11. Fisheries Impact Assessment

11.1 Introduction

This section addresses the potential fisheries impacts that may arise from the construction and operation of the Project and the associated works. The findings of literature review were presented. The potential impacts on the fisheries sensitive receivers within the study area were assessed in accordance with the criteria and guidelines stated in Annexes 9 and 17 of the EIAO-TM and suitable mitigation measures were proposed during both construction and operation phases to mitigate the potential adverse impacts to an environmentally acceptable level.

11.2 Environmental Legislations, Standards and Guidelines

The following legislation, standards and guidelines related to capture and culture fisheries and fisheries impact assessment have been adopted in the assessment:

- Fisheries Protection Ordinance (Cap 171);
- Marine Fish Culture Ordinance (Cap 353);
- Water Pollution Control Ordinance (WPCO) (Cap. 358); and
- Environmental Impact Assessment Ordinance (Cap. 499) and the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

Fisheries Protection Ordinance (Cap. 171) – Fishing activities in Hong Kong are governed by the Fisheries Protection Ordinance, in which destructive fishing practices are prohibited in the Hong Kong waters including the use of explosive, toxic substances, electric-fishing, dredging and suction devices that damage the seabed. Trawling activities (including pair, stern, shrimp and hang trawling) have been banned since 31 December 2012 for the protection of fisheries resources and the marine ecosystem.

Marine Fish Culture Ordinance (Cap 353) – The operation of marine fish culture activities is regulated by the Marine Fish Culture Ordinance. Culture activities include the provision of rafts or impoundments, which are located in designated areas under a licensing system.

WPCO (Cap. 358) – 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 WCZs. WQOs were established to protect the beneficial uses of water quality in WCZs and specific WQOs are applied to each WCZ.

EIAO-TM – The technical memorandum is issued under the EIAO (Cap. 499) Section 16 which sets out the principles, procedures, guidelines, requirements and criteria for conducting an EIA. Annexes 9 and 17 of the EIAO-TM specify the criteria for evaluating fisheries impact and provide guidelines for carrying out a fisheries impact assessment.

11.3 Assessment Methodology

11.3.1 Study Area

Information from the water quality impact assessment was used to determine the size of the study area as that potentially affected by perturbations to water quality parameters. The study area includes areas within 500 meters from the boundary of the Project area and covers the Western Buffer and Southern WCZs, as designated under the WPCO (Cap. 358). The assessment area is shown in **Figure 11.1**.

11.3.2 Literature Review

Baseline information on fisheries resources in the assessment area was amassed via desktop review of available literatures. This review included relevant fisheries baseline data presented in Port Survey 2006 (AFCD, 2013a) and other relevant information available in other reports and publications, including but not limited to the following:

- Fisheries Resources and Fishing Operations in Hong Kong Waters, ERM (1998);

The information available was comprehensive and no information gaps were identified and therefore no fisheries field surveys were considered necessary.

The impact assessment followed the criteria and guidelines for evaluating and assessing fisheries impacts as stated in Annex 9 and 17 of the EIAO-TM.

11.4 Baseline Conditions

11.4.1 Description of Physical Environmental Background

A detailed description of the physical marine habitat is presented in the Water Quality Assessment and the key aspects are summarised below.

In terms of water quality, the Western Buffer WCZ in 2011 attained an overall WQOs compliance rate of 75% with a low DO level recorded in the summer months of 2011. The Southern WCZ has attained an overall WQO 67% with high compliance rate of 100% for unionised ammonia and 94% for DO, but TIN recorded at all stations within the Southern WCZ did not comply with the WQO, possibly due to influence of Pearl River flow (EPD, 2012).

