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 identified water quality impacts to an acceptable level. The assessment has been conducted in accordance with Annexes 6 and 14 of EIAO-TM as well as the technical requirements stipulated in Clause 3.4.6 and Appendix D1 of the EIA Study Brief (ESB-261/2013).

6.2 Environmental Legislation, Standards and Guidelines

Relevant legislations, standards and guidelines governing water quality in Hong Kong include the following:

i. Environmental Impact Assessment Ordinance Cap. 499 (Technical Memorandum on Environmental Impact Assessment Process Annexes 6 and 14)

ii. Water Pollution Control Ordinance (WPCO) Cap. 358

iii. Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS)

iv. Practice Note for Professional Persons on Construction Site Drainage (ProPECC Note PN 1/94)

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:

i. Annex 6 Criteria for Evaluating Water Pollution

ii. Annex 14 Guidelines for Assessment of Water Pollution

Water Pollution Control Ordinance (WPCO)

The Water Pollution Control Ordinance (WPCO) (Cap. 358) provides the statutory framework for the protection and control of water quality in Hong Kong. According to the WPCO and its subsidiary legislations, Hong Kong waters are divided into ten Water Control Zones (WCZs). Water Quality Objectives (WQOs) were established to protect the beneficial uses of water quality in WCZs and specific WQOs are applied to each WCZ. As specified in Section 3.4.6.2 of the EIA Study Brief No.ESB-261/2013, the Study Area for the water quality impact assessment should include the Western Buffer and Southern WCZ. The corresponding WQOs are listed in **Table 6.1** to **Table 6.2**.

Table 6.1: Water Quality Objectives for Western Buffer WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in a calendar year.	Secondary Contact Recreation Subzones and Fish Culture Subzones
	Not exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive in 1 calendar year. Samples should be taken at least 3 times in 1 calendar month at intervals of between 3 and 14 days.	Recreation Subzones
	Less than 1 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Water Gathering Ground Subzones
	Less than 1000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Other inland waters
Colour	Not to exceed 30 Hazen units.	Water Gathering Ground Subzones
	Not to exceed 50 Hazen units.	Other inland waters
Depth-averaged DO	Not less than 4 mg L^{-1} for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average (expressed normally as the arithmetic mean of at least 3 measurements at 1m below surface, mid depth and 1m above the seabed. However in water of a depth of 5m of less the mean shall be that of 2 measurements – 1m below surface and 1m above seabed, and in water of less than 3m the 1m below surface sample only shall apply.)	Marine waters except Fish Culture Subzones
	Not less than 5 mg L^{-1} for 90% of the sampling occasions during the years; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1 m below surface, mid-depth and 1 m above seabed).	Fish Culture Subzones
	Not less than 4 mg L^{-1}.	Water Gathering Ground Subzones
Dissolved Oxygen (DO) within 2 m of the seabed	Not be less than 2 mg L^{-1} within 2 m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
	Human activity should not cause the pH of the water to exceed the range of 6.5-8.5 units.	Water Gathering Ground Subzones
	Human activity should not cause the pH of the water to exceed the range of 6.0-9.0 units.	Other inland waters
Salinity	Change due to human activity not to exceed 10% of ambient level	Whole zone
Temperature	Not to exceed 2 ^{o}C change due to human activity.	Whole zone
Suspended Solids (SS)	Not to be raised by more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
	Human activity should not cause the SS of the water to exceed the range of 20 mg L^{-1}.	Water Gathering Ground Subzones
	Human activity should not cause the SS of the water to exceed the range of 25 mg L^{-1}.	Other inland waters

Parameters	Objectives	Sub-Zone
Unionised Ammonia (UIA)	Not to exceed 0.021 mg L^{-1}, calculated as the annual average (arithmetic mean).	Whole zone
Nutrients	Not present in quantities sufficient to cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
5-Day Biological Oxygen Demand (BOD_5)	Not to exceed 3 mg L^{-1}.	Water Gathering Ground Subzones
	Not to exceed 5 mg L^{-1}.	Other inland waters
Chemical Oxygen Demand (COD)	Not to exceed 15 mg L^{-1}.	Water Gathering Ground Subzones
	Not to exceed 30 mg L^{-1}.	Other inland waters
Toxic substances	Not to attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Not to cause a risk to any beneficial use of the aquatic environment due to human activity.	Whole zone
Turbidity	Not to reduce light transmission substantially from the normal level.	Bathing Beach Subzones

Source: Statement of Water Quality Objectives (Western Buffer Water Control Zone).

Table 6.2: Water Quality Objectives for Southern WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in a calendar year.	Secondary Contact Recreation Subzones and Fish Culture Subzones
	Not exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive in 1 calendar year. Samples should be taken at least 3 times in 1 calendar month at intervals of between 3 and 14 days.	Bathing Beach Subzones
Depth-averaged DO	Not less than 4 mg L^{-1} for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average (expressed normally as the arithmetic mean of at least 3 measurements at 1m below surface, mid depth and 1m above the seabed. However in water of a depth of 5m of less the mean shall be that of 2 measurements – 1m below surface and 1m above seabed, and in water of less than 3m the 1m below surface sample only shall apply.)	Marine waters except Fish Culture Subzones
	Not less than 5 mg L^{-1} for 90% of the sampling occasions during the years; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1 m below surface, mid-depth and 1 m above seabed).	Fish Culture Subzones
	Not less than 4 mg L^{-1}.	Inland waters of the Zone
Dissolved Oxygen (DO) within 2 m of the seabed	Not be less than 2 mg L^{-1} within 2 m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
pH	To be in the range of 6.5 - 8.5, change due to human activity not to	Marine waters excepting

