6. Water Quality Impact Assessment

6.1 Introduction

This section presents an assessment of the potential water quality impacts associated with the construction and operation phases of the Project. Recommendations for mitigation measures have been made, where necessary, to reduce the identified water quality impacts to an acceptable level.

6.2 Environmental Legislation, Standards and Guidelines

6.2.1 Environmental Impact Assessment Ordinance

The *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM) is issued by the Environmental Protection Department under Section 16 of the EIAO. It specifies the assessment method and criteria that needs to be followed in EIA studies. Reference sections in the EIAO-TM provide the details of the assessment criteria and guidelines that are relevant to the water quality impact assessment, including:

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

6.2.2 Water Pollution Control Ordinance

The *Water Pollution Control Ordinance* (WPCO) (Cap.358) provides the major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, the whole Hong Kong waters are divided into ten Water Control Zones (WCZs). Water Quality Objectives (WQOs) were established based on different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) to protect the beneficial uses of water quality in WCZs. Specific WQOs are applied to each WCZ. The Project is located within the Deep Bay WCZ and its corresponding WQOs are listed in **Table 6.1**.

Table 6.1 Water Quality Objective for the Deep Bay WCZ

Parameters	Objectives	Sub-Zone
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
	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
E. coli	Not to exceed 610 per 100 mL, calculated as the geometric mean of the all samples taken in 1 calendar year	Secondary Contact Recreation Subzone and Maricultural Subzone
	Should be zero per 100 mL, 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

Parameters	Objectives	Sub-Zone
		Ground Subzones
	Not to exceed 1000 per 100 mL, calculated as the geometric mean 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 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
Depth-averaged Dissolved Oxygen (DO)	Not less than 4.0 mg L^{-1} for 90% of samples	Outer Marine Subzone excepting Mariculture Subzone
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2.0 mg L^{-1} for 90% of samples	Outer Marine Subzone excepting Mariculture Subzone
Dissolved Oxygen (DO)	Not less than 4.0 mg L^{-1} for 90%of the sampling occasions during the year, values taken at 1m below surface	Inner Marine Subzone excepting Mariculture Subzone
	Not less than 5.0 mg L^{-1} for 90%of the sampling occasions during the year, values taken at 1m below surface	Mariculture Subzone
	Not less than 4.0 mg 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
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 ^{o}C	Whole zone
Suspended solids	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters
	Annual median not to exceed 20 mg 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	Annual mean not to exceed 0.021 mg 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

Parameters	Objectives	Sub-Zone
	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.7 milligram per litre, expressed as annual mean.	Inner Marine Subzone
	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.5 milligram per litre, expressed as annual water column average (arithmetic mean of at least 2 measurements at 1 metre below surface and 1 metre above seabed).	Outer Marine Subzone
5-Day Biochemical Oxygen Demand (BOD_5)	Not to exceed 3 mg L^{-1}	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 5 mg L^{-1}	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Chemical Oxygen Demand	Not to exceed 15 mg L^{-1}	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 30 mg 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 0.05 mg 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).

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

Discharges of effluents are subject to control 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. Specific limits apply for different areas and are different between surface waters and sewers. The limits vary with the rate of effluent flow. Sewage from the proposed construction activities would be discharged into inland waters and therefore should comply with the standards for effluent discharged into inland waters, as shown in 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 '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', as shown in Table 1 and 2 of the TM-DSS.

6.2.4 No Net Increase Requirement

Effluent treatment is required prior to discharge into the water courses in the Deep Bay Area, in order to meet the criteria of "no net increase in pollution load requirement". The underlying principle is to protect the important habitats and wildlife of the Deep Bay region.

6.2.5 Practice Note for Professional Persons on Construction Site Drainage

A practice note for professional persons was issued by the EPD to provide guidelines for 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 for dealing with 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 water quality impact due to construction site drainage.

