



**Civil Engineering and Development Department
Special Duties (Works) Division**

Agreement No. CE 34/2008(CE)

**Preliminary Feasibility Study for Container Terminal 10
at Southwest Tsing Yi – Feasibility Study**

**Executive Summary for the Preliminary Feasibility Study
(Final)**

January 2014

**Including Additional Services No. CE 34/2008-01
Alternative Container Terminal (CT) 10 Configurations and Assessments**

AECOM Asia Co. Ltd.

in association with
Scott Wilson Ltd.
BMT Asia Pacific Ltd.
Lloyds Register Asia
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Agreement No. CE 34/2008(CE)
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at Southwest Tsing Yi – Feasibility Study

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List of Abbreviations

AQO	Air Quality Objective
CASET	Computer-aided Sustainability Evaluation Tool
CD	Chart Datum
CEDD	Government of Hong Kong SAR, Civil Engineering and Development Department
CLP	China Light and Power Company
CPA	Coastal Protection Area
CT1-9	Container Terminals 1 to 9
CT10	Container Terminal 10
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance Cap. 499
EPD	Government of Hong Kong SAR, Environmental Protection Department
ETWB TCW	Environment, Transport and Works Bureau Technical Circular (Works)
HATS	Harbour Area Treatment Scheme
HKP2020	Study on Hong Kong Port – Master Plan 2020
HKP2030	Study on The Strategic Development Plan for Hong Kong Port 2030
HKPCF 05/06	Study on Hong Kong Port Cargo Forecasts 2005/2006
HKD	Hong Kong Dollars
HKPA	Hong Kong Pilots Association
HKPSG	Hong Kong Planning Standards and Guidelines
HLC	Historical Landslide Catchment
KTCT	Kwai Tsing Container Terminals
LandsD DLO	Government of Hong Kong SAR, Lands Department, District Lands Office
LPG	Liquefied Petroleum Gas
MAI	Marine Archaeological Investigation
MD	Government of Hong Kong SAR, Marine Department
MTIA	Marine Traffic Impact Assessment
NTHS	Natural Terrain Hazard Study
NTW	New Territories West
NWL	Northwest Lantau
OGV	Ocean-going Vessel
OZP	Outline Zoning Plan
PATH	Pollutants in the Atmosphere and their Transport over Hong Kong
PFS	Preliminary Feasibility Study
PHI	Potentially Hazardous Installation
QRA	Quantitative Risk Assessment
RTG	Rubber Tyred Gantry
RTV	Rivertrade Vessel
SA	Sustainability Assessment
SSSI	Site of Special Scientific Interest
SWTY	Southwest Tsing Yi
TGLA	Temporary Government Land Allocation
THB	Government of Hong Kong SAR, Transport and Housing Bureau

TIA	Traffic Impact Assessment
TKO	Tseung Kwan O
TPB	Town Planning Board
TPO	Town Planning Ordinance Cap. 131
TYLL	Tsing Yi Lantau Link
ULCS	Ultra Large Container Ship
VM	Value Management
VTC	Vessel Traffic Centre
VTs	Vessel Traffic Services

1 INTRODUCTION

1.1 Background

- 1.1.1 Following the endorsement of the Final Report of the Port Development Strategy Review 2001 in mid 2001, the Study on Hong Kong Port - Master Plan 2020 (HKP2020) was commissioned in mid 2002 to formulate a competitive and sustainable strategy and master plan for port development. HKP2020 also recommends potential sites for container terminal expansion.
- 1.1.2 The HKP2020 study examined four possible sites including East Lantau, West Tuen Mun, Southwest Tsing Yi (SWTY), and Northwest Lantau (NWL) for new container terminal development, i.e. Container Terminal 10 (CT10) as shown in **Figure 1.1.1** below.
- 1.1.3 The East Lantau and West Tuen Mun sites were ruled out during the course of the HKP2020 study based on incompatibility with strategic planning intentions and marine access issues respectively. Accordingly, the HKP2020 study recommended that the SWTY and NWL sites be taken forward for further study.

Figure 1.1.1 Possible Sites identified for CT10 in HKP2020



- 1.1.4 Following the completion of the HKP2020 study, the Government commissioned study to update the port cargo forecasts with a view to determining the optimal timing for the implementation of CT10. The Study on Hong Kong Port Cargo Forecasts 2005/2006, released in early 2008, projected that the total container throughput of Hong Kong Port would continue to have steady growth.

- 1.1.5 At the same time, the Government commissioned consultants to undertake further environmental study on the NWL site to investigate potential ecological issues identified in the HKP2020 study. Based on the findings of the further environmental study, the Government decided to study the SWTY site in preference to the NWL site given the comparatively lower ecological sensitivity of the waters at the SWTY site.
- 1.1.6 In addition, the SWTY site offers greater synergy with the existing Kwai Tsing Container Terminals (KTCT) and associated facilities and would avoid a split-port arrangement. Whilst the SWTY site would require acquisition of existing lands and associated compensation, it would require less reclamation than the NWL site and could make better use of the existing transport infrastructure. On this basis, and as announced in the 2008-09 Budget, the Government will study the SWTY site for developing the proposed CT10 Development.

1.2 The Assignment

- 1.2.1 The Government of the Hong Kong Special Administrative Region, represented by the Special Duties (Works) Division of the Civil Engineering and Development Department (CEDD), awarded Agreement No. CE34/2008 (CE): “Preliminary Feasibility Study for Container Terminal 10 at Southwest Tsing Yi – Feasibility Study” to AECOM Asia Co. Ltd.
- 1.2.2 The main objectives of the Assignment are to;
- (a) evaluate and establish the preliminary technical feasibility of the proposed development;
 - (b) formulate optimum development plans including preliminary layout plans and conceptual development plans for the CT10 Development and the reprovisioning site(s) for the affected oil depots taking into account the relevant findings of the relevant studies and the public views;
 - (c) recommend a cost effective and realistic implementation framework; and
 - (d) provide sufficient details through completing layouts and plans for the Works so as to allow further investigations and detailed designs to proceed at the next stage under a separate consultancy agreement.

- 1.2.3 The Preliminary Feasibility Study (PFS) has been carried out in two stages as follows (refer **Figure 1.2.1**);

PFS Stage 1 – Identification of Options and Concept Planning

- 1.2.4 PFS Stage 1 started with the development of a range of conceptual layout options for the CT10 Development. During the Value Management (VM) Workshop held in April 2009, three options were shortlisted for further development in Stage 1. These shortlisted layout options have undergone preliminary assessment and the layouts developed in more detail, taking into account the land use planning and compatibility, land requirements, engineering issues including road access, marine transit and infrastructure requirements. A preliminary hazard to life assessment and a preliminary environmental review have also been conducted to establish the initial feasibility of the potential sites identified for oil depots reprovisioning in broad terms. The three development options and their associated oil depots reprovisioning proposals have then undergone preliminary sustainability assessment to evaluate from a sustainability perspective and option assessment to evaluate the relative performance of the options.

PFS Stage 2 – Preliminary Technical Feasibility of Options

- 1.2.5 In PFS Stage 2, the three development options and the associated oil depot reprovisioning proposals developed in Stage 1, have been subject to further assessments to ascertain the preliminary technical feasibility and to enhance the comparative assessments of the options in preparation of public consultation.

- 1.2.6 Major technical studies completed in PFS Stage 2 include the following;

- Update of PFS Stage 1 Land Use Planning;
- Engineering Studies (Geotechnical Appraisal, Land Formation and Engineering, Terminal Engineering);
- Road Traffic Impact Assessment (TIA);
- Marine Traffic Impact Assessment (MTIA);
- Environmental Assessment (EA) - Water, Ecology, Fisheries, Air, Noise, Land Contamination, Cultural Heritage, Waste Management, Hazards, Landscape, Visual and Glare;
- Land Requirements Study;
- Implementation Strategy and Programmes; and
- Cost Estimates.

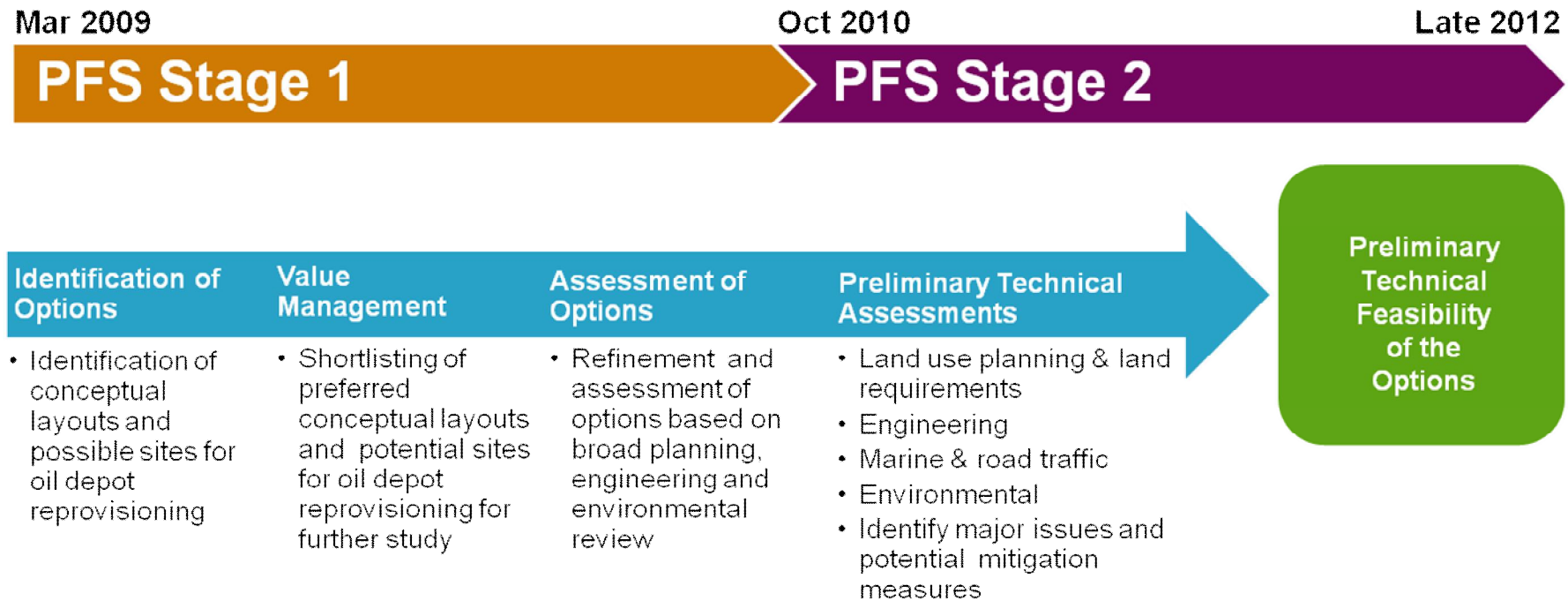


Figure 1.2.1 CT10 PFS Process

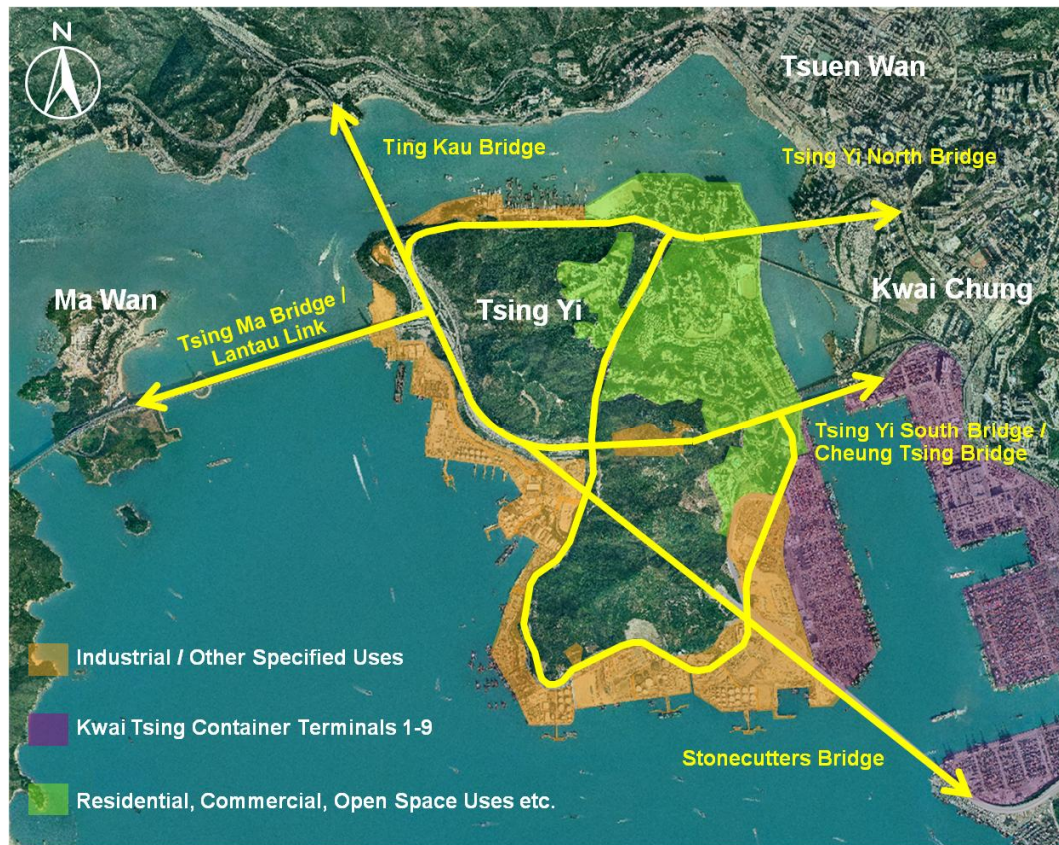
2 PRELIMINARY FEASIBILITY STUDY FINDINGS

2.1 Land Use Planning

Existing Land Use Context

- 2.1.1 The SWTY site is located along the southwestern coastline of Tsing Yi Island and falls within the approved Tsing Yi Outline Zoning Plan (OZP) No. S/TY/24, in the area designated as Industrial/Other Specified Uses (refer **Figure 2.1.1**). The site offers good synergy with the existing KTCT and Marine Facilities in Western Harbour, and can be readily linked with the strategic highway network. In terms of land use compatibility, the CT10 Development is broadly consistent with the existing industrial and container related uses in the southern and western areas of Tsing Yi.

Figure 2.1.1 SWTY Site



CT10 Development Planning Parameters

2.1.2 The major planning parameters specified for the CT10 Development that need to be accommodated under the PFS are listed below:

- a) Eight-berth Terminal of 400m berths required;
- b) Long straight container quay face of at least 1,200m (2,000m preferred);
- c) Water depth at –17mCD alongside of quay and fairway;
- d) 25ha container yard for each berth; and
- e) 10ha backup area for each berth.

2.1.3 The conceptual land use requirements for the CT10 Development have been derived based on the above planning parameters and are summarised in **Table 2.1.1** below:

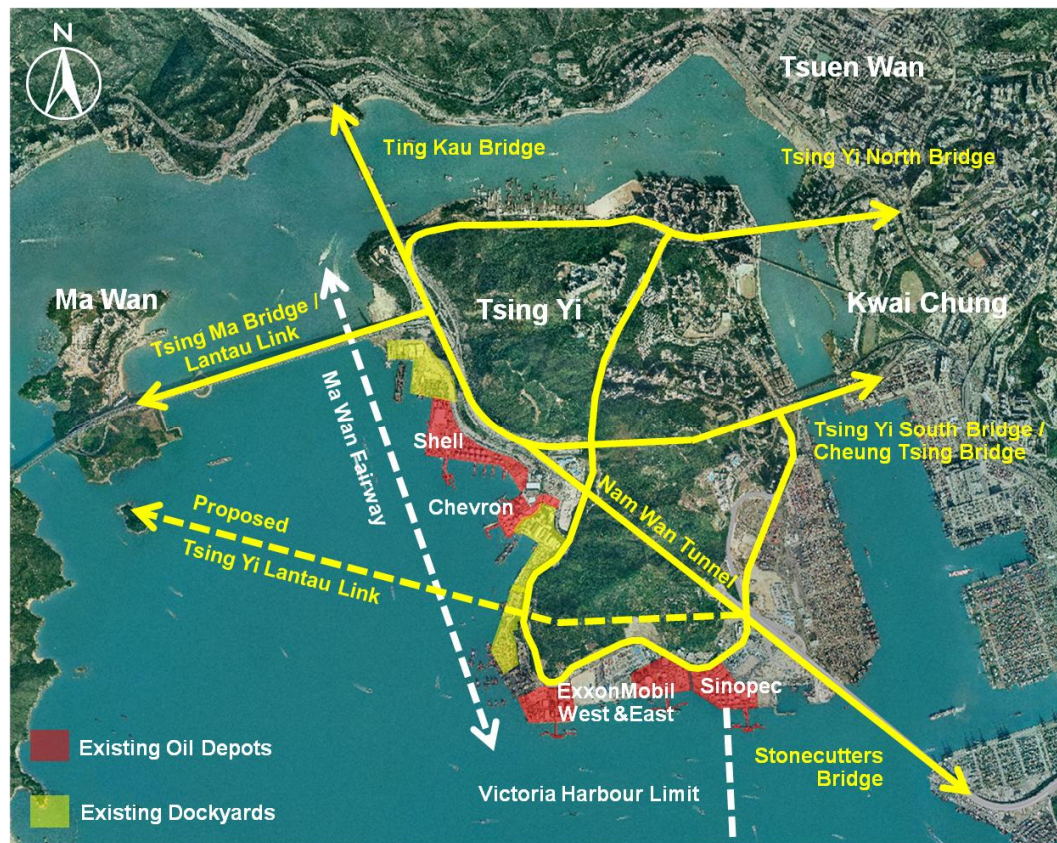
Table 2.1.1 Conceptual Land Use Requirements for CT10 Development

Use	Area (ha)
a) Other Specified Uses (Container Terminal)	200.0 (Container Yard Area)
b) Other Specified Uses (Container Related Uses)	80.0 (Port Backup Area)
– Container Storage and Repairs	33.8 – included in total above
– Container Vehicle / Lorry Park	33.8 – included in total above
– Container Freight Station / Logistics Centre	12.4 – included in total above
c) Open Space	0.5
Total	280.5

Site Constraints

2.1.4 Despite its strategic location, the site is heavily constrained by natural topography and existing development as well as its proximity to the busy Western Harbour waters. The existing land area at the site is insufficient to accommodate the required 200ha container terminal and 80ha port backup area specified in the brief. Opportunities for formation of a land platform for the development on existing land are limited by the adjoining hillsides and man-made slopes as well as the existing Nam Wan and planned Tsing Yi Lantau Link (TYLL) tunnels. Reclamation is restricted by the Victoria Harbour Limit to the East and the Ma Wan Fairway to the west and accordingly, the required land area can only be provided through significant reclamation to the south, with associated impacts on the existing marine users in the Western Harbour (refer **Figure 2.1.2**).

Figure 2.1.2 Site Constraints at SWTY Site



2.1.5 Even so, it will be necessary to make use of almost all of the existing land area at the site, which will necessitate the acquisition and redevelopment of a number of the existing industrial sites. Of the potentially affected sites, it is assumed that the general industrial and godown uses would be able to find suitable alternative sites on the open market on their own and accordingly would not require reprovisioning as part of the CT10 Development. It is proposed that the more specialised facilities such as the Yiu Lian and Euroasia dockyards and the existing oil depots would be reprovisioned as part of the CT10 Development.

2.1.6 In particular, the reprovisioning of the affected oil depots will form a major component of the CT10 Development (refer **Figure 2.1.2**). Two options for reprovisioning of the affected existing oil depots have been identified;

- Reprovisioning of the affected oil depots on a like for like basis; and
- Consolidation of operations at the existing five depots into two depots.

