

## **15 FISHERIES IMPACT**

### **15.1 Introduction**

15.1.1 This section identifies and evaluates the potential impacts on capture and culture fisheries in the assessment area resulting from the Kai Tak Development Project. The majority of works are terrestrial based and would have limited impacts on fisheries resources. However part of the Project involves marine based activities including dredging works for construction of cruise terminal and thus there is potential for adverse impacts on fisheries resources. Other works within the project that may impact fisheries resources are the construction of a public landing steps cum fireboat berth, decommissioning of the disused fuel dolphin, opening of a 600m wide runway gap, reconstruction of a section of the Kwun Tong submarine outfall and construction of submerged tunnels of Road T2 and Central Kowloon Route (CKR) as well as the localised maintenance dredging at Kai Tak Approach Channel (KTAC) as part of the KTAC odour remediation works.

15.1.2 This assessment is based on desktop review of the latest relevant literatures to describe the baseline condition, identify and evaluate potential direct, indirect, residual and cumulative impacts on fisheries resources during the Project. Mitigation measures and monitoring programme would be recommended, if necessary.

### **15.2 Environmental Legislation, Standards and Guidelines**

15.2.1 This fisheries impact assessment is conducted according to criteria and guidelines set out in the EIAO-TM Annex 9 and Annex 17 in order to provide complete and objective identification, prediction and evaluation of potential fisheries impacts arising from the Project.

15.2.2 Other local legislation that applies to fisheries and is relevant to this fisheries impact assessment includes the following:

- Fisheries Protection Ordinance (Cap. 171) – aims to promote the conservation fish and other forms of aquatic life within the Hong Kong waters by regulating fishing practises to prevent detrimental activities to the fisheries industry. The Ordinance came into effect on 30 June 1997.
- Marine Fish Culture Ordinance (Cap. 353) – regulates and protects marine fish culture by designating areas of fish culture zone, granting license, prohibiting unauthorized vessels and any deposition of chemicals or other substance which are likely to cause injury to fish in a fish culture zone. The list of designated fish culture zones was last revised in January 2000.
- The Water Pollution Control Ordinance (Cap.358) – aims to control water pollution in the waters of Hong Kong. Water control zones 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 Victoria Harbour Water Control Zone were revised in June 1997.

### **15.3 Assessment Methodology**

15.3.1 Baseline fisheries conditions are elucidated via a review of relevant literatures including the latest fisheries data presented in the AFCD Port Survey Report 2006-2007 and other relevant information available in other reports and publications listed below. No necessary field survey is identified and conducted in this assessment.

- Agreement No. CE 42/2001, Environmental and Engineering Feasibility Assessment Studies in Relation to the Way Forward of the Harbour Area Treatment Scheme – Water Quality, Ecological and Fisheries Impact Assessment (HATS EEFS Report).

- Agreement No. CE 87/2001, Further Development of Tseung Kwan O – Feasibility Study (TKOFS EIA).

15.3.2 Potential impacts on capture and culture fisheries resources arising from the Project are identified and evaluated using the EIAO-TM evaluation criteria listed in Annex 9 and guidelines presented in Annex 17. Results of the water quality modelling were used to assess the extent and severity of indirect impacts during the proposed dredging works, and in the formulation of mitigation measures, if required.

## 15.4 Description of the Environment

15.4.1 The assessment area for the fisheries impact assessment included all areas within 500 m from the boundary of the Project area, i.e. Kowloon Bay, eastern Victoria Harbour, Kwun Tong Typhoon Shelter (KTTS), To Kwa Wan Typhoon Shelter (TKWTS) and Kai Tak Approach Channel (KTAC). Based on the review on the available literature, no important nursery or spawning area is identified within the assessment area. The nearest mariculture areas identified are the Tung Lung Chau Fish Culture Zone and Ma Wan Fish Culture Zone which are 8 km and over 10 km away from the Project area respectively.

