debris flow deposits
WSD	water mains follow the road
CLP Power	no impacts
PCCW	impacts on most parts of the road
Hutchison Global Crossing	no impacts

Sewer alignment on Wang Chau	Areas of impacts
general description	Between 36 and 20m PD.; relatively undisturbed patches of lower hill slopes; metasiltstone and phylite with meta sandstone
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Hutchison Global Crossing	no impacts

Sewer alignment from Wang Chau across Tin Shui Wai to Tung Tau Tsuen	Areas of impacts
general description	Reclaimed former marine muds
WSD	water mains follow the proposed alignment
CLP Power	no impacts
PCCW	cable follows proposed alignment
Hutchison Global Crossing	cable follows proposed alignment

Sewer alignment north of Tung Tau Tsuen	Areas of impacts
general description	Approximately 5m. PD.; north of a hillock; open storage areas and temporary structures; Pleistocene terraced alluvium; part of the alignment falls within the Tung Tau Tsuen Archaeological boundary site.
WSD	no impacts
CLP Power	part impacts near the temporary structures
PCCW	part impacts near the temporary structures
Towngas	no impacts

Sewer alignment from north of Tung Tau Tsuen to San Wai STW Upgrading	Areas of impacts
general description	Approximately 10m PD.; open storage areas temporary structures; wet and low-lying area
WSD	no impacts
CLP Power	part impacts on the proposed alignment
PCCW	no major impacts
Towngas	no impacts

San Wai STW Upgrading	Area of impacts
general description	Below 10m PD.; container storage areas, but mainly situated on pond area (to north of existing plant); proposed works fall within the archaeological site boundary
WSD	existing plant
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Ngau Tam Mei/ San Tin Trunk Sewerage

Sewer alignment from Kam Tin River to Ngau Tam Mei SPS	Extent and nature of impacts
General description	on area of former ponds and estuarine sediments
WSD	no impacts
CLP Power	no impacts
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Ngau Tam Mei SPS	Extent and nature of impacts
General description	on area of former ponds and estuarine sediments
WSD	no impacts
CLP Power	no impacts
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Sewer alignment from Ngau Tam Mei SPS to Tam Mei Camp SPS	Extent and nature of impacts
General description	the sewer alignment crosses San Tam Road and then runs immediately along a channel currently under construction by TTD; the area consists of ponds or river channel
WSD	the sewer alignment will follow the water mains in this area
CPL Power	no impacts
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Tam Mei Camp SPS	Extent and nature of impacts
General description	within the river channel and its immediate riverbank to the south
WSD	no impacts
CLP Power	no impacts
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Sewer alignment from Ngau Tam Mei SPS to San Tin SPS	Extent and nature of impacts
General description	entirely on Castle Peak Road
WSD	the sewer alignment will follow the water mains in this area
CLP Power	Existing (and proposed) cable follows the sewer alignment starting approximately opposite the Maple Gardens and continues until opposite the Mai Po Village area; the cable continues to run parallel with the sewer alignment from Mai Po San Tsuen until the alignment leaves Castle Peak Road
Hutchison Global Crossing	plant follows the proposed sewer alignment along Castle Peak Road
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	cable runs along proposed sewer alignment on Castle Peak Road starting approximately opposite a fly-over crossing the Yuen Long Highway before the village of Tsing Lung Tsuen

San Tin SPS	Extent and nature of impacts
General description	on former marine sediments
WSD	water mains border the proposed pumping station
CLP Power	no impacts of existing cable; proposed cable will be located at southern end of proposed pumping station
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Sewer alignment from San Tin SPS to San Lung Tsuen SPS	Extent and nature of impacts
General description	continues on Castle Peak Road and then turns north along the lower slopes of hillock to the debris flow deposits on which the historic village of San Tin was built
WSD	the sewer alignment will follow the water mains in this area
CLP Power	cable runs same alignment on Castle Peak road as proposed sewer alignment; further no impacts
Hutchison Global Crossing	plant follows the proposed sewer alignment along Castle Peak Road; no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	cable runs along the Castle Peak Road

Fan Tin Tsuen SPS	Extent and nature of impacts
General description	Maximum of 3m PD; Pleistocene debris flow deposits
WSD	the proposed pumping station will include existing water mains
CLP Power	no impacts
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Sewer alignment from San Lung Tsuen SPS to Casino Line SPS	Extent and nature of impacts
General description	the alignment continues on Castle Peak Road and turns off southeast on Kwu Tung Road and Ka Lung Road until it reaches the existing sewerage plant
WSD	the sewer alignment will follow the water mains in this area
CLP Power	the only impacts are located on Castle Peak Road
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Cassino Line SPS	Extent and nature of impacts
General description	within existing sewage treatment plant
WSD	connects with military main and continues to the existing sewage treatment plant
CLP Power	no impacts
Hutchison Global Crossing	no impacts
Cable TV	no impacts
Towngas	no impacts
Warf New T&T	no impacts

Yuen Long South Branch Sewer

Shan Ha Tsuen SPS	Extent and nature of impacts
General description	9.3m PD; open space area in front of Shan Ha Tsuen Village
WSD	no impacts
CLP Power	cables are located on the eastern edge of the proposed pumping station
PCCW	no impacts
Towngas	no impacts

Sewer alignment connected to Sha Ha Tsuen SPS	Extent and nature of impacts
General description	sewer alignment crosses alluvial plain to the river; then continues following the river to the north; the alignment subsequently follows the artificial cut of the Yuen Long Highway up to Kung Um Road
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Alternative Sewer alignment connected to Sha Ha Tsuen SPS	Extent and nature of impacts
General description	sewer alignment crosses alluvial plain to the river; then continues following the river to the north; the alignment subsequently crosses Yuen long Highway and continues east along an area occupied with structures
WSD	partial impact by existing water mains
CLP Power	partial impact by CLP cables
PCCW	partial impact by telephone cables
Towngas	no impacts

Muk Kiu Tau Tsuen SPS	Extent and nature of impacts
General description	7.9m PD; open space area to the north of historic village of Muk Kiu Tau Tsuen; Pleistocene alluvial terrace
WSD	no impacts
CLP Power	cable is located at the western edge of the proposed pumping station
PCCW	cable runs along western edge of proposed pumping station
Towngas	no impacts

Sewer alignment extending north of Muk Kiu Tau Tsuen SPS and extending south towards Pak Sha Tsuen SPS	Extent and nature of impacts
General description	one sewer branch alignment extends north to the Yuen Long Highway along an existing nullah; another branch extends south along same nullah to the Pak Sha Tsuen SPS
WSD	existing water mains located at proposed sewer alignment
CLP Power	cable along the proposed sewer alignment and stops just south of Muk Kiu Tau Tsuen
PCCW	cable located at proposed sewer alignment
Towngas	no impacts

Pak Sha Tsuen SPS	Extent and nature of impacts
General description	12.3m PD; located to the north of the historical village of Pak Sha Tsuen; Pleistocene terraced alluvium
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Sewer alignment extending south from Pak Sha Tsuen SPS	Extent and nature of impacts
General description	sewer alignment runs south along an existing nullah
WSD	existing water mains located at proposed sewer alignment
CLP Power	cable located along proposed sewer alignment
PCCW	cable located along proposed sewer alignment
Towngas	no impacts

Sham Chung Tsuen SPS	Extent and nature of impacts
General description	8.9m PD; Holocene alluvium
WSD	no impacts

CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Sewer alignment extending north of Sham Chung Tsuen SPS and between the above station and Shui Tsiu San Tsuen SPS	Extent and nature of impacts
General description	sewer alignment extending north of the proposed pumping station following a river; the alignment continues to follow the river south to the proposed Shui Tsiu San Tsuen SPS
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Shui Tsiu San Tsuen SPS	Extent and nature of impacts
General description	located in a former pond (PCCW map)
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Sewer alignment extending south of Shui Tsiu San Tsuen SPS	Extent and nature of impacts
General description	alignment continues to follow the river
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Tai Tong Road Sewer alignment	Extent and nature of impacts
General description	sewer alignment located along Tai Tong Road
WSD	existing water mains are located at proposed sewer alignment
CLP Power	two smaller areas of impact at the southern end of this alignment
PCCW	cable located at proposed sewer alignment
Towngas	no impacts

Shung Ching San Tsuen SPS along Tai Tong Road	Extent and nature of impacts
General description	9.2m PD; open space area; Pleistocene terraced alluvium
WSD	no impacts
CLP Power	no impacts
PCCW	no impacts
Towngas	no impacts

Tai Shui Ha Road Sewer alignment	Extent and nature of impacts
General description	sewer alignment runs along an existing nullah
WSD	water mains are located along proposed alignment
CLP Power	impacts occur from Nga Yiu Tau SPS to the same height as split of nullah towards the south
PCCW	cable located at proposed sewer alignment
Towngas	no impacts

Nga Yiu Tau SPS	Extent and nature of impacts
General description	approximately 12.3m PD (nearest indication of PD height) ; open space with building located in center of proposed pumping station; Holocene alluvium
WSD	no impact
CLP Power	cable runs through proposed pumping station (east-west direction)
PCCW	no impacts
Towngas	no impacts

*15.2.5 **Archaeological background of the study area***

The proposed works, except for Tung Tau Tsuen will not impact directly on a known archaeological site (AMO-files). Known archaeological sites, however, can be found in the vicinity of the works and are briefly described below. The works at Tung Tau Tsuen will partly impact within the boundary of the known archaeological site, field evaluation will identify the nature of the archaeological deposits.

Lau Fau San/ Mong Tseng Trunk Sewage

- Mong Tseng (Neolithic, Bronze and Historical Period)
- Lau Fau San (Neolithic and Bronze period)

Yuen Long Effluent Pipe

- Tung Tau Tsuen Archaeological Site: Ming and Qing Dynasty findings and a Song Dynasty sherd (AMO-files); The boundary of the archaeological site is marked on Figure 15.45.
- Tseung Kong Wai So Kwun Tsai Archaeological Site: Finding dating to Late Neolithic, Bronze Age and Song Dynasty have been recovered (AMO-files).

Ngau Tam Mei/ San Tin Trunk Sewerage

- Mai Po (Historical Period)
- Ngau Tam Mei Tsuen South, Sun Hing Farm (Bronze and Historical Period)

Yuen Long South Branch Sewer

- Yuen Leng, Kong Tau Tsuen (Bronze Period)

15.3 Assessment Methodology for Construction Phase

15.3.1 Assessment Approach for Built Heritage

The assessment methodology for the construction phase will include impacts arising from the proposed alignments as well as the proposed pumping stations. The following assessment methodology was used:

1) A desk-based study was conducted to determine the presence of historical occupation of the study area and to assess the potential for built heritage resources to still be present. The study included information gathered from the following sources; the Antiquities and Monuments Office published and unpublished papers and studies; publications on relevant historical, anthropological and other cultural studies; unpublished archival, papers, records; collections and libraries of tertiary institutions; historical documents which can be found in Public Records Office, Lands Registry, District Lands Office, District Office, Museum of History; cartographic and pictorial documentation.

2) A field survey was conducted in all areas where built heritage potential was established and existing information was not conclusive for purposes of the assessment. The scope of the survey covered the study corridor as well as areas within close proximity to it, which was defined as being a distance of 100 metres on either side. The heritage features included in the survey consisted of the following:

- Built features (excluding graves) constructed prior to 1950
- Built features constructed post 1950, but deemed to possess cultural or historical significance
- Clan graves dating prior to the Second World War
- Cultural landscape features, such as fung shui woods or ponds
- Historical landscape features, such as agricultural field patterns, terraces, paths and trackways and ponds

The field survey incorporated the following methodology:

Built Features

The survey consisted of a field evaluation incorporating the collection of photographic, oral and written information, on the architecture and history of all structures that may be impacted by the proposed works. This information was hand recorded in the field. The information collected in the field survey was then entered onto type written forms for inclusion in the report. The design of the forms is based on AMO and ICOMOS (International Charter for the Conservation and Restoration of Monuments and Sites) standards for the recording of historical resources with modifications to suit architectural styles and situations encountered in Hong Kong. The forms have also been designed to provide details of all identified resources, including written descriptions of each recorded feature, including; age, details of architectural features, condition, past and present uses, an architectural appraisal, notes on any modifications, direction faced and associations with historical/ cultural events or individuals. They also include a photographic record of each building or structure including the exterior (the elevations of all faces of the building premises, the roof, close up for special

architectural details) and the interior (special architectural details) where possible, as well as the surroundings of the feature. The location of each feature has also been highlighted on a 1:1000 scale map. A description of the surrounding environment has also been included as part of the survey.

Graves

Pre-war clan graves were also included as part of the survey and were recorded on field recording forms, which include a written description, a photographic record, a copy of the inscription and the dimensions. Their locations have also been highlighted on a 1:1000 scale map. It should be noted that there are graves located within the Cassino Camp itself, which were not accessible as part of the survey. The graves lie a minimum distance of 10 metres from the works area, however and are separated from it by a chain link fence. There will be no impact to these graves and further investigation will not be necessary.

Cultural and Historical Landscape Features

A written description of each recorded feature has been made, including information gathered from interviews with local informants. The location of each recorded feature has been highlighted on a 1:1000 scale map and a photographic record of each identified feature made.

15.3.2 Assessment Approach for Archaeology

Desk-based research is undertaken to identify areas of original landform with archaeological potential, which have not been impacted by previous excavations. The desk-based research will also highlight known archaeological sites both within the proposed works areas and in the vicinity.
The identified areas of potential will be assessed by a field evaluation programme; comprising of field scan, auger testing programme and test pit excavations. The field evaluation programme will be endorsed by the Antiquity Authorities.

Identified areas of archaeological potential currently inaccessible due to concrete or asphalt cover or private land issues will have to be assessed after land resumption or during a programme of archaeological monitoring during the construction phase.

15.4 Results of the desk-based Study

15.4.1 Built Heritage (Baseline)

The baseline study confirmed that the Study area contained historical potential and that there was not sufficient information available to assess the potential impacts from the proposed works, therefore a field survey was carried out, the results of which are presented in Section 15.3.4.

15.4.2 Archaeology

The table below presents the results of the desk-based study in which the areas of archaeological potential were identified. Please note that no assessment was undertaken for the Yuen Long sewage treatment works effluent pipeline, Conforming scheme of 2A-IT as shown on Figure 1.4 as it is not the preferred option. An Impact Assessment for archaeology should be undertaken if this alignment is chosen.

Lau Fau San/ Mong Tseng Trunk Sewage

Mong Tseng Tsuen PS	archaeological potential of landform and relatively undisturbed
Sewer alignment from Mong Tseng to Lau Fau Shan Road	no archaeological potential (cumulative impacts of utilities; along existing nullah; area of former ponds)
Sewer alignment along Lau Fau Shan Road	no archaeological potential (road with cumulative impacts of utilities)
Lau Fau Shan PS	no archaeological potential (cumulative impacts of utilities and cutting)

Yuen Long Effluent Pipe

Works areas	Archaeological potential
YLEPS	no archaeological potential [former pond area]
Sewer alignment from YLEPS to Wang Chau	no archaeological potential [reclamation] except for the portion of the road which runs in between the historical villages
Sewer alignment on Wang Chau	some portions of the lower hill slopes appear relatively undisturbed and

	have archaeological potential
Sewer alignment from Wang Chau across Tin Shui Wai to Tung Tau Tsuen	no archaeological potential [reclamation]
Sewer alignment north of Tung Tau Tsuen	Although believed to be low in archaeological potential due to the low-lying nature of the area, part of the alignment will fall within the boundary of the Tung Tau Archaeological Site and requires therefore further testing
Sewer alignment from north of Tung Tau Tsuen to San Wai STW Upgrading	no archaeological potential [low-lying-wet area]
San Wai STW Upgrading	Although the proposed works will impact inside the boundary of the Tseung Kong Wai So Kwun Tsai Archaeological Site, the works will impact on ponds and has therefore no longer archaeological potential

Ngau Tam Mei/ San Tin Trunk Sewerage

Sewer alignment from Kam Tin River to Ngau Tam Mei SPS	no archaeological potential (former ponds and estuarine sediments)
Ngau Tam Mei SPS	no archaeological potential (former ponds and estuarine sediments)
Sewer alignment from Ngau Tam Mei SPS to Tam Mei Camp SPS	no archaeological potential (river meandering and ponds)
Tam Mei Camp SPS	no archaeological potential (river meandering)
Sewer alignment from Ngau Tam Mei SPS to San Tin SPS	no archaeological potential (road with cumulative impacts of utilities)
San Tin SPS	no archaeological potential (marine sediments)
Sewer alignment from San Tin SPS to San Lung Tsuen SPS	no archaeological potential (road and cumulative utilities impact)
Fan Tin Tsuen SPS	no archaeological potential (low-lying and existing water mains impacts)
Sewer alignment from San Lung Tsuen SPS to Casino Line SPS	no archaeological potential (road alignment and cumulative impacts of utilities)
Cassino Line SPS	no archaeological potential within existing sewerage treatment plant

Yuen Long South Branch Sewer

Shan Ha Tsuen SPS	archaeological potential of landform and relatively undisturbed
Sewer alignment connected to Sha Ha Tsuen SPS	no archaeological potential (floodplain; meandering river and road cutting)
Alternative Sewer alignment connected to Sha Ha Tsuen SPS	no archaeological potential (floodplain; meandering river and area of housing)
Muk Kiu Tau Tsuen SPS	archaeological potential of landform and relatively undisturbed
Sewer alignment extending north of Muk Kiu Tau Tsuen SPS and extending south towards Pak Sha Tsuen SPS	no archaeological potential (along existing nullah with cumulative impacts of utilities)
Pak Sha Tsuen SPS	archaeological potential of landform and relatively undisturbed
Sewer alignment extending south from Pak Sha Tsuen SPS	no archaeological potential (along existing nullah with cumulative impacts of utilities)
Sham Chung Tsuen SPS	no archaeological potential (Holocene alluvium)
Sewer alignment extending north of Sham Chung Tsuen SPS and between the above station and Shui Tsiu San Tsuen SPS	no archaeological potential (river meandering)
Shui Tsiu San Tsuen SPS	no archaeological potential (former pond area)
Sewer alignment extending south of Shui Tsiu San Tsuen SPS	no archaeological potential (river meandering)
Tai Tong Road Sewer alignment	no archaeological potential (cumulative impacts of road and utilities)
Shung Ching San Tsuen SPS along Tai Tong Road	archaeological potential of landform and relatively undisturbed
Tai Shui Ha Road Sewer alignment	no archaeological potential (cumulative impacts of road construction and utilities)
Nga Yiu Tau SPS	no archaeological potential (Holocene alluvium)

The information was presented to the Antiquities and Monuments Office and on the basis of this information the methodology was agreed. The table below shows the endorsed methodology.