Parameters	Objectives	Sub-Zone
	exceed 0.2 units.	Bathing Beach Subzones; Mui Wo (A), Mui Wo (B), Mui Wo (C), Mui Wo (E) and Mui Wo (F) Subzones.
	To be in the range of 6.0 – 9.0 units.	Mui Wo (D) Sub-zone and other inland waters.
	To be in the range of 6.0 – 9.0 for 95% of the samples, change due to human activity not to exceed 0.5 units.	Bathing Beach Subzones
Salinity	Change due to human activity not to exceed 10% of ambient level	Whole zone
Temperature	Not to exceed 2 ^{o}C change due to human activity.	Whole zone
Suspended Solids (SS)	Not to be raised by more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
	Annual median should not exceed 20 mg L^{-1}.	Mui Wo (A), Mui Wo (B), Mui Wo (C), Mui Wo (E) and Mui Wo (F) Subzones
	Human Activity should not exceed 25 mg L^{-1}, calculated as annual median.	Mui Wo (D) Sub-zone and other inland waters.
Unionised Ammonia (UIA)	Not to exceed 0.021 mg L^{-1}, calculated as the annual average (arithmetic mean).	Whole zone
Nutrients	Not present in quantities sufficient to cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.1 mg L^{-1}	Marine waters
5-Day Biological Oxygen Demand (BOD_5)	Not to exceed 5 mg L^{-1}.	Inland waters of the Zone
Chemical Oxygen Demand (COD)	Not to exceed 30 mg L^{-1}.	Inland waters of the Zone
Toxic substances	Not to attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Not to cause a risk to any beneficial use of the aquatic environment due to human activity.	Whole zone

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

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

Under the WPCO, the discharge of effluents are subject to limits set in the *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM-DSS). The limit levels vary depending on the WCZ, the receiving waters and the rate of effluent flow. Effluent discharged into inshore waters and marine waters of the Western Buffer and Southern WCZ should comply with standards set under Table10.a and Table10.b of the TM-DSS.

Practice Note for Professional Persons on Construction Site Drainage (ProPECC Note PN 1/94)

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 minimise the water quality impact due to construction site drainage.

6.3 Assessment Area and Sensitive Receivers

Assessment Area

According to Clause 3.4.6.2 of the EIA Study Brief, water quality impact assessment has been carried out in the assessment area covering the Western Buffer and Southern WCZs. The assessment area is as shown in **Figure 6.1**.

Sensitive Receivers

Key water sensitive receivers (WSRs) that may potentially be affected by the Project are listed in **Table 6.3** and the indicative locations of are shown in **Figure 6.1**.

Table 6.3: Water Sensitive Receivers

ID	Descriptions
Seawater intakes	
C1	Ocean Park Seawater Intake
Typhoon Shelters	
T1	Aberdeen Typhoon Shelter
Gazetted Beach	
B1	Deep Water Bay Beach
Streams	
S1	Natural Stream 1
S2	Natural Stream 2
Corals	
CR1	Corals near Deep Water Bay
CR2	Corals near Pumping Station
CR3	Corals near Sham Shui Kok
CR4	Corals South of Tai Shue Wan
CR5	Corals at Tai Shue Wan

6.4 Description of the Environment

According to the Marine Water Quality in Hong Kong in 2012, which is the latest available information from EPD at the time of writing this report, the Western Buffer WCZ in 2012 attained an overall WQO compliance rate of 75% with a low DO level recorded in the summer months of 2012. The Southern WCZ has attained an overall WQO 67% with high compliance rate of 100% for unionised ammonia and 94% for dissolved oxygen, but TIN recorded at all stations within the Southern WCZ did not comply with the WQO possibly due to influence of Pearl River flow.

The nearest EPD marine water quality monitoring stations to the Project are WT1, WT2, WM1, SM2, SM3 and SM4. A summary of marine water quality monitoring data routinely collected by EPD in 2012 at relevant monitoring stations is presented in **Table 6.4**.

Table 6.4: Marine Water Quality in Western Buffer and Southern Water Control Zones at Selected Stations in 2012