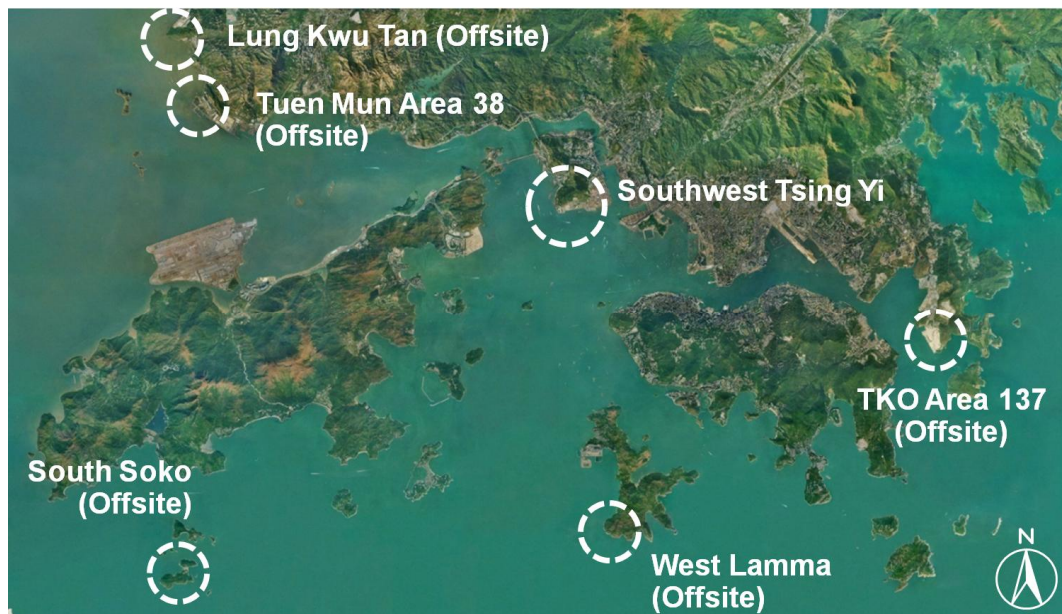
Identification of Possible Sites for Reprovisioning of Affected Oil Depots

- 2.1.7 The Study Brief defines the Potential Sites that are to be assessed for reprovisioning of the affected oil depots as follows:
- a) The reprovisioning sites identified and examined in the site searching exercise in the HKP2020 study;
 - b) Area adjacent to the CT10 Development; and
 - c) Other possible sites with similar potential.
- 2.1.8 In accordance with items (a) and (b) above, the reprovisioning sites identified and examined in HKP2020 at West Tuen Mun (namely Lung Kwu Tan) and Tseung Kwan O (TKO) Area 137 as well as the areas adjacent to the proposed CT10 Development at SWTY were identified for assessment as possible sites for reprovisioning of affected oil depots.
- 2.1.9 A desktop study was undertaken in order to identify other possible sites with similar potential for reprovisioning of affected oil depots. The basic prerequisites for an oil depot site are the availability of suitable land (whether existing or reclaimed) and deep water access for the tankers supplying products to the depot. In addition to these broad physical requirements, the following individual screening criteria were employed to shortlist other potential sites:
- sites shortlisted as potentially suitable for Potentially Hazardous Installations (PHIs) in previous studies;
 - sites where current zoning may allow PHIs - subject to permission being granted by Town Planning Board (TPB); and
 - other greenfield sites in sparsely populated or industrial areas that may potentially be suitable for PHI use under present planning permission or by the process of re-zoning.
- 2.1.10 Where sites have been the subject of previous assessment, the findings and conclusions drawn in these previous studies were reviewed primarily in order to assess whether there were any factors that would automatically render the site unsuitable for the purposes of the CT10 study. In this way, the site identification process was informed by the findings of the previous studies but not necessarily bound by their conclusions. Upon review adopting such screening criteria, it was identified that Tuen Mun Area 38, South Soko Island and West Lamma Island could also be regarded as other possible sites for further assessment.

2.1.11 On the foregoing basis, the possible sites for reprovisioning of affected oil depots identified in PFS Stage 1 were as follows (refer **Figure 2.1.3** below):

- SWTY;
- TKO Area 137;
- Tuen Mun Area 38;
- Lung Kwu Tan;
- South Soko Island; and
- West Lamma Island.

Figure 2.1.3 Possible Sites for Oil Depot Reprovisioning



Development of CT10 Layout Options

2.1.12 The CT10 layout options have been divided into following categories:

- Option 1 – all five oil depots will be reprovisioned off-site and only a transshipment centre will be provided at Tsing Yi;
- Option 2 – only one existing oil depot will be retained at Tsing Yi and others will be relocated to other selected reprovisioning sites;
- Option 3 – only two existing oil depots will be retained with transshipment centre at Tsing Yi and others will be relocated to other selected reprovisioning sites;
- Option 4 – one consolidated and one existing oil depot will be retained at Tsing Yi and others will be relocated to other selected reprovisioning sites;

- Option 5 – two consolidated oil depots, for domestic use and bunker use, will be reprovisioned at Tsing Yi; and
- Option 6 – only one domestic use consolidated oil depot will be reprovisioned at Tsing Yi and the other bunker use consolidated oil depot will be relocated to other selected reprovisioning sites.

2.1.13 For Options 1, 2, 3, and 4, sub-options were developed with different oil depot arrangements, different container berth arrangements, and different relocation sites for shipyards and mid-stream sites. In total, eleven conceptual options were developed.

Value Management (VM)

2.1.14 A VM workshop was held in PFS Stage 1 with the following objectives:

- clarify the stakeholders' needs and user requirements for subsequent studies;
- discuss key issues and constraints related to CT10 Development and oil depots reprovisioning;
- evaluate development layout options identified by the Consultants and derived by participants during the workshop based on an agreed set of assessment criteria/sub-criteria;
- select 3 layout options for further studies; and
- discuss issues and potential sites associated with oil depots reprovisioning, and preferences for their reprovisioning.

2.1.15 During the workshop, the pros and cons of each conceptual layout option were evaluated and six representative layout options were selected by the working groups, for scoring and ranking. The following criteria were evaluated in the assessment:

- container terminal development (fulfillment of planning parameters, efficiency of terminal layout, synergy with existing CT9);
- other planning and land uses (reprovisioning of affected facilities on site, consolidated oil depot);
- public perception (impacts to public);
- marine issues (impact to fairways and nearby marine facilities, safety vessels manoeuvring);
- environmental issues (PHIs' risk, transshipment risks, overall environmental impacts);
- relocation of oil depots (technical feasibility, operational acceptability; spreading of PHIs over the territory);

- construction cost; and
- programming (ability to phase development, confidence in meeting programme dates).

- 2.1.16 Option 3B, Option 5 and Option 6 scored highest and were ranked as the three conceptual development layouts that could best balance the needs and concerns of the CT10 Development after considering advantages and disadvantages from different perspectives.
- 2.1.17 In addition, the possible sites for oil depot reprovisioning were introduced to the various project stakeholders at the VM Workshop for PFS Stage 1. General views and opinions relating to each of the sites were sought, as well as preliminary feedback from stakeholders regarding prioritisation of the sites for consideration in the various PFS Stage 1 study and assessment activities.
- 2.1.18 Following discussion of the identified possible oil depot reprovisioning sites at the VM Workshop, preliminary conceptual layouts for the reprovisioned facilities at each site were developed and were subjected to broad technical assessment in PFS Stage 1 including engineering and operational requirements, land use planning compatibility and impacts, environmental issues, hazards and marine transit issues.
- 2.1.19 The Lung Kwu Tan site was subsequently ruled out based on the findings of the broad technical assessment carried out in PFS Stage 1. It was found that the introduction of additional dangerous goods marine vessel movements into the northern sections of the Ma Wan Fairway in close proximity to densely populated areas in Tsuen Wan would likely result in unacceptable societal risk levels.
- 2.1.20 The Tuen Mun Area 38 site was subsequently ruled out based on the findings of the broad technical assessment carried out in PFS Stage 1. It was found that the presence of the new Permanent Aviation Fuel Facility in the vicinity unduly restricted the marine access to the site and accordingly rendered it infeasible for the reprovisioning of the affected oil depots. In addition, the surrounding existing and planned land uses also restricted the site for PHI uses.

2.1.21 On this basis, the Lung Kwu Tan and Tuen Mun Area 38 sites were discarded at PFS Stage 1 leaving the following potential sites for reprovisioning of oil depots to be progressed for more detailed study in PFS Stage 2:

- SWTY;
- TKO Area 137;
- South Soko Island; and
- West Lamma Island.

2.1.22 The preferred conceptual CT10 Development layouts and associated oil depot reprovisioning proposals identified in PFS Stage 1 have been further developed and updated to reflect the findings of subsequent preliminary technical assessments carried out in PFS Stage 2. The conceptual layouts for all options include a total of eight (8) container vessel berths each 400m length, 200ha of container terminal area (i.e. 25ha per berth) and a further 80ha of land for port backup uses (i.e. 10ha per berth). New access roads serving the container terminal and port backup areas are provided as well as road links to the existing strategic highway network in the vicinity.

2.1.23 Under all options it is proposed that the existing Yiu Lian and Euroasia Dockyard facilities (and associated floating dock facilities) would be reprovisioned on a like for like basis on new sites within the CT10 Development at SWTY.

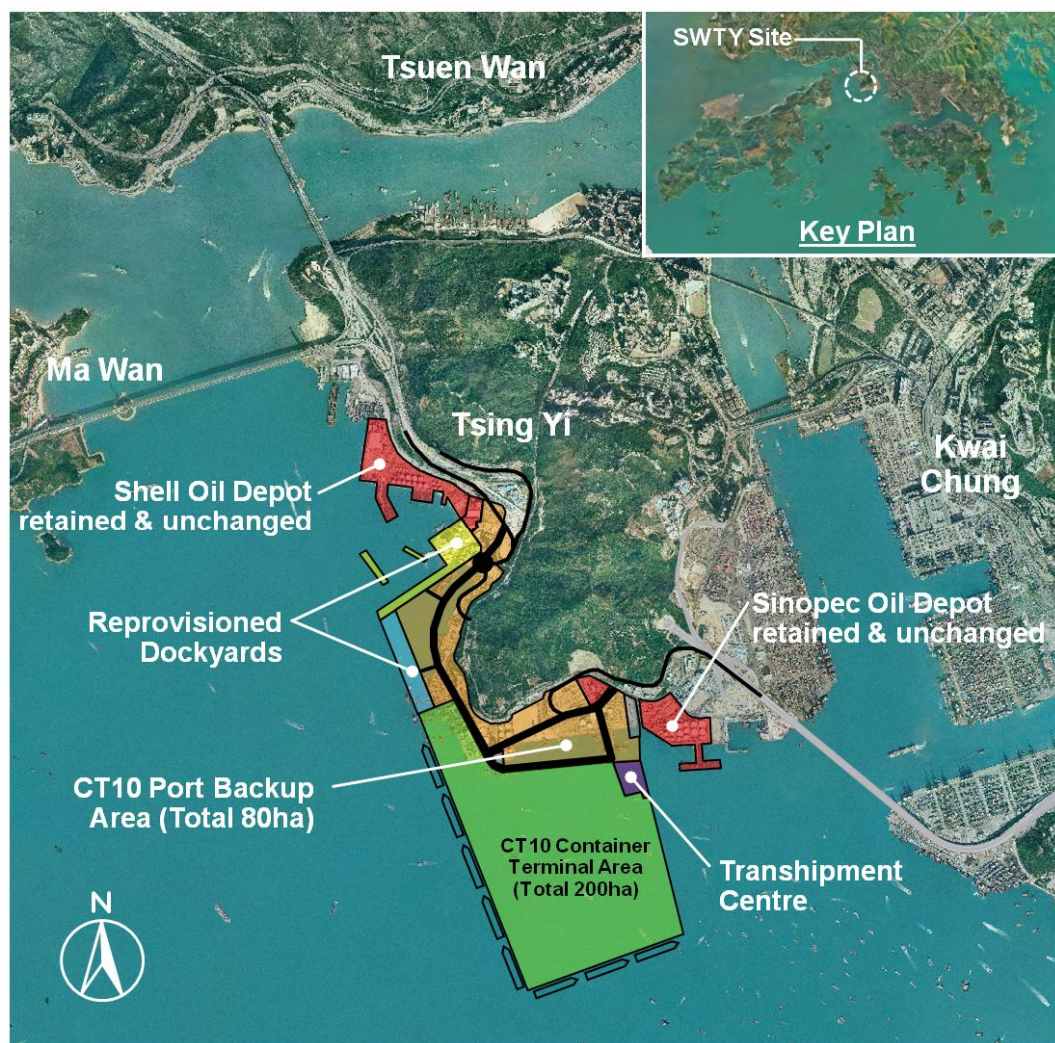
2.1.24 The proposed modes of oil depot reprovisioning are coupled with the identified potential sites for oil depot reprovisioning to form the proposals for oil depots reprovisioning for the development options as summarised below in **Table 2.1.2**.

Table 2.1.2 CT10 Development Options and Associated Reprovisioning Proposals for Affected Oil Depots

CT10 Development Option	Mode of Re-provisioning for Affected Oil Depots	Potential Site for Re-provisioning
Option 3B	Like for like re-provisioning for ExxonMobil East and West and Chevron Oil Depots (Shell and Sinopec Oil Depots retained at their current sites)	TKO Area 137 (offsite)
		South Soko Island (offsite)
		West Lamma Island (offsite)
Option 5	Consolidated domestic fuels depot	SWTY Shell site
	Consolidated bunker fuels depot	SWTY Sinopec site
Option 6	Consolidated domestic fuels depot	SWTY Shell site
	Consolidated bunker fuels depot	TKO Area 137 (offsite)
		South Soko Island (offsite)
		West Lamma Island (offsite)

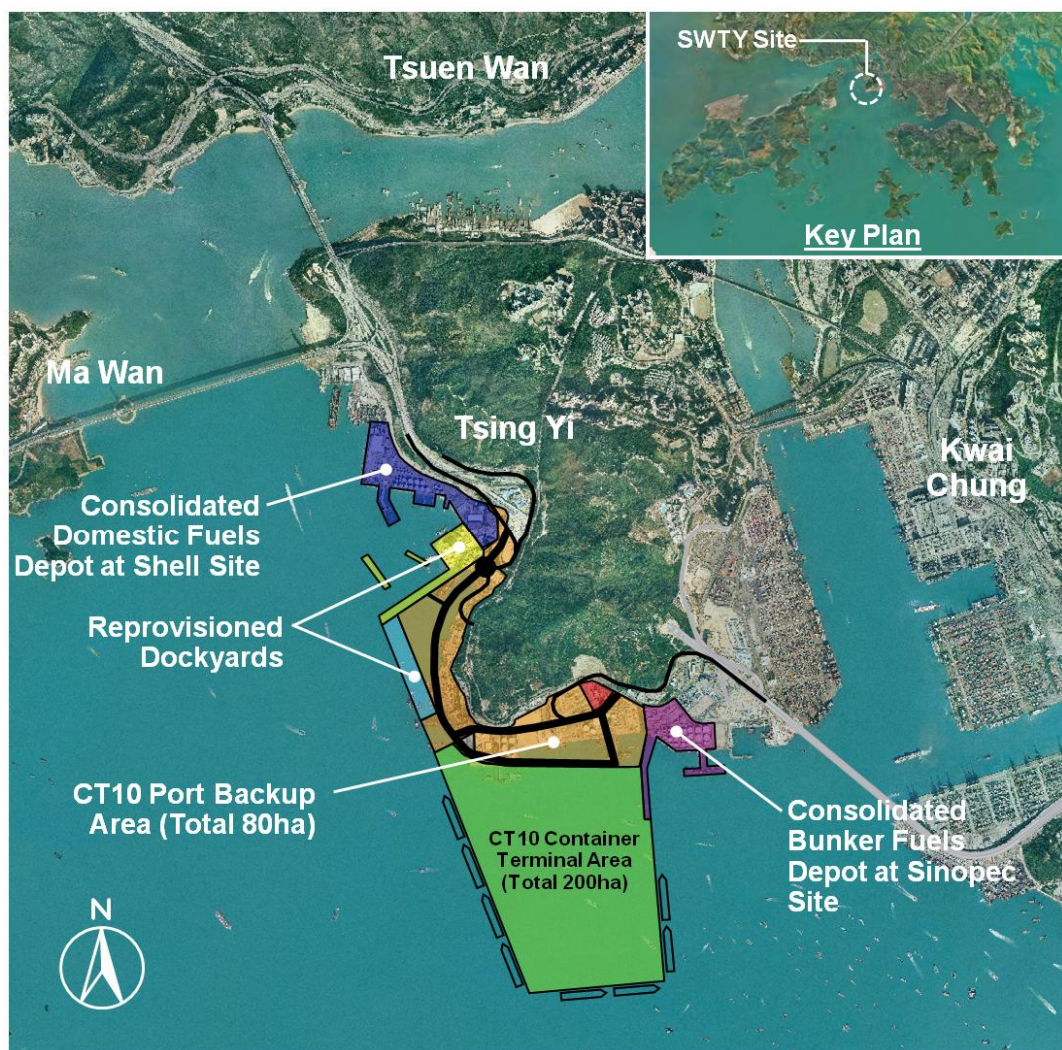
- 2.1.25 For Option 3B, the existing Shell and Sinopec Oil Depots are retained at SWTY. Decommissioning, demolition and decontamination works are required at the existing ExxonMobil East, ExxonMobil West and Chevron oil depots. The ExxonMobil and Chevron Oil Depots would be reprovisioned at one of the potential sites for oil depot reprovisioning (i.e. TKO Area 137, South Soko or West Lamma) on a like for like basis. Domestic distribution of oil and liquefied petroleum gas products from the offsite reprovisioned depots would continue to originate from SWTY via construction of a new transshipment centre.
- 2.1.26 The conceptual layout of the proposed CT10 Development at SWTY for Option 3B is shown below in **Figure 2.1.4**.

Figure 2.1.4 Conceptual Layout – CT10 Development Option 3B



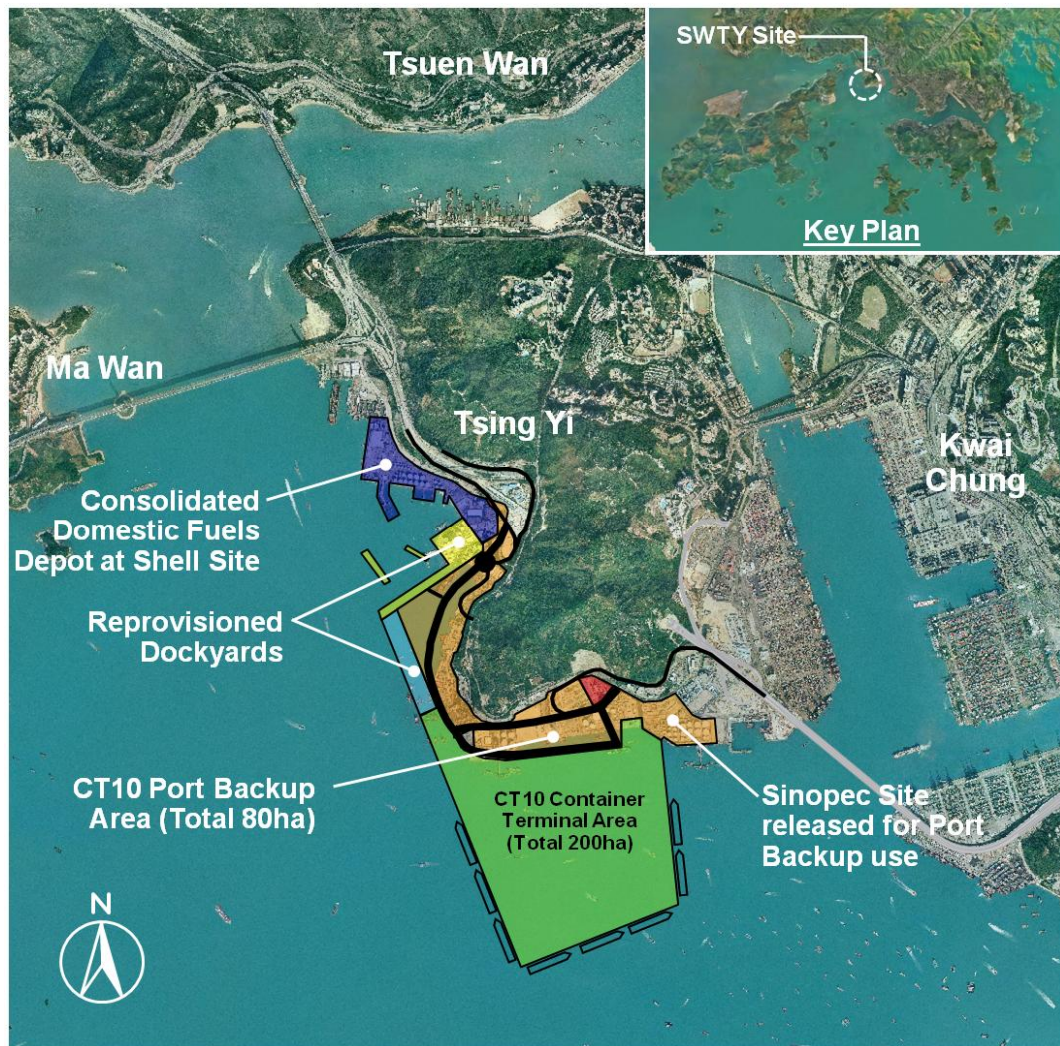
- 2.1.27 For Option 5, all five existing depots would be consolidated into two depots at SWTY. Decommissioning, demolition and decontamination works would be required at the existing ExxonMobil East, ExxonMobil West and Chevron oil depots. The existing Shell Oil Depot and existing Sinopec Oil Depot would be modified as the Consolidated Domestic Fuels Depot and the Consolidated Bunker Fuels Depot respectively through construction of additional fuel tanks and minor modification of jetty, pipeline and truck filling facilities.
- 2.1.28 The conceptual layout of the proposed CT10 Development at SWTY for Option 5 is shown below in **Figure 2.1.5**.

Figure 2.1.5 Conceptual Layout – CT10 Development Option 5



- 2.1.29 Similar to Option 5 above, Option 6 also involves consolidation of all five existing oil depots into two depots. The existing Shell Oil Depot would be modified as Consolidated Domestic Fuels Depot whilst the Consolidated Bunker Fuels Depot would be reprovisioned at one of the potential sites for oil depot reprovisioning (i.e. TKO Area 137, South Soko or West Lamna) and the existing Sinopec Oil Depot decommissioned and redeveloped for container terminal backup area.
- 2.1.30 The conceptual layout of the proposed CT10 Development at SWTY for Option 6 is shown below in **Figure 2.1.6**.