The Western Buffer WCZ and Southern WCZ contain areas of fisheries importance, details of which are described below. Within Western Buffer WCZ there is the Ma Wan fish culture zone (FCZ) (>16 km away). Within the Southern WCZ, there is the Cheung Sha Wan FCZ at Lantau Island (>16 km away), and Sok Kwu Wan FCZ (>5 km away) and Lok Tik Wan FCZ and its associated artificial reefs (ARs) (>4 km away) at Lamma Island, and Po Toi FCZ (>11 km away). Several sites within the Southern WCZ, such as Waglan (>15 km away), South Cheung Chau (>15 km away), Stanley (>6 km away) and South Lamma (>7 km away) were identified as important spawning grounds for commercial fish and crustaceans, while Sok Kwu Wan (>5 km away) and South Cheung Chau were observed to be important nursery grounds for juvenile fish, crustaceans and molluscs (ERM, 1998). The Cape d' Aguilar Marine Reserve (>10 km away) is also situated within the Southern WCZ. However given the lack of marine construction works, potential impacts are focused on the 500m assessment area and its immediate vicinity, within which no site of fisheries importance was identified.

11.4.2 Capture Fisheries

Fisheries Operation

In 2012, the capture fishing industry in Hong Kong produced an estimated 155,230 tonnes of fisheries produce valued at about $2,317 million (AFCD, 2013a). The industry consisted of approximately 4,000 fishing vessels and 8,800 local fishermen working on-board. Most of the fishing vessels were manned by family members with assistance of hired crew. Main fishing methods included trawling, long-lining, gill-netting and purse-seining, with the majority of total catch obtained through trawling.

The latest AFCD Port Survey 2006 (AFCD, 2013a) provides the best available information on capture fisheries in Hong Kong waters, including fishing activities (**Figure 11.2**), adult fish production (**Figure 11.3**), fish fry production (**Figure 11.4**) and fisheries production in terms of value (**Figure 11.5**). In Port Survey, grid cells are normally categorised into one of 6 classes (except for fish fry production), and in the following text the classes will be textually described as very low, low, moderately low, moderate, high and very high respectively. As a territory-wide trawl ban has been implemented since 31 December 2012, fishing activities and fisheries resources below would be discussed in view of the absence of trawlers from Hong Kong. It should be noted that vessels exceeding 15m length usually include many trawlers.

Within the Western Buffer WCZ, the level of overall fishing operations vary in different places, ranging from very low to moderate (> 0 – 400 vessels), out of which number of fishing vessels less than 15m length was very low to moderate (> 0 – 400 vessels) and number of fishing vessels greater than 15m length was very low to low (> 0 – 50 vessels). Therefore it is supported mostly by fishing vessels less than 15m. The types of fishing vessels operating in the study area included gill netter, long liner, hand liner, purse seiner, sampan and miscellaneous crafts, and sampans were the dominant fishing vessels (AFCD, 2013a).

Within the Southern WCZ, the level of overall fishing operations vary in different places, ranging from very low to high (> 0 – 700 vessels), out of which number of fishing vessels less than 15m length was very low to high (> 0 – 700 vessels) and number of fishing vessels greater than 15m length was very low to moderate (> 0 – 400 vessels). Therefore it is supported mostly by fishing vessels less than 15m. Locations with high level of fishing activity include Southern Lamma (>6 km away) and around Po Toi. The types of fishing vessels operating in the study area included gill netter, long liner, hand liner, purse seiner, sampan and miscellaneous crafts, and sampans were the dominant fishing vessels (AFCD, 2013a).

Within the 500m assessment area, the level of overall fishing operations was moderately-low (50 – 100 vessels), out of which number of fishing vessels less than 15m length was moderately-low (50 – 100 vessels) and number of fishing vessels greater than 15m length was very low (> 0 – < 10 vessels). Therefore it is supported mostly by fishing vessels less than 15m. The types of fishing vessels operating in the study area included gill netter, long liner, hand liner, purse seiner, sampan and miscellaneous crafts, and sampans were the dominant fishing vessels (AFCD, 2013a).

Fisheries Resources

Within the Western Buffer WCZ, the production of adult fish was very low to moderate (> 0 – 400 kg/ha) while there was no reported fish fry fisheries production from the fishermen. Production of adult fish by vessels less than 15m length was very low to moderate (> 0 – 400 kg/ha), with most contributions by sampans and purse seiners. Production of adult fish by vessels more than 15m was very low to low (> 0 to 100 kg/ha) with most contributions by trawlers. Contribution of vessels less than 15m length was relatively high. The most common capture fish was rabbitfish (Siganidae) with catches of more than 40 kg/ha.

