TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

5. WATER QUALITY IMPACT

5.1 Introduction

5.1.1.1 This section presents an assessment of potential water quality impacts arising from construction and operation of the Project, which has been conducted in accordance with the criteria and guidelines for evaluating and assessing water pollution as stated in Annex 6 and Annex 14 of the "*Technical Memorandum on Environmental Impact Assessment Process*" (EIAO-TM) as well as the requirements given in Clause 3.4.5 and Appendix D of the EIA Study Brief (No. ESB-340/2021) (hereinafter "the Study Brief").

5.1.1.2 An application for an Environmental Permit (EP) would be submitted for the following Schedule 2 Designated Projects (DPs) and the potential water quality impact due to these DPs during construction and operation phases are addressed in this assessment. These DPs include:

- New primary distributor and new district distributor roads (DP1);
- New San Tin Lok Ma Chau Effluent Polishing Plant (STLMC EPP) (DP2);
- New Water Reclamation Plant (DP3);
- Revitalisation of San Tin Eastern Main Drainage Channel (DP6);
- Recreational Development within Deep Bay Buffer Zone 2 (DP7).

5.1.1.3 The following DPs would apply the EP through separate EIA studies but their potential impacts during construction and operation phases are also addressed in this assessment. These DPs include:

- Refuse Transfer Station (RTS) (DP4);
- 400kV Electricity Substation (DP5).

5.2 Environmental Legislations, Standards and Guidelines

5.2.1 Technical Memorandum on Environmental Impact Assessment Ordinance (EIAO-TM)

5.2.1.1 The EIAO-TM was issued by EPD under Section 16 of the EIAO. Reference sections in the EIAO-TM provide the details of the assessment criteria and guidelines that are relevant to the water quality assessment, including:

- Annex 6 - Criteria for Evaluating Water Pollution
- Annex 14 - Guidelines for Assessment of Water Pollution

5.2.2 Water Quality Objectives (WQOs)

5.2.2.1 The Water Pollution Control Ordinance (WPCO) provides the major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, Hong Kong waters are divided into ten Water Control Zones (WCZs). Corresponding statements of Water Quality Objectives (WQOs) are stipulated for different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) in the WCZs based on their beneficial uses. According to Item 3.4.5.2 of the Study Brief, the assessment area for this water quality impact assessment covers the Deep Bay WCZ as designated under the WPCO. The WQOs for the watercourses in the Deep Bay WCZ relevant to the water quality impact assessment are listed in **Table 5.1**.

Table 5.1 Summary of Key Water Quality Objectives for Deep Bay WCZ

Parameters	Objectives	Subzone
Aesthetic appearance	Waste discharges shall cause no objectionable odours or discolouration of the water.	Whole Zone
	Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substances should be absent.	
	Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam.	
	There should be no recognisable sewage-derived debris.	
	Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent.	
	Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits.	
Bacteria	Should not exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in one calendar year.	Secondary Contact Recreation Subzone and Mariculture Subzone (L.N. 455 of 1991)
	Should be zero per 100 mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Should not exceed 1000 per 100 mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
	Should not exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive in one calendar year. Samples should be taken at least 3 times in a calendar month at intervals of between 3 and 14 days.	Yung Long Bathing Beach Subzone (L.N. 455 of 1991)
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2 mg/L for 90% of the sample	Outer Marine Subzone excepting Mariculture Subzone
Depth-averaged DO	Not less than 4 mg/L for 90% of the sample, taken at 1 metre below surface	Inner Marine Subzone excepting Mariculture Subzone
	Not less than 4 mg/L for 90% of the sampling, calculated as water column average	Outer Marine Subzone excepting Mariculture Subzone

Parameters	Objectives	Subzone
	Not less than 5 mg/L for 90% of the sample, taken at 1 metre below surface	Mariculture Subzone
	Not less than 4 mg/L	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, Ganges Subzone, Water Gathering Ground Subzones and other inland waters of the Zone
Colour	Waste discharges should not cause the colour of water to exceed 30 Hazen units.	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Waste discharges should not cause the colour of water to exceed 50 Hazen units.	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Temperature	Waste discharges should not cause the daily temperature range to change by more than 2℃.	Whole zone
Salinity	Waste discharges should not cause the salinity level to change by more than 10%.	Whole zone
pH	To be in the range of 6.5-8.5, change due to waste discharges not to exceed 0.2 units	Marine waters excepting Yung Long Bathing Beach Subzone
	To be in the range of 6.5-8.5	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	To be in the range of 6.0-9.0	Other inland waters
	To be in the range of 6.0-9.0 for 95% of samples, change due to waste discharges not to exceed 0.5 units	Yung Long Bathing Beach Subzone
Suspended Solids (SS)	Waste discharges should neither cause the SS concentration to be raised more than 30% nor give rise to accumulation of SS which may adversely affect aquatic communities.	Marine waters
	Waste discharges should not cause the annual median of SS to exceed 20 mg/L.	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Ganges Subzone, Indus Subzone, Water Gathering Ground Subzones and other inland waters

Parameters	Objectives	Subzone
Unionized Ammonia (UIA)	The un-ionized ammoniacal nitrogen level should not be more than 0.021 mg/L, calculated as the annual average (arithmetic mean).	Whole zone
Nutrients	(a) Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants.	Inner and Outer Marine Subzones
	(b) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.7 mg/L, expressed as annual water column average.	Inner Marine Subzones
	(c) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.5 mg/L, expressed as annual water column average.	Outer Marine Subzones
5-day Biochemical Oxygen Demand (BOD_5)	Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 3 mg/L	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 5 mg/L	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Chemical Oxygen Demand (COD)	Waste discharges shall not cause the chemical oxygen demand to exceed 15 mg/L	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Waste discharges shall not cause the chemical oxygen demand to exceed 30 mg/L	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Toxic Substances	Toxic substances in the water should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to interactions of toxic substances with each other	Whole zone
	Waste discharges shall not cause a risk to any beneficial uses of the aquatic environment.	Whole zone
Phenol	Phenols shall not be present in such quantities as to produce a specific odour, or in concentration greater than 0.05 mg/L as C_6H_5OH.	Yung Long Bathing Beach Subzone

Parameters	Objectives	Subzone
Turbidity	Waste discharges shall not reduce light transmission substantially from the normal level.	Yung Long Bathing Beach Subzone

Source: Statement of Water Quality Objectives (Deep Bay Water Control Zone).

5.2.3 Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS)

5.2.3.1 Discharge of effluents is subject to control under the WPCO. The TM-DSS gives guidance on the permissible effluent discharges based on the type of receiving waters (foul sewers, storm water drains, inland and coastal waters). The standards control the physical, chemical and microbial quality of effluents. The discharge limits vary with the effluent flow rates and the effluent should comply with the standards for effluent discharged into inland waters for irrigation, pond fish culture or amenity subject to the exact locations. Group A (for water gathering ground and within boundaries of country parks), Group B (for irrigation), C (for pond fish culture) and D (for amenity) inland water standards in TM-DSS are summarized in **Table 5.2**, **Table 5.3**, **Table 5.4** and **Table 5.5** below.

Table 5.2 Standards for Effluents Discharged into Group A Inland Waters

Determinand	Flow rate (m^3/day)				
	≤10	>10 and ≤100	>100 and ≤500	>500 and ≤1000	>1000 and ≤2000
pH (pH units)	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Temperature (℃)	35	35	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1
Conductivity (μs/cm at 20 ℃)	1000	1000	1000	1000	1000
Suspended Solids	10	10	5	5	5
Dissolved Oxygen	≥ 4	≥ 4	≥ 4	≥ 4	≥ 4
BOD	10	10	5	5	5
COD	50	50	20	20	10
Oil & grease	1	1	1	1	1
Boron	2	2	1	0.5	0.5
Barium	2	2	1	0.5	0.5
Iron	2	2	1	0.5	0.5
Arsenic	0.05	0.05	0.05	0.05	0.05
Total Chromium	0.05	0.05	0.05	0.05	0.05
Mercury	0.001	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001	0.001
Selenium	0.01	0.01	0.01	0.01	0.01
Copper	0.2	0.2	0.2	0.2	0.1
Lead	0.1	0.1	0.1	0.1	0.1
Manganese	0.5	0.5	0.5	0.5	0.5
Zinc	1	1	1	1	1
Other toxic metals individually	0.1	0.1	0.1	0.1	0.1
Total toxic metals	0.3	0.3	0.2	0.2	0.15
Cyanide	0.05	0.05	0.05	0.05	0.02
Phenols	0.1	0.1	0.1	0.1	0.1
Hydrogen Sulphide	0.05	0.05	0.05	0.05	0.05
Sulphide	0.2	0.2	0.1	0.1	0.1
Fluoride	1	1	1	1	0.5

Determinand	Flow rate (m³/day)				
	≤10	>10 and ≤100	>100 and ≤500	>500 and ≤1000	>1000 and ≤2000
Sulphate	800	600	500	400	200
Chloride	800	500	500	200	200
Total Reactive Phosphorus	1	0.7	0.7	0.5	0.5
Ammonia nitrogen	1	1	1	1	0.5
Nitrate + nitrite nitrogen	15	15	15	10	10
E. coli (count/100mL)	< 1	< 1	< 1	< 1	< 1

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Table 5.3 Standards for Effluents Discharged into Group B Inland Waters

Determinand	Flow rate (m³/day)							
	≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000
pH (pH units)	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Temperature (℃)	35	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended Solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	3	2	1
Boron	5	4	3	2.5	2	1.5	1	0.5
Barium	5	4	3	2.5	2	1.5	1	0.5
Mercury	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Selenium	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Other toxic metals individually	0.5	0.5	0.2	0.2	0.2	0.1	0.1	0.1
Total toxic metals	2	1.5	1	0.5	0.5	0.2	0.2	0.2
Cyanide	0.1	0.1	0.1	0.08	0.08	0.05	0.05	0.03
Phenols	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Fluoride	10	10	8	8	8	5	5	3
Sulphate	800	800	600	600	600	400	400	400
Chloride	1000	1000	800	800	800	600	600	400
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	5	5	5	5	5	5	5	5
Nitrate + nitrite nitrogen	30	30	30	20	20	20	10	10
Surfactants (total)	5	5	5	5	5	5	5	5
E. coli (count/100mL)	100	100	100	100	100	100	100	100

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Table 5.4 Standards for Effluents Discharged into Group C Inland Waters

Determinand	Flow rate (m³/day)			
	≤100	>100 and ≤500	>500 and ≤1000	>1000 and ≤2000
pH (pH units)	6-9	6-9	6-9	6-9
Temperature (℃)	30	30	30	30
Colour (lovibond units)	1	1	1	1

Determinand	Flow rate (m³/day)			
	≤100	>100 and ≤500	>500 and ≤1000	>1000 and ≤2000
(25mm cell length)				
Suspended Solids	20	10	10	5
BOD	20	15	10	5
COD	80	60	40	20
Oil & grease	1	1	1	1
Boron	10	5	4	2
Barium	1	1	1	0.5
Iron	0.5	0.4	0.3	0.2
Mercury	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001
Silver	0.1	0.1	0.1	0.1
Copper	0.1	0.1	0.05	0.05
Selenium	0.1	0.1	0.05	0.05
Lead	0.2	0.2	0.2	0.1
Nickel	0.2	0.2	0.2	0.1
Other toxic metals individually	0.5	0.4	0.3	0.2
Total toxic metals	0.5	0.4	0.3	0.2
Cyanide	0.05	0.05	0.05	0.01
Phenols	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.1
Fluoride	10	7	5	4
Sulphate	800	600	400	200
Chloride	1000	1000	1000	1000
Total phosphorus	10	10	8	8
Ammonia nitrogen	2	2	2	1
Nitrate + nitrite nitrogen	30	30	20	20
Surfactants (total)	2	2	2	1
E. coli (count/100mL)	1000	1000	1000	1000

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Table 5.5 Standards for Effluents Discharged into Group D Inland Waters

Determinand	Flow rate (m³/day)							
	≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (℃)	30	30	30	30	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1
Suspended Solids	30	30	30	30	30	30	30	30
BOD	20	20	20	20	20	20	20	20
COD	80	80	80	80	80	80	80	80
Oil & grease	10	10	10	10	10	10	10	10
Iron	10	8	7	5	4	2.7	2	1.3
Boron	5	4	3.5	2.5	2	1.5	1	0.7
Barium	5	4	3.5	2.5	2	1.5	1	0.7
Mercury	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001

Determinand	Flow rate (m³/day)							
	≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000
Other toxic metals individually	1	1	0.8	0.8	0.5	0.5	0.2	0.2
Total toxic metals	2	2	1.6	1.6	1	1	0.5	0.4
Cyanide	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.05
Phenols	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1
Sulphide	1	1	1	1	1	1	1	1
Sulphate	800	600	600	600	600	400	400	400
Chloride	1000	800	800	800	600	600	400	400
Fluoride	10	8	8	8	5	5	3	3
Total phosphorus	10	10	10	8	8	8	5	5
Ammonia nitrogen	20	20	20	20	20	20	20	10
Nitrate + nitrite nitrogen	50	50	50	30	30	30	30	20
Surfactants (total)	15	15	15	15	15	15	15	15
E. coli (count/100mL)	1000	1000	1000	1000	1000	1000	1000	1000

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

5.2.3.2 The TM-DSS also specifies the discharge standards into foul sewers leading into the Government's sewage treatment plants as shown in **Table 5.6** and **Table 5.7** below. Subject to the flow rate of the effluents, corresponding standards for the effluent discharge into the Government's foul sewers should be followed.

Table 5.6 Standards for Effluents Discharged into Foul Sewers leading into Government Sewage Treatment Plants

Determinand	Flow rate (m³/day)												
	≤10	>10 and ≤100	>100 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (℃)	43	43	43	43	43	43	43	43	43	43	43	43	43
Suspended Solids	1200	1000	900	800	800	800	800	800	800	800	800	800	800
Settleable Solids	100	100	100	100	100	100	100	100	100	100	100	100	100
BOD	1200	1000	900	800	800	800	800	800	800	800	800	800	800
COD	3000	2500	2200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Oil & grease	100	100	50	50	50	40	30	20	20	20	20	20	20
Iron	30	25	25	25	15	12.5	10	7.5	5	3.5	2.5	2	1.5
Boron	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Barium	8	7	6	5	4	3	2.4	1.6	1.2	0.8	0.6	0.5	0.4
Mercury	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.2	0.15	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper	4	4	4	3	1.5	1.5	1	1	1	1	1	1	1
Nickel	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Chromium	2	2	2	2	1	0.7	0.6	0.4	0.3	0.2	0.1	0.1	0.1
Zinc	5	5	4	3	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Silver	4	3	3	2	1.5	1.5	1	0.8	0.7	0.7	0.6	0.6	0.6
Other toxic metals individually	2.5	2.2	2	1.5	1	0.7	0.6	0.4	0.3	0.2	0.15	0.12	0.1
Total toxic metals	10	10	8	7	3	2	2	1.6	1.4	1.2	1.2	1.2	1
Cyanide	2	2	2	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.08	0.06

Determinand	Flow rate (m³/day)												
	≤10	>10 and ≤100	>100 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
Phenols	1	1	1	1	0.7	0.5	0.4	0.27	0.2	0.13	0.1	0.1	0.1
Sulphide	10	10	10	10	5	5	4	2	2	2	1	1	1
Sulphate	1000	1000	1000	1000	1000	1000	1000	900	800	600	600	600	600
Total nitrogen	200	200	200	200	200	200	200	100	100	100	100	100	100
Total phosphorus	50	50	50	50	50	50	50	25	25	25	25	25	25
Surfactants (total)	200	150	50	40	30	25	25	25	25	25	25	25	25

Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated.

Table 5.7 Standards for Effluents Discharged into Foul Sewers leading into Government Sewage Treatment Plants with Microbial Treatment

Determinand	Flow rate (m³/day)												
	≤10	>10 and ≤100	>100 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
Copper	1.5	1	1	1	0.8	0.6	0.5	0.4	0.3	0.2	0.15	0.1	0.05

*Note: All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated. Standards in this table apply in place of those in **Table 5.6** for the corresponding determinand.*

5.2.4 Professional Persons Environmental Consultative Committee Practice Notes (ProPECC PNs)

5.2.4.1 A ProPECC PN was issued by the EPD to provide guidelines for handling and disposal of construction site discharges. The ProPECC PN 2/23 "*Construction Site Drainage*" provides good practice guidelines for dealing with 10 types of discharge from construction sites. These include surface run-off, groundwater, boring and drilling water, wastewater from concrete batching and/or precast concrete casting, wheel washing water, bentonite slurry, water for testing and/or sterilisation of water retaining structures and water pipes, wastewater from building constructions, acid cleaning, etching and pickling wastewater, and wastewater from site facilities. Practices given in the ProPECC PN 2/23 should be followed as far as possible during construction to minimise the water quality impact due to construction site drainage.

5.2.4.2 The ProPECC PN 1/23 "*Drainage Plans Subject to Comment by the EPD*" provides guidelines and practices for handling, treatment and disposal of various effluent discharges to stormwater drains and foul sewers during the operation phase. The design of site drainage and disposal of various site effluents generated within the new development area should follow the relevant guidelines and practices as given in the ProPECC PN 1/23.

5.2.5 Environment, Transport and Works Bureau Technical Circular (ETWB TC)

5.2.5.1 ETWB TC (Works) No. 5/2005 provides an administrative framework to better protect all natural streams/rivers from the impacts of construction works. The procedures promulgated under this Circular aim to clarify and strengthen existing measures for protection of natural streams/rivers from government projects and private developments. The guidelines and precautionary mitigation measures given in the ETWB TC (Works) No. 5/2005 should be followed as far as possible to protect the inland watercourse at or near the Project area during construction phase.

5.2.6 Hong Kong Planning Standards and Guidelines (HKPSG)

5.2.6.1 Chapter 9 of the HKPSG outlines environmental requirements that need to be considered in land use planning. The recommended guidelines, standards and guidance cover the selection of suitable locations for the developments and sensitive uses, provision of environmental facilities, and design, layout, phasing and operational controls to minimise adverse environmental impacts. It also lists out environmental factors that influence land use planning and recommends buffer distances for land uses.

5.2.7 Water Quality Standards for Reclaimed Water

5.2.7.1 The water quality standards for reclaimed water to be adopted by this Project are based on the water quality standards endorsed by the "*Working Group on the Implementation of Reclaimed Water Supply in Sheung Shui and Fanling*" at its meeting on 13 July 2012 for non-potable uses. Details of the standards are summarized in **Table *5.8*** below.

Table 5.8 Reclaimed Water Quality Standards for Non-Potable Uses

Parameters	Unit	Recommended Water Quality Standards
E. coli	cfu/100mL	Non detectable
Total Residual Chlorine	mg/L	≥ 1 exiting treatment system; ≥ 0.2 at user end
Dissolved Oxygen	mg/L	≥ 2
Suspended Solids (SS)	mg/L	≤ 5
Colour	Hazen unit	≤ 20
Turbidity	NTU	≤ 5
pH	-	6 – 9
Threshold Odour Number (TON)	-	≤ 100
5-day Biochemical Oxygen Demand (BOD_5)	mg/L	≤ 10
Ammoniacal Nitrogen	mg/L as N	≤ 1
Synthetic Detergents	mg/L	≤ 5

Source: Final Environmental Impact Assessment Report under Agreement No. CE 61/2007(CE) - "North East New Territories New Development Areas Planning and Engineering Study – Investigation", Table 6.18.