Figure 2.1.6 Conceptual Layout – CT10 Development Option 6

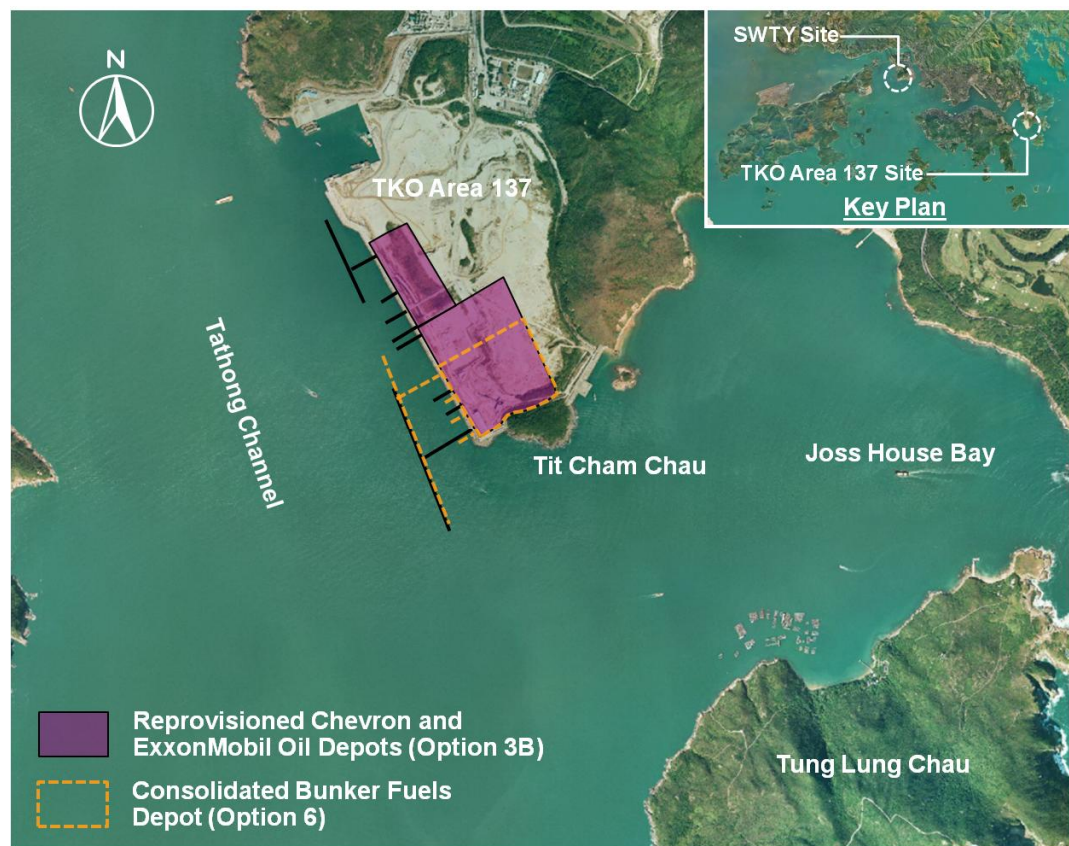


Potential Sites for Reprovisioning of Affected Oil Depots

TKO Area 137

- 2.1.31 The TKO Area 137 site is located approximately 5km southeast of the Tseung Kwan O Town Centre and is about 2.5km to the south of the LOHAS Park development in TKO Area 86, which is one of the major residential developments in TKO. The area is zoned “Other Specified Uses” annotated “Deep Waterfront Industry” (“OU(DWI)”) on the Approved Tseung Kwan O OZP No. S/TKO/20.
- 2.1.32 The proposed development would be located at the southwest part of the existing land platform of TKO Area 137 site with deep waterfront access. Marine construction works will include construction of piled tanker jetties and loading/unloading facilities. Dredging for providing adequate water depth for approach channel and turning basin is required. The conceptual layout of the proposed reprovisioned oil depots at the TKO Area 137 site is shown below in **Figure 2.1.7**.

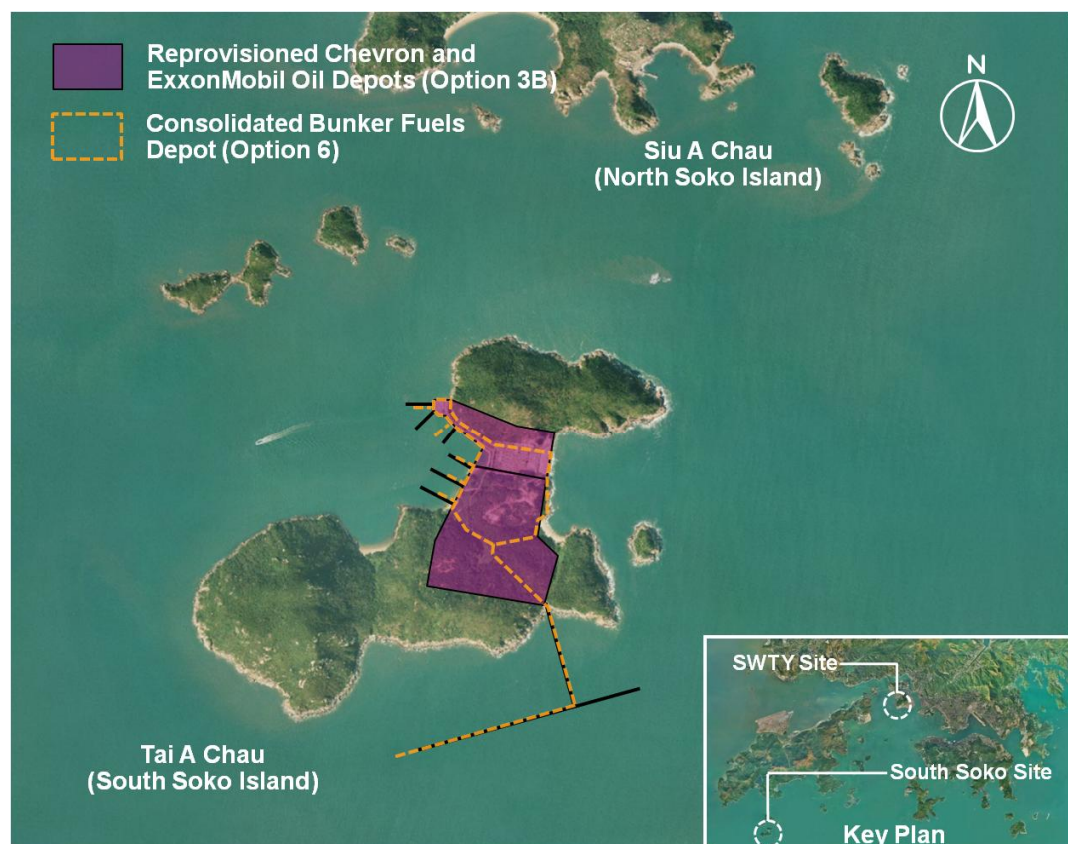
Figure 2.1.7 Conceptual Layout – Reprovisioned Oil Depots at TKO Area 137 Site



South Soko Site

- 2.1.33 South Soko Island is the largest of a small group of islands located about 6 km to the south of Lantau Island. Part of the island was formerly a detention centre for illegal immigrants which is now disused and demolished. The site is currently not covered by any statutory town plan. Should the South Soko Island site be selected, an OZP would need to be prepared to put the Area under statutory planning control.
- 2.1.34 The existing land platform previously occupied by the detention centre for illegal immigrants (disused and demolished now) will be available but not adequate for oil depot development, especially for like-for-like reprovisioning. Excavation in existing hillside on north and south of the site will be required to provide land for the development. Land formation and associated works for oil depot development at this site comprise general site formation works at existing land platform and existing natural hillside, minor reclamation from sea at west coast, construction of marine facilities and dredging to provide sufficient water depth for navigation of tankers and barges. The conceptual layout of the proposed reprovisioned oil depots at the South Soko site is shown below in **Figure 2.1.8**.

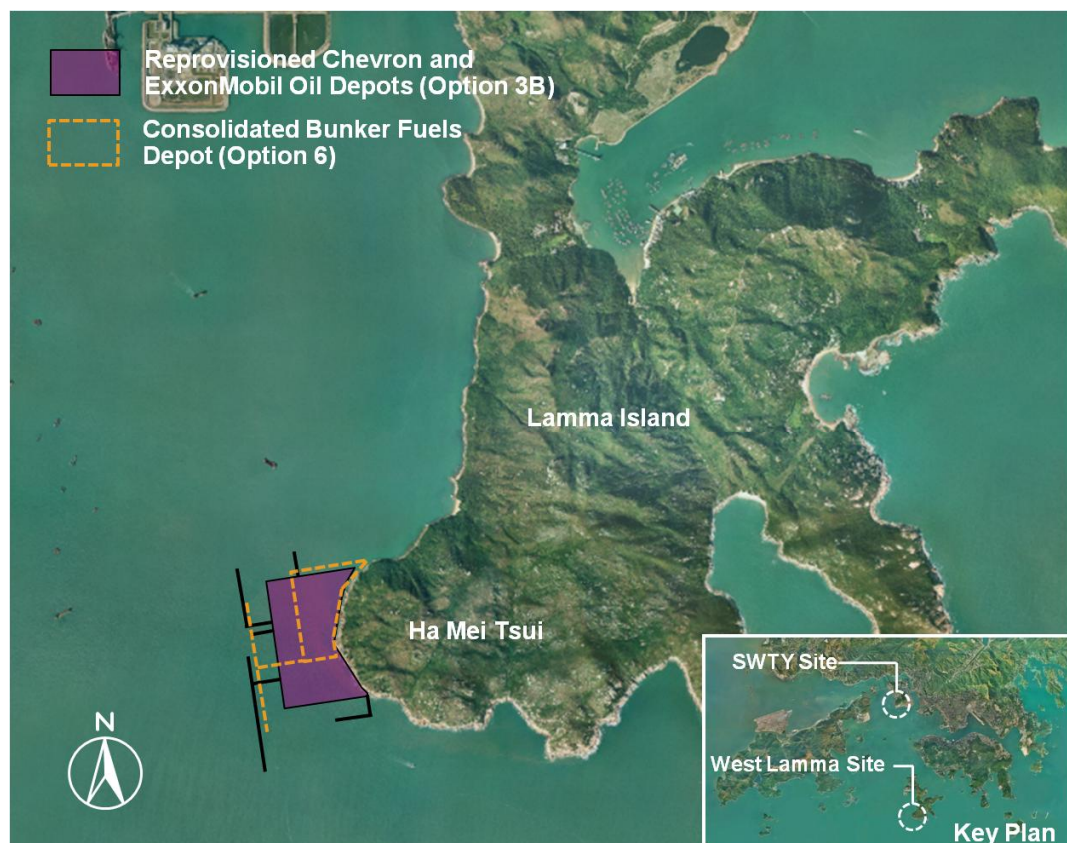
Figure 2.1.8 Conceptual Layout – Reprovisioned Oil Depots at South Soko Site



West Lamma Site

- 2.1.35 Lamma Island is currently covered by the Approved Lamma Island OZP No. S/I-LI/9. The proposed reprovisioning site is located at Ha Mei Tsui, on the southwest coast of Lamma Island. The southwestern part of the island comprises natural terrain with large hills ranging from 100m to 200m which are zoned “Site of Special Scientific Interest” (“SSSI”) and “Coastal Protection Area” (“CPA”) under the Approved Lamma Island OZP No. S/I-LI/9.
- 2.1.36 Reclamation from sea is required for formation of land platforms for the reprovisioned oil depots. Land formation and associated works for oil depot development at this site comprise reclamation from sea for land formation for the development and construction of marine facilities. The conceptual layout of the proposed reprovisioned oil depots at the West Lamma site is shown below in **Figure 2.1.9**. Extension of the Lamma Island OZP to cover the land formed by reclamation is required should the West Lamma Site be selected.

Figure 2.1.9 Conceptual Layout – Reprovisioned Oil Depots at West Lamma Site



Land Use Planning and Compatibility

CT10 Development at SWTY

- 2.1.37 In terms of land use compatibility, the CT10 Development at SWTY would be broadly consistent with the current functions undertaken at the southern part of Tsing Yi Island.
- 2.1.38 The development of CT10 will require reclamation and the extension of the approved planning scheme area of the Approved Tsing Yi OZP No. S/TY/24. Amendments to the OZP under Town Planning Ordinance (TPO) and compliance with other relevant statutory requirements would be required.
- 2.1.39 A number of existing facilities at the SWTY site, including oil depots, dockyards, industrial and container related facilities, would be affected by the CT10 Development and would require clearance and reprovisioning, in order to acquire the necessary land for the development.

Reprovisioning of Affected Oil Depots

- 2.1.40 The SWTY site offers some potential advantages in terms of meeting the proposed general site requirements and the planning and land use compatibility of the site as compared to offsite reprovisioning options. It is located in the centre of Hong Kong and is geographically in a better location to enable efficient road distribution of the domestic products. For bunkering fuels supply, the delivery destinations are mostly in the water space near KTCT. In terms of operational efficiency, oil depots in Tsing Yi allow more efficient service in view of its close proximity to the delivery destinations. It should, however, be noted that any modification in terms of the volume, type and category of petroleum products at existing sites as a result of consolidation would require planning permission.
- 2.1.41 The offsite options each have a degree of sensitivity associated with their location and physical characteristics. TKO Area 137 is located at a major marine gateway to Hong Kong, the site abuts Country Park and it is highly visible from Hong Kong Island East. The site is currently designated for accommodating deep waterfront industry under the statutory plan and is already formed and offers several planning and environmental advantages. However, strong public and local objections to the proposed oil depot use are envisaged, and prior permission from the TPB will be required.

- 2.1.42 In addition, it is understood that CEDD, Fill Management Division intends to extend the current Temporary Government Land Allocation (TGLA) for continual use of this area as temporary fill bank after the end of 2013 which may limit the extent of land available for oil depot development. Also, CEDD, Geotechnical Engineering Office, Mines Division (GEO/Mines Div) currently occupies a site located at the south eastern end of TKO Area 137 under TGLA for use as a marine unloading point for delivery of explosives by road. It is understood that CEDD intends to apply for extension of the current TGLA for continual use of the southeastern end of TKO Area 137 as a marine unloading point of delivery of explosives by road until the TGLA is terminated by LandsD/DLO or an alternative site is allocated. In the event that the project progresses beyond this preliminary feasibility stage and the TKO Area 137 site is selected as the preferred site for reprovisioning of affected oil depots, the project office should carry out a study on the co-existence of the explosives unloading facilities and the proposed reprovisioned oil depot facilities, including any necessary risk mitigation measures. Further coordination and liaison between the project and the affected existing uses would be necessary as part of any future study/design stage.
- 2.1.43 The South Soko Island has a number of ecological and marine access disadvantages, and it is likely that proposals for use of this site for reprovisioning of oil depots would attract strong objections from green groups who raised objections to the earlier proposal by China Light and Power Company (CLP) for the development of liquefied natural gas facilities at this location.
- 2.1.44 Reprovisioning of oil depots at West Lamma Island may be publicly perceived as creating significant impacts on important ecological resources and water related recreational uses. The visual integrity of the existing coastline may also be compromised. The site formation requires extensive reclamation along a sensitive natural coastal environment which is abutted by surrounding conservation areas. The new land formed by reclamation is not anticipated by the current statutory plan and a directive to extend the Approved Lamma Island OZP No. S/I-LI/9 scheme area and gazetting under Foreshore and Sea-bed (Reclamations) Ordinance (Cap. 127) and TPO would be required. It is likely that proposals for use of this site for the reprovisioning of oil depots would attract strong objections from environmentalists, green groups and conservation parties as well as the local community. The proposed site would be situated in proximity to land currently zoned as 'SSSI' and 'CPA'. Extension of the Lamma Island OZP to cover the land formed by reclamation would be required should the West Lamma Site be selected.
- 2.1.45 It is noted that thorough consultation with the general public and special interest groups including affected local residents and community groups, public policy think-tanks, green groups and other non-government organizations would be required for implementation of any of the options, but in particular for Option 3B and Option 6 which involve off site reprovisioning of affected oil depots.

PFS Stage 1 Option Assessment and Sustainability Assessment

- 2.1.46 Following the land use planning of the preferred CT10 Development Options and the associated proposals for reprovisioning of affected oil depots in PFS Stage 1 and the further development of the conceptual layouts based on the findings of the broad technical assessments, the preferred schemes were subjected to preliminary option assessment and sustainability assessment.
- 2.1.47 The findings of the Option Assessment and Sustainability Assessment are summarised in broad terms below.

Option Assessment

- 2.1.48 The PFS Stage 1 option assessment process included the following activities:
- Identification of assessment categories, criteria and basis of evaluation for each option;
 - Definition of scoring system;
 - Weighting of assessment categories and criteria;
 - Evaluation of the performance of the options against the identified assessment criteria and assignment of scores;
 - Application of the assigned assessment criteria weightings to calculate the total weighted score for each option;
 - Sensitivity testing of the outcomes; and
 - Selection of the preferred option.
- 2.1.49 The assessment categories for the option assessment included the following;
- Container Terminal Development (efficiency of terminal layout, synergy with existing KTCT, flexibility for operator take-up);
 - Land Use and Planning (development context and compatibility with known planning intentions, land use impacts, efficiency of port backup area layout, efficiency of reprovisioned facilities, compatibility with proposed TYLL);
 - Engineering (dredging and mud disposal, extent of reclamation, infrastructure impacts, engineering risk);
 - Environmental (noise/air quality, water quality, construction waste, land contamination, ecology/fisheries, cultural heritage, landscape and visual);
 - Hazards to Life (impact on existing risk levels, ability to meet government risk guidelines);
 - Road Network (road connectivity, CT10 road network);

- Marine Traffic (marine impacts and constraints on operation for CT10 Development, impacts on existing marine waterspaces, impacts on existing marine facilities);
- Public Acceptability (permitting risks);
- Arrangement for Reprovisioning of Oil Depots (impacts on operational competitiveness, impacts on oil supply during reprovisioning, impacts on oil supply during operation);
- Cost (construction cost, land acquisition, resumption and compensation/clearance cost); and
- Programme (confidence in meeting first berth commissioning date, expeditious completion of development).

2.1.50 A numerical scoring system was adopted in order to quantify the results of the option assessment and to enable comparison of the relative performance of the different options. Option 5 has been ranked first and offers the best overall performance against the identified assessment criteria.

2.1.51 The results of the option assessment are summarised in broad terms below in **Table 2.1.3**.

Table 2.1.3 PFS Stage 1 Option Assessment Summary

Assessment Category	Option 3B	Option 5	Option 6
Container Terminal Development			
Land Use and Planning			
Engineering			
Environmental			
Hazards to Life			
Road Network			
Marine Traffic			
Public Acceptability			
Arrangement for Reprovisioning of Oil Depots			
Cost			
Programme			
Overall			

Legend:

	Preferred
	Less Preferred
	Least Preferred

Sustainability Assessment

- 2.1.52 The Sustainability Assessment (SA) was carried out to identify and assess the sustainability implications of the CT10 Development at SWTY and the associated proposals for reprovisioning of affected oil depots.
- 2.1.53 Based on the technical assessments and available information in broad terms under PFS Stage 1 of CT10, the assessment was undertaken according to a number of criteria, both qualitative and quantitative. The Computer-aided Sustainability Evaluation Tool (CASET), the List of All Social Checklist Questions and a checklist questions on the three pilot areas under the First Sustainable Development Strategy set out by the Environment Bureau, Sustainable Development Division were used to assist in scoping the key issues and identifying appropriate indicators or assessment criteria.
- 2.1.54 In particular, the SA aims to identify:
- key issues and potential opportunities/mitigation measures associated with the development options;
 - key cross-cutting issues, potential benefits and disadvantage for the development options; and
 - key findings of the SA for further consideration.
- 2.1.55 The assessments were initially grouped under the three key sustainability themes of economic, environmental, and social impacts, and other considerations. The economic performance of CT10 Development Options including “cost benefit” will be analysed.
- 2.1.56 The sustainability assessment employed a mixture of quantitative and qualitative indicators or criteria that relate to a range of themes. CASET was adopted for evaluation with the support of the other PFS Stage 1 technical assessments.
- 2.1.57 The findings of the sustainability assessment are summarised below in **Table 2.1.4**.