### Capture Fisheries

15.4.2 In Hong Kong, the capture fishing industry produced an estimated 155,000 tonnes of fisheries produce valued at \$1,600 million in 2006 (AFCD, 2007). The industry consists of about 3,940 fishing vessels and 8,500 fishermen working abroad. Fishing activities are mainly conducted in the waters of the adjacent continental shelf in the South China Sea. The majority of the fishing vessels are manned by family members with the assistance of hired crew. Main fishing methods include trawling, long-lining, gill-netting, and purse-seining with the majority of the total catch obtained through trawling. Some recent data on local capture fisheries industry are summarised in **Table 15.1**.

**Table 15.1 Recent Hong Kong Capture Fisheries Industry Figures**

Parameter	2006	2005	2004	2003	2002	2001	2000	1999
Fishing fleet size (No. of vessels)	3,940	4,150	4,300	4,600	4,470	5,100	5,250	5,170
Local fishers engaged in capture fisheries	8,500	9,170	9,700	10,100	10,860	11,560	11,900	12,900
Mainland deckhands employed	No data	No data	No data	3,908	4,100	4,560	5,200	6,300
Production (tonnes)	155,000	162,000	167,500	157,400	169,790	174,000	157,010	127,780
Value of production (HK\$ million)	1,600	1,600	1,600	1,500	1,600	1,700	1,600	1,500

Note: no data = data were unavailable at time of reporting  
Source: AFCD Annual Reports, 1999 - 2006

- 15.4.3 The latest AFCD Port Survey 2006-2007 (AFCD, 2007) provides the most updated and detailed information on capture fisheries in Hong Kong waters, including both fishing operation and fisheries production (adult fish and fry). The fishing operation within the assessment area was supported by vessels less than 15 m only. Sampans were the dominant fishing vessels but other vessels such as Gill Netters, Long Liners, Hand Liners, Purse Seiners and miscellaneous crafts were also operated within the assessment area. The capture fisheries data by vessels less than 15 m in the assessment area are summarised in **Table 15.2**.

**Table 15.2 Summary of Capture Fisheries Data in Assessment Area by Vessels < 15m**

Parameter	Kowloon Bay	Eastern Victoria Harbour	KTTS	TKWTS	KTAC
No. of vessels	100-400	100-400	100-400	10-50	0
Adult fish production in terms of weight (kg/ha)	100-400	100-400	200-400	> 0 and < = 50	0
Fish fry production in terms of weight (kg/ha)	0	0	0	0	0
Fisheries production (adult and fry) in terms of value (HK\$ /ha)	5,000-10,000	5,000-10,000	5,000-10,000	1,000-2,000	0

Source: AFCD, 2007 at (<http://www.afcd.gov.hk>)

- 15.4.4 The latest Port Survey did not record any fishing operation or fisheries production in the KTAC, showing that this area has no or very limited value in capture fisheries.
- 15.4.5 The scale of fishing activities in terms of number of fishing vessels operating in the Kowloon Bay, eastern Victoria Harbour and KTTS are considered to be moderate (100-400 vessels) as compared with other fishing grounds in Hong Kong. In contrast, fisheries operation in the TKWTS is very limited with only 10-50 vessels recorded.
- 15.4.6 In terms of weight, fisheries production for adult fish in the Kowloon Bay, eastern Victoria Harbour and KTTS were moderate with yield of 100-200, 100-400 and 200-400 kg/ha respectively while very low adult fish production with yield of less than 50 kg/ha were recorded at the TKWTS.
- 15.4.7 Important nursery grounds can be identified from the main areas of fry collection for the mariculture industry. However fry collection in Hong Kong has been much reduced in scale in recent years and the latest interview studies (AFCD, 2007) report that fry collection only occurs in a few areas. These areas are mostly eastern inshore waters, such as Crooked Harbour, Double Haven, Long Harbour and Port Shelter, all outside the assessment area. This indicates that there are no important spawning or nursery grounds for fish recruitment within the assessment area (ERM, 1998).
- 15.4.8 The most common capture fish in the assessment area was Rabbitfish (Siganidae). Very high production of over 60 kg/ha of this species was recorded in the Kowloon Bay, eastern Victoria Harbour, KTTS and TKWTS. This species is fast-growing fish of relatively low commercial value.
- 15.4.9 Other medium-valued species such as Seabream (Sparidae) and crab produced moderate yield of about 20-40 kg/ha annually in Kowloon Bay, eastern Victoria Harbour, KTTS and TKWTS. Other species such as Croaker (Sciaenidae), Squid and Shrimp were scarcely reported (less than 5 kg/ha) in Kowloon Bay, eastern Victoria Harbour and KTTS, except Sardine and Mullet which produce 5-10 kg/ha respectively in KTTS and part of eastern Victoria Harbour.

