5 Water Quality Impact

5.1 Introduction

This section identifies and assesses potential water quality impacts associated with the construction and operation phases of the Project. Specific items relating to sewerage are found in more detail in *Chapter 6 – Sewerage and Sewage Treatment Implications*.

5.2 Environmental Legislation, Standards and Guidelines

There are several regulatory controls and guidance documents relevant to water quality impacts applicable to the Project, including:

- Environmental Impact Assessment Ordinance (Cap. 499)
- Water Pollution Control Ordinance (Cap. 358)
- Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
- "No Net Increase in Pollution Load" Requirement in Deep Bay
- Practice Note for Professional Persons on Construction Site Drainage.

5.2.1 Environmental Impact Assessment Ordinance

Annexes 6 and 14 of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM), issued under Section 16 of the Environmental Impact Assessment Ordinance (EIAO), outline the criteria and guidelines for assessing water quality impacts.

5.2.2 Water Pollution Control Ordinance

The Water Pollution Control Ordinance (WPCO), and its subsidiary legislation, provides the main statutory framework for the protection and control of water quality in Hong Kong. Water quality is controlled through a set of Water Quality Objectives (WQOs) defined for each of the ten demarcated Water Control Zones (WCZs) in Hong Kong. The WQOs determine the water quality that should be achieved and maintained to support beneficial uses such as marine waters, inland waters, bathing beach subzones, secondary contact recreation subzones and fish culture subzones.

In accordance with Section 3.4.4.2 of the EIA Study Brief (ESB-276/2014), consideration has been given to the requirements of the Deep Bay WCZ. The respective WQOs for this WCZ are presented in **Table 5.1**.

Table 5.1: Water Quality Objectives for Deep Bay WCZ

Water Quality Parameters	Objectives	Deep Bay WCZ Subzone
Offensive Odour, Tints	Not to be present	Whole zone
Colour	Not to exceed 30 Hazen units	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones

Water Quality Parameters	Objectives	Deep Bay WCZ Subzone
	Not to exceed 50 Hazen units	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Visible foam, oil scum, litter	Not to be present	Whole zone
Escherichia coli (E. coli)	Not to exceed 610 per 100mL, calculated as the geometric mean of the all samples taken in one calendar year	Secondary Contact Recreation Subzone and Maricultural Subzone
	Should be zero per 100mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 1,000 per 100mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
	Not to exceed 180 per 100mL, 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
Dissolved Oxygen (DO)	Not less than 4.0mg/L^{-1}	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
- depth-averaged	Not less than 4.0mg/L^{-1} for 90% of samples	Outer Marine Subzone except Mariculture Subzone
- within 2m of the seabed	Not less than 2.0mg/L^{-1} for 90% of samples	Outer Marine Subzone except Mariculture Subzone
- 1m below the surface	Not less than 4.0mg/L^{-1} for 90%of the sampling occasions during the year	Inner Marine Subzone except Mariculture Subzone
	Not less than 5.0mg/L^{-1} for 90%of the sampling occasions during the year	Mariculture Subzone
pH	To be in the range of 6.5 - 8.5, change due to waste discharge not to exceed 0.2	Marine waters excepting Yung Long Bathing Beach Subzone
	Not to exceed the range of 6.5 – 8.5 due to waste discharge	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. Waste discharge shall not cause the natural pH range to be extended by more than 0.5 units	Yung Long Bathing Beach Subzone
Salinity	Change due to waste discharge not to exceed 10% of ambient	Whole zone
Temperature	Change due to waste discharge not to exceed 2°C	Whole zone
Suspended solids	Waste discharge not to raise the natural	Marine waters

Water Quality Parameters	Objectives	Deep Bay WCZ Subzone
	ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities	
	Annual median not to exceed 20mg/L^{-1} due to waste discharges	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Ganges Subzone, Indus Subzone, Water Gathering Ground Subzones and other inland waters
Unionized Ammonia (Ammoniacal nitrogen)	Annual mean not to exceed 0.021mg/L^{-1} as unionised form	Whole zone
Nutrients	Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants	Inner and Outer Marine Subzone
	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.7mg/L^{-1}, expressed as an annual mean.	Inner Marine Subzone
	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.5mg/L^{-1}, expressed as annual water column average (arithmetic mean of at least 2 measurements 1m below surface and 1m above seabed).	Outer Marine Subzone
5-Day Biochemical Oxygen Demand (BOD_5)	Not to exceed 3mg/L^{-1}	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 5mg/L^{-1}	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Chemical Oxygen Demand (COD)	Not to exceed 15mg/L^{-1}	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 30mg/L^{-1}	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Waste Discharge should not cause a risk to any beneficial use of the aquatic environment.	Whole zone
Phenol	Not to be present to produce a specific odour, or in concentration greater than 0.05mg/L^{-1} as C_6H_5OH	Yung Long Bathing Beach Subzone
Turbidity	Not to reduce light transmission substantially from normal level due to waste discharges	Yung Long Bathing Beach Subzone

