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11. FISHERIES

11.1 Introduction

11.1.1 Background and Purpose of the Fisheries Impact Assessment

11.1.1.1 This section presents the baseline fisheries conditions within the Assessment Area, and the assessment results of the potential fisheries impacts resulting from the construction and operation of the Project. The location plan and description of the Project are presented in **Figure 1.1** and **Chapter 2** respectively.

11.1.1.2 According to the EIAO-TM, baseline conditions for fisheries resources were evaluated based on information from available literature and site visits conducted for the purposes of this EIA. Measures required to mitigate any identified adverse impacts are recommended, where appropriate, and residual impacts are assessed.

11.1.2 Structure of the Fisheries Impact Assessment

11.1.2.1 The remainder of this Fisheries Impact Assessment section is organised as follows:

- Section 11.2 introduces the criteria and guidelines related to the impact assessment for this Project
- Section 11.3 provides the assessment approach and methodologies undertaken to evaluate the fisheries resources to be impacted by the Project
- Section 11.4 presents the baseline information of fisheries resources within the Assessment Area
- Section 11.5 predicts the potential fisheries impacts arising from the Project, and evaluates the significance of each of these identified potential impacts
- Section 11.6 presents the cumulative impact due to Project and concurrent projects within the Assessment Area
- Section 11.7 provides information on proposed mitigation measures to avoid, minimize and compensate for the adverse impacts identified
- Section 11.8 identifies the potential residual impacts arising from the Project
- Section 11.9 presents the need and the details of a monitoring and auditing programme for the Project
- Section 11.10 summarises the key findings and recommendation from the Fisheries Impact Assessment chapter.

11.2 Environmental Legislation, Standards and Guidelines

11.2.1.1 This fisheries impact assessment makes reference to the following HKSAR Government ordinances, regulations, standards, guidelines, and documents when identifying the importance of fisheries resources, and evaluating and assessing potential impacts arising from the Project:

- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499)
- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) Annexes 9 and 17
- Water Pollution Control Ordinance (Cap. 358)

11.3 Assessment Methodology

11.3.1 Assessment Area

11.3.1.1 In accordance with the EIA Study Brief No. ESB-340/2021, the Assessment Area for fisheries impacts includes areas within 500 metres from the boundary of the Project and associated works, and other areas that would be potentially impacted by the construction

or operation of the Project. Special attention is also given to pond culture resources and activities, as well as any watercourses which may serve as water sources for the fishpond areas (**Figure 11.1** refers).

11.3.1.2 Literature review and desktop study were conducted to collate the latest baseline conditions regarding fisheries resources within the Assessment Area, which includes sources of information such as:

- Agriculture, Fisheries and Conservation Department (AFCD) Annual Reports;
- AFCD website on aquaculture;
- AFCD website on oyster culture;
- AFCD website on Accredited Fish Farm Scheme;
- Report of the Committee on Sustainable Fisheries (2010);
- EIA Report for Development of Lok Ma Chau Loop – EIA Report (AEIAR-176/2013) (CEDD & PlanD, 2013a);
- EIA Report for North East New Territories New Development Areas Planning and Engineering Study – Investigation – EIA Report (AEIAR-175/2013) (CEDD & PlanD, 2013b);
- Proposed Comprehensive Development at Wo Shang Wai, Yuen Long – EIA Report (AEIAR-120/2008) (Profit Point Enterprises Ltd, 2008);
- Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link – EIA Report (AEIAR-143/2009) (MTRC, 2009); and
- Recent aerial photos.

11.3.1.3 The baseline conditions established from desktop study were considered relevant to the current assessment. Nonetheless, in order to obtain the latest site-specific information, site visits were also conducted for the verification of the ponds and associated fisheries activities, where accessible. Site visits were conducted between November 2021 and October 2022. The conditions of the fishponds and the fisheries activities were observed and recorded. Interview was also conducted with the representatives/members of Hong Kong New Territories Fish Culture Association (HKNTFCA) to obtain further information on the local pond fisheries. The baseline information on fishpond conditions were further reviewed based on relevant information provided by AFCD.

11.3.2 **Assessment for Pond Fish Culture**

11.3.2.1 General activity status of the fishponds was categorised as follows:

- **Active:** currently utilised for commercial aquaculture activities (described in **Section 11.3.2.2**), including commercial fishponds, fish fry ponds, and indoor fish farms;
- **Inactive:** no current commercial aquaculture activities and management (e.g. overgrown vegetation at pond bunds which hindered culture activities, and lack of equipment such as aerator), but no major physical constraints to its resumption in the short-term, including fishponds with fish present in non-commercial quantities and ponds for recreational fishing;
- **Abandoned:** ponds in which there was physical evidence that aquaculture has not been practised for years (typically ponds with overgrown vegetation or dried up) and/or where there are obvious physical constraints to the resumption of fisheries activities (e.g. inaccessible or fenced off);
- **Others:** ponds that were unrelated to commercial aquaculture activities, including concreted ornamental ponds, ponds created for wetland compensation or ecological enhancement, flood storage ponds, or wastewater treatment, etc. These “other ponds” were irrelevant to fisheries impacts and were scoped out from further assessment.

11.3.2.2 The status of fishpond management was investigated with reference made to the evidence of aquaculture activities, such as the presence of fishing operation (e.g. stocking, feeding, harvesting), management activities (e.g. pumping of water, draining, dredging, re-profiling, and maintenance grass trimming), and the presence and conditions of associated

equipment (e.g. aerators, conditions of pond bund, fodder). Attention was also given to any watercourses which potentially serve as water sources for fishponds.

11.3.3 Assessment Approach

11.3.3.1 The criteria and guidelines set out in Annexes 9 and 17 of the EIAO-TM were followed to evaluate and assess the impact of Project construction and operation on the fisheries resources. The coverage of the fisheries resources concerned shall include but not limited to aquaculture sites, culture activities, production, aquaculture potential, etc. Potential direct / indirect, on-site / off-site, primary, secondary, cumulative and residual fisheries impacts arising from the construction and operation of the Project were identified and evaluated. Mitigation measures as well as environmental monitoring and auditing programme were recommended, where necessary.

11.4 Fisheries Baseline Information

11.4.1 Description of Physical Environmental Background

Aquaculture (Pond Fish Culture)

11.4.1.1 Within the Assessment Area, an extensive area of fishponds was identified at the northern portion (north of San Tin Highway), including areas such as Lok Ma Chau and San Tin. Smaller fishponds were also identified to the south, mainly at Shek Wu Wai and Ngau Tam Mei. Pond fish culture of various activity statuses were identified, which include active, inactive, and abandoned fishponds (refer to **Figure 11.1A to 11.1I**).

Other Fisheries Resources

11.4.1.2 No other fisheries resources such as capture fisheries, other aquaculture (oyster culture and Fish Culture Zones) and sites of fisheries importance (Artificial Reef) were recorded within the Assessment Area. The nearest oyster culture area (outside the Assessment Area) is located about 5.9 km west of the Project site in Deep Bay Water Control Zone (WCZ), while no capture fisheries, Fish Culture Zones and Artificial Reef were identified within Deep Bay WCZ. Considering the absence of these other fisheries resources, potential impacts on these resources are not anticipated. Detailed information on these resources is scoped out from the remainder of this chapter.