Parameter		Aberdeen (South) WT1	Aberdeen (West) WT3	Hong Kong Island (West) WM1	Hong Kong Island (South) SM2	East Lamma Channel SM3	East Lamma Channel SM4
Temperature (°C)		23.0 (15.3 – 28.5)	22.9 (15.2 – 28.6)	22.9 (15.4 – 27.6)	23.1 (15.7 – 27.9)	22.9 (15.9 – 28.0)	23.3 (16.2 – 28.2)
Salinity		29.8 (26.4 – 32.7)	29.9 (27.4 – 32.5)	31.2 (28.2 – 33.1)	31.6 (29.5 – 33.0)	31.7 (30.4 – 32.9)	31.2 (27.6 – 32.8)
Dissolved Oxygen (DO) (mg/L)	Depth-averaged	7.4 (5.0 – 9.3)	7.1 (4.6 – 9.2)	6.8 (3.6 – 9.5)	6.9 (5.1 – 8.5)	6.7 (4.3 – 8.4)	6.9 (4.5 – 9.0)
	Bottom	7.2 (5.0 – 9.0)	6.5 (4.4 – 9.0)	6.5 (2.1 – 9.6)	6.5 (3.2 – 8.4)	6.3 (3.6 – 8.5)	6.6 (2.6 – 8.7)
Dissolved Oxygen (DO) (% Saturation)	Depth-averaged	101 (76 – 133)	97 (70 – 131)	94 (53 – 126)	96 (77 – 114)	92 (65 – 113)	95 (66 – 113)
	Bottom	99 (75 - 122)	89 (67 - 108)	88 (31 – 115)	90 (46 – 114)	87 (50 – 114)	91 (37 – 114)
pH		7.8 (7.6 – 8.0)	7.8 (7.6 – 7.9)	7.8 (7.5 – 8.0)	7.9 (7.6 – 8.2)	7.8 (7.5 – 8.2)	7.8 (7.5 – 8.2)
Secchi Disc Depth (m)		2.8 (2.0 – 3.5)	2.7 (2.0 – 3.0)	2.7 (2.0 – 3.5)	2.6 (1.8 – 3.0)	2.9 (2.0 – 4.2)	2.7 (1.9 – 3.8)
Turbidity (NTU)		15.5 (1.4 – 81.2)	16.1 (1.48 – 80.0)	12.5 (2.0 – 98.1)	3.7 (0.8 – 7.7)	3.0 (2.2 – 4.3)	2.2 (0.8 – 3.5)
Suspended Solids (SS) (mg/L)		3.3 (1.6 – 4.9)	4.6 (2.0 – 7.9)	6.0 (2.1 – 11.3)	5.8 (1.0 – 12.9)	3.7 (2.2 – 7.0)	3.0 (0.9 – 4.5)
5-day Biochemical Oxygen Demand (BOD_5) (mg/L)		0.5 (<0.1 – 1.1)	0.6 (<0.1 – 1.2)	0.4 (<0.1 – 1.2)	0.5 (0.1 – 1.2)	0.5 (0.1 – 1.6)	0.5 (0.2 – 1.0)
Ammonia Nitrogen (mg/L)		0.055 (0.026 – 0.086)	0.070 (0.050 – 0.113)	0.062 (0.027 – 0.107)	0.051 (0.010 – 0.084)	0.063 (0.011 – 0.107)	0.074 (0.010 – 0.123)
Unionised Ammonia (UIA) (mg/L)		0.002 (<0.001 – 0.005)	0.002 (<0.001 – 0.006)	0.002 (<0.001 – 0.004)	0.002 (<0.001 – 0.006)	0.002 (<0.001 – 0.007)	0.002 (<0.001 – 0.009)
Nitrite Nitrogen (mg/L)		0.035 (0.009 – 0.061)	0.037 (0.011 – 0.063)	0.033 (0.007 – 0.071)	0.025 (0.007 – 0.057)	0.028 (0.008 – 0.069)	0.030 (0.008 – 0.071)
Nitrate Nitrogen (mg/L)		0.256 (0.038 – 0.570)	0.253 (0.050 – 0.460)	0.170 (0.044 – 0.403)	0.114 (0.028 – 0.230)	0.121 (0.038 – 0.223)	0.148 (0.040 – 0.330)
Total Inorganic Nitrogen (TIN) (mg/L)		0.35 (0.13 – 0.69)	0.36 (0.18 – 0.58)	0.27 (0.14 – 0.50)	0.19 (0.09 – 0.33)	0.21 (0.11 – 0.31)	0.25 (0.11 – 0.47)
Total Kjeldahl Nitrogen (mg/L)		0.21 (0.08 – 0.28)	0.24 (0.11 – 0.32)	0.20 (0.14 – 0.28)	0.19 (0.14 – 0.27)	0.21 (0.15 – 0.29)	0.23 (0.13 – 0.40)
Total Nitrogen (mg/L)		0.50 (0.28 – 0.89)	0.53 (0.32 – 0.80)	0.40 (0.22 – 0.66)	0.33 (0.21 – 0.45)	0.36 (0.24 – 0.42)	0.40 (0.21 – 0.57)
Orthophosphate Phosphorus (mg/L)		0.013 (0.003 – 0.029)	0.017 (0.006 – 0.031)	0.015 (0.004 – 0.030)	0.010 (0.004 – 0.023)	0.013 (0.006 – 0.024)	0.013 (0.006 – 0.030)
Total Phosphorus (mg/L)		0.03 (0.03 – 0.04)	0.04 (0.03 – 0.04)	0.03 (0.02 – 0.05)	0.03 (<0.02 – 0.04)	0.03 (<0.02 – 0.04)	0.03 (<0.02 – 0.05)
Silica (as SiO_2) (mg/L)		0.98 (0.53 – 1.37)	1.13 (0.65 – 1.40)	1.02 (0.46 – 1.60)	0.76 (0.21 – 1.20)	0.85 (0.31 – 1.37)	0.82 (0.30 – 1.47)
Chlorophyll-*a* (µg/L)		4.9 (0.6 – 16.9)	4.2 (0.6 – 12.2)	1.9 (0.5 – 7.9)	2.7 (0.6 – 7.9)	2.1 (0.6 – 5.4)	3.0 (0.3 – 11.5)
E. coli (count/100ml)		300 (200 – 850)	2000 (970 – 3200)	71 (7 – 990)	59 (3 – 330)	40 (6 – 220)	16 (1 – 3100)
Faecal Coliforms (count/100ml)		670 (250 – 2000)	3500 (2000 – 6100)	140 (15 – 1300)	110 (15 – 540)	68 (15 – 330)	31 (2 – 4300)

Source: Adopted from EPD Marine Water Quality in Hong Kong in 2012(downloaded online)

Notes:

1. Except as specified, data presented are depth-averaged values calculated by taking the means of three depths: surface, mid-depth, bottom.
2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.
3. Data in brackets indicate the ranges.