Table 2.1.4 – PFS Stage 1 Sustainability Assessment Summary

Sustainability Assessment Checklist	Option 3B			Option 5	Option 6		
	South Soko	TKO Area 137	West Lamma		South Soko	TKO Area 137	West Lamma
Cost-Benefit							
Criteria air pollutants							
Toxic air pollutants							
Carbon dioxide emitted per year							
Energy consumption							
Excessive noise							
Fixed capital							
Freight costs							
Landfill capacity							
Managed marine habitat							
Managed terrestrial habitat							
Marine eco-value							
Marine water quality							
Construction Waste							
Municipal waste							
River water quality							
Significant Landscape Features (Area)							
Significant Landscape Features (Point)							
Terrestrial eco-value							
Travel distance							
Travel speed							
Unemployment Rate							
Equal opportunity							
Physical/mental health							
Archaeological/historical sites							
Hazard to life							
Public acceptability							
Marine Risk							
Planning and lands							
Overall							

Legend:

Preferred
Less Preferred
Least Preferred

2.1.58 Option 5 was identified as the best ranked option represented by the most highest ranked indicators, the least worst ranked indicators (none) and the lowest summation of rankings. Some of the key results are summarised as follows:

- Option 5 has the highest number of first (1) ranking;
- Option 3B TKO and Option 6 TKO have the second and third highest number of first (1) ranking respectively;
- Economic associated indicators: Option 3B TKO performs the best among all options;
- Environmental associated indicators: Option 5 performs the best; while South Soko Island and West Lamma Island of Option 3B & Option 6 are less preferable due to the ecological concerns over the Chinese White Dolphins, Finless Porpoises and coral of Option 3B and 6, as well as additional indirect fishery impact which may be significant; and
- Social associated indicators: Option 5 performs the best, while both Options 3B and 6 with the South Soko Island are less preferable.

Summary

2.1.59 Overall, Option 5 was found to offer advantages over Option 3B and Option 6, mainly through avoiding offsite reprovisioning and eliminating the associated offsite impacts. Accordingly, Option 5 was recommended as the preferred option in PFS Stage 1. Nevertheless, all three shortlisted options were carried through to Stage 2 for establishing the broad technical feasibility in order to facilitate any future public consultation activities for preliminary technical feasibility assessment in PFS Stage 2.

2.1.60 A summary of the key findings of the technical assessments carried out in PFS Stage 2 is presented in the following sections of this executive summary.

2.2 Geotechnical Appraisal

- 2.2.1 On the basis of the preliminary geotechnical models, an initial geotechnical appraisal of the CT10 Development site, as well as the potential reprovisioning sites for oil depots, has been carried out to identify potentially significant ground engineering issues which will affect the costs and programme of the CT10 Development.
- 2.2.2 The existing man-made slopes and retaining walls that will affect, or be affected by, the development have been identified and grouped into four different categories in respect of how they will affect, or be affected by, the proposed development. The current status of the identified man-made features has also been presented to give a preliminary indication of the scale of the geotechnical studies that will need to be carried out at the future design stages of the CT10 Development. A desktop study has also been performed to determine whether Natural Terrain Hazard Study (NTHS) is required in the future detailed feasibility study stage and recommendations made accordingly.
- 2.2.3 Based on the preliminary geotechnical appraisal, the following further site investigations and assessments are recommended to be conducted in future design stages of the project:
- Further ground investigation, including marine and land-base drillholes as necessary to fully define the geological conditions across the site;
 - Vibrocore sampling and laboratory testing for thorough review of sediment quality across the entire site and to ascertain the nature and properties of the materials to be dredged, where necessary;
 - Magnetometer survey for the former explosive dumping ground at SWTY to acquire more information on the extent and potential quantity of explosives remaining at the site;
 - Further review on the stability of the existing seawalls and man-made features with respect to the proposed works under this project;
 - A NTHS is recommended for the future design stage of the project; and
 - Further review of the Historical Landslide Catchments (HLCs) within the footprint of the CT10 development.

2.3 Land Formation and Engineering

2.3.1 Engineering aspects for land formation and reclamation for the CT10 Development at SWTY site and oil depot reprovisioning at potential sites (i.e. TKO Area 137, South Soko Island and West Lamma Island) have been reviewed. The proposed reclamation configuration, formation level and reclamation method for various sites are presented. Preliminary settlement calculations for the proposed reclamation (for SWTY and West Lamma sites) have been conducted to demonstrate the effectiveness and performance of the proposed reclamation. Preliminary land formation and reclamation plans and typical sections for the proposed reclamation, seawalls and berth structures for each development site have been prepared.

2.3.2 The approximate site area at SWTY for each development option is indicated in **Table 2.3.1** (refer **Figures 2.1.4 to 2.1.6**).

Table 2.3.1 Approximate Site Area for CT10 Development at SWTY

	Site Area (ha)		
	Option 3B	Option 5	Option 6
Existing Land	70.4	82.7	87.8
Reclamation	263.0	260.5	244.0
Total	333.4	343.2	331.8

2.3.3 For both Options 3B and 6, additional land formation works are required offsite for reprovisioning of affected oil depots. The approximate site locations and layout options for offsite reprovisioning of affected oil depots under Option 3B and Option 6 at the South Soko, TKO Area 137 and West Lamma sites are shown in **Figures 2.1.7 to 2.1.9**.

2.3.4 For the South Soko site, additional reclamation area of about 0.6ha is required at Sai Wan of South Soko Island abutting the existing land platform. At the West Lamma site, the proposed oil depots will be built on newly reclaimed land platforms of about 27.5ha and 12.4ha for the reprovisioned Chevron and ExxonMobil oil depots and the consolidated bunker fuel depot respectively. No reclamation is required for either Option 3B or Option 6 at the TKO Area 137 site.

2.3.5 Preliminary estimates have been made for the quantities of the dredged marine sediments and the various types of fill materials required for land formation of the sites. These estimates are summarised in **Table 2.3.2** below for the three development options.

Table 2.3.2 Estimated Quantities of Materials

Land Formation and Associated Activities (all quantities are insitu volume)		Option 3B ^[1] (million m ³)	Option 5 (million m ³)	Option 6 ^[1] (million m ³)
Dredged Sediment from Navigation Channel and Anchorage Area	L ⁽³⁾	8.84 – 13.76	8.65	6.93 – 10.82
	Mp ⁽³⁾	3.18	3.40	2.85
	Mf ⁽³⁾	4.31 – 6.04	4.41	3.44 – 5.33
Dredged Sediment from Seawall Foundation	L ⁽³⁾	9.09 – 10.9	8.83	8.36 – 10.73
	Mp ⁽³⁾	0	0	0
	Mf ⁽³⁾	0.79	0.81	0.82
Dredged Sediment from Landing for Utilities Installation	L ⁽³⁾	N/A – 0.22 ^[2]	N/A	N/A – 0.22 ^[2]
Public Fill for Reclamation		42.67 – 47.56	40.55	38.48 – 40.84
Sand Fill for Reclamation		19.22 – 20.95	18.61	17.56 – 18.27
Rock Fill for Seawall Construction		10.36 – 11.48	9.20	8.68 – 9.21
Sand Fill for Seawall Construction		0.88 – 3.12	2.62	2.19 – 3.74
Rock Fill for Water Main and Power Cable Installation		N/A – 0.18 ^[2]	N/A	N/A – 0.18 ^[2]

Notes:

1. Range of values shown for Option 3B and Option 6 are dependent on the selected site for reprovisioning of affected oil depots.
2. Applicable for South Soko Site only.
3. Marine sediment is classified in accordance with Environment, Transport and Works Bureau Technical Circular (Works) - (ETWB TCW) No.34/2002 based on its contamination levels:
 - Category L – Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level (LCEL). The material must be dredged, transported and disposed of in a manner which minimises the loss of contaminants either into solution or by re-suspension.
 - Category M – Sediment with any one or more contaminant levels exceeding the LCEL and none exceeding the Upper Chemical Exceedance Level (UCEL). The material must be dredged and transported with care, and must be effectively isolated from the environment upon final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment. Category Mp are sediments that pass the biological test and category Mf are sediments that fail the biological test.

2.3.6 Preliminary drainage, sewerage, water supply and utility assessments have been carried out to establish the preliminary technical feasibility of the three CT10 Development Options in broad terms. Major demand requirements and new facilities required for the development have been identified, and the corresponding extent of land required for the new utilities and services have also been delineated for land use planning purposes. The major findings and proposals with respect to the CT10 Development are summarised as follows:

- For new waterfront developments such as the proposed container terminal and the reprovisioned dockyards, surface runoff will be collected by new drainage system within these sites and discharged to the sea via outfalls in new seawalls. Hence, there should be no impact on the existing drainage system in the hinterland caused by these new waterfront developments. The surface runoff within the open space, backup areas and new access roads of the CT10 Development will be collected by surface drainage such as U channels and gullies prior to discharge to sea via storm drains connecting to the existing/extended box culverts across the reclamation in order to discharge through the new seawalls. The drainage system will mainly be located within new roads, adequately sized to avoid impacts to the drainage system in the hinterland;
- Currently, there is no public sewerage system to the south and west of Tsing Yi. New sewers will need to be constructed along the new roads to collect sewage from CT10 Development and be connected to the existing sewerage system. Due to the undulated ground profile, sewage pumping station will be required within CT10 Development to pump the sewage before connection to existing gravity sewerage system;
- For serving CT10 Development and other new facilities, the existing fresh water and salt water supply mains will be extended into the area as far as practicable such that water supply connections could be made available. The new water mains and fire hydrants will mainly be located under the footpaths within the new development and along the new roads; and

- The existing CLP Tsing Yi Power Station is located at Tsing Yi Road next to the ExxonMobil East Oil Depot. Due to new demands from container terminal and port backup facilities, upgrading of the facilities within the CLP site may be required, subject to further investigation in future design stage of the project. The portion of the CLP site currently occupied by substation, equipment, office and warehouse will be retained to avoid the possible disturbance to the power supply to the island. Meanwhile, the remaining portion of the CLP site currently used for open storage will be acquired for CT10 Development use. It is assumed that 3ha of land will be retained which already allows for space for future upgrading of the facilities. New 11kV power cables would be laid along verges of the new access road network to minimise disruption to road traffic should maintenance works require to be carried out in the future.

2.3.7 In the event that the project progresses beyond this preliminary feasibility stage, comprehensive Drainage Impact Assessment, Sewerage Impact Assessment and Water Supply Impact Assessment would need to be carried out as part of future detailed design/study stage based on the selected CT10 Development Option.

2.4 Terminal Engineering

2.4.1 Terminal layouts have been developed for Options 3B, 5 and 6 based on the CT10 being subdivided into two self-contained container terminals – East and West. The main criteria used for the development of the preliminary layouts were:

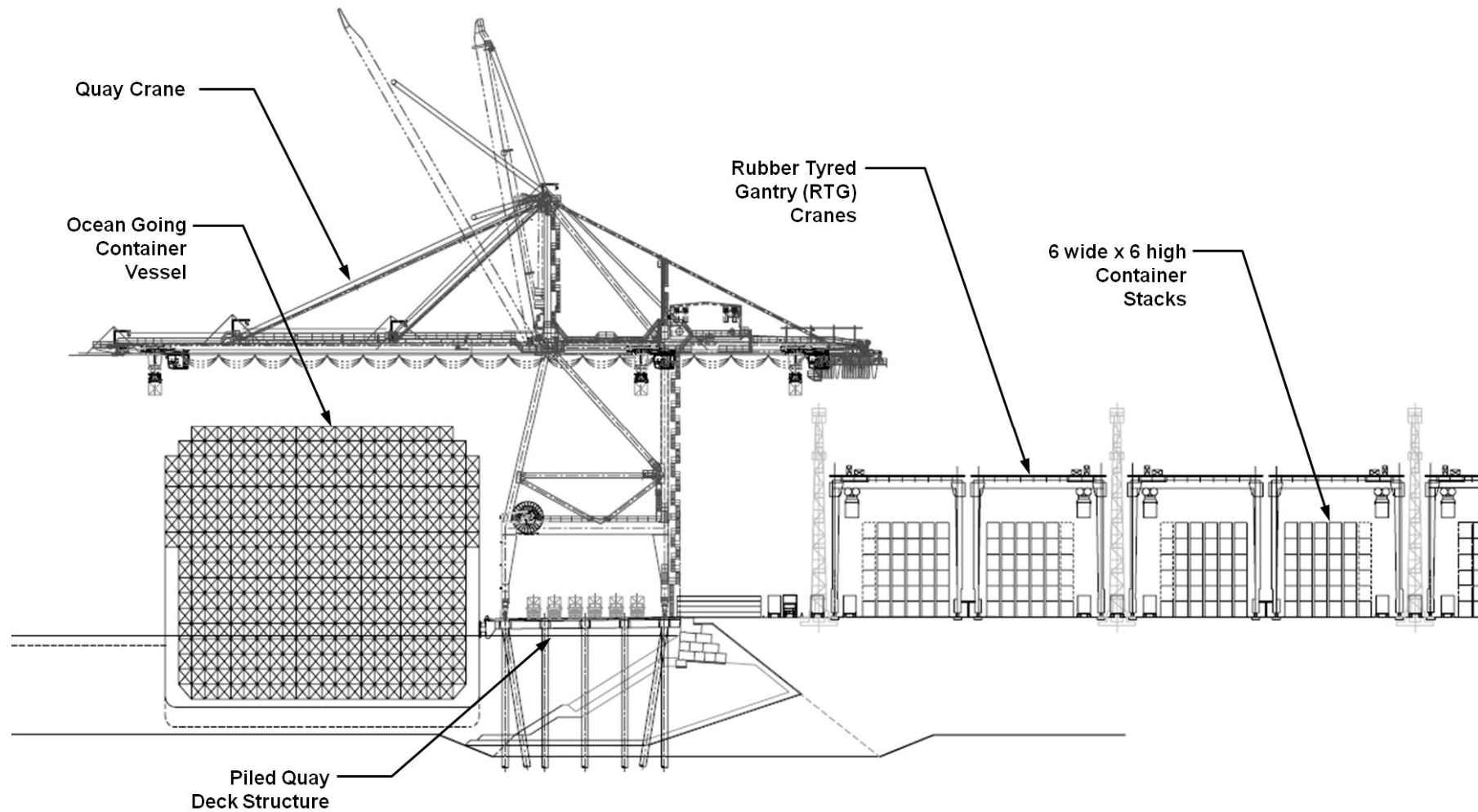
- A total of 8 berths each of 400m long and 200 ha of terminal area (i.e. 25 ha per berth);
- Logical and space efficient layout of operational facilities within the container terminals;
- High throughput capacities and stacking densities at least equal to existing terminals; and
- An operational system based on proven existing technology.

2.4.2 For ship to shore operations, conventional gantry cranes are proposed, but using the currently most widely used rail span of 100 ft / 30.48m to better suit the large outreach required and allow space for six traffic lanes between the rails. The proposed cranes will have sufficient outreach for 24 rows of containers across the deck.

2.4.3 Yard operations will be performed using Rubber Tyred Gantry (RTG) Cranes working in container stacks 6 rows wide and 6 containers high, similar to the existing KTCT. Air and noise emissions will be minimised through the use of electrically powered machines connected to conductor rails, so that only when the cranes are moved between stacks will their diesel engines be needed.

- 2.4.4 The overall terminal layouts include container stack layouts (with areas for reefer containers and multi-purpose uses), possible traffic circulation routes, ancillary facilities such as the main entry/exit gates, buildings and maintenance areas, security boundaries, emergency access gates and indicative locations for lighting towers.
- 2.4.5 The container stack densities (in terms of container ground slots, or spaces, per hectare) of the six terminal layouts were estimated and were found to be very similar to those at CT9 South, the largest and most recent built in Hong Kong. A typical cross section of the proposed CT10 container terminal layout is shown in **Figure 2.4.1**.

Figure 2.4.1 Typical Cross Section of Container Terminal

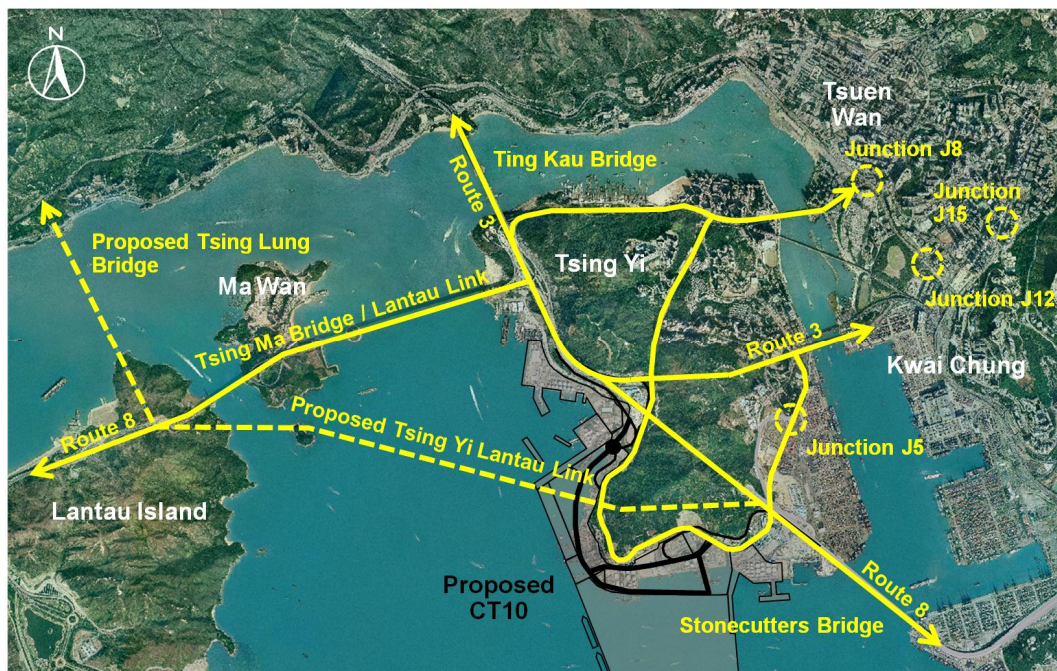


2.5 Traffic Impact Assessment

2.5.1 The road traffic implication of the proposed CT10 Development during the operation year 2031 for the three development options 3B, 5 & 6 has been assessed. The assessment results show that all the assessed internal junctions in the CT10 Development would operate within design capacity in 2031, except for the following hinterland junctions (refer **Figure 2.5.1** below);

- J5 – Tsing Yi Hong Wan Road / Tsing Yi Road / Tsing Sha Highway;
- J8 – Tsuen Tsing Interchange;
- J12 – Kwai Tsing Interchange; and
- J15 – Kwai Chung Road / Kwai On Road

Figure 2.5.1 – Road Connectivity and Critical Junctions and Links for SWTY Site

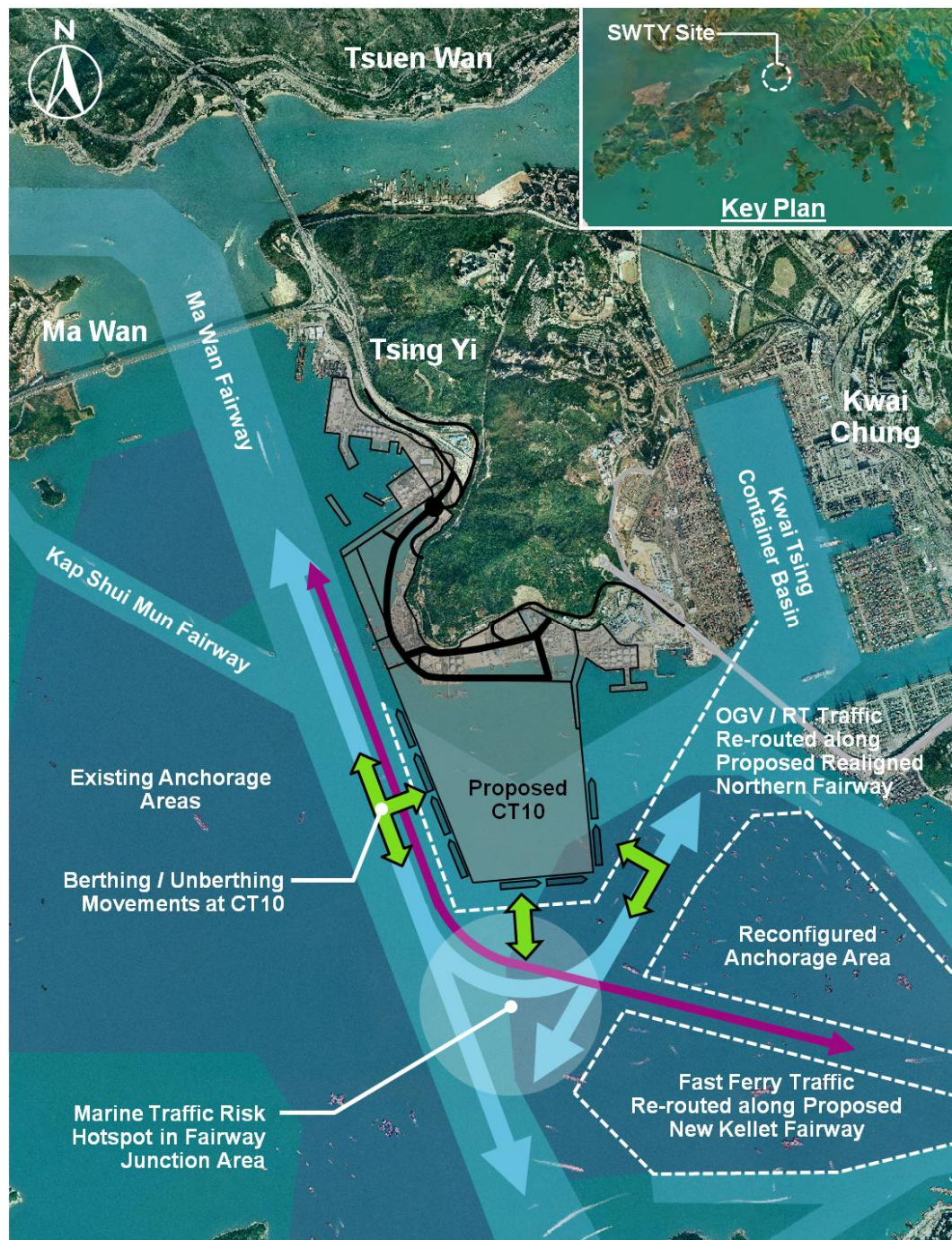


- 2.5.2 Junction improvement measures have been proposed to improve the performance of the overloaded junctions, except for Junction J8, which is site constrained. The capacity analysis suggested that the junctions would operate within their design capacities with the implementation of the proposed improvement measures in year 2031. However, further assessment of junction J5 taking into account other additional potential logistics sites and barging sites in Tsing Yi (over and above those assumed for the purposes of this study) indicates that it is likely to operate beyond capacity even with the proposed improvement measures. In the event that the project progresses beyond this PFS stage, further detailed study would be required to identify regional solutions to the potential capacity issues at junction J5 in light of these other additional potential developments.
- 2.5.3 The TIA also indicated that all the local roads in the vicinity of the CT10 Development will be operated within design capacity while some strategic roads (Ting Kau Bridge and Tsing Ma Bridge) will be overloaded in year 2031.
- 2.5.4 Sensitivity tests have been performed to examine the traffic impact on strategic routes with the introduction of TYLL. The results indicated that TYLL would significantly improve the performance of Tsing Ma Bridge and Tsing Yi North West Interchange but that the Ting Kau Bridge would still operate beyond manageable level in year 2031.
- 2.5.5 The potential long-term future capacity issues identified for both the Ting Kau Bridge and Tsing Ma Bridge are a strategic issue caused by the natural growth of existing traffic, together with the additional traffic generated by numerous planned future developments and infrastructure in the New Territories West (NTW) and Lantau areas. These developments include the Hong Kong Zhuhai Macau Bridge, Tuen Mun Chek Lap Kok Link, remaining developments in Tung Chung, New Development Areas, new logistic sites and barging points in Kwai Tsing area, the proposed CT10 and other developments in NTW etc. Further district/strategic planning studies are required to resolve these long-term future potential capacity issues, which may include the consideration of new infrastructure schemes such as TYLL and the previously planned Tsing Lung Bridge.