Notes:
1. Apart from total residual chlorine which has been specified, the water quality standards for all parameters shall be applied at the point-of-use of the system.
2. Where reclaimed water is treated for immediate usage, the level of total residual chlorine may be lower than the one specified in this table.
3. Immediate usage means the collected grey water / rainwater is drawn into the treatment process immediate before a particular round of usage and the treated water will be depleted after that round of usage is completed.

5.3 Description of Environment

5.3.1 Study Area

5.3.1.1 According to Item 3.4.5.2 of the EIA Study Brief (No. ESB-340/2021), the Study Area for this water quality impact assessment includes areas within 500 metres from the boundary of the Project area and shall cover Deep Bay Water Control Zone (WCZ) and other affected WCZs as designated under the Water Pollution Control Ordinance (Cap. 358) and water sensitive receivers (WSRs) in the vicinity of the Project. The baseline condition of water bodies in the Study Area was established based on the routine river and marine water quality monitoring data collected by EPD and river water quality monitoring data collected by DSD. Descriptions of the baseline conditions provided in the subsequent sections are extracted from the EPD's reports "*Marine Water Quality in Hong Kong in 2022*" and "*River Water Quality in Hong Kong in 2022*" which contains the latest information published by EPD on marine and river water quality.

5.3.2 Marine Water

5.3.2.1 The baseline water quality condition of marine water was established from the marine water quality monitoring data routinely collected by EPD in the Deep Bay WCZ. A summary of EPD monitoring data collected in 2022 for Deep Bay WCZ is presented in **Table 5.9**.

Table 5.9 Summary EPD's Routine Marine Water Quality Data for Deep Bay WCZ in Year 2022

Parameters		Inner Deep Bay			Outer Deep Bay		WPCO WQO
		DM1	DM2	DM3	DM4	DM5	(in inland waters)
Temperature (℃)		24.8 (17.9 - 32.4)	25.0 (18.0 - 32.1)	24.9 (18.9 - 31.0)	25.0 (18.5 - 30.6)	24.5 (18.4 - 29.9)	Not more than 2℃ in daily temperature range
Salinity		14.9 (0.5 - 23.3)	17.0 (0.4 - 25.8)	21.6 (5.4 - 29.1)	23.2 (8.0 - 31.2)	25.2 (9.0 - 32.7)	Not to cause more than 10% change
Dissolved Oxygen (mg/L)	Depth Average	6.5 (4.9 - 9.2)	6.0 (4.9 - 7.8)	6.0 (4.8 - 6.9)	5.9 (4.7 - 7.0)	5.8 (5.0 - 6.7)	Marine Subzone excepting Mariculture Subzone: Not less than 4 mg/L for 90% of samples Mariculture Subzone: Not less than 5 mg/L for 90% of samples
	Bottom	N/A	N/A	N/A	5.7 (4.1 - 7.4)	5.8 (4.7 - 7.2)	Outer Marine Subzone excepting Mariculture Subzone: Not less than 2 mg/L for 90% of samples
Dissolved Oxygen (% Saturation)	Depth Average	85 (63 - 123)	80 (66 - 111)	82 (71 - 94)	80 (67 - 94)	80 (71 - 90)	Not available
	Bottom	N/A	N/A	N/A	79 (57 - 99)	80 (67 - 92)	Not available
pH		7.4 (7.0 - 8.5)	7.4 (6.9 - 8.3)	7.5 (7.1 - 7.9)	7.5 (7.1 - 7.9)	7.6 (7.1 - 8.0)	Marine Waters excepting Yung Long Bathing Beach Subzone: 6.5 - 8.5 (±0.2 from natural range) Yung Long Bathing Beach Subzone: 6.0-9.0 for 95% of samples (±0.5 from natural range)
Secchi Disc Depth (m)		1.1 (0.9 - 1.6)	1.2 (0.9 - 1.5)	1.5 (1.2 - 2.2)	1.9 (1.2 - 2.9)	1.9 (1.7 - 2.7)	Not available
Turbidity (NTU)		85.9 (9.9 - 288.0)	90.0 (9.4 - 384.0)	46.0 (1.8 - 264.0)	32.3 (5.4 - 144.0)	23.4 (4.0 - 78.1)	Yung Long Bathing Beach Subzone: Not reduce light transmission substantially from the normal level.
Suspended Solids (SS) (mg/L)		27.6 (7.0 – 58.0)	26.2 (4.7 - 65.0)	9.3 (2.6 - 22.0)	7.4 (3.2 - 14.0)	5.2 (3.3 - 9.7)	Not more than 30% increase
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)		1.8 (<0.1 - 6.0)	1.5 (0.4 - 3.2)	0.8 (0.2 - 3.5)	0.7 (<0.1 - 3.3)	0.9 (0.1 – 2.9)	Not available
Ammonia Nitrogen (NH_3-N) (mg/L)		0.538 (0.088 - 1.200)	0.379 (0.050 - 1.400)	0.182 (0.024 - 0.420)	0.127 (0.038 - 0.200)	0.098 (0.009 - 0.190)	Not available
Unionised Ammonia (UIA) (mg/L)		0.008 (0.002 - 0.024)	0.007 (<0.001 - 0.043)	0.003 (<0.001 - 0.011)	0.002 (<0.001 - 0.007)	0.002 (<0.001 – 0.006)	Not more than annual average of 0.021mg/L
Nitrite Nitrogen (NO_2-N) (mg/L)		0.161 (0.094 - 0.420)	0.119 (0.067 - 0.200)	0.066 (0.025 - 0.130)	0.061 (0.033 - 0.130)	0.057 (0.020 - 0.137)	Not available
Nitrate Nitrogen (NO_3-N) (mg/L)		1.200 (0.840 - 1.800)	1.120 (0.510 - 2.300)	0.700 (0.280 - 1.200)	0.630 (0.300 - 1.200)	0.558 (0.140 - 1.270)	Not available
Total Inorganic Nitrogen (TIN) (mg/L)		1.90 (1.13 - 2.61)	1.61 (0.70 - 2.89)	0.95 (0.41 - 1.49)	0.82 (0.43 - 1.43)	0.71 (0.28 - 1.41)	Inner Marine Subzone: Not more than annual mean of 0.7 mg/L Outer Marine Subzone: Not more than annual water column average of 0.5 mg/L
Total Kjeldahl Nitrogen (TKN) (mg/L)		0.93 (0.46 - 2.10)	0.73 (0.37 - 2.10)	0.40 (0.19 - 0.82)	0.35 (0.18 - 0.64)	0.31 (0.12 – 0.88)	Not available
Total Nitrogen (TN) (mg/L)		2.29 (1.40 - 3.37)	1.96 (0.95 - 3.59)	1.16 (0.51 - 1.85)	1.04 (0.56 - 1.61)	0.93 (0.44 - 1.56)	Not available

Parameters	Inner Deep Bay			Outer Deep Bay		WPCO WQO (in inland waters)
	DM1	DM2	DM3	DM4	DM5	
Orthophosphate Phosphorus (PO_4) (mg/L)	0.120 (0.018 - 0.180)	0.100 (0.014 - 0.130)	0.059 (<0.002 - 0.160)	0.029 (<0.002 - 0.073)	0.016 (<0.002 - 0.038)	Not available
Total Phosphorus (TP) (mg/L)	0.26 (0.16 - 0.41)	0.22 (0.13 – 0.35)	0.12 (0.05 – 0.21)	0.09 (0.04 – 0.13)	0.06 (0.03 – 0.10)	Not available
Silica (as SiO_2) (mg/L)	5.74 (1.70 – 8.90)	5.17 (0.96 – 11.00)	3.74 (1.30 – 7.40)	3.57 (0.99 – 7.50)	3.00 (0.86 – 8.10)	Not available
Chlorophyll-*a* (µg/L)	8.8 (2.1 – 45.0)	8.9 (2.1 – 33.0)	3.0 (0.8 – 7.5)	1.9 (0.5 – 5.2)	2.0 (0.5 – 5.9)	Not available
E. coli (count/100mL)	500 (31 – 4900)	170 (3 – 10000)	32 (<1 – 430)	17 (<1 – 250)	20 (2 – 940)	Secondary Contact Recreation Subzones and Mariculture Subzone (L.N. 455 of 1991): Not exceed 610 per 100mL Yung Long Bathing Beach Subzone (L.N.455 of 1991): Not exceed 180 per 100mL
Faecal Coliforms (count/100mL)	1200 (88 – 24000)	430 (9 – 18000)	53 (<1 – 900)	35 (1 – 760)	43 (2 – 1900)	Not available

Notes:
1. Data source: EPD Marine Water Quality in Hong Kong in 2022.
2. Except as specified, data presented are depth-averaged values calculated by taking the means of three depths: Surface, Mid-depth, Bottom.
3. Data presented are annual arithmetic means of depth-averaged results except for *E. coli* and faecal coliforms that are annual geometric means.
4. Data in brackets indicate the ranges.

5.3.2.2 According to the EPD's publication Marine Water Quality in Hong Kong 2022, the overall WQO compliance rate of the Deep Bay was 67% in 2022, as compared with a ten-year average of 47% in 2009-2018. There has been full compliance of the NH_3-N WQOs in the past seven years. Although Deep Bay, as compared with other WCZs, had higher nutrient levels with annual depth-averaged TIN levels exceeding the respective TIN WQOs, a noticeable long-term decrease in TIN levels since mid-2000s has been seen. Also, there were only few reported cases of red tides in Deep Bay, likely ascribed to the presence of considerable areas of unique wetland habitats and high background turbidity which could become a key factor limiting the photosynthesis and growth of phytoplankton in the bay despite ample local nutrients supply.

5.3.2.3 Overall speaking, there have been significant water quality improvements in Deep Bay since mid-2000s as a result of the joint efforts (e.g. provision and upgrading of sewage collection and treatment facilities) of the Hong Kong SAR and Shenzhen Governments in reducing its pollution loads.

5.3.3 Inland Water

5.3.3.1 The water quality monitoring results at EPD's river water quality monitoring stations at Kam Tin River (KT1, KT2) is shown in **Table 5.10**. The overall WQO compliance rate for Kam Tin River in 2022 was 46%, as compared with 18% in 1992. The two monitoring stations (KT1 and KT2) at Kam Tin River were graded “Fair” and "Bad" WQI respectively in 2022.

Table 5.10 Summary Statistics of River Water Quality of Kam Tin River Collected by EPD in 2022

Parameters	Kam Tin River		WPCO WQO (in inland waters)
	KT1	KT2	
Dissolved Oxygen (mg/L)	5.4 (3.1 - 7.0)	3.7 (1.1 - 6.9)	Not less than 4 mg/L

Parameters	Kam Tin River		WPCO WQO (in inland waters)
	KT1	KT2	
pH	7.4 (7.1 - 7.9)	7.4 (7.2 - 8.0)	Yuen Long & Kam Tin (Upper) Subzone: within the range of 6.5-8.5
Suspended Solids (mg/L)	8.8 (1.5 - 27.0)	35.0 (3.8 - 58.0)	Yuen Long & Kam Tin (Upper) Subzone: Annual median not to exceed 20 mg/L
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)	10.0 (5.2 - 14.0)	21.0 (3.2 - 150.0)	Yuen Long & Kam Tin (Upper) Subzone: Not to exceed 3 mg/L
Chemical Oxygen Demand (mg/L)	20 (12 - 65)	52 (9 - 170)	Yuen Long & Kam Tin (Upper) Subzone: Not to exceed 15 mg/L
Oil & Grease (mg/L)	<0.5 (<0.5 - 0.8)	1.1 (<0.5 - 2.4)	Not available
E. coli (count/100mL)	41 000 (5 000 - 340 000)	110 000 (24 000 - 1 700 000)	Not available
Faecal Coliforms (count/100mL)	150 000 (52 000 - 470 000)	270 000 (62 000 - 1 900 000)	Not available
Ammonia-nitrogen (mg/L)	4.100 (0.670 - 10.000)	7.800 (0.480 - 25.000)	Not available
Nitrate Nitrogen (NO_3-N) (mg/L)	0.870 (0.410 - 3.300)	0.200 (<0.002 - 0.560)	Not available
Total Kjeldahl Nitrogen (TKN) (mg/L)	5.45 (1.80 - 12.00)	9.00 (1.90 - 31.00)	Not available
Orthophosphate Phosphorus (PO_4) (mg/L)	0.770 (0.260 - 1.300)	0.830 (0.180 - 2.400)	Not available
Total Phosphorus (TP) (mg/L)	1.20 (0.40 - 1.60)	1.40 (0.44 - 3.80)	Not available
Sulphide (mg/L)	<0.02 (<0.02 - 0.04)	0.05 (<0.02 - 0.11)	Not available
Aluminium (μg/L)	<50 (<50 - <50)	<50 (<50 - 70)	Not available
Cadmium (μg/L)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	Not available
Chromium (μg/L)	<1 (<1 - <1)	<1 (<1 - <1)	Not available
Copper (μg/L)	2 (1 - 7)	1 (<1 - 4)	Not available
Lead (μg/L)	<1 (<1 - <1)	<1 (<1 - <1)	Not available
Zinc (μg/L)	10 (<10 - 25)	<10 (<10 - 25)	Not available
Flow (m^3/s)	0.462 (0.244 - 17.587)	0.414 (0.186 - 15.984)	Not available

Notes:
1. Data source: EPD River Water Quality in Hong Kong in 2022.
2. Data presented are in annual medians of monthly samples; except those for faecal coliforms and *E. coli* which are in annual geometric means.
3. NM indicates no measurement taken.
4. Figures in brackets are annual ranges.
5. cfu – colony forming unit
6. Values at or below laboratory reporting limits are presented as laboratory reporting limits.

5.3.3.2 In additional to the EPD's routine river water quality monitoring data, the water quality monitoring data collected by DSD at Ngau Tam Mei Channel was also used to establish the baseline water quality conditions. The water quality monitoring data collected between year 2013 and year 2020 at the two monitoring stations are tabulated in **Table 5.11** below.

Table 5.11 Summary Statistics of River Water Quality of Ngau Tam Mei Channel Collected by DSD

Parameters	Ngau Tam Mei Channel		WPCO WQO (in inland waters)
	Upstream	Downstream	
Dissolved Oxygen (% Saturation)	57 (30 - 95)	62 (18 - 91)	Not available
pH	7.5 (7.2 - 8.3)	7.7 (7.2 - 8.1)	within the range of 6.0-9.0
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)	7 (4 - 11)	6 (2 - 10)	Not to exceed 5 mg/L
Ammonia as N (as N mg/L)	4.1 (0.5 - 7.7)	4.5 (0.5 - 6.8)	Not available

Notes:
1. Data source: DSD EcoDMS (data collected between year 2013 and year 2020).
2. Data presented are medians.
3. Data in brackets indicate the ranges.

5.3.3.3 Ngau Tam Mei Channel is located in Yuen Long. It was channelized in 2005. It drains water from the Ngau Tam Mei area and flows into Kam Tin River. Based on the monitoring results, the Ngau Tam Mei Channel waters are in low DO levels. High BOD_5 and ammonia-nitrogen levels indicated that the channel is contaminated by organic and nutrient pollutants.

5.4 Identification of Water Sensitive Receivers

5.4.1.1 The Project Site is located in the east of San Tin Wetland, the surface runoff in the vicinity is collected by the channelized nullahs such as channel at south of Lung Hau Road, rivers near LMC / San Tin Highway Connection, tributary rivers of Shenzhen River near Shek Wu Wai, rivers near Shek Wu Wai Road and San Tin Highway, and rivers near Castle Peak Road (Mai Po) before discharging into Deep Bay. Existing WSRs include Wetland Conservation Area (WCA), Wetland Buffer Area (WBA), fish ponds, San Tin Eastern Main Drainage Channel, watercourses and SSSI within and in the vicinity of the Project. The WSRs also include the retention lakes proposed under the Project.

5.4.1.2 The proposed STLMC EPP is located at Mai Po Lung Tsuen. The existing land of the site is zoned "Green Belt" ("GB") and "Open Storage" ("OS"). Currently, the site is occupied mainly by brownfield operations.

5.4.1.3 WSRs within 500m from the boundary of the Project were identified with reference to Annex 14 of the EIAO-TM. These WSRs are presented in **Table 5.12** and shown in Figure 5.1, Figure 5.1A to Figure 5.1L.