6.5 Assessment Methodology

In accordance with Clause 3.4.6 and Appendix D1 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, where applicable, has been recommended.

6.6 Identification, Prediction and Evaluation of Environmental Impacts

Construction Phase

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

- Construction site runoff;
- General construction activities;
- Expansion of existing storm u-channel;
- Interception of natural streams;
- Site Formation works;
- Foundation works;
- Construction of sewage sump pit and rising mains;
- Accidental spillage; and
- Sewage effluent from the construction workforce.

Construction Site Runoff

The surface runoff from construction works areas may contain increased loads of suspended solids (SS) and contaminants. Potential sources of pollution from construction 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 stormwater;
- 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 cause increased levels of SS and DO depletion into nearby channels and stormwater drains.

Mitigation measures and good site practices outlined in ProPECC Note PN 1/94 and listed in **Section 6.7** should be implemented to control construction site runoff and drainage from the works area. The Contractor would also be required to apply for a discharge license under the WPCO. With implementation of the recommended mitigation measures along with compliance of the effluent standards set under TM-DSS, construction site runoff discharge to the nearby channels, storm drains or the marine environment is not anticipated to cause adverse impact to the identified sensitive receivers and adverse water quality impacts.

General Construction Activities

On-site construction activities may result in water pollution from uncontrolled discharge of debris and rubbish such as packaging, construction materials, chemicals and refuse. Good construction and site management practices should be observed to ensure that litter, fuels and solvents do not enter the public drainage system and existing streams and rivers.

With proper implementation of the good construction and site management practices mentioned in **Section 6.7**, water pollution arising from the general on-site construction activities can be prevented, and water quality impacts and impact to the identified sensitive receivers would not be anticipated.

Expansion of Existing Storm U-Channel

The existing 650mm storm u-channel located at the southeast hillside of the Project, discharging to Outfall No. 3, will be insufficient for the 50-year design storm after operation of the Project. The indicative location of the proposed expansion can be found in **Figure 6.2**. As such, there is a need to expand the section of existing storm u-channel before the sand trap of Outfall No. 3. This may result in water pollution from release of SS into the marine environment due to the following activities:

- Excavation;
- General construction activities.

Release of SS into the marine environment during the expansion of the storm u-channel can cause increased levels of SS and oxygen demand to the nearby marine environment. However, with good site practice outlined in ProPECC Note PN 1/94 and proper implementation of mitigation measures mentioned in **Section 6.7** for expansion of existing storm u-channel, the potential water quality impacts due to expansion of storm u-channel would be minimised to within acceptable limits and adverse impacts to the identified sensitive receivers are not anticipated.

Interception of Natural Streams

There are two natural streams behind the existing “Bird’s Paradise” that collect surface runoff and discharge into the artificial pond, “Bird’s Paradise”, which is then intercepted and the runoff will be discharged to Outfall No. 2 near the “Middle Kingdom”. Due to the relocation of the “Bird’s Paradise” and construction of the Project, 75m of S1 will be foreshortened and diverted to Outfall No.1 near Sham Wan Road via the new site drainage channel as shown in **Figure 6.2**. S2 will not be affected, but the existing box culvert diverting the stream to the “Flamingo Pond” will be demolished and the water from S2 will be

diverted to the storm outfall at the southeast hillside of the Project via the new site perimeter u-channel. The u-channels will be constructed using the "open cut" method. The indicative location of the proposed site drainage channel and can be found in **Figure 6.2**.

Based on the construction method, potential water quality impacts due to SS release would be during excavation and storage of stockpiles on site. With the proper implementation of mitigation measures mentioned in **Section 6.7** for interception of natural streams, the potential water quality impacts due to diversion of the natural streams would be minimised to within acceptable limits and adverse impacts to the identified sensitive receivers are not anticipated.

Site Formation Works

Construction of the Project involves excavation for site formation. Excavated material may have to be stored on-site before being sorted and reused or transported off-site. On-site stockpiles of construction materials may generate site runoff during rainfall events if the stockpile is not properly covered. Seawater seepage through the seawall is not anticipated as the excavation will not reach the water table. The resulting site runoff from the site formation area will contain high levels of suspended solid and may lead to increased SS levels and oxygen demand if washed into nearby streams, storm drains or marine environment.

Stockpiles of excavated materials will be covered with tarpaulin or similar impermeable cover to minimise runoff generation. With adoption of the aforementioned excavation method and implementation of the good construction practices as stated in ProPECC Note PN 1/94 and the recommended mitigation measures mentioned in **Section 6.7** for site formation works, no adverse impact to the identified sensitive receivers and water quality impact are anticipated.