2.6 Marine Traffic Impact Assessment

- 2.6.1 Reclamation for CT10 would result in significant intrusion into the Western Harbour which would necessitate realignment and rearrangement of the existing fairways and anchorages in the vicinity. Proposed changes to the layout of the Western Harbour to accommodate the CT10 reclamation are similar for the three options and have been developed to minimise impacts on existing marine users. The existing fairway junction and approach to the KTCT basin are relocated to the south clear of the CT10 reclamation, while the Ma Wan Fairway alignment is retained unchanged.
- 2.6.2 A new Kellett Fairway is proposed mainly to facilitate fast ferry movements through the Western Harbour and the existing Kellett Bank anchorages are rearranged accordingly. The new Kellett Fairway is favoured as fast ferries approaching Ma Wan are diverted away from the high traffic density Southern & Northern Fairways, and this fairway may also provide a passage for mega-sized cruise vessels transiting to the future cruise terminal in the Eastern Harbour at Kai Tak.
- 2.6.3 The proposed marine planning scheme for the CT10 Development is shown schematically in **Figure 2.6.1**. Comparative analysis has identified that:
- The risk levels assessed within the Study Area and the Western Waters in terms of collision levels would increase significantly by 2031, even if no CT10 were built;
 - It is found that following the construction of CT10 at SWTY, the projected collisions in the Western Harbour will generally increase, with particular high risk focus area at the southwest corner of the future CT10 and its surrounding waters, together with significant ocean-going vessel (OGV) and rivertrade vessel (RTV) traffic “bunching” at this waterspace;
 - The introduction of the CT10 geometry alone has led to an increase of risk level at (i) 37% under existing traffic level and (ii) 48% under 2031 traffic level, a finding comparable with the 40% risk increase solely due to the traffic growth between 2010 to 2031; and
 - Analysis of CT10 Development under future traffic conditions identifies that collision levels would increase by 104%.
- 2.6.4 It has been recognised that given future traffic growth (with or without CT10 Development being considered), the rate of incidents increases is unavoidable and there is a clear need to review management of vessel activities to reduce the focus around the high risk level “hot spot” as highlighted in **Figure 2.6.1**.

Figure 2.6.1 Marine Planning Scheme for CT10 Development and Potential Marine Traffic Impacts at SWTY



Berthing and Transit Simulations

- 2.6.5 Simulations were carried out for a total of 34 scenarios. 7 scenarios were considered as “*Challenging*” manoeuvres, 3 scenarios were “*Difficult*” and 2 scenarios was “*Very Difficult*” which could not safely be conducted in the extreme tidal currents simulated. Apart from these manoeuvres, the other 22 scenarios were “*Comfortable*” where the approach and departure manoeuvres simulated could be undertaken with a degree of safety.

2.6.6 Based on the simulation runs conducted, it was observed that:

- Any berthing manoeuvres at the west berth requiring a turn along the Ma Wan Fairway should not be attempted during peak ebb current. Turning movements are likely to take beyond 60 minutes within the Ma Wan Fairway and significant obstruction to existing traffic is anticipated;
- Berthing/un-berthing movements at the west and south berths are of particular concern, as they are conducted within the busy crossing areas of all other traffic. The poor navigation & traffic conditions associated with these manoeuvres suggest that operations at the west and south berths are to be restricted to tidal limitations. Specific berthing constraints should be ultimately developed according to the outcomes of full mission bridge simulation with members of the Hong Kong Pilots Association (HKPA), that would be required in any detailed MTIA should the development proceed further;
- Berthing/unberthing movements at the west and south berths would significantly impact vessels including fast ferries, RTVs, OGVs and local vessels transiting along the Ma Wan Fairway and vessels in/out of the existing CT1-9 along the Northern Fairway;
- Berthing/unberthing movements at the Sinopec Oil Depot during peak ebb current are of particular concern. Manoeuvring movements at this berth are likely to obstruct the outbound traffic from CT1-9 for up to 30 minutes and local traffic management measures would be required;
- A typical berthing/un-berthing manoeuvre under non-peak tide conditions, at the west or south berth face, may create a partial obstruction of 20 – 30 minutes within the Ma Wan Channel/waterspace adjacent to berth. In some cases, adequate waterspace will exist for vessels to be scheduled to pass the obstruction, in others it will not;
- At least four tugs are to be assigned to assist the large containerhips during strong wind and current conditions. Consideration should be given to increasing the power (up to 60 tonnes bollard pull) of these tugs;
- The floating dock will require a tight berthing guideline restricting arrivals to slack water; and
- The reprovisioned oil facilities can be readily accessed. However, consideration will need to be given to tight tidal constraints during peak tidal periods.

2.6.7 Given the location and configuration of the CT10 development, impacts on existing marine traffic associated with vessel berthing and unberthing manoeuvres at CT10 are inevitable, as shown schematically on **Figure 2.6.1**. Mitigation of the resulting impacts to acceptable levels would require the implementation of advanced marine traffic management and scheduling systems.

Development Options Review

- 2.6.8 A qualitative assessment has been conducted to review the relevance of the key MTIA findings for the Option 5 layout to the other options, i.e. Option 3B and Option 6. It is concluded that key findings from the collision risk assessment and manoeuvring simulations being developed under Option 5 are applicable, in board terms, to Option 3B and 6 considering the CT10 reclamation geometry, future cargo vessels movements, dockyard and oil depots' activities.
- 2.6.9 A site comparison considering offsite reprovisioning sites at TKO Area 137, South Soko and West Lamma has also been conducted in respect to the potential level of marine traffic impacts to existing marine traffic and facilities in the vicinity of the sites - no clear preference for any particular site emerges on marine operational grounds alone.

Operation Issues and Risk Control

- 2.6.10 It has been concluded that the presence of tidal constraints at Ma Wan does not impact the distribution of the vast majority of OGV transit activity. An analysis of the "Capacity" of the Ma Wan Channel has been conducted and suggests that the current operational limit is in the order of 60 – 70 vessels per day. As such, the channel is currently at two-thirds capacity and could sustain increases of 50% of future growth capacity.
- 2.6.11 Taking into account that a maximum capacity along the Ma Wan Fairway is estimated at 70 daily transits the Ma Wan Fairway is anticipated to reach its maximum capacity with the addition of any future CT10 west berth movements.
- 2.6.12 A risk assessment of collisions has been conducted to review risk levels at the Western Harbour during berthing movement at the west and south face berths including the baseline 2010 traffic levels and a reduction of 450m available waterspace adjacent to berths for vessel passage. The analysis (which has very conservatively assumed a worst-case obstruction being present 100% of the time) has identified a 10 and 14% increase over the baseline risk profile with the increase in collisions predominately in waterspaces at the southwest corner of future CT10 Development and its surrounding waters.
- 2.6.13 In order to transit a greater volume of traffic in the Western Harbour, it has been identified that the service rate of the Ma Wan Channel must be increased requiring the co-ordination and management of vessels as they approach HK from the south, and departures from the Shenzhen container terminals. Alternatively, vessels to/from the Shenzhen container terminals could use the Tonggu Waterway. An overall increase in risk potential has been identified as a result of re-arrangement of the Western Harbour marine facilities including the CT10 Development. Given this, an overview on operational risk controls and port management measures have been presented that would assist in mitigating some of the local impacts brought about by the CT10 Development, and assist more generally in the efficient routing of vessels within Hong Kong waters.

2.7 Environmental Assessment (EA)

- 2.7.1 The EA study carried out under this PFS has provided a preliminary assessment on the potential environmental impacts associated with the construction and operation of the CT10 Development at SWTY and the associated reprovisioning of affected oil depots at the various potential reprovisioning sites. Specific mitigation measures required for the Project have been proposed.
- 2.7.2 It is noted that the CT10 project comprises a number of designated projects under the Environmental Impact Assessment Ordinance (EIAO) and that the Environmental Protection Department (EPD) has previously issued two Environmental Impact Assessment (EIA) Study Briefs relating to the proposed development as follows;
- EIA Study Brief ESB-194/2008, “Container Terminal 10 Development at Southwest Tsing Yi”, issued on 19 August 2008; and
 - EIA Study Brief ESB-214/2010, “Decommissioning, Reprovisioning, Construction and Operation of Affected Oil Depots at Southwest Tsing Yi”, issued on 23 June 2010.
- 2.7.3 In the event that the project progresses beyond this preliminary feasibility stage, a detailed EIA Study would need to be carried out under EIAO. The EIA shall be conducted to meet the requirements of the applicable EIA Study Briefs and the Technical Memorandum under the EIAO.
- 2.7.4 A summary of the key environmental outcomes arising from the EA Study are presented in this section of the executive summary.

Water Quality

- 2.7.5 The key issue from the construction activities associated with the CT10 Development and reprovisioning of affected oil depots would be the potential water quality impact due to the release of sediment-laden water during dredging and filling activities, construction site runoff, and discharge of construction site effluent. With the implementation of mitigation measures such as the installation of silt curtain, use of closed grab dredgers and tight control on dredging rate, the water quality impact due to the CT10 construction among three CT10 Development Options at the SWTY site and associated potential sites for reprovisioning of affected oil depots are likely to be acceptable.

- 2.7.6 The proposed reclamation off the southwest coast of Tsing Yi would alter tidal flows in the vicinity of the existing Harbour Area Treatment Scheme (HATS) outfall including diverting a greater proportion of flow through the Rambler Channel (refer **Figure 2.7.1**). One side effect of these changes is an increase in the size of the “mixing zone” required for dispersion of the treated effluent within the Western Harbour. However, these effects on water quality are localised in the vicinity of the Western Harbour, and not considered likely to affect the overall water quality in Hong Kong.
- 2.7.7 In addition, the diversion of additional flow through Rambler Channel carries with it greater amounts of pollutants from the HATS outfall and results in a minor deterioration of water quality at the recently reopened Tsuen Wan beaches, including marginal exceedance of the Water Quality Objectives at Approach Beach. However, this exceedance is not observed for Option 6 which has a relatively smaller reclamation area and reduced southward projection when compared to Option 3B and Option 5. The size and projection of the proposed CT10 reclamation will need to be critically examined as part of future design / study stage to minimise impacts on tidal flows and water quality in Western Harbour and surrounding areas.

Figure 2.7.1 – Potential Water Quality Impacts



Ecology

- 2.7.8 Land-based construction activities, reclamation, dredging and other marine works would be required for the CT10 Development and reprovisioning of oil depots. Terrestrial, subtidal habitats, intertidal and marine waters habitats of low to high ecological values, and associated wildlife (e.g. terrestrial flora and fauna, corals, Chinese White Dolphin and Finless Porpoise) would be affected by the proposed works, both permanently and temporarily. There would be direct loss and indirect impacts (e.g. physical disturbance from noise, dust, water and light pollution, and increased human activities) on terrestrial habitats and associated wildlife from land-based works. There would also be direct loss and indirect impacts on intertidal, subtidal, marine waters, Chinese White Dolphin and Finless Porpoise habitats and associated fauna from marine works.
- 2.7.9 The potential ecological impacts at the SWTY site are relatively small. The ecological value of this reclaimed land is low. Although subtidal and marine waters habitats of relatively large scale would be affected, the ecological values of the habitats are low.
- 2.7.10 Similarly, the potential ecological impacts at TKO Area 137 associated with offsite reprovisioning of affected oil depots under Option 3B and Option 6 are relatively small as the site has already been reclaimed. Both the reclaimed land and the marine habitats are of low ecological values. Although shrubland of moderate ecological value is located adjacent to the proposed land-based works, no direct encroachment into the Clear Water Bay Country Park is anticipated. Nevertheless, consent of the Country and Marine Parks Authority is required for implementation of any works encroached into the country parks area such as associated works in the perimeter of TKO Area 137, if any. Both SWTY and TKO Area 137 are not important habitats of marine mammals. With the implementation of mitigation measures (e.g. adoption of standard good site practices), no unacceptable ecological impacts would be expected.
- 2.7.11 At the West Lamma site, the potential impacts are expected to be low to moderate for both Option 3B and Option 6 due to the indirect impacts on Romer's Tree Frog and White-bellied Sea Eagle, and the direct and indirect impacts to Finless Porpoise. Although the South Lamma Island SSSI, Conservation Area and CPA are located nearby, no unacceptable ecological impacts would be expected with the implementation of proper mitigation measures (e.g. scheduled works outside breeding seasons of White-bellied Sea Eagle and Romer's Tree Frog, avoid direct loss of flora species of conservation interest).

- 2.7.12 In South Soko, moderate to high (Option 3B) and low to moderate (Option 6) ecological impacts would be expected due to the loss of secondary woodland, shrubland and plantation habitats from land-based works and the temporary disturbance to high-valued Finless Porpoise habitats in south coast of South Soko from the proposed marine works. Even with the implementation of the identified mitigation measures (e.g. compensatory tree and shrub planting, specific measures for marine mammals) adverse residual impacts are expected in South Soko due to the loss of secondary woodland, shrubland and plantation habitats by the substantial site formation and slope cutting works.

Fisheries

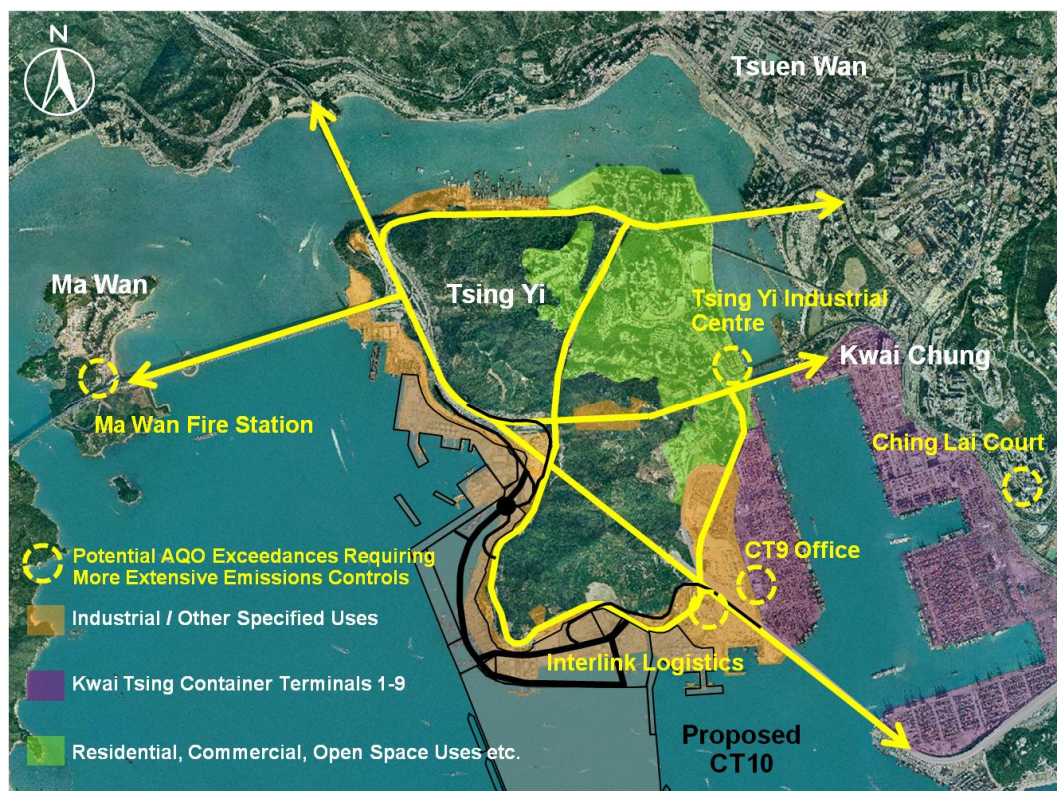
- 2.7.13 There are no areas containing important fisheries resources around the vicinity of the Project site at SWTY. Fishing production values are low in terms of weight and value with only a small number of fishing vessels utilizing this area. Marine construction areas at the TKO Area 137 are of moderate to high fisheries production values in terms of weight and value. There are no nursery areas or spawning grounds located near the TKO and SWTY proposed site.
- 2.7.14 The West Lamma and South Soko sites are located within areas of high fisheries production value both in terms of weight and value. The West Lamma and South Soko sites are also located near to nursery areas and spawning grounds for commercially important fish species.
- 2.7.15 Direct impacts arising from the proposed marine works include temporary and permanent loss of fishing grounds at SWTY and for Option 6 and Option 3B, the selected site for reprovisioning of affected oil depots. However, given the relatively low value of fisheries production at SWTY and the relatively small loss areas at the potential sites for oil depot reprovisioning (for Option 6 and Option 3B), it is estimated that the annual loss fisheries production due to the proposed marine works of any options would be less than 1%.
- 2.7.16 Changes in water quality during marine works construction may cause indirect impact to fisheries resources. Mitigation measures, such as application of slit curtains, careful phasing of dredging works and controlled dredging rate would be applied in order to control the suspended solid levels during the construction phase. In addition, proper design and operational practice of the oil depots, and emergency response plan would be carried out in case of accidental oil spillage. Monitoring of water quality parameters at the Fish Culture Zones would be recommended during construction.

- 2.7.17 All three options require reclamation for the CT10 Development, leading to direct loss of fishing grounds. However, the reclamation site at SWTY only supports low fisheries production. For Option 3B and Option 6, external reprovisioning of oil depots is required. This would induce adverse fisheries impacts on potential reprovisioning sites.

Air Quality

- 2.7.18 Air quality issues have been identified in the Kwai Tsing area due to regional air pollution sources, existing local emissions from highways, industrial uses and port operations, and the proposed CT10. Some potential exceedences of the Air Quality Objectives (AQO) have been predicted in the Kwai Tsing and Ma Wan areas, in particular around CT 1 to 9 under the unmitigated scenario (refer **Figure 2.7.2**).
- 2.7.19 It is predicted that reducing the air emissions from CT10 alone would not be adequate to resolve the air quality problem, in particular in the vicinity of the existing CT1 to 9. Mitigation measures, including the employment of electrified land-based off-road cargo handling equipment, can be adopted to alleviate the potential air quality impacts associated with both the proposed CT10 and existing port operations.

Figure 2.7.2 Potential Air Quality Impacts



- 2.7.20 The new AQO which is expected to be implemented in 2014 will amount to new air quality standard much lower than the prevailing AQO in Hong Kong. When the government announces the new AQO, it is packaged with a set of future pollution control measures. Without all the newly proposed measures, the current PATH model (refer “Pollutants in the Atmosphere and their Transport over Hong Kong”) results presented in air quality chapter of EA do show exceedance of the new AQO criteria at most of the Air Sensitive Receivers. To test compliance with the new AQO, it is necessary to revise the PATH emission inventory to reflect the future reduction of emission resulted from the newly proposed pollution control measures by the government. Only with these measures, CT10 project is able to meet the new AQO. In other words, a complete rerun of the PATH model will be required for compliance checking of the new AQO under future EIA Study in the event that the CT10 project advances beyond preliminary feasibility stage.