Table 5.12 Water Sensitive Receivers

ID	Description	Within Project Area? (Yes/No)	Nature	Remarks
WC-N1	Shenzhen River	No	modified watercourse	-
WC-N2	Lok Ma Chau Meander	No	nature watercourse	-
WC-N2a	near Lok Ma Chau Tsuen	Yes (partially)	semi-natural watercourse	section within the Project site will be modified
WC-N2b	hillside of Lok Ma Chau Tsuen	No	nature watercourse	-
WC-N3	San Tin Eastern Main Drainage Channel (STEMDC)	Yes	modified watercourse	will be revitalized
WC-N4	along Lok Ma Chau Road	Yes	modified watercourse	will be modified

ID	Description	Within Project Area? (Yes/No)	Nature	Remarks
WC-N5	west of Ha Wan Fisherman San Tsuen	Yes	semi-natural watercourse	will be modified
WC-N6	between Lok Ma Chau Road and San Sham Road	Yes	semi-natural watercourse	will be revitalized
WC-N6a	along Chau Tau West Road, discharge to WC-N6	Yes (partially)	modified watercourse	will be modified
WC-N6b	west of Chau Tau Tsuen, discharge to WC-N6	Yes	modified watercourse	will be modified
WC-N6c	along Lok Ma Chau Road, discharge to WC-N6	Yes	modified watercourse	will be revitalized
WC-N6d	west of Chau Tau Tsuen	Yes (partially)	modified watercourse	will be modified
WC-N6e	east of Chau Tau Tsuen, discharge to WC-N6f	No	modified watercourse	-
WC-N6f	east of Chau Tau Tsuen, discharge to WC-N6c	Yes	modified watercourse	will be modified
WC-N7	Sam Po Shue	Yes (partially)	semi-natural watercourse	section within the Project site will be modified
WC-N8	San Tin Western Main Drainage Channel (STWMDC)	Yes (partially)	semi-natural watercourse	section within the Project site will be revitalized
WC-N8a	Tsing Lung Tsuen (TLT) drainage channel, near Castle Peak Road - San Tin Section	Yes	modified watercourse	will be revitalized
WC-N8b	near Castle Peak Road - San Tin Section	Yes	modified watercourse	will be modified
WC-N9	in Mai Po	Yes (partially)	semi-natural watercourse	section within the Project site will be modified
WC-N10	Lin Barn Tsuen	No	semi-natural watercourse	-
WC-N11	Hop Shing Wai	Yes	semi-natural watercourse	will be modified
WC-N12	Mai Po Lo Wai	No	semi-natural watercourse	-
WC-N13	southwest of Lok Ma Chau Station	No	modified watercourse	-
WC-N14	northeast of San Tin Stormwater Pumping Station	No	modified watercourse	-
WC-N15	near Fan Tin Tsuen	No	semi-natural watercourse	-
WC-N15a	along San Tin Tsuen Road	No	modified watercourse	-
WC-S1	hillslope of Hadden Hill, discharge to WC-S2	Yes	semi-natural watercourse	will be modified
WC-S1a	hillslope of Hadden Hill	No	nature watercourse	-
WC-S2	near Pang Loon Tei, discharge to WC-S3	Yes	semi-natural watercourse	will be modified
WC-S3	upstream section of STEMDC	Yes	modified watercourse	will be revitalized
WC-S3a	upstream section of S3, at south of Pang Loon Tei	Yes	semi-natural watercourse	will be modified
WC-S3b	upstream section of S3a, at south of Pang Loon Tei	Yes	semi-natural watercourse	will be modified
WC-S3c	upstream section of S3a, at south of Pang Loon Tei	No	nature watercourse	-
WC-S4	short section of watercourse, east of WC-S5	Yes	modified watercourse	will be modified
WC-S5	east of Shek Wu Wai, join WC-S6 at San Tin Highway and discharge to WC-N8a	Yes	modified watercourse	will be modified
WC-S5a	upstream section of WC-S5, along western boundary of San Tin Barracks	Yes	semi-natural watercourse	will be modified

ID	Description	Within Project Area? (Yes/No)	Nature	Remarks
WC-S5b	upstream section of WC-S5a, along western boundary of San Tin Barracks	Yes	modified watercourse	will be modified
WC-S6	east of Shek Wu Wai, join WC-S5 at San Tin Highway and discharge to WC-N8a	Yes	modified watercourse	will be modified
WC-S6a	upstream section of WC-S6, east of Shek Wu Wai San Tsuen	Yes (partially)	semi-natural watercourse	will be modified
WC-S6b	upstream section of WC-S6, west of Shek Wu Wai San Tsuen	Yes	modified watercourse	will be modified
WC-S7	along Sam Tam Road	Yes (partially)	modified watercourse	section within the Project site will be modified
WC-S7a	upstream section of WC-S7, running across village in Ko Hang	Yes	semi-natural watercourse	will be modified
WC-S7b	upstream section of WC-S7a, join WC-S7a in Ko Hang	Yes	semi-natural watercourse	will be modified
WC-S8	running across Ki Lun Tsuen to the east	No	semi-natural watercourse	-
MW-N1	along STEMDC	Yes	mitigation wetland	will be modified and reinstated upon completion
MW-N2	flood storage pond adjacent to San Tin Tsuen Road	No	pond	-
MW-N3	Lotus Pond at San Tin, west of Tsing Lung Tsuen	Yes	mitigation wetland	will be modified and reinstated upon completion
MW-N4	Lok Ma Chau Ecological Enhancement Area (LMC EEA)	No	mitigation wetland	-
MW-N5	Ecological Area, at southern edge of the LMC Loop, adjoining the LMC Meander	No	mitigation wetland	-
P-N1	continuous pond area at Lok Ma Chau, adjacent to Lok Ma Chau Meander, within WCA	Yes (partially)	ponds	partial area within the Project site will be removed-
P-N2	continuous pond area at Sam Po Shue, south of MP-N4 and adjacent to STEMDC, within WCA	Yes (partially)	ponds	partial area within the Project site will be removed
P-N3	continuous pond area at Sam Po Shue, between P-N2 and WC-N7, within WCA	Yes (partially)	ponds	partial area within the Project site will be removed
P-N4	continuous pond area at Sam Po Shue, south of P-N3, within WCA	Yes	ponds	will be removed
P-N5	continuous pond area at San Tin, within WCA	Yes (partially)	ponds	partial area within the Project site will be removed
P-N6	continuous pond area at San Tin, within WBA	No	ponds	-
P-N7	continuous pond area at San Tin, within WBA	Yes	ponds	will be removed
P-N8	continuous pond area at San Tin, within WBA	No	ponds	-
P-N9	at Lok Ma Chau	No	ponds	-
P-N10	adjacent to San Sham Road, near WC-N6	Yes	ponds	will be modified
P-N11	Chau Tau	No	ponds	-
P-N12	Ko Hang	No	ponds	-
P-N13	southern of Tsing Lung Tsuen	No	ponds	-
P-S1	continuous pond area at Shek Wu Wai, along WC-S5 and WC-S6	Yes	ponds	will be removed

ID	Description	Within Project Area? (Yes/No)	Nature	Remarks
P-S2	west of San Tin Barracks	Yes	ponds	will be removed
P-S3	Pang Loon Tei	Yes	ponds	will be removed
P-S4	south of Pang Loon Tei	Yes	ponds	will be removed
P-S5	south of Pang Loon Tei	Yes	ponds	will be removed
P-S6	south of Ki Lun Tsuen Playground	No	ponds	-
P-S7	near Pang Loon Tei	Yes	ponds	will be removed
WF-S1	at Shek Wu Wai	Yes	Wet agricultural area	will be removed
SSSI-N1	Mai Po Village SSSI	No	An area of the woodland, located south of a junction between Tam Kon Chau Road and Castle Peak Road (Mai Po section)	-
WCA	Wetland Conservation Area	Yes (partially)	Wetland Conservation Area	partial area within the Project site will be modified
WBA	Wetland Buffer Area	Yes (partially)	Wetland Buffer Area	partial area within the Project site will be modified
CA-N1	Conservation Area	Yes (partially)	Conservation Area	partial area within the Project site will be modified
CA-N2	Conservation Area	No	Conservation Area	-
CA-S1	Conservation Area	No	Conservation Area	-

5.4.1.4 Several natural watercourses (WC-N2, WC-N2b, WC-S1a and WC-S3c) are identified within the assessment area. LMC Meander WC-N2 was the largest natural watercourse in the northern portion of Assessment Area. WC-N2 was originally part of Shenzhen River and was restored to mitigate the loss of fishponds from training of the Shenzhen River. Water in WC-N2 was upstream of Shenzhen River and originated from adjacent hillside (e.g. from Lok Ma Chau Tsuen area) and therefore the water quality was less polluted compared to Shenzhen River. Some tidal influence was observed. WC-N2b was a small natural stream originated from hillside of Lok Ma Chau Tsuen and leads northward to LMC Meander. WC -S1a is a very short section of natural watercourse, which flowed from the northeast to the southwest and was located in the south-western hillslope of Hadden Hill in the Ki Lun Tsuen area. WC-S3c was located on the south of Pang Loon Tei, and flowed from the south to the north, in close proximity outside the Project boundary. WC-S3c was the upstream section of the STEMDC (WC-S3).

5.4.1.5 Other watercourses identified within the assessment area are modified watercourses and semi-natural watercourses.

5.4.1.6 Shenzhen River (WC-N1) was the largest modified watercourse in the northern portion of Assessment Area. It is approximately 18 km long and flows into Deep Bay. It was modified as training works such as straightening and deepening were carried out in Shenzhen River to prevent flooding. Tidal influence occurs along the entire Shenzhen River.

5.4.1.7 STEMDC (WC-N3 and WC-S3) is a drainage channel running along the west of San Sham Road and flowed northward into Shenzhen River. WC-N4 is a drainage channel along Lok Ma Chau Road that flows northwest into WC-N3. WC-N6a, WC-N6b, WC-N6c, WC-N6d, WC-N6e and WC-N6f are network of drainage channel system in Chau Tau, flowing to STEMDC via WC-N6. WC-N8a and WC-N8b are the upper sections of STWMDC (WC-N8) located near Castle Peak Road - San Tin Section. WC-N14 is a short, modified watercourse northeast of San Tin Stormwater Pumping Station, flowing towards the west into an underground culvert adjacent to the Stormwater Pumping Station. WC-15a is a drainage channel along San Tin Tsuen Road, east of the Lotus Pond. WC-S4 is a short section of watercourse. It is northwest-flowing and run through the developed area and village area in the Shek Wu Wai area. WC-S5 and WC-S6 are located between the agricultural area in Shek Wu Wai area. These watercourses are north-flowing, merge together near San Tin Highway, then flows further up north and discharge into the Deep Bay area. WC-S7 is a concrete-lined drainage channel situated at highly developed residential areas, and flowed towards north to northeast.

5.4.1.8 WC-N2a (approximately 650 m long) is a semi-natural watercourse which is one of the upstream tributaries of LMC Meander, located near Lok Ma Chau Tsuen, flowing through marsh, agricultural land, and through ponds and discharging into LMC Meander. WC-N5 is located at west of Ha Wan Fisherman San Tsuen, between ponds and village areas, flowing towards southwest into STEMDC through underground culvert. WC-N6 is the convergence of modified watercourses (WC-N6a to N6f) in Chau Tau. WC-N7, WC-N8, WC-N9 and WC-N12 are man-made watercourses formed during the formation of fishponds in San Tin and Mai Po, while all flows towards the northwest into Shenzhen River. WC-N10 and WC-N11 are located in Lin Barn Tsuen, which flowing north towards Shenzhen River. WC-N15 is a semi-natural watercourse connecting to the flood storage pond next to San Tin Tsuen Road. WC -S1 flows from the northeast to the southwest and joins WC-S2. WC-S2 flows from the east towards the northwest and finally joins STEMDC (WC-S3). WC-S3a and WC-S3b are upstream to STEMDC (WC-S3), flowing towards the north. WC-S5a runs along the western boundary of San Tin Barracks to WC-S5. WC-6a runs along the western side of Siu Hum Tsuen to WC-S6. WC-S7a and WC-S7b run through Ko Hang village, flows from towards the northwest, and later converged with the modified drainage channel WC-S7. WC-S8 occurs on the southeastern boundary of the assessment area, passing through Ki Lun Tsuen to the east of Saddle Pass. This watercourse was east-flowing and converged with other watercourses into Sheung Yue River.

5.4.1.9 Some mitigation wetlands (MW-N1 to N5) were proposed under various designated projects within the Assessment Area. The STEMDC wetland (MW-N1) and a flood storage pond adjacent to San Tin Tsuen Road (MW-N2) were created upon the construction of the STEMDC. An artificial wetland (Lotus Pond, MW-N3) was created to mitigate the loss of fishponds due to construction of flood protection embankment and floodwater storage pond under a drainage works conducted near Tsing Lung Tsuen before the year 2000. To compensate the loss of fishponds, marsh and reedbed from the construction of Sheung Shui to LMC Spur Line, a Lok Ma Chau Ecological Enhancement Area (LMC EEA, MW-N4) was created. An Ecological Area (MW-N5) along the southern edge of the LMC Loop, adjoining the LMC Meander is designated under the Development of Lok Ma Chau Loop to compensate for the loss of reedbed and freshwater marsh and minimise impacts on bird flight lines.

5.4.1.10 Two major continuous pond area were recorded adjacent to Lok Ma Chau Meander (P-N1) and San Tin – Sam Po Shue area (P-N2 to P-N8), separated on the east and west side of San Sham Road and the STEMDC respectively. Majority of the ponds recorded in Lok Ma Chau area (P-N1) are inactive fishponds. Continuous ponds are located along Lok Ma Chau Meander while other ponds are scattered in Ha Wan Tsuen. Ponds recorded in San Tin – Sam Po Shue and Lok Ma Chau area are closely linked fishponds which formed a large continuous ponds landscape. All ponds in Sam Po Shue (P-N2, P-N3 and P-N4) are abandoned fishponds where fishery operations are terminated. P-N5 are active fishponds, where pond bunds are subjected to regular fishery operation. A small area of pond in P-N6 is situated on the south-eastern edge of the ponds, adjacent to village areas. Majority of ponds in P-N7 and P-N8 are inactively managed and subject to high level of disturbance such as traffic with heavy vehicles, operation of adjacent open storage, brownfields, and human settlement.

5.4.1.11 A number of ponds of various sizes are identified within the Project site at the Shek Wu Wai area (P-S1), which are mainly small and scattered in the area between the watercourses WC-S5 and WC-S6. Other isolated ponds are scattered throughout the Project Area, mainly near village areas such as Pang Loon Tei (P-S3, P-S4, P-S5 and P-S7). Most of these ponds are located near village areas and are not observed with fisheries production, and are inactively managed by nearby villagers, or abandoned.

5.4.1.12 A few small patches of wet agricultural lands (WF-S1) are found within the Project site at Shek Wu Wai.

5.4.1.13 An area of the wooded habitats is designated as the Mai Po Village SSSI (SSSI-N1), located to the south of a junction between Tam Kon Chau Road and Castle Peak Road (Mai Po section).

5.4.1.14 The Project site is located within the Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA).

5.4.1.15 Three patches of conservation areas (namely CA-N1, CA-N2 and CA-S1) are located within the assessment area. CA-N1 and CA-N2 are designated as conservation area under the Approved San Tin Outline Zoning Plan (OZP) No. S/YL-ST/8, Approved Lok Ma Chau Loop OZP No. S/LMCL/2 and Approved Mai Po and Fairview Park OZP No. S/YL-MP/6 to cover part of the wetland and fishpond north of San Tin near Deep Bay area and Lok Ma Chau (LMC) Meander. Part of Hadden Hill (Ki Lun Shan) and Kai Kung Leng is designated as CA (CA-S1) under the Approved Ngau Tam Mei OZP No. S/YL-NTM/12.

5.4.1.16 Key marine WSRs in Deep Bay were identified and their indicative locations are shown in Appendix 5.1. These marine WSRs include:

Table 5.13 Marine Water Sensitive Receivers

ID (refer to Appendix 5.1)	Description
E1	Mai Po Marshes SSSI
E2	Mai Po and Inner Deep Bay Ramsar Site / Inner Deep Bay SSSI
E3	Oyster Culture Area
E4	Mangroves
E5	Mangroves along Shan Pui River
E6	Mangroves along Kam Tin River (near Ngau Tam Mei Channel)
E7	Mangroves along Kam Tin River (near Shan Pui River)
E8	Mai Po Marshes SSSI (south of Lut Chau)

5.4.1.17 For mangroves, there is considerable evidence that mangroves are generally adapted to muddy or sandy substrate and used to turbid water, and are survived in dramatic changes in salinity environment due to the nature of the inter-tidal habitat in which they grow (i.e. salinity levels can fluctuate from freshwater to sea water (0-34 ppt)). No suspended solids and salinity criteria are recommended for this WSR.

5.5 Assessment Methodology

5.5.1 General

5.5.1.1 The assessment approach employed to assess the potential water quality impacts associated with the construction and operation of the Project followed the detailed technical requirements given in Appendix D of the Study Brief and the Project information as presented in **Section 2**. Criteria and guidelines for evaluating and assessing water pollution followed Annex 6 and 14 of the EIAO-TM.

5.5.1.2 The WSRs that may be affected by the Project have been identified. Potential sources of water quality impact that may arise during the construction and operation stages of the Project are related to wastewater generated from land-based construction works and discharge/reuse of treated sewage effluent from the STLMC EPP. All the identified sources of potential water quality impact were evaluated, and their impact significance determined.

Practical water pollution control measures were recommended to mitigate identified water quality impact to acceptable levels.

5.5.2 Construction Phase

5.5.2.1 All the identified sources of potential water quality impacts from the land-based construction works were evaluated and their impact significance determined. Practical water pollution control measures were recommended to mitigate identified water quality impacts.

5.5.3 Operation Phase

Modelling Tools

5.5.3.1 The hydrodynamic and water quality modelling platforms were developed by Delft Hydraulics, namely the Delft3D-FLOW and Delft3D-WAQ respectively.

5.5.3.2 Delft3D-FLOW is a 3-dimensional hydrodynamic simulation programme which calculates non-steady flow and transport phenomena that result from tidal and meteorological forcing on a curvilinear, boundary fitted grid.

5.5.3.3 Delft3D-WAQ is a water quality model framework for numerical simulation of various physical, biological and chemical processes in 3 dimensions. It solves the advection-diffusion-reaction equation for a predefined computational grid and for a wide range of model substances.

Modelling Scenarios

5.5.3.4 The following four assessment scenarios have been evaluated in this Study:

- Scenario 1: Base Case – Current water quality situation (without any improvement works in Inner Deep Bay);
- Scenario 2 - "*Without Project*" condition;
- Scenario 3: Normal operation of the proposed STLMC EPP (ADWF = 125,000 m^3/day); and
- Scenario 4: Emergency Discharge from the proposed STLMC EPP - 2-hr emergency discharge of raw sewage from the proposed STLMC EPP under power / plant failure (total emergency discharge = 27,500m^3).

Review of Current Situation

5.5.3.5 According to the EIA study for "*Yuen Long Effluent Polishing Plant - Investigation, Design and Construction*" (AEIAR-220/2019, hereafter YLEPP EIA Study), the Yuen Long Model was adopted for water quality modelling. As presented in this EIA report, "Scenario 1" represents the current water quality condition without any improvement works conducted upstream of Deep Bay waters. Therefore, the modelling results of Scenario 1 of this EIA report can represent the Base Case of this Study and are presented in this Study for comparison with the modelling results conducted under this Study (i.e. Scenario 2, 3 and 4 as mentioned in **Section 5.5.3.4**).

“Without Project” and “With Project” conditions – Scenarios 2 and 3

5.5.3.6 Scenario 2 represents the "without Project" condition in Inner Deep Bay. The model assumptions of this "without Project" scenario followed that adopted in "Scenario 2" of the approved EIA study for "*Yuen Long South Effluent Polishing Plant*" (AEIAR-278/2022), which assumed that the Yuen Long South Effluent Polishing Plant (YLSEPP), Hung Shui Kiu Effluent Polishing Plant (HSKEPP), Lok Ma Chau Loop Sewage Treatment Works (LMCL STW) and Shek Wu Hui Effluent Polishing Plant (SWH EPP) would be in operation, and the existing Yuen Long Sewage Treatment Works (YLSTW) would be upgraded to Yuen Long Effluent Polishing Plant (YLEPP).

5.5.3.7 Under normal operation of the proposed STLMC EPP (Scenario 3), tertiary treatment would be provided to reduce residual pollution loading of the treated effluent. It is expected that a new tertiary effluent polishing plant would be constructed with a capacity to treat ADWF up to 125,000 m^3/day. It is also planned that a portion of tertiary treated effluent will be reclaimed to supply STLMC DN for non-potable uses, which will cut down the freshwater demand in the region and will save precious freshwater resources. However, to address the uncertainties, it is assumed as a worst case scenario that the maximum amount of tertiary effluent (125,000 m^3/day) from the proposed STLMC EPP will be discharged to Ngau Tam Mei Channel under this scenario for conservative assessment. The likely future reduction in pollution load due to the removal of seven pig farms and two chicken farms (approximately 75,200 livestock based on maximum rearing capacities), and collection of sewage from unsewered areas would also been included under this scenario. The additional sewage collected from the unsewered areas is tabulated in **Table 5.14**.

Table 5.14 Additional Sewage Collected from the Unsewered Areas

Existing Villages in STLMC DN	ADWF (m^3)
Shek Wu Wai	250 (1)
Unsewered Villages (2)	10,000 (1)
Nearby Villages and Developments (3)	9,000 (1)
Total Sewage Discharge	19,250

Notes: 1. ADWF were given and verified by EPD on 15 February 2022 and 4 May 2022 respectively.
2. Unsewered villages includes Tung Chun Wai, Yan Shau Wai, Wing Ping Tsuen, On Lung Tsuen, Ming Tak Tong, San Lung Tsuen, Tsing Lung Tsuen, Fan Tin Tsuen, San Tin, Ha Wan Tsuen, Lok Ma Chau Tsuen, Pun Uk Tsuen and Chau Tau Tsuen.
3. Nearby villages and developments include Mai Po Lo Wai, Yau Mei San Tsuen, Wo Shang Wai, Wai Chai Tsuen, Royal Palms, Palm Spring, Scenic Heights, Maple Gardens, Rolling Hills, Vineyard, Green Crest and Casa Paradizo.