Foundation Works

Foundation works are required for supporting the future building structures. As mentioned in **Chapter 2**, pre-bored H-pile is more likely to be adopted due to suitability in boring through rocks and to the moderate levels of anticipated building loads. Water generated from bored piling process will contain high SS levels and may lead to increased SS levels and oxygen demand if washed into nearby streams, storm drains or marine environment.

Mitigation measures recommended in **Section 6.7** for foundation works, such as temporary drainage system and good site practices as stated in ProPECC Note PN 1/94 should be properly implemented to collect all un-treated water from the works area, and avoid un-treated water entering nearby storm drains or the marine environment. With implementation of the good construction practices and the recommended mitigation measures, no adverse impact to the identified sensitive receivers and water quality impact are anticipated.

Construction of Sewage Sump Pit and Rising Mains

Under the current design, sewage generated from the Project will be discharged to the sewer main at Nam Long Shan Road via a pump room and rising mains up the hillside with an emergency overflow pipe connected to the Sham Wan Road public sewers. Twin rising mains with a diameter of 150mm each will be constructed between the new sewage sump pit and the receiving DSD manhole at Nam Long Shan Road. The rising mains will be constructed with concrete support and laying of precast pipe units without any

excavation required. The construction of the sewage sump pit may result in water pollution from release of SS into the marine environment due to the following activities:

- Sheet piling;
- Excavation.

Excavated material may have to be stored on-site before being sorted and reused or transported off-site. On-site stockpiles of construction materials may generate site runoff during rainfall events if the stockpile is not properly covered. Water generated from sheet piling activities and the resulting site runoff from stockpiles will contain high levels of suspended solid and may lead to increased SS levels and oxygen demand if washed into nearby streams, storm drains or marine environment.

Stockpiles of excavated materials will be covered with tarpaulin or similar impermeable cover to minimise runoff generation and site runoff should be diverted to wastewater treatment facilities for treatment prior to discharge. With adoption of the aforementioned excavation method and implementation of the good construction practices as stated in ProPECC Note PN 1/94 and the recommended mitigation measures mentioned in **Section 6.7** for construction of sewage sump pit and rising mains, no adverse impact to the identified sensitive receivers and water quality impact are anticipated.

Accidental Spillage

Chemicals and fuel would 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 generate water pollution to nearby sensitive receivers.

However, it is expected that with the implementation of proper storage of chemicals and spill containment measures, contamination of top soil and water pollution due to construction site runoff can be prevented. Hence with implementation of the good construction practices and mitigation measures specified in **Sections 6.7** for accidental spillage, no adverse impact to the identified sensitive receivers and water quality impact are anticipated.

Sewage Effluent from the 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. With implementation of mitigation measures suggested in **Section 6.7** for sewage effluent from the construction workforce, adverse water quality impact and impact to the identified sensitive receivers are not anticipated.

Operation Phase

Potential sources of water quality impact associated with operation of the Project include:

- Sewage from staff and visitors;
- Discharge of used pool water;

- Discharge of spent cooling water;
- Discharge from flamingo pond and sea turtle exhibit;
- Overflow from the New Sewage Sump Pit;
- Runoff from road surfaces; and,
- Runoff from on-site planting area.

Sewage from Staff and Visitors

Sewage and wastewater effluents generated from the staff and visitors at the Project will contain high levels of nutrients. Untreated discharge of domestic sewage into the water environment would cause excessive algal growth and reduce dissolved oxygen in the water body.

Sewage generated on site will be connected to the public sewerage. It is proposed to be discharged to the 450mm diameter sewer at Nam long Shan Road and then conveyed to the Aberdeen Preliminary Treatment Works (APTW). It is estimated that total average dry weather flow (ADWF) generated from the proposed Project and peak sewage flow to be handled by APTW in 2021 would be approximately 68,042m^3/day and 1.65 m^3/s (Peak flow) respectively. Based on the Sewage Impact Assessment in **Chapter 7**, the existing APTW will have adequate capacity to handle the increased sewage loads generated from the Project. Hence adverse water quality impact and impact to the identified sensitive receivers due to the additional sewage and wastewater generated by the Project is not anticipated.

Discharge of Used Pool Water

As confirmed by the Operation Team, an approximate 10,500m^3 of used pool water will be generated and discharged from the 28 swimming pools on site annually during operation under a separate flushing system from the backwash system, as shown in **Figure 6.3**. Volumes of each pool have been summarised in **Table 6.5**. As the Project will maintain operational throughout the year, discharge of pool water will be performed in phases with several pools at a time, and the discharge volume per day will not exceed the highest flow band set in table 10b of the TM-DSS, which is 6000m^3.

The used pool water will contain 0.2 mg/L of residual chlorine. As the residual chlorine level is within the 1mg/L of TM-DSS effluent criteria, the impact due to residual chlorine discharge is anticipated to be minimal. With reference to **Section 10.6.10.2**, impact to the nearby marine ecology due to discharge of used pool water is anticipated to be insignificant. Impact to other identified sensitive receivers is also anticipated to be insignificant.