Lau Fau San/ Mong Tseng Trunk Sewage

Works areas	Proposed methodology
Mong Tseng Tsuen PS (Figure 15.44)	Field scan Minimum of 10 auger hole tests One test pit excavation
Sewer alignment from Mong Tseng to Lau Fau Shan Road	no action required
Sewer alignment along Lau Fau Shan Road	no action required
Lau Fau Shan PS	no action required

Yuen Long Effluent Pipe

Works areas	Proposed methodology
YLEPS	no action required
Sewer alignment from YLEPS to Wang Chau	no action required at this stage; Archaeological monitoring of the excavation works near the historical villages will be required.
Sewer alignment on Wang Chau (Figure 15.43)	Field scan of the entire area a minimum of 20 auger hole tests Two test pits
Sewer alignment from Wang Chau across Tin Shui Wai to Tung Tau Tsuen	no action required
Sewer alignment north of Tung Tau Tsuen (Figure 15.45)	Field scan of the entire area a minimum of 20 auger hole tests Two test pits (currently occupied by villager and landowner issues may arise)
Sewer alignment from north of Tung Tau Tsuen to San Wai STW Upgrading	no action required
San Wai STW Upgrading	no action required

Ngau Tam Mei/ San Tin Trunk Sewerage

Works areas	Proposed methodology
Sewer alignment form Kam Tin River to Ngau Tam Mei SPS	No action required
Ngau Tam Mei SPS	no action required
Sewer alignment from Ngau Tam Mei SPS to Tam Mei Camp SPS	no action required
Tam Mei Camp SPS	no action required
Sewer alignment from Ngau Tam Mei SPS to San Tin SPS	no action required
San Tin SPS	no action required
Sewer alignment from San Tin SPS to San Lung Tsuen SPS	no action required
Fan Tin Tsuen SPS	no action required
Sewer alignment from San Lung Tsuen SPS to Casino Line SPS	no action required
Cassino Line SPS	no action required

Yuen Long South Branch Sewer

Works areas	Proposed methodology
Shan Ha Tsuen SPS (Figure 15.46)	Field scan Minimum of 10 auger hole tests One test pit excavation
Sewer alignment connected to Sha Ha Tsuen SPS	no action required
Alternative Sewer alignment connected to Sha Ha Tsuen SPS	no action required
Muk Kiu Tau Tsuen SPS	no action required
Sewer alignment extending north of Muk Kiu Tau Tsuen SPS and extending south towards Pak Sha Tsuen SPS	no action required
Pak Sha Tsuen SPS	no action required
Sewer alignment extending south from Pak Sha Tsuen SPS	no action required
Sham Chung Tsuen SPS	no action required
Sewer alignment extending north of Sham Chung Tsuen SPS and between the above station and Shui Tsiu San Tsuen SPS	no action required
Shui Tsiu San Tsuen SPS	no action required
Sewer alignment extending south of Shui Tsiu San Tsuen SPS	no action required
Tai Tong Road Sewer alignment	no action required
Shung Ching San Tsuen SPS along Tai Tong Road (Figure 15.47)	Field scan Minimum of 10 auger hole tests One test pit excavation

Tai Shui Ha Road Sewer alignment	no action required
Nga Yiu Tau SPS	no action required

15.5 Results of Built Heritage Survey (Construction Phase)

15.5.1 ***Built Features***

A large number of resources were identified in the field survey. The information for each structure recorded in the field survey has been put into table form and can be found in Appendix 15.1. The majority of the structures were located within the boundaries of historical villages. As part of the field survey, the setting and surroundings of each village was noted, the information that was gathered is presented below. The figure number corresponding to the map illustrating the location of each of the recorded resources is also provided in the text.

Lau Fau Shan Road/ Mong Tseng Tsuen

(a)San Hing Wai (Figure 15.4)

The village is set facing Lau Fau Shan Road and is situated at the base of and on lower hill slopes rising eastwards. The village is currently backed by a lychee orchard. Today the village consists of a mixture of historical and modern buildings. Replacement of older buildings is ongoing as was evidenced by construction works noted during this field survey. The village paths and domestic drainage outlets are concrete, but in places the original stone features could be seen to have simply been covered by concrete rather than replaced. The majority of the recorded houses were either in use as residences or being used for holding a family shrine or for general storage. The predominant type of recorded structures were green brick courtyard style terrace houses. The majority of these houses were relatively unaltered on their exteriors and still had decorative canopies over their entranceways. The bricks in the structures were for the most part a uniform pale green to grey colour and long and narrow in shape. There was no standard bonding pattern noticeable.

(b) Chung Yuen(Figure 15.5)

Chung Yuen consists of a small number of houses to the west of Sha Kong Wai village. It consists mainly of modern village housing. The only historical structures are a green brick terrace row and single end terrace unit.

The village of Sha Kong Wai did not fall within the study area. There was, however, a Tin Hau temple associated with the village, located about 100 metres to its east that did fall within the study area. The temple and its associated shrine can be found on Figure 15.6. A recently constructed Kwun Yum statue was also located nearby and it can be found on Figure 15.7

(c) Mong Tseng Tsuen (Figure 15.8)

Mong Tseng Tsuen is located on a hill slope and contained examples of stone terracing, especially at the rear of the village leading up to a fung shui wood. Twenty-two of the twenty-five recorded features were green brick courtyard terrace units. Four of these structures were ruins. The remaining structures were for the most part abandoned or being used for storage. Stone lined drains were still in use parts of the village, although concrete drains were also present.

San Tin / Mai Po

(a) San Tin (Figure 15.9)

Three villages fell within the study area for the project, San Lung, Tsuen, on Lung Tsuen and Fan Tin Tsuen. The latter is the centre of the settlement and contains a number of culturally important buildings, including a Declared Monuments, Man Lun Fung Ancestral Hall. The surveyed villages also contained a number of other historical buildings, although the majority of older buildings have been replaced by modern villages blocks. The majority of these structures were courtyard terrace style green brick houses. A number of these houses were inhabited. Many of the green brick units also had stone elements integrated into their structures, i.e. courses of cut granite along the lower portions of their walls, granite corner stones and carved door and gate frames, threshold stones and lintels.

(b) Mai Po Tsuen (Figure 15.10)

The majority of the houses in the village are modern, with only six historical houses found to still be standing. These houses were all green brick courtyard style terrace units. Their condition was generally poor with no evidence of regular maintenance. The bricks ranged from green to grey to pale brown. Bricks in several of the structures were heavily eroded. The local inhabitants informed that they refer to the entire village as Mai Po Tsuen, even though they are given two names on the 1:1000 scale map, i.e. Mai Po Lo Wai and Mai Po San Tsuen. The Yeung Hau Kung temple (AAHB-227) is also found on this figure.

(c) Yau Mei San Tsuen (Figure 15.11)

Yau Mei San Tsuen is not an historical village having been settled post 1950. The shrine associated with the village was reconstructed in 1975.

Shap Pat Heung

(a) Shan Ha Tsuen (Figure 15.12)

The village contains a large number of historical buildings, including domestic structures and study halls (each branch of the clan has their own study hall). The ancestral hall of the village has been restored in traditional style. The majority of domestic structures were courtyard style terrace houses of green brick. The majority of these buildings were relatively unaltered externally and retained decorative features. The majority of brick structures contained dark green to pale grey bricks. The paler bricks could be seen in several instances to be suffering from various degrees of erosion. Many of the houses, both old and new had a traditional shrine consisting of a stone placed in concrete with an incense holder in front.

(b) Tin Liu Tsuen (Figure 15.13)

The village is set on flat land and there was no evidence of a fung shui wood in the vicinity. The village gate and temple were both of traditional green brick construction. The majority of recorded resources were green brick terrace units. The majority of bricks were pale green grey in colour. Several of the structures contained concrete parapets on their facades, having had their decorative canopies removed.

(c) Muk Kiu Tau Tsuen (Figure 15.14)

The majority of structures in this village were modern, but at least ten years old. The village gate and ancestral hall of the Wu family are traditional green brick structures. The majority of bricks used in the structures were dark green in colour and in good condition.

(d) Pak Sha Tsuen (Figure 15.15)

Unlike the two nearby villages of Tin Liu Tsuen and Muk Kiu Tsuen, the gate of this village is of modern construction. Only a small number of structures were recorded in the village. The condition of many of these was very poor with almost half being ruinous. There were three examples of courtyard style terrace units remaining in the village.

(e) Tai Tong Tsuen (Figure 15.16)

The majority of the structures in the village were modern. The older buildings were for the most part abandoned or being used for storage. The area at the back of the village contained the ruins of a large study hall. There were several new buildings under construction at the time of the survey.

(f) Wong Nai Tun Tsuen (Figure 15.17)

This small village contained a higher percentage of older buildings than many of the other recorded villages. The houses ranged from large green brick, two storey structures to simple single storey, single room terrace units.

(g) Shui Tsiu San Tsuen (Figure 15.18 and 15.19)

The village contains a large number of ancestral halls, reflecting the different clans associated with the village. The ancestral halls are of similar architectural style, relatively undecorated façade with piers at both sides, open entrance hall and main hall. The gate of the village also reflects this style. The recorded houses of the village

were constructed of green brick. They were not of a single architectural style. The majority of the structures in the village dated to the 1960's and 70's.

(h) Sham Chung Tsuen (Figure 15.20)

Again the majority of buildings in this village were modern. The older houses were for the most part, green brick courtyard style terrace units. Most of these buildings still had a decorative canopy over the entranceway. The bricks used in the structures varied from dark green to pale grey. The houses also contained examples of cut granite elements, such as corner stones, door frames and threshold stones.

(i) Shui Tsui Lo Wai (Figure 15.21)

The large number of clans associated with the village is reflected in the large number of ancestral halls found there. The majority of the halls have been rebuilt. As with most of the surveyed villages the majority of structures here were modern.

(j) Hung Tso Tin (Figure 15.21)

The village contains very few older structures. These were mostly houses, constructed of green brick and lacking any decorative features. The ancestral hall was rebuilt ten years ago. The village well ceased to be used about a decade ago.

(k) Cheng Chun Wai (Figure 15.22)

Very little of the traditional village still remains, apart from a disused well and village gate in very poor condition. The rest of the village is completely modern and does not contain a traditional layout.

(l) Nam Hang Tsuen (Figure 15.23)

The recorded structures in the village consisted of houses and a Kwun Yum hall. The houses were for the most part green brick terrace units with various degrees of modification.

(m) Tong Tau Po Tsuen (Figure 15.24)

The village has very few historical buildings, with only four house units being recorded. These were green brick terrace in style.

The village of Nga Yiu Tau does not contain a traditional layout and only contained a shrine and a green brick terrace row, Figure 15.25. The Tai Shu Ha Tin Hau temple is also located along to the north east of the village and is also shown in Figure 15.25.

(n) Shung Ching San Tsuen

Shung Ching San Tsuen does not contain a traditional village layout. There are several examples of mansions scattered throughout the area, the oldest remaining one, 'Yau Lo' (AAHB-213) being built in 1936, Figure 15.26. A church built in the 1930's is also located on this map. Other mansions (AAHB-208, 209 and 210), Figure 15.27. These structures are very grand in style and contain numerous decorative architectural features. The area was originally inhabited for the most part, by Hakka people from Mui Yuen. The area was traditionally associated with the village of Hung Tso Tin. It was given the name Shung Ching San Tsuen approximately 30 years ago. The Shung Ching Public School (AAHB-215) was built in 1950, see Figure 15.28.

The locations of a gate and road inscription plaque (AAHB-211 and 212) can be seen on Figure 15.29, a shrine (AAHB-207) on Figure 15.30. An ancestral hall located on Tai Shu Ha Road West (AAHB-216) is shown in Figure 15.31.

Fung Lok Wai

(a) Tai Tseng Wai (Figure 15.32)

This village contained a number of older buildings. The majority of them were terrace houses, constructed of brick with no decorative features and a single pitched roof. The houses often had foundations of uncut or very roughly cut stones. A number of the houses were abandoned, used only for storage or housing family shrines. The traditional houses that were still being occupied often had alterations such as window additions, modern

doors/gates and air conditioner units. As was seen in the village of Shing Uk Tsuen, most of the replacement village houses appear to have been constructed during the 1960's and 1970's.

(b) Shing Uk Tsuen (Figure 15.32)

This village contains a number of traditional structures. Many of the domestic structures were courtyard style terrace units. The majority of these structures were either abandoned or closed up and not being used as houses. Many of the modern replacement structures date to the 1970's and 1980's. There is no current building activity going on in the village. There are still a number of cut stone pieces, taken from demolished buildings, in the village.

(c) Ng Uk Tsuen (Figure 15.33)

This village contained a number of traditional structures in various conditions, although many of the older houses were abandoned or ruinous. The majority of replacement buildings in the village were at least ten years old and there was no evidence of ongoing construction. The area behind the village contained a fung shui wood.

The location of a shrine located on Fuk Shing Street can be seen on Figure 15.32.

Buddhist Blessing Stones

Twenty-four (indicated as B01 through B024 in this report) of these stones were identified in the field survey. All of the stones consist of a rectangular engraved granite block. As the basic form of the stones is the same, individual recording forms were not employed in the survey. Instead photographs of each stone have been included in Appendix 15.2 and the locations of the stones can be found on the following figures:

- B01, B02 and B03 (Figure 15.4)
- B04 and B05 (figure 15.5)
- B06 (Figure 15.20)
- B07 (Figure 15.21)
- B08 (Figure 15.30)
- B09 (Figure 15.30)
- B10, B11, B12 , B13, B14 and B15 (Figure 15.10)
- B16 (Figure 15.31)
- B17 (Figure 15.26)
- B18 and B19 (Figure 15.34)
- B20 (Figure 15.35)
- B21 (Figure 15.36)
- B22, B23 and B24 (Figure 15.11)

15.5.2 Graves

1:1000 scale maps of the study areas indicated that there were graves located in several areas. The field survey confirmed that the majority of graves were modern. The following historical graves were identified in the grave survey, (catalogue, including photographs and inscriptions, is included in this report in Appendix 15.3).

(a) Mong Tseng Tsuen (Figure 15.37)

YLKT-G01 Brick and concrete enclosure, in very poor condition, inscription obscured.

YLKT-G02 Two graves of the Cheung family. Last renovated during the Qing Dynasty, untended. Majority of inscription indiscernible. Concrete and brick construction.

YLKT-G03 Stone and concrete circular enclosure, inscription unreadable, untended.

(b) San Tin Park (Figure 15.38)

YLKT-G04 Concrete enclosure, over 100 years old according to local informants. Man family. Renovated in 1987. Modern structure.

(c) Kah Lung Road (Figures 15.39,15.40, 15.41 and 15.42)

YLKT-G05 Concrete enclosure, last renovated 1984 (previously 1858), modern features. Man family.

YLKT-G06 Concrete, over brick, enclosure with red and green decoration. Man family.

Renovated in 1962, modern features.

YLKT-G07 Concrete enclosure with pebble finish. Renovated in 1991. Man family.

YLKT-G10 Modern large concrete enclosure, pebble finish with red trim. Man and Law families.

YLKT-G11 Large concrete enclosure, pebble finish with red trim. Renovated in 1988. Man clan.

YLKT-G12 Concrete grave enclosure, modern features, original grave dating back to the Ming Dynasty. Man clan

YLKT-G13 Concrete enclosure. Red steps. Man clan. No renovation date.

YLKT-G14 A: Double grave, concrete, renovated in 1998. Modern features, originally dated to Qing Dynasty. **B:** Same style as A, renovated in 1954, man clan. Modern features.

YLKT-G15 Concrete enclosure with red and blue design above inscription. Man clan, renovated in 1954. Modern features.

YLKT-G16 Concrete enclosure with red rounded pattern over inscription. Qing renovation noted (1774), modern features, renovation date not noted.

YLKT-G17 Concrete enclosure with red decoration. Man clan. Modern features, brick underneath concrete visible in cracks.

YLKT-G18 A to F A series of renovated graves dating originally back to the Ming and Qing period. Concrete enclosures, modern features. Man clan.

YLKT-G19 Concrete enclosure with semi-circular platform. Modern features, renovated 1946. Man clan.

15.5.3 Cultural and Historical Landscape Features

As noted earlier, the aerial photographs showed that many of the villages traditionally contained fung shui woods and ponds. The field survey confirmed that the vast majority of these features are no longer in existence. Local informants noted that most of the woods were cut down in the 1970's and 80's for road and village/ light industry building construction. Fung shui woods were identified behind the villages of Mong Tseng Tsuen, see Figure 15.8 and Wong Nai Tun Tsuen, see Figure 15.17. None of the villages retained ponds.

15.6 Results of the Archaeological Field Evaluation (Construction Phase)

15.6.1 Mong Tseng Tsuen PS (Figure 15.44)

(a) Field scan

Field scan of the area proved difficult, as the Proposed Pumping Station (PPS) area is heavily overgrown. No natural cuts were observed, while the southern end of the PPS was used as dumping area for building rubble. No archaeological material was found.

(b) Minimum of 10 auger hole tests

Ten auger hole tests were evenly spaced within the PPS. The results of the auger tests indicated that the PPS is an alluvial area with interspersed rocks and water table level at an approximate depth of 1.2 meters below the surface. No archaeological finds were recovered from the tests.