Source: Statement of Water Quality Objectives (Deep Bay Water Control Zone). Water Pollution Control Ordinance (Cap. 358R), 1997.

5.2.3 Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

Effluent discharges are controlled under the WPCO. The *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM-DSS) sets limits for effluent discharges under Cap. 358AK. Specific limits are set for different WCZs, effluent flow rates and discharges to surface waters, coastal waters and sewers.

During the construction phase, any discharges made to inland waters shall comply with Table 6 of the TM-DSS. Sewage from the proposed operation activities would be discharged to the public sewerage network leading to Shek Wu Hui Sewage Treatment Works and therefore should comply with the relevant standards for effluents discharged into foul sewers leading to Government sewage treatment plants, and the standards for effluents discharged into foul sewers leading to Government sewage treatment plants with microbial treatment, determined in Table 1 and 2 of the TM-DSS.

5.2.4 No Net Increase in Pollution Load Requirement in Deep Bay

The Hong Kong Government has recognised the ecological importance of the Deep Bay area. All projects within the Deep Bay watershed are required to ensure that there is no net increase in pollution load to the area.

5.2.5 Practice Note for Professional Persons on Construction Site Drainage

Environmental Protection Department (EPD) issued a practice note for professional persons on the handling and disposal of construction site discharges. The Practice Note for Professional Persons on *Construction Site Drainage* (ProPECC Note PN 1/94) provides good practice guidelines to manage the various types of discharge from a construction site. Practices outlined in ProPECC Note PN 1/94 should be followed as far as possible during construction to minimize the potential water quality impacts from construction site drainage.

5.3 Assessment Area, Water Sensitive Receivers and Background Conditions

5.3.1 Assessment Area and Water Sensitive Receivers

In accordance with Section 3.4.4 of the EIA Study Brief, the study area for the water quality impact assessment comprises the area 500m from the Project boundary, the Deep Bay WCZ and sensitive receivers in the vicinity of the Project site.

The Project site is located between the urban areas of Sheung Shui/ Fanling and the Shenzhen River in the North District, with part of the site within the Frontier Closed Area. The Project site is situated in the watersheds of the Shenzhen River, Ping Yuen River (River Ganges) and their tributaries.

No areas of conservation value, ecological importance or mariculture activities have been identified in the vicinity of the Project site. Nine fish ponds and five watercourses have been identified as water sensitive receivers nearby the Project site, as presented in **Figure 5.1** and listed below:

- P1 – P15 – Ponds
- R1 – Nam Hang Channel
- R2 – Upstream section of the Nam Hang River
- R3 – Upstream of Ping Yuen River
- R4 – Nullah
- R5 – Stream at Man Kam To Road
- R6 – Stream at Man Kam To Road
- R7 – Channel at Kong Nga Po Road.

5.3.2 Background Water Quality Conditions

The Project site is situated within the inland waters of the Deep Bay WCZ. There are no existing EPD marine or river water quality monitoring stations in the immediate vicinity of the Project site. The closest river water quality monitoring stations are located downstream on the Ng Tung River (River Indus) and Ping Yuen River (River Ganges). The closest marine water quality monitoring station, DM1 at Inner Deep Bay, is located more than 1.5km from the Project boundary.

5.3.2.1 River Water Quality

The Project site is located at the headwaters of four river sub-catchments; the Ping Yuen River, Ng Tung River, Nam Hang River and tributaries of the Shenzhen River. The closest river water quality monitoring stations include IN1 (downstream) and IN2 (midstream) on the River Indus, are located approximately 1.5km southwest and 1.2km south of the Project boundary. Another nearby river water quality monitoring station is located approximately 2km northeast of the Project boundary, GR1, on the River Ganges.