Sam Po Shue Wetland Conservation Park (SPS WCP)

11.4.1.3 The Agriculture, Fisheries and Conservation Department (AFCD) has commenced a Strategic Feasibility Study on the Development of Wetland Conservation Parks System, which proposed the SPS WCP as the first park to be developed. The Government will establish the SPS WCP to enhance the ecological quality and biodiversity of the Northern Metropolis, provide quality outdoor eco-education and recreation facilities for public enjoyment, as well as introduce modernised aquaculture in the park, and provide opportunities for scientific research. The SPS WCP, with a proposed area of approximately 338 ha, will serve dual purposes. First, it allows the Government to enhance the overall ecological value, biodiversity and connectivity in the Deep Bay area through proactive conservation and management. Secondly, it will enhance the ecological function and capacity of 288 ha of wetlands with active conservation management and enhance the fisheries resources of 40 ha of fishponds with modernised aquaculture, to compensate for the loss in wetland habitats and fisheries resources arising from the development of San Tin Technopole and to achieve no-net-loss in ecological function and capacity of the wetlands concerned. Within the SPS WCP, there will be 253 ha of ecologically enhanced fishponds compensating for pond habitat loss, 35 ha of enhanced freshwater wetland habitat compensating for other freshwater wetland habitat loss, 40 ha of enhanced fishponds compensating for fisheries loss, and about 10 ha reserved for other supporting facilities. Furthermore, the 253 ha ecologically enhanced fishponds are anticipated to continuously support aquaculture activities, thus serving dual functions. The impact on

these wetlands concerned are provided in **Section 10.8**, while the derivation of the enhancement area is further elaborated under **Section 10.11** and **Section 11.7.2**.

11.4.2 **Pond Fish Culture Activities and Resources**

Desktop Study

- 11.4.2.1 The pond fish / aquaculture industry of Hong Kong is mainly centred in the northwest New Territories. The northern portion of the Project site and the Assessment Area encroaches within this area of aquaculture activities.
- 11.4.2.2 According to AFCD (2023a), local inland fishponds covered approximately 1,129 ha in 2022. These ponds produced 2,073 tonnes of freshwater fish amounting to HK\$55 million. Fisheries production from the local fishponds accounted for about 4% of the total local freshwater fish consumption in 2020 (AFCD, 2021).
- 11.4.2.3 The vast majority of these farms engaged in carp polyculture and farmed species such as Bighead Carp, Grass Carp, Common Carp and Silver Carp in combination with Tilapia or Grey Mullet. Small portion (about 8%) of pond fish culture in Hong Kong involve monoculture of carnivorous species such as giant groupers, seabreams, and spotted scats at brackish fishponds near the coastline (AFCD, 2023a). The aquaculture species Jade Perch (*Scortum barcoo*) was introduced by AFCD to the local fisheries industry (AFCD, 2011). Since 2010, AFCD has mastered the induced spawning and fry rearing techniques and was able to produce Jade Perch fry in mass quantity, reducing fry cost and maintaining the supply of fry (AFCD, 2023c).
- 11.4.2.4 Fishponds farms have been gradually declining in numbers since the 1970s, especially in the Deep Bay area as these farms are being replaced by urban development. **Table 11.1** presents the AFCD figures on fishpond area and annual fish production in Hong Kong from 2013 to 2022.

Table 11.1 Fishpond Area and Annual Fish Production in Hong Kong from 2013 to 2022

Year	Fishpond Area (ha)	Annual Fish Production (Tonnes)
2022	1,129	2,073
2021	1,130	2,926
2020	1,130	2,516
2019	1,131	2,278
2018	1,132	2,536
2017	1,132	2,543
2016	1,135	2,543
2015	1,140	2,092
2014	1,140	2,001
2013	1,150	2,187

Source: AFCD (2021, 2023a)

- 11.4.2.5 A voluntary Accredited Fish Farm Scheme (AFFS) has been launched by AFCD to assist local aquaculturists to increase the competitiveness of their aquaculture products and to provide quality and safe aquaculture products to the public by introducing good aquaculture practices to local aquatic farms, increase transparency by standardising the production process, and introducing pre-marketing product test (AFCD, 2022b).
- 11.4.2.6 Site visits were conducted between 2009 and 2010 to investigate the fisheries status of ponds under the Environmental Impact Assessment (EIA) Study for the Development of Lok Ma Chau Loop (the Loop) (CEDD & PlanD, 2013a). No fishponds were identified within the Loop, as they were filled and lost after the Shenzhen River Regulation Project, and the area within the Loop was not actively managed and was considered as marshes,

dominated by emergent vegetation (prior to the development of the Loop). A mixture of active, inactive and abandoned ponds were identified to the south of the Loop, while the fishponds close to Ha Wan Tsuen were mainly inactive or abandoned (CEDD & PlanD, 2013).

- 11.4.2.7 Under the EIA Study conducted for the North East New Territories New Development Areas Planning and Engineering Study – Investigation (CEDD & PlanD, 2013b), no active fishponds were identified within the current Assessment Area.

11.4.3 **Fisheries Resources within the Assessment Area**

Recent Site Visit Findings

- 11.4.3.1 Considering the difference in site conditions, the Assessment Area is separated along Fanling Highway and San Tin Highway, into the northern portion (e.g. San Tin, Sam Po Shue, Lok Ma Chau and Chau Tau), and the southern portion (e.g. Shek Wu Wai, Ki Lun Tsuen, and Pang Loon Tei).

- 11.4.3.2 During recent site visits conducted under the current EIA Study between November 2021 and October 2022, more than 250 fishponds were identified, mostly concentrated on the northern portion of the Assessment Area. The distribution and physical conditions of the ponds are similar and comparable to the baseline conditions identified from literature review, which are considered relevant for assessment. Latest changes in baseline fisheries condition include some update in the activity statuses of the fishponds, which are described below.

- 11.4.3.3 About 99.75 ha of fishpond area was recorded within the Project site and about 244.68 ha within the Assessment Area, which includes both pond habitats and some overgrown areas that are no longer open water pond habitats. The estimated fish production within the Project site and the Assessment Area is about 208 tonnes and 511 tonnes respectively. These fishponds were further categorised as active, inactive, and abandoned as described in **Section 11.3.2**, while representative photographic records of these fishponds are presented in **Appendix 11.1**. Some ponds observed within the Assessment Area were unrelated to commercial fisheries production. These were categorised as “other ponds” and scoped out from further evaluation as they were not related to fisheries assessment.

Summary of Fisheries Resources

- 11.4.3.4 **Active:** About 55.38 ha of active fishponds were observed within the Project site, while the total area of active fishpond within the Assessment Area was about 145.76 ha. These active fishponds were observed as open water pond habitats with active aquaculture activities and fisheries production.
- 11.4.3.5 **Active (Indoor):** Very small areas of indoor active fish farms were observed within the Project site (about 0.03 ha), while the total of area of indoor active fish farm within the Assessment Area was about 0.08 ha. These active indoor fish farms were mostly located within village areas (e.g. Shek Wu Wai, Ngau Tam Mei), within enclosed indoor structures.
- 11.4.3.6 **Inactive:** About 30.35 ha of inactive fishponds were observed within the Project site, while the total area of inactive fishpond within the Assessment Area was about 56.53 ha. These inactive fishponds were observed as open water pond habitats. While no active aquaculture activities were observed at these inactive fishponds, there are no major physical constraints to its resumption to activities in the short-term, hence these inactive fishponds are considered with potential values to support future aquaculture activities.
- 11.4.3.7 **Abandoned (Open Water):** About 8.93 ha of abandoned fishponds (open water) were observed within the Project site, with a total of about 20.08 ha within the Assessment Area. While these areas were observed as open water pond structure, there are no aquaculture

activities observed, with constraints in resumption of fisheries activities, such as fenced off and inaccessible ponds, and/or overgrown pond bunds or deteriorated pond structures.