5.5.3.8 The effluent flow and qualities of the STLMC EPP assumed in the water quality modelling are tabulated in **Table 5.15**.

Table 5.15 Assumed Effluent Flow and Qualities of the Proposed STLMC EPP under Normal Operation Scenario

Parameters (4)	Unit	Proposed STLMC EPP
Flow	m^3/day	125,000
5-day Biochemical Oxygen Demand (BOD_5) (1)	mg/L	10
Suspended Solids (SS) (1)	mg/L	10
Ammonia Nitrogen (NH_3-N) (2)	mg/L	2
Total Nitrogen (TN) (2)	mg/L	10
Total Phosphorus (TP) (2)	mg/L	1
E. coli (3)	count/100mL	100 (5)

Notes: 1. Data are 95th percentile of effluent quality of the proposed STLMC EPP.
2. Data are annual average of effluent quality of the proposed STLMC EPP.
3. Data are monthly geometric mean of effluent quality of the proposed STLMC EPP.
4. The parameters salinity, Org-N and Total Oxidized Nitrogen (TON) are assumed to be <0.1 ppt, 0 mg/L and 8 mg/L respectively as conservative approach.
5. E. coli standards are set based on the WPCO TM and receiving water body.

Emergency Discharge from STLMC EPP – Scenario 4

5.5.3.9 Water quality modelling was carried out to address the impact from the discharge of untreated effluent under temporary failure of power supply as well as other incidents such as pump or equipment failure.

5.5.3.10 In the event of emergency situations, untreated effluent would be discharged directly into Deep Bay. The most common reason for system failure events refers to unstable power supply. Given that a number of contingency measures will be provided to the proposed STLMC EPP, such as provision of standby unit for all major equipment and back-up power for dual power supply, it is unlikely to have power outage for the proposed STLMC EPP. In case of unstable power and system hanged, the standby units would serve the process and the maximum system restarting time will be 2 hours according to DSD's normal practice. Interim bypass after the Primary Sedimentation Tank (PST) will also be provided and raw sewage could be treated by primary solid/liquid separation in case there is failure in downstream treatment units to avoid raw sewage discharge.

5.5.3.11 For the purpose of illustrating the possible water quality effect under this emergency situation, it is assumed that the emergency discharge would occur for a period of 2 hours with a total discharge volume of 27,500 m^3. This emergency discharge scenario was simulated for both dry and wet seasons. The emergency effluent would be discharged via the proposed STLMC EPP outfall to Ngau Tam Mei Nullah. The effluent flow and qualities of the proposed STLMC EPP assumed in the water quality modelling under emergency situation are tabulated in **Table 5.16**.

Table 5.16 Assumed Effluent Flow and Qualities of the Proposed STLMC EPP under Emergency Discharge Scenario

Parameters (4)	Unit	Design Load for Proposed STLMC EPP (2-hr Emergency)
Flow	m^3	27,500
5-day Biochemical Oxygen Demand (BOD_5) (1)	mg/L	210
Suspended Solids (SS) (1)	mg/L	320
Ammonia Nitrogen (NH_3-N) (2)	mg/L	30
Total Kjeldahl Nitrogen (TKN) (2)	mg/L	50
Total Phosphorus (TP) (2)	mg/L	7
E. coli (1)	count/100mL	4.0×10^7

Notes: 1. Peak flow (Peak Factor: 2.62) is assumed during emergency discharge (i.e. 125,000 m^3/day x 2/24 x 2.62 = 27,292 m^3). The calculated value is rounded up to 27,500 m^3 for conservative design assumption.
2. Design loads shown in above table are based on the influent characteristics of San Wai Sewage Treatment Facility (with additional safety margin added). The calculated value is rounded up to achieve a conservative design assumption.
3. The parameters salinity and Total Oxidized Nitrogen (TON) are assumed to be <0.1 ppt and 0 mg/L respectively as conservative approach.

Model Grid Layout and Properties

5.5.3.12 The Delft3D Yuen Long (YL) Model adopted under the EIA study for "*Yuen Long Effluent Polishing Plant - Investigation, Design and Construction*" (AEIAR-220/2019, hereafter YLEPP EIA Study) was further refined the model grids in the whole Inner Deep Bay for this Study (hereinafter referred to the “San Tin / Lok Ma Chau (STLMC) Model”). **Appendix 5.2** shows the grid layout and properties of the STLMC Model at the study area. As shown in **Appendix 5.2**, the grids were refined by means of a domain decomposition technique to achieve fine grid sizes near the Project. The STLMC Model covers the Hong Kong western waters including the North Western, North Western Supplementary, Western Buffer and Deep Bay Water Control Zones (WCZs) and the adjacent Mainland waters including the Pearl River Estuary. The STLMC Model consists of 40,230 grid cells. Grid size at the open waters is less than 400m in general. The grid cells near Mai Po Nature Reserve are about 70m. The grid quality of the detailed model is generally good except in some areas at or close to the land boundary. In view of the small flow velocity at the land boundary, numerical errors associated with the change of orthogonality should be small. Therefore, the closed grid cells at the coastlines have been adjusted to form a grid line that is parallel to land boundary (rather than keeping these closed grid cells orthogonal). Orthogonality at open grid cells has been checked to be adequate. The grid properties of detailed model grid including orthogonality, N-smoothness and M-smoothness are shown in **Appendix 5.2**.

5.5.3.13 The STLMC Model is linked to the Update Model, which was constructed, calibrated and verified under the project "*CE42/97 Update on Cumulative Water Quality and Hydrological Effect of Coastal Development and Upgrading of Assessment Tool (Update Study)*". Computations were first carried out using the Update Model to provide open boundary conditions to the STLMC Model. The Update Model covers the whole HKSAR and the adjacent Mainland waters including the discharges from Pearl River. The influence on hydrodynamics and water quality in these outer regions would be fully incorporated into the STLMC Model.

5.5.3.14 The performance of the STLMC Model has already been checked against with the YL Model which adopted under the YLEPP EIA Study. The results of the actual simulation periods (with sufficient spin-up periods) for water level, depth averaged flow speed, depth averaged flow directions, salinity predicted by the two models have been compared at two indicator points within the modelled area. The results of momentary flows and accumulated flows have been compared at the selected cross section to check for the consistency. Locations of the selected indicator points and cross section are shown in **Appendix 5.2-04**. Momentary flow represents the instantaneous flow rate at a specific time in m^3/s whereas accumulated flow represents the total flow accumulated at a specific time in m^3. The comparison plots are given in **Appendix 5.2-05 to 5.2-16**. The comparison plots indicated that the model results predicted by both models were in general consistent with each other which implied that the model settings of the STLMC Model as well as the nesting procedures were carried out correctly. There would have minor difference between the two model results which was caused by the difference in grid resolutions between the two models. As the STLMC Model has relatively finer grid resolution, it should have a more accurate representation of the bathymetry and coastline in Deep Bay waters as compared to the YL Model and hence the deviations are considered to be reasonable.

Model Bathymetry

5.5.3.15 The bathymetry schematization of this model has been updated based on the depth data from marine charts (Charts for Local Vessels 2018) produced by the Hydrographic Office of Marine Department, with incorporation of the projects affecting bathymetry (tabulated in **Table 5.17**). The hydrodynamic effect of the Contaminated Mid Pit (CMP) at East Sha Chau and The Brothers has also been incorporated and the final level at the CMP after capping was assumed in the modelling scenarios.

Simulation Periods

5.5.3.16 For each modelling scenario, the hydrodynamic simulations were performed for both dry and wet seasons, and the simulation period covered a 15-day full spring-neap cycle (excluding the spin-up period) for each of the dry and wet seasons. The hydrodynamic results of 15 days were then used repeatedly to drive the water quality simulations for at least a 15-day full spring-neap cycle (excluding the spin-up period) for each dry and wet season respectively. A spin-up period of 7 days and 45 days was provided for hydrodynamic simulation and water quality simulation respectively. Hence, the hydrodynamic model simulation period consisted of a spin-up period of 7 days plus an actual simulation period of 15 days (total 22 days). Water quality module for Scenario 1 and 2 (with proper model spin up) simulated for annual results incorporating seasonal variations in Pearl River discharges, solar radiation, water temperature and wind velocity. For emergency discharge scenario, the simulation period consisted of a spin-up period of 45 days plus an actual simulation period of at least 15 days spring-neap cycle with long enough for recovery of the receiving water. The worst case scenario would include discharge near slack water of neap tide. In order to determine whether sufficient spin-up period was provided for both hydrodynamic and water quality the simulations, a Spin-up Test has been conducted by repeating the model run for one more simulation period to check the spin-up period is sufficient. The Spin-up Test results were presented in

Appendix 5.3. It was found that the results of the two successive model runs were consistent with each other, which indicated that the spin-up period was sufficient.

Other Model Settings and Model Parameters

5.5.3.17 The general settings of the model such as the approach to the setup of boundary and initial conditions as well as the model coefficients and parameters followed those adopted under the YLEPP EIA Study.

Assessment Year and Coastline Configurations

5.5.3.18 Major factors that would affect the water quality stimulated would be (i) the change in pollution loading discharged to marine waters; and (ii) the change in coastline configurations in Year 2046.

5.5.3.19 The maximum Project design capacity of 125,000 m^3/day was adopted for worst case assessment as it represents the worst case in terms of the amount of Project flow under operation phase.

5.5.3.20 The planned reclamations as listed in **Table 5.17** would be completed and therefore would represent a worst case in terms of the tidal flushing and assimilation capacity of the marine water. **Table 5.17** shows the coastal development projects incorporated in the coastline configurations for modelling.

Table 5.17 Projects Incorporated in Modelling

Project	Source of Information on Project Layout
Development of Integrated Waste Management Facilities (IWMF) Phase 1	EIA Report for "Development of IWMF Phase 1" (EIAO Register No.: AEIAR – 163/2012)
Harbour Area Treatment Scheme (HATS) Stage 2A	EIA Report for "HATS Stage 2A" (EIAO Register No.: AEIAR – 121/2008)
Hong Kong – Zhuhai – Macao Bridge (HZMB) Hong Kong Boundary Crossing Facilities (BCF)	EIA Report for "HZMB Hong Kong BCF" (EIAO Register No.: AEIAR – 145/2009)
Hong Kong Link Road (HKLR)	EIA Report for "HZMB – Hong Kong Link Road" (EIAO Register No.: AEIAR – 144/2009)
New Contaminated Mud Marine Disposal Facility (MDF) at Airport East / East Sha Chau Area	EIA Report for "New Contaminated Mud MDF at Airport East / East Sha Chau Area" (EIAO Register No.: AEIAR – 089/2005)
Expansion of Hong Kong International Airport into a Three-Runway System (3RS)	EIA Report for "3RS" (EIAO Register No.: AEIAR – 185/2014)
Sha Tin to Central Link (SCL)	EIA Report for "SCL Protection Works at Causeway Bay Typhoon Shelter: (EIAO Register No.: AEIAR – 159/2011), EIA Report for "SCL – Hung Hom to Admiralty Section" (EIAO Register No.: AEIAR – 166/2012) and EIA Report for "SCL – Tai Wai to Hung Hom Section" (EIAO Register No.: AEIAR – 167/2012)
Kai Tak Cruise Terminal	EIA Report for "Dredging, Works for Proposed Cruise Terminal at Kai Tak" (EIAO Register No.: AEIAR – 115/2007)
Tuen Mun – Chek Lap Kok Link (TM-CLKL)	EIA Report for "TM-CLKL" (EIAO Register No.: AEIAR – 146/2009)

Project	Source of Information on Project Layout
Tung Chung New Town Extension (TCNTE)	EIA Report for "TCNTE" (EIAO Register No.: AEIAR – 196/2016)
Contaminated Mid Pit (CMP) at South Brothers	EIA Report for "New Contaminated Mud Marine Disposal Facility at Airport East / East Sha Chau Area" (EIAO Register No.: AEIAR-082/2004) *(Remark: The hydrodynamic effect of the capped CMP will be incorporated into the hydrodynamic model. The final level after capping of the CMP is assumed in the model under all modelling scenarios)*
CMP at East Sha Chau	
Sunny Bay Reclamation	PWP Item No. 751CL - Planning and Engineering Study on Sunny Bay Reclamation
Lung Kwu Tan Reclamation	Agreement No. CE27/2015(CE) "Technical Study on Reclamation at Lung Kwu Tan - Feasibility Study", Final Final Report.

<u>Background Pollution Loading</u>

5.5.3.21 The pollution loading of the proposed EPP used for modelling was compiled with reference to the design flow and loads. The pollution loading of other background discharges to the marine water was based on the pollution loads complied for the YL Model under the YLEPP EIA study for cumulative assessment.

5.5.3.22 In addition to the background pollution loading extracted from the YLEPP EIA study, the following pollution loads in **Table 5.18** from concurrent EIA projects were also considered to assess the cumulative impacts.

Table 5.18 Pollution Loads within Deep Bay from Concurrent EIA Projects

Project	Source of Information
Hung Shui Kiu Effluent Polishing Plant (EIA Study Brief No.: ESB-312/2019)	A new Hung Shui Kiu Effluent Polishing Plant with a design secondary plus treatment capacity of 90,000 m^3/d
Yuen Long South Effluent Polishing Plant (EIAO Register No.: AEIAR – 237/2020)	A new Yuen Long South Effluent Polishing Plant with a design tertiary treatment capacity of 65,000 m^3/d
Yuen Long Effluent Polishing Plant (EIAO Register No.: AEIAR – 220/2019)	The existing Yuen Long STW will be upgraded to Yuen Long Effluent Polishing Plant with a design tertiary treatment capacity of 150,000 m^3/d.
North East New Territories New Development Areas (EIAO Register No.: AEIAR – 175/2013)	Increase population of around 180,000 with sewage treated at the expanded Shek Wu Hui Effluent Polishing Plant with a design tertiary treatment capacity of 190,000 m^3/d.
Development of Lok Ma Chau Loop (EIAO Register No.: AEIAR – 176/2013)	Development of Lok Ma Chau Loop with sewage treated at the proposed Lok Ma Chau Sewage Treatment Works with a design tertiary treatment capacity of 18,000 m^3/d.
Remaining Phase Development of the New Territories North - Planning and Engineering Study for NTN New Town and Man Kam To – Investigation (EIA Study Brief No. ESB-341/2021)	Increase population of around 200,000 with new sewerage treatment works. As no design information is available, the pollution loading has not been taken into account.

5.6 Identification, Prediction and Evaluation of Environmental Impacts

5.6.1 Construction Phase

5.6.1.1 No marine works would be required for construction of the Project. General construction works for the Project would be land-based only. The potential sources of water quality impacts arising from the inland construction works of the Project include:

- General construction activities;
- Construction site run-off;
- Construction works near watercourses;
- Construction works in watercourses;
- Removal or diversion of watercourses;
- Removal or filling of ponds and wet areas;
- Accidental spillage;
- Sewage from construction workforce; and
- Groundwater from contaminated areas, contaminated site run-off and wastewater from land decontamination.

General Construction Activities

5.6.1.2 Wastewater generated from construction activities, including general cleaning and polishing, wheel washing, dust suppression and utility installation may contain high SS concentrations. It may also contain a certain amount of grease and oil. Potential water quality impacts due to the wastewater discharge can be minimised if construction and site management practices are implemented to ensure that litter, fuels, and solvents do not enter public drainage systems. It is expected that if the good site practice suggested in **Sections 5.7.1.1 to 5.7.1.14** are followed as far as practicable, the potential water quality impacts associated with construction activities would be minimal.

Construction Site Runoff

5.6.1.3 The Project development is divided by stages as shown in **Appendix 2.1**. The average daily run-off generated from the construction sites for different phases of the Project development is given in **Table 5.19** below. The total works area for Main Phase development (of approximately 290 ha) would be amongst the largest, with an estimated daily run-off of about 1,802 m^3. The construction site run-off generated from all other phases of the Project development (with smaller works areas) would be smaller. The assumptions adopted for quantification of the daily construction site run-off are as follows.

- According to the DSD's "*Stormwater Drainage Manual*", annual rainfall in Hong Kong is about 2,400 mm. The Update Study suggested that only rainfall events of sufficient intensity and volume would give rise to runoff and that runoff percentage is about 44% and 82% for dry and wet season, respectively. Therefore, it was assumed that only 1,512 mm (i.e. 2,400 mm x (82%+44%)/2) of the 2,400 mm annual rainfall would be considered as effective rainfall that would generate surface runoff.
- It is also assumed that the works area at each phase of the Project development would be only 50% active at any one time.
- The run-off coefficient is assumed to be 0.3 (for unpaved area).

Table 5.19 Averaged Daily Construction Site Run-off for the Project by Phases

Phase (refer to Appendix 2.1)	Approximate Area (ha)	Approximate Daily Volume of Construction Site Run-off (m^3/day)
Initial Phase	244	1,516
Main Phase	290	1,802
Remaining Phase	35	217

5.6.1.4 As compared to the design flow capacity of the STLMC EPP of 125,000 m^3/day as mentioned in **Section 5.5.3.7**, the quantity of construction site run-off estimated for the Project is considered small. The actual construction site run-off during the construction period would vary, i.e. could be higher during wet season (e.g. April to October) and lower in dry season (e.g. November to March).

5.6.1.5 Potential pollution sources of site run-off may include:

- Run-off and erosion of exposed bare soil and earth, drainage channel, earth working area and stockpiles;
- Release of any bentonite slurries, concrete washings and other grouting materials with construction run-off or storm water;
- Wash water from dust suppression sprays and wheel washing facilities; and
- Fuel, oil and lubricants from maintenance of construction vehicles and equipment.

5.6.1.6 During rainstorms, site run-off would wash away the soil particles on unpaved lands and areas with the topsoil exposed. The run-off is generally characterized by high concentration of SS. Release of uncontrolled site run-off would increase the SS levels and turbidity in the nearby water environment. Site run-off may also wash away soil particles that were contaminated by the construction activities and therefore cause water pollution.

5.6.1.7 Wind-blown dust would be generated from exposed soil surfaces in works areas. It is possible that wind-blown dust would fall directly onto the nearby water bodies when a strong wind occurs. Dispersion of dust within the works areas may increase the SS levels in surface run-off causing a potential impact to the nearby sensitive receivers.

5.6.1.8 It is important that proper site practice and good site management be followed to prevent run-off with high level of SS from entering the surrounding waters. Best Management Practices (BMPs) in controlling construction site discharges are recommended for this Project as described in **Sections 5.7.1.1 to 5.7.1.14**. In view of the sensitive nature of the Deep Bay WCZ, an Emergency Response Plan (ERP) should also be developed to minimise the potential impact from construction site discharges under failure of treatment facilities during emergency situations or inclement weather. An outline of the ERP is provided in **Sections 5.7.1.31 to 5.7.1.32**. With the implementation of BMPs to control construction site effluents and ERP to minimise water quality impact under emergency situations, disturbance of water bodies would be avoided and deterioration in water quality would be minimal.

