

1. Modelling Approaches

1.1 Model Adoption and Refinement

1.1.1 The Delft3D suite of modelling tools is used to conduct the hydrodynamic simulations. The hydrodynamic model for this Project has adopted and reviewed that of the previously approved Tung Chung New Town Extension (TCNTE) EIA Report (AEIAR-196/2016).

Grid Refinement

1.1.2 The grid of the hydrodynamic model was adopted and modified from the grid of the TCNTE Model, which is shown in Appendix 5.3 of the EIA Report. To provide a better representation of the hydrodynamic conditions induced by the Project, the grid of the hydrodynamic model was refined in the following areas within and at the regional vicinity of the reclamation area.:

- Tsing Lung Tau;
- Sham Tseng;
- Ma Wan; and
- Tsing Yi.

1.1.3 As the hydrodynamic model was adopted and modified from the TCNTE Model, the extents of both models are the same (i.e. the entirety of Western Waters, Central Waters and Southern Waters of Hong Kong, and the adjacent waters of Pearl River Delta).

Bathymetry Schematisation:

1.1.4 The bathymetry schematization of the hydrodynamic model was based on the sea depth data from the marine charts published by the Hydrographic Office of the Marine Department of Hong Kong.

Coastline Configurations and Modifications

1.1.5 To assess the hydrodynamic conditions of the marine waters at an “ultimate scenario”, other planned and proposed projects involving land reclamation were also included within the hydrodynamic model. However, it should be noted that some of these Projects are under study and their layouts may be subjected to further modifications.:

- HKIA 3rd Runway System
- Tung Chung New Town Extension (Under Construction);
- Reclamation at Lung Kwu Tan;
- Sunny Bay Development;
- Artificial Islands in the Central Waters; and
- Tsing Yi – Lantau Link.

1.2 Model Validation

1.2.1 As discussed above, the modelling grids from the adopted TCNTE Model has been refined to suit the needs of this Project. Hence a modelling validation exercise has been conducted to ensure that the performance of the hydrodynamic model is not affected by the grid refinement. Detailed model validation methodology can be referred to Appendix 5.5 of the EIA Report.

1.3 Modelling Parameters

Vertical Layers

1.3.1 The hydrodynamic model is 3-dimensional with a total of 10 vertical water layers (i.e. the total depth divided by 10). The thickness of each water layer is defined in the model as a percentage of the water depth where the total sum of all the vertical layers should be 100%. All the vertical layers of the calibration model were assigned to have the same vertical contribution. Thus, each of the vertical layers in the calibration model contributes 10% of the total water depth.

Boundaries and Initial Conditions

1.3.2 The hydrodynamic model covers the outer regions surrounding Hong Kong Waters, including the Pearl River Estuary, Macau, Lamma Channel, Deep Bay, and the Wanshan Archipelago. To account for the hydrodynamic influences of these outer regions on the waters of Hong Kong, their discharges were therefore also incorporated within the model. Specifically, the model included the major sources within the Pearl River Estuary, which includes Freshwater sources from Humen, Jiaomen, Hongqili, Hengmen, and Deep Bay.

1.3.3 Uniform values were used to setup the initial conditions for the hydrodynamic model, with water level set at 1.8m, salinity at 30ppt (parts per thousand), and temperature at 25°C. To minimise the effects of the initial conditions (which affects the model’s accuracy and stability), a spin-up period of four full spring/neap cycles were conducted. The “Restart File” produced from the fourth spin-up simulation was then used as the initial conditions for the fifth and final simulation period of 1 spring/neap cycle. The results obtained from the fifth simulation period of the hydrodynamic model were used for the hydrodynamic impact assessment. This setup was used for both dry season and wet season simulations.

1.3.4 The hydrodynamic model adopted a uniform wind speed of 5 m/s for both dry and wet season simulations. As for wind direction, Northeast (45°) was adopted for dry season simulations, whereas Southwest (225°) was adopted for wet season simulations.

Major Discharges

- 1.3.5 The major discharge sources within Hong Kong Waters are identified as outfalls of major sewage treatment works. As such, sewage outfalls from the Hong Kong International Airport, Tung Chung West, and The Stonecutter Islands Sewage Treatment Works were included. However, other minor storm and sewage outfalls within Hong Kong Waters are considered negligible and would not change the overall hydrodynamic regime and are thus excluded from this calibration exercise.
- 1.3.6 Average freshwater inflows from rivers within the Pearl River Estuary for both dry and wet seasons were applied separately in the dry and wet season simulations of the hydrodynamic model respectively.

Simulation Periods

- 1.3.7 The hydrodynamic model covers both dry and wet season simulations. Each simulated period covers the entire 15-day full spring-neap cycles, which is preceded by a “spin-up” period to allow the model to stabilise.

1.4 Modelling Scenarios

- 1.4.1 As discussed above, the purpose of conducting the hydrodynamic modelling is to assess the overall hydrodynamic impacts induced by the reclamation of the northern anchor at Tsing Lung Tau. Hence, two modelling scenarios are proposed (i.e. without the reclamation associated with the Project, and with the reclamation associated with the Project), which is summarised in **Table 1**.

Table 1 Summary of Hydrodynamic Modelling Scenarios

Scenario	Hydrodynamic Regime	Coastline / Bathymetry	Purpose
Scenario H01 – “Base Case”	Without project scenario in ultimate coastline configuration using refined model	<ul style="list-style-type: none"> • HKIA 3rd Runway System (Under Construction) • Tung Chung New Town Extension (Under Construction) • Reclamation at Lung Kwu Tan^[1] • Sunny Bay Development^[1] • Artificial Islands in the Central Waters^[1] • Tsing Yi – Lantau Link^[1] • Road P1 (Tai Ho – Sunny Bay Section)^[1] 	For operational phase assessment without project scenario
Scenario H02 – “Operational Phase”	With project scenario in ultimate coastline configuration using refined model	<ul style="list-style-type: none"> • Reclamations listed in “Without Project” Scenarios • Route 11 (This project) 	For operational phase assessment with project scenario

Note:

[1] Exact reclamation boundaries for these projects are to be confirmed and may be subjected to further modifications.

1.5 Assessment Parameters

- 1.5.1 To assess the overall impact on the hydrodynamic regime, 5 cross sections and observation points at the following locations were used to compare different hydrodynamic parameters (i.e. instantaneous discharge, cumulative discharge, and velocity). Hydrodynamic results for both dry and wet seasons were compared.
- 1.5.2 The locations of cross sections and observation points are listed below, which are displayed under Appendix 5.6 of the EIA Report.:
- Siu Lam;
 - Kap Shui Mun;
 - Ma Wan Channel;
 - Rambler Channel; and
 - Victoria Harbour.