The latest river water quality monitoring data available from EPD[1] for these monitoring stations on the Ng Tung River shows the compliance with WQOs to be 60% at IN1 and 92% at IN2, respectively, which is an improvement on 2012 compliance for IN1, and a slight deterioration for IN2. The low compliance at IN1 is understood to result from backflows from the Shenzhen River. Despite the low compliance of IN1, both sections of the River Indus achieved 'Good' status in EPD's Water Quality Index in 2013. Monitoring station GR1 for the Ping Yuen River showed a compliance rate of 77% in 2013, a slight improvement on 2012, achieving 'Fair' status in the Water Quality Index.

Table 5.2 presents a summary of the most recently available EPD water quality data for 2013 for the Ng Tung River (IN1 and IN2) and Ping Yuen River (GR1), respectively.

[1] EPD, 2014. River Water Quality in Hong Kong in 2013. The Government of the Hong Kong Special Administrative Region.

Table 5.2: Annual Summary of Water Quality Data for EPD Monitoring Stations IN1, IN2 and GR1 (2013)

Water Quality Parameter	Deep Bay WCZ River WQOs	IN1 Downstream	IN2 Midstream	GR1 Downstream
DO (mg/L^{-1})	≥ 4.0	6.0 (2.0 – 8.5)	7.1 (6.2 – 12.2)	7.5 (6.2 - 9.0)
pH	6.5 – 8.5	7.2 (6.8 – 7.6)	7.4 (6.8 – 8.0)	7.3 (7.0 - 7.7)
Suspended Solids (mg/L^{-1})	≤ 20.0	**26.0** (4.0 – 370.0)	4.0 (1.0 – 11.0)	8 (3 - 19)
BOD_5 (mg/L^{-1})	≤ 3.0	**4.0** (1.0 – 18.0)	2.0 (<1.0 - 21.0)	9 (<1 - 41)
COD (mg/L^{-1})	≤ 15.0	14.0 (8.0 – 83.0)	5.0 (2.0 – 20.0)	14 (6 - 48)
Oil & Grease (mg/L^{-1})	N/A	< 0.5 (< 0.5 – 0.6)	< 0.5 (< 0.5 – 0.6)	< 0.5 (< 0.5 - 0.5)
Faecal Coliforms (cfu/100mL)	N/A	46,000 (6,800 – 330,000)	19,000 (2,200 - 70,000)	31,000 (1,700 - 700,000)
E. coli (cfu/100mL)	N/A	13,000 (400 – 210,000)	2,600 (330 - 9,000)	13,000 (1,600 - 89,000)
Ammonia-nitrogen (mg/L^{-1})	N/A	0.69 (0.13 - 4.80)	0.37 (0.18 - 2.60)	3.30 (0.20 - 14.00)
Nitrate-nitrogen (mg/L^{-1})	N/A	2.70 (0.94 - 5.50)	1.05 (0.61 - 1.50)	2.20 (1.00 - 6.90)
Total Kjeldahl nitrogen (mg/L^{-1})	N/A	2.00 (0.80 - 5.90)	1.15 (0.35 - 2.70)	5.00 (0.55 - 21.00)
Orthophosphate (mg/L^{-1})	N/A	0.14 (0.08 - 0.48)	0.09 (0.02 - 0.15)	0.89 (0.17 - 3.30)
Total Phosphorus (mg/L^{-1})	N/A	0.37 (0.16 - 1.60)	0.14 (0.08 - 0.21)	1.25 (0.47 - 3.90)
Total Sulphide (mg/L^{-1})	N/A	< 0.02 (< 0.02 - < 0.02)	< 0.02 (< 0.02 - < 0.02)	< 0.02 (< 0.02 - < 0.02)
Aluminium (mg/L^{-1})	N/A	250 (70 - 2,400)	80 (<50 - 190)	123 (< 50 - 320)
Cadmium (mg/L^{-1})	N/A	< 0.1 (< 0.1 - 1.0)	< 0.1 (< 0.1 - 1.0)	< 0.1 (< 0.1 - 1.6)
Chromium (mg/L^{-1})	N/A	1 (< 1 - 24)	< 1 (< 1 - < 1)	< 1 (< 1 - < 1)
Copper (mg/L^{-1})	N/A	4 (< 1 - 41)	2 (< 1 - 10)	3 (2 - 6)
Lead (mg/L^{-1})	N/A	3 (< 1 - 24)	< 1 (< 1 - 1)	1 (< 1 - 3)
Zinc (mg/L^{-1})	N/A	40 (20 - 210)	20 (14 - 30)	26 (16 - 57)