6.3 Project Description

The OWTF 2 is designed to treat 300 tons/day of organic waste generated by the Commercial and Industrial (C&I) Sectors. The organic waste to be received at the site will be collected from various sources in the New Territories. The processing of organic waste includes pre-treatment, anaerobic digestion, and post-treatment (such as dewatering and composting). It is predicted that approximately 213 m^3 of effluent per day will be generated during processing that will require treatment and disposal. (A detailed breakdown of the wastewater generation is presented in **Table 6.5**).

The Project site area and alignment of a new sewer to connect the site to the sewerage network is shown in **Figure 6.1**. The scope of the works within Project comprises the following:

- Demolition and removal of the existing above ground structures of the Livestock Waste Composting Facility;
- Construction of superstructure for an office and enclosed waste reception area;
- Installation and operation of organic waste treatment facilities;
- Installation and operation of biogas holding tanks;
- Installation and operation of air treatment, auxiliary facilities for biogas processing, utilisation and transmission;

Though not part of the Project at Sha Ling the following activities are identified and assessed as a cumulative impact:

- Road widening of carriageway at Kong Nga Po Road;
- Connection for OWTF2 to Sha Ling LPS and the existing NENT sewage network to discharge at SWHSTW.

6.4 Assessment Area and Sensitive Receivers

According to Clause 3.4.6.2 of the EIA Study Brief, water quality impact assessment has been carried out in all areas within 500m from the Project site boundary and other areas such as water courses and the associated water systems in the vicinity that might be impacted by the Project.

The Project site is located at Sha Ling in the North District, within the Frontier Closed Area (See **Figure 6.2**). There are no areas of conservation value, ecological importance or mariculture activities identified in

the vicinity of the Project site. Four fish ponds and two watercourses are identified as the nearby inland water sensitive receivers. The closest water sensitive receiver identified in this assessment are the water ponds and a small stream located on the northeast side of the Project site.

6.5 Description of the Existing Environment/ Background Water Quality

There are no EPD marine and river water quality monitoring stations in vicinity of the Project site. The nearest EPD marine water quality monitoring station DM1 in the Inner Deep Bay is located more than 1.5 km from the Project site boundary. The nearest inland water monitoring stations are identified about 1 km at the upstream end of Shenzhen River, River Indus and its tributaries. The nearest river water quality monitoring stations (IN1 and IN2) in the River Indus are located at about 1.5 km south-west and 1.2 km south of the Project site boundary. EPD monitoring data collected at these two monitoring stations in 2011 is summarised in **Table 6.2**.

According to the *River Water Quality in Hong Kong in 2011*, which is the latest available information from EPD, the upstream section of River Indus has a relatively high WQO compliance rate of 75% and rated with "Excellent" in the Water Quality Index (WQI). The compliance rate decreases downstream, with the midstream and downstream stations rated with "Good" and "Bad" WQI. The compliance rates of the midstream station (IN2) and the downstream station (IN1) were 85% and 42% for River Indus. The report suggested that the downstream of River Indus is affected by backflow from Shenzhen River[1].

Table 6.2: Summary of River Water Quality Monitoring Data at River Indus (2011)

Parameter	River WQOs	River Indus	
		IN1	IN2
Dissolved Oxygen (mg/L)	≥ 4	3.7 (2.4 – 7.8)	5.8 (3.6 – 10.3)
pH	6.5 – 8.5	7.3 (7.1 – 7.4)	7.4 (7.1 – 8.3)
Suspended solids (mg/L)	≤ 20	36 (21 – 460)	11 (7 - 40)
5-day Biochemical Oxygen Demand (mg/L)	≤ 3	7 (3 – 28)	3 (2 – 10)
Chemical Oxygen Demand (mg/L)	≤ 15	15 (8 - 28)	9 (6 – 16)
Oil & grease (mg/L)	NA	<0.5 (<0.5 – 0.8)	<0.5 (<0.5 – 0.9)
Faecal coliforms (cfu/100mL)	NA	420,000 (29,000 – 4,500,000)	39,000 (9,000 – 350,000)
E. coli (cfu/100mL)	NA	180,000 (7,000 – 2,500,000)	4,100 (280 – 66,000)
Ammonia-nitrogen (mg/L)	NA	4.75 (0.95 – 12.00)	0.77 (0.25 – 2.70)
Nitrate-nitrogen (mg/L)	NA	2.85 (0.04 – 4.90)	1.20 (0.81 – 1.80)
Total Kjeldahl nitrogen (mg/L)	NA	6.05 (1.80 – 15.00)	1.55 (0.79 – 3.40)
Ortho-phosphate (mg/L)	NA	0.24 (0.04 – 0.41)	0.11 (0.03 – 0.16)