Construction Works near Watercourses

5.6.1.9 Watercourses are located within the Project area as identified in **Section 5.4**. Construction works near these watercourses may pollute the stormwater or inland waters due to potential release of construction wastes. Construction wastes are generally characterised by high concentration of SS and elevated pH. Adoption of good housekeeping and mitigation measures would reduce the generation of construction wastes and potential water pollution. The implementation of measures to control run-off and drainage water will be important for the construction works adjacent to the inland water in order to prevent run-off and drainage water with high levels of SS from entering the water environment. With the implementation of adequate construction site drainage and BMPs as described in **Sections 5.7.1.1 to 5.7.1.14** and provision of mitigation measures as specified in ETWB TC (Works) No. 5/2005 "*Protection of natural streams/rivers from adverse impacts arising from construction works*" as detailed in **Section 5.7.1.15**, it is anticipated that water quality impacts would be minimised.

5.6.1.10 Revitalisation and Greening of Drainage Channel Banks of existing drainage channels including STEMDC and STWMDC, running through the Project will be revitalised (e.g. enhancing the greening of the channel banks through the provision of "grasscrete" or similar products). The "grasscrete" or similar products will only be placed on the channel banks above the channel water. No underwater works would be required for the revitalisation works. The modification works at riverbank may pollute the channels due to potential release of construction wastes. The revitalisation works will be conducted in stages in dry season only when the water flow is low. Implementation of measures to control run-off and drainage water will be important for the construction works adjacent to the revitalised drainage channel water in order to prevent run-off and drainage water with high levels of SS from entering the revitalised drainage channel. With the implementation of adequate construction site drainage and BMPs as described in **Sections 5.7.1.1 to 5.7.1.14** and provision of mitigation measures as specified in ETWB TC (Works) No. 5/2005 "*Protection of natural streams/rivers from adverse impacts arising from construction works*" as detailed in **Section 5.7.1.16**, no unacceptable water quality impacts would be anticipated.

<u>Construction Works in Watercourses</u>

5.6.1.11 According to Section 2, two main drainage channels (STEMDC and STWMDC) and other smaller water courses are proposed for revitalization.

5.6.1.12 Potential impacts may be generated by discharge of construction materials, wastewater, sediment and spillage to the channel waters in the downstream. The construction method and sequence of the proposed construction in watercourses / channels should be carefully designed so that all the construction works including any excavation would be undertaken within a dry zone and physically separated from the water flow in the existing watercourses / channels.

5.6.1.13 Impermeable sheet pile walls or cofferdam walls or steel casing would be installed to fully enclosed the construction works area in watercourses / channels prior to the commencement of any works in watercourses / channels. Dewatering of the construction works area or diversion of water flow would be undertaken before the construction works to avoid water flow in the construction works area. Silt removal facilities would be used to clarify the effluent generated from the dewatering operation before discharging back to the watercourses / channels as a precautionary measure. Any construction works including excavation and piling activities would be undertaken in a dry zone surrounded by the impermeable sheet pile walls or cofferdam walls or steel casing. Depending on the water level in the watercourses / channels (especially the downstream areas which is subject to tidal influence) during the construction, where practicable, silt curtain would be installed around the construction works area inside the watercourses / channels as a second layer of protection to further minimise sediment and contaminant release. All wastewater generated from the excavation and piling activities would be considered as part of the construction site effluent, which would be properly collected and treated as appropriate to meet the standards stipulated in the TM-DSS before disposal.

5.6.1.14 Excavated materials (including sediment) may be generated from the construction works. Mitigation measures for handling and disposal of excavated materials and sediment as recommended in **Section 5.7.1.22** should be followed to minimise the potential environmental impacts arising from the excavated materials.

5.6.1.15 It is also recommended that the construction works in watercourses / channels should be undertaken in dry season, where practicable, when the water flow is low. With the adoption of the construction method as described above, together with the adequate construction site drainage as recommended in **Sections 5.7.1.1 to 5.7.1.14** as well as the protection measures for construction works near watercourses as detailed in **Section 5.7.1.15**, it is anticipated that water quality impacts would be minimised.

Removal / Diversion of Watercourses

5.6.1.16 The two main drainage channels (STEMDC and STWMDC) will be retained and revitalised. Due to the proposed developments, the watercourses (except STEMDC and STWMDC) within the Project site will be permanently removed / diverted / realigned under this Project. Removal of these existing watercourses would involve diversion of water flow from their existing routes to the new routes through the proposed covered drainage system of the new development and demolition of the existing watercourses. Construction of the new channel and new drainage network may involve excavation and use of concrete.

5.6.1.17 Potential impacts may be generated by discharge of concrete slurry and other grouting materials generated by concreting works as well as the release of construction materials, wastewater, excavated sediment, spillage and contaminants to the receiving waters in the downstream (due to soil excavation for construction of new drainage and demolition of the existing watercourses). All these construction works should be undertaken in dry conditions to avoid potential water quality impacts upon the downstream water quality.

5.6.1.18 The tentative works sequence for diversion and removal of watercourses is described below. Construction works at watercourse would be undertaken only after flow diversion or dewatering operation is fully completed to avoid water flow in the works area. Dewatering of watercourse would be performed by diverting the water flow to new or temporary drainage. Where necessary, cofferdams or similar impermeable sheet pile walls should be used to isolate the works areas from neighbouring waters. The permanent or temporary drainage for carrying the diverted flow from existing watercourse to be removed would be constructed and completed before dewatering of that existing watercourse. Construction of all the proposed permanent and temporary drainage would be undertaken in a dry condition prior to receiving any water flow.

5.6.1.19 Excavated materials (including sediment) may be generated from the removal and diversion of watercourses. Mitigation measures for handling and disposal of excavated materials and sediment as recommended in **Section 5.7.1.22** should be followed to minimise the potential environmental impacts arising from the excavated materials.

5.6.1.20 Mitigation measures for protection of downstream water quality from diversion and removal of watercourses are described in **Sections 5.7.1.17 to 5.7.1.20**. With adoption of the recommended mitigation measures, there should not be significant sediment and contaminant release to the downstream water.

Removal / Filling of Ponds and Wet Areas

5.6.1.21 Due to the new developments, the existing ponds and wet agricultural area within the Project site will be completely removed under this Project.

5.6.1.22 All the ponds and wet areas to be removed should be isolated and not connected to any existing watercourse. The associated construction works would include draining the water in ponds / watercourses before filling up these areas or before commencement of any excavation and construction works. The water of these ponds and wet areas to be drained would probably be sediment-laden and would carry a certain level of pollutants. Direct dumping of these drained waters to the nearby watercourse will not be allowed.

5.6.1.23 The drained water generated from dewatering of the ponds / wet areas to be removed should be temporarily stored in appropriate storage tanks or containers for reuse on-site as far as practicable and any surplus water should be tankered away for disposal at the STW. Any surplus water should be treated as necessary before disposal to the STW in compliance with the TM-DSS. In order to minimise the potential impact, dewatering works at ponds / wet areas should be conducted within dry season to minimise the quantity of drained water. No direct discharge of drained water from these construction works will be allowed.

5.6.1.24 Excavated materials (including sediment) may be generated from the construction works in ponds and wet areas. Mitigation measures for handling and disposal of excavated materials and sediment as recommended in **Section 5.7.1.22** should be followed to minimise the potential environmental impacts arising from the excavated material. Together with the adoption of the mitigation measures for removal of ponds and wet areas as recommended in **Sections 5.7.1.21 and 5.7.1.21**, no unacceptable water quality impact would be expected.

Accidental Spillage

5.6.1.25 The use of engine oil and lubricants and their storage as waste materials have the potential to create impacts on the water quality if spillage occurs. Waste oil may infiltrate into the surface soil layer, or runoff into adjacent waterbodies, increasing hydrocarbon levels. Groundwater pollution may also rise from the improper use and storage of chemical and petroleum products within the site area where groundwater infiltrates into the area. Infiltration of groundwater may occur at areas where there are faults and/or fissures in the rock mass. The potential impacts could however be mitigated by practical mitigation measures and good site practices (as given in **Sections 5.7.1.24 to 5.7.1.26**).

Sewage from Construction Workforce

5.6.1.26 During the construction of the Project, the workforce on site will generate sewage effluents, which are characterized by high level of BOD, ammonia and *E. coli*. Based on the DSD Sewerage Manual, the sewage production rate for construction workers is estimated at 0.35 m^3 per worker per day. For every 100 construction workers working simultaneously at the construction site, about 35 m^3 of sewage would be generated per day. Potential water quality impacts upon the local drainage and fresh water system may arise from these sewage effluent, if uncontrolled.

5.6.1.27 However, this temporary sewage can be adequately handled by interim sanitary facilities, such as portable chemical toilets. According to the Reference Materials on Construction Site Welfare, Health and Safety Measures that issued by the Construction Industry Council (i.e. Section 5.6.10), the number of toilet facilities provided on site shall be at a ratio of not less than 1 for every 25 workers. The number of the chemical toilets required for the construction site should be subject to later detailed design, the capacity of the chemical toilets, and contractor's site practices. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

5.6.1.28 Provided that sewage is not discharged directly into stormwater drains or inland waters adjacent to the construction site, and temporary sanitary facilities are used and properly maintained, no adverse water quality impact would be anticipated. Mitigation measures and good site practices as given in **Sections 5.7.1.26 and 5.7.1.27** should be implemented.

Groundwater from Contaminated Areas, Contaminated Site Run-off and Wastewater from Land Decontamination

5.6.1.29 It is identified that some of the construction works areas would have land contamination issues. Proper land contamination remediation and mitigation measures are proposed in **Section 8**. Any contaminated material disturbed, or material which comes into contact with the contaminated material, has the potential to be washed with site run-off into watercourses. Any wastewater discharge from land decontamination processes could also adversely affect the nearby water environment. Excavated contaminated materials would be properly stored, housed and covered to avoid generation of contaminated run-off. Open stockpiling of contaminated materials will not be allowed. Any contaminated site run-off and wastewater from land decontamination activities will be properly treated and disposed in compliance with the requirements of the TM-DSS. Mitigation measures for contaminated site run-off and wastewater from land decontamination are recommended in **Section 5.7.1.28**. With proper implementation of the recommended mitigation measures, the potential water quality impacts arising from the land decontamination works would be minimised.

5.6.1.30 Groundwater pumped out or from dewatering process during excavation works in the contaminated areas would be potentially contaminated. Any contaminated groundwater will be either properly treated or properly recharged into the ground in compliance with the requirements of the TM-DSS. No direct discharge of contaminated groundwater will be adopted. Mitigation measures and monitoring requirements for contaminated groundwater discharge/recharge are recommended in **Sections 5.7.1.29 to 5.7.1.30**. With proper implementation of the recommended mitigation measures, no unacceptable water quality would be expected from the groundwater generated from contamination areas.

5.6.2 Operation Phase

5.6.2.1 The pollution sources / impacts associated with the Project operation would include:

- Sewage Disposal Strategy for the New Developments;
- Emergency Discharge from the New STLMC EPP;
- Sewage and Sewerage System;
- Emergency Discharge from Sewage Pumping Stations (SPSs);
- Treated Effluent Reuse;
- Surface Run-off from New Developments;
- Changes of Hydrology and Potential Flooding Risk
- Revitalisation and Greening of Drainage Channel Banks;
- Maintenance flushing for Reclaimed Water Service Reservoir (RWSR);
- Maintenance flushing for Fresh Water Service Reservoir (FWSR);
- Potential Impact from Refuse Transfer Stations and Refuse Collection Points
- Spent Effluent from District Cooling System; and
- Maintenance of Drainage System.

<u>Sewage Disposal Strategy for the New Developments</u>

5.6.2.2 Sewage effluent will be generated from the new developments. A public sewerage system will be built to collect and convey all the sewage effluents generated from the Project area to the new STLMC EPP for proper disposal.

5.6.2.3 With reference to the assessment Sewerage and Sewage Treatment Implications in Section 6, there is no existing sewerage system within the vicinity of STLMC DN. A new sewage discharge system shall be provided for the sewage impact arising from the proposed development for ultimate treatment at the proposed STLMC EPP. The EPP will be designed up to tertiary level treatment standard to enable for reuse of reclaimed water while the rest of the treated sewage effluent is suggested to discharge to the Deep Bay. A new water reclamation plant will provide treatment for the treated sewage effluent (TSE) that is suitable for reuse within the proposed development for non-portable uses such as toilet flushing and controlled irrigation.

<u>Effluent Discharge from the New STLMC EPP</u>

5.6.2.4 During the operation phase, sewage discharge will be the major water pollution source. As mentioned in **Section 2**, a number of existing livestock farms, including seven pig farms and two chicken farms, will be removed. **Table 5.20** to **Table 5.22** summarized the pollution loadings to Deep Bay under Scenario 1, 2 and 3.

Table 5.20 Assumed Pollution Load to Deep Bay under Scenario 1

	BOD (kg/d)	TN (kg/d)	TP (kg/d)	*E. coli* (no./d)
Discharge from STWs/EPPs	700	1,862	84	1.4×10^{14}
Background Loads	18,740	10,499	1,059	4.2×10^{16}
Total	**19,440**	**12,361**	**1,143**	**4.2×10^{16}**

Table 5.21 Assumed Pollution Load to Deep Bay under Scenario 2

	BOD (kg/d)	TN (kg/d)	TP (kg/d)	*E. coli* (no./d)
Discharge from STWs/EPPs	1,075	2,150	215	2.2×10^{11}
Background Loads	8,359	7,214	757	1.5×10^{16}
Total	**9,434**	**9,364**	**972**	**1.5×10^{16}**

Table 5.22 Assumed Pollution Load to Deep Bay under Scenario 3

	BOD (kg/d)	TN (kg/d)	TP (kg/d)	*E. coli* (no./d)
Discharge from STWs/EPPs	1,700	3,400	340	3.4×10^{11}
Background Loads	8,011	6,953	735	1.4×10^{16}
Total	**9,711**	**10,353**	**1,075**	**1.4×10^{16}**

5.6.2.5 Although there would be an increase in pollution loads for BOD, TN and TP due to the proposed effluent discharge from the STLMC EPP (125,000 m^3/day) under Scenario 3 (as compared to Scenario 2), the overall pollution loads discharge to Deep Bay WCZ under Scenario 2 and 3 would be reduced, having considered the improvement in background pollution loadings from other interfacing projects. The water quality simulation results of Scenarios 1, 2 and 3 are presented in **Appendix 5.4** as contour plots for salinity, DO, BOD_5, TIN, UIA, TN, TP, *E. coli*, SS and sedimentation rates for dry and wet seasons respectively. All contour plots in **Appendix 5.4** are presented as arithmetic averages expect for the *E. coli* levels which are geometric mean values and the DO levels which are 10th percentile values. The model results at different WSR points and EPD monitoring stations in inner subzone of Deep Bay WCZ (i.e. DM1, DM2 and DM3) are summarized in **Appendix 5.5**. The WSR points include Mai Po Marshes SSSI, Mai Po Inner Deep Bay Ramsar Site, oyster culture area and mangroves. The model results (in **Appendix 5.5**) are presented as arithmetic depth-averaged values except for the *E. coli* levels (which are geometric mean depth-averaged values) and the DO levels (which are presented as minimum depth-averaged values at E5 to E8 and 10th percentile depth-averaged values for the remaining WSRs and EPD stations) for comparison with the assessment criteria. Locations of WSRs and EPD stations are shown in **Appendix 5.1**.

Overall Water Quality in Deep Bay due to Project Effluent Discharge

Dissolved Oxygen

5.6.2.6 Under Scenario 1 (Base Case), except for the Oyster Culture Area (E3) and EPD station DM3, non-compliance was predicted at the selected WSRs (E1, E2, E4-E8) and EPD stations (DM1 and DM2). For marine WSRs and EPD stations, the DO levels at Mai Po (E1 and E2), mangroves in Inner Deep Bay (E4) and EPD stations DM1 and DM2 were predicted to be 2.1-3.9 mg/L. For inland WSRs, the DO levels at mangroves along Shan Pui River and Kam Tin River (E5-E8) were predicted to be <0.1-1.5 mg/L. Having considered the improvement in background pollution loadings from other interfacing projects in Deep Bay (Scenario 2) and operation of the STLMC EPP (Scenario 3), it was found that the DO levels would be improved as compared to Scenario 1. The model results showed that the DO levels would be improved at the marine WSRs (3.4-4.5 mg/L under Scenario 2 and 3.3-4.5 mg/L under Scenario 3) and inland WSRs (1.0-2.6 mg/L under Scenario 2 and 0.9-2.8 mg/L under Scenario 3). Compliance with WQO for DO was predicted at WSRs E2 (Mai Po Inner Deep Bay Ramsar Site / Inner Deep Bay SSSI) and

E3 (Oyster Culture Area), and EPD stations DM1 and DM3 under Scenarios 2 and 3. The low DO levels at these WSRs were mainly contributed from other background pollution sources and commissioning of the STLMC EPP would improve the overall DO levels in Deep Bay.

Biochemical Oxygen Demand

5.6.2.7 The WQO stated that the BOD levels for Yuen Long & Kam Tin (Lower) subzone (i.e. E5-E8) should not exceed 5 mg/L. As shown in the modelling results, the annual BOD levels at E5-E8 were predicted to be 15.2-29.5 mg/L under Scenario 1 as compared to the WQO of no more than 5 mg/L. The predicted BOD levels would be reduced to 8.6-14.1 mg/L under Scenario 2 and 8.6-13.0 mg/L under Scenario 3. The high BOD levels were mainly contributed from other background pollution sources and non-compliances for BOD were predicted under both Scenarios 1, 2 and 3.

5.6.2.8 There is no WQO for BOD available for Deep Bay marine waters. Under Scenario 1, the BOD levels at all selected WSRs and EPD stations were predicted to be 2.2-12.5 mg/L. In comparison with the BOD levels under Scenario 1, the predicted BOD levels at the WSRs would be reduced to 2.2-9.9 mg/L under Scenario 2 and 2.3-10.3 mg/L under Scenario 3. No adverse water quality impact for BOD would therefore be expected.

Salinity

5.6.2.9 The model predicted that the effluent discharge of STLMC EPP would only slightly affect the salinity levels at relevant WSRs and EPD stations in Deep Bay. The maximum decrease in salinity levels was found at E1 (Mai Po Marshes SSSI). The predicted salinity levels at E1 under Scenario 1 would be 10.3 ppt. The predicted salinity levels at E1 under Scenario 2 and 3 would be 10.5 ppt and 9.3 ppt respectively. The maximum percentage change in salinity levels at E1 was calculated as 9.7%, which comply with the WQO of no more than 10% change from the background levels. No adverse water quality impact for salinity would therefore be expected.

Unionized Ammonia / Total Inorganic Nitrogen

5.6.2.10 Under Scenario 1, the predicted annual TIN and UIA levels at all selected WSRs and EPD Stations were ranged from 2.43-12.95 mg/L (for TIN) and 0.041-0.337 mg/L (for UIA) respectively, which have already exceeded the WQO for TIN (0.7 mg/L) and UIA (0.021 mg/L). Having considered the improvement in background pollution loadings from other interfacing projects in Deep Bay (Scenario 2) and operation of the STLMC EPP (Scenario 3), the TIN and UIA levels would be reduced at all selected WSRs in Deep Bay. In comparison with the TIN levels under Scenario 1, the predicted TIN levels at the WSRs would be reduced to 2.23-8.53 mg/L under Scenario 2 (maximum reduction in TIN level of 4.42 mg/L) and 2.24-8.43 mg/L under Scenario 3 (maximum reduction in TIN level of 4.52 mg/L). In comparison with the UIA levels under Scenario 1, the predicted UIA levels at the WSRs would be reduced to 0.034-0.150 mg/L under Scenario 2 (maximum reduction in UIA level of 0.191 mg/L) and 0.034-0.140 mg/L under Scenario 3 (maximum reduction in UIA level of 0.202 mg/L). The predicted non-compliance for TIN and UIA were mainly contributed by the background pollution sources, which carries a high loading of nitrogen nutrients (as compared to the WQO for TIN and UIA).

