

## **7 FISHERIES IMPACT**

### **7.1 Introduction**

7.1.1 This section presents the potential fisheries impacts generated from the construction and operation of the TKO-LT Tunnel.

7.1.2 Baseline conditions for fisheries resources in the assessment area were identified from the latest relevant literature. Potential direct, indirect, cumulative and residual impacts on fisheries resources during the construction and operation phases of the Project were identified and evaluated. Mitigation measures have been recommended where necessary.

### **7.2 Environmental Legislation, Standards and Criteria**

7.2.1 This fisheries impact assessment was conducted according to criteria and guidelines set out in the Annex 9 and Annex 17 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) in order to provide complete and objective identification, prediction and evaluation of potential fisheries impacts arising from the Project. EIAO-TM Annex 17 sets out the methodology for assessment of fisheries impacts and Annex 9 provides the evaluation criteria.

7.2.2 Other local legislations that are relevant to this fisheries impact assessment include:

- Fisheries Protection Ordinance (Cap. 171) – promotes the conservation of fish and other forms of aquatic life within Hong Kong waters by regulating fishing practices to prevent detrimental activities to the fisheries industry.
- Marine Fish Culture Ordinance (Cap. 353) – regulates and protects marine fish cultured by designating areas of fish culture zone, granting licenses, prohibiting unauthorized vessels and any deposition of chemicals or other substances which are likely to cause injury to fish in a fish culture zone.
- Water Pollution Control Ordinance (Cap. 358) – aims to control water pollution in waters of Hong Kong. Water control zones (WCZs) are designated with individual water quality objectives to promote the conservation and best use of those waters in the public interest. The most updated water quality objectives for the Junk Bay WCZ, Eastern Buffer WCZ and Victoria Harbour WCZ were revised in June 1997.

### **7.3 Assessment Methodology**

#### Assessment Area

7.3.1 As specified in the EIA Study Brief, the assessment area for the fisheries impact is the same as that for water quality impact assessment and includes areas within Junk Bay WCZ, Eastern Buffer WCZ and Victoria Harbour WCZ, as designated under the Water Pollution Control Ordinance, and areas likely to be impacted by the Project.

#### Assessment Approach

7.3.2 Baseline information on fisheries resources in the assessment area was acquired through desktop review of available literature. This review included relevant fisheries baseline data

presented in Port Survey 2006 (AFCD, 2012a) and other relevant information available in other reports and publications. Information gaps were not identified and therefore no field surveys were considered necessary.

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

## **7.4 Description of the Environment**

### Sites of Fisheries Importance

- 7.4.1 There is one mariculture area identified in the assessment area, Tung Lung Chau Fish Culture Zone (FCZ), which is approximately 5 km to the southeast of the proposed Project area. The locations of the key fisheries resources within the assessment area are shown in **Figure 7.1**. Based on the findings of the literature review, no important nursery or spawning area was identified within the assessment area (AFCD, 1998).

### Capture Fisheries

- 7.4.2 In 2011, the Hong Kong capture fishing industry landed approximately 170,720 tonnes of fisheries product value at \$2,358 million (AFCD, 2012a). The industry consisted of about 4,000 fishing vessels and 8,500 fishermen. Fishing activities were mainly conducted in the waters of the adjacent continental shelf in the South China Sea. The majority of the fishing vessels were manned by family members with the assistance of hired crews. Main fishing methods included trawling, long-lining, gill-netting and purse-seining, with the majority of the total catch obtained through trawling. Some recent data on Hong Kong capture fisheries industry is summarized in **Table 7.1**

**Table 7.1 Recent Hong Kong Capture Fisheries Industry Figures**

<b>Year Parameter</b>	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>	<b>2007</b>	<b>2006</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>	<b>2002</b>	<b>2001</b>
<b>Fishing fleet size (No. of vessels)</b>	4,000	3,900	3,700	3,800	4,000	3,950	4,150	4,300	4,600	4,470	5,100
<b>Local fisherman engaged in capture fisheries</b>	8,500	8,200	7,600	7,900	8,500	8,500	9,170	9,700	10,100	10,860	11,560
<b>Production (thousand tonnes)</b>	170.72	168	159	158	154	155	162	167.5	157.4	169.8	174
<b>Value of produce (HK\$ million)</b>	2,358	2,100	2,000	1,780	1,530	1,600	1,600	1,600	1,500	1,600	1,700

Source: AFCD 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012a

7.4.3 The latest AFCD Port Survey 2006 (AFCD 2012a) provides the most updated information on capture fisheries in Hong Kong waters, including both fishing operation and fisheries production (adult fish and fry). In general, the highest fish yields in Hong Kong were obtained in the eastern waters (e.g. Tolo Harbour, Crooked Haven, Port Shelter, and Po Toi) and the southwestern waters (e.g. Lamma Island, Cheung Chau and Soko Island).