[1] River Water Quality in Hong Kong in 2011

Parameter	River WQOs	River Indus	
		IN1	IN2
Total phosphate (mg/L)	NA	0.66 (0.36 – 3.40)	0.21 (0.14 – 0.32)
Total Sulphide (mg/L)	NA	<0.02 (<0.02 – 0.34)	<0.02 (<0.02 – <0.02)
Aluminium (µg/L)	NA	295 (190 – 3,200)	140 (<50 – 490)
Cadmium (µg/L)	NA	<0.1 (<0.1 – 0.5)	<0.1 (<0.1 – <0.1)
Chromium (µg/L)	NA	5 (1 – 67)	<1 (<1 – <1)
Copper (µg/L)	NA	7 (3 – 12)	2 (1 – 3)
Lead (µg/L)	NA	3 (2 – 19)	2 (1 – 5)
Zinc (µg/L)	NA	40 (20 – 280)	20 (10 – 30)
Flow (L/s)	NA	NM	NM

Source: River Water Quality in Hong Kong in 2011

Remarks:

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. Figures in brackets are annual ranges
3. NM – no measurement taken
4. cfu – colony forming unit
5. Values at or below laboratory reporting limits are presented as laboratory reporting limits
6. Equal values for annual medians (or geometric means) and ranges indicate that all data are the same as or below laboratory reporting limits

Water sampling at the nearby sensitive receivers was conducted on 15 April 2013. Two locations were chosen as the upstream (W3) and downstream (W1) of the same water course and sampling was also conducted at a fish pond (W2) west of the Project area. The locations of the sampling points are identified in **Figure 6.3**.

The sampling results show compliance with WQO for the tested parameters at W1 and W3, but exceedances of BOD at W2. The monitoring results are summarised in **Table 6.3**.

Table 6.3: Summary of Water Sampling on 15 April 2013

Parameters	Unit	LOR		Monitoring Locations					
				W1		W2		W3	
pH		0.1	Mean		6.8		8.2		6.8
			Range	6.7	6.8	8.1	8.2	6.8	6.8
Turbidity	NTU	1	Mean		2		23		19
			Range	2	3	22	23	19	19
D.O. Content	mg/L	0.1	Mean		4.3		12.8		5.9
			Range	4.3	4.3	12.7	12.8	5.9	5.9
D.O. Percentage	%	1	Mean		50		154		72

Parameters	Unit	LOR		Monitoring Locations					
				W1		W2		W3	
			Range	50	50	154	155	72	72
Suspended Solids	mg/L	2	Mean		<2		16		4
			Range	<2	<2	15	16	4	4
5-day Biochemical Oxygen Demand	mg/L	2	Mean		<2		10		<2
			Range	<2	<2	9	11	<2	<2

6.6 Assessment Methodology

In accordance with Clause 3.4.6 and Appendix D of the EIA Study Brief, the assessment has been carried out in accordance with Annexes 6 and 14 of the EIAO-TM.

Potential pollutants from point discharges and non-point sources discharging as surface water runoff, sewage or polluted discharge generated from the Project that could affect the quality of surface water runoff and nearby waters have been considered. The potential water quality impacts and their impact significance have been determined. Mitigation measures to reduce any identified adverse impacts on water quality to acceptable levels have been also determined.

6.7 Identification of Environmental Impact

6.7.1 Construction Phase

Potential sources of water quality impact associated with construction activities for the Project include:

- Construction site runoff;
- General construction activities;
- Excavation works;
- Accidental spillage; and,
- Sewage effluent from the construction workforce.