Total Nitrogen

5.6.2.11 No WQO for total nitrogen (TN) available for Deep Bay waters. The model predicted that the TN levels would be reduced at all selected WSRs and EPD stations in Deep Bay under Scenarios 2 and 3 (as compared to Scenario 1). The TN levels in Deep Bay were mainly contributed from other background pollution sources.

Total Phosphorus

5.6.2.12 No WQO for total phosphorus (TP) available for Deep Bay waters. The model predicted that the TP levels would be reduced at all selected WSRs and EPD stations in Deep Bay under Scenarios 2 and 3 (as compared to Scenario 1). No adverse water quality impact for TP would therefore be expected.

Suspended Solids

5.6.2.13 The WQO stated that the SS levels should be no more than 30% from the ambient levels in general (except for E5-E8). The model predicted that the SS levels would be reduced at all selected WSRs and EPD stations in Deep Bay and hence comply with the WQO for SS for no more than 30% increase from the ambient levels. No adverse water quality impact for SS would therefore be expected. In addition, the model predicted that the sedimentation rates in inner Deep Bay would be reduced as compared to Scenario 1 as shown in Appendices 5.4. No adverse water quality impact for sedimentation rate would therefore be expected.

5.6.2.14 The WQO stated that the SS levels for Yuen Long & Kam Tin (Lower) subzone (i.e. E5-E8) should not exceed 20 mg/L. Under Scenario 1, the SS level at E5-E8 were predicted to be 47.0-76.9 mg/L, which has already exceeded the WQO for SS (<20 mg/L). In comparison with the SS level under Scenario 1, the predicted SS levels at the WSRs would be reduced to 29.0-48.2 mg/L under Scenario 2 (maximum reduction in SS level of 28.7 mg/L) and 27.9-35.6 mg/L under Scenario 3 (maximum reduction in SS level of 41.4 mg/L). The predicted non-compliance for SS was mainly contributed by the background pollution sources, which contained high SS levels (as compared to the WQO).

E. coli

5.6.2.15 The WQO stated that the *E. coli* level for mariculture subzone [i.e. Oyster Culture Area (E3)] should not exceed 610 no./100mL (geometric mean in one calendar year). The model predicted that the *E. coli* level at E3 would comply with the WQO (13 no./100mL) under all normal operation scenarios. For inland WSRs (i.e. E5-E8), the *E. coli* levels were predicted to be 1,194-9,718 no./100mL, which exceeded the WQO for *E. coli*. Having considered the improvement in background pollution loadings from other interfacing projects in Deep Bay (Scenario 2) and operation of the STLMC EPP (Scenario 3), the predicted *E. coli* levels at the WSRs would be reduced to 52-627 no./100mL under Scenario 2 and 40-315 no./100mL under Scenario 3, which comply well with the WQO for Yuen Long & Kam Tin (Lower) subzone of not to exceed 610 no./100mL. For marine WSRs and EPD stations (except E3), the model predicted that the *E. coli* levels would be reduced under Scenarios 2 and 3 (ranged from 14-250 no./100mL under Scenario 1 to 8-175 no./100mL under Scenario 2 and 8-176 no./100mL under Scenario 3). Commissioning of the STLMC EPP would improve the overall *E. coli* levels in Deep Bay and no adverse water quality impact would therefore be expected.

5.6.2.16 It should be noted that the effluent of the STLMC EPP would be discharged to Ngau Tam Mei Channel, joins Kam Tin River and finally discharge to Deep Bay. As mentioned in **Section 5.3.3.3**, the Ngau Tam Mei Channel is contaminated by organic and nutrient pollutants, the tertiary treated effluent from the STLMC EPP would provide better water quality than the existing Ngau Tam Mei Channel water quality which provide an opportunity to revitalize the channel.

5.6.2.17 In summary, the proposed STLMC EPP would improve the overall water quality in the Inner Deep Bay. The model predicted that the proposed STLMC EPP would reduce the TIN, UIA, TN, TP, SS, sedimentation rate and *E. coli* levels in inner Deep Bay. The overall DO levels were predicted to be improved due to the reduction in overall pollution loads discharge in Inner Deep Bay. The predicted change in salinity levels would comply well within the WQO of no more than 10% change from the background levels (as compared to Scenario 1). No unacceptable water quality impact from normal operation of the proposed STLMC EPP upon the receiving marine water would therefore be expected.

Emergency Discharge from the New STLMC EPP

5.6.2.18 During emergency situations, such as loss of power supply, or mechanical faults / equipment failures, untreated effluent may overflow and cause potential impacts at downstream WSRs. Emergency discharge due to emergency situations (e.g. power /

equipment failure) may occur at the proposed STLMC EPP. Scenario 4 assumed that an emergency discharge from the STLMC EPP would occur for a period of 2 hours in case of power or plant failure. The model results at different WSR points and EPD monitoring stations in Inner subzone of Deep Bay WCZ (i.e. DM1, DM2 and DM3) under Scenario 4 are summarized in **Appendix 5.5** for DO, BOD, TIN, UIA, TN, TP, *E. coli* and SS. It should be noted that the water quality modelling results presented in **Appendix 5.5** is for reference only which should not be used for assessing the impact of the short-term emergency discharge under Scenario 4.

Dissolved Oxygen

5.6.2.19 The impact of short-term emergency discharge under Scenario 4 on the WSRs as presented in **Appendix 5.6 and 5.7** was insignificant in general. According to **Appendix 5.5**, the predicted DO levels at all the selected WSRs under emergency discharge scenario (0.7-5.9 mg/L under Scenario 4) were lower than the DO levels predicted under normal operation of STLMC EPP scenario (0.9-5.9 mg/L under Scenario 3) but better than that predicted under “Base Case” scenario (<0.1-5.7 mg/L under Scenario 1). Biggest DO impact were predicted at mangroves along Shan Pui River (E5) and Kam Tin River (near Shan Pui River, E7). The predicted DO levels at E5 and E7 were predicted to be 2.5 mg/L and 2.3 mg/L under Scenario 4, which were better than the predicted DO level of 1.5 mg/L and <0.1 mg/L under Scenario 1.

Biochemical Oxygen Demand

5.6.2.20 The biggest BOD impact due to the short-term emergency discharge under Scenario 4 was observed at mangrove along Kam Tin River (near Ngau Tam Mei Channel, E6). The predicted BOD level at E6 was predicted to be 13.6 mg/L, which was lower than the predicted BOD level under Scenario 2 (without Project) of 14.1 mg/L.

Unionized Ammonia / Total Inorganic Nitrogen

5.6.2.21 The biggest TIN and UIA impacts due to the short-term emergency discharge under Scenario 4 was observed at mangroves along Kam Tin River (near Ngau Tam Mei Channel, E6). The predicted TIN and UIA levels at E6 were 11.14 mg/L and 0.173 mg/L respectively. As mentioned previously, the Study Area are subject to high nitrogen nutrient loads due to the background discharges, with non-compliances for TIN and UIA recorded in Deep Bay WCZ even under both Scenarios 1 (Base Case), 2 (without Project) and 3 (normal operation of STLMC EPP).

Suspended Solids

5.6.2.22 The biggest SS impact due to the short-term emergency discharge under Scenario 4 was observed at Mai Po Marshes SSSI (E1) and mangrove along Kam Tin River (near Ngau Tam Mei Channel, E6). The predicted SS levels at E1 and E6 were 34.9 mg/L and 37.4 mg/L, which was less than 30% ambient SS levels as predicted under Scenario 2. Full compliance with the SS objective would be achieved at all selected WSRs under emergency discharge scenario.

E. coli

5.6.2.23 The biggest *E. coli* impact due to the short-term emergency discharge under Scenario 4 was observed at mangrove along Kam Tin River (near Ngau Tam Mei Channel, E6). The predicted *E. coli* level at E6 was predicted to be 452 no./100mL, which was better than the predicted *E. coli* level under Scenario 2 of 627 no./100mL.

Time Series Results at Selected WSRs

5.6.2.24 The time series plots under the emergency discharge scenarios at selected WSRs are presented in **Appendices 5.6 and 5.7**. The time series plots for E1-E8 are presented for key parameters of concern including DO, BOD, TIN, UIA, TN, TP, *E. coli* and SS to illustrate the time changes of pollution elevations at WSRs both close to and further away from the emergency discharge point.

5.6.2.25 Elevation on selected water quality parameters was observed at all selected WSRs, except for E3. The elevated levels at these WSRs were observed right after the emergency discharge. The elevated levels at these WSRs would be recovered to the normal operation of STLMC EPP (Scenario 3) in a relatively short time of about 2.5 day after termination of the emergency discharge. The more distant WSRs, including Oyster Culture Area (E3) was found not to be elevated during or after the emergency discharge event. **Table 5.23** presented the maximum percentage change due to the emergency discharge from STLMC EPP.

Table 5.23 Maximum Percentage Change due to Emergency Discharge

WSRs	Parameters (Depth Averaged)							
	DO	BOD	TIN	UIA	TN	TP	*E. coli*	SS
Dry Season								
E1	-11.2%	67.8%	3.3%	9.3%	5.1%	6.7%	4.5 $\times 10^5$ %	14.5%
E2	-2.3%	11.0%	1.0%	2.2%	1.4%	2.2%	1.9 $\times 10^4$ %	3.9%
E3	-0.2%	1.1%	0.2%	0.4%	0.2%	0.4%	0.0%	0.4%
E4	-9.3%	63.1%	2.9%	7.6%	4.3%	6.0%	5.0 $\times 10^5$ %	12.7%
E5	-15.4%	84.5%	5.6%	16.9%	8.6%	11.0%	6.7 $\times 10^4$ %	28.9%
E6	-14.5%	435.0%	36.1%	171.8%	58.7%	64.8%	6.5 $\times 10^6$ %	191.2%
E7	-12.5%	207.7%	13.6%	48.5%	21.4%	27.0%	2.4 $\times 10^6$ %	72.9%
E8	-17.9%	190.5%	12.1%	41.7%	20.0%	25.8%	9.9 $\times 10^5$ %	74.7%
Wet Season								
E1	-8.4%	20.3%	4.6%	9.2%	6.9%	5.5%	7.6 $\times 10^5$ %	13.3%
E2	-1.5%	2.8%	5.8%	6.7%	3.4%	3.1%	4.2 $\times 10^6$ %	2.8%
E3	-0.2%	0.2%	0.6%	0.6%	0.5%	0.9%	0.6%	0.5%
E4	-5.3%	13.6%	6.2%	10.7%	7.6%	6.3%	7.5 $\times 10^6$ %	8.3%
E5	-10.8%	34.2%	7.9%	15.4%	11.5%	8.9%	3.4 $\times 10^4$ %	18.4%
E6	-14.2%	241.0%	44.7%	131.5%	72.6%	42.3%	3.7 $\times 10^7$ %	120.9%
E7	-11.4%	80.0%	18.2%	40.6%	27.3%	14.9%	2.7 $\times 10^6$ %	26.8%
E8	-12.4%	79.4%	16.3%	32.2%	24.8%	15.6%	6.4 $\times 10^6$ %	30.3%

Notes: The values in the above table refers to the percentage change between emergency discharge (Scenario 4) and normal operation of YLSEPP (Scenario 3) with maximum elevation for each water quality parameters. Hence,
Maximum Percentage Change = max. of [(concentration under Scenario 4) – (concentration under Scenario 3)] / (concentration under Scenario 3)

5.6.2.26 To minimise the risk of untreated effluent discharge due to emergency events, a number of contingency measures will be provided to the STLMC EPP, such as provision of standby unit for all major equipment and back-up power for dual power supply. Details of the mitigation measures are discussed in **Section 5.7.2**. With the above design provision as contingency measures, the risk of failure of STLMC EPP is considered to be negligible.

Sewage and Sewerage System

5.6.2.27 Sewage flow to be generated from the new developments proposed under this Project will be discharged to the new sewerage system and therefore this Project will not induce any adverse hydraulic impacts upon the existing sewerage system. The new sewerage network will be built with adequate capacity to accommodate the new sewage flow from this Project together with other existing / concurrent projects within the catchment of the new Developments. Also, new STLMC EPP and three new SPSs with adequate capacities will be provided under this Project to handle the additional sewage flow from this Project and other concurrent projects. Sewage overflow or emergency bypass due to capacity constraints of the sewerage system would not be anticipated.

5.6.2.28 Ageing or damage of the proposed sewerage system could cause leakage or bursting of the untreated sewage to the nearby receiving waters. Pollutant levels of the receiving watercourses would temporarily increase in case of damage of sewage pipelines or rising mains. 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 sewerage system. Precautionary measures such as using twin rising mains are mentioned in **Section 5.7.2.3** to minimise the risk of failure of the proposed sewerage system. With proper implementation of the recommended precautionary measures, no adverse water quality impact arising from damage on sewerage system is anticipated.

Emergency Discharge from Sewage Pumping Stations

5.6.2.29 Three new SPSs are proposed under the Project. The design capacities of the three SPSs are summarised in **Table 5.24** below.

Table 5.24 Design Capacities of Sewage Pumping Stations

SPS	Design Capacities (m^3/day)
SPS in site OU.1.2	30,176
SPS in site OU.3.2	52,317
SPS in site OU.5.7	96,484

5.6.2.30 The normal operation of these SPSs would actually have beneficial effect through the enhancement of the efficiency of the sewerage system. However, potential water quality impact may arise from emergency overflow / bypass of sewage from the proposed SPS due to pump failure, power supply failure and damage to pressure main or flooding.

5.6.2.31 Emergency bypass culverts will be built to convey any emergency overflow from the SPS to the nearby watercourses. **Table 5.25** below summarises the tentative discharge point of emergency overflow for each SPS and the downstream receiving water that would potentially be affected by the emergency overflow.

Table 5.25 Tentative Discharge Points of Emergency Overflow from SPS and Downstream Receiving Water

SPS	Discharge Point of Emergency Overflow and Downstream Receiving Water (WSR ID refer to Table 5.12)
SPS in site OU.1.2	to STEMDC (WC-N3), which would then discharge to Shenzhen River in the north of the Project site and finally enters the marine water of Deep Bay WCZ.
SPS in site OU.3.2	to STEMDC (WC-N3), which would then discharge to the Shenzhen River in the north of the Project site and finally enters the marine water of Deep Bay WCZ.
SPS in site OU.5.7	to WC-N8a, which would then discharge to the STWMDC (WC-N8) and Shenzhen River in the northwest of the Project site and finally enters the marine water of Deep Bay WCZ.

5.6.2.32 All the selected discharge points of emergency bypass are located at modified watercourses. The ecological values of these watercourses were evaluated to be low to moderate as mentioned in **Section 10**.

5.6.2.33 Under the emergency situation, raw sewage from the SPS proposed under this Project will be discharged to the modified watercourses leading to Deep Bay. SPS with similar emergency discharge arrangement was previously assessed under the approved EIA for San Wai STW (SW STW) and "*Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2*". The approved EIA for SW STW assessed the water quality impact due to an emergency discharge of raw sewage from Ha Tsuen Sewage Pumping Station of 246,000

m^3/day for a duration of 12 days. Since the emergency discharge assessed in the approved EIA for SW STW would also enter the modified watercourses leading to Deep Bay, similar to the emergency discharge arrangement of this Project, the findings of the approved EIA for SW STW can be applied here.

5.6.2.34 According to the approved EIA for SW STW, the emergency discharge from Ha Tsuen Sewage Pumping Station would cause an increase in *E. coli*, UIA and TIN in the receiving waters. The baseline conditions for TIN and UIA would be recovered in 5 to 8 days after termination of the emergency discharge. For *E. coli*, its concentration would decrease more rapidly and return to the baseline level in a much shorter period. Since the capacities of the proposed SPS are well below that assessed in the approved EIA for SW STW, the time required for *E. coli*, UIA and TIN to return to the baseline value is expected to be shorter. Based on the past experience, breakdown of SPS could be recovered in only hours, which is much shorter than the emergency period of 12 days assessed in the approved EIA for SW STW. Thus, the actual water quality impact that would result from the emergency bypass from the proposed SPS could be much smaller than that predicted in the approved EIA for SW STW.

5.6.2.35 Since the potential water quality impact arising from overflow, if any, from the proposed SPS would be reversible, no long-term insurmountable water quality impact would be expected from the emergency overflow from the SPS.

5.6.2.36 In order to minimise the chance of emergency sewage discharge, standby pump would be provided to cater for emergency breakdown or maintenance of the duty pump. Backup power supply in the form of dual / ring circuit power supply or generator would be provided to secure electrical power supply. Hence, the likelihood of complete failure of both “duty” and “standby” power / equipment at two or more SPS together at the same time is considered as an extremely remote situation. The scenario with complete failure of two or more of these SPS together is not expected.

5.6.2.37 Various precautionary measures to be incorporated in the design of the proposed SPS are recommended in **Section 5.7.2.4**. With incorporation of the recommended preventive measures, the chance of emergency sewage bypass would be exceptionally rare.

5.6.2.38 In order to minimise the potential water quality impact in case of emergency discharge, development of a Contingency Plan in the detailed design stage is recommended to deal with the remote occurrence of emergency discharge. An outline of the Contingency Plan is also given in **Section 5.7.2.5**.

<u>Treated Effluent Reuse</u>

5.6.2.39 The water reclamation plant will be installed to treat part of the treated sewage effluent (TSE) under tertiary treatment from the new STLMC EPP for the production of reclaimed water for beneficial uses such as toilet flushing and irrigation. The reclaimed water to be produced from the water reclamation plant shall meet the specific water quality standards as shown in **Table 5.8**. The water reclamation plant will not generate extra sewage and therefore will not increase the discharge to the public sewerage system and STLMC EPP.

5.6.2.40 In case the operation of the water reclamation plant is suspended under emergency or maintenance situations, the TSE collected from the STLMC EPP will be discharged to the drainage system and eventually to the Ngau Tam Mei Channel in the Deep Bay WCZ. The increase in the pollution load due to the emergency discharge of TSE to the marine water of the Deep Bay WCZ would be minimal as compared to the emergency discharge of the STLMC EPP.

5.6.2.41 The proposed water reclamation plant will not increase the overall sewage load from the Project. In addition, no wastewater / sludge will be discharged into the environment from the proposed water reclamation plant. Hence, no additional source of water quality impact would result from the proposed water reclamation facility.

Surface Run-off from New Developments

5.6.2.42 Surface run-off to be generated from the Project is known as non-point source pollution. A small amount of oil, grease and grit may be deposited on the surfaces of the road within the development sites and these pollutants could be washed into the nearby drainage system or watercourses during rainfall events. Surface run-off generated from other paved or developed areas within the development sites may also contain debris, refuse, dust from the roof of buildings and cleaning agents used for washing streets and building façade, which may also affect the quality of the nearby receiving water environment, if uncontrolled.