(c) One test pit excavation

The PPS is located on private land and no permission was gained to conduct a test pit excavation.

15.6.2 Sewer alignment on Wang Chau (Figure 15.43)

(a) Field scan

The surface was scanned for finds wherever possible. The study area is located on hill slopes and the vegetation cover consists of shrubs and trees. The hill slopes is occupied by graves and some of the open grave cuts could be checked for finds and stratigraphy. No archaeological finds were recovered from this area.

(b) Minimum of 20 auger hole tests

A total of twenty auger holes were conducted on the lower hill slopes at Wang Chau. The results of the tests indicate colluvial deposits on decomposing rock. Most of the auger holes had to be abandoned at shallow depths due to rock encounter. No archaeological finds or cultural soils were encountered in the tests.

(c) Two test pits

Test pit 1(Figure 15.43 and Appendix 15.4)
The test pit was located at the lower hill slopes of Wang Chau in the vicinity of recent graves. It measured 2 by 2 meters and was hand excavated to a maximum depth of 1.50m. An auger hole test was conducted to further verify the stratigraphy.
TBM (0.685m) was taken on a grave located to the south of the test pit.

A total of three sterile contexts were recorded during the excavation (Appendix 15.5). **Context 01** was brown very slightly silty and slightly gravelly silt. This topsoil had a thickness between 0.12 and 0.24m. **Context 02** consisted of reddish yellow slightly sandy and slightly gravelly silt with angular to sub-angular cobbles. The colluvial layer had an approximate thickness of 0.70m. **Context 03** was recorded around a depth of 0.80m below the surface and continued until the hand excavation of the test pit was halted for safety reasons at a depth of approximate 1.50m. It consisted of strong brown slightly sandy and slightly gravelly but very silty clay with decomposing angular to sub-angular cobbles. The auger hole test was halted immediately below the surface due to rock.

Test pit 2 (Figure 15.43 and Appendix 15.4)
The test pit was located at the lower hill slopes of Wang Chau. It measured 1.5 by 1.5 meters and was hand excavated to a depth of 0.70m due to the encounter of a fairly recent grave. No auger hole test was conducted due to the grave.
TBM (3.260m) was taken on the grave located to the east-northeast of the test pit.

A total of four contexts were recorded during the excavation (Appendix 15.5). **Context 01** was brown very slightly sandy and very slightly clayey silt with angular cobbles and roots. This topsoil had a thickness between 0.12 and 0.34m. **Context 02** consisted of reddish yellow slightly clayey silt with the occasional angular cobble. This fill layer contained some concrete chunks and red brick fragments. The fill layer had a thickness between 0.18 and 0.50m and covered the top of a grave structure. **Context 03** is the grave structure itself (Appendix 15.5) and the soil on the western side of the test pit, which had a high lime residue content related to the actual burial coffin (Appendix 15.4). This soil with lime fragments was encountered at a depth of approximately 0.60m below the surface. **Context 04** was light yellowish brown gravelly silt, which was excavated on the front side of the grave, representing the fill/colluvium covering the grave structure. This layer was excavated to a depth of 0.83m after which the excavation was halted.

15.6.3 Sewer alignment north of Tung Tau Tsuen (Figure 15.45)

The following methodology was proposed for the sewer alignment north of Tung Tau Tsuen:
- Field scan of the entire area
- Minimum of 20 auger hole tests
- Two test pits

The area however, is covered by asphalt and light industry workshops and was unavailable for testing.

*15.6.4 **Shan Ha Tsuen SPS (Figure 15.46)***

(a) Field scan

The PPS area at Shan Ha Tsuen is located between a road and a light industry works area. It is fairly low-lying and small ditches with water run across the site. The surface of the PPS is mainly covered by grasses and the visibility was relatively good. No archaeological material was found.

(b) Minimum of 10 auger hole tests

The PPS area proved more or less rubbish and rubble free. The results of the auger tests indicated that this alluvial area is very wet. Water table was encountered at depths of 0.50 and 0.60m below the surface in the southern part of the PPS area and approximately 0.90m in other parts. No archaeological finds were recovered and no cultural soils encountered.

(c) One test pit excavation

Test pit 1 (Figure 15.46 and Appendix 15.4)
The test pit was located in the northern part of the PPS. It measured 2 by 2 meters and was hand excavated to a depth of approximately 0.80m. An auger hole was conducted to further verify the stratigraphy.
TBM (0.620m) was taken from the NW corner of the male toilets located to the north west of the test pit.

A total of nine contexts were recorded during the excavation (Appendix 15.5). **Context 01** was dark brown very slightly sandy, slightly silty clay. The topsoil was very irregular in thickness due to the ridge and furrow agriculture and its thickness ranged between 0.08 and 0.20m. All the subsequent recorded contexts are alluvial deposits. **Context 02** consisted of brown very slightly sandy silty clay and had a thickness between 0.04 and 0.20m. **Context 02** included thirteen tile fragments, fourteen pieces of village ware and four porcelain fragments and one marble (Appendix 15.4). **Context 03** was grey slightly sandy silty clay and had a maximum thickness of 0.12m. This alluvial layer was recorded only in the southern half of the test pit and thinned out towards the north, it included the following material: one small tile fragment and two undiagnostic village ware sherds. **Context 04** consisted of yellowish brown slightly sandy and slightly gravelly silty clay with a thickness of 0.15m. **Context 05** was very pale brown slightly silty clay. The hand excavation was halted at depths between 0.38 and 0.78m below the surface due to water table. **Context 05** had a thickness of 0.80m. **Context 06** was found at a depth of 1.20m below the surface and consisted of reddish yellow slightly silty clay. **Context 07** was light brown very slightly clayey sand at a depth of 1.83m below the surface. **Context 08** consisted of grey gravelly sand at a depth of 2.20m below the surface. And Finally **Context 09** was yellowish brown slightly gravelly sand recorded at a depth of 2.25m below the surface. The auger hole test was abandoned at a depth of 2.28m due to auger failing to hold soil.

*15.6.5 **Shung Ching San Tsuen SPS (Figure 15.47)***

(a) Field scan

The area of the PPS could be divided into two parts. The southern half was covered in concrete, which is part of a new residential development called Regalia Garden. The northern half of the PPS is occupied by high grasses. The surface wherever possible was scanned for finds, however, the surface was covered by building debris and rubbish in many places. No archaeological remains were found.

(b) Minimum of 10 auger hole tests

All auger tests were positioned in the northern half of the PPS. The southern half of the PPS was found to be covered in concrete and was not available for testing. The results of the auger hole tests indicated that the entire area may be covered in fill. No archaeological findings were recovered from the auger tests.

(c) One test pit excavation

Test pit 1(Figure 15.47 and Appendix 15.4)
The test pit was located in the centre of the PPS. It measured 2 by 2 meters and was hand excavated to a depth of approximately 1.40m. An auger hole test was conducted to further verify the stratigraphy.
TMB was taken on the south-western corner of the east gate post of the entrance to the Regalia Garden, which is located to the south of the test pit.

A total of nine contexts were recorded during the excavation (Appendix 15.5). **Context 01** was light brown very sandy and very gravelly silt with cobbles. This fill layer also contained building debris, plastic and wood and had a thickness of approximately 0.40m. **Context 02** was a fill layer of brown very gravelly and very sandy silt. Building debris, metal, plastic, wood and general rubbish was excavated from the **Context 02** layer with a thickness between 0.70 and 0.85m. **Context 03** was the last fill layer and consisted of olive sandy and gravelly clay with similar to above inclusions. It had a thickness of 0.40m. The hand excavation of the test pit was halted at a depth of approximately 1.40m below the surface. The auger test recorded the following sterile alluvial contexts: **Context 04**, very dark grey very slightly sandy silty clay was recorded at a depth of 1.47m below the surface. **Context 05** was olive grey gravelly and silty clay at a depth of 1.58m below the surface. **Context 06** consisted of olive silty and gravelly clay at a depth of 1.70m below the surface. **Context 07** was olive sandy gravel at a depth of 1.92m below the surface. **Context 08** consisted of olive yellow very slightly clayey, gravelly sand at a depth of 2.09m below the surface. And finally **Context 09** was encountered at a depth of 2.88m below the surface and consisted of light yellowish brown silty, sandy and gravelly clay. The auger test was halted at a depth of 2.92m below the surface due to end of auger was reached.

15.7 Assessment Results for Built Heritage (Construction Phase)

The assessment of impacts will be divided in the following manner:
1) Firstly, by type of resource, i.e. built heritage resources, graves and cultural / historical landscapes;
2) Secondly, by alignment; and
3) Thirdly, by location of the resources and of the works areas,

- for works areas that are located outside village boundaries, resources within the assessed villages will be grouped as a village group.
- For works areas that are located within village boundaries, resources in close proximity to the works areas will be assessed individually
- All resources located outside of village boundaries will be assessed individually

The results of the impact assessment will be presented in table form. Tables will be presented for each alignment and will include, the recorded features, their distance from the works and the potential adverse impacts. Both pumping stations and sewage alignments will be assessed as part of the construction phase. The works to be carried out as part of the construction phase are not expected to generate adverse vibration impacts or cause any structural damage to any of the identified resources situated further than 10 metres away from the proposed works. Works to be carried out in very close proximity to identified resources, i.e. > 10 metres may potentially cause contact or vibration damage to these resources. It should be noted that only structures containing historical architectural features will be assessed for vibration damage as part of this report, as heritage resources, such as shrines, ancestral halls etc, that are of modern construction will not require any specialist assessment.

15.7.1 ***Impact on Resources***

Lau Fau San to Mong Tseng

Table 15.1: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment or PPS site	Potential Negative Impacts
San Hing Tsuen	Tsz Tongs, Houses and a fung shui wall (AAHB-01 to 20)	40m	None, as the structures are located at a sufficient distance from the works area
Mong Tseng Tsuen	Tsz Tong, Houses, Well and a Shrine (AAHB-29 to 53)	15m	None, as the structures are located at a sufficient distance from the works area
Chung Yuen	Houses and a Shrine (AAHB-23 to 25)	40m	None, as the structures are located at a sufficient distance from the works area

Table 15.2: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Lau Fau San Road	Modern constructed shrine (AAHB-21)	5m	Possible damage from contact with construction machinery or equipment and possible access restrictions; due to the close proximity to works area.
	Shrine (AAHB-22)	20m	None, as the shrine is located at a sufficient distance from the alignment.
Near Sha Kong Wai	Temple and Shrine (AAHB-26 and 27) Kwun Yum Statue (AAHB-28)	30m	None, as the temple, shrine and statue are located at a sufficient distance from the alignment.

San Tin to Ngau Tam Mei

Table 15.3: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
On Lung Tsuen	Various Resources (AAHB-406 to 418 and 450 to 460)	20 m	None, as the structures are located at a sufficient distance from the works areas
Fan Tin Tsuen	Various Resources (420 to 426 and 428 to 432, 484, 485 and 503)	30 m	None, as the structures are located at a sufficient distance from the works areas
	Ming Yuen Tong (AAHB-433)	<5 m	Possible structural damage from vibration and/or contact with construction machinery or equipment due to the close proximity to works area.
	Shun Yue Tong and San Yeh Man Tong (AAHB-486 and 487)	<5 m	Possible structural damage from vibration and/or contact with construction machinery or equipment due to the close proximity to works area.
	Shrine (AAHB-419)	<5 m	Possible structural damage from vibration and/or contact with construction machinery or equipment and possible access restrictions; due to the close proximity to works area.
	Man Lun Fung (AAHB-405)	<5m	Possible structural damage from vibration and/or contact with construction machinery or equipment due to the close proximity to works area.
San Lung Tsuen	Various Resources (AAHB-436, 481, 482, 488 to 494 and 496 to 502)	10 m	None, as the structures are separated from the works area by modern buildings.
Mai Po Tsuen	Well, Village Gate, Ancestral Hall, House, Shrine and Temple (AAHB- 229 to 241)	15 m	None, as the structures are located at a sufficient distance from the alignment and separated from it by a concrete wall.

Table 15.4: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Castle Peak Road (San Tin to Mai Po)	Temple (AAHB-505)	100 m	None, as the temple is located at a sufficient distance from the alignment.
	Temple and shrine (AAHB-227)	>5 m	Possible structural damage to the temple from vibration and/or contact with construction machinery or equipment and possible access restrictions to both the temple and shrine; due to the close proximity to works area and works area being located on the access route.
	Well (AAHB-228)	20 m	None, as the well is located at a sufficient distance from the works areas
	Modern village Gates (AAHB-231 and 240)	>5 m	Possible damage from contact with construction machinery or equipment.
Castle Peak Road (Yau Mei Tsuen)	Shrine (AAHB-242)	30 m	Access restrictions, as the path to the shrine originates on Castle Peak Road (a works area)
	Gate (AAHB-243)	25 m	None, as the gate is located at a sufficient distance from the alignment.

Shap Pat Heung

(a) Shan Ha Tsuen

Table 15.5: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Shan Ha Tsuen	Houses, Stone Platform, Tsz Tongs/ Study halls, Well, Cannons and a Shrine (AAHB-177 to 206)	30 m	None, as the structures are located at a sufficient distance from the alignment and the proposed pumping station is not visible from any of the recorded resources.

(b) Kung Um Road

Table 15.6: Potential impacts to resources within villages

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Tin Liu Tsuen	Shrine, Houses, Temple and a Well (AAHB-244 to 260)	20 m	None, as the structures are located at a sufficient distance from the works area
Muk Kiu Tau Tsuen	Modern constructed shrine (AAHB-262)	<5 m	Possible damage from contact with construction machinery or equipment and possible access restrictions; due to the close proximity to works area.
	Gate, Well, Houses, Ancestral Hall and Temple (AAHB-261 and 263 to 271)	100 m	None, as the structures are located at a sufficient distance from the works areas

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Pak Sha Tsuen	Shrine (AAHB-272)	10 m	None, as the structures are located at a sufficient distance from the works areas
	Gate Houses Temple Shed Study hall and Well (AAHB-273 to 284)	60 m	

(c) Sham Chung Drainage Alignment

Table 15.7: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Tai Tong Tsuen	Gate, Shrines, Ancestral halls, Shed, Study Hall and houses (AAHB-54 to 69)	35 m	None, as the structures are located at a sufficient distance from works areas
Wong Nai Tun Tsuen	Shrine, Tsz Tong and Houses (AAHB-70 to 86)	50 m	None, as the structures are located at a sufficient distance from the works area
Shui Tsiu San Tsuen	Study Halls, Houses, Ancestral halls, Gates and Shrines (AAHB-87 to 116)	50 m	None, as the structures are located at a sufficient distance from the works area
Sham Chung Tsuen	Houses, Temple and Shrine (AAHB-117 to 128)	90 m	None, as the structures are located at a sufficient distance from the alignment

Table 15.8: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Near Tai Tong	School (AAHB-86)	20 m	None, as the school grounds are separated from the works area by a compound wall and the alignment is located within the bounds of a large drainage channel.
Near Sham Chung Tsuen	Shrine (AAHB-130)	10 m	None, as the structures are located at a sufficient distance from the alignment

(d) Tai Tong Road

Table 15.9: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Shui Tsui Lo Wai	Houses, Ancestral halls, Shrine, Study hall and cannon (AAHB-131 to 153)	50 m	None, as the structures are located at a sufficient distance from the alignment
Hung Tso Tin	Well, Ancestral hall, House (AAHB-154 to 162)	30 m	None, as the structures are located at a sufficient distance from the alignment

Nam Hang Tsuen	Houses and Temple (AAHB-165, 166, 167 to 173)	70 m	None, as the structures are located at a sufficient distance from the alignment
Cheng Chu Wai	Gate, Well, House (AAHB--174 to 176)	30 m	None, as the structures are located at a sufficient distance from the alignment

Table 15.10: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Tai Tong Road	Modern constructed village gates (AAHB-129, 131, 162, 153, 164 and 211)	5 m	Possible damage from contact with construction machinery or equipment and possible access restrictions; due to the close proximity to works area.
	Temple (AAHB-163)	30 m	None, as the structures are located at a sufficient distance from the alignment
	School (AAHB-215)	20 m	None, as the structures are located at a sufficient distance from the alignment
	Shrine (AAHB-207)	>5 m	Possible contact damage and access restrictions due to the close proximity to works areas
	House (AAHB-208, 209 and 210)	55 m	None, as the structures are located at a sufficient distance from the alignment
	Inscription stone (AAHB-212)	10 m	None, as the inscription stone is located at a sufficient distance from the alignment.

(e) Tai Shu Ha Road

Table 15.11: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Tong Tau Po Tsuen	Gates, Ancestral Hall and Houses (AAHB-217 to 233)	70 m	None, as the structures are located at a sufficient distance from the alignment.

Table 15.12: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Alignment or PPS Site	Potential Negative Impacts
Tai Shu Ha Road East	Shrine (AAHB-224)	>5 m	Possible damage from contact with construction machinery or equipment and possible access restrictions; due to the close proximity to works area.
	House (AAHB-225)	80 m	None, as the house is located at a sufficient distance from the alignment.
	Temple (AAHB-226)	20 m	Access restrictions from works on Tai Shu Ha Road East
Tai Shu Ha Road West (Shung Ching Tsuen)	House (AAHB-213)	60 m	None, as the structures are located at a sufficient distance from the alignment
	Church (AAHB-214)	90 m	
	Ancestral Hall (AAHB-216)	70 m	

Yuen Long Effluent Pipeline

Table 15.13: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Alignment	Potential Negative Impacts
Shing Uk Tsuen	House, Tsz Tong, Study Hall and Shrine (AAHB-285 to 314)	40 m	None, as the structures are located at a sufficient distance from the alignment.
Tai Tseng Wai	House, Gate, Tsz Tong, Study Hall and Shrine (AAHB-315 to 354)	40 m	None, as the structures are located at a sufficient distance from the alignment.
Ng Uk Tsuen	House, Sheds, Shrine, Tsz Tong, Well, Gate, School and Rural Committee Building (AAHB-356 and 358 to 393)	55 m	None, as the structures are located at a sufficient distance from the alignment.