Noise Impacts

- 2.7.21 Dominant noise sources surrounding the SWTY site include traffic on Tsing Yi Road, Tsing Sha Highway, Stonecutters Bridge and the existing oil depots, dockyards and port facilities.
- 2.7.22 The use of powered mechanical equipment during the construction phase of the Project is expected to create construction noise nuisance given the extent of the development, in particular the demolition works, site formation (including reclamation), road upgrading works. Mitigation measures including implementation of good site practices, use of noise barriers / acoustic enclosures, use of low noise construction plants and equipment and scheduling of works to avoid sensitive periods are available to reduce the construction noise impacts to EPD’s recommended daytime noise levels. On this basis, no issues associated with construction noise impacts are expected for any of the CT10 Development Options or oil depot reprovisioning sites.
- 2.7.23 Noise impacts from the CT10 operation activities, namely those from truck movement, hauling, stacking etc. can be effectively mitigated by implementing noise control treatment at source such as using quiet plant and equipment. It is anticipated that the marine traffic noise arising from the operation of the CT10 project will not pose an adverse impact on the nearby Noise Sensitive Receivers within the SWTY or any of the oil depot reprovisioning sites.

- 2.7.24 The existing roads in southeastern Tsing Yi are already subject to relatively high levels of container related traffic and preliminary assessment estimates that the future overall noise levels (including CT10 induced traffic) on some existing roads in southeastern Tsing Yi would exceed the relevant noise criteria (refer **Figure 2.7.3**). Roadside noise mitigation measures would need to be reviewed to identify measures to relieve the potential traffic noise issues on these roads. Such measures might include either localised re-surfacing of sections of the existing road or construction of roadside noise barriers.

Figure 2.7.3 Potential Road Traffic Noise Impacts on Existing Roads



Waste Management and Land Contamination

- 2.7.25 The proposed CT10 Development at SWTY will require substantial volumes of fill material and will result in the generation of a substantial volume of dredged sediments including contaminated sediments requiring special handling and disposal. The comparatively smaller reclamation area required for Option 6 means that it offers some reduction in fill material requirements and generation of dredged sediments when compared with Option 5 and Option 3B.
- 2.7.26 The project will generate between 30-40Mm³ (bulk volume) of dredged sediments (depending on which option is selected) of which around 20% would be contaminated and would require special treatment and disposal.

- 2.7.27 At present non-dredged reclamation methods have been proposed, however, further study would be required to confirm feasibility of non-dredged seawall construction methods in this application which result in savings of 10-15Mm³. In any case, there would still be around 20Mm³ of dredged sediment generated by the realignment of the existing navigation channels.
- 2.7.28 Volumes of this magnitude cannot be accommodated at the existing or planned disposal sites within Hong Kong and future planning would be required to identify suitable disposal sites, possibly including consideration of cross boundary disposal.
- 2.7.29 All three CT10 Development Options would involve decommissioning of existing oil depots, dockyards and industrial facilities at the SWTY site. The range of site area potentially requiring soil/groundwater remediation for the three CT10 Development Options is substantial with Option 3B offering some advantage over Option 5 and Option 6 primarily through retention of the existing Shell and Sinopec oil depots.

Cultural Heritage

- 2.7.30 No cultural heritage or built heritage resources are identified at or in the vicinity of the SWTY site, and accordingly, potential cultural heritage impacts on landside construction and operation of the CT10 Development are not expected at the SWTY site for any of the three CT10 Development Options (Option 3B, Option 5 and Option 6).
- 2.7.31 The proposed offsite reprovisioning of affected oil depots under Option 3B and Option 6 introduces potential cultural heritage impacts at the TKO Area 137, South Soko and West Lamma sites. The proposed oil depot reprovisioning at TKO Area 137 would be built on formed land. Hence, there would be no concern on terrestrial archaeology and built heritage for both Option 6 and Option 3B. However, two shipwrecks of uncertain origin recorded near TKO Area 137 have indicated uncertain origins, which require Marine Archaeological Investigation (MAI) during the EIA stage.
- 2.7.32 Potential impacts on a number of cultural heritage resources have been identified, including Tai A Chau Site of Archaeological Interest, existing Tin Hau Temple and shrines at South Soko and impacts on possible shipwrecks and sites of archaeological interest at West Lamma. In all cases, further site investigation and rescue excavation and/or relocation would be required prior to construction works.

- 2.7.33 Potential cultural heritage issues have been identified for the waters around SWTY as well as the TKO Area 137, South Soko Island and West Lamma sites. As these sites have not been fully subject to previous MAIs and EIAs, further investigations in the EIA stage including MAI are recommended to confirm their heritage value and assess potential impacts on cultural heritage identified.

Landscape and Visual Impact

- 2.7.34 The CT10 Development is generally compatible with the prevailing land uses and landscape character at the SWTY site and it is considered that landscape and visual impacts associated with the development could be mitigated to acceptable levels. Potential mitigation measures include reinstatement/compensatory tree and shrub planting, tree planting screens, reduction of excessive height and bulk of structures, sensitive architectural and chromatic treatment, green roofs and vertical greening and aesthetic improvement planting of viaduct structures. The combined landscape and visual impacts at Tsing Yi would be similar for the three options
- 2.7.35 In addition, both Option 3B and Option 6 would require offsite reprovisioning of affected oil depots and would induce additional landscape visual impacts at the selected reprovisioning site.
- 2.7.36 Of the potential sites for reprovisioning of affected oil depots, the TKO Area 137 site would create the least landscape and visual impacts. This is because it does not require reclamation and occupies land specifically zoned for industrial use, thus minimizing landscape impacts. Visually Sensitive Receivers already view the site in a state of transition and in the context of neighbouring industrial uses. The proposed development at TKO Area 137 is therefore compatible with the existing landscape character and planning intent.
- 2.7.37 The potential site at West Lamma would create the highest landscape and visual impact because it is essentially “greenfield” development, with the required reclamation affecting a sensitive undeveloped area zoned for conservation. It is incompatible with the existing landscape character and the planning intent. The proposed development at the South Soko site is also incompatible with the existing landscape character and planning intent. However, there are certain elements that reduce the level of landscape and visual impact when compared with West Lamma, namely that it would require a much smaller amount of reclamation, could utilise an abandoned site and would be partially screened by its own topography and that of other islands (the North Sokos). For these reasons, it is ranked as intermediate in terms of overall landscape and visual impacts between the TKO Area 137 and West Lamma site options.

Glare

- 2.7.38 Outdoor area lighting will be required for operational and security purposes for 24 hour operation of the container terminal facilities at the SWTY site. The potential glare impacts generated by the CT10 Development are expected to be similar to the glare impacts dealt with at the existing Kwai Tsing CT1-9 terminals. These impacts could be mitigated to acceptable levels through detailed lighting design with particular attention to the number, orientation and aiming points of the luminaries and the provision of cut-off louvers or hoods to limit the angle of light emitted for selected light towers.

Hazards

- 2.7.39 Based on the results of the Hazard Assessment carried out as part of this PFS, the land-based and marine-based activities for the CT10 Development can comply with the relevant risk criteria. In some cases, risk reduction measures will be required to comply with these requirements. Such measures may include the relocation of certain facilities, provision of automated isolation valves and couplings, use of advanced modelling software during detailed design and provision of mechanical protection to pipelines.
- 2.7.40 In addition, risk issues associated with development in the vicinity of existing oil depots can be reduced by assigning land uses with relatively lower working population densities such as empty container storage and repair areas and lorry parking in the immediate vicinity of the depots. Unpopulated buffer areas can be assigned in areas subject to relatively higher prevailing risk levels.
- 2.7.41 In particular, it is recommended that the predicted population increase for the construction phase be reduced (e.g. through staging of construction activities, etc.) so as to be comparable to the predicted population increase for the operational phase. If this option is carried forward to the detailed design stage, then the measures proposed to manage the population increase during the construction phase should be evaluated in detail in future Quantitative Risk Assessment (QRA) to confirm compliance with the requirements of the relevant risk criteria.
- 2.7.42 If the project advances beyond the preliminary feasibility stage, a detailed QRA should be carried out as part of any future EIA study to confirm the acceptability of risk levels associated with the selected CT10 Development Option and associated oil depot reprovisioning scheme. The risk reduction measures proposed at the PFS stage should also be re-evaluated in the QRA for the detailed design phase to confirm continued compliance with the requirements of the relevant risk criteria and requirements from relevant departments to minimise the potential risk of hazardous installations. Any additional or alternative risk reduction measures should be included in the final design as required.

2.8 Land Requirements

- 2.8.1 A number of existing facilities at the SWTY site, including oil depots, dockyards, industrial and container related facilities would be affected by the CT10 Development and would require acquisition, clearance and reprovisioning, in order to acquire the necessary land for the development.
- 2.8.2 The estimated land acquisition costs are substantial for all options, though reduced for Option 3B (HKD16,086.1M to HKD16,195.4M) when compared to Option 5 (HKD20,365.8M) and Option 6 (HKD20,375.6M to HKD20,434.8M) primarily through retention of the existing Shell and Sinopec Oil Depots unchanged at SWTY. The lead-time associated with the acquisition of the affected lands has been estimated at 3 years for Option 5 and Option 6 and 2 years for Option 3B.

2.9 Cost Estimates

- 2.9.1 A summary of the overall project cost estimates at May 2011 price level is summarised in **Table 2.9.1**.
- 2.9.2 Option 3B offers some advantage over Option 5 and Option 6 mainly through reduced land acquisition costs at SWTY. It is noted that the costs associated with land acquisition and reprovisioning of the affected oil depots and dockyards represent around 40-50% of the total estimated costs.

Table 2.9.1 Overall Project Cost Estimate for CT10 Development

Item	Description	Option 3B			Option 5	Option 6		
		TKO	Soko	Lamma		TKO	Soko	Lamma
Overall Project Cost Estimate (HK\$Bn)								
A	Construction Works (Base Estimate) ⁽¹⁾	33.90	34.51	35.04	32.27	32.95	33.28	33.60
B	Contingencies ⁽¹⁾	5.76	5.87	5.96	5.49	5.60	5.66	5.71
C	Further Study, Detailed Design & Related Services ⁽¹⁾	2.89	2.94	2.98	2.75	2.81	2.83	2.86
⁽¹⁾ Subtotal (May 2011 Price Level):		42.54	43.31	43.98	40.50	41.36	41.77	42.17
Estimated Land Acquisition Costs:		16.10	16.20	16.09	20.37	20.39	20.43	20.38
⁽¹⁾ Total (May 2011 Price Level) (HK\$Bn):		58.64	59.51	60.07	60.86	61.75	62.20	62.54

Note:

- (1) Includes both private operators and Government expenditures

2.10 Implementation Strategy and Programmes

2.10.1 Overall implementation programmes for the three development options and associated oil depots reprovisioning proposals have been prepared. These programmes are preliminary in nature with an intention to reflect the likely lead time required for the first berth commissioning and completion of the CT10 Development, taking account of the key activities to be involved, including but not limited to, public consultation, detailed feasibility study, EIAO and other relevant statutory procedures, negotiation with existing users affected by the development, detailed design and construction of the CT10 Development and the reprovisioning works.

2.10.2 Whilst the duration of various activities varies between the options, the sequence and critical activities are generally common and include the following:

Planning and Design Stage

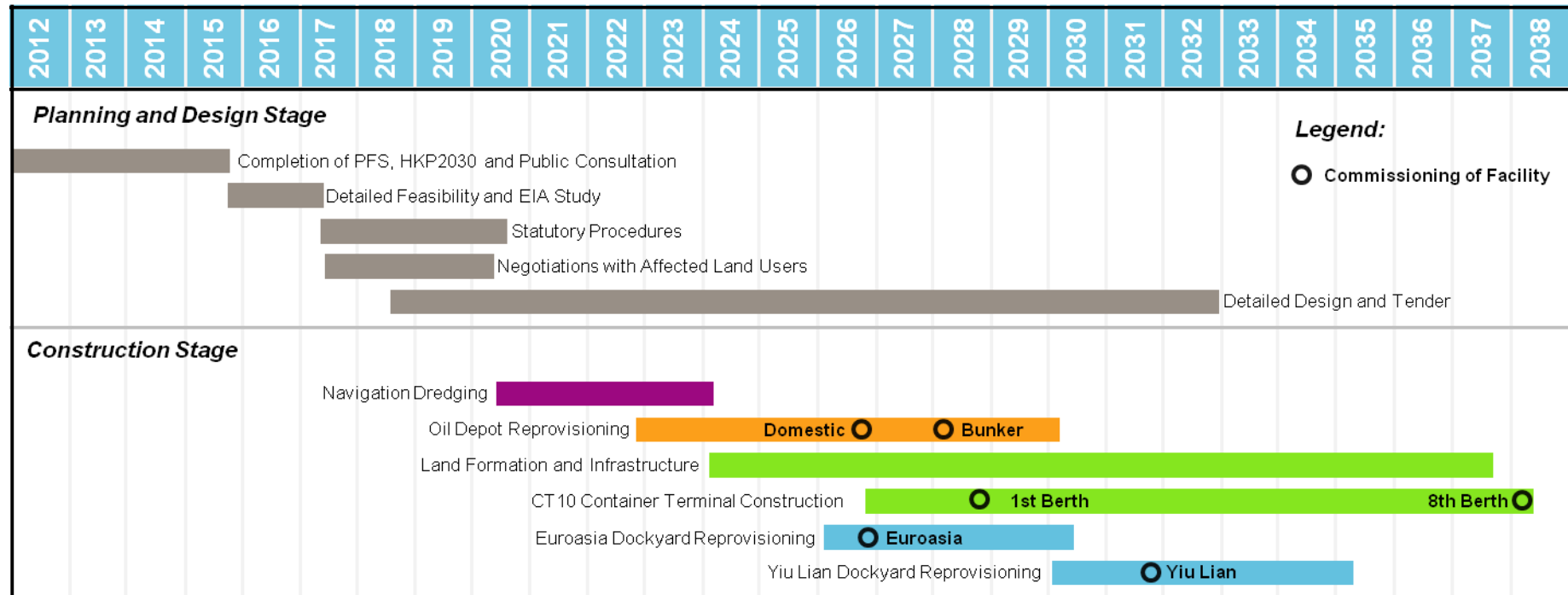
- Completion of the Study on the Strategic Development Plan for Hong Kong Port 2030 and Public consultation;
- Detailed feasibility study (including EIA);
- Negotiations with affected land users;
- Completion of statutory procedure pertaining to TPO and Foreshore and Seabed (Reclamation) Ordinance and authorization of the works; and
- Detailed design, tendering and contract award for navigation dredging in Western Harbour.

Construction Stage

- Navigation Dredging in Western Harbour for Fairway Realignment and Anchorage Reprovisioning;
- Land Formation and Infrastructure at SWTY; and
- Container Terminal 10.

2.10.3 A simplified bar-chart programme illustrating the overall sequence of works for Option 5 is shown below in **Figure 2.10.1**.

Figure 2.10.1 Simplified Programme (Option 5)



Note: All estimated key commissioning dates are updated assuming commencement of detailed feasibility study and EIA in 2015. This results in an increase of 2.5 years from the dates presented in PFS Stage 2 Study on Implementation Strategy and Programmes and Final Report.

- 2.10.4 As noted above, whilst the overall sequence of activities is similar amongst the options, the activity durations vary. The estimated completion dates of the construction works for the CT10 Development at SWTY and the oil depots reprovisioned at TKO Area 137, South Soko Island or West Lamma Island for Option 3B, Option 5 and Option 6 are summarised in **Table 2.10.1** below.

Table 2.10.1 Key Commissioning Dates for CT10 Development Options

Container Terminal & Reprovisioned Facilities	Commissioning Dates						
	Option 3B			Option 5	Option 6		
	TKO Area 137	South Soko	West Lamma		TKO Area 137	South Soko	West Lamma
Reprovisioned Chevron and ExxonMobil Oil Depots	2024	2025	2025				
Transshipment Centre	2028	2030	2030				
Consolidated Domestic Fuels Depot				2026	2026	2026	2026
Consolidated Bunker Fuels Depot				2028	2025	2026	2026
Container Terminal							
1 st Berth	2030	2031	2031	2028	2029	2029	2029
8 th Berth	2038	2040	2040	2038	2036	2036	2036
Reprovisioned Euroasia Dockyard	2026	2028	2028	2026	2026	2026	2026
Reprovisioned Yiu Lian Dockyard	2032	2033	2033	2031	2031	2031	2031

Note: All estimated key commissioning dates are updated assuming commencement of detailed feasibility study and EIA in 2015. This results in an increase of 2.5 years from the dates presented in PFS Stage 2 Study on Implementation Strategy and Programmes and Final Report.

- 2.10.5 Assuming that detailed feasibility and EIA studies commence in 2015, the estimated date for commissioning of the first container terminal berth would be 13-16 years later – in 2028 to 2031.
- 2.10.6 On the same basis, the estimated date for commissioning of the eighth and final container terminal berth would be 2036 to 2040.
- 2.10.7 Option 5 offers a marginal advantage in terms of the time required for first berth commissioning whilst Option 6 offers marginal advantage in the time for overall completion, mainly through the reduced amount of reclamation required at the SWTY site.

3 ALTERNATIVE CT10 CONFIGURATIONS AND ASSESSMENTS

3.1 Introduction

3.1.1 In late September 2012, CEDD instructed AECOM to carry out additional services entitled “Additional Services (AS) No. CE34/2008-01 – Alternative Container Terminal 10 (CT10) Configurations and Assessments”.

3.1.2 The objective of these Additional Services is to carry out marine planning, broad technical assessment and detailed MTIA for an alternative CT10 configuration with a view to reducing the fundamental marine traffic and safety impacts identified for the eight-berth terminal studied under the PFS as outlined in **Section 2.6** of this executive summary.

3.2 Marine Planning of Alternative CT10 Configurations

Option Identification and Assessment

3.2.1 The specified marine planning requirements for the Alternative CT10 Configurations included the following:

- The total number of CT10 berths shall be not less than 4;
- No container terminal berths shall be located on the west or south faces of the CT10 reclamation – all container berths shall be located on an inner eastern basin with a view to reducing marine impacts on Ma Wan and Northern Fairways, including the approach to the existing KTCT;
- The sharp corner at southwestern corner of the CT10 reclamation shall be avoided to increase the viewing angle for marine traffic approaching the Ma Wan Fairway;
- Examination of the inshore traffic waterway along the Ma Wan Fairway to allow more space for safe manoeuvring and movement of local and rivertrade and other small vessels; and
- The arrangement for reprovisioning of the affected oil depots and dockyards and the layout of port backup area, road access and connectivity for the alternative configuration shall be consistent with that proposed for the Option 5 developed under PFS Stage 2 (refer **Section 2.1** of this executive summary).

3.2.2 Based on the identified key marine planning issues and the specified marine planning requirements, additional marine planning criteria were derived for the identification and development of alternative CT10 configurations as follows:

- Limiting the location and orientation of the CT berths to minimise marine traffic impacts arising from the marine activities in the Ma Wan and Northern Fairways and the approach to/from KTCT. This requires consideration of east facing berths or berths set within a basin; and
- Limiting the development within the envelope of the Option 5 layout developed under PFS Stage 2 as follows:
 - Limiting the southward projection of the reclamation to less than or equal to the southward projection of the PFS Stage 2 Option 5 layout, to minimise the identified marine traffic bunching at the southwestern corner and associated impacts on marine traffic safety;
 - Limiting westward alignment of CT10 reclamation to less than or equal to the westward projection of the PFS Stage 2 Option 5 layout, in order to maintain buffer area adjacent to the existing Ma Wan Fairway as per the requirements of the brief; and
 - Limiting the eastward extent of reclamation to that of less than or equal to the eastward projection of the PFS Stage 2 Option 5 layout to remain clear of the Victoria Harbour Limit.

3.2.3 Subject to the marine planning requirements and additional marine planning criteria summarised above, a variety of terminal layout options were identified for Alternative CT10 Configurations with a view to minimizing or avoiding the key marine planning and marine traffic safety issues identified for the eight berth CT10 Development Options studied in PFS Stage 2.

3.2.4 The identified options were reviewed and subjected to preliminary marine traffic impact assessment in order to provide a basis for the comparison of the options and selection of the preferred option for further development. The review of the options incorporated the outcomes of marine planning workshop held to obtain the views of the key government departments / bureaux including, CEDD, Transport and Housing Bureau (THB) and Marine Department (MD).