- 11.4.3.8 **Abandoned (Overgrown):** About 4.74 ha of abandoned fishponds (overgrown) were observed within the Project site, with a total of about 8.91 ha within the Assessment Area. These areas were not observed with aquaculture activities and were overgrown with vegetation. Resumption of fisheries activities is not anticipated at these areas.
- 11.4.3.9 **Other Ponds (Non-Fisheries related):** About 0.32 ha of other ponds structures were observed within the Project site, with a total of about 13.32 ha within the Assessment Area. While an open water structure was observed at these ponds, these ponds were not observed to support any fisheries resources, with no aquaculture activities nor fisheries production (e.g. irrigation pond, mitigation wetland, etc.). These pond structures were included in **Figure 11.1** for comprehensive presentation, but does not contribute to fisheries resources.
- 11.4.3.10 Assessment on the potential fisheries impact from the loss of fishpond area and associated fisheries resources are further described in **Section 11.5.2**.

Distribution of Fisheries Resources

Northern Portion

- 11.4.3.11 Fishponds within the northern portion of the Assessment Area comprise some fishponds near Lok Ma Chau and Ha Wan Tsuen, and a relatively extensive and contiguous area of fishponds near San Tin and Sam Po Shue. Fishponds near Lok Ma Chau and Ha Wan Tsuen comprise a mosaic of active, inactive, and abandoned fishponds adjacent to village areas. These fishponds were subject to some disturbances in the vicinity, including the viaduct and the operation of LMC Spur Line, and construction activities along Ha Wan Tsuen East Road as the western connection road for the Loop which resulted in some portions of the ponds being completely or partially filled (**Figure 11.1D** refers).
- 11.4.3.12 Fishponds near San Tin and Sam Po Shue area are more contiguous and larger in area. Most of these fishponds were observed with active fisheries activities and stocked with aquaculture species. The active fishponds were mainly observed with freshwater aquaculture species such as Common Carp, Tilapia, and Mulletts. Some inactive and abandoned ponds were observed near the village area at Mai Po Village, which were observed with various extent of overgrown vegetation along the pond bund and/or within the pond area. A large area of inactive and abandoned fishponds was observed at Sam Po Shue area, on the west of Lok Ma Chau Boundary Control Point (LMC BCP). This area of fishpond was observed to be fenced off, while stockpiling, heavy vehicles, and excavators were observed within the area.
- 11.4.3.13 According to an interview with local fishermen representatives (HKNTFCA), about 200 fish farmers were supported by the wider fishpond areas near Mai Po and San Tin. No fish fry supplier farms were in operation in the area, while fish fry was mainly imported and purchased from mainland China. According to the interview, revenue had been in decline in the past two decades, due to increased cost (e.g. cost of aquaculture operation and rental), and decreased competitiveness in the fisheries market. The interviewees have expressed willingness to incorporate innovation and transformation in the fisheries industry, such as the introduction of fish species with higher market price, incorporating innovative methods for aquaculture, and/or incorporating eco-tourism activities.

Southern Portion

- 11.4.3.14 All of the fishponds identified within the southern portion of the Assessment Area were mostly small-sized and scattered between village and agricultural areas around Shek Wu Wai, and some near Pang Loon Tei and Ngau Tam Mei. Most of these fishponds were either active, or abandoned, showing various signs of vegetation overgrown and transition

into grassy and/or marshy habitats. Some ponds adjacent to village and agricultural areas were observed to be filled.

The active fishponds in the southern portion of the Assessment Area include some small active ponds located within Shek Wu Wai area (between the mosaic of agricultural areas and other ponds) mainly practising aquaponics, and some scattered active fishponds in Ngau Tam Mei. A total of four indoor fish farms were observed within the Assessment Area, including two on the south of Shek Wu Wai San Tsuen (**Figure 11.1G** refers), one near the east of Ki Lun Tsuen (**Figure 11.1F** refers), and one in Ngau Tam Mei (**Figure 11.1H** refers).

Other Observations

- 11.4.3.15 According to AFCD (2009), water sources for fishponds are generally from rainwater, stream, well, seawater, or from adjacent fishponds (where water was pumped and drained from one pond to another). Within the Assessment Area, fishponds were likely to rely on rainwater, and from adjacent ponds as water sources. While some watercourses were identified in the Assessment Area, these watercourses were often observed to receive domestic discharge or runoffs from nearby villages, open storage, workshop areas, and agricultural areas (e.g. Shek Wu Wai and San Tin area), and were likely unsuitable for fish culture. Some watercourses near Lok Ma Chau (LMC) originated from the hillside areas at the south of LMC, and may potentially serve as supplementary water source for these ponds near LMC (**Figure 11.1** refers).

11.5 Identification and Evaluation of Potential Impacts

11.5.1 Identification of Potential Impacts

- 11.5.1.1 Due to the absence of oyster culture, capture fisheries, and sites of fisheries importance within the Assessment Area, direct and indirect impacts are not anticipated on these resources. Potential impacts arising from the proposed development would be loss of pond fish culture area (i.e. fishponds), aquaculture activities and aquaculture potential, etc. The loss of fishponds as well as other associated impacts that would occur at construction and operation phases are as follows:

Construction Phase – Direct Impact

- Loss of Active Fishponds
- Loss of Inactive Fishponds
- Loss of Abandoned Fishponds
- Temporary Loss of Fishponds

Construction Phase – Indirect Impact

- Deterioration of Water Quality and Hydrological Condition
- Indirect Injury / Mortality on Cultured Fish
- Bund Stability
- Blockage of Access

Operation Phase – Indirect Impact

- Deterioration of Water Quality and Hydrological Condition
- Blockage of Access

Secondary Impact from Wetland Enhancement

- Potential Fisheries Impact from Ecological Enhancement at Sam Po Shue Wetland Conservation Park

- 11.5.1.2 Each of the identified potential impacts on fisheries resources are further described and evaluated in the following sections, with reference made to the evaluation criteria denoted in EIAO-TM. A summary of impacts on fisheries resources are provided in **Table 11.2 – Table 11.4**.

11.5.1.3 The Government will develop the Sam Po Shue Wetland Conservation Park (SPS WCP) with a proposed area of approximately 338 ha to create environmental capacity for the development of San Tin Technopole. Among the 338 ha, while 10 ha is reserved for supporting facilities such as visitor center and other basic infrastructure, the Government will enhance the ecological function and capacity of 288 ha of wetlands and fisheries resources of 40 ha of fishponds by establishing the SPS WCP with active conservation management and modernised aquaculture to compensate for the loss in wetland habitats and fisheries resources arising from the development of San Tin Technopole and to achieve no-net-loss in ecological function and capacity of the wetlands concerned. The Government aims to start the development of SPS WCP in around 2026/2027 for completion by 2039 or earlier to tie in with the full operation of San Tin Technopole. For the site formation works of the first batch of land at San Tin Technopole targeted for commencement in late 2024, no pond filling will be involved. On current planning, pond filling works will not start until 2026/27, and the pace of pond filling will tie in with the development progress of the SPS WCP. To this end, a working group will be formed between CEDD (as San Tin Technopole's works agent) and AFCD (as SPS WCP's sponsoring department) to coordinate the progress of pond filling and SPS WCP implementation.