Table 15.14: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Alignment	Potential Negative Impacts
Near Ng Uk Tsuen	Temple (AAHB-355)	85 m	None, as the temple is located at a sufficient distance from the alignment
Corner of Fuk Shun St. and WSD service Road	Shrine (AAHB-357)	<5m	Possible damage from contact with construction machinery or equipment and possible access restrictions; due to the close proximity to works area.

15.7.2 ***Impact on Buddhist Blessing Stones***

All of the Buddhist blessing stones are located within close proximity to the works areas and may receive possible contact damage due to their close proximity to works areas.

15.7.3 ***Impact on Graves***

The following assessment is based on the following factors, the type of works associated with the proposed project, the distance of the works and the fact that all of the graves are modern reconstructions, consisting of, in almost all cases, concrete. These graves do not possess historical architectural features that would possibly require special protective measures due to their fragile nature, during construction.

Table 15.15: Impacts to recorded graves

Number	Location	Distance from alignment	Potential Negative Impact
YLKT-G1	Mong Tseng Tsuen	60 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G2	Mong Tseng Tsuen	100metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G03	Mong Tseng Tsuen	50 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G04	San Tin Park	60 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G05	Ka Lung Road	20 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G06	Ka Lung Road	20 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G07	Ka Lung Road	30 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G08	Ka Lung Road	25 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G09	Ka Lung Road	25 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G10	Ka Lung Road	25 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G11	Ka Lung Road	25 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G12	Ka Lung Road	25 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G13	Ka Lung Road	15 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G14	Ka Lung Road	50 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G15	Ka Lung Road	50 metres	None, as the grave is located at a sufficient distance from the alignment

Number	Location	Distance from alignment	Potential Negative Impact
YLKT-G16 (A to F)	Ka Lung Road	50 metres	None, as the grave is located at a sufficient distance from the alignment
YLKT-G17	Ka Lung Road	10 metres	None, as the grave is located at a sufficient distance from the alignment

15.7.4 Impact on Cultural and Historical Landscape Features

The two identified features, i.e. the fung shui woods associated with the villages of Mong Tseng Tsuen and Wong Nai Tun Tsuen both lie at a sufficient distance from the works area and will not be impact by the proposed projects.

15.8 Assessment Results on Archaeology (Construction Phase)

15.8.1 Desk-based assessment result (Archaeology During Construction Phase)

The results of the desk-based research identified:

- Areas of archaeological potential, of which five areas were agreed with the AMO for field evaluation at the EIA stage (field evaluation results are presented below);
- Yuen Long sewage treatment works effluent pipeline, conforming scheme 2A-IT is not the preferred option and has not been assessed, if this alignment is the preferred option and full cultural heritage impact assessment will have to be conducted; and
- Area of archaeological potential currently under road and thus not accessible for field evaluation :

Sewer alignment from YLEPS to Wang Chau

This proposed sewer alignment will occur on both Pleistocene terraced alluvium and debris flow deposits. The existing impacts on these original landforms, according to the desk-based research, are limited to water mains alignment and PCCW cable on the road. The area between the villages lies at a PD level of approximately 5m. Archaeological sites are known on similar landform as described here, for instance at Mong Tseng, Mai Po, Tung Tau and Tseung Kong Wai. The desk-based research did not indicate disturbance of the area along the road and identified no previous investigation in the area.

15.8.2 Assessment of the field evaluation (Archaeology during Construction Phase) – Appendix 15.6

(a) Mong Tseng Tsuen PS

Auger test results indicate an alluvial deposit is located at the PPS area. The proximity of the historical buildings of Mong Tseng suggests Qing Dynasty material should be found, although none was recovered from the auger hole testing. A test pit excavation will confirm any Qing Dynasty remains or identify other periods in this area.

(b) Sewer alignment on Wang Chau

The field scan, auger programme and test pit excavations all identified that the lower hill slopes of Wang Chau have no archaeological potential.

(c) Sewer alignment north of Tung Tau Tsuen

The desk-based research had identified the sewer alignment at Tung Tau Tsuen to have archaeological potential, due to asphalt and concrete cover the area proved not available for testing at this moment.

(d) Shan Ha Tsuen SPS

Auger test and test pit excavation results indicate an alluvial deposit is located at the PPS area. The deposits were sterile and the water table level was encountered at depths above 1 meter below the surface. No archaeological deposits, features or cultural soils were encountered.

(e) Shung Ching San Tsuen SPS

Part of the area was unavailable for testing. The portion, which was tested during the field evaluation, indicated that the area has been artificially raised. Original alluvial layers did not appear until 1.55m below the surface. The alluvial deposits are low-lying and near water table, diminishing the archaeological potential in this area.

15.9 Mitigation Measures on Built Heritage for Construction Phase

The presentation of mitigation measures will be presented in the following tables.

Lau Fau Shan to Mong Tseng Tsuen

Table 15.16: Mitigation recommendations for resources within villages

Location	Resource	Distance	Mitigation Recommendations
Lau Fau Shan Road	Modern constructed shrine (AAHB-21)	>5 m	The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing; Access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

San Tin to Ngau Tam Mei

Table 15.17: Mitigation recommendations for resources within villages

Location	Resource	Distance	Mitigation Recommendations
Fan Tin Tsuen	Man Lung Fung Ancestral Hall (AAHB-405)	<5m	As the works are in close proximity to the southwestern wall of the ancestral hall, which is a Declared Monument, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.
	Shrine (AAHB-419)	<5 m	The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing; Access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.
	Ming Yuen Tong (AAHB-433)	<5 m	As the works are in close proximity to the southeastern wall of the ancestral hall, which is a Grade II building, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.
	Shun Yue Tong and San Yeh Man Tong (AAHB-486 and 487)	<5m	As the works are in close proximity to the southeastern walls of both of the Shun Yue Tong and San Yeh Man Tong, which are Grade I and Grade II buildings, respectively, the contractor must carry out a condition survey of both of the buildings. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.

Table 15.18: Mitigation recommendations for resources outside villages

Location	Resource	Distance	Mitigation Recommendations
Castle Peak Road (San Tin to Mai Po)	Temple and shrine (AAHB-227)	>5 m 10m	The temple, although renovated contains historical architectural elements and is located directly on the edge of the works area. Hence, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures. The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access to the temple and shrine should be maintained through the provision of walkways separated from the works areas by metal barriers. The base of the gates should be provided with a protective covering in the form of heavy duty plastic sheeting, supported by scaffolding where necessary.
	Modern constructed village gates (AAHB-231 and 240)	>5 m	
Castle Peak Road (Yau Mei Tsuen)	Shrine (YLKT-02-242)	30 m	The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access from Castle Peak Road should be maintained through the provision of walkways separated from the works areas by metal barriers.

Shap Pat Heung

(a)Shan Ha Tsuen

There were no impacts associated with this alignment and pumping station, therefore no mitigation is required.

(b) Kung Um Road

Table 15.19: Mitigation recommendations for resources within villages

Location	Resource	Distance	Mitigation Recommendations
Muk Kiu Tau Tsuen	Shrine (AAHB-262)	5 m	The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing; Access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

(c) Sham Chung Drainage Channel

There were no impacts associated with this alignment and pumping station, therefore no mitigation is required.

(d) Tai Tong Road (Northern Section)

Table 15.20: Mitigation recommendations for resources outside villages

Location	Resource	Distance	Mitigation Recommendations
Tai Tong Road	Gates (AAHB-129,131,153,162, 164 and 211)	c.5 m	The base of the gates should be provided with a protective covering in the form of heavy duty plastic sheeting, supported by scaffolding where necessary.
Tai Tong Road	Shrine (AAHB-207)	>5 m	The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing; Access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

(e) Tai Shu Ha Road

Table 15.21: Mitigation recommendations for resources outside villages

Location	Resource	Distance	Mitigation Recommendations
Tai Shu Ha Road East	Shrine (AAHB-224)	>5 m	The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing; Access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.
	Temple (AAHB-226)	15 m	The entrance to the temple is located directly from Tai Shu Ha Road, access from the road should be maintained throughout the construction phase.

(f) Tai Shu Ha Road West

There were no impacts associated with this alignment and pumping station, therefore no mitigation is required.

Yuen Long Effluent Pipeline

Table 15.22: Mitigation recommendations for resources outside villages

Location	Resource	Distance	Mitigation Recommendations
Corner of Fuk Shun St. and WSD Service Road	Shrine (AAHB-357)	<5m	The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing; Access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

15.9.1 ***Buddhist Blessing Stones***

The stones do not contain any fragile elements and will not require any protective measures during the works.

15.9.2 ***Graves***

There will be no impacts to any of the surveyed graves in the study area or to those located within the Cassino camp, therefore no mitigation measures will be necessary.

15.9.3 ***Cultural and Historical Landscape Features***

No cultural or historical landscape features will be impacted by the project, therefore, no mitigation measures will be required.

15.10 Mitigation Measures on Archaeology for Construction Phase

15.10.1 Mong Tseng Tsuen PS *(non-designated element)*

The site is private and field survey was not allowed. Further investigation should be carried out after the resumption of the land and prior to commencement of any works. The investigation should comprise of a minimum of one test pit excavation, measuring no less than 2 by 2 meters to verify the stratigraphy and potential archaeological deposits in the Mong Tseng PPS.

15.10.2 Sewer alignment on Wang Chau (non- designated element)

The results from the field investigation indicate a lack of archaeological deposits and cultural soils. No further action is required.

15.10.3 Sewer alignment north of Tung Tau Tsuen (non- designated element)

The site was occupied by local villagers and field survey was not allowed. Investigation should be carried out after the resumption of the land and prior to commencement of any works. The investigation should comprise of a minimum of 20 auger hole tests and two test pit excavations measuring no less than 2 by 2 meters to verify the stratigraphy and potential archaeological deposits within the known archaeological site.

15.10.4 Shan Ha Tsuen SPS (non-designated element)

The field investigation results indicate that the area exists of sterile alluvial deposits with a high water table and is thus considered to have no archaeological potential. No further action is required.

15.10.5 Shung Ching San Tsuen SPS (non-designated element)

The field investigation results indicate that the area has been artificially raised by 1.5m fill. Sterile alluvial deposits were encountered at a depth of more than 1.5m. No further action is required.

15.10.6 Sewer alignment from YLEPS to Wang Chau (non- designated element)

Archaeological monitoring is recommended during the excavations of the sewer alignment between the historic villages of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen.

15.11 Assessment Methodology for Operational Phase

15.11.1 Potential Sources of Impact During Operational Phase

Archaeology.

No impacts on archaeological deposits are anticipated during the operational phase.

Built Heritage

The impact assessment for the operational phase will deal with the proposed sites of the pumping stations and will entail aesthetic impacts. The recording methodology used in the assessment will be the same as that used for the construction phase.

15.11.2 Assessment Approach for Operational Phase

The assessment methodology for impacts, which may occur during the operational phase is the same as for impacts which will occur during the construction phase.

15.12 Assessment Results for Operational Phase

15.12.1 Archaeology

The impacts on the archaeological deposits will occur during the construction phase. No impacts are expected during the operational phase.

15.12.2 Built Heritage

The impacts with the operational phase are associated with the proposed pumping station buildings.

Lau Fau Shan to Mong Tseng Tsuen

(a) Mong Tseng Tsuen pumping Station

Table 15.23: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Proposed Pumping Station	Potential Negative Impacts
Mong Tseng Tsuen	Tsz Tong, Houses, Well and Shrine (AAHB-29 to 53)	15 m	Aesthetic impacts affecting the environmental setting of the resources

San Tin to Ngau Tam Mei

Table 15.24: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Proposed Pumping Station	Potential Negative Impacts
On Lung Tsuen	Various resources (AAHB-406 to 418 and 450 to 460)	60 m	None, as the structures are not located in the vicinity of a proposed pumping station
Fan Tin Tsuen	Various Resources (AAHB-419 to 426, 428 to 432, 484, 485 and 503)	40 m	None, as the structures are not located in the vicinity of a pumping station
	Man Lun Fung (AAHB-405)	10 m	Aesthetic impacts affecting the environmental setting of the resources
	Ming Yuen Tong (AAHB-433)	15 m	
San Lung Tsuen	Various Resources (AAHB-436, 481, 482, 488 to 494 and 496 to 502)	45 m	None, as the structures are not located in the vicinity of a pumping station

Table 15.25: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Proposed Pumping Station	Potential Negative Impacts
Castle Peak Road (San Tin to Mai Po)	Temple (AAHB-505)	over 100 m	None, as the structures are not located in the vicinity of a pumping station
	Temple and shrine (AAHB-227)	over 100 m	
	Well (AAHB-228)	over 100 m	
	Gates (AAHB-311 and 321)	over 100 m	
Castle Peak Road (Yau Mei Tsuen)	Shrine (AAHB-242)	over 100 m	None, as the structures are not located in the vicinity of a pumping station
	Gate (AAHB-243)	over 100 m	

Shap Pat Heung

(a) Shan Ha Tsuen

Table 15.26: Potential impacts to resources within villages

Village	Resource	Minimum Distance to the Proposed Pumping Station	Potential Negative Impacts
Shan Ha Tsuen	Houses, Stone Platform, Tsz Tongs/ Study halls, Well, Cannons and a Shrine (AAHB-177 to 206)	30 m	None, as the structures are not located within the vicinity of a pumping station.

(b) Kung Um Road

Table 15.27: Potential impacts to resources within villages

Location	Resource	Minimum Distance to the Proposed Pumping Station	Potential Negative Impacts
Pak Sha Tsuen	Gate Houses Temple Shed Study hall and Well and Shrine (AAHB-272 to 284)	60 m	None, as the structures are not located in the vicinity of a pumping station

(c) Sham Chung Drainage Channel

There are no resources within 100 metres of a proposed pumping station; therefore, there will be no associated impacts.

(d) Tai Tong Road (Northern Section)

There are no resources within 100 metres of a proposed pumping station; therefore, there will be no associated impacts.

(e) Tai Shu Ha Road

Table 15.28: Potential impacts to resources outside villages

Location	Resource	Minimum Distance to the Proposed Pumping Station	Potential Negative Impacts
Tai Shu Ha Road East	Temple (AAHB-226)	20 m	Aesthetic impacts affecting the environmental setting of the resources

Yuen Long Effluent Pipeline

There are no resources within 100 metres of a proposed pumping station, therefore, there will be no associated impacts.

15.13 Mitigation Measures for Operational Phase

15.13.1 ***Archaeology***

No mitigation measures are required as no impacts are expected during the operational phase.

15.13.2 ***Built Heritage***

Built Features

The following resources will require mitigation measures with respect to the operational phase. The Mong Tseng Tsuen, Fan Tin Tsuen and Nga Yiu Tau pumping stations are non-Designated Elements.

(a) Lau Fau Shan to Mong Tseng

Table 15.29: Mitigation recommendations for resources within villages

Location	Resource	Minimum Distance to PPS Site	Mitigation Recommendations
Mong Tseng Tsuen	Village structures (AAHB-29 to 53)	15 m	As the pumping station is located at the front of the village, the landscaping of the area around the pumping station should include planting of foliage complimentary to the existing environmental setting, in order to screen the proposed pumping station and minimise visual impacts. The colour treatment of the proposed pumping station should minimise visual impact. (General examples can be found in Figures 14.62 through 14.65)

(b) San Tin to Ngau Mei Tsuen

Table 15.30: Mitigation recommendations for resources within villages

Location	Resource	Minimum Distance to PPS Site	Mitigation Recommendations
Fan Tin Tsuen	Man Lung Fung Ancestral Hall (AAHB-405) Ming Yuen Tong (AAHB-433)	10 m 15 m	As the proposed pumping station is located in the vicinity of two Tsz Tongs, one of which is a Declared Monument, the landscaping of the area around the proposed pumping station should include planting of foliage complimentary to the existing environmental setting, in order to screen the proposed pumping station and minimise visual impacts. The colour treatment of the proposed pumping station should minimise visual impact. It is recommended that the design and materials of the proposed pumping station should visually harmonize with the existing historic ancestral halls of Man Lun Fung and Ming Yuen Tong, for example, grey brickwork and granite are preferable for the exterior elevations. (General examples can be found in Figures 14.62 through 14.65)

(c) Tai Shu Ha Road

Table 15.31: Mitigation recommendations for resources outside villages

Location	Resource	Distance	Mitigation Recommendations
Tai Shu Ha Road East (Nga Yiu Tau)	Temple (AAHB-226)	20 m	The landscaping of the area around the pumping station should include planting of foliage complimentary to the existing environmental setting, in order to screen the proposed pumping station and minimise visual impacts. The colour treatment of the proposed pumping station should minimise visual impact. (General examples can be found in Figures 14.62 through 14.65)

Buddhist Blessing Stones

Buddhist blessing stones are placed at roadsides and mark the location of a fatal accident. The surrounding environment is not a relevant factor and thus they do not need to be assessed as to changes in their environmental setting.

Graves

There will be no impacts to any of the surveyed graves in the study area or to those located within the Cassino camp, therefore no mitigation measures will be necessary.

Cultural and Historical Landscape Features

No cultural or historical landscape features will be impacted by the project, therefore, no mitigation measures will be required.

16.0 FISHERY IMPACT

This Section of the EIA Report presents the findings of the impact assessment of the construction and operation of the proposed sewerage system and pumping stations on aquaculture fisheries resources and operations. Baseline information on the potentially affected existing aquaculture fisheries resources and operations is presented and evaluated.

16.1 Legislation and Standards

The criteria for evaluating fisheries impacts are laid out in the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). Annex 17 of the EIAO-TM outlines the general approach and methodology for the assessment of impacts. Annex 9 of the EIAO-TM recommends some general criteria that can be used for evaluating impacts to fisheries, including aquaculture fisheries resources and operations.