Table 6.5: Volumes for the Designed Pools

POOLS	Volume (m^3)
Major Pools	**>1000m^3**
Usable Wave Pool	2002
River Channel	1919
Usable Indoor Wave Pool	1636
River Channel / Lagoon	1585

POOLS	Volume (m^3)
Play Structure pool area (includes Play Structure and Slides)	1045
Minor Pools	**<1000m^3**
Infinity Pool 1	221
Teen Activity Pool	385
8 x Outdoor Spas	180 (total)
Whirlpool 2	37
Whirlpool 3	163
Toddler Pool	122
Cavern pool 1	17
Cavern pool 2	17
Cavern pool 3	17
Cavern pool 4	17
Cavern pool 5	17
Cavern pool 6	17
Double Surf Ride	156
Plunge Pool 1	357
Plunge Pool 2	174
Plunge Pool 3	357

Cleaning on the pool deck areas and removing leaves from the pool will be performed weekly and detergents/bleach will only be used to clean the pool deck areas and stone cleaning agent will only be used inside the pool area if needed to remove localised stains on pool floor. Discharge of detergents/bleach and stone cleaning agent, if untreated, can cause adverse effects to the receiving water bodies by increasing algae growth and oxygen demand, causing adverse ecological effect and affecting the pH around the discharge location.

Backwash water from the daily operation of the pool will be collected and treated by the on-site filtration system and then discharged to the sewage system together with the water generated at the pool deck areas. As the detergents/bleach used for cleaning the pool deck areas will be discharged to the sewerage network, no direct discharge is anticipated. As such, water quality impact from the detergents/bleach is considered to be insignificant.

Pool cleaning will be performed after the pools have been drained, stone cleaning agent will be used at localised areas when necessary. As the amount of stone cleaning agent used is insignificant when compare to the amount of pool water discharge, water quality impact from the stone cleaning agent is considered to be insignificant.

It is proposed that the used pool water will be discharged annually to Outfall No. 1, southwest of Middle Kingdom and the sea near Nam Long Shan. The existing storm u-channel can cater for the additional flow and would not require expansion, and the existing sewage network leading to the APTW can handle the additional load from backwash. A discharge license will be obtained under the WPCO. As no direct discharge of cleaning agents is expected at any time, no water quality impact and impact to the identified sensitive receivers are anticipated. The locations of the proposed drainage network and outfall locations are shown in **Figure 6.2**.

Discharge of Spent Cooling Water

As part of the new facilities, potable water will be used in the chiller systems. Ocean Park Corporation will consult Water Supplies Department (WSD), Electrical and Mechanical Services Department (EMSD) and Building Authority (BA) and obtain their endorsement and approval under the "Fresh Water Cooling Towers Scheme for Air Conditioning Systems". At this stage, WSD has no objection in principle over the use of portable water for cooling. Spent cooling water will be at a temperature of 38°C and contain residual chlorine at a concentration of 0.3mg/L, hence discharge of the spent cooling water into nearby storm drains or marine environment will increase the thermal and pollution loads in the receiving water bodies.

According to **Chapter 7**, during the annual cleaning process, additional chlorine will be used for cleaning the chiller tank, leaving the residual chlorine level at 5mg/L. The amount of discharge will be less than 1m^3 per day, and it will be discharged to the sewage system and diverted to APTW for treatment. The effluent quality will fulfil the criteria set in table 1 of the TM-DSS for discharges into foul sewers leading into the Government sewage treatment plants. As such, water quality impact and impact to the identified sensitive receivers are considered to be minimal.

According to the scheme design, a continuous release of 1.6L/s of spent cooling water will be generated during the Ocean Park opening hours (0900 to 2300). The spent cooling water generated will be reused on site for flushing purposes. Under the current design, a total amount of 561.57 m^3/day of flushing water is required for the Project, which will fully utilise the 69.12 m^3 spent cooling water generated daily. Hence, no spent cooling water will be directly discharged, and water quality impact and impact to the identified sensitive receivers are not anticipated.

The discharge from the cleaning of chiller tank and daily spent cooling water is not anticipated to occur at the same time. In the case where the two will be discharged together, the effluent quality will still comply with the criteria set in table 1 of the TM-DSS for discharges into foul sewers leading into the Government sewage treatment plants. As such, water quality impact and impact to the identified sensitive receivers are not anticipated.

USEPA Guidelines for Water Reuse (2004) were used for the Project Profile of Tseung Kwan O Area 86 Property Development - Rainwater and Grey Water Recycling (PP-278/2006) as a guidance standard on the water quality of the reused water.

Since then, USEPA has launched the NSF 350 Standard in the 2012 USEPA Guidelines for Water Reuse standard, which will be adopted in this Project along with the EMSD water quality objectives for re-use of spent cooling water as flushing supply and summarised in **Table 6.6** and **Table 6.7**. The Standard 350 effluent criteria are applied consistently to all treatment systems regardless of size, application, or influent quality. When the criteria in **Table 6.6** are met**,** it means the reclaimed or reused water is appropriate for indoor restricted urban water use, such as toilet flushing, and outdoor unrestricted urban use, such as surface irrigation.

Table 6.6: NSF 350 Standard under 2012 USEPA Guidelines for Water Use (Commercial Facility)

Parameters	Criteria	
	Test Average	Single Sample Maximum
BOD_5 (mg/L)	10	25
TSS (mg/L)	10	30

Parameters	Criteria	
	Test Average	Single Sample Maximum
Turbidity (NTU)	2	5
E. coli (MPN/100 mL)[2]	2.2	200
pH (SU)	6.0 – 9.0	N/A
Storage vessel disinfection (mg/L)[3]	≥ 0.5 – ≤ 2.5	N/A
Colour	MR	N/A
Odour	Non offensive	N/A
Oily film and foam	Non detectable	Non detectable
Energy consumption	MR	N/A

Source: NSF 350 Standard, 2012 Guidelines for Water Reuse, September 2012
Note:
1. N/A represents not applicable.
2. Calculated as geometric mean.
3. As total chlorine; other disinfectants can be used.
4. MR represents Measured reported only.