- 15.4.10 Overall, in terms of their capture fishery production values, fishing areas in Kowloon Bay, eastern Victoria Harbour, KTTS and TKWTS are ranked moderate to high value with production value of HK\$5000-10000/ha annually.

#### Culture Fisheries

- 15.4.11 Culture fisheries include 26 fish culture zones (FCZs) located in various sheltered coastal areas in Hong Kong marine waters and occupied about 209 ha of marine area with about 1,080 licensed operators (AFCD, 2007a). The majority of the licensed farms are small, family-based and consisting of one to two rafts with average total area of around 260m<sup>2</sup>.
- 15.4.12 Mariculture areas including marine fish culture and oyster culture were absent in the assessment area. The nearest fish culture zones (FCZs) identified in the vicinity of the Project area are Tung Lung Chau FCZ (8 km from the Project area) and Ma Wan FCZ (over 10 km away).
- 15.4.13 Although no figures are available on the individual production of these FCZs, it was estimated that culture fisheries production in 2006 was about 1,488 tonnes valued at \$89 million which catered about 7.9 per cent of local demand for live marine fish. (AFCD, 2007a). Some recent figures on marine culture fisheries are presented in **Table 15.3**.

**Table 15.3 Recent Hong Kong Culture Fisheries Industry Figures**

Parameter	2006	2005	2004	2003	2002	2001	2000
Licensed operator	1,080	1,100	1,125	1,155	1,237	1,320	1,418
Production (tonnes)	1,488	1,539	1,540	1,490	1,210	2,470	1,770
Value (HK\$ million)	89	76	79	76	57	136	102

Source: AFCD Annual Reports, 2000 – 2007 and (AFCD, 2007a)

- 15.4.14 The species cultured changed gradually over the recent years depending on the availability of imported fry. Common species under culture include green grouper, brown-spotted grouper, giant grouper, Russell's snapper, mangrove snapper, red snapper, star snapper, and pompano (AFCD, 2007a).

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

### **Construction Phase**

#### ***Direct Impact***

#### Loss of fishing grounds

- 15.5.1 Potential direct impacts on fisheries resources arising from the construction of cruise terminal would include loss of fishing area in Kowloon Bay and eastern Victoria Harbour near the southern tip of the former Kai Tak Airport runway. The proposed dredging activities for the cruise terminal are considered to be of a relatively moderate scale and would result in temporary loss of 57 ha of fishing ground.
- 15.5.2 Further temporary loss of approximately 17.4 ha of fishing ground due to dredging required for removal of built up sediment after opening of the runway gap (2 ha), seawall reconstruction associated with public landing steps cum fireboat berth (0.6 ha), construction of submersed CKR (1.4 ha) and Road T2 (4.1 ha), reconstruction of a section of the Kwun Tong submarine outfall (0.3 ha) and the localised maintenance dredging at Kai Tak Approach Channel (KTAC) as part of the KTAC odour remediation works (9 ha).

- 15.5.3 Although fisheries importance in the affected areas in Kowloon Bay, eastern Victoria Harbour and KTTS are considered as moderate to high in terms of adult fish production and commercial fishing activities as compared with other fishing locations in Hong Kong, the affected fisheries area only constitute a very small portion of the total fishing area in Hong Kong. In addition, no fisheries production and fishing operation were recorded in the KTAC and the TKWTS is considered to have relatively low fisheries importance. The loss of fishery production would be temporary and insignificant as compared with the total fishery production in Hong Kong.
- 15.5.4 Fishing activities in the affected area constitutes only a small proportion of total fishing operations in Hong Kong in terms of vessel number, and most of the vessels operating there were non-mechanised crafts such as Sampan.
- 15.5.5 The most common capture fish in the affected area was confined to Rabbitfish which is of relatively low economic value (FMO 2007). No important nursery or spawning area was identified within the assessment area (ERM, 1998).
- 15.5.6 In view of the small size of the affected area, temporary and insignificant loss of fisheries production and low impact on fishing activities, such fisheries impacts due to dredging activities are expected to be minor and acceptable.