Other relevant environmental references, legislation, guidelines and include:
** Relevant Study Brief;*
** Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 10;*
** Fisheries Protection Ordinance (Cap. 171) 1987 and its subsidiary legislation, the Fisheries Protection Regulations.*

Fisheries Protection Ordinance (Cap. 171) provides for the conservation of fish and other aquatic life and regulates fishing practices.

16.2 Assessment Methodology

The requirements of fisheries impact assessment of the Project area followed Section 3.4.7, Appendix 3 of the Study Brief. The study brief indicated the criteria and guidelines for assessing fisheries impacts as specified in Annexes 9 and 17 of the EIAO TM should be followed.

For the purpose of fisheries assessment, the assessment area is defined as all areas within 500m from the site boundary of the works area. This definition meets the requirement as stipulated by the Study Brief, i.e. “the assessment area for fisheries impact assessment included but was not limited to the fishponds in the Conservation Area near Shan Pui River and any other water system identified for fisheries purpose during the course of study”.

A desktop review of baseline conditions was conducted using relevant literature, aerial photographs and a Geographical Information System (GIS). A number of more focused baseline field surveys were then proposed to supplement and verify the review findings.

A literature review was undertaken to describe the baseline conditions in the Assessment Area, and to identify areas and species of potential fisheries importance which may be affected by the project. Reviewed documents include Government and private sector reports, as well as unpublished information.

The commercial fishery in Hong Kong is composed of capture fisheries and culture fisheries. The AFCD annual reports from 1991/1992 to 1999/2000 were consulted to assess pond culture fisheries impacts.

Field verification of the operational status of the fishponds in the Assessment Area were conducted at intervals during June 2002 and January 2003 simultaneously with the habitat surveys for terrestrial ecology. Fisheries operations such as stocking, feeding and harvesting, the presence of fisheries devices such as aerators and anti-cormorant wires, and the maintenance conditions of the facilities along the pond bunds were noted. The status of fishponds (active or abandoned) was evaluated based upon management conditions of the ponds, the presence of fish farming materials and/or equipment, and fish farming activities. The information presented in the following sections has been based on the findings of the review and these surveys.

16.3 Fisheries Baseline Condition

As stipulated in Section 3.4.7 of the EIA Study Brief, within the "Assessment Area", special attention should be paid to the fishponds in the Conservation Area near Shan Pui River.

Inland fishponds in Hong Kong, covering 1060 ha in 2000, are mainly located in the northwest New Territories. 2820 tonnes of freshwater fish, including mostly Chinese carp and some tilapia, grey mullet, snakehead and catfish, were produced in 2000, accounting for 6% of the local freshwater fish consumption.

Fishponds in the Deep Bay area and the northwest New Territories probably peaked in area during the 1970s or 1980s. In recent years, these ponds have been increasingly subject to conversion for other, more lucrative landuses, including open storage. Development projects including roads, railways, flood control schemes and housing developments have also accounted for a certain amount of pond loss.

Figure 13.2 of Section 13 shows the distributions and status of fishponds in the Assessment Area for the proposed project. Within this area, there are about 113 fishponds covering 295 ha. Among them, 60 fishponds are active (covering 230 ha), while the remaining 53 are abandoned (covering 65 ha).

The majority of the Study Area to be affected by the proposed Project has been degraded by development and urbanisation. Fisheries sensitive receivers in the Study Area comprise active fishponds.

Results from the survey estimated that there are approximately one hundred and thirteen fishponds in this area. It is estimated that the fishponds make up an area of approximately 295 hectares. The majority (78% of the total, equivalent to about 230 hectares) of these fishponds are active. The active fishponds concentrate in Shan Pui (to the north of Yuen Long Industry Estate), along the both sides of the shores of Channel 60CD (Nam Sang Wai & Tai Sang Wai), Mai Po Lo Wai and San Tin. The predominant fish species cultured in these ponds include the mullet (*Mugil cephalus*) and the four carp species traditionally cultured in Chinese pond aquaculture. These are the grass carp (*Ctenopharyngodon idellus*), the silver carp (*Hypophthalmichthys molitrix*), big-head carp (*Aristichthys nobilis*) and the common carp (*Cyprinus carpio*). Snakehead and catfish are also cultured.

The remaining active fishponds and all abandoned fishponds are scattered within the Assessment Area among urbanised/disturbed habitats. Apparently not all ponds were managed, i.e. no pump was seen and most grassy bunds were not trimmed. . Most of the ponds still had open water, except one that was overgrown with vegetation.

Fishponds at San Wai were ranked as Grade C by the Agriculture, & Fisheries & Conservation Department (AFD undated). The Categorization of Agricultural Land of AFCD ranking recorded 13 ha of fishponds at Hung Shui Kiu - Ha Tsuen area in 1995 (Reference No. 49, covering Fung Kong Tsuen, Tseung Kong Tsuen, Sik Kong Tsuen, Tung Tau Tsuen, Lo Uk Tsuen, San Wai, San Sang Tsuen, Lee Uk Tsuen and Shek Po Tsuen, see AFD 1995) and all agricultural lands were ranked as Grade D (AFD 1995) [30]. The AFCD categorization stated that most agricultural land in the area has been converted for use as open storage (*ibid.*) [30]. The field survey of the present project verified and confirmed the ranking and description in 1995.

34 ha of fishponds were recorded at the area from Lau Fau Shan to Tsim Bei Tsui in 1995 by AFCD (Reference No. 21, covering Sha Kiu Tsuen, Mong Tsang Wai, San Hing Tsuen, Sha Kong Wai and Lau Fau Shan, see AFD 1995). Though the agriculture lands there were ranked as Grade B (*ibid*) [30] but the fishponds themselves were ranked as the lowest grade for fishponds (Grade C: Areas with scattered small fishponds and substantial amount of fishponds are either either idle or filled. They are subject to high development pressure due to its proximity to developments) (AFD undated) [31].

505 ha of fishponds were recorded in the area from Ng Uk Tsuen North, Shan Pui North to Nam Sang Wai and Tai Sang Wai (Reference No.9, see AFD 1995) [30]. Both the agricultural lands inside this area and the fishponds themselves were ranked as Grade A.

In the area from Chuk Yuen Tsuen to Lok Ma Chau, 395 ha of fishponds were recorded in 1995 (Reference No.10, covering Chuk Yuen, Tai Shang Wai, Mai Po North, Lo Wai, Sna Tin North, Tam Kon Chau and Lok Ma Chau West, see AFD 1995). Both the agricultural lands inside this area and the fishponds themselves were ranked as Grade A.

All fishponds in the Shap Pat Heung area were ranked as Grade C. Only 11 ha of fishponds were recorded within the entire area (Reference 32, 42 & 43) in 1995 (AFD 1995) [30].

In the present study, only 0.75ha of active fishponds were recorded within the part of the assessment area which covers Shap Pat Heung, while 116.72 ha of active and 30.96 ha of abandoned fishponds were recorded within the part of the assessment area which covers Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T). 112.5 ha of active and 33.62 ha of abandoned fishponds were left in the remaining assessment area.

Table 16.1: Areas of fishponds within the 500m study area

	Area (ha)	
Works Package	**Active Fishponds**	**Abandoned Fishponds**
Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)	116.72	30.96
Lau Fau Shan and Mong Tseng Areas (2A-3T) Tin Shui Wai and San Wai Areas (Alternative 2A-1T)	112.50	33.62
Shap Pat Heung Area (2B-2T)	0.75	0

Based upon the above review of baseline fisheries conditions in the Assessment Area, the sensitive fisheries receivers which may be affected by the proposed project have been identified as the active fishponds within the assessment area.

16.4 Impact Identification and Evaluation for Construction Phase

Impact assessment methodology follows the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annex 9 and 17 of the EIAO-TM. Impacts are generally ranked as "minor", "moderate" or "severe", although in a few cases a ranking of "minimal" (less than "minor") may be given. The ranking of a given impact will vary based on the criteria in the EIAO-TM. The major factors giving rise to a ranking are explained in the text.

The fisheries impacts of the project components are assessed individually, then cumulatively with other past, ongoing and proposed projects. Where negative impacts are identified, efforts are made to identify feasible mitigation measures which might be developed to reduce the severity of negative impacts. These measures should be described in terms of their scope, programme, feasibility and financial implications during the construction and operation of the project. Finally, the consultants determined whether the proposed mitigation measures, if implemented, could bring the negative impacts of the project and its components within acceptable bounds.

Predominant impacts to fishery operations and resources usually occur through the loss, temporary or permanent, of areas supporting fisheries resources.

In the present proposed project, however, there will be no marine or intertidal infrastructure element involved. No temporary or permanent loss of fishing grounds or mariculture sites would result from implementation of the project. Indirect impacts on marine capture and culture fisheries usually are usually caused by changes in marine water quality. As no marine or intertidal construction works are involved, and the surface runoff will be minimal due to the distance from the construction sites to the coastline, there will be no indirect impacts to marine capture and marine culture fisheries during the construction phase. Therefore no impacts from construction of the present project on marine capture and culture fisheries are anticipated.

The potential impacts to aquaculture fisheries resources and operations arising from the construction of the proposed sewerage system and pumping stations include the direct loss of fishpond habitat resulting from the construction of the Project.

For inland fishponds, only a part (0.05 ha) of one fishpond on the alignment of sewer from the existing San Wai STW toward Tin Shui Wai will be permanently encroached (Figure 13.2). This fishpond would be liable to permanent direct impacts from the project. Within the site of the alignment, fish culture will not be possible during the construction or operational phases. This will constitute a permanent loss of fishponds. The total area of the affected ponds would be about 0.05 ha. This figure constitutes a permanent loss of less than 0.005 % of the 1060 ha of fishponds in Hong Kong (AFCD 2001) [29].

This fishpond, though classified as active due to the presence of aerator and the conditions of the pond bunds, was isolated from other active fishponds in the area. Given the small percentage of loss and its isolated location, the impact on inland fishpond culture in Hong Kong from the loss of this part of one fishpond due to the proposed project is ranked as minimal.

None of the other alignments or pumping stations would cause any permanent direct impacts to fishponds.

An area of 0.20 ha distributed in three fishponds (mainly underneath pond bunds) at Shan Pui will be temporarily occupied as works areas (Figure 13.2). This area, however, will be reinstated after the construction, and only consistute a temporary direct impact.

16.4.1 Tin Shui Wai and San Wai Areas (Alternative 2A-1T)

This element includes a sewer alignment starting from Ha Tsuen, passing through Tin Shui Wai and ending at Yuen Long STW.

Direct impacts arised from this element include a permanent loss of 0.05ha active fishpond area and a temporary loss of 0.20 ha active fishpond area.

The only permanent direct impact predicted to occur to aquaculture fisheries is the permanent direct loss of part of an active fishpond as a result of the construction of the sewerage alignment Alternative 2A-1T. It is calculated that approximately less than 0.05 ha of the fishpond will overlap with the alignment and thus will be lost through construction. Based on the size of this loss, this loss of fishpond is ranked as minimal deemed acceptable.

The majority of the proposed sewerage alignment will be constructed along the roads and main drainage channels that are urbanised and disturbed. Three active fishponds within WCA in Shan Pui, however, are adjacent to the section of sewer alignment running along the Yuen Long STW western boundary. Due to the need of work areas during the construction of the sewer, a total of 0.20 ha fishpond areas (mainly underneath pond bunds), distributed along the three fishpond's edges which are in contact with the sewer alignment, will be occupied during the constuction phase. These fishpond areas will be reinstated after the construction works are finished. Based on the size of this loss and its limited duration of loss, this impact on fishpond is ranked as minor.

One abandoned fishpond in Shan Pui is close to the further westward section of the alignment. The sewer alignment is also near one active fishpond and one abandoned fishpond in San Wai. Though the sewers are proposed to be buried underneath footpaths and roads and the ground surface will be reinstated afterwards, site runoff from the works areas might affect the fishponds and consistute indirect impacts. Given the nature of the impacts and the small number of fishponds potentially affected, the impact is ranked as minor.

No direct or indirect impact on fishponds would be expected from construction of the pumping station.

16.4.2 Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)

This element includes a sewer alignment which starts at Siu Hum Tsuen, runs southwest along Castle Peak Road till Ngau Tam Mei, switches to the embankment of the newly constructed 100CD drainage channel, and ends at 60CD drainage channel.

No fishponds would be directly affected by the alignment. The majority of the proposed sewerage alignment will be constructed along the roads and main drainage channels that are urbanised and disturbed. For the majority of the sewer alignment, there is also no fishpond near or close to the alignment, except the section of alignment close to the sewage treatment works in Ngau Tam Mei in where the alignment is adjacent to six active fishponds. Near Mai Po Lo Wai, the alignment is close to another active fishpond. Two abandoned fishponds in San Wai also near a section of alignment.

The sewers are proposed to be buried underneath footpaths and roads and the ground surface will be reinstated afterwards. Site runoff from the works areas might affect the fishponds. Given the nature of the impacts and the small number of fishponds potentially affected, the impact is ranked as minor.

16.4.3 ***Lau Fau Shan and Mong Tseng Areas (2A-3T)***

This element includes a sewer alignment starting from Lau Fau Shan, and another one starting at Mong Tseng. These two sections join at Sha Kong Wai Tsai, cross the Tin Shui Wai Western Drainage Channel, and join the sewer of 2A-1T.

There is a small area of sea and coastline within the assessment area, located at the northwest end of this part of the assessment area. This marine area, however, is away from the alignment and would not be subject to any direct or indirect impact from the project.

The majority of the proposed sewerage alignment will be constructed along the roads and embankment of main drainage channels that are urbanised and disturbed. No fishponds would be directly affected by the alignment. For the majority of the sewer alignment, there is also no fishponds near or close to the alignment, except the section at Mong Tseng where the alignment will follow an existing road which is adjacent to one active and two abandoned fishponds.

The sewers are proposed to be buried underneath footpaths and roads and the ground surface will be reinstated afterwards. Site runoff from the works areas might affect the fishponds. Given the nature of the impacts and the small number of fishponds potentially affected, the impact is ranked as minor.

16.4.4 ***Shap Pat Heung Area (2B-2T)***

As described above, presently there are only 0.75 ha of active fishponds within this part of the assessment area. Moreover, all active fishponds are located close to the southern assessment area boundary and far away from the locations of all proposed works. No land resumption process would be needed for the fishponds within this part of the assessment area. No direct or indirect impacts on fishponds or their operations would be expected from the project.

16.5 Impact Avoidance and Mitigation Measures for Construction Phase

In accordance with the guidelines in the EIAO-TM on fisheries impact assessment the approaches to mitigating impacts to fisheries, in order of priority, are avoidance, minimising, and compensation.

Only 0.05 ha of fish pond will be permanently lost for the entire project, and 0.20 ha of fish pond areas will be temporarily occupied during construction. As the proposed construction of the sewerage system and pumping stations are not predicted to have a significant or unacceptable impact on aquaculture fisheries resources and operations in the assessment area, no fisheries-specific mitigation measures are required.

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16.5.1 ***Tin Shui Wai and San Wai Areas (Alternative 2A-1T)***

Permanent direct impacts of this project to fish culture in fishponds in San Wai would be minor. No mitigation would be required.

Standard site practice should be enforced to minimise the site runoff disturbance to the surroundings. Sedimentation during construction should be prevented by erection of sediment barriers and operation of siltation traps in works sites close to fishponds which could potentially be affected. Temporary work sites/disturbed areas immediately should be reinstated after completion of the construction works. The work site boundaries should be checked regularly to ensure that they are not exceeded and that no damage occurs to surrounding areas.

16.5.2 ***Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)***

Standard site practice should be enforced to minimise the site runoff disturbance to the surroundings. Sedimentation during construction should be prevented by erection of sediment barriers and operation of siltation traps in works sites close to fishponds which could potentially be affected. Temporary work sites/disturbed areas immediately should be reinstated after completion of the construction works. The work site boundaries should be checked regularly to ensure that they are not exceeded and that no damage occurs to surrounding areas.

16.5.3 Lau Fau Shan and Mong Tseng Areas (2A-3T)

Standard site practice should be enforced to minimise the site runoff disturbance to the surroundings. Sedimentation during construction should be prevented by erection of sediment barriers and operation of siltation traps in works sites close to fishponds which could potentially be affected. Temporary work sites/disturbed areas immediately should be reinstated after completion of the construction works. The work site boundaries should be checked regularly to ensure that they are not exceeded and that no damage occurs to surrounding areas.

No adverse temporary or permanent impacts of the proposed project to the existing capture fisheries and mariculture near Lau Fau Shan are expected. No impact mitigation would be required.

16.5.4 Shap Pat Heung Area (2B-2T)

No mitigation measure is required as no direct or indirect impacts are anticipated.

16.6 Impact Identification and Evaluation for Operational Phase

No operational phase impacts are expected to aquaculture fisheries resources and operations as a result of the operation of the sewerage system and pumping stations.

16.7 Impact Avoidance and Mitigation Measures for Operational Phase

No mitigation measure is required as no operational phase Impacts are expected.

From the information presented above, no adverse fisheries impact associated with the proposed project is expected. An evaluation of the impact in accordance with the EIAO-TM Annex 9 is presented in Table 16.2.