Source: EPD, 2014. River Water Quality in Hong Kong in 2013. The Government of the Hong Kong Special Administrative Region.
Notes:
1. Data presented are in annual medians of monthly samples; except those for faecal coliforms and *E. coli* which are in annual geometric means.
2. Values in brackets are annual ranges. Values in **bold** type are exceedances of the WQOs.
3. cfu – colony forming unit.
4. Values at or below laboratory reporting limits are presented as laboratory reporting limits.

5.3.2.2 Other Inland Water Quality

Water quality samples were taken as part of the approved EIA study for the Development of Organic Waste Treatment Facilities, Phase 2 (AEIAR-180/2013), at three nearby sensitive receivers adjacent to the Project site. The samples were taken at the downstream end of Nam Hang River, where it meets Man Kam To Road (R1), a fish pond at the westernmost point from the Project site (P4), and a fish pond to the southwest of the Project site (P1), as identified in **Figure 5.1**. The samples were taken on 15 April 2013 and the water quality results are presented in **Table 5.3**.

Table 5.3: Water Quality Data for Nearby Water Sensitive Receivers (from 15 April 2013)

Water Quality Parameter	Watercourse R1	Pond P4	Pond P1
DO (mg/L^{-1})	4.3 (4.3 - 4.3)	12.8 (12.7 – 12.8)	5.9 (5.9 – 5.9)
DO (% saturation)	50 (50 - 50)	154 (154 – 155)	72 (72 – 72)
BOD_5 (mg/L^{-1})	< 2 (< 2 - < 2)	**10** (9 – 11)	< 2 (< 2 - < 2)
pH	6.8 (6.7 - 6.8)	8.2 (8.1 – 8.2)	6.8 (6.8 – 6.8)
Suspended Solids (mg/L^{-1})	< 2 (< 2 - < 2)	16 (15 – 16)	4 (4 – 4)
Turbidity (NTU)	2 (2 - 3)	23 (22 – 23)	19 (19 – 19)

Source: Development of Organic Waste Treatment Facilities, Phase 2. Environmental Impact Assessment Report. Environmental Protection Department. AEIAR-180/2013.
Notes: Values in brackets are sample ranges, where applicable. Values in **bold** type are exceedances of the WQOs.

The results show compliance with all WQOs except for BOD_5 at Pond P4.

5.4 Assessment Methodology

In accordance with Section 3.4.4 of the EIA Study Brief, the water quality impact assessment has been carried out in accordance with Appendix D of the EIA Study Brief and the guidelines of Annex 6 and 14 of the EIAO-TM.

Potential pollutants that may be generated from the Project have been identified covering both point source and non-point sources. The potential water quality impacts and their impact significance taking into account the nearby water sensitive receivers have also been determined, and where necessary, appropriate mitigation measures have been recommended to reduce any identified adverse impacts on water quality.

5.5 Identification and Evaluation of Water Quality Impacts

The Project involves co-locating existing police facilities within the Project Area, the construction of new police facilities and improvement works to the existing Kong Nga Po Road.

5.5.1 Construction Phase

The main construction elements of the Project broadly include site formation, foundation works, retaining walls and slope works, general building and structure works and improvements to the existing Kong Nga Po Road. Therefore, potential sources of construction-related water quality impacts include:

- General construction activities
- Construction site runoff (including from excavation, site formation and foundation works)
- Accidental spillage of chemicals
- Sewage from construction workforce
- Construction works in close proximity to inland watercourses.

5.5.1.1 General Construction Activities

Inadequate storage of construction materials and waste has the potential to impact water quality, through:

- Release of construction debris and general refuse such as packaging and construction materials
- Spillage/ overflow of construction materials such as stockpiles.

Implementation of good site management practices can mitigate the impacts of general construction activities on water quality. Thus it is not anticipated that there would be any adverse impacts on water quality as a result of construction activities.