7.4.4 This fishing operation within the assessment area was mainly supported by vessels of less than 15 m in length. Sampans and purse seiners were the dominant fishing vessels but other vessels such as gill netters, stem trawler, shrimp trawler, hang trawler, long liners, handliners and miscellaneous crafts were also operated within the assessment area. The capture fisheries data in the assessment area are summarized in **Table 7.2**. The proposed reclamation area for the project is located in Chiu Keng Wan within the Junk Bay.

**Table 7.2 Summary of Capture Fisheries Data in the Assessment Area**

<b>WCZ Parameter</b>	<b>Eastern Buffer WCZ</b>	<b>Junk Bay</b>	<b>Eastern Victoria Harbour</b>	<b>Mid Victoria Harbour</b>	<b>Western Victoria Harbour</b>
<b>No. of vessels</b>	100 – 400	100 - 400	100 - 400	100 - 400	10 – 100
<b>Adult fish annual production in terms of weight (kg/ha)</b>	100 – 400	100 - 200	100 - 400	100 - 400	>0 and ≤ 100
<b>Fish fry annual production in terms of density (tails/ha)</b>	None Reported	None Reported	None Reported	None Reported	None Reported
<b>Fisheries annual production (adult and fry) in terms of value (HK\$/ha)</b>	2,000 – 10,000	2,000 – 10,000	5,000 – 10,000	5,000 – 10,000	>0 to 5,000

Source: AFCD 2012a

7.4.5 The number of fishing vessels operating within the assessment area was generally between 100 and 400 vessels except the western Victoria Harbour (10 – 100 vessels).

7.4.6 In terms of weight, the adult fish production ranged from >0 to 400 kg/ha on an annual basis within the assessment area. Within each water control zone, adult fish production can vary in different regions. In fact, the weight of adult fish production within the proposed reclamation of the Project in Junk Bay ranged from 100 to 200 kg/ha only. Mid-Victoria Harbour and the west coast of Tung Lung Chau yielded adult fish production of 200 - 400 kg/ha, but these areas are located at distance (>5 km) from the proposed marine works.

7.4.7 In recent years, fry collection in Hong Kong has reduced in scale. The latest interview studies reported that fry collection only occurs in a few areas (AFCD, 2012a). The highest fry collection was mainly found in the northeast inshore waters at Three Fathoms Cove, Crooked Harbour, Double Haven, and Long Harbour. No fish fry production was reported within Junk Bay WCZ, Eastern Buffer WCZ and Victoria Harbour WCZ.

7.4.8 Important nursery grounds can be identified from the sites where juveniles of commercial fish and crustaceans are abundant, and most fry of high value species are found; and important spawning grounds are the sites where mature individuals are abundant. According to the “Fisheries Resources and Fishing Operations in Hong Kong Waters” (AFD, 1998), nursery grounds of commercial fisheries resources were identified at Northeast Waters, Port Shelter, Lamma Island and South Lantau; whilst spawning grounds of commercial fisheries resources were identified at Northeast Waters, Eastern Waters, Southeast Hong Kong in Mirs Bay, South Lamma, South Cheung Chau, Northeast Lantau, and South Lantau (AFD, 1998). These areas are all outside the assessment area.

7.4.9 Overall, in terms of capture fishery production value, the assessment area showed a range of production value from >HK\$0 to 10,000 annually. Moderate production (HK\$5,000 – 10,000 /ha) occurred in mid and eastern Victoria Harbour, whilst a low to moderate production value (HK\$2,000 – 10,000 /ha) was recorded in the proposed reclamation within Junk Bay.

7.4.10 Capture fisheries production of the top ten fish families within the assessment area is summarized in **Table 7.3**.