6.7.1.1 Construction Site Runoff

The surface runoff from construction works areas may contain suspended solids (SS), contaminants and increased loads of sediments. Potential sources of pollution from site drainage include:

- Runoff and erosion from site surfaces, drainage channels, earth working areas and stockpiles;
- Release of any bentonite slurries, concrete washings and other grouting materials with construction runoff and storm water;
- Wash water from dust suppression sprays and wheel wash facilities; and,
- Fuel, oil, solvents and lubricants from maintenance of construction vehicles and mechanical equipment.

Sediment laden runoff particularly from works areas subjected to excavation or earth works, if uncontrolled, may carry pollutants (adsorbed onto the particle surfaces) into any nearby stormwater drains. Mitigation measures and good site practices should be implemented to control construction site runoff and drainage from the works area, to avoid runoff and drainage water with high levels of SS entering the nearby stormwater system.

6.7.1.2 General Construction Activities

On-site construction activities may result in water pollution from the following:

- Uncontrolled discharge of debris and rubbish such as packaging, construction materials and refuse
- Spillages of liquids stored on-site, such as oil, diesel and solvents etc.

Good construction and site management practices should be observed to ensure that litter, fuels and solvents do not enter the drainage system and existing streams and rivers.

6.7.1.3 Excavation Works

Construction of the OWTF2 involves excavation to form the foundation. Excavated material may have to be stored on-site before being sorted, reused or transported off-site. On-site storage of loose soil in stockpiles may generate site runoff during rainfall, if the stockpile is not properly covered. Site runoff of this kind contains high levels of suspended solid and may lead to increased SS levels and oxygen demand in the water environment if washed into nearby streams or storm drains.

6.7.1.4 Accidental Spillage

A variety of chemicals could be stored on-site during the construction phase of the Project. These chemicals may include petroleum products, spent lubricants, oil and grease, mineral oil, solvent and other chemicals. Accidental spillages of these chemicals may contaminate the top soil at the construction site. The contaminated soil particles in the works area may then be washed away as construction site runoff and cause water pollution.

6.7.1.5 Sewage Effluent from Construction Workforce

Domestic sewage would be generated from the workforce during the construction phase. However, portable chemical toilets will be provided within the construction site. The Contractor would have the responsibility to ensure that chemical toilets are used and properly maintained, and that licensed Contractors are employed to collect and dispose of the waste off-site at approved locations. Therefore no water quality impacts are anticipated from this activity.

6.7.2 Operation Phase

Potential areas of concern on operation phase water quality impacts include:

- Sewage effluents and sewerage impact;
- Wastewater generation from the organic waste treatment processes; and
- Contaminated stormwater runoff and accidental spillages.

6.7.2.1 Sewage Effluents and Sewerage Impact

Sewage and wastewater effluents generated from the operation staff and visitors at the proposed facility can contain high levels of nutrients. Direct discharge of domestic sewage into the water environment would

cause excessive algal growth and reduce dissolved oxygen in the water body. Connection to the existing NENT sewerage network is required, which will be planned during the design stage.

6.7.2.2 Wastewater Generation from the Organic Waste Treatment Processes

The proposed OWTF 2 will convert source-separated organic waste into compost and biogas. The plant will process around 300 tonnes of organic waste per day when in operation. Details of possible wastewater sources are shown in **Table 6.4**:

Table 6.4: Estimated Wastewater Volumes by Source at OWTF2

Element	m^3 / year	m^3 / day	Peak (L / s)
From separator to WWTP	83,651	229.18	5.31
From other sources to WWTP (i.e. domestic wastewater, wash water other than vehicle washing water, and leachate)	14,381	39.40	0.91
Total to WWTP	98,032	268.58	6.22
Sludge (disposal)	3,657	10.02	0.23
Filtrate recycled to compost	919	2.52	0.06
Treated effluent total	93,457	256.05	5.93
Treated effluent recycled to pulper	15,695	43.00	1.00
Treated effluent to public sewer	77,762	213.05	4.93

Leachate from the waste reception and composting process

Organic waste would be collected and transported to OWTF 2 by dedicated organic waste collection vehicles. On arrival at OWTF 2, the source-separated organic waste would be tipped from the dedicated organic waste collection vehicles into an enclosed receiving pit. Due to the wet nature of organic waste, some leachate generation is anticipated in the reception area.