5.5.1.2 Construction Site Runoff

Surface water runoff and site drainage from construction works areas may contain suspended solids, sediments and contaminants which can pollute watercourses, increasing the oxygen demand and deteriorating the water quality. The potential sources of pollution from surface water runoff and site drainage include:

- Runoff and erosion from site formation areas, excavations for foundation works, drainage channels and material stockpiles leading to suspended sediment and high oxygen demand in runoff entering the stormwater system
- Release of bentonite slurries, concrete washwater and other grouting materials into site runoff and the stormwater system
- Sediment laden washwater from dust suppression sprays and wheel wash facilities entering the stormwater system
- Fuel, oil, solvents and lubricants from maintenance of construction vehicles and mechanical equipment, entering the stormwater system.

Uncontrolled discharges from a construction site have the potential to adversely impact nearby drainage areas, but can be managed through good site practices and appropriate temporary drainage facilities. The indicative drainage arrangement during construction phase (subject to detailed design and Contractor arrangements) is shown in **Figure 5.2**. The good site practices outlined in ProPECC Note PN1/94 will be implemented to control site runoff and drainage on-site and prevent uncontrolled discharges to these off-site drainage areas during construction phase.

5.5.1.3 Accidental Spillage of Chemicals

Chemicals stored on-site during construction such as petroleum, oil and grease, lubricants and solvents have the potential to enter the surface water drainage system through accidental spillage on the construction site, penetrating the ground and carried in site runoff to stormwater drains. To mitigate the impacts of these contaminants, appropriate site storage and bunding of chemicals should be implemented as part of good site practice.

5.5.1.4 Sewage from Construction Workforce

Sewage will be generated by the workforce during the construction phase. Release of untreated sewage into the surrounding environment can result in eutrophication and depletion of dissolved oxygen levels in surface water bodies, which can kill off fishes and aquatic organisms and adversely impact the aquatic environment. On-site portable toilets should be provided to mitigate the impacts of this potential pollution source. The toilets should be regularly maintained and the sewage transported off-site by a licensed contractor for treatment.

5.5.1.5 Construction Works in Close Proximity to Inland Watercourses

Construction activities such as the earthworks, slope stabilisation and installation of utilities involved in the re-profiling, realignment and widening works along Kong Nga Po Road, have the potential to impact nearby inland watercourses through the release of discharges and runoff laden with suspended solids and other polluting characteristics such as high pH. Similarly, flow through existing cross-drains/ culverts intersecting the road should be controlled by temporary diversions, where necessary, to reduce the potential for construction site discharges polluting the receiving water quality. Suitable mitigation measures to control the release of such pollutants should be implemented to minimise the impact on these watercourses.

5.5.2 Operation Phase

The potential operation phase water quality impacts associated with the Project include:

- Stormwater runoff
- Accidental spillage of chemicals, oils and fuels
- Runoff generated by the Police Driving and Traffic Training Facilities (PD&TTF)
- Treated sewage effluent discharge to Deep Bay WCZ
- Emergency discharge from the proposed sewage pumping station (SPS).

5.5.2.1 Stormwater Runoff

During operation phase, stormwater runoff from paved surfaces within the Project site will be directed to a managed stormwater drainage system. Runoff from the roofs of buildings, road surfaces including access roads within the site, the PD&TTF and the helipad, may carry suspended solids and other pollutants such as fuel, oils and heavy metals that could enter nearby surface water bodies if uncontrolled. Mitigation measures including installation of silt traps and petrol interceptors in the stormwater drainage system can effectively reduce the potential impacts of these pollutants on downstream river water quality.

5.5.2.2 Accidental Spillage of Chemicals, Oils and Fuels

On-site storage of chemicals for the maintenance of plant and vehicles has the potential to adversely impact water quality. This potential water quality impact could be realised in the event of accidental spillage resulting in contamination of the stormwater drainage system. Appropriate containment, storage and

bunding measures should be implemented and maintained throughout the operation phase in accordance with the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes" to minimise the impacts on water quality.

Accidental spillage of fuel at the petrol/ diesel filling station during petrol and diesel refilling activities required to maintain the police vehicle fleet at the PD&TTF and at the helipad location due to helicopter refuelling operation may also occur. To reduce the potential for runoff of spilt fuels into the drainage system, stormwater drains shall not be located within the refuelling areas of the petrol/ diesel filling station and helipad unless properly equipped with oil interceptors, and staff undertaking refuelling activities shall be trained on the proper handling and operation of the refuelling system to minimise the risk of spillages. Staff shall also be trained on the proper procedures for cleanup of any spilt fuels to prevent contamination of the surrounding areas.