11.5.2 **Construction Phase – Direct Impact**

11.5.2.1 Under the Revised RODP (**Figure 2.1** refers), fishponds within the Project site will be subject to direct permanent loss as a result of the proposed development (**Figure 11.1** refers), resulting in the direct loss of fish ponds, fisheries production, aquaculture activities and aquaculture potential. While some of the fishponds may potentially be preserved, subject to detailed land use design under the Revised RODP, a conservative approach has been adopted under the current assessment, assuming that all fishponds within the Project boundary will be lost, except for some of the fishponds located within the proposed AFCD Fisheries Research Centre (about 5.65 ha) where no more than 2.86 ha fishponds will be retained, which includes about 2.00 ha of active fishpond, and 0.86 ha of abandoned fishpond (open water) (**Figure 11.3** refers). The exact area of fishponds to be retained is subject to approval from relevant departments (AFCD) on the site requirement during the detailed design in the subsequent design and construction stage.

Loss of Active Fishponds

11.5.2.2 Key fisheries resources within the Project site includes active fishponds (55.38 ha) and indoor active fish farms (0.03 ha), mostly situated near San Tin area to the northwest of San Tin Tsuen Road, as well as some active fishponds near Ha Wan Tsuen and in Shek Wu Wai areas. Direct permanent loss of these active fishponds may result from the Project, except for some of the active fishponds at the proposed AFCD Fisheries Research Centre (refer to **Figure 11.3**), which would be retained under the Project (subject to AFCD's approval on the site requirement during detailed design and construction stage). There would be a direct permanent loss of fisheries production and aquaculture activities at active fishponds (about 53.38 ha) and active fish farm (indoor) (0.03 ha), totalling to 53.41 ha.

11.5.2.3 The expected loss of active fishponds and indoor fish farm (53.41 ha) makes up 53.54% (about 53.5%) of the overall fishpond areas within the Project site (99.75 ha, as described in **Section 11.4.3.3**) within the Project boundary. Some loss of aquaculture activities and fisheries production would arise in the absence of mitigation measures, resulting in impacts on the local fisheries industry. Considering the potential cumulative impact (combined loss of active fishponds with concurrent projects) as described in **Section 11.6**, mitigation measures (such as the compensation of fishpond areas and development of modernised aquaculture practices) are proposed in **Section 11.7**.

Loss of Inactive Fishponds

11.5.2.4 Inactive fishponds of 30.35 ha were identified within the Project site, which would all be subject to potential direct loss under the Revised RODP. These inactive fishponds were observed with some overgrown vegetation, with no aquaculture activities observed during

the recent site visits. These inactive fishponds are not anticipated to support significant fisheries production. Nonetheless, these fishponds hold the potential to revert as active fishponds to support aquaculture activities, especially those that were situated adjacent to existing active fishponds (e.g. near Sam Po Shue and Ha Wan Tsuen).

- 11.5.2.5 Under a conservative approach adopted under the current assessment, potential minor impact may arise due to the potential of these inactive ponds. While fisheries production is not anticipated from these inactive fishponds, mitigation measures (compensation of fishpond areas) are also considered, due to the potential value of these inactive fishponds to be reverted to support aquaculture in the future, and the cumulative impact as described in **Section 11.6**. Mitigation measures are further described in **Section 11.7**.

Loss of Abandoned Fishponds

- 11.5.2.6 Abandoned fishponds (open water) (8.93 ha) and abandoned fishponds (overgrown) (4.74 ha) were identified within the Project site. No fisheries activities were identified at these abandoned fishponds, while the conditions of these fishponds were no longer suitable for short-term resumption into active fisheries activities (e.g. inaccessibility, deteriorated pond bund and overall pond structure, habitat transition, etc.). Furthermore, 0.86 ha of abandoned fishponds (open water) would be retained at the proposed AFCD Fisheries Research Centre under the Project (**Section 11.5.2.1** refers), subject to AFCD's approval on the site requirement during detailed design and construction stage. Direct loss of these abandoned fishponds (open water) (8.07 ha) and abandoned fishponds (overgrown) (about 4.74 ha). The loss of these abandoned fishpond areas is not likely to result in significant impact on aquaculture activities.

Temporary Loss of Fishponds

- 11.5.2.7 Under the current Project layout, some ponds will be partially encroached by the Project boundary. During the construction phase, all ponds and wet areas to be removed shall be isolated and not connected to any existing watercourse. The associated construction works would include draining the water in ponds before filling up these areas or before commencement of any excavation and construction works. As such, some temporary loss of ponds adjacent to the Project boundary may also arise during the construction phase. Considering the short-term and reversible nature of these temporary loss, fisheries impact is anticipated to be minor.

11.5.3 Construction Phase – Indirect Impact

Deterioration of Water Quality and Hydrological Condition

- 11.5.3.1 Some active fishponds were situated directly adjacent to the Project boundary, including some fishponds at San Tin area (adjacent to the northwest boundary), and some small and scattered at LMC (adjacent to the northeast boundary). Considering the proximity and the downstream location of these active fishponds to the development boundary, indirect impacts on cultured fish may arise from construction activities (e.g. deterioration of water quality from uncontrolled run-off and erosion of exposed bare soil and earth, increase in suspended solids, excavated materials and sediments from construction works in ponds, potential chemical and contaminant spillage, potential change in hydrodynamics, and blockage of access roads).
- 11.5.3.2 In the absence of mitigation measures, this could result in potentially minor to moderate impacts on the remaining ponds, particularly those that were located adjacent to the Project boundary. Examples of relevant water quality control measures are provided in **Section 11.7.1**, while details of these mitigation measures are available at **Section 5**. With the proper implementation of these mitigation measures, unacceptable impacts on water quality are not expected. There will be no adverse impacts on cultured fish due to potential water quality deterioration during the construction phase.

- 11.5.3.3 As the fishponds within the Assessment Area mostly rely on rainwater and adjacent fishponds as water sources, potential water quality impacts on the nearby watercourses are also not likely to result in indirect impacts on the cultured fish.

Indirect Injury / Mortality of Cultured Fish

- 11.5.3.4 Indirect water quality impact from construction activities may affect the survival of cultured fish. For example, accidental spills of oils and other chemicals could affect aquatic organisms (including aquaculture fisheries), resulting in lethal / sublethal impacts (e.g. direct mortality, reproductive retardation). Removal of vegetation during site formation could also elevate sediment levels in site runoff, increasing suspended solids (SS) level in the aquatic environment. Furthermore, discharge from land-based construction works (e.g. excavated materials and sediments from construction works in ponds, general cleaning and polishing, wheel washing, dust suppression, utility installation, etc.) and construction site runoff (e.g. runoff and erosion of exposed bare soil and earth, earth working area and stockpiles, etc.) could also cause a temporary increase in SS level. Such increase in suspended particles could potentially injure cultured fish and clog their respiratory and feeding systems, resulting in impact on fisheries production.
- 11.5.3.5 Mitigation measures will be implemented to control runoff and drainage from the construction site, as well as the adoption of guidelines and good site practices for handling and disposal of construction discharges, excavated materials and sediments (refer to **Section 5** and **11.7.1**). Unacceptable impacts on water quality, and the associated potential indirect injury / mortality on cultured fish are not expected.

