

16 Summary of Environmental Outcomes

16.1 Population and Environmental Sensitive Areas Protected

- 16.1.1.1** As described in Section 1.5, CEDD commissioned the TKO Study in 2002 to formulate a comprehensive plan for further development of TKO and improvement of its overall design with a view to building TKO into a new town that can boast of its convenience, vibrancy, distinctive urban design and quality living environment. As an integral part of the TKO Study, the long-term transport need of TKO had been examined.
- 16.1.1.2** The TKO Study identified that the existing TKO Tunnel would have insufficient capacity to cater for projected traffic flow to be generated from further population intake and industrial developments in TKO. It recommended that a new external road network comprising the CBL and TKO-LT Tunnel should be provided to meet the anticipated traffic flow. The TKO Study was substantially completed in 2005 with endorsement of its recommendations.
- 16.1.1.3** The consequence of not proceeding with the Project would have been a constraining factor upon the planning and development of Area 87 and Area 137 due to traffic congestion along Wan Po Road and at the existing TKO tunnel. The Area 87 and Area 137 projects have since proceeded in the knowledge that CBL and TKO-LT Tunnel would meet the anticipated traffic demand.
- 16.1.1.4** With the CBL and Route 6, including TKO-LT Tunnel, the journey time between TKO Area 86 and Kowloon would be significantly reduced. Currently, from the junction of Wan Po Road and Wan O Road, the journey to Gascoigne Road, Yau Ma Tei, is approximately 35 minutes. After completion of these projects, it is estimated the journey time will be reduced by 20 minutes. Without CBL and TKO-LT Tunnel, long queue lengths at the existing TKO Tunnel will only be further exacerbated by the traffic generated by further development of TKO.

16.2 Approaches Adopted to Avoid Environmental Impacts

- 16.2.1 The EIA Study for Further Development of Tseung Kwan O Feasibility Study concluded that a route option without CBL would be environmentally undesirable and was not suitable for further consideration. In the absence of CBL and TKO-LT Tunnel, there would be increased traffic through TKO Town Centre, overloading its road network and causing heavy congestion. Higher traffic flows through TKO Town Centre will result in greater levels of air and noise impacts. Therefore, with the development of CBL and TKO-LT Tunnel, environmental impacts due to increased traffic and congestion through TKO Town Centre have been avoided.

16.3 Approaches Adopted to Minimize Environmental Impacts

- 16.3.1 Approaches adopted to minimize environmental impacts have been one of the key considerations throughout the entire project development and design. The following sections provide a summary of key approaches adopted.

- Route alignment and design option evaluation to develop a feature bridge design for CBL and become a landmark for TKO;
- Deployment of large span piers to minimize construction works and work front;
- Addition of ‘green features’ such as footpath and cycle track to connect to existing and planned cycle tracks; and
- Deployment of construction methods such as off-site precast segmental construction, off-site fabrication and non-dredge method.

Route alignment and design option evaluation to develop a feature bridge design for CBL and become a landmark for TKO

- 16.3.1.1 According to “Further Development of Tseung Kwan O Feasibility Study – Final Topical Study Report: Cross Bay Link” (2005), the four route alignment options are appraised broadly in terms of traffic performance, compatibility with land use planning intentions, and potential environmental impacts. As result, Scheme A (Bridge Arrangement) would be preferred as its compatible with the land use planning for TKO, met the necessary functional requirements for this

road link and would also perform best in terms of technical criteria including environmental performance.

- 16.3.1.2 From an evaluation of a long list of bridge design options, six were identified to be technically feasible for the project and shortlisted by the Final Design Options Review Report (2010). Consultation with the government departments and the Sai Kung District Council in November 2009 confirmed the six design options to be taken forward for public consultation. As result, Design Option 5, the Eternity Arch, gained the most support and was therefore subsequently taken forward as the preferred option for CBL. Details refer to **Section 3.3**.

Large span pier design to minimize works front and construction works

- 16.3.1.3 The span of the piers for CBL ranges from 75m to 200m. This span is larger than the normal 50m span for bridge structures. With the larger span, a smaller number of piers are required, and thus the works front number and construction works is reduced. Associated impacts on marine water quality and marine habitat loss are therefore minimised. Details refer to **Sections 8** and **10**, respectively.