5.5.2.3 Runoff Generated by the PD&TTF

During operation, the skid pan training facilities at the PD&TTF may generate surface runoff. Clean water will be sprayed onto the skid pan surface in a controlled manner each time the facility is used to reduce resistance between the vehicle tyres and the skid pan surface. Although the amount of water sprayed each time is small (just enough to wet the skid pan surface) and only the area of the skid pan is sprayed, the surface runoff generated may carry suspended solids and pollutants into the stormwater drainage system. Mitigation measures such as silt traps and petrol interceptors should be installed to minimise the impact on downstream water quality.

5.5.2.4 Treated Sewage Effluent Discharge to Deep Bay WCZ

Sewage generated throughout the operation stage of the Project will be conveyed to SWHSTW for treatment via a new sewer connecting to the existing public sewerage system. Sewage flows have been estimated to be 150.08m^3/ day (details are presented in **Chapter 6**).

An on-site SPS will be installed to transfer sewage flows from the Project site to the existing pumping station (PS3), then via the existing public sewerage system for treatment at SWHSTW. PS3 and the associated rising main to SWHSTW are to be upgraded as part of Agreement No. CE 1/2015(DS) to handle the additional flows from the Project as well as from other developments in the vicinity.

Expansion requirements for SWHSTW have already been considered in the EIA for the NENT New Development Areas (AEIAR-175/2013) and will be implemented under its Phase 1A expansion. EPD has also recently re-confirmed that the expanded SWHSTW will be able to handle the additional sewage loading from the Project. As all sewage flows generated by the Project will be discharged to the SWHSTW, there would be no adverse water quality impact due to sewage effluent during operation phase, and no net increase in pollutant loads to Deep Bay WCZ due to the Project.

5.5.2.5 Emergency Discharge from the Proposed SPS

There is the potential for emergency discharges of untreated sewage as a result of pump failure at the proposed on-site SPS, despite there not being an emergency overflow pipe at the SPS. Mitigation measures in accordance with the EPD Guidance Note "Environmental Guidance Note for Sewage Pumping Stations which is not a Designated Project" shall be implemented such as buffer capacity, standby pump capacity and backup power supply, to ensure contingency measures are in place in the event of mechanical or electrical failure of installed plant.

5.6 Mitigation of Adverse Water Quality Impacts

The proposed mitigation measures for construction and operation phase are presented below.

5.6.1 Construction Phase

5.6.1.1 General Construction Activities

Construction waste, debris and refuse generated on-site should be stored or contained appropriately to prevent them entering nearby watercourses or blocking stormwater drains. Regular off-site removal of these materials should be maintained to minimise the volume of waste present on the construction site at any one time. Stockpiles of construction materials such as cement and excavated material should be covered when not in use to reduce the potential for water pollution. With the adoption of these good site practices, no adverse water quality impacts are anticipated.

5.6.1.2 Construction Site Runoff

Adoption of good site practices outlined in ProPECC Note PN1/94 should be made as far as practicable to minimise site surface runoff from construction works areas, and control the dispersion of sediments and contaminants to inland waters. The following measures are recommended, but are not exhaustive, and other relevant measures listed in ProPECC Note PN1/94 should be implemented as necessary to minimise the impacts of construction on downstream water quality:

- Temporary site drainage facilities are to be designed and implemented by the Contractor prior to commencement of construction to convey surface runoff to storm drains. The design of the silt/ sand removal traps and sediment basins shall follow the design in ProPECC Note PN1/94.
- Perimeter cut-off drains shall be installed in advance of any excavation and site formation works to convey site runoff from the works areas to the silt removal facilities.
- Runoff into the excavation areas during rainstorm events shall be minimised as far as practicable. Any wastewater pumped out of the excavation areas shall be treated to remove suspended solids prior to discharge.
- Maintenance and inspection of the drainage system and sediment removal facilities should be carried out regularly to remove any sediment and blockages, especially when rainstorms are forecast.