Fisheries production in terms of value was very low to moderate (> 0 – 5,000 HK$/ha) (AFCD, 2013a). The area was also not found to be an important spawning or nursery ground for commercial species (ERM, 1998).

Within the Southern WCZ, the production of adult fish was very low to very high (> 0 – 1000 kg/ha) while fish fry production was only reported around Northeastern Lamma (Luk Chau Wan and Sok Kwu Wan) at > 0 to 100 tails/ha, and around Po Toi at > 0 to < 50 tails/ha. Production of adult fish by vessels less than 15m length was very low to moderate (> 0 – 400 kg/ha) while that by vessels more than 15m length was very low to high (> 0 – 600 kg/ha). Locations with high or very high adult fish production include Soko Islands (>27 km away), South Cheung Chau, South Lamma and Po Toi. Scad (Carangidae) and shrimp were the most common capture species with catches of more than 60 kg/ha. Outside of the Southern WCZ, shrimp may also be found in high abundance around Tai O and Yan O. Production of croaker (Sciaenidae) was very low to high (< 5 – 60 kg/ha) while production of seabream (Sparidae) was very low to moderately-low (< 5 – 20 kg/ha). Fisheries production in terms of value was very low to very high (> 0 – 20,000 HK$/ha) (AFCD, 2013a). Fisheries Resources and Fishing Operations in Hong Kong Waters (ERM, 1998) also support the results of the Port Survey, as it was found to be important spawning and nursery grounds for a number of commercial species, including the fish species *Leiognathus brevirostris, Johnius belangerii, Protonibea diacanthus, Gymnothorax reevesii, Inegocia japonica, Alepes djedaba, Acanthopagrus schlegelii schlegelii, Cynoglossus macrolepidotus, Larimichthys crocea* and *Oxyurichthys tentacularis*; the shrimp species *Metapenaeus joyneri, Solenocera crassicornis, Metapenaeus affinis, Metapenaeopsis barbata* and *Metapenaeopsis palmensis*; the crab species *Portunus pelagicus*; and the mantis shrimps *Oratosquilla spp*. and *Dictyosquilla foveolata*.

Within the 500m assessment area, the production of adult fish was moderate (200 – 400 kg/ha) while there was no reported fish fry fisheries production from the fishermen. Adult fish production by vessels less than 15m length was moderate (200 – 400 kg/ha) while that by vessels more than 15m length was very low (> 0 to ≤ 50 kg/ha). Rabbitfish (Siganidae) and squid were the most common capture species with catches of 40 – 60 kg/ha. Outside of the assessment area, squid may also be found in high abundance around Po Toi, Ninepin Islands, Shelter Island and Grass Island. Production of croaker (Sciaenidae) was low (5 – 10 kg/ha) while production of seabream (Sparidae) was very low (< 5 kg/ha). Fisheries production in terms of value was moderate (2,000 – 5,000 HK$/ha) (AFCD, 2013b). The area was also not found to be an important spawning or nursery ground for commercial species (ERM, 1998).

Fisheries Enhancement Areas

AFCD has been implementing an Artificial Reef (AR) project since 1996 to enhance fisheries resources and promote biodiversity in Hong Kong's marine waters (AFCD, 2013b). There is one AR site in the Southern WCZ at Lo Tik Wan FCZ, consisting of 6 units of biofilters with a total volume of 330 m^3, which were deployed in 2008 with the objective of enhancing habitat quality and marine resources. However, the AR is situated far away from the Project footprint (>4 km away).

The Cape D'Aguilar Marine Reserve, which lies on the southeastern tip of Hong Kong island and occupying a total sea area of approximately 20 ha, was designated on 5 July 1996 (AFCD, 2013c). It is the only marine reserve in Hong Kong where all kinds of fisheries activities are prohibited, and serves the purpose of enhancing fisheries resources in the surrounding area. However, the marine reserve is located far away from the Project footprint (>10 km away).