Bund Stability

- 11.5.3.6 Construction activities that occur adjacent or in close vicinity to fishponds may result in indirect impacts on these fishponds by affecting the stability of the pond bund, potentially resulting in instability of the pond structure, or water seepage. In the absence of mitigation measures, this could inhibit pond usage and result in potentially minor to moderate impacts on the remaining ponds adjacent to the development boundary. With appropriate mitigation measures implemented to ensure the stability of the pond bund during construction phase, (e.g. sheet pile wall and associated grouting, further described in **Section 11.7.1.1**), adverse impacts on aquaculture activities are not anticipated.

Blockage of Access

- 11.5.3.7 During construction phase, construction activities and associated temporary works (e.g. stockpiling area) may potentially affect the access to the remaining fishpond areas. Without mitigation measures, this may result in minor to moderate impact on fishpond area. Mitigation measures (e.g. provision of temporary road and access arrangement) would be in place to minimise the potential blockage and the associated impact on fishpond area. The construction within the Project boundary has also been separated into various phases, allowing provision of access to the fishpond areas.

11.5.4 Operation Phase – Direct Impact

- 11.5.4.1 In view of the land use under the Revised RODP, no additional direct impacts on fisheries resources (e.g. loss of fishponds) are anticipated during the operation phase of the proposed development.

11.5.5 Operation Phase – Indirect Impact

Deterioration of Water Quality

- 11.5.5.1 As described above, some active fishponds were situated directly adjacent to the Project boundary, at San Tin and LMC areas. Potential indirect impacts could arise from uncontrolled surface runoff, and subsequent deterioration in water quality. Mitigation

measures will be implemented for potential water quality impact arising from the operation phase of the Project (refer to **Section 5**). Furthermore, in view of the proposed land use under the Revised RODP, an “eco-interface” with widths of 20 – 35 m was proposed along the northwest of the Project boundary near San Tin area. This “eco-interface” area would comprise eco-friendly and/or landscaping features to provide buffer to the remaining fishponds and other wetland habitats near San Tin area. Sewage discharge and/or surface runoff are not anticipated from this “eco-interface” area. Adverse impacts on cultured fish due to potential water quality deterioration during the operation phase are not anticipated.

Blockage of Access

- 11.5.5.2 Considering the provision of access during construction phase, and upon the completion of construction activities, no further impact is anticipated to arise during the operation phase of the proposed development.

11.5.6 Secondary Impact from Wetland Enhancement

Potential Fisheries Impact from Ecological Enhancement at the proposed SPS WCP

- 11.5.6.1 Under the ecological impact assessment of this study (**Section 10** refers), enhancements in the form of “ecologically enhanced fishponds” and “enhanced freshwater wetland habitat” are proposed as mitigation measure for the unavoidable loss of ponds and other freshwater wetland habitats under the Revised RODP as well as to achieve no-net-loss in ecological function and capacity of the wetlands concerned. The enhanced wetland would be implemented within the proposed SPS WCP, located on the northwest of the Project boundary (**Figure 11.2** refers). Details on the wetland compensation framework (including enhanced wetland) are provided in **Section 10** (Ecological Impact Assessment) and subject to further planning and design under later studies of the proposed SPS WCP project.
- 11.5.6.2 Upon the establishment of the proposed SPS WCP, the WCP is expected to enhance the ecological function and capacity of 288 ha of wetlands (253 ha of “ecologically enhanced fishponds” and 35 ha of “enhanced freshwater wetland habitats”). Fishponds within the San Tin and Sam Po Shue area mostly comprise active fishponds, while small areas of inactive fishponds, abandoned fishponds, and brownfields were also observed.
- 11.5.6.3 Existing active fishpond areas within the wetland enhancement areas proposed at the proposed SPS WCP will be subject to ecological enhancement measures, including both low-intensity ecological management such as re-profiling and/or partial drain-down of the fishponds as “ecologically enhanced fishponds”, while a small proportion of the ponds will also be subject to intensive ecological management (e.g. feeding of trash-fish to increase feeding opportunities for birds). While these “ecologically enhanced fishponds” are anticipated to continuously support aquaculture activities, thus serving dual functions, some degree of secondary impact may be anticipated at these active fishponds due to decrease in aquaculture activities from ecological management.
- 11.5.6.4 On the other hand, the proposed wetland enhancement will also involve the conversion of some inactive fishponds, abandoned fishponds, and brownfields into “ecologically enhanced fishponds”. No existing aquaculture production is anticipated at these inactive fishponds, abandoned fishponds, and brownfields, while some aquaculture production is anticipated upon the establishment of ecologically enhanced fishponds. As such, a coordinated management of fishponds under the proposed SPS WCP would be adopted, and no significant impact on the overall aquaculture activities and production would be anticipated.

11.5.7 Summary of Fisheries Impact

11.5.7.1 Based on the above discussion, potential adverse impacts on fisheries resources arising from the construction, operation, and associated wetland enhancement of the Project, where present, are summarised in **Table 11.2 – Table 11.4.**

Table 11.2 Summary of Impact on Fisheries Resources (Active Fishponds)

Criteria	Proposed Development		Wetland Enhancement at the proposed SPS WCP
	Construction Phase	Operation Phase	
Nature of impact	<u>Direct impact:</u> - Permanent loss of active fishponds - Temporary loss due to pond draining along Project boundary (minor) <u>Indirect impact:</u> - None anticipated with mitigation measures	No adverse direct and indirect impacts are anticipated	<u>Direct and indirect impact:</u> - None anticipated <u>Secondary impact:</u> - Fisheries production anticipated to slightly decrease at existing active fishponds
Size of affected area	<u>Direct impact:</u> - Permanent loss of active fishpond: 53.38 ha - Permanent loss of active fish farm (indoor): 0.03 ha <u>Indirect impact:</u> - Minor to moderate in the absence of mitigation measures	N/A	<u>Direct and indirect impact:</u> - None anticipated <u>Secondary Impact:</u> - Subject to detailed design of enhanced wetland (288 ha) within SPS WCP
Loss of fisheries resources	Direct loss of aquaculture activities and fisheries production	N/A	Fisheries production anticipated to slightly decrease due to ecological management
Destruction and disturbance of nursery and spawning grounds	N/A (No nursery and spawning ground within Assessment Area)		
Impacts on fishing activity	N/A (No fishing activities within Assessment Area)		
Impact on aquaculture activity	Loss of aquaculture activity from loss of active fishponds	N/A	Potential reduction of fisheries resources
Overall impact before mitigation	Moderate	Insignificant	Minor

Table 11.3 Summary of Impact on Fisheries Resources (Inactive Fishponds)

Criteria	Proposed Development		Wetland Enhancement at the proposed SPS WCP
	Construction Phase	Operation Phase	
Nature of impact	<u>Direct impact:</u> - Permanent loss of inactive fishponds (which would also result in loss in aquaculture potential) - Temporary loss due to pond draining along Project boundary <u>Indirect impact:</u> - None anticipated	No adverse direct and indirect impacts are anticipated	<u>Direct impact:</u> - Some inactive fishponds in SPS WCP will be converted to ecologically enhanced fishponds <u>Indirect impact:</u> - None anticipated <u>Secondary impact:</u> - Increase in fisheries production