Table 16.2: Evaluation of fisheries impacts in accordance with EIAO-TM Annex 9

Impacts	Criteria					
	Nature of impact	Size of affected area	Loss of fisheries resources/ production	Destruction and disturbance of nursery and spawning grounds	Impact on fishing activity	Impact on aquaculture activity
Tin Shui Wai and San Wai Areas (Alternative 2A-1T)						
Construction phase						
Land work area	Permanent loss of part of a fishpond due to conscturction of sewers	0.05 ha of active fishpond to be resumed	About 0.05 ha fishpond area will be lost.	No impact on nursery and spawning grounds would be caused.	NA	0.05 ha of fishpond in San Wai would be affected by the project.
Land work area	Temporary loss of 0.20 ha of fishpond area due to the need of works areas	0.20 ha of active fishpond to be temporary occupied	About 0.20 ha fishpond area will be temporary lost.	No impact on nursery and spawning grounds would be caused.	NA	0.20 ha of fishpond areas in Shan Pui would be temporarily affected by the project.
Land work area	Site runoff	5 active fishponds and 2 abandoned fishponds are potentially subject to site runoff	NA	No impact on nursery and spawning grounds would be caused.	NA	Water quality inside fishponds might be affected
Operational phase						
Sewage Alignment	Permanent occupation of fishponds.	0.05 ha of active fishpond	About 0.05 ha fishpond area will be lost.	No impact on nursery and spawning grounds would be caused.	NA	Permanent loss of 0.05 ha of fishpond in San Wai
Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)						
Construction phase						

Impacts	Criteria					
	Nature of impact	Size of affected area	Loss of fisheries resources/ production	Destruction and disturbance of nursery and spawning grounds	Impact on fishing activity	Impact on aquaculture activity
Land work area	Site runoff	7 active fishponds and 2 abandoned fishponds are potentially subject to site runoff	NA	No impact on nursery and spawning grounds would be caused.	NA	Water quality inside fishponds might be affected
Operational phase						
No impact	NA	NA	NA	NA	NA	NA
Lau Fau Shan and Mong Tsang Areas (2A-3T)						
Construction phase						
Land work area	Site runoff	1 active fishponds and 2 abandoned fishponds are potentially subject to site runoff	NA	No impact on nursery and spawning grounds would be caused.	NA	Water quality inside fishponds might be affected
Operational phase						
No impact	NA	NA	NA	NA	NA	NA
Shap Pat Heung Area (2B-2T)						
Construction phase						
No impact	NA	NA	NA	NA	NA	NA
Operational phase						
No impact	NA	NA	NA	NA	NA	NA

Although there are a number of concurrent projects that are currently implemented or planned, each project will provide its own mitigation measures. Cumulative impacts predicted to arise from the proposed project in conjunction with concurrent projects are not expected to result in greater adverse impacts to fisheries sensitive receivers than would impacts arising from the concurrent projects independently.

There are no residual impacts expected to occur to aquaculture fisheries as a result of the construction and operation of the proposed sewerage system and pumping stations.

As direct impacts to fishponds are predicted to be minimal while the indirect impacts during construction phase to be minor, the development of a monitoring and audit programme to assess the effects of the proposed project on fisheries is not considered necessary. Monitoring and audit activities designed to detect and mitigate any unacceptable impacts to water quality will also serve to protect against temporary unacceptable impacts to fisheries resources.

Deep Bay is facing long-term pollution problems which threaten the sensitive ecosystem in Deep Bay. HKSAR Government is planning to substantially reduce pollution loadings in Deep Bay. Under the Yuen Long/Kam Tin Sewerage Master Plan, sewage networks will be provided to unsewered villages and new developments, and sewage effluents from Yuen Long and Kam Tin will be transported out of Deep Bay to the better flushed water in Urmston Road for disposal (EPD 2001). The proposed project is an important component of the Plan.

Though Grade A active fishponds were identified within the assessment area with the majority concentrated to the Shan Pui, Nam Sang Wai, Tai Sang Wai and San Tin, the majority of assessment area appears to be degraded through urbanisation and development. None of the sewer alignment or the pumping station locations would constitute permanent direct impacts to any Grade A active fishponds. Only a fraction (0.05 ha) of a Grade C fishpond in San Wai would be subject to direct loss. Potential impacts to fisheries resources and operations may arise from permanent loss of fishponds. Due to the small percentage compared to the overall resources in Hong Kong, permanent losses of fisheries resources due to the project are predicted to cause minimal impacts to HKSAR fisheries. The impact is minimal and acceptable.

A total area of 0.20 ha will be temporarily occupied at three Grade A fishponds at Shan Pui during the construction phase. These fishponds will be reinstated after the construction works and thus the impact is minor and acceptable.

Based on the above impact assessment, no unacceptable impacts to aquaculture fisheries resources and operations are expected to occur as a result of the construction and operation of the proposed sewerage system and pumping stations.

17.0 ENVIRONMENTAL MONITORING AND AUDIT (EM&A)

An EM&A programme during the construction and operational phases will be prepared in accordance with the findings of EIA report, Study brief, "Environmental Monitoring and Audit - Guidelines for Development Projects in Hong Kong and Annex 21 of the TM-EIAO" to ensure that the predicted impacts are within the relevant standards. Contingency plans will also be incorporated into the EM&A manual in case that Action or Limit Levels are exceeded. In addition, the implementation schedule (Appendix 17.1) will clearly identify the actions and responsibility of different parties in the design, construction and operational stages. The implementation schedules will form the basis of the Environmental Permit conditions and contractual requirements to be formulated at the detailed design stage.

17.1 Air Quality Impact

17.1.1 ***Construction Phase (Air Quality)***

Dust suppresion requirements given in the Air Pollution Control (Construction Dust) Regulation have been proposed. In order to ensure the impact is minimal, EM&A requirements have been proposed. Monitoring locations are presented in Table 17.1 and the EM&A details are described separately in the Environmental Monitoring and Audit (EM&A) Manual.

Table 17.1: Representative air quality monitoring locations

Package	AML ID	EIA ASR Ref	Description	Land Uses	Approx. Distance to Sewer/Pumping Station (m)
Tin Shui Wai Area (2A-1T)	AM1	AT11	Tin Wah Estate, Wah Long House	R	26
	AM2	AT21	Jade Court, Block A	R	15
	AM3	AT15	Maywood Court, Block 8	R	32
	AM4	AT29	Dunwell Group	C	53
Lau Fau Shan Area (Alternative 2A-3T)	AM5	AL01	Deep Bay Road, workshop	C	17
	AM6	AL07	San Hing Tseun, No.37	R	16
	AM7	AL13	Tin Ying Road, Interin Housing, Block 2	R	128
	AM8	AL24	Mong Tseng Tseun, No.1	R	18
Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)	AM9	AN02	Kam Pok Road, Man Yuen Chuen No.19	R	12
	AM10	AN10	Castle Peak Raod Tam Mei, village house	R	32
	AM11	AN15	Ngau Tam Mei, village house	R	25
	AM12	AN23	Castle Peak Road Mai Po, No.55, Koon Ying School	G/IC	18
	AM13	AN29	Castle Peak Road San Tin No.128/ Future School	G/IC	36
	AM14	AN40	Fan Tin Tseun, Lun Fung Ming Ancestral Hall	G/IC	11
	AM15	AN46	Ka Lung Road, village house	R	10
	AM16	AN51	Ka Lung Road, No.54, San Tin Barrack	G/IC	16
Shap Pat Heung Area (2B-2T)	AM17	AS04	Sha Ha Tseun, No.548	R	26
	AM18	AS17	Muk Kiu Tau Tseun, No.1	R	18
	AM19	AS23	Pak Sha Tseun, No.62	R	32
	AM20	AS25	Wong Nai Tun Tseun, No.47C	R	16
	AM21	AS36	Shun Ching San Tseun, No.211	R	12
	AM22	AS40	Shui Tsiu San Tseun, No.181	R	19
	AM23	AS52	Shung Ching San Tseun	R	20
	AM24	AS64	Tai Kei Leng, No.702	R	13
	AM25	AS70	Tong Tau Po Tseun, No.1	R	24

17.1.2 ***Operational Phase (Air Quality)***

With the provision of adequate mitigation measures, there is no EM&A requirement during the operational phase.

17.2 Noise Impact

17.2.1 ***Construction Phase (Noise)***

A construction noise assessment has been undertaken with the consideration of cumulative impacts arising from other projects proposed in the vicinity of the study area. Unmitigated construction noise would cause exceedance of the daytime construction noise criteria. Mitigation measures such as adopting quiet plant, limiting the use of PME, using of temporary barriers along site boundary, and employing temporary and movable barrier close to construction plants for sewage pumping station construction have been

recommended. However, residual impact at some NSRs are predicted.

The recommended monitoring locations are presented in Table 17.2 and requirement are detailed in the Environmental Monitoring and Audit (EM&A) Manual. The effectiveness of on-site control measures could also be evaluated through the monitoring. All the recommended mitigation measures should be incorporated into the EM&A programme for implementation during the construction phase.

Table 17.2: Representative noise monitoring locations

Package	NML ID	EIA NSR Ref	Represent No of Dwelling in the area	Remark/Description
Tin Shui Wai Area (2A-1T)	NM1	NT08	9	-
	NM2	NT09	-	school
	NM3	NT15	256	-
	NM4	NT21	3	-
Lau Fau Shan Area (Alternative 2A-3T)	NM5	NL03	-	-
	NM6	NL08	15	-
	NM7	NL13	3	-
	NM8	NL22	6	-
Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T)	NM9	NN02	42	-
	NM10	NN09	21	-
	NM11	NN14	3	-
	NM12	NN23	87	-
	NM13	NN27	12	-
	NM14	NN29	3	-
	NM15	NN30	-	-
	NM16	NN35		-
	NM17	NN40	12	-
	NM18	NN46	6	-
	NM19	NN51	9	-
Shap Pat Heung Area (2B-2T)	NM20	NS01	3	-
	NM21	NS11	3	-
	NM22	NS17	3	-
	NM23	NS21	3	-
	NM24	NS26	12	-
	NM25	NS31	6	-
	NM26	NS35	6	-
	NM27	NS40	15	-
	NM28	NS46	15	-
	NM29	NS51	9	-
	NM30	NS52	12	-
	NM31	NS54	3	-
	NM32	NS60	3	-
	NM33	NS64	12	-
	NM34	NS72	21	-
	NM35	NS37b	12	-
	NM36	NS42a	9	-
	NM37	NS70a	3	-
	NM38	NS49b	-	School

17.2.2 ***Operational Phase (Noise)***

In order to ensure that compliance with the noise limits specified in the report are achieved, noise commissioning at the site boundary and louvres at all the proposed sewage pumping stations shall be conducted as a requirement for Practical Completion. The measurement data during commissioning should be submitted to the Environmental Team (ET) Leader for checking against the noise design criteria.

17.3 Water Quality Assessment

With implementation of the recommended mitigation measures, the potential water quality impact will be minimal. No EM&A requirement will therefore be required during construction and operational phases.

17.4 Waste Management

The Contractor shall prepare a Waste Management Plan and execute the requirements according to the EM&A manual. A trip-ticket system should be established in accordance with the Works Bureau Technical

Circular No. 5/99 to monitor the disposal of public fill and solid wastes at public filling facilities and landfills, and to control fly-tipping. During site inspections and submission review, the ET Leader shall pay special attention to the issues relating to waste management, and check whether the Contractor has followed the relevant contractural clauses and satisfied the procedures as stipulated under the legislation of Hong Kong.

17.5 Land Contamination Implications

With implementation of the recommended mitigation measures, health and safety precaustionary measures and confirmatory test, the potential impact will be minimal. No special EM&A requirement will be required during construction and operational phases.

17.6 Ecological Assessment

The implementation of standard site practice stated in Section 13.6 of the EIA, such as use of quiet machinery and prevention of site runoff, shall also be checked as part of the environmental monitoring and audit procedures during the construction period.

The following recommendations are also made for the Works Package (Figure 13.5).

17.6.1 ***Designated Elements***

- Restriction of construction period to April through October for elements within WCA, i.e. AP1and 430m of AS1, to minimise disturbance to wintering birds;
- Reinstatement of temporary works area to its original conditions, in particular, for the three fish ponds along AS1. Appropriate construction method will be adopted to ensure that no dewatering of nearby fishpond is required. Such construction method shall be agreed by DSD before commencement of works.
- Provision of a detailed replanting plan during the detailed design stage for the 0.35ha of replanting area at San Pui Ponds to compensate for the loss of 0.23ha of 60CD mitigation planting area to YLEPS (See Section 13.6.1 for details).

The above conditions shall be complied as part of the construction contract.

17.6.2 ***Non Designated Elements***

- Restriction of construction period to April through October for elements within WCA, i.e., section of S1 to minimise disturbance to wintering birds;
- Restriction of construction period to September through March for sewer alignment sections S4/S5 within 100m from Mai Po Village and Mai Po Loong Egretries to minimise disturbance to the egretries during the breeding season;
- Reinstatement of temporary works area to its original conditions, in particular, for mixed woodland habitats along AS3. The contractor shall refer to the results of vegetation surveys conducted at the mixed woodland habitat by DSD during the detailed design phase for reinstatement.

The above conditions shall be complied as part of the construction contract.

No other ecology-specific measures are considered necessary.

17.7 Landscape and Visual Impacts

With implementation of the recommended mitigation measures, the potential impact will be minimal. No

EM&A requirement will be required during construction and operational phases.

17.8 Cultural Heritage Assessment

17.8.1 ***Archaeology***

The assessment has concluded that the construction of the proposed works may adversely impact on areas of archaeological potential in areas not available at the field evaluation stage. :

The mitigation recommendation is the following:

1. Pre-testing is required at the following locations:
   - Mong Tseng Tsuen PS (non-designated element). The pre-testing should comprise of the hand excavation of a minimum of one test pit measuring no less than 2 by 2 meters; and
   - Sewer alignment north of Tung Tau Tsuen (non-designated element). The pre-testing should comprise of a field investigation with a minimum of 20 auger hole tests and hand excavation of two test pits measuring no less than 2 by 2 meters.

Pre-testing should be undertaken prior to construction, but after land resumption at Mong Tseng and north of Tung Tau Tsuen and surface removal of concrete and asphalt at north of Tung Tau Tsuen.

2. Archaeological monitoring is recommended at the sewer alignment around the historical village of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen (non-designated element) (see Figure 15.48). The archaeological evaluation and archaeological monitoring should be conducted by a qualified archaeologist, who should be licensed by the Antiquities Authority before the evaluation or archaeological monitoring takes place. This licensing procedure is a statutory requirement stated in Sections 12 and 13 in the Antiquities and Monuments Ordinance (Cap. 53). The contractor should inform AMO the time schedule of the archaeological evaluation or archaeological monitoring and notify AMO two weeks prior to the commencement of the evaluation or archaeological monitoring so as to allow AMO to arrange the on-site monitoring. The licensed archaeologist, when conducting the archaeological monitoring during construction phase, should adopt a minimum 5% sampling strategy.

Finally, if the conforming scheme 2A-IT of the Yuen Long sewage treatment works effluent pipeline is preferred, an archaeological impact assessment will have to be conducted prior to construction.

17.8.2 ***Built Heritage***

Construction Phase

The following resources will require mitigation during the construction phase:

i) Lau Fau Shan to Mong Tseng

Lau Fau Shan Road

Modern shrine AAHB-21: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works area by metal barriers.

ii) San Tin to Ngau Tam Mei

Fan Tin Tsuen

Man Lun Fung Ancestral Hall AAHB-405: As the works are in close proximity to the southwestern wall of the ancestral hall, which is a Declared Monument, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted

to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures

Shrine AAHB-419: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Ming Yuen Tong AAHB-433: As the works are in close proximity to the southeastern wall of the ancestral hall, which is a Grade II building, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.

Shun Yue Tong (Grade II) and San Yeh Man Tong (Grade I) AAHB-486 and 487: As the works are in close proximity to the southeastern walls of both of the ancestral halls, the contractor must carry out a condition survey of both of the buildings. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.

Castle Peak Road (San Tin to Mai Po)

Temple and shrine AAHB 227: The temple, although renovated contains historical architectural elements and is located directly on the edge of the works area. Hence, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures. The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access to the temple and shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Modern Village Gates AAHB-231 and 240: The base of the gates should be provided with a protective covering in the form of heavy duty plastic sheeting, supported by scaffolding where necessary.

Castle Peak Road (Yau Mei Tsuen)

Shrine AAHB-242: The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access from Castle Peak Road should be maintained through the provision of walkways separated from the works areas by metal barriers.

iii) Shap Pat Heung

Kung Um Road

Shrine AAHB-262: The shrine should be provided with a minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Tai Tong Road

Modern Village Gates AAHB-129, 131,153,162, 164 and 211: The base of the gates should be provided with a protective covering in the form of heavy duty plastic sheeting, supported by scaffolding where necessary.

Shrine AAHB-207: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Tai Shu Ha Road East

Shrine AAHB-224: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Temple AAHB-226: The entrance to the temple is located directly from Tai Shu Ha Road, access from the road should be maintained throughout the construction phase.

(iv) Yuen Long Effluent Pipeline

Shrine AAHB-357: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Operational phase

- The following resources will require mitigation measures for the operational phase:
- Mong Teng Tsuen (village structures, AAHB-29 to 53)
- Fan Tin Tsuen (Ming Yuen Tong AAHB-433 and Man Lun Fung AAHB-405)
- Tai Shu Ha Road East, Nga Yiu Tau (Tin Hau Temple AAHB-226)

The mitigation will consist of landscaping of the area around the pumping station should include planting of foliage complimentary to the existing environmental setting, in order to screen the proposed pumping station and minimise visual impacts. The colour treatment of the proposed pumping station should minimise visual impact.

Buddhist Blessing Stones

There will be no impacts to Buddhist blessing stones during either the construction or operational phases, therefore no mitigation measures will be necessary.

Graves

There will be no impacts to any of the surveyed graves in the study area or to those located within the Cassino camp during either the construction or operational phases, therefore no mitigation measures will be necessary.

Cultural and Historical Landscape Features

No cultural or historical landscape features will be impacted by the project during either the construction or operational phase; therefore, no mitigation measures will be required.

17.9 Fisheries Assessment

With implementation of the site practices to control site runoff during construction, the minor indirect impact would be acceptable. No EM&A requirement will be required during construction and operational phases.

18.0 SUMMARY OF ENVIRONMENTAL OUTCOMES

18.1 Air Quality Impact

Similar to the previous EIA report (Designated Project) on CE31/99 "Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1", the sewer and rising mains will be constructed in 50m segments. With such small scale of construction works, the potential dust impact would be limited and short term in nature. Regarding the sewage pumping stations, most part of the structures will be constructed underground while the pumping station building will be about 1-storey above ground level. Scaffolding with effective dust screens, sheeting or netting and automatic water spraying equipment shall be erected around the perimeter of the building during construction. With the implementation of proper contractual clauses and Best Site Practice controlled within the APC (Construction Dust) Regulation, adverse dust impact is not anticipated. An effective EM&A system is proposed to ensure the dust impact during construction phase is controlled within the legislative criteria.