11.4.3 Culture Fisheries

In 2012, the total production of marine fish culture in Hong Kong was estimated to be 1,299 tonnes valued at $117 million. There are 26 FCZs occupying about a total marine area of 209ha, and operated by 1,008 licensed operators (AFCD, 2013d). Most of the licensed farms are small, family-based and consist of one to two rafts with average total area of around 290 m^2. Common marine fish species under culture in Hong Kong include green grouper, brown-spotted grouper, giant grouper, Russell's snapper, mangrove snapper, goldlined seabream, star snapper and red drum. Within the Western Buffer WCZ, there is the Ma Wan FCZ; within the Southern WCZ, there are Cheung Sha Wan, Lo Tik Wan, So Kwu Wan and Po Toi FCZ; however within the 500m assessment area, there is no aquaculture activity.

11.4.4 Areas of Fisheries Importance

Based on the literature review, there is no area of fisheries importance identified within the assessment area. Although there are several sites of fisheries importance within the Western Buffer and Southern WCZs where the assessment area lies, they are all situated far away from the Project footprint.

11.5 Identification and Evaluation of Potential Fisheries Impacts

11.5.1 Construction Phase

Direct Loss of Fishing Grounds

The construction works of the proposed Project (an indoor zone, an outdoor zone and a general approach area) are all land-based activities. No reclamation or dredging in the marine environment or construction of seawall will be involved. Therefore no impact due to loss of fishing ground would occur.

Direct Disturbance to Fishing Activities

The existing pier at TSW will be used to load the superstructures associated with building roof during the later construction phase. As reported from the Port Survey 2006 (AFCD, 2013a), level of fishing operation within the assessment area is moderately-low, and mainly consists of sampans. Given that the sampans are highly mobile, and the traffic of vessels associated with the construction activities is expected to be kept to a minimal, the construction marine traffic will not be expected to interfere with the fishing activities of small vessel operators in the area. High level of fishing activity around Southern Lamma and Po Toi are far away (>11 km away) from the assessment area, and hence it is not expected that the construction vessels will cross this area often. Therefore, direct impact on fishing operations is predicted to be temporary and insignificant.

Indirect Impact of Deterioration of Water Quality

As there is no marine works such as reclamation, dredging or construction of artificial seawall, no impact on fisheries resources associated with the marine works will be expected. However, as discussed in the water quality impact assessment (**Chapter 6**), potential indirect impacts to the fisheries resources due to changes in water quality associated with land-based construction works may occur. These include construction site runoff, discharge of debris, rubbish and spillages of liquids from general construction activities, release of suspended solids (SS) into the marine environment due to expansion of the existing storm u-channel, interception of two natural streams, site formation and foundation works, construction of sewage sump pit and rising mains, accidental spillage and sewage effluent from the construction workforce. However, with good site practices and mitigation measures in place to control construction site runoff and drainage from the works area, it is anticipated that the impacts to fisheries activities will be temporary and insignificant.

The location of several fisheries sensitive receivers within the Western Buffer and Southern WCZs (including Cheung Sha Wan FCZ (>16 km away), Sok Kwu Wan FCZ (>5 km away), Lok Tik Wan FCZ and its associated ARs (>4 km away), Po Toi FCZ (>11 km away), important nursery and spawning grounds for commercial species in Southern Hong Kong are far away from the proposed Project, and hence impacts from the land-based construction works are expected to be negligible. No fisheries-specific mitigation measures are thus required.

From the information presented above, no significant impacts on the fisheries resources within the assessment area will be expected during the construction phase. An evaluation of the impact in accordance with Annex 9 of the EIAO-TM is presented in **Table 11.1** for the construction phase.