Criteria	Proposed Development		Wetland Enhancement at the proposed SPS WCP
	Construction Phase	Operation Phase	
Size of affected area	<u>Direct impact:</u> - Permanent loss of inactive fishpond: 30.35 ha <u>Indirect impact:</u> - None anticipated	N/A	- Subject to detailed design of the enhanced wetland (288 ha)
Loss of fisheries resources	Considering no active aquaculture observed, no loss of fisheries production anticipated	N/A	None – fisheries production is expected to increase
Destruction and disturbance of nursery and spawning grounds	N/A (No nursery and spawning ground within Assessment Area)		
Impacts on fishing activity	N/A (No fishing activities within Assessment Area)		
Impact on aquaculture activity	None anticipated	N/A	Increased area for aquaculture activity upon fishpond conversion
Overall impact before mitigation	Minor	Insignificant	Insignificant

Table 11.4 Summary of Impact on Fisheries Resources (Abandoned Fishponds)

Criteria	Proposed Development		Wetland Enhancement at the proposed SPS WCP
	Construction Phase	Operation Phase	
Nature of impact	<u>Direct impact:</u> - Permanent loss of abandoned fishponds - Temporary loss due to pond draining along Project boundary <u>Indirect impact:</u> - None anticipated	No adverse direct and indirect impacts are anticipated	<u>Direct impact:</u> - Some abandoned fishponds in SPS WCP will be converted to ecologically enhanced fishponds <u>Indirect impact:</u> - None anticipated <u>Secondary impact:</u> - Increase in fisheries production
Size of affected area	<u>Direct impact:</u> - Permanent loss of abandoned fishpond (open water): 8.07 ha - Permanent loss of abandoned fishpond (overgrown): 4.74 ha <u>Indirect impact:</u> - None anticipated	N/A	- Subject to detailed design of the enhanced wetland (288 ha)
Loss of fisheries resources	Considering no active aquaculture observed, no loss of fisheries production anticipated	N/A	None – fisheries production is expected to increase
Destruction and disturbance of nursery and	N/A (No nursery and spawning ground within Assessment Area)		

Criteria	Proposed Development		Wetland Enhancement at the proposed SPS WCP
	Construction Phase	Operation Phase	
spawning grounds			
Impacts on fishing activity	N/A (No fishing activities within Assessment Area)		
Impact on aquaculture activity	None anticipated	N/A	Increased area for aquaculture activity upon fishpond conversion
Overall impact before mitigation	Insignificant	Insignificant	Insignificant

11.6 Cumulative Impacts

- 11.6.1.1 Cumulative impact may arise during the construction and operation of the proposed Project, due to interaction with other developments in the area. Major concurrent projects that may impose cumulative impact on aquaculture activities and production include the Development of LMC Loop – Main Works Package 1, and the Strategic Feasibility Study on the Development of Wetland Conservation Parks (WCP) System under the Northern Metropolis Development Strategy (**Table 2.7** of **Section 2** refers).
- 11.6.1.2 Under the development of the Loop, the loss of fisheries resources was assessed to be minor impact (CEDD & PlanD, 2013a). Nonetheless, with the direct loss of active and inactive fishponds from the proposed development under the current assignment, aquaculture production in the wider San Tin and LMC area may be subject to potential cumulative loss.
- 11.6.1.3 Mitigation measures are proposed under the current Project to minimise the potential impact on aquaculture activities, which includes compensation and enhancement measures, further detailed in **Section 11.7**. With the implementation of the mitigation measures, fisheries impact arising from the current Project are expected to be mitigated to an acceptable level. No adverse cumulative impact on aquaculture activities is expected with the implementation of mitigation measures.

11.7 Mitigation of Adverse Environmental Impacts

11.7.1 Minimisation

Maintaining Bund Stability

- 11.7.1.1 During the construction stage, all ponds to be removed (including ponds partially encroached by the Project boundary) shall be isolated and not connected to any existing watercourse. The pond would then be drained before filling up these areas or before commencement of any excavation and construction works. To maintain bund stability of remaining adjacent ponds, a layer of shoring or sheet pile wall should be erected along the site boundary adjacent to fishponds. In addition, the shoring / sheet pile wall should have grouting or a grout curtain to avoid water seepage from the fishpond to the excavation area. With the implementation of shoring / sheet pile, the stability of the fishpond bund shall be preserved, and significant impacts on aquaculture activities shall be minimised.

Minimisation of Potential Water Quality Impacts

- 11.7.1.2 As described in **Section 11.5**, impact on cultured fish due to the potential deterioration of water quality are not anticipated. Mitigation measures and good site practices should be implemented during the construction phase, as proposed in **Section 5** (e.g. proper covering of construction debris and stockpiling of material to avoid runoff into the ponds), to further minimise potential water quality impact on the ponds adjacent to the Project boundary.

Surface drainage system shall also be provided to collect road run-off during the operation phase of the Project. Examples of mitigation measures for potential water quality impact include:

Control of Site Run-off

- Implementation of Best Management Practices (BMPs), following the guidelines for handling and disposal of construction site discharges detailed in ProPECC PN 1/94 "Construction Site Drainage";
- Controlling surface run-off from construction site into storm drains via adequately designed channels, earth bunds or sand bag barriers, directing the runoff to sand / silt removal facilities such as sand traps, silt traps and sedimentation basins;
- Minimising soil excavation in wet season (April to September), or where impracticable, proper covering of temporarily exposed slope surfaces, while intercepting channels should be provided along the crest / edge of excavation;
- Proper covering of open stockpiles of construction materials during rainstorms (e.g. with tarpaulin or similar fabric).

Control of Other Construction-Related Activities

- All vehicles and plants should be cleaned before they leave the construction site to minimise the deposition of earth, mud and debris in surrounding areas;
- Acidic wastewater generated from acid cleaning, etching, pickling and similar activities should be neutralised to within the pH range of 6 to 10 before discharging into foul sewers. If there is no public foul sewer in the vicinity, the neutralized wastewater should be tankered off site for disposal into foul sewers or treated to a standard acceptable to storm drains and the receiving waters;
- The Waste Disposal Ordinance (Cap 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation, should be observed and complied with for control of chemical wastes. The Contractor is also recommended to develop management procedures for chemicals used and prepare an emergency spillage handling procedure to deal with chemical spillage in case of accidents.

11.7.1.3 Further details of these mitigation measures are available at **Section 5**. With the implementation of the above mitigation measures and the mitigation measures as described under the Water Quality Impact Assessment (refer to **Section 5**), no adverse impact on cultured fish is anticipated from the Project.

11.7.2 Compensation

Direct Loss of Aquaculture Activities

11.7.2.1 Under the Project, there will be unavoidable loss of fishponds, mainly at San Tin and LMC areas, and a small area of fishponds near Shek Wu Wai area. As discussed in **Section 11.5** and **Table 11.2 – Table 11.4**, moderate and minor impacts on aquaculture activities are anticipated from the direct loss of active fishponds (about 53 ha) and inactive fishponds (about 30 ha) respectively, under the Project. Considering the concurrent projects and the potential cumulative impact on aquaculture activities in the wider San Tin and LMC area, the loss of active and inactive fishponds (about 83 ha) will be compensated within the proposed SPS WCP (**Figure 11.2** refers). The Government aims to start the development of SPS WCP in around 2026/2027 for completion by 2039 or earlier to tie in with the full operation of San Tin Technopole. For the site formation works of the first batch of land at San Tin Technopole targeted for commencement in late 2024, no pond filling will be involved. On current planning, pond filling works will not start until 2026/27, and the pace of pond filling will tie in with the development progress of the SPS WCP. To this end, a working group will be formed between CEDD (as San Tin Technopole's works agent) and AFCD (as SPS WCP's sponsoring department) to coordinate the progress of pond filling and SPS WCP implementation.