Addition of ‘green features’ such as footpath and cycle track to connect to existing and planned cycle tracks

- 16.3.1.4 Several recreational facilities were also proposed in the TKO Study to further enhance the living environment of the TKO residents. These include a riverine park along the Eastern Channel, a waterfront promenade in town centre south, an area for water sports and recreational facilities at the TKO Stage I Landfill site, and the construction of more cycle tracks in the new developments. CBL will provide a new cycle track which will be connected to the existing and other planned cycle tracks to form a complete loop in TKO. In addition to CBL, new footbridge located at the Eastern Channel, Southern Bridge, is being planned to complement the existing Northern Bridge.

Deployment of construction methods such as off-site precast segmental construction, off-site fabrication and non-dredge method

- 16.3.2 Off-site construction offers many environmental benefits. In general, by moving construction away from the site, potential nuisance to

local residents and the impact on the local environment would be reduced. However, the purpose of the off-site fabrication is not to transfer the problems elsewhere. The concrete pre-casting and steel fabrication yards in China are purpose-built facilities, with production line practices implemented. Hence, the impacts would be better managed and controlled. Details refer to **Section 4**.

- 16.3.2.1** Non dredging works are envisaged for the construction of CBL. Piling and pile cap construction would occur in three different sections for the Main Bridge, Eastern Approach and Western Approach. Cylindrical steel casings (of the pile diameter) would be installed at each pile location within the steel sheet pile cofferdam. Excavation from within the cylindrical steel casing would be undertaken from the seabed level down to the pile founding level. This construction method would avoid the need to dredge sediment because the pile cap would be located above the sea bed. Sediment excavated from within the cylindrical steel pile casings would be placed in barge and disposed in accordance with regulations. Details refer to **Section 4**.

16.4 Approaches Adopted to Mitigate Environmental Impacts

- 16.4.1** With the development of CBL and TKO-LT Tunnel, environmental impacts due to increased traffic and congestion throughout TKO Town Centre have been avoided, thus, providing economic and social benefits to the surrounding communities. However, due to the inherent environmental impacts due to construction activities, CBL has minimized its environmental impacts where possible. Where the impacts could not be minimized, efforts have been made to mitigate the impacts as far as practicable. The EIA has recommended a package of mitigation measures that would be required. The Environmental Mitigation Implementation Schedule in the EM&A Manual has clearly stated the details of such mitigation measures, the timeframe and the implementation agents. Some of the key mitigation measures are discussed in the following sections.

16.4.2 Measures adopted to Mitigate Air Quality Impacts

- 16.4.2.1** In order to reduce dust emission from the Project and achieve compliance with the TSP criteria at ASRs during construction phase, mitigation measures in form of regular watering under a good site

practice should be adopted. In addition to the watering and required intensity, the Contractor will also be obliged to follow the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation.

16.4.2.2 In accordance with the Air Pollution Control (Construction Dust) Regulation, the following dust suppression measures should also be incorporated by the Contractor to control the potential for dust nuisance throughout the construction phase:

- Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or sprayed with water to maintain the entire surface wet and then removed or backfilled or reinstated where practicable within 24 hours of the excavation or unloading;
- Any dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads;
- A stockpile of dusty material should not extend beyond the pedestrian barriers, fencing or traffic cones;
- The load of dusty materials on a vehicle leaving a construction site should be covered entirely by impervious sheeting to ensure that the dusty materials do not leak from the vehicle;
- Where practicable, vehicle washing facilities with high pressure water jet should be provided at every discernible or designated vehicle exit point. The area where vehicle washing takes place and the road section between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;
- When there are open excavation and reinstatement works, hoarding of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period;
- The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials;
- Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously;
- Any area that involves demolition activities should be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after the activities so as to maintain the entire surface wet;

- Where a scaffolding is erected around the perimeter of a building under construction, effective dust screens, sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the building, or a canopy should be provided from the first floor level up to the highest level of the scaffolding;
- Any skip hoist for material transport should be totally enclosed by impervious sheeting; and
- Exposed earth should be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shortcrete or other suitable surface stabiliser within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies.