Table 11.1: Evaluation of Potential Fisheries Impacts during Construction Phase

Parameter	Loss of Fishing Grounds	Disturbance to Fishing Operations	Deterioration of Marine Water Quality
Nature of Impact	No loss of fishing ground as there will be no loss of marine area	Temporary and insignificant	Temporary and insignificant
Size of Affected Area	No	Fishing vessels operations will be obstructed by the vessels transporting the superstructures	Subject to results of water quality impact assessment
Loss of Fisheries Resources/Production	No	Constitutes a small proportion of total fisheries production in Hong Kong	The potential impacts would be temporary and negligible with good site practices and mitigation measures in place.
Destruction and Disturbance of Nursery and Spawning Grounds	No	No recognised spawning or nursery grounds within the assessment area. Thus, no destruction or disturbance of areas of fisheries importance is expected due to the project works. Spawning and nursery grounds in Southern Hong Kong are far away (>5 km away) to be affected.	No recognised spawning or nursery grounds within the assessment area. Thus, no destruction or disturbance of areas of fisheries importance is expected due to the project works. Spawning and nursery grounds in Southern Hong Kong are far away (>5 km away) to be affected.
Impact on Fishing Activity	No	Moderately-low number (50 – 100 vessels) of fishing vessels, mostly consisting of sampans, will be affected.	Impacts to fishing activities in the area due to indirect disturbance of water quality are expected to be localised and temporary. Impact to fish with wide distribution range is insignificant.
Impact on Aquaculture Activity	No	There is no FCZ within the assessment area. Within the Western Buffer and Southern WCZs, there are the Cheung Sha Wan FCZ (>16 km away), Sok Kwu Wan FCZ (>5 km	There is no FCZ within the assessment area. Within the Western Buffer and Southern WCZs, there are the Cheung Sha Wan FCZ (>16 km away), Sok Kwu Wan FCZ (>5 km

Parameter	Loss of Fishing Grounds	Disturbance to Fishing Operations	Deterioration of Marine Water Quality
		away), Lok Tik Wan FCZ and its associated ARs (>4 km away) and Po Toi FCZ (>11 km away). However, since they are far away from the proposed Project no impact on culture fisheries activity is identified.	away), Lok Tik Wan FCZ and its associated ARs (>4 km away) and Po Toi FCZ (>11 km away). However, since they are far away from the proposed Project no impact on culture fisheries activity is identified.

11.5.2 Operation Phase

Direct Loss of Fishing Grounds

There will be no direct impacts to fisheries resources during the operation phase as there is no reclamation works. No direct impact on fisheries resources is expected to results from the operation of the Project.

Direct Impact of Disturbance to Fishing Operations

As there is expected to be no vessel to the Project area during the operation phase, there would not be any notable changes to the marine traffic vessel numbers or patterns in the area as a result of the implementation of the project. As such, impacts to fishing operations are expected to be negligible.

Indirect Impact of Change of Hydrology and Tidal Flow

As no reclamation is proposed in this Project, the implementation of the Project would not induce any changes to the hydrology and tidal flow of marine waters. Therefore, there will be no implications on fisheries resources and fisheries operations.

Indirect Impact of Deterioration of Marine Water Quality

During the operation phase, change in marine water quality may arise due to 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. However, with mitigation measures in place to control the sewages and runoffs from the Project area, it is anticipated that the impacts to fisheries activities will be reduced to negligible. As part of the new facilities, potable water will be used in the chiller system. Spent cooling water will be at a temperature of 38°C and contain residual chlorine at a concentration of 5 mg/L, and a continuous release of 1.6 L/s of spent cooling water will be generated during the park opening hours (0900 to 2300) according to the scheme design. Spent cooling water generated will be reused fully on site for flushing purposes, and there will be no direct discharge of spent cooling water. Used pool water will be discharged seasonally to the storm drains and into the marine environment via storm outfalls, but as detailed in **Chapter 6 Water Quality** the residual chlorine level is in compliance with the TM-DSS, impact on water quality due to residual chlorine discharge is anticipated to be minimal. Subsequently the effect on fisheries is expected to be insignificant.

The location of several fisheries sensitive receivers within the Western Buffer and Southern WCZs (including Cheung Sha Wan FCZ (>16 km away), Sok Kwu Wan FCZ (>5 km away), Lok Tik Wan FCZ and

its associated ARs (>4 km away), Po Toi FCZ (> 11 km away), important nursery and spawning grounds for commercial species in Southern Hong Kong (>5km away) are far away from the proposed Project, and hence impacts from the sewages and runoffs are expected to be negligible. No fisheries-specific mitigation measures are thus required.