Table 6.7: EMSD Water Quality Objectives for Re-use of Spent Cooling Water as Flushing Supply

Parameters	Water Quality Objectives
SS (mg/L)	<10
DO (mg/L)	>2
BOD_5 (mg/L)	<10

Source: Code of Practice for Water-cooled Air Conditioning System, Part 2: Operation and Maintenance of Cooling Towers, 2006 Edition, EMSD

The operator should ensure the water quality of the spent cooling water meets the standards set in **Table 6.6** and **Table 6.7** before use for flushing.

Discharge from Flamingo Pond and Sea Turtle Exhibit

Currently, there are no discharges from the flamingo pond at the Ocean Park during normal operation (there is occasional discharge of excess storm water entering the ponds from the hinterland streams, which overflows to the storm water drain after heavy rainfall). The flamingo pond is subject to natural evaporation and in fact fresh water is regularly added to top up the water level. Discharge from the flamingo pond will be performed as needed, and the amount, in combination of the discharge of used pool water and Sea Turtle Exhibit, should not exceed 6000m^3 per day.

Backwash water from the Flamingo and Sea turtle Exhibit are to be stored, treated then reused in these systems. The actual waste discharge is not related to the amount of backwash to be undertaken in these systems. The systems that treat the backwash water will, from time to time (once weekly) need to discharge small amounts of water. At these times the total volume would not exceed 60m^3 on days where discharge is required. All discharged water will be sterilised via passage through UV units. This system recycles as much water as possible in the sea turtle exhibit and flamingo pools to minimise discharges, energy usage and allows greater system control when compared to high volume exchanges daily. Daily system recirculation is equal to 99.7% of total system volume. As mentioned above, the discharge quantity, in combination of the discharge of used pool water and Flamingo Pond, should not exceed 6000m^3 per

day. As the discharge water is filtered and disinfected seawater, there should be no concern over discharge back to the sea in the limited volume.

The water from both locations will be treated regularly with ozone, and then filtered with carbon filter follow by UV treatment to prevent microbial growths and filtration of fine materials. As such, the water discharge is not anticipated to contain a high level of nutrients or fine materials and water quality impact and impact to the identified sensitive receivers are anticipated to be minimal.

Overflow from the New Sewage Sump Pit

According to **Chapter 7**, a new sewage sump pit with a capacity of 12m^3 will be provided as part of the Project to convey the additional sewage loads generated by the Project to the public sewerage network at Nam Long Shan Road. The sewage sump pit will have a connection to the existing Sham Wan Road sewerage networks, under emergency, any sewage will overflow into the existing sewerage networks. As such, there will not be any emergency discharge to the marine environment. Therefore, no water quality impact and impact to the identified sensitive receivers are anticipated.

Runoff from Road Surfaces

Runoff from road surfaces may contain grit, oil and debris from the road users including vehicles and pedestrians. As mentioned in **Section 6.7** for runoff from road surfaces, the road drainage system design has already included silt traps in the gully inlets to remove silt and grit before the runoff enters the public storm water drainage system. Regular general cleaning will be performed around the Ocean Park area to remove refuse from road surfaces to avoid refuse getting into the storm drains.

With the increase in paved areas from Project and the new onsite storm drainage system, Outfall No. 3 will receive an increase storm load. As mentioned in **Section 6.4**, Southern WCZ currently does not meet the TIN WQO. Although the discharge location of Outfall No. 3 is situated inside the Western Buffer WCZ, it is approximately just 190m away from the Southern WCZ, and additional discharge might cause stress to the water body of Southern WCZ.

A simple model was used to calculate the mixing zone of TIN due to Project, based on the results in **Table 3** of **Appendix 6.1**, the additional TIN load due to Project is below the Western Buffer or Southern WCZ WQO for TIN, therefore, impacts to the water quality in Southern WCZ is not anticipated.

With the mitigation measures mentioned in **Section 6.7** in place, it is expected that the impact on water quality and the identified sensitive receivers will be minimal.

Runoff from On-site Planting Area

According to scheme design consultant, 0.01L/m^2 of fertilizers is estimated to be applied weekly after to the plants at Project area and pesticides and herbicides will only be used in the case of pest and weed control during operation. Excessive amount of pesticides, herbicides and fertilizers on plants will be washed away during watering. If the runoff enters the storm drains system without treatment, pesticides, herbicides and fertilizers may enter the receiving water bodies causing increase in pollution loads, excessive algal growth and reduce dissolved oxygen.

With the implementation of the mitigation measures measured in **Section 6.7** for runoff from on-site planting area, pesticides, herbicides and fertilizers discharge to the drainage system is anticipated to be minimal. As such, impact to the identified sensitive receivers and water quality impact due to discharge of pesticides, herbicides and fertilizers are considered to be minimal.