**Table 7.3 Fisheries Production (kg/ha) of the Top Ten Families in the Assessment Area**

WCZ Top Ten Fish Families	Eastern Buffer WCZ	Junk Bay	Eastern Victoria Harbour	Mid Victoria Harbour	Western Victoria Harbour
Scad (Caragidae)	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5
Shrimp	≤ 5	≤ 5	None reported	None reported	≤ 5
Rabbitfish (Siganidae)	20 – 60	20 - 60	> 60	> 60	≤ 5 – 20
Squid	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5
Croaker (Sciaenae)	5 – 20	≤ 5 – 10	≤ 5	≤ 5	≤ 5 – 10
Crab	10 – 20	5 – 20	20 – 40	10 – 40	≤ 5 - 20
Mullet (Mugiidae)	≤ 5	≤ 5 – 10	5 – 10	≤ 5	≤ 5
Sardine (Clupeidae)	≤ 5 – 10	≤ 5 – 10	≤ 5 – 10	≤ 5	≤ 5
Seabream (Sparidae)	10 – 40	10 - 40	10 - 40	5 - 20	≤ 5
Anchovy (Engraulidae)	≤ 5 – 40	None Reported	None Reported	None Reported	≤ 5

Source: AFCD 2012a

7.4.11 The most common capture fish within and near the proposed reclamation area was the low valued Rabbitfish (Siganidae) (AFD, 1998), followed by Seabream (Sparidae). Rabbitfish was also the most common capture fisheries in the rest of the assessment area.

### Culture Fisheries

- 7.4.12 Marine culture fisheries include marine culture and oyster culture. Mariculture areas for marine fish in Hong Kong includes 26 fish culture zones (FCZs) located in various sheltered coastal areas in Hong Kong marine waters occupying approximately 209 ha of marine area with about 1,015 licensed operators in 2011 (AFCD, 2012b). The majority of the licensed fish farms are small, family-based and consist of one to two rafts with average total area of around 280 m<sup>2</sup>. Oyster culture has been practiced on the Deep Bay mudflats for at least 200 years. Production from oyster culture in 2011 was about 60 tonnes (meat only) valued at \$4 million (AFCD, 2012b).
- 7.4.13 There is one FCZ but no oyster culture present in the assessment area. The location of the Tung Lung Chau FCZ is shown in **Figure 7.1**. It is located approximately 5 km away from the proposed marine works area.
- 7.4.14 Although no figures are available for the individual production of FCZs, it was estimated that culture fisheries of marine fish production in 2011 weighted 1,185 tonnes and was valued at \$94 million which catered for approximately 8% of local demand for live marine fish (AFCD, 2012b). Recent figures on marine fish culture are present in **Table 7.4**.

**Table 7.4 Recent Figures for Hong Kong Marine Culture Fisheries Industry**

Year	No. of licensed operators	Production (tonnes)	Value (HK\$)
2011	1,015	1,185	94
2010	1,035	1,512	118
2009	1,050	1,437	92
2008	1,060	1,370	82
2007	1,070	1,532	99
2006	1,078	1,490	89
2005	1,092	1,540	76
2004	1,125	1,540	79
2003	1,155	1,490	76
2002	1,240	1,211	57
2001	1,370	2,470	136

Source: AFCD 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012b

- 7.4.15 The species cultured in Hong Kong varied depending on the availability of imported fry. Common species under marine culture included Green Grouper, Brown-spotted Grouper, Giant Grouper, Russell's Snapper, Mangrove Snapper, Goldlined Seabream, Star Snapper and Red Drum (AFCD, 2012b).

## **7.5 Identification, Prediction and Evaluation of Environmental Impacts**

### Construction Phase

- 7.5.1 The proposed marine works required under the Project could cause potential impacts to fisheries resources. Marine-based construction activities associated with the Project include:

- Approximately 3 ha of reclamation works for protection of the depressed Road P2;
- Piling works for the construction of marine piers (approximately 0.6 ha) for the elevated slip roads at TKO Interchange; and
- Construction and decommission of two temporary barging points at Chiu Keng Wan and Cha Kwo Ling (approximately 0.3 ha).

7.5.2 The potential impacts to the fisheries resources within the assessment area may include:

- Permanent and temporary loss of fishing ground (refer to **Figure 7.2** and **Figure 7.3**); and
- Indirect impact to fisheries resource due to change in water quality.