Greening Area of STLMC DN

5.6.2.43 Within the area to be developed under this Project (of about 610 ha), about 522 ha are already developed / paved areas (including brownfield sites / wasteland / village developments) under the existing situation. The remaining area of about 88 ha consists of greening / unpaved surface (such as plantation, grassland, shrubland, etc.) under the existing condition. Without this Project, the amount of paved / unpaved area in the future is assumed to be the same as that under the existing situation.

5.6.2.44 Based on the Hong Kong Planning Standards and Guidelines (HKPSG) and general guidelines for designing public open space, the percentages of greening (such as soft landscape and tree planting) to be provided for area to be developed under this Project would range from 30% to 70% for regional and district open space, 30% to 85% for local open space and 20% to 30% for new government facilities / school / residential development areas. Based on these percentages of greening, it is estimated that a minimum 172 ha of greening (i.e. 438 ha paved area) would be provided under this Project within the area to be developed.

Non-Point Source Pollution from Surface Run-off

5.6.2.45 According to the DSD's "*Stormwater Drainage Manual*", annual rainfall in Hong Kong is about 2,400 mm. The Update Study suggested that only rainfall events of sufficient intensity and volume would give rise to runoff and that runoff percentage is about 44% and 82% for dry and wet season, respectively. Therefore, it was assumed that only 1,512 mm (i.e. 2,400 mm x (82%+44%)/2) of the 2,400 mm annual rainfall would be considered as effective rainfall that would generate surface runoff.

5.6.2.46 More surface run-off would be generated from the paved area and less from the unpaved area. The total paved surface within the area to be developed under this Project is around 522 ha and 438 ha under the existing situation and after the Project completion, respectively. Assuming 0.9 as the run-off coefficient for paved areas while 0.3 as the runoff coefficient for unpaved surface, the average daily run-off generated under the existing situation is estimated to be about 20,555 m^3/day (= 0.9 × 1,512 mm/year × 5.22 km^2 + 0.3 x 1,512 mm/year x 0.88 km^2). Similarly, the average daily run-off generated during the Project operation would be about 18,467 m^3/day (= 0.9 × 1,512 mm/year × 4.38 km^2 + 0.3 x 1,512 mm/year x 1.72 km^2).

Table 5.26 Non-Point Source Pollution from Area to be Developed under the Project

Parameters (in kg/day) (1)	Approximate Loading under Existing Condition and Likely Future Condition (without this Project)	Approximate Loading (kg/day) under Likely Future Condition (with this Project)
SS	890	800
BOD	462	416
NH_3-N	4	4
Org-N	25	22
TIN (2)	12	11
TN	37	33
TP	4	4

Notes: 1. According to the Update Study, the typical concentration of suspended solids (SS), biochemical oxygen demand (BOD), ammonia nitrogen (NH_3-N), organic nitrogen (Org-N), total nitrogen (TN) and total phosphorus (TP) in Hong Kong stormwater run-off would be 43.3 mg/L, 22.5 mg/L, 0.2 mg/L, 1.2 mg/L, 1.8 mg/L and 0.2 mg/L respectively. These typical run-off concentrations were applied to the daily run-off as mentioned above to estimate the non-point source pollution.
2. Total inorganic nitrogen (TIN) is equal to total nitrogen (TN) minus organic nitrogen (Org-N).

5.6.2.47 Stormwater control measures including Best Management Practices (BMPs), various blue-green infrastructure and Storm Water Pollution Control Plan would be implemented within the development sites to: (1) control erosion and sedimentation; (2) control run-off quantity and quality; (3) eliminate pollutants in point source discharge from drainage outfalls; (4) prevent "first flush" pollution; and (5) eliminate pollutant discharge in stormwater run-off from entering the poor flushing water of Deep Bay, as described in **Sections 5.7.2.6 to 5.7.2.14**. The effects of these stormwater control measures have not been taken into consideration in the quantification of non-point source pollution as given in **Table 5.26** above. It is expected that with proper implementation of the recommended measures, the water quality impact due to the non-point source pollution from the new development area would be minimised.

Changes of Hydrology and Potential Flooding Risk

Flood Retention Facilities

5.6.2.48 The drainage impact arising from the proposed development has been assessed. Based on the review of characteristics of drainage catchment and the arrangement of new drainage network to be built within the Project area, flood retention facilities are proposed to minimise potential flooding risk.

5.6.2.49 Flood retention facilities which comprise of flood retention lakes and underground storage tanks are proposed under this Project as flood mitigation measures to protect the low-lying villages, including Shek Wu Wai, Chau Tau Tsuen, and Yan Shau Wai from flooding due to increase in surrounding formation levels as well as long-term climate change. The flood retention lakes would be open lakes which are designed for temporarily retaining stormwater run-off to avoid overflow of adjacent drainage channels. The underground storage tanks are covered tanks would be designed for collecting runoff from the nearby drainage system through gravity flow to avoid overflow of nearby open drainage channels. The stored run-off at all flood retention facilities will be conveyed to the adjacent drainage channels after heavy rains.

5.6.2.50 With implementation of the recommended flood protection measures, the potential flooding risk would be minimised. The recommended measures would be completed before the construction works for the development.

Change of Flow Regime and Hydrology

5.6.2.51 Due to the proposed developments, the watercourses within the Project site (except STEMDC, WC-N6 and STWMDC) will be permanently removed / diverted / realigned under this Project. These watercourses are part of the tributaries of Shenzhen River. All the watercourses to be removed or diverted are however considered minor water channels only. The main drainage channels within the assessment area including the STEMDC and STWMDC would remain unchanged within the Project area. The hydraulics of water flow may be changed due to removal or diversion of these minor watercourses, but the impact is expected to be localised and small. No significant change on the flow regime and hydrology within the assessment area is expected.

Change of Groundwater Levels

5.6.2.52 Dewatering would be performed for the minor watercourses to be removed under this Project. Since most of these minor watercourses are artificial concrete-lined channels and the scale of these watercourses is small, no significant drawdown of groundwater would be expected from the proposed dewatering operation. Dewatering at a few ponds and wet areas would also be required but the scale of all these ponds and wet areas is very small, and hence, no significant groundwater drawdown would be expected from the dewatering work. Overall, no significant change of ground water level in the study area would result from this Project.

Revitalisation and Greening of Drainage Channel Banks

5.6.2.53 Revitalisation and Greening of Drainage Channel Banks of existing drainage channels including STEMDC and STWMDC, running through the Project will be revitalised (e.g. enhancing the greening of the channel banks through the provision of “grasscrete” or similar products). The “grasscrete” or similar products will only be placed on the channel banks above the channel water. No change to the hydrodynamics and water quality would result from the revitalisation and greening works during the Project operation.

Maintenance flushing for Reclaimed Water Service Reservoir (RWSR)

5.6.2.54 A RWSR is proposed for storage of the reclaimed water from the water reclamation plant. Reclaimed water stored in the reservoirs will be employed for beneficial uses such as toilet flushing. The RWSR will be covered to prevent overflow during storm events. Cleansing of the RWSR, if required, will be conducted by lowering the water in the reservoir by discharging the reclaimed water to the drainage system. The remaining water in the bottom layer (the sludge) will be pumped out and disposed by a licensed waste collector. After the cleansing operation, the cleansing effluent will also be collected by a licensed waste collector and will not be discharged into the stormwater system.

Maintenance flushing for Fresh Water Service Reservoir (FWSR)

5.6.2.55 A FWSR is proposed for storage of fresh water for fresh water supply. The water stored in the FWSR will be distributed to the users and there will not be any discharge from the operation of the FWSR. Cleansing of the FWSR, if required, will be conducted by lowering the water in the service reservoir by discharging the fresh or unpolluted water to the stormwater drainage system. Measurement of the residual chlorine level in the FWSR water to be discharged should first be conducted to ensure that any residual chlorine in the FWSR water is properly decayed and lowering of the residual chlorine level in the FWSR water to be discharged is observed prior to any discharge of the FWSR water. The remaining water in the bottom layer (the sludge) will be pumped out and disposed by a licensed waste collector. After the cleansing operation, the cleansing effluent will also be collected by a licensed waste collector and will not be discharged into the stormwater system.

Potential Impact from Refuse Transfer Stations and Refuse Collection Points

5.6.2.56 The potential sources of water pollution to be generated from the proposed refuse transfer station (RTS) and refuse collection points (RCP) would be the potential spillage of pollutants (e.g. rubbish, dirt, debris, etc.) and associated contaminated surface run-off or washed water from any floor cleansing activities. The RTS and RCP will be housed or covered to prevent generation of contaminated rainwater run-off. All contaminated surface run-off or washed water would be collected and diverted to appropriate treatment facilities for proper treatment before discharge to the foul sewers. Site drainage would be regularly maintained. The proposed RTS is a scheduled 2 DP and thus the discussion above is only preliminary and subject to the future detailed EIA study.

Spent Effluent from District Cooling System

5.6.2.57 Water circulation for the operation of the potential district cooling system (DCS) will be in closed circuit. Regular bleed-off discharge of the proposed DCS will be re-used on site for flushing purpose or conveyed to STLMC EPP for effluent treatment subject to further liaison with vetting departments. During emergency or maintenance condition, spent effluent will be discharged from DCS to the sewerage system. No adverse water quality impact upon the water environment would be expected from the proposed DCS.

Maintenance of Drainage System

5.6.2.58 Desilting or maintenance works in watercourses may cause a release of fines and sediment-bound contaminants to the downstream receiving waters. Any required maintenance or desilting work (e.g. to remove any silt, grit or rubbish deposited in the inland water system) should be carried out during periods of low flow in the dry season to isolate the temporary work area from the channel water by barrier to prevent sediment suspension from entering the surrounding water. All debris, grit or rubbish generated from the maintenance activities should be collected and handled in compliance with the Waste Disposal Ordinance. Excavated sediment, if any, generated from the river maintenance activities should be tested and classified in accordance with the ETWB TCW No. 34/2002 for determining the disposal arrangement for the sediment. No direct disposal of the maintenance wastes into the inland watercourses will be allowed.

5.7 Mitigation of Adverse Environmental Impacts

5.7.1 Construction Phase

Construction Site Run-off and General Construction Activities

5.7.1.1 Control of potential pollution of nearby water bodies during the construction phase of the Project should be achieved by measures to:

- prevent or minimise the likelihood of pollutants (generated from construction activities) being in contact with rainfall or run-off; and
- abate pollutants in the stormwater surface run-off prior to the discharge of surface run-off to the nearby water bodies.

5.7.1.2 These principle objectives should be achieved by implementation of the Best Management Practices (BMPs) of mitigation measures in controlling water pollution. The guidelines for handling and disposal of construction site discharges as detailed in the ProPECC PN 2/23 "*Construction Site Drainage*" should be followed, where applicable. All effluent discharged from the construction site should comply with the standards stipulated in the TM-DSS. The following measures are recommended to protect water quality of the inland and coastal waters, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impacts.

Construction Site Run-off

5.7.1.3 Surface run-off from construction site should be discharged into storm drains via adequately designed sand / silt removal facilities such as sand traps, silt traps and sedimentation basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Perimeter channels at site boundaries should be provided as necessary to intercept storm run-off from outside the site so that it will not wash across the site. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.

5.7.1.4 Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly (as well as at the onset of and after each rainstorm) to prevent overflows and localised flooding. Before disposal at the public fill reception facilities, the deposited silt and grit should be solicited in such a way that it can be contained and delivered by dump truck instead of tanker truck. Any practical options for the diversion and realignment of drainage should comply with both engineering and environmental requirements in order to provide adequate hydraulic capacity of all drains.

5.7.1.5 Construction works should be programmed to minimise soil excavation in the wet season (i.e. April to September). If soil excavation cannot be avoided in these months or at any time of year when rainstorms are likely, temporarily exposed slope surfaces should be covered e.g. by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Intercepting channels should be provided (e.g. along the crest / edge of excavation) to prevent storm run-off from washing across exposed soil surfaces. Arrangements should always be in place in such a way that adequate surface protection measures can be safely carried out well before the arrival of rainstorm.

5.7.1.6 Earthworks final surfaces should be well compacted and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate drainage like intercepting channels should be provided where necessary.

5.7.1.7 Measures should be taken to minimise the ingress of rainwater into trenches. If excavation of trenches in the wet season is necessary, they should be dug and backfilled in short sections. Rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.

5.7.1.8 Open stockpiles of construction materials (e.g. aggregates, sand and fill material) on sites 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.

5.7.1.9 Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers. Discharge of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

Boring and Drilling Water

5.7.1.10 Water used in ground boring and drilling for site investigation or rock / soil anchoring should as far as practicable be re-circulated after sedimentation. When there is a need for final disposal, the wastewater should be discharged into storm drains via silt removal facilities.

Wheel Washing Water

5.7.1.11 All vehicles and plants should be cleaned before they leave a construction site to minimise the deposition of earth, mud and debris on roads. A wheel washing bay should be provided at every site exit if practicable and washwater should have sand and silt settled out or removed before discharging into storm drains. The section of construction road between the wheel washing bay and the public road should be paved to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.

Acid Cleaning, Etching and Pickling Wastewater

5.7.1.12 Acidic wastewater generated from acid cleaning, etching, pickling and similar activities should be neutralised to within the pH range of 6 to 10 before discharging into foul sewers. If there is no public foul sewer in the vicinity, the neutralized wastewater should be tankered off site for disposal into foul sewers or treated to a standard acceptable to storm drains and the receiving waters.

Rubbish and Litter

5.7.1.13 Good site practices should be adopted to remove rubbish and litter from construction site so as to prevent the rubbish and litter from spreading from the site area. It is recommended to clean the construction site on a regular basis.

Effluent Discharge

5.7.1.14 There is a need to apply to EPD for a discharge licence for discharge of effluent from the construction site under the WPCO. The discharge quality must meet the requirements specified in the discharge licence. All the runoff and wastewater generated from the works areas should be treated so that it satisfies all the standards listed in the TM-DSS. The beneficial uses of the treated effluent for other on-site activities such as dust suppression, wheel washing and general cleaning etc., can minimise water consumption and reduce the effluent discharge volume. If monitoring of the treated effluent quality from the works areas is required during the construction phase of the Project, the monitoring should be carried out in accordance with the relevant WPCO licence.

Construction Works near Watercourses

5.7.1.15 To minimise the potential water quality impacts from the construction works located near any inland watercourses, the practices outlined in ETWB TC (Works) No. 5/2005 "*Protection of natural streams / rivers from adverse impacts arising from construction works*" should be adopted where applicable. Relevant mitigation measures are listed below:

- Impermeable sheet piles and/or cofferdams should be used as required to divert water flow from the construction works area so that all the construction works would be undertaken within a dry zone and physically separated from the watercourses.
- The proposed works should preferably be carried out within the dry season where the flow in the stormwater culvert / water channel / stream is low.
- The use of less or smaller construction plants may be specified in works areas close to the inland water bodies.
- Temporary storage of materials (e.g. equipment, filling materials, chemicals and fuel) and temporary stockpile of construction materials should be located well away from any watercourses during carrying out of the construction works.
- Stockpiling of construction materials and dusty materials should be covered and located away from the any watercourses.
- Construction debris and spoil should be covered up and/or disposed of as soon as possible to avoid being washed into the nearby water receivers.
- Construction activities, which generate large amount of wastewater, should be carried out a distance away from the watercourses, where practicable.
- Mitigation measures to control site run-off from entering the nearby water environment should be implemented to minimise water quality impacts. Surface channels should be provided along the edge of the waterfront within the work sites to intercept the run-off.
- Construction effluent, site run-off and sewage should be properly collected and/or treated.
- Any temporary works site inside the stormwater watercourses should be temporarily isolated, such as by placing of sandbags or silt curtains with lead edge at bottom and properly supported props to prevent adverse impact on the stormwater quality.

- Proper shoring may need to be erected in order to prevent soil / mud from slipping into the inland water bodies.

Revitalisation of Drainage Channel Banks

5.7.1.16 The key water quality measure for protection of the revitalised drainage channel water is to avoid polluted site run-off from reaching the revitalised drainage channel water. Relevant mitigation measures should follow the practices outlined in ETWB TC (Works) No. 5/2005 "*Protection of natural streams / rivers from adverse impacts arising from construction works*" as listed below:

- Impermeable sheet piles and/or cofferdams should be used as required to divert water flow from the construction works area so that all the construction works would be undertaken within a dry zone and physically separated from the revitalised drainage channel water.
- The proposed works should preferably be carried out within the dry season where the flow in the revitalised drainage channel is low.
- The use of less or smaller construction plants may be specified in works areas close to the revitalised drainage channel.
- Temporary storage of materials (e.g. equipment, filling materials, chemicals and fuel) and temporary stockpile of construction materials should be located well away from the revitalised drainage channel during carrying out of the construction works.
- Stockpiling of construction materials and dusty materials should be covered and located away from the revitalised drainage channel water.
- Construction debris and spoil should be covered up and/or disposed of as soon as possible to avoid being washed into the nearby revitalised drainage channel.
- Construction activities, which generate large amount of wastewater, should be carried out a distance away from the revitalised drainage channel, where practicable.
- Mitigation measures to control site run-off from entering the nearby revitalised drainage channel should be implemented to minimise water quality impacts. Surface channels should be provided along the edge of the revitalised drainage channel within the work sites to intercept the run-off.
- Construction effluent, site run-off and sewage should be properly collected and/or treated.
- Any temporary works site inside the revitalised drainage channel should be temporarily isolated, such as by placing of sandbags or silt curtains with lead edge at bottom and properly supported props to prevent adverse impact on the revitalised drainage channel water.
- Proper shoring may need to be erected in order to prevent soil / mud from slipping into the revitalised drainage channel.

Removal / Diversion of Watercourses

5.7.1.17 The construction works for removal and diversion of watercourses should be undertaken within a dry zone. Cofferdams or similar impermeable sheet pile walls should be used as necessary to isolate the works areas from the neighbouring waters.

5.7.1.18 The tentative works sequence for provision of a dry zone for the construction works is described as follows. Construction works at watercourse should be undertaken only after flow diversion or dewatering operation is fully completed to avoid water flow in the works area. Dewatering of watercourse should be performed by diverting the water flow to new or temporary drainage. Where necessary, cofferdams or similar impermeable sheet pile walls should be used to isolate the works areas from neighbouring waters. The permanent or temporary drainage for carrying the diverted flow from existing watercourse to be removed should be constructed and completed before dewatering of that existing watercourse. Construction of all the proposed permanent and temporary drainage should be undertaken in a dry zone prior to receiving any water flow.

5.7.1.19 The Contractor should provide a dry zone for all the construction works to be undertaken in watercourses and stormwater drainage following the tentative works sequence as described above or using other approved methods as appropriate to suit the works condition. The flow diversion works should be conducted in dry season, where possible, when the flow in the watercourse is low. The wastewater and ingress water from the site should be properly treated to comply with the WPCO and the TM-DSS before discharge.

5.7.1.20 The site practices outlined in the ProPECC PN 2/23 "*Construction Site Drainage*" and ETWB TC (Works) No. 5/2005 "*Protection of natural streams/rivers from adverse impacts arising from construction works*" should be adopted for the proposed demolition or diversion of watercourses where applicable.