16.4.2.3 For the barging facilities proposed at the site compound, the following good site practice is required:

- All road surfaces within the barging facilities should be paved,
- Vehicles should pass through designated wheel wash facilities, and
- Continuous water spray should be installed at the loading point.

16.4.2.4 The above requirements should be incorporated into the Contract Specification for the civil work. In addition, an audit and monitoring programme during the construction phase should be implemented by the Contractor to ensure that the construction dust impacts are controlled to within the HKAQO.

16.4.2.5 No exceedances of the relevant AQOs are predicted at all representative ASRs during operational phase and cumulative air quality impact or adverse residual air quality impact is not anticipated. Mitigation measures for operational phase are not necessary.

16.4.3 Measures Adopted to Mitigate Noise Impacts

16.4.3.1 For construction phase, the extent of temporary works areas where construction plant would be operated has been reduced to minimize the airborne construction noise impacts as far as practicable. However, unmitigated construction noise would exceed the daytime noise criteria, and therefore, mitigation measures are therefore required. The following mitigation measures have been considered:

- Good site practices to limit noise emissions at the source,
- Use of quiet plant and working methods,

- Use of site hoarding as noise barrier to screen noise at ground level of NSRs,
- Use of shrouds/temporary noise barriers to screen noise from relatively static PMEs,
- Scheduling of construction works outside school examination periods in critical area, and
- Alternative use of plant items within one worksite, wherever practicable.

16.4.3.2 However, as predicted mitigated noise levels and predicted cumulative noise impacts exceed the noise criterion for Planned Primary School & Secondary School near Wan Po Road during examination period, the contractor should further confirm the construction program of this NSR at the commencement of the CBL construction and reschedule the construction work outside the examination period as far as possible.

16.4.3.3 For the operational phase, partial enclosures along Road D9 and application of low noise surfacing material along CBL and Road D9 have been proposed as noise impacts are contributed by CBL and Road D9.

16.4.4 Measures Adopted to Mitigate Sediment Quality Impacts

16.4.4.1 It is estimated that a total of approximately 4,300m³ marine deposit is required to be excavated from the pile casings. Amongst the excavated volume, approximately 97% is Category L sediment (Type 1 open sea disposal). Category Mp (Type 1 open sea disposal at dedicated sites), Mf (Type 2 confined marine disposal), and H (Type 2 confined marine disposal) sediments contribute to about 3% of the total volume.

16.4.5 Measures Adopted to Mitigate Water Quality Impacts

16.4.5.1 During construction phase, pile excavation should be undertaken in such a manner as to minimise resuspension of sediments. Standard good practice measures should therefore be implemented including the following requirements:

- All pile excavation works shall be conducted within a cage type silt curtain;

- Floating single silt curtain shall be employed for all marine works;
- Mechanical grabs (with a size of 5m³) shall be designed and maintained to avoid spillage and should seal tightly while being lifted;
- Barges and hoppers shall have tight fitting seals to their bottom openings to prevent leakage of material;
- Any pipe leakages shall be repaired quickly. Plant should not be operated with leaking pipes;
- Loading of barges and hoppers shall be controlled to prevent splashing of dredged material to the surrounding water. Barges or hoppers shall not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation;
- Excess material shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessel is moved;
- Adequate freeboard shall be maintained on barges to reduce the likelihood of decks being washed by wave action;
- All vessels shall be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash; and
- The works shall not cause foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the works site.

16.4.5.2 In accordance with the Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94), construction phase mitigation measures, where appropriate, should include the following:

- The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC PN 1/94. The detailed design of the sand/silt traps should be undertaken by the contractor prior to the commencement of construction.
- Open stockpiles of construction materials (for example, aggregates, sand and fill material) of more than 50m³ should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any marine water bodies.
- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facilities should be provided at every construction site exit where practicable. Wash-water should have sand and silt settled out and removed at least on a weekly basis to ensure the

continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains.