#### ***Indirect Impact***

##### Changes in water quality

- 15.5.7 Indirect impacts on fisheries resources would mainly be associated with changes of water quality due to dredging activities. Dredging activity would be necessary for the following works packages associated with the Kai Tak Development:
- Construction of cruise terminal (capital and maintenance dredging)
  - Construction of public landing steps cum fireboat berth
  - Opening of runway gap (dredging along the seawalls)
  - Submerged tunnels of Road T2 and CKR
  - Reconstruction of a section of the Kwun Tong submarine outfall
  - Localised maintenance dredging at KTAC as part of KTAC odour remediation works
- 15.5.8 Possible concurrent dredging activities that would also affect the Project include:
- Submarine gas main relocation
  - Wan Chai Reclamation Phase 2
  - Western Cross Harbour Main
  - Further Development of Tseung Kwan O
  - Lei Yue Mun Waterfront Enhancement
- 15.5.9 Surface runoff from land based construction activities could lead to a deterioration of marine water quality which could in turn adversely affect fisheries resources. However the mitigation measures proposed in the water quality impact assessment (see Section 8 of this report) are considered sufficient to prevent sediment / pollution laden water entering marine waters and thus no impact associated with surface runoff is expected on fisheries resources.

*Elevation of suspended solids (SS)*

- 15.5.10 Dredging activities would temporarily elevate the suspended sediment level and create sediment plumes. Effects on fisheries resources could be lethal or sublethal through reduction in survivorship, growth rate and reproductive potential due to stress incurred by the need to constantly flush out deposited material. High SS level may clog gill structure of fish and cause physical damage and hinder transfer of oxygen. Fish egg and larval fish (fry) are more susceptible to deleterious impacts from sedimentation through smothering and clogging of their respiratory systems. Adult fish are generally less sensitive to effects from suspended sediments.
- 15.5.11 Suspended sediment plume occurs naturally in the marine environment by wave action and vertical flux of water current. Fish has evolved behavioural adaptations to sudden turbid water, including clearing their gills by flushing water or simply moving to less turbid waters.
- 15.5.12 In order to assess the nature and extent of potential impacts on marine ecological resources resulting from dredging activities associated with the Kai Tak Development and other possible concurrent projects as identified above, representative worst case scenarios were selected for water quality modelling. The scenarios modelled covered all possible concurrent dredging works and the assessment results were presented in Section 5 of the approved EIA Report on Dredging Works for Proposed Cruise Terminal at Kai Tak (EIAO Register No. AEIAR-115/2007). The results of sediment plume modelling discussed below therefore cover the potential impacts of increased sediment loading for all the possible works packages identified. Any exceedances of WQO's for the area are discussed individually.
- 15.5.13 Based on the prediction of the sediment plume modelling for the unmitigated scenarios under the water quality impact assessment as presented in the approved EIA Report on Dredging Works for Proposed Cruise Terminal at Kai Tak (CT Dredging EIA), potential water quality impact due to elevation of SS would occur at coastal waters of the Kowloon Bay. It is predicted that impacts to fisheries resources immediately outside of the dredging areas would occur because the elevation of SS is predicted to significantly increase from ambient levels at several locations (Appendices 5.4 to 5.9 of the CT Dredging EIA refer). A number of mitigation measures such as the use of closed grab dredgers to control water quality are therefore recommended to confine sediment plume within the proposed dredging areas and to minimize the SS elevation during dredging operations. These mitigation measures are discussed in detail in Water Quality Section 8, Para. 8.8.6.
- 15.5.14 With the implementation of the proposed mitigation measures as suggested in the water quality impact assessment of the CT Dredging EIA, the water quality modelling results indicate that the SS elevation arising from this Project could be effectively reduced. In view of the temporary nature of such impact, only minor impact on capture fisheries is anticipated.
- 15.5.15 Impact is not expected to occur at the far field fisheries sensitive receivers such as Tung Lung Chau FCZ and Ma Wan FCZ are located outside the influence zone of the predicted sediment plumes (Appendices 5.4 to 5.9 of the CT Dredging EIA refer). Thus, it is expected that unacceptable impacts to these areas, due to elevated SS levels arising from dredging works, would not occur.