#### Direct Impacts

##### *Loss of Fishing Grounds*

7.5.3 The proposed reclamation for the protection of Road P2 and the bridge pier construction would occupy the fishing ground permanently, and result in a permanent loss of approximately 3.6 ha (3 ha due to reclamation and 0.6 due to bridge piers) of fishing ground in Junk Bay. The construction barges for the bridge structure and the temporary barging points at Chiu Keng Wan and Cha Kwo Ling would limit the access of the fishing vessels to the works area during the construction phase. Approximately 19 ha of marine area (18.9 ha at inner Junk Bay and 0.1 ha at Eastern Victoria Harbour due to the Cha Kwo Ling barging point) would be occupied temporarily for the duration of the construction period (approximately 4.5 years). The marine works area would be reopened for fishing after construction. The temporary marine works area within inner Junk Bay yields low fisheries production while the size of the temporary barging point at Cha Kwo Ling is small (approximately 0.1 ha) with low to moderate fisheries production. Impacts arising from the loss of fishing grounds due to the barging point at Cha Kwo Ling within the Victoria Harbour WCZ are negligible, while the direct impact of the Project on fisheries resources and operations within Junk Bay is low.

#### Indirect Impacts

##### *Changes in Water Quality*

7.5.4 Indirect impacts on the fisheries resources would be associated with changes of water quality due to reclamation works, piling works, and site runoff from the land-based construction works. Details are described and evaluated below.

##### *Elevation of Suspended Solids (SS)*

7.5.5 Marine works would disturb the seabed and cause a temporary increase in SS level. The increase in SS level may potentially cause lethal or sublethal effects on fish. High SS levels may clog gill structures of fish and thus hinder transfer of oxygen. Eggs and early life stages (fry) are more susceptible to smothering of respiratory surface due to high sediment levels.

7.5.6 Adult fish are more likely to move away when they detect certain SS level and therefore less sensitive to the effects from SS. Suspended sediment fluxes occur naturally in the marine environment, particularly in estuaries, and consequently fish have evolved behavioural adaptations to tolerate increased SS loads, including clearing their gills by flushing more water over them. Where SS levels become excessive, fish may move to less turbid waters. If SS levels exceed tolerance thresholds and the fish are unable to move away from the area,

they may become stressed or even die. The rate, timing and duration of SS elevations will influence the type and extent of impacts on fish and crustaceans (CPPC, 2006). Lethal response had not been observed in adult fish at SS level less than 125 mg/L, and sublethal effects were only reported at levels exceeded 90 mg/L. However, guideline values were identified for fisheries and selected marine ecological sensitive receivers in Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment based on international marine water quality objective guidelines for the ecosystem protection. The recommended value was 50 mg/L (AFCD, 2001). Besides, the Water Quality Objective (WQO) for SS (i.e. elevation of less than 30% of ambient baseline level) is also generally applicable to fisheries sensitive receivers inside the relevant water control zones.

- 7.5.7 Potential impacts on fisheries resource arising from elevation of SS in Junk Bay were identified in the modeling results from water quality assessments. The water quality modeling results are based on the scenario that the marine works of Cross Bay Link (CBL) is happening concurrently and the application of silt curtain has been implemented. Under these conditions, the modeling results showed no exceedance of SS levels. The maximum level of suspended solid is 1.5 mg/L which is in compliance with WQOs (**Table 5.16** and **Table 5.17 refer**).
- 7.5.8 Indirect impacts are not expected to occur at Tung Lung Chau FCZ as the predicted SS level would be below 50 mg/L. Therefore, possible indirect impacts would be insignificant. (**Table 5.16** and **Table 5.17 refer**).

#### Oxygen Depletion

- 7.5.9 Increase in SS in water column combined with a number of other physical or biotic factors would reduce dissolved oxygen (DO) in water column. Elevated SS reduces light penetration, lowers the photosynthetic rate of phytoplankton and so lowers the rate of oxygen production in the water column. Also the release of inorganic substances from the dredged sediment may cause eutrophication and algal bloom. Oxidation of dead algae may use up some of the oxygen in the water. If oxygen levels are depleted to low levels, fish, especially those in early life stages may be unable to tolerate such conditions and suffer hypoxia-induced mortality and / or stress including reduced feeding and growth rate.
- 7.5.10 The WQO standard in Junk Bay regarding DO levels for bottom-waters should remain above 2.0 mg/L and for the average depth it should remain above 4.0 mg/L. Both standards should be in compliance for 90% of the time. Based on the water quality modeling results in **Section 5** and **Table 5.20.**, the depletion in DO level caused by the proposed works (refer to **Table 7.6**) is anticipated to be 0.02 mg/L at most. The DO level would be similar to that of the baseline condition and also in compliance with the WQOs. Thus, indirect impacts on the fisheries resources arising from the oxygen depletion would be insignificant.