Option Development

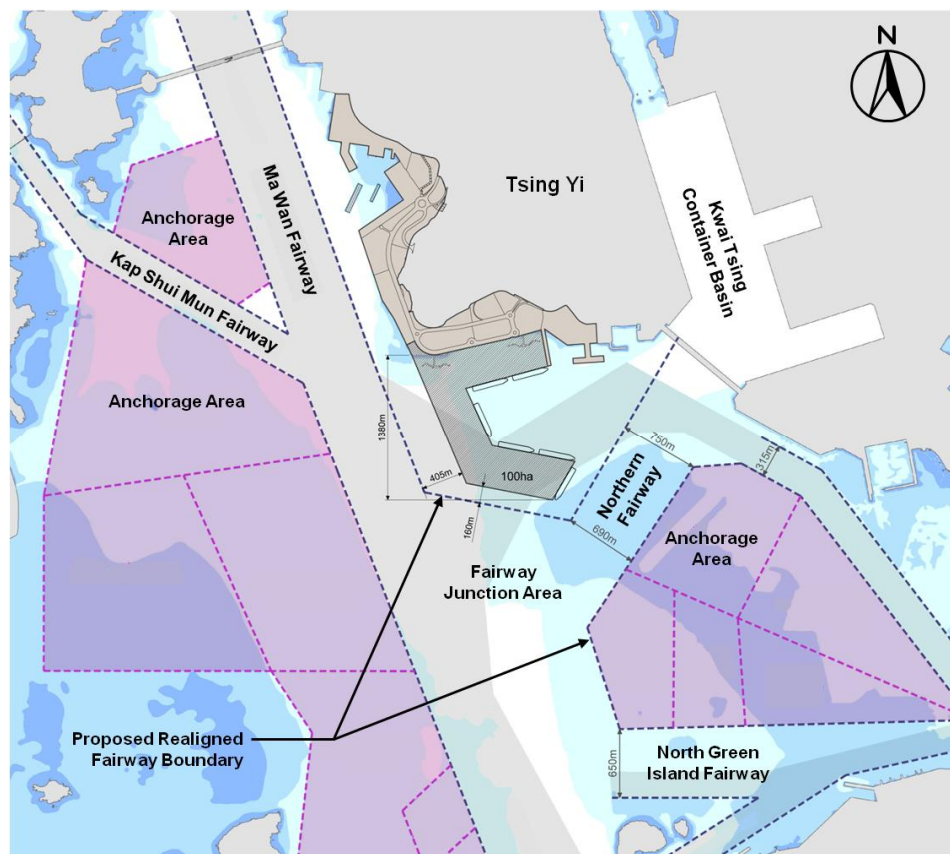
- 3.2.5 The preferred option for the Alternative CT10 Configuration was then further developed including the definition of the preliminary arrangement for the reprovisioned facilities, port backup areas and road access and connectivity as well as the further refinement and optimization of the CT10 berth and reclamation layout based on the outcomes of the marine planning workshop and subsequent inputs from government.
- 3.2.6 The reduction in the number of container terminal berths results in a reduced requirement for container terminal and port backup area. This in turn provides opportunities for optimization of the backup area and road layout with a view to reducing the total size and, in particular, the western and southern projections of the reclamation in order to address the identified marine safety issues.
- 3.2.7 The main constraint on the northern edge of container terminal area, and accordingly the southern edge of the reclamation is providing adequate land area for the requisite port backup areas and port roads. The alignment of the roads and dimensions of the adjoining port backup areas have been optimised as far as practicable at this preliminary stage and the northern edge of the container terminal area adjusted northwards accordingly. Similarly, the alignment of the proposed new roads servicing the CT10 Development has been reviewed and revised to more closely follow the existing SWTY coastline and the western projection of the reclamation has been reduced accordingly.
- 3.2.8 Ultimately, the Option A5 configuration comprising a 100ha container terminal with 50ha port backup area was considered to offer the best balance between the provision of appropriately sized new CT facilities and the minimization of the associated negative marine traffic impacts.
- 3.2.9 On this basis, an eastern facing, modified six berth Option A5 configuration with no ocean going vessel berthing along the western and southern faces has been taken forward as the Alternative CT10 Configuration for detailed MTIA and broad technical assessment under these Additional Services.
- 3.2.10 The Alternative CT10 Configuration container terminal features five 400m length berths arranged around an eastern facing quay with dedicated waterspace for CT10 manoeuvring provided outside the adjoining fairway areas. In addition, consideration was given to the potential provision of an additional 400m length berth on the outer southeastern face of the container terminal. Similar to the PFS Stage 2 Option 5 layout, the Alternative CT10 Configuration also involves consolidation of the five existing oil depots at SWTY into two consolidated depots.

3.2.11 An optimised marine planning scheme was developed to take advantage of the reduction in southward projection of the Alternative CT10 Configuration and to further mitigate the identified marine traffic impacts. The main features of the scheme are summarised as follows:

- The existing Ma Wan Fairway alignment is maintained and additional nearshore waterspace provided off the western face of the CT10 reclamation;
- The realigned Northern Fairway is further widened to provide additional manoeuvring waterspace for vessels to/from KTCT;
- The fairway junction area to south of the CT10 reclamation is shifted southward and the reprovisioned waterspace enlarged; and
- The scheme includes provision of a widened North Green Island Fairway for re-routing of fast ferries and local and rivertrade vessels. This separation may assist in the dilution of a major convergence zone across a wider waterspace.

3.2.12 The Alternative CT10 Configuration and the associated optimised marine planning scheme are shown below in **Figure 3.2.1**.

Figure 3.2.1 Marine Planning Arrangement – Alternative CT10 Configuration



3.3 Broad Technical Assessment

- 3.3.1 Broad technical assessment of land use planning issues, road traffic impacts, engineering issues, environmental impacts and risk associated with the Alternative CT10 Configuration has been carried out with reference to the PFS Stage 2 CT10 layouts and study findings.

Land Use Planning

- 3.3.2 Land use planning and compatibility issues are broadly similar to those identified for the PFS Stage 2 option layouts. In terms of land use compatibility, the CT10 Development is broadly consistent with the existing industrial and container related uses in the southern and western areas of Tsing Yi.
- 3.3.3 The Alternative CT10 Configuration will require reclamation and the extension of the approved planning scheme area of the Approved Tsing Yi OZP No. S/TY/24. Amendments to the OZP under TPO and compliance with other relevant statutory procedures would be required.

Road Connectivity and Traffic Impact

- 3.3.4 Broad assessment of road connectivity and traffic impacts associated with the Alternative CT10 Configuration has been carried out with reference to the previous PFS Stage 2 TIA study findings.
- 3.3.5 The reduction in container terminal area, number of berths and associated port backup area for the Alternative CT10 Configuration results in a reduction in overall trip ends (traffic generation and attraction) of around 25% for the container terminal facility and around 37% for the associated port backup area when compared to the PFS Stage 2 option layouts.
- 3.3.6 As a result, all of the key road links assessed as part of these additional services would have better performance than that of the PFS Stage 2 option layouts. In particular, traffic would be significantly reduced on the portion of the existing Tsing Yi Road running from the SWTY site to the existing CT9 roundabout in southeast Tsing Yi. However, potential long-term future capacity issues are still identified for the two critical strategic links, i.e. Ting Kau Bridge and Tsing Ma Bridge.

- 3.3.7 As noted previously, the potential long-term future capacity issues identified for both the Ting Kau Bridge and Tsing Ma Bridge are a strategic issue caused by the natural growth of existing traffic, together with the additional traffic generated by numerous planned future developments and infrastructure in the NTW and Lantau areas. Further district/strategic planning studies are required to resolve these long-term future potential capacity issues, which may include the consideration of new infrastructure schemes such as TYLL and the previously planned Tsing Lung Bridge.

Engineering Assessment

- 3.3.8 Broad assessment of land formation and engineering issues associated with the Alternative CT10 Configuration has been carried out along with assessment of likely changes to the overall project cost estimates and implementation schedules for the PFS Stage 2 option layouts.
- 3.3.9 The reduction in CT10 container terminal area for the Alternative CT10 Configuration results in a corresponding reduction in reclamation area and fill material requirements. However, the formation of the CT10 basin results in an increase in overall seawall length and associated dredging requirements as well as an increase in navigation dredging volumes when compared to the PFS Stage 2 option layouts.
- 3.3.10 Overall project costs for the Alternative CT10 Configuration are potentially reduced by 7-13% compared to the PFS Stage 2 option layouts, mainly through reduced costs for reclamation fill and associated ground treatment works at SWTY (but noting increased seawall construction and dredging requirements as identified above).
- 3.3.11 The commissioning date of the sixth and final berth for the Alternative CT10 Configuration is estimated to be in 2035, which is 3 years earlier than the estimated commissioning date of the eighth and final berth for the PFS Stage 2 Option 5 layout.

Environmental Assessment

- 3.3.12 Broad assessment of impacts on water quality, ecology, fisheries, air quality, noise, land contamination, waste management and landscape and visual amenity associated with the Alternative CT10 Configuration has been carried out with reference to the previous PFS Stage 2 EA study findings.
- 3.3.13 The reduction in container terminal and port backup area for the Alternative CT10 Configuration results in a reduction in the CT10 equipment and plant inventory, road traffic and marine traffic which in turn results in a reduction in CT10 associated air quality and noise impacts when compared to the PFS Stage 2 option layouts.
- 3.3.14 The reduction in reclamation area and associated reduction in construction stage impacts on water quality, marine ecology and fisheries is largely offset by the increase in dredge volumes resulting in net impacts similar to the PFS Stage 2 option layouts.
- 3.3.15 However, the Alternative CT10 Configuration will create an embayment within the proposed CT10 basin, which may affect the flow regime in the SWTY area and induce associated operational stage water quality impacts. Given the proximity of the embayment to the existing HATS treated effluent outfall, these impacts may include reduced pollutant dispersion ability and potential deterioration of local water quality. Potential mitigation measures may include provision of a means for maintaining tidal flushing of the CT10 basin embayment through the reclamation, by way of culverts, channels or other engineering solution. The likelihood of pollutants being entrapped in the large basin and the consequential adverse water quality impacts due to the embayment would need to be carefully and quantitatively assessed at the EIA stage, including the identification of effective mitigation measures.
- 3.3.16 The Alternative CT10 Configuration will result in a potential increase in the volume of dredged sediments requiring disposal when compared to the PFS Stage 2 option layouts. As identified under the PFS Stage 2 EA study, volumes of this magnitude cannot be accommodated at the existing or planned disposal sites within Hong Kong and future planning would be required to identify suitable disposal sites, possibly including consideration of cross boundary disposal.
- 3.3.17 Aside from the differences noted above, the overall development footprint and associated land formation works at the SWTY site are similar to those required for the PFS Stage 2 option layouts, meaning that impacts on terrestrial ecology, land contamination, cultural heritage and landscape and visual impact are unchanged.

- 3.3.18 In the event that the project progresses beyond this preliminary feasibility stage, a detailed EIA Study would need to be carried out under EIAO. The EIA shall be conducted to meet the requirements of the applicable EIA Study Briefs and the Technical Memorandum under the EIAO. The actual construction and operational impact and associated mitigation measures shall be further assessed under the EIA Stage if the Project proceeds further in the future.

Risk Assessment

- 3.3.19 Broad qualitative assessment of the potential implications of the Alternative CT10 Configuration on the risk levels assessed under the PFS Stage 2 HA study has been carried out.
- 3.3.20 As there is no significant change to either the proposed PHI facilities or the surrounding nearby populations, it is considered that there would be no significant change to the individual risk contours and societal risk curves generated for the Consolidated Domestic Fuel Depot and the Consolidated Bunker Fuels Depot under the PFS Stage 2 HA study.
- 3.3.21 If the project advances beyond the preliminary feasibility stage, a detailed QRA should be carried out as part of any future EIA study to confirm the acceptability of risk levels associated with the selected CT10 Development Option and associated oil depot reprovisioning scheme. The risk reduction measures proposed at the PFS stage should also be re-evaluated in the QRA for the detailed design phase to confirm continued compliance with the requirements of Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 12, and additional or alternative risk reduction measures should be included in the final design as required.

3.4 Marine Traffic Impact Assessment

- 3.4.1 Additional MTIA study has been carried out to assess marine traffic impacts and navigation safety issues associated with the Alternative CT10 Configuration and Marine Planning Scheme.

Hazard Assessment

- 3.4.2 Hazards associated with the Alternative CT10 Configuration are similar to those identified for the PFS Stage 2 option layouts and include the following issues:

- **Marine Traffic** - collision risk associated with:
 - (i) increased level of traffic in existing environment, and additional traffic arising from CT10 including the potential barging activities;
 - (ii) concentration of marine traffic at the junction SW corner of CT10 resulting from a reduction of waterspace around south-west of Tsing Yi together with significant OGV, RTV and local vessel traffic “bunching”; and
 - (iii) co-existence of oil depots and container terminal near the existing container terminal approaches.
- **Navigation** - constraints and challenges of Ultra Large Container Ship (ULCS) access, with particular respect to channel capacity, reduction in channel width (due to blockage by berthing operations), potential “knock-on” effect such as conflicting traffic issues/generation of blind sectors, mixed traffic threat and the metocean (wind, wave current) environment; and
- **Operational** - impact on the potential time delay to vessels navigation in the vicinity of the CT10, including other ULCS using the fairway.

Marine Traffic Risk Assessment

- 3.4.3 The marine traffic risk levels within the Study Area at SWTY have been assessed using the “DYMITRI” dynamic marine traffic model. A risk assessment of collisions has been conducted for scenarios considering the existing and future traffic levels - with and without the Alternative CT10 Configuration.
- 3.4.4 As identified under the PFS Stage 2 MTIA study, risk levels assessed within the Study Area and the western waters are expected to increase by 2031 as a result of forecast traffic growth, with or without CT10, with risk levels concentrated in the waters to the southwest of Tsing Yi.

- 3.4.5 In view of uncertainties in the prediction of future marine operating environment in future years, the forecast future marine risk level in 2031 is presented in terms of:
- **Upper Bound Level:** despite the historical trend of reducing incidents per arrival in the last 15 years, an un-factored risk level is identified as it would be prudent to take the worst case scenario rather than using optimistic projection when concerning port safety; and
 - **Lower Bound Level:** adopting a 40% safety improvement factor for the 2031 case accordingly for reference only, based on the future continuation of the steady improvement trend in marine safety pattern that has been broadly sustained over the last 15 years.
- 3.4.6 The resulting modelled increases in the background risk levels due to future marine traffic growth only (i.e. without CT10), are 88% and 13% for the Upper Bound and Lower Bound estimates respectively.
- 3.4.7 Whilst the southward projection of the Alternative CT10 Configuration is reduced compared with the PFS Stage 2 option layouts, the reclamation still results in an overall net reduction within the Western Harbour and associated “bunching” of OGV and RTV traffic within the waterspace to the southwest of the CT10 reclamation.
- 3.4.8 The introduction of the Alternative CT10 Configuration and associated revisions to fairway alignments and geometry alone has led to an increase of risk level at 22%. This can be interpreted as either (a) more significant than the estimated 13% Lower Bound increase in future marine risk levels due to background traffic growth alone (i.e. without CT10); or (b) relatively less significant when compared to the estimated 88% Upper Bound increase in future marine risk levels without CT10.
- 3.4.9 In either case, the resulting marine traffic safety impacts are reduced when compared to the PFS Stage 2 option layouts, mainly through the provision of increased waterspace at the fairway junction and the alternative routing of fast ferries through a wider Southern Fairway.
- 3.4.10 Comparative analysis has identified that the Alternative CT10 Configuration will bring upon a lesser degree of risk increase as compared to the PFS Stage 2 option layouts. At 2031 traffic level the model predicts the percentage of risk levels increase as (i) 22% for the Alternative CT10 Configuration and (ii) 48% for the PFS Stage 2 Option 5 layout.

- 3.4.11 Given future traffic growth (with or without CT10), the rate of incidents increases is unavoidable and there is a clear need to review management of vessel activities to reduce the focus around high-risk level “hot spots”.

Berthing and Manoeuvring Simulations

- 3.4.12 The Alternative CT10 Configuration has been incorporated into the 3D terrain at the full bridge simulator at the Hong Kong MD Training Centre and has been adopted for the conduct of navigation simulations, including representative passing traffic data, by the HKPA.

- 3.4.13 Navigation simulations were conducted for a total of 20 scenarios to confirm safety of navigation of the designed container vessel and tanker movements. The findings of the simulation scenarios are summarised as follows:

- **Approach** – CT10 approach movements involve vessel transit crossings across the Kwai Tsing approach and will impact existing vessel movements in/out KTCT: a typical approach is anticipated to obstruct the traffic to/from KTCT for approximately 30 - 45 minutes;
- **Berthing** – No particular concern has been identified for berthing manoeuvres inside the CT10 basin. For safe navigation (and to minimise time obstructing the KTCT access) it is preferred for the vessel approach to conduct turning and avoid slow manoeuvring movements at the edge of the KTCT approach waterspace;
- **Unberthing & Departure** – Unberthing manoeuvres tested have been considered “not easy” or “difficult” as the margin of safety for vessel clearance between adjacent berth is small, but not dangerous. It has been demonstrated from the navigation simulations that departure movements from berths aligned inside the CT10 basin are anticipated to obstruct the traffic to/from KTCT for up to 20 – 30 minutes under normal or worst case conditions;
- **Potential 6th CT10 Berth at SE Face (CT10#6)** – The approach simulation runs at CT10#6 were considered “straight-forward” and is anticipated to obstruct the traffic to/from KTCT for up to 30 minutes under normal and worst case conditions. It has been recommended by the Pilots to restrict berthing port side to only to avoid turning manoeuvres in the KTCT approach fairway. For departure case vessel it is required to proceed to the turning circle and make a starboard turn for unberthing.

It has been identified that mooring alongside CT10#6 is not preferred taken into account the need for secure mooring considering that there may be motions and loads induced in the mooring lines arising from the passage of vessels to/from KTCT and the risks of breaking of mooring lines that could lead to vessel drifting in busy waterways; and

- ***New Arrangement at Oil Depots*** – No particular concern has been identified at the Sinopec and Shell Oil Depots. However it has been demonstrated that the slow tanker manoeuvres particularly inside the CT10 basin are anticipated where the berthing of oil tanker at Sinopec Oil Depot is anticipated to create an obstruction for up to 30 – 40 minutes at the basin entrance.

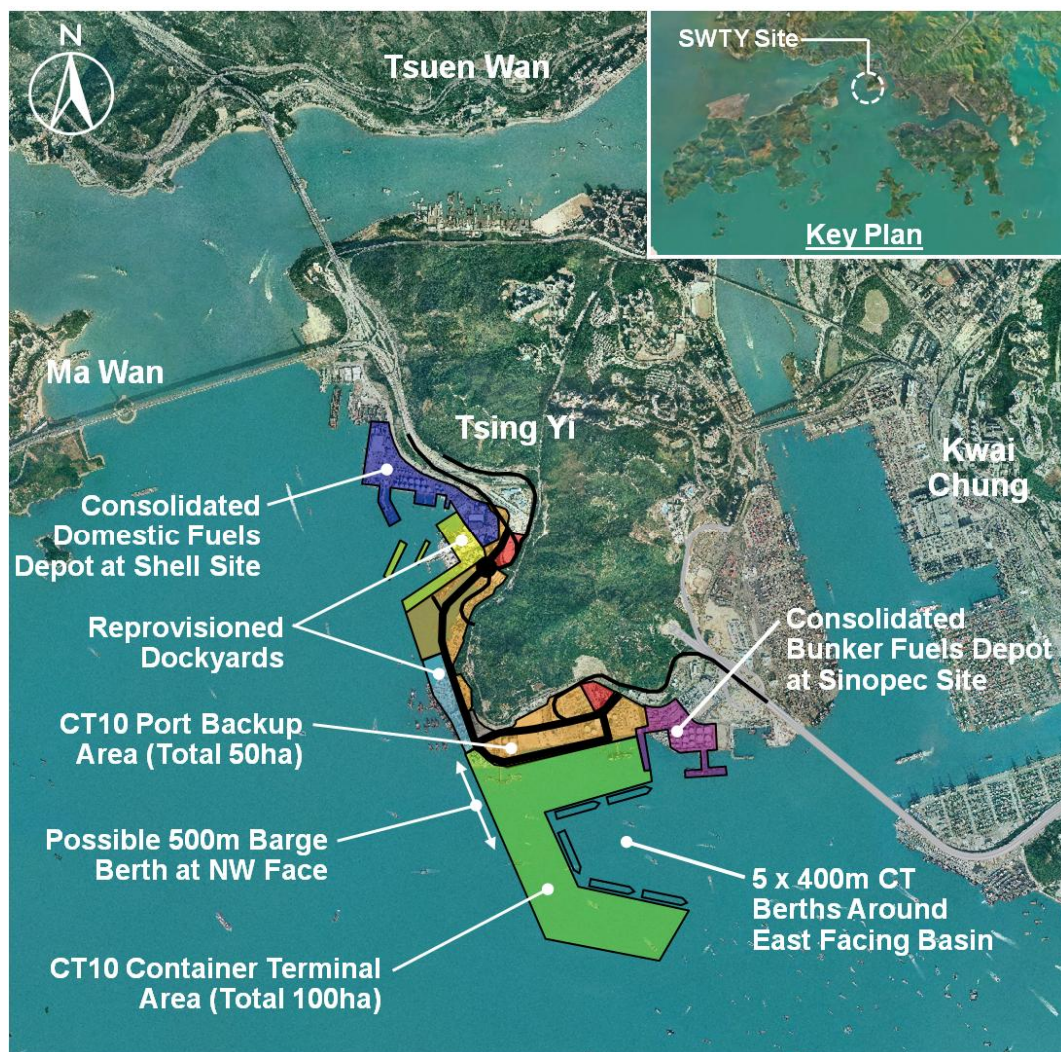
Operational Issues and Risk Control

- 3.4.14 A capacity assessment at the Port Approach (i.e. the approach to the existing Kwai Tsing Container Basin) has been conducted in order to assess potential time delay impacts.
- 3.4.15 Assessment of the capacity of the KTCT approach (the “port entrance area”) based on the predicted future traffic levels, including CT10 traffic, indicates that the port entrance would likely exceed its maximum operational limit at the design year based on a six berth CT10.
- 3.4.16 Total portal time calculation suggested capacity at port approach is feasible for a five berth CT10 based on existing practices among terminal operators, HKPA and tugs. It is envisaged vessel scheduling could be regularly conducted through full cooperation between Vessel Traffic Centre (VTC), port operators and pilots in future years and further improvement in port efficiency in order to meet future growth at the existing terminals with or without the development of CT10.
- 3.4.17 An overall increase in risk potential has been identified as a result of re-arrangement of the Western Harbour marine facilities including the CT10 Development. Given this, an overview on operational risk controls and port management measures have been presented that would assist in mitigating some of the local impacts brought about by the CT10 Development, and assist more generally in the efficient routing of vessels within Hong Kong waters.
- 3.4.18 The proposed re-planning scheme for the Alternative CT10 Configuration includes a widened Southern Fairway where fast ferries could be routed west prior to heading north. The realigned ferry route overall is likely to increase by <5 minutes, consultation with stakeholders should be undertaken regarding the change in route alignment and impacts on journey time. Future implementation of alternating ferry routes to/from China Mainland would require approval among the Transport Department and MD and consensus from ferry operators.