- Final surface levels should be compacted and final surface protections installed to prevent erosion caused by rainstorms.
- Open stockpiles of material should be covered on site with waterproof layers such as tarpaulin to reduce the potential for sediment laden runoff entering the drainage system.
- The wheels of all vehicles and plant should be cleaned before leaving the works areas to remove sediment, soil and debris from the tracks. The washwater should be treated to remove any suspended sediment.
- Surface water from concrete batching areas and the rest of the site should be separated as far as possible. Wastewater from any concrete batching plant (if required) shall be treated to the required standards including pH adjustment and settlement of suspended sediments before discharging to stormwater drains.
- Manholes (including those constructed as part of the Project) should be adequately covered and temporarily sealed at all times to prevent silt, construction materials or debris from entering the drainage system, and to prevent storm runoff from entering foul sewers. The discharge of surface runoff into foul sewers should be prevented so as not to overload the sewerage system.

The construction phase discharges would be collected by the temporary drainage system installed by the Contractor and then treated on-site to remove sediment prior to discharge to the off-site drainage areas as indicated in **Figure 5.2**. The Contractor would be required to obtain a discharge licence from EPD under the WPCO for all discharges from site including those eventually leading to the existing public drainage system. All discharges require the water quality to meet the requirements of the TM-DSS, and additional precautionary measures shall be implemented by the Contractor as necessary (such as provision of additional temporary storage and on-site treatment units to cater for heavy rainstorm events) to ensure the water quality requirements at the point of discharge are met. With the implementation of these good site practices, no adverse water quality impacts are anticipated.

5.6.1.3 Accidental Spillage of Chemicals

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. This will prevent contamination of top soil, groundwater and water pollution due to construction site runoff. The Contractor should register as a chemical waste producer if chemicals are to be generated from site. Off-site disposal of chemical waste should only be carried out in accordance with the requirements of the WDO.

The labelling and storage of chemicals should be in accordance with the “Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes” maintained at all times by the Contractor. Oils and fuels should only be stored in designated areas which have appropriate pollution prevention control facilities such as oil and grease traps and petrol interceptors. The maintenance of vehicles should only be undertaken in areas of the site served by these pollution prevention measures. To prevent the spillage of fuels and solvents to nearby stormwater drains, all fuel tanks and storage areas should be locked and

located on sealed areas of the site, within bunded areas with a capacity equal to 110% of the storage capacity of the largest container. The bund should be drained of surface water after each rainfall event.

With the adoption of good site practices, no adverse water quality impacts are expected.

5.6.1.4 Sewage from Construction Workforce

Portable toilets will be used throughout the construction phase and will be regularly maintained, collected and disposed by a licensed waste collector to a public sewage treatment works for suitable treatment.

With the adoption of good site practices, no adverse water quality impacts are expected.

5.6.1.5 Construction Works in Close Proximity to Inland Watercourses

The close proximity of the construction works to inland watercourses has the potential to adversely impact the receiving water quality especially where existing drainage culverts intersect the Project area along Kong Nga Po Road. Therefore mitigation measures such as temporary diversions of existing drainage culverts/ watercourses before construction commences and during construction should be implemented, in addition to those listed in ProPECC Note PN1/94 *Construction Site Drainage* and ETWB TC (Works) No. 5/2005 *Protection of Natural Streams/rivers from Adverse Impacts Arising from Construction Works*.

Mitigation measures of relevance from ETWB TC (Works) No. 5/2005 include:

- Stockpiling of construction materials and spoil, should be properly covered and located away from any natural stream/river.
- Construction works close to the inland waters should be carried out in dry season as far as practicable where the flow in the surface channel or stream is low.
- Removal of existing vegetation alongside the riverbanks should be avoided or minimised. When disturbance to vegetation is unavoidable, all disturbed areas should be hydroseeded or planted with suitable vegetation to blend in with the natural environment upon completion of works.

Through the implementation of these good site management practices, adverse water quality impacts are not anticipated.

5.6.2 Operation Phase

5.6.2.1 Stormwater Runoff

The stormwater drainage system will be designed in accordance with Drainage Services Department's (DSD) Stormwater Drainage Manual (SDM). As part of this design, silt removal facilities such as silt traps will be installed to reduce the potential for suspended solids entering the drainage system. Petrol interceptors should also be installed in areas with the potential to generate runoff contaminated with petrol and grease from vehicles, especially during 'first flush' rainfall events. Regular maintenance of these silt

traps and interceptors particularly at the onset of and after each major rainstorm event will ensure the impacts on downstream river water quality are minimised.

With the incorporation of these design measures it is anticipated that there will be no adverse water quality impacts as a result of the Project.