*Contaminant Release During Dredging Activities*

- 15.5.16 Dredging activities can potentially cause the release of contaminants from marine mud. Potential impacts on fisheries resources include the accumulation of contaminants in the tissues of fish, resulting in sublethal effects which may alter behaviour, 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.



- 15.5.17 In-vitro laboratory assessment of sediment samples indicated that the concentrations of cadmium, copper, nickel, mercury, unionised ammonia and total inorganic nitrogen contaminants exceeded the assessment criteria. However the laboratory tests do not take into account the dilution factor after the contaminants are released. Water quality modelling results predict that levels of contaminants would be much lower than the relevant standards at monitoring sites nearby the source. This is because any contaminants released during dredging are immediately diluted by the large volume of marine water within the dredging site. Thus, it is considered that long-term off-site marine water quality impact is unlikely and any local water quality impact will be transient (Sections 5.8.8 to 5.8.18 of the CT Dredging EIA refer).

Decrease of dissolved oxygen (DO)

- 15.5.18 The relationship between SS and DO are complex. Increase in SS in water column combining with a number of other physical or biotic factors would reduce DO in water column. Elevated SS reduces light penetration, lower the photosynthetic rate of phytoplankton and so lower the rate of oxygen production in water column. Also, the release of inorganic substances from the dredged sediments 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.
- 15.5.19 The WQO standard for the Victoria Harbour that the average-depth and bottom water DO should remain above 4 mg/L and 2 mg/L respectively for 90% of the time is adopted in this assessment. Based on results of the water quality modelling of the CT Dredging EIA, the possible concurrent dredging activities would cause a maximum DO depletion of less than 0.02 mg/l in the Victoria Harbour (Tables 5.24 to 5.26 of the CT Dredging EIA refer). Therefore no adverse impact on fisheries resources would be expected from the Project.

Maintenance Dredging

- 15.5.20 With reference to the CT Dredging EIA, maintenance dredging will be required during operation of the proposed cruise terminal at a frequency of about once every 5 to 10 years. The approximate time to complete maintenance would be <6 months for each berth. The maximum dredging rate during maintenance dredging (2,000 m<sup>3</sup> per day) would be lower than that during the capital dredging (total of 8,000 m<sup>3</sup> per day during Stage 1 dredging and 4,000 m<sup>3</sup> per day during Stage 2 dredging). As only minor adverse impacts are predicted during capital dredging (12 months), maintenance dredging (<6 months) is not expected to have any significant adverse effect on fisheries resources with the implementation of the water quality mitigation measures recommended for capital dredging (Section 5.9 of the CT Dredging EIA refers).

Sediment Treatment/Bioremediation of Kai Tak Approach Channel

- 15.5.21 In-situ bioremediation is being considered to suppress odour generated from the contaminated sediment along the seabed of KTAC. The major environmental concerns associated with *in-situ* bioremediation are the potential release of nitrate-nitrogen, ammonia and heavy metal contaminants from the sediments into the surrounding water bodies during the bioremediation activities. Based on a pilot scale field test carried out in the Kai Tak Approach Channel in 2006, no significant adverse impact on water quality is expected. As no fisheries operations or production are recorded in the KTAC no adverse impact on fisheries resources are expected as a result of sediment treatment/bioremediation (see Section 8.7.21 – 8.7.22).