3.5 Recommended Alternative CT10 Configuration

- 3.5.1 Based on the findings of the MTIA study it is recommended that the Alternative CT10 Configuration is progressed based on provision of five OGV container terminal berths located around the proposed eastern facing basin, i.e. the Recommended Alternative CT10 Configuration.
- 3.5.2 A revised Conceptual Outline Development Plan and Preliminary Land Use Layout Plan for the Recommended Alternative CT10 Configuration have been prepared. The revised Conceptual Outline Development Plan for the Recommended Alternative CT10 Configuration is shown in **Figure 3.5.1**.

Figure 3.5.1 Conceptual Outline Development Plan – Recommended Alternative CT10 Configuration



- 3.5.3 The likely changes to cost estimates, implementation schedule and key commissioning dates have been updated to include the further likely changes associated with the reduction from the six-berth layout to the five-berth Recommended Alternative CT10 Configuration.
- 3.5.4 The resulting likely changes to the overall project cost estimate are shown below in **Table 3.5.1** compared with the overall project cost estimates prepared for PFS Stage 2 option layouts. Overall project costs for the Recommended Alternative CT10 Configuration are potentially reduced by 9-14% compared to the PFS Stage 2 option layouts, mainly through reduced costs for reclamation fill and associated ground treatment works at SWTY (but noting increased seawall construction and dredging requirements).
- 3.5.5 The resulting likely changes to the key commissioning dates are shown in **Table 3.5.2** compared with the key commissioning dates for PFS Stage 2 option layouts. The commissioning date of the fifth and final berth for the Recommended Alternative CT10 Configuration is estimated to be in 2034, which is 3.5 years earlier than the estimated commissioning date of the eighth and final berth for the PFS Stage 2 Option 5 layout.

Table 3.5.1 Likely Changes to Overall Project Cost Estimate for Recommended Alternative CT10 Configuration Compared with PFS Stage 2 Option Layouts

Item	Description	Option 3B			Option 5	Option 6				Recommended Alternative CT10 Configuration (5 Berth Layout)
		TKO Area 137	South Soko	West Lamma		TKO Area 137	South Soko	West Lamma		
Overall Project Cost Estimate(HK\$M)										
A	Construction Works (Base Estimate) ⁽¹⁾	33,895.9	34,511.1	35,044.6	32,265.0	32,953.3	33,276.2	33,596.3		26,526.6
B	Contingencies ⁽¹⁾⁽²⁾	5,762.3	5,866.9	5,957.6	5,485.1	5,602.1	5657.0	5,711.4		4,509.5
C	Further Study, Detailed Design & Related Services ⁽¹⁾⁽³⁾	2,885.3	2,936.9	2,981.7	2,748.3	2,806.1	2,833.2	2,860.1		2,266.3
⁽¹⁾ Subtotal (May 2011 Price Level) HK\$M:		42,543.5	43,314.9	43,983.9	40,498.3	41,361.5	41,766.4	42,167.8		33,302.4
Estimated Land Acquisition Costs:		16,099.1	16,195.4	16,086.1	20,365.8	20,388.6	20,434.8	20,375.6		20,365.8
⁽¹⁾ Total (May 2011 Price Level) HK\$M:		58,642.6	59,510.3	60,070.0	60,864.1	61,750.1	62,201.2	62,543.4		53,668.2
Range of Percentage Change from PFS Stage 2 Option Layouts										-9% to -14%

Note:

- (1) Include both private operators and Government expenditures
- (2) “Contingencies” have been estimated using the “Estimating using Risk Analysis” (ERA) promulgated by Work Branch Technical Circular No. 22/93 as detailed in the PFS Stage 2 Study on Cost Estimates. Risk items for which contingency has been applied include, geotechnical works, delays due to land acquisition, contract variations, market conditions, utilities diversions, contractors claim attitude, design development, EIA requirements and programme variations.
- (3) “Further Study, Detailed Design and Related Service” include allowance for consultancy costs that would be required beyond the current PFS including public consultation, detailed feasibility study, detailed design, resident site staff costs and supervision in chief.

Table 3.5.2 Likely Changes Key Commissioning Dates for Recommended Alternative CT10 Configuration Compared with PFS Stage 2 Option Layouts

Container Terminal & Reprovisioned Facilities		Option 3B			Option 5	Option 6			Recommended Alternative CT10 Configuration (5 Berth Layout)
		TKO Area 137	South Soko	West Lamma		TKO Area 137	South Soko	West Lamma	
Reprovisioned Chevron and ExxonMobil Oil Depots		2024	2025	2025					
Transshipment Centre		2028	2030	2030					
Consolidated Domestic Fuels Depot					2026	2026	2026	2026	2026
Consolidated Bunker Fuels Depot					2028	2025	2026	2026	2028
CT10 Container Terminal	First Berth	2030	2031	2031	2028	2029	2029	2029	2029
	Final Berth	2038 8 th Berth	2040 8 th Berth	2040 8 th Berth	2038 8 th Berth	2036 8 th Berth	2036 8 th Berth	2036 8 th Berth	2034 5 th Berth
Reprovisioned Euroasia Dockyard		2026	2028	2028	2026	2026	2026	2026	2025
Reprovisioned Yiu Lian Dockyard		2032	2033	2033	2031	2031	2031	2031	2031

Note: All estimated key commissioning dates are updated assuming commencement of detailed feasibility study and EIA in 2015. This results in an increase of 2.5 years from the dates presented in PFS Stage 2 Study on Implementation Strategy and Programmes and Final Report.

4 CONCLUSIONS

4.1 Preliminary Feasibility Study

- 4.1.1 Optimum development plans for the proposed CT10 Development at SWTY and the associated proposals for reprovisioning of affected oil depots have been prepared based on the outcomes of land use planning study undertaken under this PFS. The proposed CT10 Development has been planned as an 8 berth terminal of 400m berths, with 25ha of container terminal and 10ha of port backup area provided per berth at the SWTY site in accordance with the specified requirements.
- 4.1.2 Conceptual development layout plans, preliminary land use layout plans have been prepared on the basis of the land use planning study and taking into account the findings of the various other technical studies carried out under this PFS. Preliminary layout drawings have been prepared and engineering details identified in order to provide sufficient details for further investigation and detailed designs to proceed at a future design and/or study stage in the event that the project progresses beyond this preliminary feasibility stage.
- 4.1.3 Cost estimates, construction and overall development programmes have been formulated on the basis of the planned facilities and a recommended implementation framework for the CT10 Development has been identified. On the basis of the recommended implementation strategy and estimated overall development programmes the first new berth would potentially be commissioned from between 2030-2031 for Option 3B (depending on the selected site for oil depot reprovisioning), 2028 for Option 5 and 2029 for Option 6.
- 4.1.4 The preliminary technical feasibility of the CT10 Development and associated reprovisioning of affected oil depots has been evaluated under the various technical and engineering studies carried out under this PFS as summarised in the section above.
- 4.1.5 Whilst the site may be considered to be a relatively more difficult site from a geotechnical, metocean and engineering perspective than the nearby CT9 site at south east Tsing Yi, no insurmountable issues have been identified with respect to the land formation and engineering aspects of the CT10 Development and associated reprovisioning of affected oil depots. In general, the envisaged construction methods would be consistent with methods employed on past similar works in Hong Kong.

4.1.6 It is noted that the estimated volume of dredged sediment generated by the works and the required volume of reclamation fill are both substantial. Whilst every effort has been made to minimise the requirement for dredging within the works, cross boundary disposal is still likely to be required. Similarly, the estimated volume of public fill and sand fill required for the reclamation will require close liaison with Fill Management and possibly the identification of suitable cross boundary sources as the project progresses in order to secure sufficient supply of fill throughout the works.

4.1.7 EA carried out under this PFS has identified a number of potential impacts that would require mitigation, as summarised in **Section 2.7** of this executive summary. In particular, the following environmental aspects would require further detailed study as part of any future EIA study carried out under EIAO:

- **Air Quality:** Preliminary air quality modeling carried out under this PFS indicates some potential regional air quality issues in the Kwai Tsing Area due primarily to the already high background emissions associated with the existing road traffic, container terminal development and marine activities.

Further detailed assessment under future EIA study is likely to require adoption of EPD's updated regional and marine emissions inventories and review against the recently announced proposed new AQOs which are scheduled for implementation in 2014.

Given the identified issues regarding the prevailing air quality in the Kwai Tsing area, compliance under future EIA is likely to be challenging and will be heavily dependent on the implementation of tightened regional / territory wide emissions control measures as may be packaged with the proposed new AQOs; and

- **Waste Management:** The project will generate between 30-40 million m³ of dredged sediments, of which around 20% would be contaminated and would require special treatment and disposal.

Non-dredged reclamation methods have been proposed, however, further study would be required to confirm the feasibility of alternate non-dredged seawall construction methods. Even with the adoption of such methods, there would still be around 17 to 28 million m³ of dredged sediment generated by the realignment of the existing navigation channels.

Based on preliminary investigation carried out under this PFS, it appears that volumes of this magnitude are unlikely to be able to be accommodated at the existing or planned disposal sites within Hong Kong and future planning would be required to identify suitable disposal sites, possibly including consideration of cross boundary disposal.

- 4.1.8 Aside from the environmental issues discussed above, two fundamental transport issues relating to the SWTY site have been identified under the TIA and MTIA Studies carried out under this PFS. Both issues would have some bearing on the feasibility of the proposed CT10 Development at SWTY and will require further review and study in the event that the project advances beyond this preliminary feasibility stage. These issues are summarised briefly as follows;

Road Traffic Issues

- 4.1.9 TIA carried out under this PFS concluded that all internal CT10 road links and junctions were predicted to operate within capacity at the design year. Potential road traffic impacts were observed to be similar between the three options.
- 4.1.10 However, long-term future potential capacity issues have been identified at the design year for two of the existing strategic highway links; Ting Kau Bridge and Tsing Ma Bridge.
- 4.1.11 The potential long-term future capacity issues identified for both the Ting Kau Bridge and Tsing Ma Bridge are a strategic issue caused by the natural growth of existing traffic, together with the additional traffic generated by numerous planned future developments and infrastructure in the NTW and Lantau areas including the proposed CT10 Development. Further district/strategic planning studies are required to resolve these long-term future potential capacity issues, which may include the consideration of new infrastructure schemes such as TYLL and the previously planned Tsing Lung Bridge.

Marine Traffic Issues

- 4.1.12 The planned scale of the proposed CT10 Development (as required to satisfy the planning parameters defined in the Brief) necessitates substantial land formation off the southwest coast of Tsing Yi and corresponding realignment and rearrangement of fairways and anchorage areas in Western Harbour.

- 4.1.13 The MTIA carried out under this PFS has identified potential marine traffic risk issues associated with marine operations in the Western Harbour at the design year. The risk levels assessed within the Study Area and the Western Waters in terms of collision and contact levels would increase significantly at the design year, because of the increased forecast of traffic, with CT10's development, the condition is particularly focused in particular at the area southwest of CT10. Significant adverse impact with existing traffic among RTVs and local vessel traffic is anticipated and, in particular, fast ferries transits are of key concern comprising high passenger carrying capacity. In the event that passage restrictions are required to be implemented, it is envisaged that the imposed scheduling will pose particular challenges and would not be welcomed by vessels transiting Ma Wan Channel generally and the ferry operators in particular. Navigation at the CT10 berths was found to be feasible, but challenging, with a number of berths subject to potential tidal and operational constraints. These issues were observed to be broadly similar between the three CT10 Development options.
- 4.1.14 Navigation simulations have been conducted. The conflicting traffic conditions associated with manoeuvres at CT10 suggests that operations at the western and southern berths are to be restricted to tidal limitations. It is envisaged that the imposed constraints/limitation would not be welcomed by the existing (CT1-9) and future (CT10) operators. It has been identified that berthing manoeuvres may be safely conducted but challenging, and imposing obstruction to passage of the Ma Wan and Northern Fairways (CT1-9's entrance and exit), and six out of eight berths within the CT10 will be subject to tidal and operational constraints to avoid the need to perform manoeuvres that have proved challenging within the simulations. More importantly, the remaining two berths will impose obstructions to the entrance and exit to the current container terminal.
- 4.1.15 None of the simulations for berthing/unberthing operations at CT10 under 50% and 100% tidal conditions has been identified as feasible, and the feasibility of implementation is subject to the practicality/workability of the proposed mitigation measures and its acceptance by the relevant stakeholders. Moreover, the proposed CT10 Development would impose significant impacts to the existing port operators as a whole, i.e. possible time delay on a daily basis of up to 6.5 hours and 6.0 hours for CT1-9 operators and vessel, transiting Ma Wan Channel respectively. It is envisaged that the imposed constraints/limitations would not be welcomed by the existing (CT1-9) and future (CT10) operators. These issues were observed to be broadly similar between the three CT10 Development options
- 4.1.16 A number of additional controls and mitigation measures have been identified to maintain safe vessel operations. However, whilst these measures can potentially improve the situation, they cannot completely mitigate all of the predicted impacts.

4.1.17 The MTIA has recommended various mitigation measures to maintain safe vessel operations; however, the scale of CT10 is such that mitigation alone cannot completely mitigate all impacts due to the fundamental massive land formation. Should the CT10 project under the recommended layout is to be proceeded further, a detailed MTIA needs to be concluded to address the outstanding marine concerns including but not limited to the following:

- Identification of very specific berthing constraints at CT10 with the co-operation of the HKPA (i.e. when and under what conditions berthings/unberthings are preferred);
- Practicality and effectiveness of the proposed mitigation measures, developed in co-operation with MD's Vessel Traffic Services (VTS) Unit and port operators given the successful implementation of Vessel Traffic Management and Information System cannot be assured at this study stage; and
- Assessment on daily total (overall) potential time delay brought about by the CT10 Development.

4.1.18 It is critical that further risk controls and efficiency improvements in port management measures are adopted in the coming years to sustain the good safety levels of the port. As identified previously, the magnitude of the potential impacts is closely related to the large scale of the CT10 Development and its intrusion into the Western Harbour and proximity to the existing Ma Wan Fairway. From a marine viewpoint, the outstanding marine concerns are best addressed further as part of any future detailed feasibility study stage, should the CT10 Development be progressed further.

4.2 Alternative CT10 Configurations and Assessments

Marine Planning

4.2.1 Marine planning for an Alternative CT10 Configuration has been carried out in consultation with the key government departments / bureaux including CEDD, MD and THB with a view to reducing the fundamental marine traffic and safety impacts identified for the eight-berth terminal studied under PFS Stage 2.

4.2.2 An Alternative CT10 Configuration comprising a 100ha container terminal with 50ha port backup area has been developed and assessed. The Alternative CT10 Configuration container terminal features five 400m length berths arranged around an eastern facing quay and consideration of a potential additional sixth 400m length berth provided on the outer southeastern face of the container terminal.

Broad Technical Assessment

- 4.2.3 Broad technical assessment carried out for the Alternative CT10 Configuration indicates that, in general, impacts and issues associated with land use planning, road traffic, engineering, cost and programme, environmental impact and risk are generally similar to, or reduced, when compared to the PFS Stage 2 option layouts.
- 4.2.4 However, the likelihood of pollutants being entrapped in the proposed CT10 basin and the consequential adverse water quality impacts due to the embayment would need to be carefully and quantitatively assessed at the EIA stage, including the identification of effective mitigation measures.

Marine Traffic Impact Assessment

- 4.2.5 Similar to the findings of the PFS Stage 2 MTIA study, the future baseline marine risk levels within the Study Area (without CT10) are predicted to increase significantly at the design year due to future marine traffic growth. The magnitude of this increase is dependent on assumptions made regarding the continuation of the long-term downward trend in marine collision rates that is observed over the last 15 years. Upper and lower bound estimates of future baseline marine risk levels have been presented on this basis.
- 4.2.6 Detailed MTIA carried out for the Alternative CT10 configuration indicates that the CT10 development would contribute to a further increase in marine risk levels of 22% at the design year when compared with the future baseline “without CT10” scenario, with risk levels concentrated at the southwest corner of the CT10 reclamation.
- 4.2.7 Preliminary assessment of potential locations for possible barge berths at CT10 has been carried out. Barge berths are not recommended along the SW, S or SE faces of the CT10 reclamation due to the close proximity to the marine risk hotspot at to the south of the CT10 reclamation. The introduction of barge traffic at these locations was found to further increase risk levels due to conflicts with OGVs, fast ferry traffic and local craft. On this basis, the NW face of the reclamation has been identified as being the preferred location for provision of possible barge berths for CT10.

- 4.2.8 The CT10 induced impacts on existing marine traffic in the adjacent waters are significantly reduced when compared to the PFS Stage 2 option layouts, mainly due to the following:
- a) Minimisation of the southward projection of the CT10 reclamation;
 - b) Reduction in the number of CT10 OGV berths and consequently the magnitude of CT10 vessel traffic;
 - c) Exclusion of OGV berthing from the exposed western and southern faces; and
 - d) Provision of additional manoeuvring waterspace outside of the adjacent fairways for OGVs arriving at and departing from CT10.
- 4.2.9 However, even with the above improvements, navigation simulation carried out for the Alternative CT10 Configuration indicates that vessels manoeuvring to and from CT10 would obstruct vessel movements in and out of the existing KTCT for up to 30 – 45 minutes.
- 4.2.10 Assessment of the capacity of the KTCT approach (the “port entrance area”) based on the predicted future traffic levels (including CT10 traffic) indicates that the port entrance would likely exceed its maximum operational limit at the design year based on a six berth CT10. The capacity was found to be marginally acceptable when reduced to five CT10 berths.
- 4.2.11 It is noted that actual port operations at the port entrance would be subject to unscheduled/random arrival and departure patterns. The interfaces between marine traffic accessing CT10 and marine traffic accessing the existing Kwai Tsing Container Basin would require careful management to minimise the associated potential delay impacts. Effective management of these scheduling issues would require full cooperation between VTC, pilots and the various port operators.
- 4.2.12 It is recommended that improvements in port management are instigated in addition to planned VTS upgrades to sustain and expand port efficiency as well as safety. Such actions would be consistent upgrades underway across major ports worldwide (i.e. Singapore & Rotterdam).
- 4.2.13 In addition, controls on barge berth activities should be included in land grant conditions to limit impacts on traffic in Ma Wan Fairway (i.e. limits on double/triple berthing and staging in waterspace adjacent to facility). Nevertheless, effective enforcement is likely to require increased MD resources, including increased monitoring.

- 4.2.14 Whilst these measures can potentially improve the situation, they cannot completely mitigate all of the predicted impacts. It is critical that further risk controls and efficiency improvements in port management measures are adopted in the coming years to sustain the good safety levels of the port.

Recommended Alternative CT10 Configuration

- 4.2.15 Based on the findings of the MTIA study it is recommended that the Alternative CT10 Configuration is progressed based on provision of five OGV container terminal berths located around the proposed eastern facing basin, i.e. the Recommended Alternative CT10 Configuration. The northernmost 500m of the NW face of the reclamation has been identified as being potentially suitable for provision of possible barge berths for CT10.
- 4.2.16 Whilst the Recommended Alternative CT10 Configuration can substantially reduce the marine traffic impacts identified for the PFS Stage 2 option layouts, the CT10 Development will still inevitably impact the existing marine traffic patterns within the western waters.
- 4.2.17 In light of the identified marine traffic impacts, it is recommended that the required size and configuration of the proposed CT10 Development are further optimised along with the associated changes to fairway geometry in the Western Harbour as part of any future detailed feasibility study stage.

4.3 Next Steps

- 4.3.1 Following the completion of this PFS, and subject to a decision from Government to proceed, detailed feasibility and EIA studies would be required for the selected CT10 Development Option as detailed in the recommended implementation strategy and development programmes.