Dewatering of digestate

The outgoing material from the digester will be conveyed to a centrifuge (separator) to separate liquid and solid fractions, resulting in a wastewater flow of 229.18 m^3/day and a peak flow of 5.31L/s. The wastewater generated would cause adverse water quality impact if discharged uncontrolled.

Condensate from biogas drying, odour treatment and ventilation system

Biogas from the digester contains moisture. Removal of water from biogas by condensation, or other means, is required before conveying gas to a gas holder. A small amount of wastewater would be generated from condensate removal.

In addition a small amount of wastewater would be generated during the odour treatment process.

Washing of waste delivery trucks

Vehicle washing facilities will be provided for washing outgoing waste delivery vehicles. The system would be automatic with high pressure jets washing down wheels and under body. Wash water would require disposal and this could cause adverse water quality impact if uncontrolled.

Untreated wastewater from wastewater treatment plant

Wastewater generated on-site would be treated at wastewater treatment plant before discharge into the public sewerage network. The treatment plant will consist of biological treatment to treat nutrient rich wastewater. Prolonged breakdown of the plant might cause higher loading to the existing sewerage network, as the wastewater is not treated before discharge. In addition, if the plant and pipes are not maintained, leaking of untreated wastewater may occur from damaged pipes or storage tanks and this might cause adverse water quality impact.

Leakage of materials from wastewater treatment

Sludge will generate from the wastewater treatment process. Sludge will be recycled to the composting process and/or disposed of to an appropriate sludge treatment facility off site. If the plant is not maintained, leaking of sludge and wastewater might take place which could lead to adverse water quality impacts.

6.7.2.3 Contaminated Stormwater Runoff and Accidental Spillages

General construction works would be carried out in both wet and dry seasons. Heavy rainfall during wet seasons may generate silty runoff from the site where vegetation has been removed. If the site runoff is not managed properly, runoff may enter the nearby stream/drains causing elevated level of SS (and oil/grease if accidental spillage of chemicals occurred at the site).

Water from composting plant, on-site water treatment facilities and digesters contain high levels of nutrients, *E. coli*, microorganisms and SS. Accidental spillage from these facilities, if not contained properly, may enter the nearby streams/drains causing elevated level of BOD, COD and SS.

6.8 Prediction, Evaluation and Mitigation of Environmental Impact

6.8.1 Construction Phase

6.8.1.1 Construction site runoff

The site practices outlined in ProPECC Note PN 1/94 should be followed as far as practicable in order to minimise surface runoff and erosion, which can cause increase level of SS and DO depletion if entering nearby storm water drains. The following measures are recommended to protect water quality of the inland areas, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impacts:

- At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works and erosion and sedimentation control facilities implemented. Channels, earth bunds or sand bag barriers should be provided on site to direct storm water to silt removal facilities. The design of the temporary on-site drainage system should be undertaken by the Contractors prior to the commencement of construction;

- Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM standards under the WPCO. The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC Note PN 1/94. Sizes may vary depending upon the flow rate. The detailed design of the sand/silt traps should be undertaken by the Contractors prior to the commencement of construction;
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit should be regularly removed, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times;
- Measures should be taken to minimise the ingress of site drainage into excavations. If excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from foundation excavations should be discharged into storm drains via silt removal facilities;
- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at construction site exit where practicable. Wash-water should have sand and silt settled out and removed regularly to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains;
- Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system;
- Manholes (including newly constructed ones) should be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and stormwater runoff being directed into foul sewers;
- Precautions should be taken at any time of the year when rainstorms are likely. Actions should be taken when a rainstorm is imminent or forecasted and actions to be taken during or after rainstorms are summarised in Appendix A2 of ProPECC Note PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes; and,
- Bentonite slurries used on site should be reconditioned and reused wherever practicable. Temporary enclosed storage locations should be provided on site for any unused bentonite that needs to be transported away after all the related construction activities are completed. The requirements in ProPECC Note PN 1/94 should be adhered to in the handling and disposal of bentonite slurries.

