Appendix D

Modelling requirements

Repositioning and Long Term Operation Plan of Ocean Park

Modelling software general

1. The modelling software shall be fully 3-dimensional capable of accurately simulating the stratified condition, salinity transport, and effect of wind and tide within the model area.

2. The modelling software shall consist of hydrodynamic, water quality and particle dispersion modules. The hydrodynamic and water quality modules shall have been proven with successful applications locally and overseas.

3. The hydrodynamic and water quality modules shall be strictly mass conserved at all levels.

4. An initial dilution model shall be used to characterize the initial mixing of the discharge, and to feed the terminal level and size of the plume into the far field water quality modules where necessary. The initial dilution model shall have been proven with successful applications locally and overseas.

Model details – Calibration & Validation

1. No field data collection is required for model calibration for this study. However, to incorporate all major influences on hydrodynamic and water quality, the models shall be properly calibrated and validated before its use in this study in the Hong Kong waters, the Pearl Estuary and the Lema Channel, with the field data collected by:

   - Hydraulic and Water Quality Studies in Victoria Harbour (1987)
   - Port and Airport Development Strategy - Enhancement of WAHMO Mathematical Models (1990)
   - Strategic Sewage Disposal Scheme Stage II - Oceanic Outfall, Oceanographic Surveys and Modelling (1992)
   - Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (1998)
   - EPD's routine monitoring data
   - Tidal data from HK Observatory, Macau and relevant Mainland Authorities.

2. Tidal data shall be calibrated and validated in both frequency and time domain manner.

3. For the purpose of calibration and validation, the model shall run for not less than 15 days of real sequence of tide (excluding model spin up) in both dry and wet seasons with due consideration of the time required to establish initial conditions.

4. In general the hydrodynamic models shall be calibrated to the following criteria:

Criteria	Level of fitness with field data
• tidal elevation (rms)	< 8 %
• maxi. phase error at HW and LW	< 20 minutes
• maxi. current speed deviation	< 30 %
• maximum phase error at peak speed	< 20 minutes
• maximum direction error at peak speed	< 15 degrees
• maximum salinity deviation	< 2.5 ppt

Model details – Simulation

1. The water quality modelling results shall be qualitatively explainable, and any identifiable trend and variations in water quality shall be reproduced by the model. The water quality model shall be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, air-water exchange, contaminant release of dredged and disposed material, and benthic processes. It shall also simulate salinity and *E.* coli. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.

2. The models shall at least cover the Hong Kong waters, the Pearl Estuary and the Lema Channel to incorporate all major influences on hydrodynamic and water quality. A fine grid model can be used for detailed assessment of this study. It shall either be dynamically linked to a far field model or form part of a larger model by gradual grid refinement. The coverage of the fine grid model shall be carefully designed such that its boundary is remote enough and would not be affected by the proposed project. The model coverage area shall be agreed with EPD. For indicative purpose, it shall cover at least an area of about 10 km radius from the discharge points of the project.

3. In general, grid size at the area affected by the project shall be less than 400 m in open waters and less than 75 m around sensitive receivers. The grid schematisation shall be agreed with EPD. All models shall either be dynamically linked to a far field model or form part of a larger model by gradual grid refinement.

Modelling assessment

1. Scenarios to be assessed shall cover all phases of development being considered, including normal operation of the project and storm events, which shall be agreed with EPD. Scenarios to be assessed shall cover the baseline condition and scenarios with various different options proposed by the Applicant in order to quantify the environmental impacts and improvements that will be brought about by these options. Corresponding pollution load, bathymetry and coastline shall be adopted in the model set up.

2. Hydrodynamic and water quality models shall be run for (with proper model spin up) at least a real sequence of 15 days spring-neap tidal cycle in both dry season and wet season.

3. For assessing storm events, catchment runoff models should used to estimate the stormwater discharge quantity and quality of discharge loading, pattern and duration. For hydrodynamic and water quality simulations, a period of at least 15 days spring-neap cycle, or long enough for recovery of the receiving water, shall be simulated. Detailed methodology shall be agreed with EPD.

4. The results shall be assessed for compliance of Water Quality Objectives. Daily sedimentation rate shall be computed and its ecological impact shall be assessed.

5. The impact on all sensitive receivers shall be assessed.

6. All modelling input data and results shall be submitted in digital media to EPD.

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