Removal / Filling of Ponds and Wet Areas

5.7.1.21 Construction works at the existing ponds / wet areas should be conducted only after dewatering of these ponds / wet areas is fully completed. The drained water generated from the dewatering of these ponds / wet areas to be removed should be temporarily stored in appropriate storage tanks or containers for reuse on-site as far as possible. Any surplus drained water should be tankered away for disposal at the STW in a controlled manner. No direct discharge of drained water to the stormwater drainage system or marine water should be allowed.

Disposal of Excavated Materials and Sediment

5.7.1.22 All excavated materials generated from construction of the proposed river revitalisation works, removal and diversion of watercourses, removal and construction works in ponds and wet areas should be collected and handled in compliance with the Waste Disposal Ordinance. Excavated sediment, if any, generated from the excavation activities in the channels should be tested and classified in accordance with the ETWB TCW No. 34/2002 for determining the disposal arrangement for the sediment. The disposal of excavated sediments should be minimised according to the relevant requirements in the Waste Management Implications in **Section 7**. No direct disposal of the construction wastes or excavated materials into the stormwater drainage system and marine water would be allowed.

Accidental Spillage

5.7.1.23 Contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation, should be observed and complied with for control of chemical wastes. The Contractor is also recommended to develop management procedures for chemicals used and prepare an emergency spillage handling procedure to deal with chemical spillage in case of accident occurs.

5.7.1.24 Any service shop and maintenance facilities should be located on hard standings within a bunded area, and sumps and oil interceptors should be provided. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage should only be undertaken within the areas appropriately equipped to control these discharges.

5.7.1.25 Disposal of chemical wastes should be carried out in compliance with the Waste Disposal Ordinance. The Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes published under the Waste Disposal Ordinance details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport.
- Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents.
- Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area.

Sewage from Construction Workforce

5.7.1.26 No discharge of sewage to the stormwater drains or inland water will be allowed. Adequate and sufficient portable chemical toilets should be provided in the works areas to handle sewage from construction workforce. A licensed collector should be employed to clean and maintain the chemical toilets on a regular basis.

5.7.1.27 Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the surrounding environment. Regular environmental audit of the construction site should be conducted to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site.

Groundwater from Contaminated Areas, Contaminated Site Run-off and Wastewater from Land Decontamination

5.7.1.28 Remediation of contaminated land should be properly conducted following the recommendations of Land Contamination Assessment in **Section 8**. Any excavated contaminated material and exposed contaminated surface should be properly housed and covered to avoid generation of contaminated runoff. Open stockpiling of contaminated materials should not be allowed. Any contaminated runoff or wastewater generated from the land decontamination processes should be properly collected and diverted to wastewater treatment facilities (WTF) as necessary. The WTF shall deploy suitable treatment processes (e.g. oil interceptor / activated carbon) to reduce the pollution level to an acceptable standard and remove any prohibited substances (such as total petroleum hydrocarbon) to an undetectable range. All treated effluent from the wastewater treatment system shall meet the requirements as stated in TM-DSS and should be either discharged into the foul sewers or tankered away for proper disposal.

5.7.1.29 No direct discharge of groundwater from contaminated areas should be adopted. Prior to any excavation works within the potentially contaminated areas, the baseline groundwater quality in these areas should be reviewed based on the past relevant site investigation data and any additional groundwater quality measurements to be performed with reference to "*Guidance Note for Contaminated Land Assessment and Remediation*" and the review results should be submitted to EPD for examination. If the review results indicated that the groundwater to be generated from the excavation works would be contaminated, this contaminated groundwater should be either properly treated or properly recharged into the ground in compliance with the requirements of the TM-DSS. If wastewater treatment is to be deployed for treating the contaminated groundwater, the wastewater treatment unit shall deploy suitable treatment processes (e.g. oil interceptor / activated carbon) to reduce the pollution level to an acceptable standard and remove any prohibited substances (such as total petroleum hydrocarbon) to an undetectable range. All treated effluent from the wastewater treatment plant shall meet the requirements as stated in the TM-DSS and should be either discharged into the foul sewers or tankered away for proper disposal.

5.7.1.30 If deployment of wastewater treatment is not feasible for handling the contaminated groundwater, groundwater recharging wells should be installed as appropriate for recharging the contaminated groundwater back into the ground. The recharging wells should be selected at places where the groundwater quality will not be affected by the recharge operation as indicated in Section 2.3 of TM-DSS. The baseline groundwater quality should be determined prior to the selection of the recharge wells, and submit a working plan to EPD for agreement. Pollution levels of groundwater to be recharged shall not be higher than pollutant levels of ambient groundwater at the recharge well.

Groundwater monitoring wells should be installed near the recharge points to monitor the effectiveness of the recharge wells and to ensure that no likelihood of increase of groundwater level and transfer of pollutants beyond the site boundary. Prior to recharge, free products should be removed as necessary by installing the petrol interceptor. The Contractor should apply for a discharge licence under the WPCO through the Regional Office of EPD for groundwater recharge operation or discharge of treated groundwater.

Emergency Response Plan for Construction Site Discharges

5.7.1.31 The following measures should be implemented by the Contractors to minimise the chance of emergency construction site discharge (due to failure of treatment facilities such as sand traps, silt traps, sedimentation basins, oil interceptors etc.):

- Provide spare or standby treatment facilities of suitable capacities for emergency replacement in case damage or defect or malfunctioning of the duty treatment facilities is observed.
- Conduct daily integrity checking of the construction site drainage and treatment facilities to inspect malfunctions, in particular before, during and after a storm event.
- Carry out regular maintenance or desilting works to maintain effectiveness of the construction site drainage and treatment facilities in particular before, during and after a storm event.

5.7.1.32 An ERP should be developed to minimise the potential impact from construction site discharges under failure of treatment facilities during emergency situations or inclement weather. The ERP should give the emergency contacts to mobilise flood retention facilities and stakeholders to be notified as well as the details of the proposed construction site drainage system and the design and operation of duty and standby treatment facilities. The ERP should also provide the procedures and guidelines for routine integrity checking and maintenance of the drainage system and treatment facilities as well as the emergency response and rectification procedures to restore normal operation of the treatment facilities in case of treatment failure during emergency situation or inclement weather. The Best Management Practices (BMPs) in controlling water pollution arising from the construction activities and an event and action plan with action and limit levels for water quality monitoring should be included in the ERP. The ERP should be submitted to the EPD for approval before commencement of the construction works.

5.7.2 Operation Phase

Emergency Discharge from the New STLMC EPP

5.7.2.1 Given the sensitivity of inner Deep Bay in term of water quality and ecology, extensive effort will be expedited to avoid the occurrence for emergency discharge. In order to achieve this, the design of STLMC EPP will be cautiously reviewed to include additional provisions including as follows:

- Applied peaking factors for all major treatment units and electrical and mechanical equipment to avoid equipment failure;
- By-pass mechanism would be provided for both coarse screens and fine screens in the inlet to avoid/minimize failure in coarse/fine screens; Interim by-pass would be provided after the PST to avoid raw sewage by-pass as much as possible;
- Standby unit for all major equipment would be provided in case of unexpected breakdown of pumping and treatment facilities such that the standby pumps and treatment facilities could take over and function to replace the broken pumps; and
- Back-up power for dual power supply would be provided in case of power failure to sustain the function of pumping and treatment facilities.

5.7.2.2 To provide a mechanism to minimise the impact of emergency discharges and facilitate subsequent management of any emergency, an Emergency Response Plan will be formulated prior to commissioning of STLMC EPP to set out the emergency response procedures and actions to be followed in case of equipment or sewage treatment failure. The plant operators of STLMC EPP should carry out necessary follow-up actions according to the procedures of the contingency plan to minimise any impacts on the identified WSRs due to emergency bypass. Regular maintenances and inspections to all treatment units, penstocks and plant facilities are necessary to maintain a good operation condition. A follow-up water quality monitoring exercise shall be conducted after each emergency discharge event to monitor the recovery of water quality in the vicinity.

<u>Sewage and Sewerage System</u>

5.7.2.3 The following precautionary measures are recommended to minimise the risk of failure of the proposed sewerage system:

- Regular inspection, checking and maintenance of the sewerage system;
- Provisions of twin rising mains as backup and to facilitate maintenance and repairing purposes;
- Provisions of leakage collection systems linking to the nearest chamber at its downstream to the rising main for collection of sewage leakage from the damaged rising main;
- Use tankers to store emergency discharge and transport to the EPP by registered tankers companies for disposal in case of both twin rising mains failure; and
- Provisions of spare / standby parts of sewage pipeworks to facilitate maintenance and repairing of equipment.

<u>Sewage Pumping Stations</u>

5.7.2.4 In order to minimise the chance of emergency sewage discharge, the following precautionary measures are proposed to be incorporated in the design of the SPS:

- A standby pump and screen should be provided to cater for breakdown and maintenance of the duty pump in order to avoid emergency discharge.
- Backup power supply in the form of dual / ring circuit power supply or generator should be provided to secure electricity supply.
- An alarm should be installed to signal emergency high water level in the wet well.
- An emergency storage tank should be provided for the proposed SPS to cater for breakdown and maintenance of duty pump.
- Regular maintenance and checking of plant equipment should be undertaken to prevent equipment failure.
- Twin rising mains system should be provided to facilitate maintenance works and to avoid emergency discharge of sewage.
- A telemetry system to the nearest manned station / plant should be provided so that swift action can be undertaken in case of malfunction of the unmanned facilities.
- A bar screen (with clear spacing of approximately 25 mm) should be provided to cover the lower half of the opening of any emergency sewage bypass which can prevent the discharge of floating solids into receiving waters as far as practicable while ensuring flooding at the facilities would not occur event if the screen is blocked.

5.7.2.5 A Contingency Plan to deal with the emergency discharges that may occur during operation of the SPS should be developed in the detailed design stage including the following items:

- Locations of water bodies or WSRs in the vicinity of the emergency discharges.
- A list of relevant government departments to be informed and to provide assistance in the event of emergency discharge, including key contact persons and telephone numbers.
- Reporting procedures required in the event of emergency discharges.
- Procedures listing the most effective means in rectifying the breakdown of the SPS in order to minimise the discharge duration.

Best Stormwater Management Practices and Stormwater Pollution Control Plan

5.7.2.6 With reference to Clause 2.3, Annex 6 of the EIAO-TM, mitigation measures including Best Management Practices (BMPs) to reduce stormwater pollution arising from the Project are as follows.

Design Measures to Control Erosion and Run-off Quantity

5.7.2.7 Exposed surface shall be avoided within the development sites to minimise soil erosion. The development site shall be either hard paved or covered by landscaping area and plantation where appropriate.

5.7.2.8 The major water channels and nullahs within the development sites should be retained as far as practicable to maintain the original flow path. The drainage system should be designed to avoid flooding.

5.7.2.9 Green areas / tree / shrub planting etc. should be introduced within the development site as far as possible including open space and along roadside amenity strips and central dividers, which can help to reduce soil erosion.

Devices / Facilities to Control Pollution

5.7.2.10 Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system.

5.7.2.11 Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater run-off, where appropriate.

5.7.2.12 Evergreen tree species, which in general generate relatively smaller amount of fallen leaves, should be selected where possible.

Administrative Measures

5.7.2.13 Good management measures such as regular cleaning and sweeping of road surface / open areas is suggested. The road surface / open area cleaning should also be carried out prior to occurrence of rainstorm.

5.7.2.14 Manholes, as well as storm water gullies, ditches provided among the development areas should be regularly inspected and cleaned (e.g. monthly). Additional inspection and cleansing should be carried out before forecast heavy rainfall.

Maintenance of Drainage System

5.7.2.15 For maintenance of stormwater drainage system, reference should be made to ETWB TC (Works) No. 14/2004 "*Maintenance of Stormwater Drainage Systems and Natural Watercourses*" where applicable. The circular sets out the departmental responsibilities for the maintenance of stormwater drainage systems and natural watercourses in government and private lands. Any required maintenance or desilting work (e.g. to remove any silt, grit or rubbish deposited in the inland water system) should be carried out during periods of low flow in the dry season to minimise impacts on downstream water quality and sediment suspension.

Water Reclamation Plant

5.7.2.16 As mentioned in **Section 2 and 6 of the EIA Report**, a new water reclamation plant is proposed under this Project which will receive the tertiary treated effluent from the STLMC EPP during operation phase. Ultrafiltration treatment process is recommended to employed for water reclamation, enhancing reduction of pollution loads (BOD, TN and TP). Once the water reclamation plant has commenced operation, the tertiary treated effluent from the STLMC EPP will be further polished into reclaimed water which will cut down the freshwater demand in the area, saving precious freshwater resources and reducing the pollution loading discharge to the Deep Bay waters. The potential water quality impact from the STLMC EPP effluent would decrease as compared with the worst-case scenario of STLMC EPP as predicted in **Section 5.6.2** (i.e. Scenario 3 – full discharge of 125,000 m^3/day to Deep Bay). **Table 5.27** gives an estimation on the pollution loads with implementation of proposed Water Reclamation Plant. As shown in **Table 5.27**, with implementation of proposed Water Reclamation Plant under Scenario 3, the pollution loads (BOD, TN and TP) to Deep Bay would be reduced as compared to Scenario 2.

Table 5.27 Improvement of Pollution Load with Water Reclamation Plant

	BOD (kg/d)	TN (kg/d)	TP (kg/d)	*E. coli* (no./d)
pollution load to Deep Bay under Scenario 2 (1)	9,434	9,364	972	1.5×10^{16}
pollution load to Deep Bay under Scenario 3 (2)	9,711	10,353	1,075	1.4×10^{16}
pollution load to Deep Bay under Scenario 3 + with Water Reclamation Plant (3)	9,149	9,228	962	1.4×10^{16}

Notes: 1. Total pollution load to Deep Bay under Scenario 2, as shown in **Table 5.21**.
2. Total pollution load to Deep Bay under Scenario 3, as shown in **Table 5.22**.
3. The capacity of the water reclamation plant is 112,500 m^3/day as stated in **Section 2 and 6**. The effluent qualities of BOD, TN and TP are assumed to be 5 mg/L (annual average), 10 mg/L (annual average) and 1 mg/L (annual average) respectively.

5.8 Evaluation of Residual Impacts

5.8.1.1 With proper implementation of the recommended mitigation measures, no residual water quality impact would be anticipated from the Project during construction phase and no adverse residual impact would be anticipated during operational phase.

5.9 Environmental Monitoring and Audit

5.9.1 Construction Phase

5.9.1.1 The potential water quality impact from the land-based construction works can be controlled by the recommended mitigation measures. Nonetheless, in view of that the Project site is surrounded by ecological sensitive areas, water quality monitoring and regular site inspections should be undertaken during the construction to ensure that the recommended mitigation measures are properly implemented. A WPCO license should be obtained if there has construction drainage discharge. Self-monitoring and reporting should be carried out for monitoring the construction drainage discharge in accordance with the WPCO license.

5.9.2 Operation Phase

5.9.2.1 Under normal operation of STLMC EPP, monitoring of the treated effluent quality will be governed by the WPCO license to ensure that the effluent quality would comply with the design standards.

5.9.2.2 Water quality monitoring is recommended for the first year of normal operation and emergency discharge of STLMC EPP. Detailed environmental monitoring procedures are provided in the standalone EM&A manual.

5.10 Environmental Acceptability of Schedule 2 Designated Projects

<u>New primary distributor and new district distributor roads (DP1)</u>

5.10.1.1 With proper implementation of the recommended mitigation measures and BMPs for construction activities (as detailed in Section 5.7.1), as well as the mitigation measures and BMPs to reduce pollution arising from the surface water run-off during the operation phase (as described in Section 5.7.2), no unacceptable water quality impact would be resulted from the proposed roads.

<u>New San Tin Lok Ma Chau Effluent Polishing Plant (STLMC EPP) (DP2) and Water Reclamation Plant (WRP) (DP3)</u>

5.10.1.2 With proper implementation of the recommended mitigation measures and BMPs for construction activities (as detailed in Section 5.7.1), and additional provisions to avoid the occurrence for emergency discharge (as detailed in Section 5.7.2), no unacceptable water quality impact would be resulted from the proposed EPP and WRP.

<u>Revitalisation of San Tin Eastern Main Drainage Channel (DP6) and Recreational Development within Deep Bay Buffer Zone 2 (DP7)</u>

5.10.1.3 With proper implementation of the recommended mitigation measures and BMPs for construction activities near watercourses and avoid polluted site run-off from reaching the revitalised drainage channel water (as detailed in Section 5.7.1), and BMPs to reduce pollution arising from the surface water run-off during the operation phase (as described in Section 5.7.2), no unacceptable water quality impact would be resulted from DP6 and DP7.

<u>Other DPs</u>

5.10.1.4 For Refuse Transfer Station (RTS) (DP4) and 400kV Electricity Substation (DP5), the detailed water quality impact of these Schedule 2 DPs will be further investigated in separate EIA studies under the EIAO. The EM&A requirements for these Schedule 2 DPs will also be provided under separate EIA studies.

5.11 Conclusion

<u>Construction Phase</u>

5.11.1.1 Water quality impacts from the construction works are associated with the general construction activities, construction site run-off, accidental spillage, and sewage effluent from construction workforce. The site practices as outlined in the ProPECCPN 2/23 "*Construction Site Drainage*" and the ETWB TC (Works) No. 5/2005 "*Protection of natural streams / rivers from adverse impacts arising from construction works*" are recommended to minimise the potential water quality impacts from the construction activities. Proper site management and good site practices are also recommended to ensure that construction wastes and other construction-related materials would not enter the nearby watercourses. Sewage effluent arising from the construction workforce would be handled through provision of portable toilets. Water quality monitoring and regular site inspection will be implemented for the construction works to ensure that the recommended mitigation measures are properly implemented.

5.11.1.2 An ERP is recommended to minimise the potential water quality impact from construction site discharges under failure of treatment facilities during emergency situations or inclement weather.

5.11.1.3 With the implementation of the recommended mitigation measures, the construction works for the Project would not result in unacceptable impacts on water quality.

Operation Phase

5.11.1.4 All sewage generated from the Project will be discharged to the public sewerage system and diverted to STLMC EPP for proper treatment. The TSE from the EPP will be treated at the proposed water reclamation plant and pumped to the Reclaimed Water Service Reservoir. The Project would induce water quality beneficial effect by providing new sewerage to the existing unsewered areas.

5.11.1.5 In view of the potential adverse effect of emergency sewage bypass and sewage leakage on the quality of the nearby watercourses, various precautionary measures are proposed to be incorporated in the design of the SPS and rising mains to avoid emergency bypass and leakage of sewage to the maximum practicable extent. A Contingency Plan is also recommended to deal with the remote occurrence of emergency discharge. With the incorporation of the precautionary measures and Contingency Plan as recommended in this EIA, the possibility of emergency sewage bypass and sewage leakage would be remote and the potential water quality impacts in the unlikely event that an overflow / leakage does occur would be minimised.

5.11.1.6 Another source of potential impact during the operational phase will be the run-off or non-point source pollution from road surfaces and developed areas. Stormwater control measures including adequate stormwater drainage system with suitable pollutant removal devices, blue-green infrastructure and best stormwater management practices are recommended for the Project to minimise the non-point source pollution. With proper implementation of the recommended mitigation measures, it is anticipated that the water quality impacts associated with the non-point source discharge from road surfaces and developed areas would be minimised.