#### Release of Contaminant from Marine Sediment

- 7.5.11 The reclamation can potentially cause the release of contaminants (e.g. heavy metal, inorganic nutrients, etc.) from the marine sediment. Potential impacts on fisheries resources may include the accumulation of contaminants in the tissues of fish, resulting in sublethal effects which may alter behavior, reproduction and increase susceptibility to disease. Eggs, larvae and juveniles are particularly susceptible to the sublethal effects of contaminants, and elevated levels may lead to increased mortality. Bioaccumulation in commercially important fish species may ultimately impact human health. High nutrient levels in marine water arising from marine sediment may trigger rapid increase in phytoplankton, resulting in algal bloom. The phytoplankton may produce biotoxins which could be lethal to fish.



7.5.12 In order to assess the level of contaminants released, elutriate modeling tests have been conducted. Test results show the concentration of dissolved metals to be within compliance of the water quality objectives (refer to **Table 5.5**). Impacts on fisheries resources due to bioaccumulation of released contaminants from dredged sediment is therefore not expected to occur.

Operation Phase

7.5.13 Potential water quality impacts during operational phase would be due to road surface runoff. Runoff from road surfaces and leaks from vehicles may be contaminated, however the road work designs are equipped with adequate drainage systems and appropriate oil interceptors which would guide the polluted runoff to be properly treated. Therefore, no significant impacts on fisheries resources are expected during the operation phase of the Project.

7.5.14 The overall evaluation of fisheries impact arising from the proposed marine works are summarized in **Table 7.5**.

**Table 7.5 Summary of Potential Fisheries Impact during Construction Phase**

Criteria	Construction Phase Impact
<b>Nature of Impact</b>	<p><u>Direct Impact</u>  Permanent loss of fishing ground due to the proposed reclamation and pier construction is permanent in nature. Temporary loss of fishing ground for the construction of bridge structure and operation of the two temporary barging points would last for about 4.5 years.</p> <p><u>Indirect Impact</u>  All water quality parameters such as level of SS, contaminants and nutrients released and DO levels would be in compliance of the water quality objectives.</p>
<b>Size of Affected Area</b>	<p><u>Direct Impact</u>  Low. Approximately 3.6 ha (3 ha due to reclamation and 0.6 ha due to bridge piers) of fishing ground would be permanently lost to reclamation and pier construction, and about 19 ha of fishing ground would be temporarily lost.</p> <p><u>Indirect Impact</u>  Insignificant. Water quality parameters would stay within compliance with water quality objectives under the mitigated scenario.</p>
<b>Loss of Fisheries Resource / Production</b>	<p>Low. The loss is considered to be an insignificant portion of the total fisheries production in Hong Kong.</p>
<b>Destruction and Disturbance of Nursery and Spawning Grounds</b>	<p>No destruction and disturbance of important nursery and spawning grounds for commercial fisheries species.</p>
<b>Impact on Fishing</b>	<p>Low. The fishing grounds in Junk Bay where reclamation for</p>

Criteria	Construction Phase Impact
<b>Activity</b>	TKO-LT Tunnel is proposed supports 100 – 400 fishing vessels and adult fish production with an annual weight of 100 – 200 kg/ha and annual value of HK\$2,000 – 5,000/ha. The size of the fishing ground loss is small. The affected area only supports a small proportion of fisheries production in Hong Kong. Whilst the fishing ground loss within the Eastern Victoria Harbour supports 100 – 400 fishing vessels, adult fish production of 100 – 400 kg/ha and HK\$2,000 – 10,000/ha annually. The size of temporary loss of fishing grounds within the Eastern Victoria Harbour is insignificant (0.1 ha).
<b>Impact on Aquaculture Activity</b>	Insignificant impacts to Tung Lung Chau FCZ within the assessment area.
<b>Overall Fisheries Impact</b>	Low. The permanent loss of low valued fishing ground is small and the nature of other potential impacts are temporary and within a small area.