### **Operational Phase**

- 15.5.22 No operational phase impacts on fisheries resources are expected to result from operation of the project as fishing activity will not be restricted in the sea area (turning area) off the cruise ship terminal and public landing steps cum fireboat berth. If cruise ships or other vessels are manoeuvring in these areas, then they would not be accessible to fishing vessels but this is no different from the other areas of the harbour where other vessel traffic would impose similar restriction on fishing activities. No permanent impact is expected. Additionally, all construction works would take place within the existing land limits of the Kai Tak Development site and no structures would extend beyond these land limits. Thus, no loss of fishing ground is expected to result from operation of the project.

### **15.6 Mitigation of Environmental Impacts**

- 15.6.1 Following EIAO-TM Annex 17, mitigation measures are discussed in this section to avoid, minimize, and compensate for identified fisheries impacts.
- 15.6.2 The mitigation measures recommended in the water quality impact assessment to control water quality would also serve to protect fisheries resources from indirect impacts and ensure no adverse impact on fisheries resources would result from the Project.

### **15.7 Evaluation of Residual Environmental Impacts**

- 15.7.1 The only residual impact would be the temporary loss of 74.4 hectares of fishing area. In view of the small size of affected area, negligible loss of fisheries production and low impact on fishing activities, direct loss of fishing area within the dredging areas is considered as minor and acceptable.

### **15.8 Evaluation of Cumulative Environmental Impacts**

- 15.8.1 There are a number of possible concurrent construction projects involving dredging and marine works that would be conducted in the vicinity of the Project area that may have cumulative effects on the deterioration of water quality in the Victoria Harbour and other far field sites. Water quality modelling predicted that the dredging and filling works undertaken for these concurrent projects would result in elevation of SS level of more than 30 % of ambient level at several locations under the worse case scenario.
- 15.8.2 Cumulative potential impacts on fisheries resources would be the same as the potential impacts predicted above. However with the implementation of proper mitigation measures recommended in the water quality impact assessment, cumulative impact on water quality parameters in the Project area could be effectively minimized and the associated fisheries impacts are thus expected to be acceptable in accordance with the findings of the CT Dredging EIA.

### **15.9 Environmental Monitoring and Audit**

- 15.9.1 No unacceptable fisheries impacts would be expected from the Project. Thus, no fisheries specific monitoring programme would be required.



## 15.10 Summary

- 15.10.1 Literature reviews of existing information indicated that identified fishing area in Kowloon Bay, eastern Victoria Harbour and KTTS are of moderate to high fisheries values while that in TKWTS and KTAC are of relatively low value. There are no fish culture zones and important spawning or nursery grounds identified in and within the immediate vicinity of the Project area. The nearest mariculture areas are FCZs at Tung Lung Chau and Ma Wan which are 8 km and over 10 km away, respectively, of the Project area.
- 15.10.2 Direct and indirect impacts on fisheries resources arising from the Project were identified and evaluated. The Project will result in the temporary loss of approximately 74.4 hectares of fishing area due to dredging associated with the Project. In view of the small size of affected areas, temporary and insignificant loss of fisheries production and low impact on fishing activities, fisheries impacts due to loss of fishing area within the dredging areas is considered as minor and acceptable.
- 15.10.3 Indirect impacts of change of water quality arising from the Project would be temporary and insignificant based on the predictions from water quality modelling. Mitigation measures suggested in the water quality impact assessment to control water quality (Section 8, Para., 8.8.1-8.8.26) would also serve to protect fisheries resources from indirect impacts. No significant adverse impact on fisheries resources would be expected from the Project and therefore no necessary fisheries-specific mitigation measures would be required. No cumulative impacts on fisheries resources are expected.
- 15.10.4 No operational phase impacts on fisheries resources are expected to result from operation of the project as fishing activity will not be restricted in the sea area (turning area) off the cruise ship terminal and public landing steps cum fireboat berth. If cruise ships or other vessels are manoeuvring in these areas, then they would not be accessible to fishing vessels but this is no different from the other areas of the harbour where other vessel traffic would impose similar restriction on fishing activities. No permanent impact is expected. Additionally, all construction works would take place within the existing land limits of the Kai Tak Development site and no structures would extend beyond these land limits. Thus, no loss of fishing ground is expected to result from operation of the project.

## 15.11 References

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