Secondary Impact from Wetland Enhancement at the proposed SPS WCP

- 11.7.2.2 As discussed in **Section 11.5.6**, existing fishponds within the proposed SPS WCP would be subject to active conservation management measures under the wetland compensation framework (through enhancement of ecological functional value) to compensate for the loss in wetland habitats arising from the development of San Tin Technopole, resulting in some potential decrease in aquaculture production and minor impact on aquaculture activities. Nonetheless, these “ecologically enhanced fishponds” are anticipated to continuously support aquaculture activities and pond fish culture, thus serving dual functions alongside wetland enhancement. On the other hand, upon the establishment of the proposed SPS WCP, aquaculture production would also be increased from the conversion of existing inactive and abandoned fishponds, as well as brownfield areas into “ecologically enhanced fishponds”. As these ponds will be under coordinated management in the proposed SPS WCP, no further compensation area would be required.

Fisheries Compensation

- 11.7.2.3 The requirement of fisheries compensation mainly arises from the direct permanent loss of active fishponds (which support existing aquaculture activities and production), and the permanent loss of inactive fishponds (with potential value to support future aquaculture activities upon conversion). The Government will introduce a suite of mitigation measures to enhance the fisheries resources (e.g. fisheries activities and production, culture area and aquaculture potential etc.) of the proposed SPS WCP with a view to compensate for the loss of fishponds arising from the development of the San Tin Technopole as well as making an overall improvement to the utilisation of fisheries resources for aquaculture and promoting sustainable development of the industry in the long run. The Government will enhance the fisheries resources of 40 ha of land in the SPS WCP, including incorporation of modernised aquaculture, to compensate for the loss in fisheries resources arising from the development of San Tin Technopole. Descriptions and justifications of these mitigation measures are described in **Sections 11.7.2.4 to 11.7.2.16**.

Fisheries Enhancement Area in the proposed SPS WCP

- 11.7.2.4 The Government will reserve 40 ha of land in the proposed SPS WCP as a fisheries enhancement area, in which the fisheries resources will be enhanced by incorporation of modernised aquaculture and proper planning and management of aquaculture activities therein. The fisheries enhancement area shall be delineated separately from the 253 ha “ecologically enhanced fishponds”, of which the purpose would conflict with aquaculture activities for food fish production since the “ecologically enhanced fishponds” mainly serve to provide ecological enhancement and attract foraging birds and other wildlife.

Development of Modernised Aquaculture

- 11.7.2.5 The proposed fisheries enhancement area shall utilise existing fishponds, abandoned fishponds, and brownfield areas within the proposed SPS WCP as far as possible, and shall be actively managed for modernised aquaculture, comprising both indoor and outdoor facilities, where aquaculture activities and fisheries production are generally anticipated to be multiplied upon establishment. The aforementioned measures would improve both the yield and the quality of aquaculture production, promoting the sustainable development and modernization of the fisheries industry.
- 11.7.2.6 Modernised aquaculture generally refers to intensive high-density aquaculture activities, indoor or outdoor, with the adoption of innovative green technologies, such as recirculating aquaculture system (RAS), compartmentalisation, remote real-time environmental monitoring, species selection, ecological polyculture, nutrition management, disease prevention and health management, etc., that create water bodies and environmental conditions suitable for fish growth under high-density stocking conditions.
- 11.7.2.7 Compared to traditional pond fish farming practices, the introduction of modernised aquaculture technology and management would enable fisheries operation in a compact

area while achieving a higher level of aquaculture production. For example, RAS in China has achieved more than double aquaculture production (Li and Zhang, 2011); while the Grass Carp individuals produced with RAS were reported to be of better sizes and quality, thus more popular with consumers (Zhou et al., 2019). Other example of modernised aquaculture in China was reported to involve constructed aquaculture tanks of 3 m tall, 12 m wide, and was reported to result in 15-fold fisheries production in Jiangmen (XinHui, 2023). Another example in Shaoguan has also report production of Sweetfish with improved quality and market price (Hong Kong Commercial Daily, 2023). Overseas examples of RAS have also suggested better control over environmental parameters, and reduced water consumption (EUMOFA, 2020). Compartmentalisation in aquaculture production systems has been suggested to provide better control and management of aquaculture disease emergencies (Zepeda et al., 2008). These applications would improve both the yield and the quality of aquaculture production, providing an overall improvement in the aquaculture industry.

- 11.7.2.8 Specifically, the application of RAS has been suggested as the way-forward in the future of aquaculture (Wu et al., 2017). In light of the increased requirement to effectively regulate water quality to ensure sustainable development of aquaculture, RAS has gained momentum and increased in its application. With the application of RAS, stocking density was highly increased with enhanced overall production, such as a maximum yield of 100 kg/m³ in Europe, and in some cases, up to 300 kg/m³ (pikeperch production in the Netherlands). In France, almost all fingerling production and rearing of turbot and sole are carried out using RAS, while about 70% of aquaculture production is achieved through RAS in Spain and Portugal. Rearing of salmon fry has increased via the application of RAS in Norway, from 350,000 individuals in 2005 to 3.8 million individuals in 2009, suggesting 11-fold increase. Aside from increase production, increased aquaculture diversity was observed, where RAS has started its application to various aquaculture species, now encompassing shrimp, shellfish, and algae farming. In North America, RAS models are highly developed for culturing cold-water species such as salmon and trout. RAS is the development direction for land-based aquaculture in mainland China, and it can only be achieved through large-scale and high-efficiency farming. In 2014, the scale of industrial aquaculture in China approached nearly 60 million m², with a production of 367,000 tonnes. Among them, the scale of industrial marine aquaculture accounted for over 25.645 million m², with a production of 170,000 tonnes. The combined marine industrial aquaculture areas of Shandong and Fujian provinces accounted for more than half of the national total. The marine industrial aquaculture areas in Tianjin and Hainan provinces are quite similar, both exceeding 400,000 m² (Wu et al., 2017).
- 11.7.2.9 Modernisation of aquaculture practices was well-received from interview and discussion with the local fish farmers (**Section 11.4.3.13** refers). With the incorporation of modernised aquaculture, and with multiplied fisheries production anticipated, the enhancement of fisheries resources at the proposed fisheries enhancement area would be adequate to compensate for the loss of active and inactive fishponds. No unacceptable impact on fisheries resource would be anticipated upon the implementation of fisheries enhancement area. Detailed design of the fisheries enhancement area would be further formulated in later detailed studies of the proposed SPS WCP project.

Establishing the AFCD Fisheries Research Centre

- 11.7.2.10 While modernised aquaculture (such as compartmentalisation) has been practised in Hong Kong in some extent (SkyPost, 2019), these aquaculture activities have not been well-documented and lacks technical support, hence are yet to be widespread and well-established within the industry. Proper technical support would ensure the proper implementation of these practices to enhance actual fisheries aquaculture production. As such, under the Project, an AFCD Fisheries Research Centre shall be established at a location near the Loop (**Figure 11.3** refers) to bridge the technical gap by providing support to the modernised aquaculture that is currently practised only in a limit extent in Hong Kong. Details of layout and design are subject to AFCD's approval on the site requirement in the design and construction stage.