During the operational phase, major air quality impact would be related to the potential odour emissions from Sewage Pumping Stations. An odour removal filter with the following H_2S removal efficiency has been recommended in the EIA report:

- of not less than 99.5% for AP1 SPS of 2A-1T.
- of not less than 99.5% for P1 to P5 SPS of 2A-2T and 2B-1T.
- of not less than 95% for all SPS at 2A-3T (A1 to A2); and
- of not less than 95% for all SPS at 2B-2T (B1 to B7).

Owing to the large setback distance of more than 400m and conveying of treated sewer at YLEPS, it is confirmed that YLEPS is not a potential odour source.

The entire SPS; especially wet wells and screening collection areas should be enclosed in a building structure (Similar to that shown in Figure 14.62 of the EIA report) and the discharge point of the odour removal system should be directed away from the adjacent sensitive uses, and the discharge height should not be less than those assumed in Table 7.4. With the implementation of the recommended odour control measures, the computer dispersion modelling results showed that the odour levels at the air sensitive receivers around the SPS would be well below the EPD odour criterion.

18.2 Noise Impact

The construction noise impact of the project is due to the construction of the sewerage and the pumping station. There will also be cumulative construction noise impact due to the concurrent construction activities in the vicinity of the project site.

The distance of the most identified existing and future noise sensitive receiver are located very close to the work fronts. With the use of quieter plant, temporary noise barrier / enclosure, reschedules the construction program and regrouping the construction activities, residual construction noise impacts are still predicted at some noise sensitive receivers. However, the adverse residual impact will be temporary and will last for few days in daytime only. It is considered as acceptable.

During the operational phase, with the use of silencer, enclosure and acoustic louvre in the pumping station, adverse residual impact is not anticipated.

18.3 Water Quality Impact

Potential impacts during the construction phase will be arisen from pollutants in surface run-off, which may enter surface water or the stormwater drain directly before discharging into Deep Bay. Mitigation measures recommended in ProPECC PN 1/94 Construction Site Drainage will be implemented. There will also be cumulative construction water quality impact due to the concurrent construction activities in the vicinity of the project site. Given that the mitigation measures in their corresponding EIA studies (if designated projects) or ProPECC PN 1/94 are proper installed, cumulative impact is also not anticipated.

The normal operation of the Yuen Long / Kam Tin Sewerage and Sewage Disposal Stage 2 works will result in improvement of water quality in both the inland and marine waters in the NWWCZ and Deep Bay WCZ after the treatment of the San Wai Sewage Treatment Plant. Therefore no other mitigation measures will be required.

During the operational phase, potential water quality impact will be arisen from emergency discharge from pumping station and operation of the rising mains. Mitigation measures are proposed as follows:

Emergency Operation of Pumping Stations
- The discharge point of the overflow bypass should be below the low water mark (i.e. location of minimum water level in stream in dry season);
- The discharge point of the overflow bypass should be away from sensitive receivers such as fish ponds, water gathering grounds, country parks, nature reserves, sites of special scientific interest, marine parks/marine reserves, streams with water for human consumption, etc.;
- A contingency plan for emergency discharge shall be developed;
- The overflow bypass should be operated only in an emergency, such as prolonged power failure. Overflow mechanism must not occur to facilitate routine maintenance on a regular basis;
- If the pumping station is unmanned, a telemetry system should be provided to the nearest manned station/plant so that swift actions could be taken in the case of malfunction of the unmanned facilities;
- Hand-cleaned screens should be provided at the overflow bypass to prevent the discharge of floating solids into receiving water bodies. The clear spacing of the bar screen should normally be about 25mm;
- Standby pump should be provided to facilitate maintenance and repairing of equipment; and
- Dual (back-up) power supply should be provided. Dual power supply could be in the format of ring main, or an automatic-operated emergency generator with sufficient capacity to cope with the demand loading of the essential plant equipment.

Emergency Operation of Rising Main
- Twin rising mains are provided for backup and repairing purpose
- Should the twin rising mains be failure, tankers will be used to store the emergency discharge and transport to the YLSTW or SWSTW for disposal.

With the implementation of the above mitigation measures, water quality impact during the operational phase is not anticipated.

18.4 Waste Management Implications

The following quantities of waste are expected to arise during the construction of the proposed gravity sewer and pumping station: public fill of 111,460m^3 (46,168m^3 from 3 work items of Designated Elements and 65,292m^3 from 38 work items of Non-designated Elements under 4 packages); and chemical waste (less than hundred liters per month); and general refuse.

Good waste management practices have been recommended to ensure that adverse environmental impacts from the handling and disposal of construction and operational wastes are prevented or minimized. A separate C&DMMP will be prepared by the DSD project office for departmental vetting before upgrading of this project to Category "A" in Public Works Programme. An overall Waste Management Plan (WMP) should incorporate DEP's comments and be approved by DEP. Since the project site is located closed to the WBA or WCA, it is important to put control clauses in the contract to disposal waste away from the ecological sensitive areas. The WMP should also include the following:
- The type of C&D generated;
- The amount for each type of C&D material;
- The location of waste sorting; and
- The location of disposal.

No unacceptable environmental impacts will result from the construction and operation of the proposed sewerage and Pumping Stations.

18.5 Land Contamination Impact

The preliminary investigation identified the land uses adjacent to the proposed alignment of the sewers/raising mains with the minimal potential to give rise to land contamination, as defined in the EPD's guidance documents. As the various premises in question are all fairly small in size, the proposed sewers/raising mains alignment and the location of pumping stations do not lie within the potential contaminated premises, and the

land contamination potential is judged to be localised, the overall contamination concerns to the Project site area are considered to be very low.

Although the risk of land contamination of the Project site area is very low, it is still recommended to conduct the "Confirmatory Soil Test" during the excavation to further safeguard the construction workers. Since great portion of the alignments are located underneath major roads, road closure for confirmatory testing is not feasibility. Therefore, it is suggested that the testing should be conducted during detailed design stage or the commencement of work when site access is still feasible.

18.6 Ecological Impact

Most of the study area, particularly the area to be directly affected by the proposed Project is highly urbanised and degraded by existing and on-going development. Habitats found within the study area include plantation, mixed woodland, grassland/shrubland, cultivated land/orchard, fishpond, stream/channel, mangrove, and disturbed/urbanized/wasteland areas. Two species of plants and 4 species/groups of birds of conservation interest were recorded.

The designated elements would cause a permanent loss of 0. 39 ha of urbanized/disturbed/wasteland and 0.23ha of plantation for construction of pumping stations, and a temporary loss of 0.24 ha of urbanized/disturbed/wasteland and 0.20 ha of fishponds for construction of sewers. There will be no-net-loss in wetland area at the WCA and CA. After implementation of mitigation measures, there is no adverse impact.

The non-designated element would cause a permanent loss of 0.95 ha of urbanized/disturbed/wasteland, 0.05 ha of fishponds and 0.12 ha of cultivated land and a temporary loss of 25.49 ha of urbanized/disturbed/wasteland, 0.46 ha of mixed woodland, 0. 28 ha of shrubland/grassland, 0.02 ha of plantation and 0.14 ha of cultivated land. The overall ecological impacts are ranked as minor. Standard site practice and recommendations to each works package are made and no residual impacts are anticipated.

A detailed tree survey should be performed during the detailed design phase (with the ultimate alignment) by the DSD at the mixed woodland (Item AS3) in order to provide information for site reinstatement by the contractor.

It is recommended that the construction period of items within WCA (Package 2A-1T alternative), i.e. the pumping station AP1 and 430m of AS1 be restricted to April through October to avoid the potential disturbance to wintering waterbirds. In order to reduce the impact on the nearby fishpond within WCA, laying of sewer will be conducted in 20m segment. The construction works will also be scheduled during non rainy days. Appropriate construction method will be adopted to ensure that no dewatering of nearby fishpond is required. Such construction method shall be agreed by DSD before commencement of works.

Replanting area would also be provided to compensate for the loss of 60CD mitigation planting area on a like-to-like basis by using the native species recorded in the existing 60CD planting (Table 13.28). A potential replanting area is located at Shan Pui Ponds. These abandoned ponds are within WCA and are government ponds. These ponds form an island between 60CD and are accessible by boat. The grassy area highlighted in Figure 13.5 is above high tide zone and will not be subject to tidal action. About 0.35 ha will be planted, which can compensate for the loss from YLEPS at a 1.5:1 ratio to off-set the time loss and to reduce of risk of poor survival. Saplings of native tree species recorded in 60CD plantation including *Sapium sebiferum, Hibiscus tiliaceus* and *Celtis tetrandra* subsp. *sinensis* and others including *Macaranga tanarius* and *Melia azedarach* will be used in the replanting area. Maintenance schedule should be specified in the landscape contract and should include irrigation and weeding on a bimonthly basis for the first year of establishment to enhance survival. Tree seedlings dead within the first year should be replaced by the landscape contractors. Upon completion of the landscape contract the plantation should be handed over to AFCD. A detailed replanting plan should be included during the detailed design stage.

It is also recommended that the construction period of items within WCA (Package 2A-2T and 2B-1T), i.e. 560m of S1 along 100CD, be restricted to April through October to avoid the potential disturbance to wintering waterbirds. Due to the potential noise disturbance from construction works, the construction period of the alignment sections within 100m from Mai Po Village and Mai Po Loong egretries shall be restricted to September through March to avoid breeding season as possible to reduce disturbance to breeding birds.

Work sites/disturbed areas shall be reinstated immediately after completion of the construction works, in particular, through on-site tree/shrub planting along the woodland section at Tin Shui Wai, and 3 fishponds within WCA.

On top of the EIAO application, a rezoning request to change the landuse for some pumping stations are required by DSD during detailed design stage. Supporting ecological impact assessment is required to justify the case. Without the approval from the Town Planning Board, land right for construction will not be given.

18.7 Landscape and Visual Impact

Construction Phase mitigation measures shall include the following mitigation measures (note: In all cases, the proposed mitigation measures for designated and non-designated elements will be the same):

- Regular checks should be carried out to ensure that the work site boundaries are not transgressed, hoardings are properly maintained and that no damage is being caused to the surrounding areas.
- Topsoil (uncontaminated), where identified, should be stripped and stored for re-use in the reinstatement of topography and soft landscape, where practical.
- The potential for soil erosion should be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (e.g. plastic sheeting or a grass cover established by hydroseeding) over newly exposed soil.
- Waste disposal and cleansing of equipment should be strictly controlled on site to prevent ground contamination.
- All existing trees shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this Specification, the Contractor shall be required to submit, for approval, a detailed working methodology for the protection of trees prior to undertaking any works adjacent to all retailed trees.
- Trench excavation for pipe laying to be located a minimum of 2 m from the nearest part of roadside tree trunks.
- Reinstatement of turf grass cover disturbed during excavation for installation of pipeline under the waterway.
- Reduce construction time to a minimum.
- Transplantation of affected trees to holding nursery with the view to relocation within the immediate vicinity towards the completion of construction works.
- Ensure requirements for stockpiles are reduced wherever possible and that stockpiles do not transgress works site boundaries.
- Ensure vegetation removal at any site of trench works, directional drilling or construction of pumping station does not include unnecessary trimming or disruption of tree roots and branches of adjacent vegetation.

Operational Phase measures shall include the following mitigation measures (note: In all cases, the proposed mitigation measures for designated and non-designated elements will be the same):

- Tree planting to compensate for any affected trees.
- Turfing/grassing of the roof of the YLEPS (Figure 14.66).
- Pumping Stations located so as to avoid sensitive landscape features as far as practicable.
- Pumping stations should be designed so as to complement the surrounding rural environment. In particular, a clay brick tile should be used as a building finish to reduce visual impact of the structures. This treatment is shown in Figures 14.62 to 14.65 inclusively.
- Soft landscape works around the pumping stations will include multi-layered trees and shrubs to screen and enhance the structures. Wherever possible, they will be continuous with nearby street trees and amenity plantings.

With the incorporation of mitigation measures, it is concluded that the landscape and visual impacts for both Designated and Non-Designated Elements will be acceptable.

18.8 Cultural Heritage Impact

18.8.1 ***Archaeology***

The assessment has concluded that the construction of the proposed works would not have adverse archaeological impact provided that the following mitigation recommendations are implemented:

1. Pre-testing is required at the following locations:

- Mong Tseng Tsuen PS (non-designated element). The pre-testing should comprise of the hand excavation of a minimum of one test pit measuring no less than 2 by 2 meters; and
- Sewer alignment north of Tung Tau Tsuen (non-designated element). The pre-testing should comprise of a field investigation with a minimum of 20 auger hole tests and hand excavation of two test pits measuring no less than 2 by 2 meters.

Pre-testing should be undertaken prior to construction, but after land resumption at Mong Tseng and north of Tung Tau Tsuen and surface removal of concrete and asphalt at north of Tung Tau Tsuen.

2. Archaeological monitoring is recommended at the sewer alignment around the historical village of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen (non-designated element). The archaeological evaluation and archaeological monitoring should be conducted by a qualified archaeologist, who should be licensed by the Antiquities Authority before the evaluation or archaeological monitoring takes place.

18.8.2 ***Built Heritage***

Construction Phase

The following resources will require mitigation during the construction phase:

a) Lau Fau Shan to Mong Tseng

Lau Fau Shan Road - Modern shrine AAHB-21: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works area by metal barriers.

b) San Tin to Ngau Tam Mei

Fan Tin Tsuen - Man Lun Fung Ancestral Hall AAHB-405: As the works are in close proximity to the southwestern wall of the ancestral hall, which is a Declared Monument, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.

The colour treatment of the proposed pumping station at Fan Tin Tsuen (P4) should minimise visual impact. It is recommended in the detailed design stage that the design and materials of the proposed pumping station should visually harmonize with the existing historic ancestral halls of Man Lun Fung and Ming Yuen Tong, for example, grey brickwork and granite are preferable for the exterior elevations.

Shrine AAHB-419: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Ming Yuen Tong AAHB-433: As the works are in close proximity to the southeastern wall of the ancestral hall, which is a Grade II building, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.

Shun Yue Tong (Grade II) and San Yeh Man Tong (Grade I) AAHB-486 and 487: As the works are in close proximity to the southeastern walls of both of the ancestral halls, the contractor must carry out a condition

survey of both of the buildings. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.

c) Castle Peak Road
Castle Peak Road (Yau Mei Tsuen) - Shrine AAHB-242: The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access from Castle Peak Road should be maintained through the provision of walkways separated from the works areas by metal barriers.

Temple and shrine AAHB 227: The temple, although renovated contains historical architectural elements and is located directly on the edge of the works area. Hence, the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures. The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access to the temple and shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Modern Village Gates AAHB-231 and 240: The base of the gates should be provided with a protective covering in the form of heavy duty plastic sheeting, supported by scaffolding where necessary.

Castle Peak Road (Yau Mei Tsuen) - Shrine AAHB-242: The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access from Castle Peak Road should be maintained through the provision of walkways separated from the works areas by metal barriers.

d) Shap Pat Heung
Kung Um Road - Shrine AAHB-262: The shrine should be provided with a minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Tai Tong Road - Modern Village Gates AAHB-129, 131,153,162, 164 and 211: The base of the gates should be provided with a protective covering in the form of heavy duty plastic sheeting, supported by scaffolding where necessary.

Shrine AAHB-207: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Tai Shu Ha Road East - Shrine AAHB-224: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Temple AAHB-226: The entrance to the temple is located directly from Tai Shu Ha Road, access from the road should be maintained throughout the construction phase.

e) Yuen Long Effluent Pipeline
Shrine AAHB-357: The shrine should be provided with a buffer zone of minimum 1 m, marked out by high visibility fencing and access to the shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Operational phase

The following resources will require mitigation measures for the operational phase:

- Lau Fau Shan to Mong Tseng: Village structures (AAHB-29 – 53) in Mong Tseng Tsuen

- San Tin to Ngau Mei Tsuen: Man Lung Fung Ancestral Hall (AAHB-405) and Ming Yuen Tong (AAHB-433) in Fan Tin Tsuen
- Tai Shu Ha Road: Temple (AAHB-226) in Tai Shu Ha Road East (Nga Yiu Tau)

The mitigation will consist of landscaping of the area around the pumping station should include planting of foliage complimentary to the existing environmental setting, in order to screen the proposed pumping station and minimise visual impacts. The colour treatment of the proposed pumping station should minimise visual impact.

With the incorporation of mitigation measures during construction and operating phases, adverse impact related to cultural heritage is not anticipated.

18.9 Fisheries Impact

Within the non Designated Elements, none of the sewer alignment or the pumping station locations would constitute permanent direct impacts to any Grade A active fishponds. Only a fraction (0.05 ha) of a Grade C fishpond in San Wai would be subject to direct loss. Potential impacts to fisheries resources and operations may arise from permanent loss of fishponds. Due to the small percentage compared to the overall resources in Hong Kong, permanent losses of fisheries resources due to the project are predicted to cause minimal impacts to HKSAR fisheries. The impact is minimal and acceptable.

Within the Designated Elements, a total area of 0.20 ha will be temporarily occupied at four Grade A fishponds (mainly earth bunds) at Shan Pui during the construction phase. These fishponds will be reinstated after the construction works and thus the impact is minor and acceptable.

Indirect impacts might be caused by site runoff from the works areas. The impact is ranked as minor in nature. Good site practice would be sufficient to mitigate this potential impact.