7.5.15 In summary, based on the water quality modeling, the overall impact to the fisheries production in the vicinity of the affected area is expected to be low. Any potential significant impacts would exist only during the construction phase. Furthermore, the area of the impact is small and sustains a low and low to moderate value (low value in Eastern Victoria Harbour and low to moderate in inner Junk Bay) in terms of fisheries production.

## 7.6 Evaluation of Cumulative Impacts

7.6.1 Marine-based construction works for this Project would commence in January 2016 and finish in October 2020. Marine works associated with a number of other, separate projects within the assessment area would likely overlap with the construction phase of this Project, and are listed in **Table 7.6**.

**Table 7.6 Summary of Concurrent Projects**

Project	Project Proponent	Construction Programme	Major Marine-based Works
Cross Bay Link	Civil Engineering and Development Department	May 2017 to August 2018	Filling
Trunk Road T2	Civil Engineering and Development Department	End of 2015 to end of 2020	Dredging and filling
CLP Windfarm	China Light and Power	January 2017 to September 2017	Grab dredging and suction caisson

7.6.2 Marine-based construction works of CBL would be undertaken within Junk Bay concurrently with the Project. According to the CBL EIA study report (CEDD, 2013), a small area of

fishing ground of less than 0.3 ha would be permanently lost and approximately 9.6 ha would be temporarily lost during the nine month construction phase. Together with the fishing ground loss of the Project (3.6 ha of permanent and 19 ha of temporary loss for less than five years), the cumulative permanent and temporary loss within Junk Bay would be approximately 3.9 ha and 28.6 ha respectively. Given the small area of permanent loss and the timeframe for the temporary loss, the cumulative loss of fishing grounds arising from the Project and CBL is considered to be acceptable.

- 7.6.3 Marine-based construction activities, such as dredging and filling works required in the above projects may produce indirect impacts to fisheries resources. Cumulative water quality modeling including all three of the above projects, indicate that water quality parameters such as SS levels, contaminants and nutrients released and DO levels would be in compliance with the WQOs under the mitigated scenario (**Table 5.16** to **Table 5.17** refer).
- 7.6.4 No significant cumulative impacts are expected to occur from concurrent projects mentioned above (**Table 7.6** refers) under the mitigated scenario.

## **7.7 Evaluation of Residual Impacts**

- 7.7.1 The identified residual impacts would be the permanent loss of 3.6 ha (3 ha due to reclamation and 0.6 ha due to bridge piers) and temporary loss of 19 ha of fishing ground in Junk Bay resulting from the proposed reclamation works, bridge construction works and temporary barging points. In view of the small size and low fisheries importance of the area being affected, this residual impact is considered acceptable.
- 7.7.2 With the implementation of appropriate mitigation measures, water quality impacts as a result of the Project works would be minimized and acceptable. Residual impacts on fisheries resources due to water quality deterioration is acceptable as water quality standards would be in compliance with WQOs during operation phase.

## **7.8 Mitigation of Adverse Environmental Impacts**

- 7.8.1 According to the guidelines in Annex 17 of EIAO-TM, the general policy for alleviating fisheries impacts in order of priority are avoidance, minimization and compensation.
- 7.8.2 Potential impacts on fisheries resources and fishing operations arising from the Project have been avoided or minimized by minimizing the extent of reclamation and the application of non-dredge method (refer to **Section 2.5**). The alignment option for the TKO-LT Tunnel, particularly in relation to the extent of reclamation for the protection of P2 road and landing area for the elevated slip roads connecting the interchange with CBL, has been substantially evaluated and revised. The option with minimal reclamation extent (approximately 3.6 ha) has been selected. Therefore, the direct loss of fishing ground in Junk Bay due to reclamation has been largely avoided.
- 7.8.3 Mitigation measures recommended in the water quality impact assessment for controlling water quality impact will also serve to protect fisheries from indirect impacts and ensure no unacceptable impact on fisheries resources and operations. The proposed mitigation measure to be undertaken by the contractor includes the installation of single floating silt curtain at the opening of the newly installed seawall during the reclamation of Road P2. For more detailed mitigation measures regarding water quality refer to **Section 5**.
- 7.8.4 Mitigation measures are only required during construction phase in order to minimize SS levels as well as to contain the spread of sediments so that there are no potential threats to fisheries resources.