6.7 Recommendation of Mitigation Measures

Construction Phase

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. The following measures are recommended to protect water quality of the inland areas:

- 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 site formation 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 Contractor would be required to obtain a license from EPD under the WPCO for discharge to the public drainage system or the marine environment. Construction site discharge should be collected by the temporary drainage system installed by the Contractor and treated or desilted on-site to fulfil the WPCO discharge license requirements before discharge.

General Construction Activities

Best Management Practices (BMPs) should be implemented at the construction site, including proper handling, sorting and storage of construction solid waste, debris and refuse generated on-site prior to disposal. Stockpiles of cement and other construction materials should be kept covered when not being used. The Contractor should also follow the guidelines set in the “Pesticides Used for Outdoor Mosquito Control”, published by AFCD in 2010, for mosquito control on site to avoid water quality impact.

Expansion of Existing Storm U-Channel

As mentioned in **Section 6.6** for expansion of existing storm u-channel, the expansion of sections of existing storm u-channel before the silt trap is required to cater for the 50-year design storm after operation of the Project. No works will be conducted at or outside of seawall. Guidelines and measures summarised in ProPECC PN 1/94 for trenching activities should be implemented.

Interception of Natural Streams

Guidelines and measures summarised in ProPECC PN 1/94 for excavation and stockpiling activities should be implemented.

Site Formation Works

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. Measures will be taken to minimise water ingress into the excavation. Diverting any water from the excavated areas to on-site wastewater treatment facilities for treatment prior to discharge

should also be performed. Other measures that need to be implemented before, during and after rainstorms are summarised in ProPECC PN 1/94.

Foundation Works

As mentioned above for the construction site runoff, the Contractor would be required to obtain a license from EPD under the WPCO for discharge to the public drainage system or the marine environment. Water generated from the bored piling activities should be treated to ensure that the requirements of the TM standards under the WPCO are met before discharge at the designated location.

Construction of Sewage Sump Pit and Rising Mains

Measures for excavation works summarised for site formation works should also be implemented during construction of the sewage sump pit.

During the laying of rising mains, guidelines and measures summarised in ProPECC PN 1/94 for trenching activities should be performed. Concrete water generated from the construction of the concrete support should be collected and treated with the wastewater treatment facilities prior to discharge.

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.

Sewage Effluent from the Construction Workforce

The Contractor should provide temporary sanitary facilities, such as portable chemical toilets within the construction site to handle sewage from the workforce. The Contractor has 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.

Operation Phase

Sewage from Staff and Visitors

According to **Chapter 7**, during operation of the Project, sewage effluent would be discharged to the existing APTW via the new sewage sump pit then the new rising main, which is connected to the existing 450mm diameter sewer connection at Nam Long Shan Road. It is estimated that the additional sewage volume from the Project can be handled by the APTW and no further mitigation measure is required.

Discharge of Used Pool Water

Discharge of used pool water to the storm drains and water from pool deck area to the sewage system will be subject to the future WPCO discharge license. Given that the concentration of residual chlorine is below the 1mg/L TM-DSS effluent discharge criteria and the water from pool deck area should meet the TM-DSS effluent discharge criteria, no water quality impact is anticipated and no specific mitigation measure is required.

Discharge of Spent Cooling Water

As the spent cooling water will be fully utilised on site as flushing water, there will be no direct discharge to the environment and no specific mitigation measure is required.

Discharge from Flamingo Pond and Sea Turtle Exhibit

As mentioned in **Section 6.6** for “Discharge from Flamingo Pond and Sea Turtle exhibit”, discharge to the environment is not anticipated to contain high level of nutrients. As such, no specific mitigation measure is required.

Overflow from the New Sewage Sump Pit

As mentioned in **Section 6.6**, an emergency overflow pipe will be constructed and connected to the existing sewerage network at Sham Wan Road. Any overflow will be discharged to the public sewer networks and no emergency discharge into the sea is anticipated and no specific mitigation measure is required.

Runoff from Road Surfaces

Road drainage system design has already included silt traps in the gully inlets to remove silt and grit before the runoff enters the public storm water drainage system. Silt traps should be regularly checked and maintained to ensure efficient operation.

Runoff from On-site Planting Area

As major runoff of the pesticides, herbicides and fertilizers is generated during watering, it is recommended that watering of plants on site should always be performed before application of pesticides, herbicides and fertilizers. Regular training should also be provided to frontline staff on the appropriate treatment and disposal of pesticides, herbicides and fertilizers.

6.8 Evaluation of Residual Impact

Construction Phase

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

Operation Phase

No significant residual water quality impact is anticipated with the current design and implementation of the recommended mitigation measures.

6.9 Cumulative Impact

As mentioned in **Chapter 2**, the construction programme and operation commencement time of the hotel development is yet to be confirmed. As such, no concurrent project could be identified for cumulative impact assessment.

6.10 Conclusion

Construction Phase

During the construction phase, potential water quality impact would be generated from foundation works, 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 the Project is anticipated.

Operation Phase

Sewage effluent from operation of the Project would be discharged to the APTW via a new sewer connection to the existing sewerage network at Nam Long Shan Road and no overflow is anticipated from the new sewage sump pit.

Other potential impacts during operation phase include discharge of used pool water, spent cooling water and Flamingo Pond and Sea Turtle exhibit, and runoff from road surfaces and planting areas. With implementation of the recommended mitigation measures, adverse water quality impact is not expected.