18.10 Summary of Options Review

18.10.1 Options Considered on Package Alignment (Designated Element)

For the design of the Yuen Long Effluent pipline, two alignment options have been reviewed:

- Conforming Scheme of 2A-1T (Figure 1.4 & Figures 1.4.1 to 1.4.6) - The proposed works under the conforming scheme are divided into six works items. The whole section is 7,350m long of twin rising mains of 1400mm in diameter. Major parts of the sewage alignment (2,140m) and the Yuen Long Effluent Pumping Station will be located within the Deep Bay Buffer Zone, Wetland Conservation Area and Wetland Buffer Area.
- Alternative Scheme of 2A-1T (Figure 1.1 & Figures 1.1.5 to 1.1.9) - The proposed works under the alternative scheme are divided into seven works items. The whole section has been reduced to 6,990m long of twin rising mains of 1400mm in diameter. Except for the small-scale Yuen Long Effluent Pumping Station (same SPS location as the Conforming Scheme) on a plantation area, the alignment will run away from the Deep Bay Buffer Zone and about 80% of the sewage alignment will be laid underneath existing and future roads.

Considerations have been given comprehensively (in Section 5) in order to identify the preferred alignment that would achieve an optimal balance between environmental, engineering, connectivity, work programme etc, in accordance with the latest available information. It is concluded that the 2A-1T Conformign Scheme is a "No built" option while the 2A-1T is selected as the Preferred Option.

18.10.2 Options Considered for Locatons of Yuen Long Effluent Pumping Station (AP1) and alignment within WCA (AS1) – Designated Element

For the selection of the Yuen Long Effluent pumping station, three alternative sites have been investigated in the vicinity of YLSTW (Appendix 5.1). DSD has therefore conducted a detailed utility search, ground review and engineering investigations on the alternative sites and other nearby areas. Judging from the respective pros and cons of the three options as well as the surrounding site conditions as mentioned above, Option 1 is the most preferable and viable site option for the YLEPS from engineering, environmental and land points of view. Detailed engineering justifications, maintenance problems and supportive reasoning have been sent to relevant

authorities to justify Option 1 (the current design) is the only feasible option. Other options, including Options 2 and 3 are considered to be technically/engineering infeasible.

18.10.3 Options Considered for Locations of San Lung Tsuen SPS (P4) – Non Designated Element

For the selection of the San Lung Tsuen pumping station (P4), DSD has conducted a detailed utility search, ground review and engineering investigations on the site. Geographical, topographical, hydraulic, engineering, environmental, land availability and maintenace aspects have been considered in details. Two sites for the San Lung Tsuen SPS had been proposed by DSD for initial engineering consideration (Figure 5.1). However, owing to the fact that the land is a private site and there is currently a new building development under construction, this proposal for alternative site had been discarded. No other vacant site can be found in the nearby area. The current location has been selected and no adverse environmental impact is identified when mitigation measures are incorporated.

19.0 CONCLUSION

19.1 Air Quality

19.1.1 ***Construction Dust***

Designated Elements and Non-designated Elements

With the implementation of proper contractual clauses and Best Site Practice controlled within the APC (Construction Dust) Regulation, adverse dust impact is not anticipated. An effective EM&A system is proposed to ensure the dust impact during construction phase is controlled within the legislative criteria.

19.1.2 ***Odour Impact During Operational Phase***

Designated Elements

Cumulative odour assessment has been conducted. Best practical means and proper mitigation measures including effective ventilating system and odour removal filters have been proposed, and no adverse odour impact during operational phase would be anticipated. For YLEPS (AP1/OP1 of 2A-1T) and Ngau Tam Mei SPS (P1 of 2A-2T/2B-1T), a filter with H_2S removal efficiency of not less than 99.5% has been recommended.

Non-designated Elements

An odour removal filter with the following H_2S removal efficiency shall be provided:

- of not less than 99.5% for P2 to P5 SPS of 2A-2T and 2B-1T.
- of not less than 95% for all SPS at 2A-3T (A1 to A2); and
- of not less than 95% for all SPS at 2B-2T (B1 to B7).

Best practical means and proper mitigation measures including effective ventilating system have been proposed such that no adverse odour impact during operational phase would be anticipated.

19.2 Noise

19.2.1 ***Construction Noise***

Designated Elements and Non-Designated Elements

Concurrent construction noise impacts from both pumping station and sewers have been assessed. A theoretical worst case in construction noise assessment has been undertaken with the consideration of cumulative impacts arising from other projects proposed in the vicinity of the study area. Unmitigated construction noise would cause exceedance of the daytime construction noise criterion.

Mitigation measures such as adopting quiet plant, limiting the use of PME, using of temporary barriers along site boundary, and employing movable barrier close to construction plants for sewage pumping station construction have been recommended. It is also recommended that sewers and the rising mains shall be constructed in segments of up to a maximum 50m in length at any one time in order to reduce the time of noise impact.

Due to the proximity of some NSRs to the works site, noise exceedances are predicted even with the adoption of the best practical mitigation measures for some isolated occasions.

The exceedances are resulted from the construction activities along the pipework segment, which will have impact on the following NSRs at:

- Tin Shui Wai Area (2A-1T): NT16 – 18, NT20 – 22, NT24, NT22a and NT24a. A maximum noise level of 85.9dB(A) is found at NT22a.
- Ngau Tam Mei and San Tin Areas (2A-2T and 2B-1T): NN02, NN09, NN13-14, NN17, NN21- 22, NN24-27, NN43, NN45-47, NN50-52, NN19a and NN26a. With a maximum noise level of 89.4dB close to NN46-47.
- San Lung Tsuen Area (2B-2T): NN31a, NN32-33, NN35-36, and NN38-40. Maximum noise level is 86.8dB at NN40.
- Shap Pat Heung Area (2B-2T): NS01, NS11, NS13, NS16-17, NS24-28, NS31, NS34-36, NS40, NS42, NS45-48, NS51-57, NS59-61, NS64, NS66, NS68-70, NS72, NS19a&b, NS37a&b, NS39a, NS42a, NS49a, NS52a, NS70a, NS76 and NS76b. Maximum noise level is 89.4dB at NS66.

- Lau Fau Shan Area (Alternative 2A-3T): NL13, NL22, NL29 and NP01. With a maximum noise level of 81.4dB at NP01.

The maximum predicted noise level will occur during road pavement and finish works, which is 19.4 dB (A) greater than the day-time noise criteria. However, the period of such an exceedance is expected to last no more than 2 days. For other construction activities, minor exceedance will be experienced for a period of 1-2 weeks on sewage laying works and half month on site preparation, respectively. The affected periods for each work packages and items have been detailed in Section 8.9. Also, a systematic event and action plan on noise impact should be undertaken as the core part of the EM&A programme in order to minimize the potential complaint.

It is recommended that regular monitoring of noise at NSRs as part of the EM&A programme will be required during the construction phase.

19.2.2 ***Operational Noise***

Designated Elements

There is no NSR within 300m from the YLEPS (AP1/OP1), and noise impact is not anticipated. For pumping station at Ngau Tam Mei Pumping Station (P1), the nearest NSR is located at 52m away and the maximum allowable SWL at lourve has been established.

Non-designated Elements

During the operational stage, noise impacts due to the proposed sewage pumping stations will not be anticipated provided that proper acoustic treatment, including silencer or acoustic louvre is incorporated. In addition, absorptive wall linings could also be used to further reduce the internal reverberant noise. Basic building design such as to avoid any opening or louvres facing the nearest NSR should also be adopted. Noise commissioning at the site boundary and louvers of the proposed SPS is recommended.

19.3 Water Quality Assessment

Designated and Non-designated Elements

The construction phase impacts include:

- the potential impacts on inland water quality from the land based construction activities; and
- the potential impacts on inland water quality from crossings of the local streams.

Potential impacts on surface water quality due to land based construction activities would primarily occur due to surface run-off and wastewater generation from within the construction sites, including sewage effluent from the workforce. The potential impacts may be readily controlled by on-site mitigation measures, which were specified in detail. Pipe Jacking method will also be adopted in crossing the local stream in order to avoid adverse impact on water quality.

The operational phase impacts include:

- The potential impacts on inland and marine water quality due to the connection of currently unsewered areas to the Yuen Long STW; and
- The potential impacts on inland and marine water quality due to uncontrolled effluent discharges due to failure of pumping stations.

The water quality modelling result has been reviewed. After the commence of the project, there will be a decrease in the discharge of untreated sewage effluent to inland waterways through connection to the Yuen Long STW but an increase in the treated effluent flows from the Yuen Long STW. The results of the water quality modelling also revealed that there would be improvements in marine water quality in the vicinity of the mouth of the Shan Pui River, where the Yuen Long STW discharges. An assessment of the impacts of the Stage 1 works on inland water quality indicated that there would be a reduction in polluting discharges to the inland waterways.

Mitigation measures were recommended to reduce the risks of failure of pumping stations and to ensure that timely responses are initiated in cases of failure in order to prevent adverse impacts on water quality due to the discharge of untreated sewage effluent.

No monitoring of water quality would be required during either the construction or operational phases. It was recommended that regular audits of the implementation of the specified mitigation measures be carried out during the construction of the Project.

19.4 Waste Management

Designated Elements and Non-designated Elements

The following quantities of waste are expected to arise during the construction of the proposed gravity sewer and pumping station: public fill of 111,460m^3 (46,168m^3 from 3 work items of Designated Elements and 65,292m^3 from 38 work items of Non-designated Elements under 4 packages); and chemical waste (less than hundred liters per month); and general refuse.

Screening, solid waste, silt and debris will arise from the operation of the proposed Pumping Stations. Approximately 14.5m^3 per month of material will be generated from the pumping station. The impact of its disposal at landfill will be minimal. The generation of chemical wastes is expected to be very small and no adverse environmental impacts are envisaged.

Good waste management practices have been recommended to ensure that adverse environmental impacts from the handling and disposal of construction and operational wastes are prevented or minimized. It is concluded that no unacceptable environmental impacts will result from the construction and operation of the proposed sewerage and Pumping Stations.

19.5 Land Contamination Assessment

Designated Elements and Non-designated Elements

A number of potentially contaminated premises are located within 50m of the proposed alignment of the gravity sewer and the pumping station. These premises include vehicle and mechanic maintenance and repair yards; car dismantling and dumps yards; construction equipment storage yards; small scale metal scrap yards; plastic drum cleaning/recycling and un-licensed petroleum filling station. The review of the historical and current land use was undertaken using information from aerial photographs, site visits and government and public information on potential "hot spot" area.

The assessment results indicated that the overall contamination concerns to the Project site area are very low. It is considered that the preparation of the Contamination Assessment Plan (CAP) for the detail site investigation, is not required and not practical for the Project site, as the proposed sewer alignment and the location of pumping station do not lie within the potential contaminated premises.

Although the risk of land contamination of the Project site area is very low, it is still recommended to conduct a "Confirmation Soil Test" during the trench excavation to further safeguard the construction workers. The details of the Confirmatory Soil Test are stipulated in Section 12.6. In case of the excavated soils are confirmed as contaminated, the remediation method as stipulated in Section 12.7 will be adopted to remediate the contaminated soils before disposal.

19.6 Ecological Assessment

Most of the study area, particularly the area to be directly affected by the proposed Project is highly urbanised and degraded by existing and on-going development. Habitats found within the study area include plantation, mixed woodland, grassland/shrubland, cultivated land/orchard, fishpond, stream/channel, mangrove, and disturbed/urbanized/wasteland areas. Two species of plants and 4 species/groups of birds of conservation interest were recorded.

Designated Elements

The designated elements would cause a permanent loss of 0. 39 ha of urbanized/disturbed/wasteland and 0.23ha of plantation for construction of pumping stations, and a temporary loss of 0.24 ha of urbanized/disturbed/wasteland and 0.20 ha of fishponds for construction of sewers. There will be no-net-loss in wetland area at the WCA and CA.

Non-designated Elements

The non-designated element would cause a permanent loss of 0.95 ha of urbanized/disturbed/wasteland, 0.05 ha of fishponds and 0.12 ha of cultivated land and a temporary loss of 25.49 ha of urbanized/disturbed/wasteland, 0.46 ha of mixed woodland, 0. 28 ha of shrubland/grassland, 0.02 ha of plantation and 0.14 ha of cultivated land. The overall ecological impacts are ranked as minor. Standard site practice and recommendations to each works package are made. No residual impacts are anticipated.

19.7 Landscape & Visual Impact Assessment

Designated Elements

The following pumping stations are designated elements and are therefore, required to undertake the approved mitigation measures as stated in Section 14.9.1:

- Yuen Long Effluent Pumping Station (Package 2A - 1T); and
- Ngau Tam Mei Sewage Pumping Station (Package 2A - 2T).

For the designated elements, it is concluded that in accordance with the definitions in the EIAO Annex 10, the landscape and visual impacts **will be acceptable with mitigation measures**.

Non-designated Elements

For the non-designated elements, it is concluded that in accordance with the definitions in the EIAO Annex 10, the landscape and visual impacts will be **acceptable with mitigation measures**.

19.8 Archaeology Assessment

Designated Elements

No archaeological impacts will occur on Designated Elements.

Non-designated Elements

- Mong Tseng Tsuen PS

Further investigation should be carried out after the resumption of the land and prior to commencement of any works. The investigation should comprise of a minimum of one test pit excavation, measuring no less than 2 by 2 meters to verify the stratigraphy and potential archaeological deposits in the Mong Tseng PPS.

- Sewer alignment on Wang Chau

The results from the field investigation indicate a lack of archaeological deposits and cultural soils. No further action is required.

- Sewer alignment north of Tung Tau Tsuen

Investigation should be carried out after the resumption of the land and prior to commencement of any works. The investigation should comprise a minimum of sewer alignment north of Tung Tau Tsuen (non-designated element). The pre-testing should comprise a minimum of 20 auger hole tests and two test pit excavations measuring no less than 2 by 2 meters, to verify the stratigraphy and potential archaeological deposits within the known archaeological site.

- Shan Ha Tsuen SPS

The field investigation results indicate that the area exists of sterile alluvial deposits with a high water table and is thus considered to have no archaeological potential. No further action is required.

- Shung Ching San Tsuen SPS

The field investigation results indicate that the area has been artificially raised by 1.5m fill. Sterile alluvial deposits were encountered at a depth of more than 1.5m. No further action is required.

- Sewer alignment from YLEPS to Wang Chau

Archaeological monitoring is recommended during the excavations of the sewer alignment between the historic villages of Tai Tseng Ng Uk Tsuen, Tai Tseng Wai and Shing Uk Tsuen (Figure 15.48).

19.9 Built Heritage Assessment

19.9.1 ***Designated Elements and Non-Designated Elements***

All impacts fall within non-designated elements of the project.

Built Features

Mitigation measures for the construction stage including condition surveys and the implementation of monitoring and precautionary measures for the following resources in Fan Tin Tsuen: Man Lun Fung Ancestral Hall (AAHB-405), Ming Yuen Tong (AAHB-433) and the Shun Yue Tong and San Yeh Man Tong AAHB-486 and 487.

Shrine AAHB-21 (Lau Fau Shan Road), Shrine AAHB-419 (Fan Tin Tsuen), Shrine AAHB-262 (Kung Um Road), Shrine AAHB-224 (Tai Shu Ha Road East), Shrine AAHB-207 (Tai Tong Road), Shrine AAHB-242 (Yau Mei Tsuen) and Shrine AAHB-357 (Fuk Shun Street): a buffer zone should be provided of minimum 1 m, marked out by high visibility fencing and access to the shrines should be maintained through the provision of walkways separated from the works area by metal barriers.

Temple AAHB-226: Access from Tai Shu Ha road should be maintained throughout the construction phase.

Temple and shrine AAHB 227: the contractor must carry out a condition survey of the building. This survey must be carried out in advance of works and a report must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The report must be submitted to AMO for approval before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures. The shrine is located at a sufficient distance as to not require any protective measures during the construction phase. Access to the temple and shrine should be maintained through the provision of walkways separated from the works areas by metal barriers.

Mitigation measures for the operational stage, including landscaping of the area around the pumping station by planting of foliage complimentary to the existing environmental setting, will be required by the following resources:

- Lau Fau Shan to Mong Tseng: Village structures (AAHB-29 – 53) in Mong Tseng Tsuen
- San Tin to Ngau Mei Tsuen: Man Lung Fung Ancestral Hall (AAHB-405) and Ming Yuen Tong (AAHB-433) in Fan Tin Tsuen
- Tai Shu Ha Road: Temple (AAHB-226) in Tai Shu Ha Road East (Nga Yiu Tau)

Buddhist Blessing Stones

There will be no impacts to Buddhist blessing stones during either the construction or operational phases, therefore no mitigation measures will be necessary.

Graves

There will be no impacts to any of the surveyed graves in the study area or to those located within the Cassino camp during either the construction or operational phases, therefore no mitigation measures will be necessary.

Cultural and Historical Landscape Features

No cultural or historical landscape features will be impacted by the project during either the construction or operational phase, therefore, no mitigation measures will be required.

19.10 Fisheries Assessment

Designated Elements

0.2 ha of temporary fish pond loss (mainly earth bunds) would be caused by the Designated Elements of this project. The fishpond areas will be reinstated after construction.

Indirect impacts might be caused by site runoff from the works areas. The impact is ranked as minor in nature. Good site practice would be sufficient to mitigate this potential impact.

Non-designated Elements

Though Grade A active fishponds were identified within the assessment area with the majority concentrated to the Shan Pui, Nam Sang Wai, Tai Sang Wai and San Tin, the majority of assessment area appears to be degraded through urbanisation and development. None of the sewer alignment or the pumping station locations would constitute permanent direct impacts to any Grade A active fishponds. Only a fraction (0.05 ha) of a Grade C fishpond in San Wai would be subject to direct loss. Potential impacts to fisheries resources and operations may arise from permanent loss of fishponds. Due to the small percentage compared to the overall resources in Hong Kong, permanent losses of fisheries resources due to the project are predicted to cause minimal impacts to HKSAR fisheries. The impact is minimal and acceptable.

A total area of 0.20 ha will be temporarily occupied at four Grade A fishponds (mainly earth bunds) at Shan Pui during the construction phase. These fishponds will be reinstated after the construction works and thus the impact is minor and acceptable.

Indirect impacts might be caused by site runoff from the works areas. The impact is ranked as minor in nature. Good site practice would be sufficient to mitigate this potential impact.

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