- Construction solid waste, debris and rubbish on site should be collected, handled and disposed of properly to avoid water quality impacts.
- All fuel tanks and storage areas should be provided with locks and sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank to prevent spilled fuel oils from reaching water sensitive receivers nearby.
- Regular environmental audit on the construction site should be carried out in order to prevent any malpractices. Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the meander, wetlands and fish ponds.

16.4.5.3 Regarding sewage from workforce, portable chemical toilets and sewage holding tanks should be provided for handling the construction sewage generated by the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance. Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the Project. Regular environmental audit on the construction site should be conducted in order to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site.

16.4.5.4 During operational phase, proper drainage systems with silt traps and oil interceptors should be installed, maintained and cleaned at regular intervals as a precautionary measure to mitigate potential runoff from road surfaces.

16.4.6 Measures Adopted to Mitigate Impacts on Waste Management

16.4.6.1 The amount of C&D material that would need to be transported off site has been minimized as far as practicable in the design. The Project Proponent will ensure all the mitigation measures mentioned in the C&DMMP will be complied with. Wherever practicable, C&D materials should be segregated from other wastes to avoid

contamination and ensure acceptability at public filling areas or reclamation sites. Good site practices have also been recommended for chemical waste, general refuse and disposal of chemical waste will follow the relevant ordinances.

16.4.6.2 Prior to the commencement of the construction works, the contractors should incorporate recommendations into a Waste Management Plan to provide an overall framework for waste management and reduction.

16.4.6.3 It is not anticipated that large quantities of waste would be generated during the operational phase. Only a small amount of general refuse would be generated from the footpath and cycle track along CBL and Road D9. Waste collection bins and recycling bins would be provided.

16.4.7 **Measures Adopted to Mitigate Marine Ecology and Fisheries Impacts**

16.4.7.1 Besides the adoption of larger span piers to minimize impacts on marine ecology and fisheries resources, good site practices and site runoff control measures would be sufficient to protect water quality. The integrity and effectiveness of all silt curtains should be regularly inspected. Effluent monitoring should be incorporated to make sure that the discharged effluent from construction sites meets the relevant effluent discharge guidelines. For works on land, standard site runoff control measures will be established and strictly enforced to ensure that discharge of contaminated or silt-laden runoff into marine waters is minimised.

16.4.7.2 The water quality programme could also serve the purposes to protect the marine communities inside Junk Bay. No species ecological or fisheries monitoring programme is needed.

16.4.8 **Measures Adopted to Mitigate Landscape and Visual Impacts**

16.4.8.1 The proposed landscape and visual mitigation measures for the CBL during construction and operation phase are listed below. Generally, all mitigation measures are to be implemented as early as possible and many of these mitigation measures perform multiple functions.

Construction Phase Mitigation Measures

- The construction area and contractor's temporary works areas should be minimised to avoid impacts on adjacent landscape.
- Reduction of construction period to practical minimum.
- Topsoil, where identified, should be stripped and stored for re-use in the construction of the soft landscape works, where the soil material meets acceptable criteria and where practical. The Contract Specification shall include storage and reuse of topsoil as appropriate.
- Existing trees on boundary of the Project Area shall be carefully protected during construction. Detailed Tree Protection Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas. (Tree protection measures will be detailed at Tree Removal Application stage).
- Trees unavoidably affected by the works shall be transplanted where practical. Trees should be transplanted straight to their final receptor site and not held in a temporary nursery. A detailed Tree Transplanting Specification shall be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme.
- Advance screen planting to proposed roads and associated structures.
- Hydroseeding or sheeting of soil stockpiles with visually unobtrusive material (in earth tone).
- Screening of construction works by hoardings/noise barriers around works area in visually unobtrusive colours, to screen Works.
- Control night-time lighting and glare by hooding all lights.
- Ensure no run-off into water body adjacent to the Project Area.
- Avoidance of excessive height and bulk of buildings and structures