The construction phase discharge would be collected by the temporary drainage system installed by the Contractor and then treated or desilted on-site before discharge to storm water drains. The Contractor would be required to obtain a license from EPD under the WPCO for discharge to the public drainage system.

6.8.1.2 General Construction Activities

Implementation of good construction and proper site management should be performed. Collection of construction solid waste, debris and refuse generated on-site, then handled and disposed of properly to avoid entering any nearby stormwater drain; stockpiles of cement and other construction materials should be kept covered when not being used. This can prevent water pollution arising from the wastewater generated from the on-site construction activities. It is anticipated that water quality impacts caused by general construction activities would be insignificant with proper implementation of recommended mitigation measures.

6.8.1.3 Excavation Works

Excavated material and on-site storage of loose soil can generate site runoff during rainfall causing increase of SS concentration in the nearby watercourses. The construction programme should be properly planned to minimise excavation works during the wet season (April to September), temporarily exposed slope/soil surfaces should be covered by a tarpaulin or other means, as far as practicable. Interception channels should be provided (e.g. along the crest/edge of the excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm. Other measures that need to be implemented before, during and after rainstorms are summarized in ProPECC PN 1/94. With the implementation of good construction practices and mitigation measures, no adverse water quality impact is anticipated.

6.8.1.4 Accidental Spillage

The Contractor should register as a chemical waste producer if chemical wastes are produced from 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. This will prevent contamination of top soil and water pollution due to construction site runoff.

Maintenance of vehicles and equipment, involving activities with potential for leakage and spillage, should only be undertaken within areas appropriately equipped to control these discharges.

Oils and fuels should only be stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to any nearby storm water drain, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

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.

With the implementation of good construction practices and mitigation measures, no adverse water quality impact is anticipated.

6.8.1.5 Sewage Effluent from Construction Workforce

Domestic sewage would be generated from the workforce during construction phase. However, temporary sanitary facilities, such as portable chemical toilets should be installed within the construction site to handle sewage from the workforce. The Contractor have the responsibility to ensure that chemical toilets are used and properly maintained, and that licensed Contractors are employed to collect and dispose of the waste off-site at approved locations. Therefore, adverse water quality impact is not anticipated.

6.8.2 Operation Phase

6.8.2.1 Sewage Effluent and Sewerage Impact

During operation of OWTF 2, sewage effluent would be generated from operation staff and visitors. Generated sewage should be discharged to the Shek Wu Hui Sewage Treatment Works (SWHSTW) via a new sewer connection between OWTF2 to the Sha Ling Pumping Station, part of the existing NENT sewerage network.

In order to minimise the risk of exceeding flow capacity of the sewerage system, on-site underground storage of effluent is recommended for the OWTF 2, with a capacity of 6 hours of peak flow. Using the values presented in the preliminary design, the on-site storage required to buffer excess capacity would be equivalent to 30 m^3. A belowground effluent retention tank would function to store effluent produced during peak periods when usage of the Sha Ling pumping station is high. Effluent stored during such periods could then be pumped out of the retention tank and discharged into the public sewer during off-peak times when capacity is sufficient.

With the implementation of the above recommended design measure, no adverse water quality impact is anticipated and no further mitigation measure is considered necessary.

6.8.2.2 Wastewater Generation from Organic Waste Treatment Processes

Wastewater will be generated from the OWTF 2 including leachate from the waste reception and composting process, dewatering of the digestate from the digesters, condensate from biogas drying, odour treatment and ventilation system and washing of waste delivery trucks. Wastewater must be collected and diverted to the wastewater treatment plant.

An adequately sized WWTP with technologies such as membrane bioreactor, reverse osmosis or multi-phase separation process or system should be provided for the OWTF 2. Polluting parameters in the effluent should be in compliance with the requirements as specified in the TM-DSS.