## **7.9 Environmental Monitoring and Audit Requirements**

- 7.9.1 No unacceptable residual fisheries impact is expected from the project. No monitoring program specified for fisheries is required. However, monitoring of water quality parameters during the construction phase of the Project would be required to ensure the effectiveness of the mitigation measures (refer to **Section 5.10.1**).

## **7.10 Conclusion**

- 7.10.1 Following the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the EIAO-TM, a study based on existing information on commercial fisheries resources and fishing operations within the waters of the assessment area has been undertaken. Sensitive areas of nearby FCZs, spawning areas and nursery grounds have been identified, where present.
- 7.10.2 No important spawning or nursery grounds were identified within or in the immediate vicinity of the proposed marine works area, while the nearest Fish Culture Zone FCZ\_ (Tung Lung Chau FCZ) is located approximately 5 km away from the proposed marine works area. The importance of capture fisheries resources in the vicinity of the proposed marine works area was identified as low in terms of both production weight and value. Fish fry production was absent from the assessment area and therefore would not be affected by the proposed works.
- 7.10.3 The Project would cause about 3.6 ha permanent loss and 19 ha temporary loss of fishing area in inner Junk Bay and Eastern Victoria Harbor due to the proposed marine works. Considering the generally low importance of the fishing areas in inner Junk Bay and Eastern Victoria Harbour when compared to the overall Hong Kong fisheries production and the low and low to moderate production at these areas, the direct impact of the Project on fisheries resources and operations would be regarded as low.
- 7.10.4 No significant indirect impacts due to deterioration of water quality are expected. However, mitigation measures for water quality impact, such as reduced filling rates, closing of seawall before reclamation and refining construction schedule between concurrent projects would still be implemented to protect fisheries resources. No operational phase impacts are expected.

### **References**

Agriculture and Fisheries Department (1998). Fisheries Resources and Fishing Operation in Hong Kong Waters. Prepared by ERM for Agriculture and Fisheries Department, HK SAR Government.

Agriculture, Fisheries and Conservation Department (2001). Final Report. Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment. Prepared by Centre for Coastal Pollution and Conservation, City U Professional Services Limited for Agriculture, Fisheries and Conservation Department, HK SAR Government.

Agriculture, Fisheries and Conservation Department (2002). Agriculture, Fisheries and Conservation Department Annual Report 2001-2002.

Agriculture, Fisheries and Conservation Department (2003). Agriculture, Fisheries and Conservation Department Annual Report 2002-2003.

Agriculture, Fisheries and Conservation Department (2004). Agriculture, Fisheries and

Conservation Department Annual Report 2003-2004.

Agriculture, Fisheries and Conservation Department (2005). Agriculture, Fisheries and Conservation Department Annual Report 2004-2005.

Agriculture, Fisheries and Conservation Department (2006). Agriculture, Fisheries and Conservation Department Annual Report 2005-2006.

Agriculture, Fisheries and Conservation Department (2007). Agriculture, Fisheries and Conservation Department Annual Report 2006-2007.

Agriculture, Fisheries and Conservation Department (2008). Agriculture, Fisheries and Conservation Department Annual Report 2008-2009.

Agriculture, Fisheries and Conservation Department (2009). Agriculture, Fisheries and Conservation Department Annual Report 2008-2009.

Agriculture, Fisheries and Conservation Department. (2010). Agriculture, Fisheries and Conservation Department Annual Report 2009-2010.

Agriculture, Fisheries and Conservation Department (2011). Agriculture, Fisheries and Conservation Department Annual Report 2010-2011.

Agriculture, Fisheries and Conservation Department. (2012a) Fisheries: Capture Fisheries.[http://www.afcd.gov.hk/english/fisheries/fish\\_cap/fish\\_cap\\_latest/fish\\_cap\\_latest.html](http://www.afcd.gov.hk/english/fisheries/fish_cap/fish_cap_latest/fish_cap_latest.html). Accessed on 19 September 2012.

Agriculture, Fisheries and Conservation Department (2012b). Fisheries: Aquaculture.[http://www.afcd.gov.hk/english/fisheries/fish\\_aqu/fish\\_aqu\\_mpo/fish\\_aqu\\_mpo.html](http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html). Accessed on 19 September 2012.

Civil Engineering and Development Department (2013). Agreement No. CE 43/2008(HY) Cross Bay Link, Tseung Kwan O – Investigation. Environmental Impact Assessment Report.