Operation Phase Mitigation Measures for Cross Bay Link

- Compensatory tree planting for all felled trees shall be provided to the satisfaction of relevant Government departments. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 3/2006.
- A continuous belt of screen planting along the roads. Planting of the belt of trees shall be carried out as advance works ahead of other site formation and building works.
- Maximise soft landscape of the site, Where space permits, roadside berms /slope treatment works should be created.
- During detailed design, refine structure layout to create a planting strips along the roads to enhance greenery.
- Use appropriate (visually unobtrusive and non-reflective) building structural materials and colours, and aesthetic design in built structures.
- Streetscape elements (e.g. paving, signage, street furniture, railing etc.) shall be sensitively designed in a manner that responds to the local context, and minimises potential negative landscape and visual impacts. Lighting units should be directional and minimise unnecessary light spill.
- Avoidance of excessive height and bulk of buildings and structures.

16.4.9 Measures Adopted to Mitigate Landfill Gas Impacts

16.4.9.1 General advice and recommendations for avoidance of environmental impacts related to LFG during construction and operational phases have been addressed. Where applicable, specific measures for handling the hazards identified during the construction and operational phases should be addressed to further reduce the likelihood of incidents and increase the level of safety to the workers and the public. These measures should be reviewed taking into account of the findings of the detailed Qualitative LFG Hazards Assessment (QLFGHA) to be undertaken by the project proponent (Refer to **Section 14.7.12**).

16.4.9.2 All contractors participating in the works should be aware that methane and carbon dioxide are always likely to be present in the soil and rock voids and all works should be undertaken on the basis of an “assumed presence of LFG”.

- 16.4.9.3** The precautionary measures outlined in Paragraphs 8.3 to 8.49 and the monitoring requirements and procedures specified in Paragraphs 8.23 to 8.28 of EPD's Landfill Gas Hazard Assessment Guidance Note should be adopted.
- 16.4.9.4** Depending on the results of measurements, the actions in the event of LFG being detected in excavations as presented in Table 14.6 should be implemented as a minimum. In order to ensure that evacuation procedures are implemented in the event of the trigger levels, it is recommended that a person, such as the Safety Officer, is nominated, with deputies, to be responsible for dealing with any emergency which may occur due to LFG.
- 16.4.9.5** General recommended precautionary and protection measures during the design stage should be adopted. For example, as the risk category at the proposed CBL development ranged from low to medium, "some precautionary measures" to "engineering measures required" should be applied by the project proponent to protect the proposed development. To avoid engineering measures, underground rooms or void should be avoided in the CBL development as far as practicable.
- 16.4.9.6** General recommended precautionary and protection measures during the operational phase should also be adopted such as inspection or maintenance of the utilities services at the area within the 250m Consultation Zone, maintenance workers should assume presence of landfill gas at all times and utility companies should undertake a LFG surveillance exercise at the utility manholes/inspection chambers.
- 16.4.9.7** Existing monitoring of wells will continue to be monitored by EPDs Landfill Restoration Contractors as part of the restoration contract for TKOL-II/III and to protect site workers and future owners within the 250m Consultation Zone, it is recommended that monitoring of any LFG which may be migrated to the site should be undertaken during the construction on CBL infrastructure when the works involve confined spaces.

16.4.10 Environmental Monitoring and Auditing

16.4.10.1 In addition to the mitigation measures as described above (see more details in the Environmental Mitigation Implementation Schedule within the EM&A Manual), a comprehensive environmental monitoring and auditing programme would be implemented to cover various aspects of concern. An independent environmental checker would also be employed to ensure that all the necessary mitigation measures are implemented in a timely and orderly manner.

16.4.11 Overall

16.4.11.1 Mitigation measures and good site practices to minimize the environmental impacts were recommended throughout the impact assessments of air quality, noise, sediment quality, water quality, waste management, marine ecology, fisheries, landscape and visual, and landfill gas. As the Marine Archaeological Investigation did not locate any cultural heritage resources and the diver survey indicated that in many areas the seabed had been disturbed by previous construction work, no further action or mitigation is required for cultural heritage impacts. Recommended mitigation measures were consolidated in the Implementation Schedule which specifies the responsibility, methodology and timing of implementation, such that effective and appropriate implementation of the measures can be assured.