Effluent from on-site wastewater treatment will be discharged to the SWHSTW via a new sewer connection between OWTF2 and the Sha Ling LPS, part of the existing NENT sewerage network. No further mitigation measure is considered necessary.

Leachate from the waste reception and composting process

Due to the high water content of organic waste, occasional formation of leachate would be expected. A drainage system will be provided at the reception area connecting to the proposed onsite WWTP. The leachate would be treated in the WWTP and there would be no direct discharge of leachate, hence, adverse water quality impact would not be anticipated.

Dewatering of the digestate from the separators

The wastewater generated from the dewatering of digestate from the digesters is expected to be around 229.18 m^3/day and a peak flow of 5.31L/s. The on-site WWTP will deploy suitable treatment process in order to reduce the pollution level to an acceptable standard. The effluent shall be treated according to the TM-DSS standard before discharging to foul sewers. Therefore, adverse water quality impact is not anticipated.

Condensate from biogas drying, odour treatment and ventilation system

Condensate from biogas handling and wastewater from the odour treatment process would be collected and transferred to the WWTP. There is no direct discharge of wastewater to the sewer and therefore adverse water quality impact would not be anticipated.

Washing of waste delivery trucks

Surplus wastewater generated from the vehicle washing facilities would be collected and transferred to the WWTP for further treatment before discharging to the foul sewer. Hence, no adverse water quality impact is anticipated.

Untreated wastewater from wastewater treatment plant

Maintenance of the WWTP and its connection pipe work would be conducted regularly to confirm the condition of the holding tank and pipes. This will ensure early detection of any damage for repair or replacement. Hence, no adverse water quality impact is anticipated.

Leakage of materials from WWTP

Regular scheduled maintenance of the WWTP will be carried out to confirm the condition of the facility and detect any damages at an early stage for repair or replacement. Hence, no adverse water quality impact is anticipated.

6.8.2.3 Contaminated Stormwater Runoff and Accidental Spillages

Most of the activities of OWTF 2 will be located in enclosed buildings. Therefore, contaminated materials will not enter stormwater runoff during rainfall. Outside the building, good site practice will be adopted to prevent and contain accidental spillage, if any. All surface runoff and spillage generated inside the facility areas would be collected and transferred to the on-site wastewater treatment plant. Hence, adverse water quality impact is not anticipated.

Regular maintenance of plant facilities, as recommended in Section 6.8.2.2, will be performed to confirm the condition of plant facilities and detect any damage for repair or replacement. Training should be provided to the employees on handling accidental spillage, so that in such cases, actions can be carried out quickly to avoid runoff to nearby streams/drains.

No adverse water quality impacts are anticipated with implementation of the recommended mitigation measures.

6.9 Cumulative Impact

All potential concurrent projects identified in Chapter 2 are in the planning or feasibility study stage. The closest project is the Kong Nga Po CDA Development, which is tentatively scheduled for implementation in 2020. As the water quality impact of the Project is relatively minor, the cumulative impacts arising in conjunction with other project will not be significant, and water quality impacts for other projects, implemented after OWTF2, will be assessed separately.

6.10 Evaluation of Residual Impact

With the implementation of the recommended mitigation measures for the construction and operation phases of the proposed Project, no significant residual water quality impact is anticipated.

6.11 Environmental Monitoring and Audit

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

6.12 Conclusion

During the construction phase, potential water quality impact would be generated from site run-off, sewage from workforce, and discharge of wastewater from various construction activities. With the implementation of the recommended mitigation measures, no adverse water quality impact from the construction works for OWTF 2 is anticipated.

Sewage effluent from operation of the OWTF 2 would be discharged to the SWH STW via a new sewer connection (OWTF2 to Sha Ling LPS) and the existing NENT sewerage network. Adverse water quality impact is not expected.

Wastewater generated from the operation of the OWTF 2 would be adequately treated in the on-site wastewater treatment plant prior to discharge to the public sewerage system. Therefore, no adverse water quality impact is anticipated.