5.6.2.2 Accidental Spillage of Chemicals, Oils and Fuels

As identified in Section 5.6.1.3, adherence to the WDO and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should minimise the potential for contamination. Specifically observing the storage and labelling requirements of chemicals is considered to be a key measure to minimise potential water quality impacts. Specifically, good quality containers compatible with the chemical wastes, especially for the storage of fuel, should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached to each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc.

Refuelling activities at the PD&TTF shall be located in covered areas and the associated drainage system at these refuelling areas should be fitted with petrol interceptors and connected to the foul sewerage system, or no drainage system shall be located in the vicinity of the refuelling facilities. Regardless, a fuel spill kit shall be located at easily accessible locations to enable any spillages to be cleaned up immediately. For the helipad, only trained and designated personnel will carry out the refuelling of helicopters in accordance with the Government Flying Service (GFS) procedures. In the event that stormwater drains are located at the helipad, these drains are to be fitted with petrol interceptors and connected to the foul sewerage system where possible, with any spillages cleaned up immediately using a spill kit.

With the implementation of these measures, it is anticipated that there are no adverse water quality impacts.

5.6.2.3 Runoff Generated by the PD&TTF

As identified in **Section 5.6.2.1**, the stormwater drainage system used to collect the runoff generated at the skid pan facilities will be designed in accordance with DSD's SDM. As such the drainage system will include silt traps and petrol interceptors where necessary, to minimise the suspended sediments and pollutant concentrations entering the drainage system. With the incorporation of these design measures and regular maintenance of the drains and silt removal facilities, no adverse water quality impacts are anticipated.

5.6.2.4 Treated Sewage Effluent Discharge to Deep Bay WCZ

The proposed Project sewerage system has been designed to convey the sewage flows from the site to the public sewerage system for treatment. It is considered that the upgrade works to the public sewerage system, carried out under Agreement No. CE 1/2015(DS), at PS3 and the associated rising main to

SWHSTW will accommodate the additional Project related sewage flows, to provide conveyance of sewage for treatment. The treatment capacity at SWHSTW will also be increased under its Phase 1A expansion and will have sufficient capacity to treat Project related sewage flows during operation phase. Therefore, there should be no adverse water quality impacts on Deep Bay WCZ.

5.6.2.5 Emergency Discharge from the Proposed SPS

The SPS required to transfer Project related sewage flows to SWHSTW has been designed in accordance with the EPD Guidance Note "Environmental Guidance Note for Sewage Pumping Stations which is not a Designated Project". No emergency overflow pipe will be installed, however, measures such as a retention tank to provide 2 hours of peak flow buffer capacity will be implemented for the proposed sewerage system. Furthermore, the SPS will be equipped with 2 duty and 1 standby pumps, with backup power supply to the Project Area also considered to provide further redundancy in the system.

With the implementation of these measures, the risk of emergency discharges from the SPS will be minimal and no adverse water quality impacts are expected.

5.7 Evaluation of Cumulative and Residual Impact

The concurrent project with the potential to generate cumulative water quality impacts with the Project is the Development of Organic Waste Treatment Facilities (OWTF), Stage 2 (AEIAR-180/2013). However, the water quality impacts associated with this project are relatively minor, and appropriate mitigation measures have already been recommended under AEIAR-180/2013 to prevent adverse water quality impacts. It is thus anticipated that the cumulative impacts arising from the OWTF project in conjunction with the Project are not significant.

With the implementation of the recommended mitigation measures during construction phase and the proposed design, operation and management measures during the operation phase, it is predicted that all potential impacts would be adequately controlled. Therefore, there would be no residual impacts of the Project on water quality.

5.8 Environmental Monitoring and Audit

Adverse water quality impact was not predicted during the construction and operation phase of the Project. Thus water quality monitoring is not considered necessary. Nevertheless, appropriate mitigation measures are recommended to minimise potential water quality impacts, and regular audits should be undertaken during construction phase to ensure the recommended mitigation measures are properly implemented.

5.9 Conclusion

The water quality impact assessment has considered the potential construction and operation phase impacts associated with the Project. Mitigation measures have been recommended to ensure no adverse water quality impacts result from Project aspects such as stormwater runoff, accidental spillage of

chemicals, runoff generated by the skid pan facility, sewage generated by the construction workforce, and sewage generated through normal or emergency discharge during operation phase. With the recommended mitigation measures in place, no adverse water quality impacts are expected during construction and operation phase.