- 11.7.2.11 The proposed AFCD Fisheries Research Centre shall be implemented with accorded priority under the initial phase of the Project, for it is indispensable in serving a vital role in the provision of mitigation measures by promoting modernised aquaculture, conducting aquaculture research, and transferring modernised aquaculture techniques to local fish farms, thus facilitating the transformation and upgrading of the industry through technological advancement and improving aquaculture activities in the area.
- 11.7.2.12 Furthermore, the proposed AFCD Fisheries Research Centre would be implemented under the initial phase of the Project, while the majority of the fishpond loss in San Tin and Sam Po Shue would occur during the main phase of the Project (refer to **Appendix 2.1** for development phasing plan). With the early establishment of the Fisheries Research Centre, early enhancement of aquaculture production and activities would be possible, thus minimising fisheries impact before the establishment of fisheries enhancement area in the proposed SPS WCP.

Proper Planning of Aquaculture Activities in the proposed SPS WCP

- 11.7.2.13 In order to enhance efficiency of the overall aquaculture activities and fisheries production, a compensation strategy shall be implemented at the fisheries enhancement areas, and at the overall fishponds within the proposed SPS WCP. The compensation strategy shall include proper replanning of fishpond areas and wetland habitats within the SPS WCP, incorporating suitable modernised aquaculture technology and management practice in accordance with the environmental constraints and the purpose of aquaculture operation, and centralising the same types of aquaculture activities in the same area, etc. Details of the compensation strategy would be further formulated in later detailed studies of the proposed SPS WCP project.

Other Benefits from Fisheries Enhancement Area with Modernised Aquaculture

- 11.7.2.14 In addition to achieving a higher level of aquaculture production with less space, modernised aquaculture can achieve other value-added effects to the aquaculture industry and the environment such as time and energy saving, reduction in aquaculture sewage and carbon emissions, and income improvement. For example, RAS would achieve an ecological aquaculture system with zero wastewater discharge, and advantageous to the protection of surrounding water bodies (Peng et al., 2010; EUMOFA, 2020); while compartmentalised aquaculture production systems would exert better environmental control and minimise outbreak of disease (Zepeda et al., 2008). These factors (improved culture environment and minimisation of disease) would result in a better yield and income due to improved quality and potential market price of the aquaculture production. Other value-added effect such as time and energy saving would also suggest reduced cost of the aquaculture activities, but improved yield and income. As such, the implementation of modernised aquaculture would not only increase the aquaculture production, but would also improve the environmental sustainability and social economy of aquaculture activities, subsequently contributing to the sustainable development of the industry in the long run.
- 11.7.2.15 All of the above measures would also compensate for the loss of aquaculture opportunities and fisheries production due to the concurrent development projects; as well as provide affected fish farmers with land for rehabilitation of fish farming business and create a positive synergistic effect on conservation of wetland and aquaculture activities.
- 11.7.2.16 Upon the implementation of the essential mitigation measures at the proposed SPS WCP, it is anticipated that the fisheries resources (including aquaculture area, activities, and potential, etc.) of the industry could be enhanced, and the potential impact on aquaculture activities arising from the project would be mitigated to an acceptable level.

11.8 Evaluation of Residual Impacts

- 11.8.1.1 As described under **Section 11.5** and **11.6**, in the absence of mitigation measures, minor and moderate impacts may arise from the loss of aquaculture production and activities from the construction phase of the Project. Combined with the cumulative impact arising from

concurrent projects in the vicinity, residual impact may arise in the absence of mitigation measures.

- 11.8.1.2 As discussed in **Section 11.7**, compensation measures have been recommended under the EIA Study, including proposed fisheries enhancement area (40 ha) within the proposed SPS WCP with enhanced fisheries resources, implementation of modernised aquaculture, the establishment of indoor aquaculture facilities, and associated mitigation measures to improve aquaculture activities and fisheries production, with the proposed AFCD Fisheries Research Centre within the Project to bring forth technological advancement in the area. Upon the implementation of the proposed mitigation measures, no residual impact is anticipated from the Project.
- 11.8.1.3 Some loss of aquaculture production and activities are still observed during the time gap from the commencement of Project and the establishment of SPS WCP.

11.9 Environmental Monitoring and Audit

- 11.9.1.1 With the implementation of mitigation and precautionary measures proposed in **Section 5**, potential water quality impacts arising from the Project would be minimised. No specific EM&A programme is required for the potential water quality impact in association with fisheries impact because the monitoring and audit requirement have been covered by the EM&A programme for potential water quality impact recommended in **Section 5**. The loss of fishpond (i.e. loss of aquaculture area), aquaculture activities and potential will also be compensated by the 40 ha of area within the SPS WCP reserved solely for aquaculture, through measures described in **Section 11.7.2** (including incorporation of modernised aquaculture and the development of Fisheries Research Centre, etc.), while the location and detailed design would be subject to subsequent study. The implementation details of the fisheries enhancement area, the associated management, the supervision, and the maintenance works at the operation stage would be included during the detailed design. As the overall enhancement of fisheries resources brought about by the mitigation measures is qualitative in nature and non-measurable, no further specific monitoring and audit programme for fisheries resources and aquaculture activities would be necessary.

11.10 Conclusion

- 11.10.1.1 Key fisheries resources within the Assessment Area mainly includes active fishponds, which was mainly located at the northern portion (near San Tin, Sam Po Shue, LMC, and Ha Wan Tsuen), as well as small area of ponds at Shek Wu Wai and Ngau Tam Mei. Inactive fishponds and abandoned fishponds were also observed within the Project boundary, but were not observed to contribute to aquaculture activities from recent site visits. Nevertheless, inactive fishponds are considered as key fisheries resources owing to its potential in converting into active fishponds for aquaculture activities.
- 11.10.1.2 Under a conservation approach, impact on aquaculture activities is anticipated from the Project, arising from the loss of active fishponds (about 53 ha) and inactive fishponds (about 30 ha) within the Project boundary, which is considered to be of potentially moderate and minor impacts respectively. Taking into account the cumulative loss of fisheries resources in the wider area, fisheries compensation would be implemented for the loss of active and inactive fishponds.
- 11.10.1.3 Secondary impact may also arise from ecological enhancement measures proposed under the wetland enhancement, to be implemented at the proposed SPS WCP. Direct loss of fishpond areas is not expected within the proposed SPS WCP, but the ecological enhancement or management regime (e.g. re-profiling and/or partial drain-down of ponds) may result in secondary impact due to slightly reduced aquaculture production at existing active fishponds, which would result in potentially minor impact. On the other hand, conversion of inactive fishponds, abandoned fishponds, and brownfield within the proposed SPS WCP into active “ecologically enhanced fishponds” would result in an increase of aquaculture production. As detailed in above sections, the secondary impact will not result in significant impact on aquaculture activities.

- 11.10.1.4 A fisheries enhancement area of 40 ha has been recommended to compensate for the direct permanent loss of active and inactive fishponds, located within the proposed SPS WCP, with measures to enhance fisheries resources. These measures include the incorporation of modernised aquaculture, the implementation of AFCD Fisheries Research Centre under the initial phase of the Project, and proper planning of aquaculture activities in the proposed SPS WCP. This area for fisheries enhancement would also be delineated separately from the “ecologically enhanced fishponds” to minimise conflict with foraging birds.
- 11.10.1.5 Upon the implementation of the recommended measures, no adverse impact on fisheries resources is anticipated from the construction and operation of the Project, as well as the secondary impact arising from wetland enhancement measures.

11.11 Reference

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