From the information presented above, no significant impacts on the fisheries resources within the assessment area will be expected during the operation phase. An evaluation of the impact in accordance with Annex 9 of the EIAO-TM is presented in **Table 11.2** for the operation phase.

Table 11.2: Evaluation of Potential Fisheries Impacts during Operation Phase

Parameter	Disturbance Impact due to Deterioration of Marine Water Quality
Nature of Impact	No direct impact and no indirect impact will occur to fisheries resources within the assessment area.
Size of Affected Area	Negligible impacts to fisheries will be expected as there is no reclamation and occupation of sea area, and when the water quality mitigation measures are implemented during the operation phase.
Loss of Fisheries Resources/Production	Loss of fisheries resources and production will be negligible.
Destruction and Disturbance of Nursery and Spawning Grounds	No recognised spawning or nursery grounds within the assessment area. Thus, no destruction or disturbance of areas of fisheries importance is expected. Spawning and nursery grounds in Southern Hong Kong are far away (>5 km away) to be affected.
Impact on Fishing Activity	No operational impact is predicted.
Impact on Aquaculture Activity	Within the Western Buffer and Southern WCZs, there are the Cheung Sha Wan FCZ (>16 km away), Sok Kwu Wan FCZ (>5 km away), Lok Tik Wan FCZ and its associated ARs (>4 km away) and Po Toi FCZ (>11km away). However, since they are far away from the proposed Project no operational impact on culture fisheries activity is identified.

11.6 Cumulative Impact

Concurrent projects may include hotel development within the study area of this Project. No information is available for the construction timetable of this development. It is anticipated that the proposed hotel development would be land-based. With good site practices and mitigation measures in place, no fisheries cumulative impact is anticipated.

11.7 Recommendation of Mitigation Measures

Following the EIAO-TM Annex 17, mitigation measures will be implemented in the order of avoidance, minimisation and compensation for identified fisheries impacts.

Impacts to fisheries resources and fishing operations have been largely avoided during the construction and operation phases through the avoidance of marine works such as reclamation, dredging or seawall construction. Mitigation measures recommended in the water quality impact assessment (**Chapter 6**) for minimising water quality impacts will also minimise any adverse environmental impacts to fisheries. For the construction phase, mitigation measures recommended include constructing cut-off drains with internal drainage works and sedimentation control facilities, provision of sand/silt removal facilities for construction site runoff, discharge water from foundation excavations into storm drains, cover open stockpiles of construction materials or construction wastes on-site, and adequately cover and temporarily seal manholes, and minimising excavation works during the wet season. For the operation phase, mitigation measures include discharging sewage effluent from staff and visitors to the APTW via a new sewer connection, and

the design of an overflow connection pipe to the existing Sham Wan Road sewers to avoid any emergency discharge. Therefore, no fisheries-specific mitigation measures are required during the proposed Project.

11.8 Evaluation of Residual Environmental Impacts

No adverse significant residual impact due to the proposed Project is expected after the implementation of the mitigation measures to control water quality impacts.

11.9 Conclusion

Review of existing information on commercial fisheries resources and fishing operations within the study area shows that the importance of capture fisheries resources in the study area is moderately-low in terms of overall fishing operations, and moderate in terms of fisheries production (both weight and value). Fish fry production is absent from the assessment area and no fish culture zones, artificial reefs, important spawning areas or nursery grounds for commercial species are present.

During the construction phase, disturbance to fisheries may arise from vessel activities associated with transportation of superstructures, and indirect impact of water quality change associated with land-based construction works. However the impact on fisheries resources/production and fishing activity is predicted to be temporary and insignificant. During the operation phase, change in water quality may also occur due to discharge of sewage and runoffs. However, only negligible impact to fisheries resources/production is expected.

Furthermore, with good site practices and mitigation measures in place, it is expected that there would be no significant impacts to fisheries and no fisheries-specific mitigation measures are required given that the water quality mitigation measures are implemented properly.

11.10 References

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